NOSSAMAN LLP

ATTORNEYS AT LAW

1666 K Street, NW
Suite 500
Washington, DC 20006
T 202.887.1400
F 202.466.3215

Edward Fishman
D 202.887.1410
efishman@nossaman.com

RECEIVED
SEP 14 2017

244340

ENTERED
Office of Proceedings
September 14, 2017
Part of
Public Record

By Hand Delivery

September 14, 2017

Ms. Cynthia T. Brown
Chief, Section of Administration
Office of Proceedings
Surface Transportation Board
395 E Street, S.W.
Washington, D.C. 20423-0001

Re: STB Finance Docket No. 35743, *Application of the National Railroad Passenger Corporation under 49 U.S.C. § 24308(a) – Canadian National Railway Company*

Dear Ms. Brown:

Enclosed for filing under seal in the above-referenced proceeding are the original and ten copies of the Highly Confidential version of the Rebuttal Submission of the National Railroad Passenger Corporation ("Amtrak").

Also enclosed for filing on the public record in this proceeding are eleven copies of the Public version of Amtrak's Rebuttal Submission, which has been redacted in accordance with the applicable protective order.

We have also enclosed a disc containing three electronic copies of the Highly Confidential and Public versions of Amtrak's Rebuttal Submission. Please note that **the originals of this filing contain color images**. *See* 49 C.F.R. § 1104.2(d).

Please time and date stamp the extra copy of this cover letter and return it with our messenger. If you have any questions about this filing, please contact me.

Respectfully submitted,

Edward Fishman
Counsel for National Railroad Passenger Corporation

cc: David Hirsh, Harkins Cunningham

PUBLIC VERSION - REDACTED

BEFORE THE
SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(A) – CANADIAN NATIONAL RAILWAY COMPANY

REBUTTAL SUBMISSION OF NATIONAL RAILROAD PASSENGER CORPORATION

VOLUME I

Kevin M. Sheys
Edward J. Fishman
Justin J. Marks
Hubert T. Lee
Nossaman LLP
1666 K Street, NW, Suite 500
Washington, DC 20006
(202) 887-1400

William H. Herrmann
Christine E. Lanzon
National Railroad Passenger Corporation
60 Massachusetts Avenue, NE
Washington, DC 20002
(202) 906-3971

Counsel for National Railroad Passenger Corporation

September 14, 2017

TABLE OF CONTENTS

TAB

Volume I

JOINT REBUTTAL VERIFIED STATEMENT OF
PAUL VILTER AND JASON MAGA..A

REBUTTAL VERIFIED STATEMENT OF BENJAMIN SACKS ....B

Volume II

REBUTTAL VERIFIED STATEMENT OF ALAN FRANKEL..C

JOINT REBUTTAL VERIFIED STATEMENT OF THOMAS CROWLEY
AND ROBERT MULHOLLAND...D

JOINT REBUTTAL VERIFIED STATEMENT OF JOHN WILLIAMS AND
JUDITH ROBERTS...E

Volume III

REBUTTAL VERIFIED STATEMENT OF EDWARD FISHMAN..F

PUBLIC – REDACTED

BEFORE THE
SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(A) – CANADIAN NATIONAL RAILWAY COMPANY

REBUTTAL SUBMISSION OF NATIONAL RAILROAD PASSENGER CORPORATION

National Railroad Passenger Corporation ("Amtrak") hereby submits its Rebuttal Submission in this proceeding. The Rebuttal Submission consists of the following Rebuttal Verified Statements (accompanied by, where applicable, supporting Exhibits or Attachments).

Volume I

A. Joint Rebuttal Verified Statement of Paul Vilter and Jason Maga.

Mr. Vilter is the Assistant Vice President, Amtrak Services and Mr. Maga is a Senior Manager in the Host Railroad's Group at Amtrak. Their Joint Rebuttal Verified Statement discusses the multitude of deficiencies in CN's proposal to charge Amtrak for purported "delay costs" that CN claims to have incurred as a result of Amtrak's presence on its lines. The Vilter/Maga Joint Rebuttal Verified Statement also highlights significant problems with CN's alternative proposal to require Amtrak to fund approximately $350 million to $450 million in capital improvements on CN's lines. In addition, their Rebuttal Verified Statement explains why CN's complaints about Amtrak's schedules on the City of New Orleans and Illini/Saluki routes are unfounded. Finally, it describes the minimum changes that would be necessary if the Board decided to require the parties to retain the current checkpoint/relief-based system (despite all of its substantial flaws) instead of Amtrak's delay-based system proposal.

B. Rebuttal Verified Statement of Benjamin Sacks.

Mr. Sacks is a Principal with The Brattle Group in Washington, D.C. His Rebuttal Verified Statement addresses the various flaws with CN's proposed modifications to the checkpoint/relief-based incentive payment and penalty system. It also explains why Amtrak's delay-based system based on 80% All-Stations On-Time Performance ("80% ASOTP") does not suffer from the same deficiencies. Mr. Sacks also highlights a flaw in the methodology by which CN's expert witness Professor Dubin calculated the endpoint on-time performance target service levels used in CN's capacity modeling studies.

Volume II

C. Rebuttal Verified Statement of Alan Frankel.

Dr. Frankel is the President of Coherent Economics, LLC, a Senior Editor of the Antitrust Law Journal and an Adjunct Professor at the Loyola University Chicago School of Law. Dr. Frankel's Rebuttal Verified Statement responds to the arguments made by CN expert witness Dr. Willig about CN's claim for "delay costs." Dr. Frankel explains why CN's proposal would be contrary to the intent of Congress in providing Amtrak with statutory access to the lines of the freight railroads and with a statutory preference over freight traffic.

D. Joint Rebuttal Verified Statement of Tom Crowley and Rob Mulholland.

Mr. Crowley is the President and Mr. Mulholland is a Senior Vice President of L.E. Peabody and Associates, Inc., an economic consulting firm that has submitted testimony before the STB in numerous proceedings. Messrs. Crowley and Mulholland analyze the delay minute estimates and cost projections developed by CN expert witnesses Baranowski and Fisher. The

Crowley/Muholland Rebuttal Verified Statement illustrates that CN's delay minute estimates are unreliable and that CN's cost projections do not qualify as short-run avoidable costs under railroad accounting standards.

E. Joint Rebuttal Verified Statement of John Williams and Judith Roberts.

Mr. Williams and Ms. Roberts, President and Vice President respectively of The Woodside Consulting Group, have more than 75 years of collective experience with railroad operations, management, capacity modeling and related matters. Their Joint Rebuttal Verified Statement analyzes the capacity modeling studies conducted by CN to support CN's alternative relief claim that Amtrak should pay for over $350-$450 million in capital improvements on CN's lines. The Williams/Roberts Verified Statement highlights the design flaw and other deficiencies of the capacity modeling studies conducted by CN to support this claim. It also illustrates the deficiencies in the pure running time simulations conducted by CN's modelers.

<u>Volume III</u>

F. Rebuttal Verified Statement of Edward Fishman.

Mr. Fishman, outside counsel for Amtrak in this proceeding, is submitting a Rebuttal Verified Statement in order to verify the authenticity of certain workpapers that CN provided to Amtrak in support of the Joint Verified Statement of Harald Krueger, Brian Doyle and Nikola Rank and to submit the deposition testimony of CN's Harald Krueger regarding those workpapers and other matters relating to the capacity modeling studies that were conducted by CN.

Respectfully submitted,

____

Kevin M. Sheys
Edward J. Fishman
Justin J. Marks
Hubert T. Lee
Nossaman LLP
1666 K Street, N.W., Suite 500
Washington, D.C. 20006
(202) 887-1400

William H. Herrmann
Christine E. Lanzon
National Railroad Passenger Corporation
60 Massachusetts Avenue, NE
Washington, DC 20002
(202) 906-3971

Counsel for National Railroad Passenger Corporation

September 14, 2017

<u>PUBLIC VERSION - REDACTED</u>

BEFORE THE
SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER
49 U.S.C. § 24308(A) – CANADIAN NATIONAL RAILWAY COMPANY

**REBUTTAL JOINT VERIFIED STATEMENT OF
PAUL VILTER AND JASON MAGA**

TABLE OF CONTENTS

Page

INTRODUCTION & SUMMARY 1

I. It Would Not Be Reasonable for the Board to Require Amtrak to Pay for Alleged Freight Train Delay Costs That CN Seeks to Attribute to Amtrak 7

A. CN Freight Train Delays are Caused Predominantly by CN Freight Traffic Growth and CN's Capital Expenditure and Operating Decisions 8

B. Amtrak's Presence Does Not Prevent CN From Operating its Freight Trains At or Close to CN Schedules 16

i. CN Actual Freight Train Operations Vary Considerably from CN Schedules Due to Self-Inflicted Delays 17

ii. [redacted] 17

iii. [redacted] 19

iv. Amtrak's Presence Does Not Prevent CN from Operating a Railroad That Adheres to its Own Schedules 20

C. If the Board Ordered Amtrak to Pay Costs of Delays to CN Allegedly Caused by Amtrak, CN Would Have No Incentive to Avoid or Minimize Those Delays 21

II. CN Has Not Submitted Any Reliable Evidence to Prove That Amtrak Caused the Delays for Which It Seeks Compensation or Any Reliable Evidence Establishing the Purported Costs of Such Delays 23

A. The SRS System was Designed for Managing Freight Rail Operations and Cannot be Repurposed to Accurately Measure Freight Train Delays That CN Seeks to Attribute to Amtrak 24

i. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted] 26

ii. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted] 27

iii. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted] 28

iv. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because CN Uses So-Called "Root Causes" To Assign Delay Responsibility 29

v. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted] 30

vi. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted] 32

vii. Summary of Numerous Flaws in CN's Proposal to Use SRS as the Basis for Measuring Freight Train Delays That CN Seeks to Attribute to Amtrak 33

B. Even If the SRS System Could Somehow Be Used To Accurately Measure Freight Train Delay That CN Seeks To Attribute to Amtrak, CN Has Not Submitted Any Reliable Evidence on Purported Costs Incurred by CN As A Result of the Alleged Delays During the Analysis Period 34

III. The Board Should Not Order Amtrak-Funded Capital Improvements as Alternative Relief 35

IV. Even If the Board Orders the Parties to Retain the Current Checkpoint/Relief-Based System, the Board Should Make Significant Changes in the Checkpoint/Relief-Based System to Account for its Numerous Flaws 37

A. The Lookback Provision Should be Removed 38

B. CN's Performance Should be Measured at All Amtrak Stations and Exit Points on CN Lines 39

C. Amtrak Should Be Permitted to Use Its Share of Available Recovery Time for Station Dwell Delays and Lateness from Origin 40

D. CN Should Not Be Permitted To Earn Additional Incentive Payments Due To Circumstances Beyond Its Control 41

E. The Penalties Should Increase the Later Amtrak Trains Are Due to CN-Responsible Delays ... 42

F. The Penalties Should Begin to Increase When Monthly Average Lateness Exceeds 15 Minutes ... 42

G. Delay Attribution for Amtrak Trains Should Continue to be Based on Direct Cause, Not So-Called "Root Cause" ... 43

i. The Direct Cause is the Only Event that Conclusively Causes the Delay to the Amtrak Train ... 44

ii. CN Has Not Demonstrated That Amtrak's Currently Used "Direct Cause" System of Delay Coding Is Flawed or Inadequate ... 45

iii. The Determination of "Root Cause" Is Entirely Subjective and Would Lead to Frequent Disputes ... 47

iv. Relying on "Root Cause" for Delay Attribution Would Relieve CN of Responsibility to Avoid or Minimize Delays ... 48

v. CN's "Root Cause" Proposal Would Enable CN Dispatchers to "Self-Report" on Their Own Performance ... 50

H. CN's Proposed New Relief Items for the Checkpoint/Relief-Based System Should Be Rejected Because They Would Unreasonably Shift Delay Responsibility from CN to Amtrak ... 51

I. Adopting Amtrak Delay Codes As Relief Items Would Necessitate Certain Refinements and Conforming Changes ... 55

i. CN Proposes Adoption of Amtrak Delay Codes that are Inapplicable ... 56

ii. CN's Proposal to Adopt Amtrak Delay Codes As Relief Items Makes Retention and Addition of Certain Other Relief Items Redundant ... 57

iii. The Addition of Checkpoints and the Adoption of Delay Coding Make Many Provisions for Not Counting Trains in Quality Payment and Penalty Calculations Obsolete ... 57

iv. Relief for Westbound Amtrak Trains at Joliet is Not Necessary ... 60

v. CN's Proposed Provision for Consistent Failure to Meet Base Performance Standards Is No Substitute for an Effective Penalty System 61

V. The STB Should Deny CN's Binding Schedule Review Proposal 62

A. Summary of CN Schedule Review Proposal and Reasons It Should Be Denied 62

B. CN's Only Support for its Binding Schedule Review Proposal is Unreliable Evidence of Alleged PRT Shortfalls on Two of Amtrak's Six Services on CN Lines 64

i. CN's PRT Modeling on the City of New Orleans Service is Unreliable 65

ii. CN's PRT Modeling on the Illini/Saluki Service is Unreliable 66

iii. CN's Average Schedule Speed Comparisons Provide No Credible Evidence that Amtrak's Illini/Saluki PRT is Insufficient 67

iv. Amtrak Has Every Incentive For the PRT's In Its Schedules To Be Accurate and CN Would Not Be Prejudiced Under Amtrak's Delay-Based System or CN's Checkpoint/Relief-Based System For Any PRT Shortfalls 68

C. CN Has Not Invoked the Current Schedule Adjustment Procedure and Therefore Has No Basis to Claim It Does Not Work or Criticize Amtrak for Failing to Agree to Every Schedule Change Proposed Informally by CN 68

D. Any Modeling Conducted in Connection with Schedule Review Should Be Based on Assumptions and Objectives Established by the Parties 70

E. Amtrak is Amenable to Joint PRT Field Checks on the Illini/Saluki and City of New Orleans Routes 72

INTRODUCTION & SUMMARY

My name is Paul Vilter and I am the Assistant Vice President, Amtrak Services. From 2003 through January of 2017, I was Deputy Chief of the Host Railroads Group at Amtrak. I have over 31 years of railroad experience, including over 17 years at Amtrak and 14 years at Class I freight railroads (CSX and Conrail).[1]

My name is Jason Maga and I am a Senior Manager in the Host Railroads Group at Amtrak. I have been with Amtrak's Host Railroads Group since 2006. In my current capacity, I am responsible for leading efforts to measure and improve the performance provided to Amtrak by host railroads.[2]

As explained in Amtrak's Opening Submission, the compensation framework of the current Operating Agreement has not been successful in motivating Canadian National ("CN") to provide quality service to Amtrak. It rewards CN for poor service to Amtrak and its customers. The numerous flaws of the existing checkpoint/relief-based system are described in the Vilter Verified Statement ("Vilter V.S.") that was filed with Amtrak's Opening Submission. The problems with the Operating Agreement can be rectified by replacing the existing checkpoint/relief-based system with a delay-based system for quality payments and penalties and by removing the "lookback" limitation on penalty payments.[3]

As further explained in Amtrak's Opening Submission, Amtrak paid CN nearly [redacted] in incentive payments in fiscal year 2014 for the four Amtrak services that operate over the Illinois Central lines ("IC Lines"). However, CN's performance as the host railroad for the Amtrak services on the IC Lines during that period resulted in Amtrak passengers arriving at

---

[1] A copy of my resume is attached as part of Exhibit 1.
[2] A copy of my resume is attached as part of Exhibit 1.
[3] The delay-based quality payment and penalty system proposed by Amtrak is designed to motivate CN to minimize delays to Amtrak trains for which CN is responsible, thereby promoting improved on-time performance for Amtrak passengers. See Amtrak's Opening Statement, 11-18.

their stations in a timely manner only 33.3% to 60.7% of the time.[4] Since the filing of Amtrak's Opening Submission in September 2015, as shown in Table 1 below and Exhibit 2 attached hereto, Amtrak has continued to pay substantial incentive payments to CN for poor on-time performance.[5] Clearly, the current Operating Agreement is broken.

Table 1

	Fiscal Year 2016			
Service[6]	**CN HRDs per 10K TM**	**All Stations OTP**[7]	**Contract OTP (CN Only)**[8]	**Incentive Paid to CN**[9]
City of New Orleans	1028	62.6%	[redacted]%	$[redacted]
Illini/Saluki	1669	38.2%	[redacted]%	$[redacted]
Lincoln Service	1292	72.5%	[redacted]%	$[redacted]
Texas Eagle	1817	41.4%	[redacted]%	$[redacted]
Total:				**$**[redacted]

The purpose of this Rebuttal Verified Statement is to provide Amtrak's response to certain aspects of CN's proposed compensation and terms as described in CN's Opening

---

[4] Vilter V.S., 4. Amtrak's fiscal year runs from October 1 through September 30 of the following calendar year.

[5] See Exhibit 2, which shows Amtrak incentives paid to CN (or, with respect to the Illini/Saluki service, invoiced by CN) for poor performance on the relevant Amtrak services over the IC Lines for fiscal year 2015, fiscal year 2016 (as reflected in Table 1 above) and for fiscal year 2017 year to date (from October 1, 2016 through May 31, 2017).

[6] [redacted] However, even on the GTW Lines, CN's performance as host railroad for the Wolverine service has resulted in high levels of host responsible delay ("HRD") minutes and low levels of ASOTP. For fiscal year 2016, the Wolverine service had annual HRD minutes per 10,000 train miles of 1887 and ASOTP of 69.9%; the Blue Water service had annual HRD minutes per 10,000 train miles of 700 and ASOTP of 85.4%. The corresponding figures for fiscal year 2015 and fiscal year 2017 year to date are reflected in Exhibit 2.

[7] The All-Stations On-Time Performance ("ASOTP") calculation is for the entire Amtrak route.

[8] The Contract OTP ("KOTP") calculation applies only to CN's portion of the applicable route and is based on CN's methodology for making the calculation. Amtrak uses a different methodology, which results in a lower KOTP for the Illini/Saluki service, because of a continuing dispute between the parties about responsibility for grade crossing activation failures on that route.

[9] These figures reflect the incentives that Amtrak has paid to CN during the applicable period. CN has invoiced Amtrak for $[redacted] in incentive payments for the Illini/Saluki service for fiscal year 2016. Amtrak has not paid this invoiced amount due to the continuing dispute referenced above about the proper methodology for calculating KOTP for the Illini/Saluki service.

Submission.[10] Generally, CN proposes (1) additional base compensation for freight train delay costs that CN claims are due to Amtrak's presence, (2) vastly expanded relief for CN from its responsibility for causing delay to Amtrak trains, and (3) binding model-driven reviews of Amtrak schedules. None of these CN proposals addresses the fundamental problem that the current Operating Agreement does not motivate CN to provide quality service to Amtrak, and in fact will make the failings of the current Operating Agreement worse.

CN's Request for Freight Train Delay Costs. CN proposes an addition to the base compensation that it receives under the Operating Agreement to cover purported freight train delay costs that CN claims are due to Amtrak's presence.[11] CN proposes to use CN's Service, Reliability & Strategy ("SRS") database to quantify delay minutes allegedly caused by Amtrak and then use the delay minutes to estimate the claimed delay costs (labor, fuel, and equipment costs).[12]

CN's proposed addition to base compensation for its alleged "delay costs" should be rejected. Assuming for the sake of discussion only[13] that Amtrak were legally obligated to pay CN for freight train delay costs caused by Amtrak's presence, CN has not demonstrated that the freight train delays in question were caused by Amtrak. The delays are attributable to CN's

---

[10] Amtrak's response to other aspects of CN's proposed compensation and terms are contained in other verified statements filed today.

[11] Joint Verified Statement of Paul Ladue and Scott Kuxmann ("Ladue/Kuxmann V.S."), 52.

[12] Ladue/Kuxmann V.S., 51. The methodology for this two-step process is described in the Joint Verified Statement of Michael Baranowski and Benton Fisher ("Baranowski/Fisher V.S."). CN estimates that the labor, fuel and equipment costs of delay incurred by CN's freight trains due to the presence of Amtrak from August 1, 2013 through January 31, 2015 were $4,690,089. Baranowski/Fisher V.S., 26. The period covered by Baranowski/Fisher's analysis is herein referred to as the "Analysis Period." CN proposes to use the same process to estimate delay costs for the remainder of the pre-decision period in this proceeding and on a monthly basis going forward after the effective date of the Board's decision. Ladue/Kuxmann V.S., 51-52.

[13] The numerous reasons why CN is not entitled as a matter of law to recover such delay costs from Amtrak under the applicable statute will be explained in Amtrak's opening brief in this proceeding.

unilateral choices about: (1) how much railroad infrastructure to retain in its network, and (2) how to operate its railroad. These points are described in detail below on pages 10 - 21.

Even if CN could prove that the freight train delays in question were caused by Amtrak instead of CN's own infrastructure and operating decisions or other non-Amtrak factors, CN has failed to present a reliable system for measuring the duration and allocating responsibility for any such delays. CN's SRS database does not accurately measure [redacted] It was designed for other purposes, [redacted] and cannot be used in any reliable way to determine with any degree of accuracy the minutes of freight train delay allegedly caused by Amtrak. These points are described in detail below on pages 23 - 33.

CN has attempted to overcome the inaccuracies of the SRS system by reverse-engineering delay minutes and arbitrarily allocating those minutes to Amtrak.[14] This actually made CN's delay calculations even less reliable, as is explained in the Rebuttal Verified Statement of Thomas Crowley and Robert Mulholland (the "Crowley/Mulholland R.V.S."). To make matters worse, the methods and assumptions CN used to estimate labor, fuel and equipment costs (which are derived from the inaccurate delay minute calculations in SRS) grossly overstate the costs that CN asserts are attributable to Amtrak service. CN's failure in this respect also is explained in the Crowley/Mulholland R.V.S.

As an alternative to its proposed addition to the base compensation for purported delay costs, CN proposes that the Board order Amtrak to pay for substantial capital improvements on CN's lines which (according to CN) would restore capacity that CN asserts Amtrak consumes. This alternative proposal is based on CN capacity modeling studies described in the Joint

[14] See Baranowski/Fisher V.S. generally.

Verified Statement of Harald Krueger, Brian Doyle and Nikola Rank ("Krueger/Doyle/Rank V.S.").[15]

This alternative proposal should be rejected as well. CN's capital improvements proposal is an alternative form of relief for alleged delay costs it has failed to prove.[16] Moreover, the additional infrastructure identified in the capacity modeling studies conducted by CN would add track capacity to the CN rail network with no apparent operational relationship to the locations where Amtrak trains meet or pass other trains. CN has failed to prove that the proposed capital improvements are supported by its modeling studies or would restore the capacity that CN asserts Amtrak consumes, for the reasons described in the Rebuttal Verified Statement of John Williams and Judith Roberts (the "Williams/Roberts R.V.S").

CN's Request for Expanded Relief from Responsibility for Amtrak Train Delays. CN proposes continuation of the checkpoint/relief-based penalty and quality payment compensation [redacted], but with (1) so-called "root cause" delay attribution, (2) numerous new relief provisions, and (3) continuation of numerous relief provisions in the current Operating Agreement.[17] All of these CN elements (existing and new) would work together to vastly expand CN's relief from responsibility for causing delays to Amtrak trains, allow CN to earn even more in incentives for poor Amtrak on-time performance, and insulate CN from the possibility that poor CN handling of Amtrak trains could trigger the assessment of actual monetary penalties against CN. Even if the Board orders the parties to retain the current checkpoint/relief-based system, despite its substantial flaws that were highlighted in the Vilter Verified Statement submitted as part of Amtrak's Opening

[15] Ladue/Kuxmann V.S., 52-53.
[16] This assumes, again for purposes of discussion only, that CN would be entitled to delay cost payments at all under the applicable statute.
[17] Ladue/Kuxmann V.S., 19-21, 64, 56-62.

Submission, there are numerous changes which would need to be made to CN's proposal with respect to that system that are discussed in further detail below on pages 37 - 61.

CN's Request for Binding Model-Driven Reviews of Amtrak Schedules. Finally, CN proposes that the Board require the parties to engage in binding, model-driven reviews of Amtrak schedules.[18] The Board should not adopt CN's proposal. CN presents no evidence of inaccuracies in the Amtrak schedules on CN lines, other than alleged pure running time ("PRT") shortfalls on the Illini/Saluki and City of New Orleans services – allegations based entirely on unreliable modeling conducted by CN.[19] While CN complains that Amtrak is unwilling to modify its schedules,[20] CN has never initiated the schedule adjustment procedure in the current Operating Agreement and therefore has no basis to claim it would not work.

In any case, it would not be reasonable for the Board to require a "binding" schedule review process driven entirely by unreliable modeling conducted unilaterally by CN. Even when appropriate, modeling is merely a simulation tool producing theoretical results that can be used as an input in the schedule development process. Neither side should be bound to automatically implement those theoretical results. Moreover, the specific assumptions and objectives of the modeling exercise would need to be established and agreed upon by the parties, not prescribed by the Board or determined unilaterally by CN. Amtrak has been and continues to be willing to conduct field studies with CN of the pure running time on the CN lines used for the Illini/Saluki and City of New Orleans services. Such field studies are quick, inexpensive and easily understood. This would allow for resolution of any disagreement between the parties about the

[18] Ladue/Kuxmann V.S., 10 and 66-67.
[19] The unreliability of CN's modeling of the PRT on the City of New Orleans and Illini/Saluki service is described in the Williams/Roberts R.V.S. PRT is the travel time of a given train between two points at maximum authorized speed, without delays. Vilter V.S., 15. CN refers to this same concept as minimum run time or "MRT." See Exhibit 3, Deposition of Harald Krueger on July 7, 2017 ("Krueger Dep.") 45: 21 - 46:9.
[20] Ladue/Kuxmann V.S., 10.

appropriate pure running time on these two routes based on real-world data, without the expenditure of the substantial time and resources that would be necessary to conduct detailed modeling using mutually acceptable parameters to develop theoretical simulation results which would require field verification in any event. All of these points are discussed below on pages 62 - 73.

DETAILED TESTIMONY[21]

I. It Would Not Be Reasonable for the Board to Require Amtrak to Pay for Alleged Freight Train Delay Costs That CN Seeks to Attribute to Amtrak

It would not be reasonable for the Board to require Amtrak to pay for alleged freight train delay costs that CN seeks to attribute to Amtrak because CN makes all capital and operating decisions regarding its railroad and those decisions trigger the freight train delay that CN experiences and for which it now seeks compensation from Amtrak.[22] In addition, even if Amtrak was the cause of some CN freight train delays, and even if CN incurred additional costs associated with such delays, and even if CN could prove that Amtrak should be held financially responsible for such additional costs, CN would have no incentive – if delay costs were simply paid for by Amtrak - to use its control over the capacity of and operations on its rail network to avoid or minimize freight train delays. CN could choose to incur such freight train delays, even if they could be avoided by CN, knowing that it could extract cash payments from Amtrak for those delays.

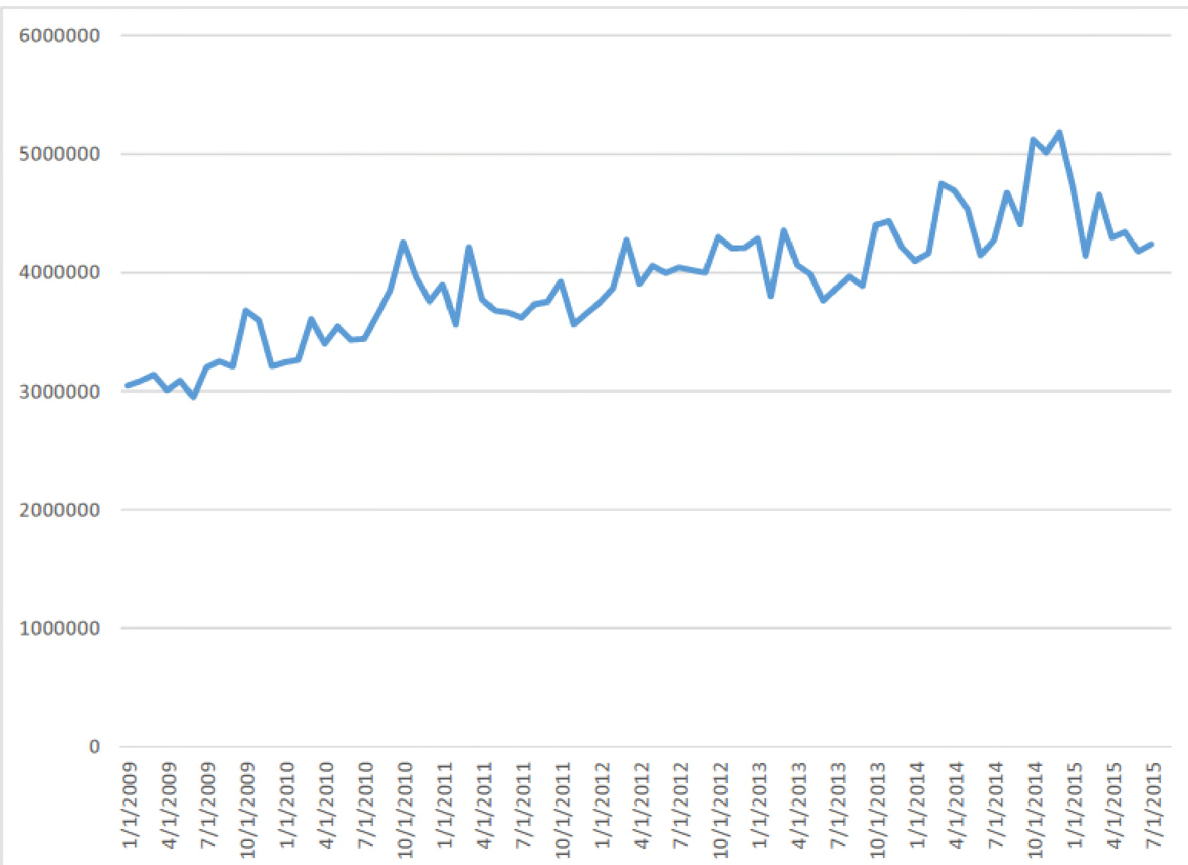
[21] The INTRODUCTION & SUMMARY section is a part of our testimony.
[22] Throughout this Verified Statement, we assume only for the sake of discussion that Amtrak could be legally obligated to pay CN for freight train delay costs caused by Amtrak's presence.

A. CN Freight Train Delays are Caused Predominantly by CN Freight Traffic Growth and CN's Capital Expenditure and Operating Decisions

CN freight train delays are caused predominantly by the dramatic growth in CN's freight business and by CN's decisions regarding capital investment and freight operations.[23]

Freight Traffic Growth. CN and its predecessors have enjoyed dramatic freight traffic growth. As the chart below from the Verified Statement of Anne Morehouse ("Morehouse V.S.") demonstrates, total gross ton miles for freight trains over the CN Subdivisions on which Amtrak operates have increased by over one-third since 2009.[24]

Total GTMs on CN Subdivisions on which Amtrak Operates



[23] CN witness Harald Krueger testified in his deposition that some level of delay on any rail network is inevitable. Exhibit 3, Krueger Dep. 306:5-7.
[24] Morehouse V.S., 3-4.

Amtrak service on CN lines has grown only modestly since the creation of Amtrak. The City of New Orleans Service has operated just one northbound and one southbound train since Amtrak took over passenger train operations on the IC on May 1, 1971.

On the Chicago – Carbondale route (excluding the City of New Orleans service discussed above), Amtrak currently operates two round trips per day. For portions of time between May of 1971 through October of 1973, Amtrak ran as many as four round trips per day on all or some parts of this route. By 1973, two of those round trips were moved to other non-CN lines. Amtrak continued to run two daily round trips over the CN route (one Chicago-Carbondale and one Chicago-Champaign) until 1986. From 1986-2006, Amtrak ran only one round trip per day on the route. Then in 2006, Amtrak restored the second round trip, running the entire distance to Carbondale.

On CN's relevant GTW corridor in Michigan, Amtrak currently operates three daily round trips over two short segments of CN totaling 26.7 miles, and one daily round trip over a 158.7 mile segment of CN. In the early 1970s, Amtrak operated two Chicago-Detroit round trips that crossed CN at a diamond in Battle Creek, Michigan. A round trip was added on CN between Battle Creek and Port Huron, Michigan in 1974. In 1982, the Detroit trains were rerouted so that instead of crossing CN at a diamond they used a one-mile segment of CN within Battle Creek. In 1994, these trains were extended from Detroit to Pontiac, Michigan along a lightly-used CN line. In 1995, a third round trip was added on this route. Each of the aforementioned Amtrak service changes on the IC Lines and GTW Lines, most of which were just a few miles long, was made with CN's approval.

The modest growth in Amtrak service also pales in comparison to the number of passenger trains that were operated on the CN lines just prior to Amtrak's establishment.

Immediately prior to Amtrak's creation, CN predecessors Illinois Central and Grand Trunk operated 32 passenger trains and 10,746 passenger train miles per day – almost three times the daily train miles that Amtrak operates on CN today. This included 8 daily round trip passenger trains that the Illinois Central operated on all or part of the Chicago-Carbondale-New Orleans route (versus the 3 daily round trips that Amtrak operates on that route today).

CN Makes Its Own Capital Decisions, Including Track Removal. CN unilaterally decides the level of railroad infrastructure to build and retain, including deciding to remove railroad infrastructure and reduce the capacity on its rail network when doing so suits CN (as long as the continuity of Amtrak's route is retained).[25]

The Illinois Central main line is a good example of this. Until the 1980s, the IC main line between Chicago and Memphis was mostly double track. In 1989, IC decided to remove one main track, converting from double track to single track along most of the main line.[26] IC made its decision based on how it would impact IC financially and operationally.[27]

South of Memphis, IC had two parallel routes for approximately 220 miles between Memphis, TN and Jackson, MS. Amtrak's City of New Orleans service used the route via the Grenada Subdivision. Then in the 1990s, IC downgraded the Grenada Subdivision and consolidated most traffic, including Amtrak, onto the single-track Yazoo Subdivision.

---

[25] CN also makes its own decisions regarding when to conduct track maintenance. Although track maintenance is essential, decisions about when to take track out of service for maintenance and how long to do so (i.e., how many maintenance personnel to assign to a maintenance project, which impacts the duration of a work block) have a temporary impact on railroad capacity much like the longer term impact of track construction and track removal decisions.

[26] Exhibit 4, Frank Malone, *Why IC is Single-Tracking,* 191 RAILWAY AGE 2, Feb. 1990, at 32 – 34 (explaining that the IC determined that greater efficiency would allow network capacity to be reduced without affecting freight service).

[27] Exhibit 5, Paul D. Schneider, *The Double-Track Dilemma – Is Single-Tracking a Sound Strategy?* TRAINS, July 1991 at 27 (IC noting that after project, it would still have 45% extra capacity and expressing the view that if there were "flaws in the plan," IC would be "ready to deal with them;" article also stating that Amtrak was "less than thrilled" with the IC's single-tracking project).

IC's single tracking project between Chicago and Memphis also had significant impact on the access to and capacity of Champaign Yard. In 1991, the segment between Champaign and Du Quoin was converted to single track with sidings. IC removed the second main track north and south of Champaign and multiple tracks from the south end of the Champaign yard.[28] In 1989, even before the single track conversion had reached the main line adjacent to Champaign Yard, IC closed the freight classification humps at Markham Yard (south of Chicago) and transferred some of the work to Champaign Yard. Thus, IC significantly reduced main line infrastructure while it expanded its freight activity at locations along the corridor such as Champaign Yard.

In her Verified Statement, CN witness Anne Morehouse[29] describes the impact of these decisions around Champaign Yard.[30] She notes that:

> [t]here is also limited infrastructure in the area: the yard is located off the single main line and includes a 16,000-foot siding that allows trains to pass when the main line is occupied. Because the yard lead is off the main line, freight trains that are too long to fit in the yard must occupy the main line to switch cars in and out of the yard. Frequently this means that if there is a train working the yard any trains passing the yard must use the siding.[31]

Anne Morehouse testifies that CN freight and Amtrak operations in and around Champaign Yard "illustrate the major impact *Amtrak* trains can have on rail traffic over a track segment with capacity constraints."[32]

---

[28] See Exhibit 6, 1979 Illinois Central Gulf Railroad Champaign Yard Track Charts and Exhibit 7, 1995 Champaign Yard Track Charts.

[29] Anne Morehouse is CN's Superintendent of the Regional Operations Center for CN's Southern Region, which includes Champaign Yard.

[30] Morehouse V.S., 8 (explaining that "most freight trains operating through that area perform work" at Champaign Yard, and that pursuant to "CN's current schedule, there is at least one freight train scheduled to be working in Champaign at any one time between 2 a.m. and 1:30 p.m., and from 2 p.m. until 10 p.m." each day).

[31] Morehouse V.S., 8-9.

[32] Morehouse V.S., 8 (emphasis added).

We disagree with Ms. Morehouse's conclusion. She makes no mention in her Verified Statement of the significant track reduction undertaken by the IC since 1989, which included the removal of main tracks and shortening of yard leads that previously would have enabled freight trains to remain off the main line(s) during switching. Nor does she acknowledge that Amtrak train operations near Champaign Yard have changed very little since 1971.[33] Nor does she acknowledge that it is CN, not Amtrak, that has scheduled freight trains to work Champaign Yard knowing that such trains must occupy the main track while other trains are operating through the area. Champaign Yard illustrates the major impact on freight train delays that CN's infrastructure reduction decisions, freight traffic growth, and operational decisions have had on CN's operations.[34]

At Champaign Yard and everywhere else on CN lines, CN decides for itself the level of railroad infrastructure to build and retain, makes decisions to remove railroad infrastructure and reduce the capacity on its rail network, and unilaterally decides what freight trains it will operate on that infrastructure and when to operate those trains. Since CN makes decisions about its own infrastructure and operations unilaterally, it is not reasonable for the Board to then allow CN to transfer any costs of such decisions onto Amtrak.

CN Sets its Own Performance Priorities and Makes its Own Operating and Asset Utilization Decisions. CN establishes its own performance priorities and makes numerous operating decisions that have a substantial impact on the level of delay experienced by CN trains.

---

[33] Amtrak's City of New Orleans, the Illini trains, and Chicago-Champaign trains have operated on the IC line since 1971. Amtrak's Saluki service began in 2006, before the dramatic growth in freight traffic on the IC main line cited by Ms. Morehouse. Between November 1971 and March 1972, and then again from December 1973 through January 1986, Amtrak operated one additional round-trip per day between Chicago and Champaign in addition to its round-trip service between Chicago and Carbondale.

[34] As part of its alternative capital expenditure proposal, CN is seeking Amtrak-funded capital improvements that would re-install some of the same infrastructure adjacent to Champaign Yard that IC removed beginning in 1989. See Williams/Roberts R.V.S, 18 n.36.

CN makes its own decisions regarding when to run freight trains. CN's freight train schedules and CN's variable adherence to those schedules, which itself depends on a number of other CN operating decisions discussed in this section, determines whether, where and to what extent CN's trains meet or pass other freight trains, commuter trains and Amtrak trains. Thus, CN's scheduling decisions have a significant impact on freight train delay. For example, suppose CN has a freight train that it wants to schedule to operate between Point A and Point B and has a choice between the freight train leaving Point A at 1:00 PM or at 5:00 PM. Suppose further that if the freight train leaves at 1:00 PM, it will not encounter any Amtrak trains during its trip, but that if it leaves at 5:00 PM, it will encounter three Amtrak trains in single-track territory during its trip and experience delay. CN may have other reasons to want to run this freight train at 1:00 PM or at 5:00 PM, but the important point is that CN *can* schedule the freight train to minimize encounters with Amtrak trains, and that Amtrak does not participate in CN's decision of when to schedule the freight train.

CN decides the number and the horsepower of locomotives used on all of its trains, which (all else being equal) determines the acceleration rate of CN trains. Higher acceleration allows CN trains to reach their maximum speeds faster and thereby reduces delay. CN also makes its own decisions regarding track maintenance. CN maintains its rail lines to the level it chooses for its business objectives, balancing the advantage of increased capacity gained from operation of faster freight trains and reduced slow orders against any increased capital and track maintenance expenses.

CN also establishes its own performance priorities and these priorities have an impact on the level of delays experienced by CN trains. For example, CN's witnesses have explained in this proceeding that its operational priorities are train and freight car velocity.[35] It is Amtrak's understanding that CN measures velocity based on the average speed at which a freight train or freight car moves between two given points. On the other hand, CN measures freight train delay as the time (in minutes) that a takes a freight train to move between two given points in excess of the specified time set forth in CN's schedule for that train.

Importantly, higher overall velocity does not always result in lower train delay. Higher velocity can require the trade-off of more train delay. For example, suppose that CN has a block of freight cars parked in a siding and that CN's operating plan has Freight Train X scheduled to pick up these cars and move them to a yard further down the line. However, sometime before Train X is scheduled to pick up these cars, Freight Train Y is passing the same siding headed to the same yard for which the cars are bound. If Train Y stops to pick up the cars, all else being equal, the block of cars will have higher velocity than they would have if they remained on the siding waiting for Train X, but Train Y will be delayed by the amount of time it takes to pick up the cars (and the cars already in Train Y will have lower velocity). One possible consequence of Train Y picking up the extra cars is that higher aggregate velocity comes with higher individual and aggregate freight train delay.

CN's operational priority relating to velocity has other delay trade-offs besides the impact of time taken for extra stops to pick up extra cars. Running longer trains for the benefit of velocity can mean that trains are longer than sidings, reducing capacity for meets and passes at sidings and increasing delays.[36] [redacted]

---

[35] Train and car velocity are "the two most important metrics by which [CN] measure[s] the success of [its] operations." Joint Verified Statement of John Summerfield, Gregg Girard and Anne Morehouse ("Summerfield/Girard/Morehouse V.S."), 20.

[36] In addition, all else being equal, longer trains are slower to accelerate to maximum operating speed and may not even be able to reach maximum operating speed.

[redacted]

[redacted]

[redacted]

CN's priority on velocity causes significant delays to CN freight trains. We understand that Exhibit 4 in the Crowley/Mulholland R.V.S. contains numerous examples from SRS during the 18-month Analysis Period of situations involving [redacted]

[37] See Exhibit 8, [redacted]

[38] Id. [redacted]

[39] Id. [redacted]

[redacted][40]

CN has not addressed any of these points. CN has not explained how freight train delay can reasonably be attributed to Amtrak given CN's freight traffic growth, its unilateral control of capital investment (and disinvestment) for infrastructure, and its performance priorities, asset utilization and operating decisions (such as prioritizing velocity and increasing train lengths). It is particularly important to consider CN's operational priorities in light of CN's proposal. In our view, it is not reasonable for CN to propose a compensation system based on a metric (freight train delay) that is at odds with what CN describes as its operational priorities (velocity and train length).

B. Amtrak's Presence Does Not Prevent CN From Operating its Freight Trains At or Close to CN Schedules

CN runs what it refers to as a "scheduled railroad." This means that CN measures its performance (at least in part) against adherence to its freight train schedules.[41] It does not mean that CN's trains adhere to their schedules or even come close to doing so. In fact, CN's freight train operations vary considerably from their schedules, and the vast majority of CN freight train delay is attributable to non-Amtrak causes. In addition, CN constantly changes its schedules, [redacted]

CN's operational variance of its own trains from their schedules, high-level of self-inflicted delays and constant changes to the schedules of its own trains dispel any impression that it is Amtrak's presence that prevents CN from running a precision railroad.

[40] Crowley/Mulholland R.V.S., 33.

[41] Although CN describes its operational priorities as train and freight car velocity, CN measures freight train delay against [redacted]

i. CN Actual Freight Train Operations Vary Considerably from CN Schedules Due to Self-Inflicted Delays

CN's actual freight train operations vary considerably from their schedules and the vast majority of CN freight train delay is attributable to non-Amtrak causes. Amtrak's expert witnesses Crowley and Mulholland have determined, based on CN's own SRS data, that CN freight trains operated at considerable variance from schedule during the Analysis Period and that most delays to CN freight trains on the subdivisions where Amtrak operates were attributable to non-Amtrak causes.[42] CN's own witnesses in this proceeding have confirmed these observations.[43]

ii. [redacted]

[redacted] It would not be reasonable for the Board to allow CN to charge Amtrak for alleged freight train delays measured against freight train schedules that are modified by CN in this manner and to this degree.

[redacted]

[42] See Crowley/Mulholland R.V.S., 34.

[43] See Baranowski/Fisher V.S., 10 ([redacted]); see also Krueger/Doyle/Rank V.S., 38 (explaining that CN's capacity modeling studies for this proceeding assumed a standard deviation of CN freight train variability from schedule to resemble real-world conditions)

[redacted]4

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

iii. [redacted]

[redacted]

49 See Exhibit 13, email from Ann MacGillivray to Larry Wizauer (Aug. 16, 2012).
50 See Exhibit 14, email from Ann MacGillivray to Donnell Day, Jason Hilmanowski, John Summerfield, Dean Macki, and Austin McConnell (Aug. 11, 2012).
51 Id.
52 See Exhibit 15, email from Eric Foster to Ann MacGillivray (Aug. 19, 2013).

[redacted] For example, [redacted] Among other things, [redacted]

iv. Amtrak's Presence Does Not Prevent CN from Operating a Railroad That Adheres to its Own Schedules

As noted above, CN runs what it refers to as a "scheduled railroad."[55] CN explains that by "running its trains to a schedule, CN helps maximize its utilization of crews, locomotives, and equipment, and produces faster and more consistent transit times for its shippers."[56] CN further states that it "brought the 'scheduled railroad' model to the U.S. freight market, and [CN's] ability to run efficiently and reliably on schedule remains critical to [CN's] competitiveness." [57]

Reading these explanations from CN's witnesses, one could not be blamed for having the impression that Amtrak's operations throw a monkey wrench into CN's well-oiled railroad machine. However, CN's frequent schedule changes, the considerable variance from schedule of CN's actual freight train operations and the predominance of CN's self-inflicted freight train

[53] See Exhibit 16, Deposition of Scott Kuxmann on June 7, 2017 ("Kuxmann Dep.") [redacted]

[54] See Exhibit 17, [redacted]

[55] Summerfield/Girard/Morehouse V.S., 11.

[56] Id.

[57] Verified Statement of Fiona Murray, 2.

delays should dispel any such impression. Amtrak's presence does not prevent CN from running a railroad that adheres to its own schedules.

C. If the Board Ordered Amtrak to Pay Costs of Delays to CN Allegedly Caused by Amtrak, CN Would Have No Incentive to Avoid or Minimize Those Delays

Even if Amtrak was the cause of certain CN freight train delays and was held financially responsible for additional costs that CN could prove were attributable to Amtrak, CN would have no incentive to use its control over the capacity of and operations on its rail network to avoid or minimize those delays if the associated costs were simply paid for by Amtrak. CN could choose to incur such freight train delays, even if they could be avoided by CN, knowing that it could extract cash payments from Amtrak for delay costs.

Perhaps even worse, CN could make operational changes with indifference to the potential costs of the resulting delays, which costs would simply be funded by Amtrak.[58] CN could change when it runs freight trains without regard for the costs of resulting additional delays and just charge them to Amtrak. CN's freight train schedules (regardless of whether CN modifies or adheres to those schedules) determine (all else being equal) whether, where and to what extent CN's trains meet or pass other Amtrak trains and thus have a significant impact on freight train delay.

CN also could run longer freight trains (as advocated by CN senior management) to increase velocity.[59] To the extent the resulting delay costs could be attributed to and charged to Amtrak, CN would be indifferent to the additional delay costs and pleased with the increased velocity. CN could even shift operating costs it knows it will incur anyway from itself to

---

[58] CN establishes its own performance priorities and makes numerous operating decisions that have an impact on the level of delay experienced by CN trains. See Section I.A above.

[59] As noted above, CN's first operational priority is train and freight car velocity and higher velocity does not always correlate with lower delay.

Amtrak. For example, suppose a CN train is bound for one of its freight yards and CN knows that if the train gets to the yard without delay it will wait in the yard anyway until it can be switched. Suppose further there also is an Amtrak train approaching the area, but it is far enough away that if CN chose to do so it could advance the freight train into the yard without delay to either the approaching Amtrak train or the freight train. In this situation, CN could either advance the freight train into the yard (where it would wait anyway), or hold it at a siding outside the yard (where it would meet the Amtrak train) with no overall effect on freight or Amtrak performance. However, if CN chooses to hold the freight train at a siding outside the yard to meet the Amtrak train, CN would code the delay to the freight train "FP" and therefore charge Amtrak for the delay that CN would have incurred anyway. CN would have every incentive to make decisions that allow it to attribute to Amtrak freight train delays for which CN would receive compensation, especially with respect to delays that CN knows its trains will incur anyway.

Also recall the previous example in which CN has a choice between operating a freight train at 1:00 PM when it will not encounter any Amtrak trains, or at 5:00 PM when it will encounter several Amtrak trains. If CN was able to charge Amtrak for any delays meeting Amtrak trains, then CN would have no incentive to schedule the freight train to operate at 1:00 PM and avoid the meets with Amtrak. Even worse, suppose that CN expects the 1:00 PM departure to result in the freight train being delayed one hour meeting other freight trains (delays for which CN would not be reimbursed), whereas the 5:00 PM departure would instead result in the same amount of delay to the freight train, except instead due to meeting Amtrak trains (delays for which CN could send Amtrak a bill). All else being equal, CN would be *better off* choosing the freight train schedule that resulted in delays meeting Amtrak trains.

In addition, CN could reduce the capacity of its rail network without regard to the costs of additional delays ostensibly caused by the presence of Amtrak. For example, CN could reduce its track maintenance standards, allowing slow orders to increase (e.g., if the benefit of lower track maintenance expenses outweighed the disadvantage of lower capacity from slower freight trains) and then send Amtrak an invoice for any associated delay costs that CN claims to have incurred.

II. CN Has Not Submitted Any Reliable Evidence to Prove That Amtrak Caused the Delays for Which It Seeks Compensation or Any Reliable Evidence Establishing the Purported Costs of Such Delays

Even assuming Amtrak could be legally obligated to pay CN for freight train delay costs allegedly caused by Amtrak, and the Board somehow concluded that it was reasonable to order such payments, CN has provided no reliable evidence that Amtrak caused the delays for which CN seeks compensation for the Analysis Period, no reliable evidence that CN incurred any additional costs as a result of the alleged delays during the Analysis Period and no reasonable system for accurately measuring the delay or quantifying the purported additional costs of such delays after the Analysis Period or prospectively.

CN proposes to use its SRS database to quantify freight train delay minutes allegedly caused by Amtrak.[60] However, the SRS System was not designed to measure the cause of freight train delay with the accuracy necessary to serve as the basis for assessing financial costs against Amtrak. Thus, CN's SRS-based calculation of the minutes of delay to CN freight trains allegedly caused by Amtrak for the Analysis Period must be rejected.[61]

CN's expert witnesses, Messrs. Baranowski and Fisher, took the already unreliable minutes of delay calculations from SRS and made them even less reliable by adding delay

[60] See Ladue/Kuxmann V.S., 50-51.
[61] For the same reasons, SRS cannot be used to reasonably measure alleged minutes of delay after the Analysis Period or prospectively.

minutes not attributed to Amtrak in the SRS system to their delay estimate. In addition, Baranowski and Fisher estimated purported labor, fuel and equipment costs that CN allegedly incurred as a result of delays that they attributed to Amtrak for the Analysis Period. However, their cost estimates are not substantiated by specific evidence that such costs are attributable to delays caused by Amtrak and include numerous types of costs which are not short-run avoidable costs.[62] Thus, even apart from CN's reliance on the unreliable calculations from SRS of the delay minutes that CN seeks to attribute to Amtrak, CN's labor, fuel and equipment cost projections also must be rejected.

A. The SRS System was Designed for Managing Freight Rail Operations and Cannot be Repurposed to Accurately Measure Freight Train Delays That CN Seeks to Attribute to Amtrak

CN proposes additions to its base compensation under the Operating Agreement to cover what it claims are the direct and "practicably quantifiable" labor, fuel and equipment costs of delay incurred by CN's freight trains due to Amtrak. CN proposes that these costs be determined using CN's SRS database to identify and quantify CN freight delay minutes caused by Amtrak.[63] The SRS database itself, CN's business processes for using the database, and the resulting data (collectively, the "SRS System") were designed to help CN operate and manage its freight rail network.[64] The SRS System does not and cannot measure freight train delay with the accuracy necessary to serve as the basis for assessing financial costs against Amtrak. Thus, even if the Board determines that Congress intended Amtrak to pay CN for freight train delay costs attributable to Amtrak, the SRS System does not provide an accurate measure of such delays.

---

[62] The Crowley/Mulholland R.V.S. describes both the unreliability of CN's delay minute calculations and the flawed nature of CN's cost projections.
[63] See Ladue/Kuxmann V.S., 50-51.
[64] See Exhibit 18, Deposition of Paul Ladue on June 7, 2017 ("Ladue Dep.") 62:6 (describing SRS as CN's "tool for managing rail traffic").

Therefore, CN's delay evidence for the Analysis Period, all of which is based on SRS reports, must be disregarded.[65]

There are several reasons why the SRS System cannot be used as the basis for measuring freight train delays that CN seeks to attribute financially to Amtrak. The first problem with SRS [redacted] Another problem is that the SRS System [redacted] As a result, the SRS System does not account for all freight train delays. Any delay accounting system that does not measure all delays introduces unnecessary subjectivity into the process of deciding which delays to include and thus makes the process unreliable. The third problem with SRS is that the system [redacted] Moreover, SRS delays are recorded by CN dispatchers, [redacted] The fourth problem with SRS is how it purports to measure the cause of freight train delay. SRS purports to measure the so-called "root cause" of the delay (rather than the direct cause). However, this concept of "root cause" attribution cannot be determined with any degree of objectivity. The fifth problem with the SRS System is that it [redacted] The sixth problem is that [redacted] We will discuss each of these problems in more detail below.

[65] Baranowski/Fisher V.S., 4-10.

i. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted]

CN's variance from schedule, self-inflicted delays and pervasive schedule changes demonstrate that CN's schedules cannot be used as a reliable baseline from which to measure freight train delays allegedly caused by Amtrak. This shifting schedule baseline is exacerbated by the ambiguous manner in which CN freight train schedules are created – Mr. Krueger testified that there is "no hard detailed scientific or consistent approach to the freight schedule" - which further undermines the reliability of measuring freight train delays against such schedules.[66] It is not reasonable for CN to send Amtrak an invoice for freight train delay that is calculated relative to a schedule that was (i) established by CN pursuant to unspecified standards and without any input from Amtrak,[67] (ii) [redacted] and (iii) thereafter not followed anyway by CN's freight trains due to the prevalence of operating delays caused by reasons other than Amtrak.[68] CN's moving-target schedules are an unreliable basis upon which to measure and charge Amtrak for freight train delays.

---

66 See Exhibit 3, Krueger Dep. 299: 13 – 300:4 ("The majority of [freight train] schedules at CN are generated either through using [the Intelligent Train Scheduling software] recognizing all of the crudeness of it and errors of it. Mixed with various or the high number of measures that we have of how long are these trains taking to get off the road and/or the management's … who has authority over the territory of how much time will they allot for this train. So ….there is no hard detailed scientific or consistent approach to the freight schedule. There is a basis of the TPC as a start indication but then that will adjust or be adjusted to the specific objectives and demands and realities of what they see.").

67 As noted on pages 12 - 16 above, CN makes its own decisions regarding freight train schedules, with no input from Amtrak. CN's scheduling decisions have a significant impact on freight train delay and on the frequency and location of planned Amtrak meets and passes. CN *could* schedule freight trains to avoid or minimize encounters with Amtrak trains.

68 See discussion on pages 16 to 21 above about CN's freight train variance from schedule, the prevalence of freight train delay attributable to non-Amtrak causes, and CN's constantly changing schedules.

ii. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted]

The second problem with SRS as a delay measurement system is that [redacted][69] [redacted]

Thus, SRS does not record all freight train delays. Under SRS, the CN dispatcher (who might have incentive to make their own performance look better) [redacted].[70] Any delay accounting system that does not measure all delays introduces unnecessary subjectivity into the process, which makes it unreliable.

[69] Baranowski/Fisher V.S., 3.

[70] It is worth noting that under Amtrak's eDR delay coding system for Amtrak trains, delay is measured against pure running time (excluding recovery time and miscellaneous time that is incorporated into the Amtrak schedules) and thus all delays to Amtrak trains are recorded without subjective selection.

iii. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted]

The third problem with SRS as a freight train delay measurement system is that it relies on CN dispatchers, [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

iv. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because CN Uses So-Called “Root Causes” To Assign Delay Responsibility

The fourth problem with SRS is how CN purports to determine the cause of freight train delay. [redacted] [redacted] As we explain in further detail in Section IV.G below, any number of events, acts, or omissions arguably could be the “root cause” of a given delay. Because there are many possible starting points and causal chains leading to a given delay, a system which allows CN to select one of them as the “root cause” is far too subjective a methodology to use in delay attribution.

---

[73] See Summerfield/Girard/Morehouse V.S., 18 (“[redacted] [redacted].
See Baranowski/Fisher V.S., 7 - 8.

[74] See Morehouse V.S., 17.

Another important problem with root cause is that the information that would be necessary to make these subjective root cause determinations regarding delays to CN freight trains – including information about CN dispatching decisions; CN maintenance practices for equipment, track and signals; how CN establishes its freight train schedules; or the SRS data that CN proposes to rely upon for determining the so-called “root cause” of freight train delay - is not equally available to Amtrak and CN and thus could not be effectively verified or audited. Since root cause depends on a chain of events and subjective judgments about which links in the chain to follow in order to determine causation, there is no “right answer.” This makes verification and audit of root cause delay attributions practically impossible. For these reasons, root cause must be rejected as the means for assigning responsibility for freight train delays under CN’s proposal, where it would be the basis for demanding payment from Amtrak.

v. SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted]

The fifth problem with the SRS system is that [redacted]

[redacted]

[redacted]

[redacted][77]

[redacted]

[redacted]0

[redacted]

vi. **SRS Cannot Be Used to Accurately Measure Freight Train Delay Because [redacted]**

[redacted]

The prevalence of [redacted] is reflected by the contorted analysis that CN expert witnesses Baranowski and Fisher conducted in their effort to attribute freight train delay minutes in SRS to Amtrak. [redacted]

[redacted]

[redacted]

[redacted]

vii. Summary of Numerous Flaws in CN's Proposal to Use SRS as the Basis for Measuring Freight Train Delays That CN Seeks to Attribute to Amtrak

In summary, CN proposes the following system as the basis for charging Amtrak for alleged delays to CN freight trains: (i) [redacted]

[redacted]

[87] The frequency of these coding errors also raises questions about the sufficiency of the SRS training provided to CN dispatchers. See Exhibit 16, Kuxmann Dep., 56:12 - 13 (stating that the SRS training he received as a CN dispatcher "was very minimal and it was pick up as you go.")

[redacted] (v) CN dispatchers make subjective determinations about the so-called "root cause" of the freight train delays reflected in SRS. For all of the reasons described in this Section II of our Rebuttal Verified Statement, CN's proposal to use SRS as the basis for extracting cash payments from Amtrak for each minute of freight train delay that CN seeks to attribute to Amtrak under the system described above should be rejected.

B. Even If the SRS System Could Somehow Be Used To Accurately Measure Freight Train Delay That CN Seeks To Attribute to Amtrak, CN Has Not Submitted Any Reliable Evidence on Purported Costs Incurred by CN As A Result of the Alleged Delays During the Analysis Period

The numerous deficiencies in attempting to use SRS as the basis for measuring freight train delays that CN seeks to attribute to Amtrak are described in detail above. Even assuming that SRS could be used in a reliable manner to measure such freight train delays, CN's claim for delay costs is based on a flawed analysis of the delay minutes reflected in SRS that CN seeks to attribute to Amtrak during the Analysis Period. As explained by Amtrak's expert witnesses, Messrs. Crowley and Mulholland, CN's delay minute estimate is both overstated and unsupported because of the flawed methodologies used by CN's expert witnesses to develop that estimate from the data in SRS. Moreover, CN has failed to substantiate the purported additional labor, fuel and equipment costs that it claims to have incurred during the Analysis Period as a result of such alleged delays that it blames on Amtrak. Messrs. Crowley and Mulholland explain why CN's cost projections are not substantiated by any specific evidence that such costs are attributable to delays caused by Amtrak and include numerous types of costs which are not short-run avoidable costs under railroad accounting standards.[88] Thus, even apart from CN's reliance on the unreliable calculations from SRS of the delay minutes that CN seeks to attribute to Amtrak, CN's labor, fuel and equipment cost projections also must be rejected.

III. The Board Should Not Order Amtrak-Funded Capital Improvements as Alternative Relief

As an alternative to being compensated through Amtrak's base payments for alleged Amtrak-caused delays to freight trains, CN says it would accept a capital investment from Amtrak ranging between $377 - $534 million to be used for capital improvements to the CN lines used for the Blue Water, Wolverine, City of New Orleans, and Illini/Saluki services.[89]

CN bases this proposed alternative relief range ($377 - $534 million)[90] on capacity modeling studies conducted by CN as described in the Krueger/Doyle/Rank V.S. As explained by Amtrak's expert witnesses John Williams and Judith Roberts, CN's capacity modeling studies fail to support CN's proposed alternative relief.[91] The capacity modeling studies are based on a number of flawed or unsupported assumptions. Moreover, CN's own studies fail to establish that the proposed capacity improvements are designed to alleviate conflicts between Amtrak trains and other trains. CN's proposed capacity improvements also would, in many cases, simply put back infrastructure in the Chicago-Memphis corridor that used to exist and that CN itself chose to remove years ago. The Williams/Roberts R.V.S. details the many flaws in CN's capacity

[88] The Crowley/Mulholland R.V.S. describes in detail both the unreliability of Baranowski/Fisher's delay minute estimates and the flawed nature of their cost projections. The Crowley/Mulholland R.V.S. also explains why many of the alleged costs included by Baranowski/Fisher in their estimate are not short-run avoidable costs under the applicable standard for "incremental costs" under 49 USC 24308(a).

[89] Ladue/Kuxmann V.S., 8 at n.15 and 52-53. We assume for the sake of discussion only that the STB has the legal authority in this proceeding to grant CN's alternative relief request for this infrastructure contribution.

[90] The range is based on different target levels of Amtrak service that were used in CN's capacity modeling studies.

[91] See generally Williams/Roberts R.V.S.

modeling analysis. We will point out two additional problems with CN's alternative relief request.

First, CN says it would accept funding from Amtrak for the proposed infrastructure improvements as "fully discharging Amtrak from further responsibility for the incremental costs of CN freight train delays due to Amtrak's *existing* services."[92] We can only assume that CN's explicit reference to Amtrak's "existing" services means that if Amtrak made these capital investments in CN's rail network and later sought to change some aspect of its service over CN, CN could seek additional compensation from Amtrak. In other words, after Amtrak's capital contribution for the infrastructure, CN could change the capacity of its rail lines or the way it operates its freight service[93] and thereafter, when Amtrak sought any change to its existing service which CN deemed to be material, CN would seek additional compensation (or additional capital investment) from Amtrak.

Second, the capacity modeling underlying CN's alternative relief proposal is based on target levels of Amtrak on-time performance that CN does not even meet today.[94] Even setting aside all of the problems with CN's modeling that are identified in the Williams/Roberts R.V.S, it is important to note that CN makes no commitment to meet the on-time performance levels used in CN's capacity modeling (or any other performance standard) in connection with the proposed capital contribution. CN appears to view the capital investment as compensation CN is owed and it would come with no commitments from CN. Thus, CN would have Amtrak make a

---

[92] Ladue/Kuxmann V.S., 53. (Emphasis added).
[93] For example, CN could reduce the capacity of other parts of its rail network; CN could change when it runs freight trains; CN could run longer freight trains; and CN could reduce its freight train operating speeds. See Section I.A, above. In fact, there are indications that CN has been increasing the length of its freight trains generally on its network, in order to move more tonnage per train, without any corresponding increase in siding length on the lines where Amtrak runs. See Exhibit 27, Bill Stephens, Leading the Way, TRAINS, Mar. 2017 at 52-59.
[94] For the reasons described in the Rebuttal Verified Statement of Benjamin Sacks ("Sacks R.V.S."), CN's methodology for determining those target on-time performance levels was flawed.

$377 - $534 million capital investment in CN's network for Amtrak's existing services with no assurance of improved performance.

IV. Even If the Board Orders the Parties to Retain the Current Checkpoint/Relief-Based System, the Board Should Make Significant Changes in the Checkpoint/Relief-Based System to Account for its Numerous Flaws

As discussed in Amtrak's Opening Submission, the checkpoint/relief-based system has failed to motivate CN to provide Amtrak with adequate service, let alone quality service worthy of compensation above incremental cost reimbursement.[95] However, if the STB ordered the parties to continue using a checkpoint/relief-based system despite its substantial flaws, Amtrak proposes the revisions to the system discussed in this Section, which include some aspects of CN's proposal (in some cases with Amtrak's modifications).[96] This alternative set of terms would not resolve the inherent problems with a checkpoint/relief-based system. However, these alternative terms are presented here in the interest of creating a complete evidentiary record.

In any continued checkpoint/relief-based system, there are seven essential elements that must be included if there is to be any chance that the system will motivate CN sufficiently to provide Amtrak with adequate service: (i) [redacted] (ii) the system should measure CN performance and penalties at all Amtrak stations and exit points on CN; (iii) Amtrak should be permitted to use its share of the available recovery time to account for station dwell delays and lateness from origin; (iv) CN should not be permitted to earn additional incentive payment due to circumstances beyond its control; (v) the penalty provision should be triggered when CN's monthly on-time performance drops below 80

---

[95] See Table 1 above and Exhibit 2 (reflecting recent on-time performance and incentive payment data).

[96] CN's proposed changes to the checkpoint/relief-based system were shown in a mark-up of Appendix V to the current Operating Agreement. Ladue/Kuxmann V.S., Exhibit 15. In order to show Amtrak's proposed changes (and to show which CN changes Amtrak could incorporate if the checkpoint/relief-based system is retained), we have included a version of Appendix V with all CN proposed changes "accepted" and then marked to show all proposed Amtrak changes. See Exhibit 28, Amtrak's Proposed Changes to Appendix V of the Current Operating Agreement.

percent; (vi) the penalty should increase the later Amtrak trains are due to CN responsible delays; and (vii) the system should continue to determine attribution for Amtrak train delays based on direct cause, rather than so-called "root" cause.

Amtrak has additional concerns about CN's proposal to add several new relief items to Appendix V of the existing Operating Agreement. If the checkpoint/relief-based system is retained, these new relief items should not be added because they would unreasonably shift responsibility for Amtrak train delays from CN to Amtrak. CN also proposes to adopt Amtrak's delay coding, revise certain relief items and apply the changes to the IC and GTW Lines.[97] If the checkpoint/relief-based system is retained despite its substantial flaws, some of the changes proposed by CN would be appropriate with certain modifications. However, several of the Amtrak delay codes that CN proposes to use as relief items are inapplicable and many of CN's proposed new relief items and many existing relief items would be (or become) redundant and therefore should not be added (or retained). Other refinements and conforming changes to Appendix V and other parts of the Operating Agreement also would be necessary if the checkpoint/relief-based system is retained. All of these items are discussed further below in Sections IV. F and G.

A. The Lookback Provision Should be Removed

If the checkpoint/relief-based system is retained, the Board should eliminate the "lookback" provision. As explained in the Vilter Verified Statement, during periods of sustained poor performance by CN in handling Amtrak trains[98] the lookback provision precludes the penalty provision in the current Operating Agreement from functioning. The same would be true in a continued checkpoint/relief-based system with a lookback provision. As stated in the Vilter

[97] Ladue/Kuxmann V.S., 56.
[98] See Exhibit 28, Section E.

Verified Statement, "[a] penalty payment that does not cost CN anything is not motivating CN to minimize CN [Host Responsible Delay] on Amtrak trains."[99]

B. CN's Performance Should be Measured at All Amtrak Stations and Exit Points on CN Lines

If the checkpoint/relief-based system is retained, the Board should increase the number of checkpoints so that CN's performance is measured at all stations as well as all exit points on CN. This improves (within the significant limitations of a checkpoint/relief-based system) the chance that CN would be motivated to provide adequate service to all Amtrak passengers and not just to those passengers traveling to the end station of a route or the endpoint on CN's rail lines.[100] As shown in the Table below, for the relevant Amtrak services over CN, the vast majority of passengers ride to and/or from intermediate stations.[101]

Service	Percentage of Passengers Traveling Endpoint to Endpoint	Percentage of Passengers Traveling To or From Intermediate Stations
Blue Water	8.4%	91.6%
City of New Orleans	7.9%	92.1%
Illini/Saluki	17.8%	82.2%
Lincoln	25.5%	74.5%
Texas Eagle	4.5%	95.5%
Wolverine	2.6%	97.6%

As demonstrated by the above statistics, CN on-time performance at intermediate stations is important to more Amtrak passengers than on-time performance at endpoint stations. The

[99] See Vilter V.S., 10; Amtrak Opening Statement, 10; Rebuttal Verified Statement of Alan Frankel ("Frankel R.V.S.").

[100] [redacted]

[101] These statistics are for fiscal year 2016 (October 1, 2015 through September 30, 2016).

current checkpoint/relief-based system, with one exception, only measures CN performance at the endpoints of CN's portion of the route.

[redacted]

C. Amtrak Should Be Permitted to Use Its Share of Available Recovery Time for Station Dwell Delays and Lateness from Origin

[redacted]

---

[102] [redacted]

[104] See Exhibit 28, Section A.1. 49 U.S.C. 24101 establishes that one of the statutory goals is "to operate Amtrak trains, to the maximum extent feasible, to all station stops within 15 minutes of the time established in public timetables." [redacted]

[105] Current Operating Agreement, Appendix V, Table 1.

[redacted]

D. CN Should Not Be Permitted To Earn Additional Incentive Payments Due To Circumstances Beyond Its Control

[redacted]

[106] See Exhibit 28, Section A.2 and Appendix II.

[107] See Exhibit 28, Sections A.3, B.1. [redacted]

[redacted]

[redacted]

[110] See Sacks R.V.S., 8.

E. The Penalties Should Increase the Later Amtrak Trains Are Due to CN-Responsible Delays

[redacted][111] [redacted][112]

F. The Penalties Should Begin to Increase When Monthly Average Lateness Exceeds 15 Minutes

Extremely late trains present particular hardships to Amtrak passengers. As explained in the Vilter Opening Verified Statement, when an Amtrak train cannot arrive at a checkpoint within tolerance under the current Operating Agreement, additional CN responsible delay minutes do not harm CN for incentive/penalty purposes and CN therefore has no incentive to try to minimize further delays. However, further delays have a significant impact on Amtrak passengers and Amtrak operations.[113] Therefore, [redacted]

[111] Current Operating Agreement, Sections B, C.
[112] See Exhibit 28, Sections C, D.
[113] Vilter V.S., 8-9.
[114] See Exhibit 28, Section D.2.

G. Delay Attribution for Amtrak Trains Should Continue to be Based on Direct Cause, Not So-Called "Root Cause"

CN makes a distinction between what it calls the "root cause" of a delay and what it calls the "proximate cause" of a delay, and proposes that delays to Amtrak trains should be attributed to their "root cause" wherever possible.[115] For the reasons explained below, the system Amtrak currently uses to attribute cause – what Amtrak calls "direct cause"[116] and what CN presumably means by "proximate cause" -- is the only reasonable way to attribute the cause of delay to Amtrak trains, and CN's proposal should be rejected.

Before discussing the advantages of Amtrak's current method of coding the "direct cause" of Amtrak train delays, it is important to note the deficiency in CN's evidence. That is, CN asks the Board to require Amtrak to create an entirely new method of categorizing delays based on what CN calls "root cause," but nowhere in its submission does CN define for the Board (or Amtrak) what it means by the phrase "root cause" or how delay attribution under a "root cause" principle would actually function.[117] [redacted]

---

[115] Ladue/Kuxmann V.S., 23, 62, and 65. Accordingly, CN proposes to amend section A.3 of Appendix V to provide that "In determining the cause of a particular delay, evidence of root cause, as opposed to proximate cause, shall be taken as the best evidence of the cause of a delay." CN Exhibit 15, Appendix V, Section A.3.

[116] Although CN's proposal differentiates "root cause" from "proximate cause," Amtrak's delay reporting is based on "direct cause." We presume that CN's use of the term "proximate cause" in its proposal is synonymous with Amtrak's "direct cause" methodology.

[117] While CN claims that its incentive/penalty proposal would "provid[e] for a methodology to determine responsibility for the root causes of delay," Willig V.S., 12, such methodology is not provided anywhere in the CN submission.

[redacted].

Apart from these deficiencies in the evidence CN has provided to support its "root cause" argument, the Board should reject CN's proposal on its merits, as it would substitute an uncertain, subjective, and unworkable standard for the clear causation standard Amtrak uses today.

i. The Direct Cause is the Only Event that Conclusively Causes the Delay to the Amtrak Train

The "direct cause" is that immediate event or condition that can conclusively be said to have resulted in a delay to an Amtrak train. When Amtrak records a delay to its train in the eDR system, it records the event or condition that actually caused the Amtrak train to slow down or stop – that is, the event or condition that directly led to the delay occurring. Although there may be a myriad of environmental, operational, decisional and other factors that individually, or together in some unknown proportion, may eventually have contributed to the opportunity for a delay, the "direct cause" of the delay is the reason that the Amtrak train is being slowed or stopped (and removal of the direct cause would permit the Amtrak train to move or regain speed). Therefore, only the direct cause can conclusively be said to have resulted in the delay to the Amtrak train.

For example, suppose a CN freight train slows down because it encounters slow orders due to CN track conditions, and then is pulled into a siding to permit a commuter train to pass. Absent either of these conditions and events, the freight train would already have been in a yard when the Amtrak train passes. Instead, the freight train and the Amtrak train arrive at a location at the same time, and CN chooses to dispatch the freight train ahead of the Amtrak train, resulting in Amtrak having to reduce its speed and incurring a delay. The direct cause of the delay to the Amtrak train is interference from the freight train which CN dispatched in front of the Amtrak train. It is possible that had the slow orders not existed, the meet with the commuter train would not have occurred, the freight train and the Amtrak train would not have been in the same place at the same time, and the CN dispatcher would not have had to make the choice between letting the Amtrak train or the freight train go first. But it would be virtually if not literally impossible to determine whether the slow orders, the commuter train, or the dispatcher's decision-making "caused" the Amtrak train to run behind the CN freight train and in what proportion the delay minutes should be allocated. In contrast, the fact that Amtrak was delayed by a freight train (the "direct cause" of the delay) is not in doubt and not a subjective determination.

ii. CN Has Not Demonstrated That Amtrak's Currently Used "Direct Cause" System of Delay Coding Is Flawed or Inadequate

Before imposing a new delay coding scheme on the parties, the Board should be convinced that there is a good reason for doing so. CN does not supply that reason.

It is important to note that Amtrak's current method of coding delays by their direct cause can work in favor of either the host railroad or Amtrak. For example, if an Amtrak train is delayed by CN freight train interference or CN slow orders, and therefore Amtrak has to re-crew the train and incurs additional delays in doing so, Amtrak codes the additional delay as a re-crew (code "SYS" for "system"), which is an Amtrak-responsible (not CN-responsible) delay because Amtrak is responsible for managing its re-crews in a manner that avoids or minimizes Amtrak crew-related delay. Conversely, under CN's "root cause" proposal as we understand it, Amtrak would code the re-crew delay as a CN-responsible delay (either Freight Train Interference or Slow Orders), because the re-crew would not have been necessary absent the earlier CN freight train interference or slow orders (that is, the freight train interference or slow orders could be considered a "root cause" of the re-crew delay).

Similarly, suppose an Amtrak train out of Chicago is forced to wait for connecting passengers from an inbound Amtrak train that was delayed by CN freight train interference. Amtrak would code the delay to the waiting outbound train as holding for connecting passengers (code "CON"), which is an Amtrak-responsible delay. Under a "root cause" concept as seemingly suggested by CN, the delay to the outbound train waiting for connecting passengers would be coded as CN-responsible Freight Train Interference.

CN has supplied two hypothetical examples that imply that Amtrak's "direct cause" delay coding is unfair to CN, but it provides no data or argument to support that implication. However, even these hypothetical "root cause" examples do not illustrate that the current system is unfair. In one example, CN argues that if Amtrak is delayed behind a CN freight train because the freight train struck a trespasser, the delay should be attributed to the trespasser strike and not the freight train delay. What CN does not reveal is that this is already how Amtrak would code such a delay.[118]

Finally, the direct cause is reported by Amtrak using a uniform set of written, published coding rules and practices applied across all Amtrak trains on all host railroad lines nationwide.[119] [redacted] The rules also provide CN an opportunity to receive, review, and request changes to delay data for every run of every train

[118] See Amtrak Service Standards Manual (Version 10, effective April 30, 2017), Instruction 30 of Section K of Chapter 7, attached hereto as Exhibit 29.
[119] Id. (Section K of Chapter 7).

before that data becomes final.[120] Amtrak's rules provide a system that is not biased toward any result but rather is based on the application of known and clear standards.

iii. The Determination of "Root Cause" Is Entirely Subjective and Would Lead to Frequent Disputes

As a practical matter it would be difficult, if not impossible, to untangle which of any number of interwoven factors played a part – and to what extent – in the circumstances surrounding each and every delay, and to choose which among them to designate as the "root cause." For each delay to an Amtrak train, one would have to arbitrarily choose how far back in time to look for contributing factors; how far away in distance to look for contributing factors; whether to include unconnected contributing factors or only those in a direct chain; to what extent the host railroad could have prevented the delay by responding differently to each contributing factor; and how much each contributing factor may have ultimately been related to the delay.

The difficulty in determining the extent to which a multitude of potential factors may have contributed to an Amtrak delay is illustrated by the following example. Suppose an Amtrak train must wait for a CN freight train that has been routed ahead of it. The reason the freight train was present at that specific time and location could be assigned to many and multiple "root" causes. Imagine a scenario where the CN freight train's original crew had "expired" under the Hours of Service Act due to a combination of the crew's schedule being very tight, meets with other freight trains, other crews not being available, and delays the freight train previously incurred at a grade crossing accident 100 miles away involving another CN freight train. Further suppose that the grade crossing accident was caused by malfunctioning gates, perhaps in part due

120 [redacted]

to an electrical storm in the area the night before. It is possible that had any of these events not occurred, or had occurred differently or at different times, or if CN had or had not taken different actions in response to any of these events, the freight train and the Amtrak train would not have been in the same place at the same time, and the CN dispatcher would not have had to make the choice between letting the Amtrak train or the freight train go first. It would be virtually if not literally impossible to accurately choose, among the myriad of factors, which (if any) of them was the "root cause" of the delay to the Amtrak train. Amtrak might argue that out of all these factors, the CN dispatcher's choice to allow the freight train to go first was the "root cause." In any event, the fact that the Amtrak train was delayed by the CN freight train (the direct cause) is not in doubt and not subjective.

Determinations of so-called "root cause" would be entirely subjective, and as such likely would be the subject of negotiation and dispute between Amtrak and CN. During calendar year 2016, there were over [redacted] individual incidents of delay to Amtrak trains on CN; it would be beyond impractical for Amtrak and CN to conduct subjective negotiations each year to attempt to determine the so-called "root cause" of each such delay, and with little hope of doing so successfully since assigning a "root cause" is inherently subjective with no "right answer."[121]

iv. Relying on "Root Cause" for Delay Attribution Would Relieve CN of Responsibility to Avoid or Minimize Delays

CN appears to argue that delays should not be coded to "freight train interference" in situations where CN can provide an excuse for why the freight train ended up in a position where CN allowed it to delay an Amtrak train. But this type of scheme ignores the extensive control CN has over its tracks and trains operating over those tracks, including the ability to respond to

[121] CN claims, without support, that recent advances in train tracking technology have made it possible to track the root causes of freight train delays. Ladue/Kuxmann V.S., 15. We are not aware of any technology that can sort through the multitude of factors that may contribute to an Amtrak delay to subjectively identify a so-called "root cause".

the many events and conditions that such trains encounter every day. It is CN, not Amtrak or any third party, that has the greatest ability to control whether an unplanned event will result in a freight train ahead of and delaying an Amtrak train. For example, a weather event might be a factor contributing to an unplanned meet between a CN freight train and an Amtrak train; but regardless of why the trains are where they are, it is up to CN to decide which train will be allowed to go first. Coding Amtrak delays based on so-called "root cause" would not give an accurate picture of how or whether CN handles and resolves the events that occur every day on every railroad, by, for example, ameliorating a contributing factor before it contributes to a delay, and dispatching trains so as to avoid freight interference when it is likely to occur for whatever reason. If the parties were required to use "root cause" to code Amtrak delays, CN would have the ability to "shut off the clock" and allow Amtrak delays to occur even when CN could have taken action to minimize or avoid the Amtrak delays in spite of unexpected events.

Relieving CN from responsibility for delaying Amtrak trains by adopting a "root cause" system would also allow CN to effectively expand the amount of recovery time available to it in the agreed-upon Amtrak schedules. That is, every Amtrak schedule has built into it a certain amount of time in addition to the time it takes a train to traverse the route at speed with no delays. The amount of recovery time in each schedule is negotiated between the parties, and is intended to account for the very types of occurrences that CN uses as examples of "root causes," such as bad weather and third-party interference on the tracks. (Similarly, Amtrak's delay-based quality payment and penalty proposal includes allowances for certain amounts of delay; it does not penalize CN just because delays exceed zero.) By relieving itself of responsibility for managing its railroad and dispatching Amtrak trains to avoid or minimize the delays resulting from such events, CN would get a "double dip" in which it is able to obtain relief for delays that would have been absorbed by recovery time.

v. CN's "Root Cause" Proposal Would Enable CN Dispatchers to "Self-Report" on Their Own Performance

Under the current delay reporting system, delays to an Amtrak train are recorded by the conductor of the train. The Amtrak conductor is in the best position to determine the direct cause of delays to his or her train. The conductor is in charge of the train, is the epicenter of activity on the train, and has access to information from multiple sources. Contrary to CN's suggestion that the conductor codes delays based simply on his or her "windshield view,"[122] the Amtrak conductor utilizes multiple sources of information, including (1) direct observation, (2) train bulletins, (3) radio traffic, and (4) information relayed by engineers, dispatchers, maintenance of way employees, signal maintainers, and other train crew members.[123] On the other hand, CN's proposal to rely on the host railroad dispatcher to determine the so-called "root cause" of delays could involve "self-reporting" on the performance of their job function, to the extent that delays (including freight train interference, which is the most prevalent type of delay on CN) are the direct result of their dispatching decisions. By contrast, with the possible exception of delays due to station dwells (which are not Host Responsible Delays), the Amtrak conductor is not "self-reporting" when recording the direct cause of delays and therefore is likely to be more

[122] Ladue/Kuxmann, 64-65.

[123] The Amtrak conductor typically will also have more information relating specifically to the direct causes of delays than the host railroad dispatcher, including but not limited to: (i) actual signal aspects at all wayside signals; (ii) arrival and departure times at stations, and the amount of delay (if any) that occurs at a station (where the host railroad dispatching system only captures passing times at certain interlockings and other control points as trains move between blocks of track that normally are miles long); (iii) passing times at locations that are not control points; (iv) signal indications at signals not controlled by the host railroad dispatcher; (v) causes of delays at stations; (vi) delays due to equipment failures; and (vii) exact mileposts of delays.

objective than the host railroad dispatcher. Thus, the Amtrak system of using conductors to determine direct cause does not suffer from this same risk of bias.

H. CN's Proposed New Relief Items for the Checkpoint/Relief-Based System Should Be Rejected Because They Would Unreasonably Shift Delay Responsibility from CN to Amtrak

CN proposes to add four new relief items to Appendix V, all of which should be denied because they would unreasonably shift responsibility for delays from CN to Amtrak.[124]

CN seeks relief for a "[d]elay of more than two minutes for each instance of delay caused by movement of an Amtrak train over a crossover between tracks."[125] If a crossover is the only possible physical move, then that move is included in the pure running time and is not a delay.[126] But if the CN dispatcher elects to cross over an Amtrak train (*e.g.,* to avoid a conflict with another train) and that Amtrak train incurs a delay, the delay should be attributed to CN and not Amtrak.[127] Since Appendix V already addresses both scenarios, the Board should reject this proposed relief item.

CN proposes a new relief item for delays caused when Amtrak arrives late and unannounced at an entry point to CN's line and is unable to move onto that line due to freight operations.[128] CN claims it is not privy to Amtrak operations off of CN lines and cannot tell

---

[124] In addition to the four proposed relief items discussed in this section, CN's proposed relief item for delays due to movement of maintenance of way trains applies only to Amtrak maintenance of way trains moving on CN between Baron and Gord and Amtrak has proposed changes to clarify this point. See Exhibit 28, B.1.b.4.

[125] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.1.e.11.

[126] Pure Running Time ("PRT") is the travel time of a given train between two points at maximum authorized speed, without delays. Vilter V.S., 15. A crossover could be the only possible physical move in a situation where the location of the Amtrak station requires the Amtrak train to cross over from one track to a parallel track in order to access the station.

[127] CN's proposal appears to be based on a claim in the Krueger/Doyle/Rank V.S. that CN's modeling studies indicated that Amtrak cross-overs should not take more than 2 minutes. Krueger/Doyle/Rank V.S., 37. However, as explained in the Williams/Roberts R.V.S., CN failed to provide any supporting workpapers or other evidence for this assertion. Williams/Roberts R.V.S., 78.

[128] Ladue/Kuxmann V.S., 59-60; Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.1.e.13.

when the Amtrak train is likely to arrive on CN's lines.[129] CN also claims that Amtrak does not regularly inform CN of when late trains are likely to arrive.[130] Accordingly, CN seeks relief for:

> Delays caused by freight train interference that prevents Amtrak from entering CN's line when an Amtrak train arrives at an entry point to a CN line more than 15 minutes after its scheduled arrival without having provided CN with notification of such arrival at least 30 minutes in advance.[131]

The responsibility for communications regarding the status and location of Amtrak trains (including trains running behind schedule by any amount of time or distance) must rest with the host railroads. When an Amtrak train is operating on the line of a host railroad, the train relies on the host for dispatching.[132] Host railroads routinely hand off freight and Amtrak trains from one railroad to another and work out such movements by communicating with each other and by providing reciprocal access to each other's dispatching screens. There is no reason why CN cannot do the same when handing off or receiving Amtrak trains.

CN can establish or use existing communication channels with other hosts to find out when the Amtrak train is likely to arrive on CN's lines. When an Amtrak train is running behind schedule, CN's dispatchers and other host dispatchers are in the best position to discuss likely hand-off times, the location of other trains in the area and other factors relating to successful and timely hand-off of Amtrak trains.[133] Host railroad dispatchers routinely communicate with each other regarding freight traffic interchange, crossing of interlockings, use of trackage rights on

---

[129] Ladue/Kuxmann V.S., 59.
[130] Id.
[131] Ladue/Kuxmann V.S., Exhibit 15, Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.1.e.13.
[132] When Amtrak trains are on Amtrak lines (which are dispatched by Amtrak), Amtrak communicates with connecting railroads regarding the status and location of its trains (including trains running behind schedule).
[133] In addition, Amtrak's dispatchers are unlikely to have the most current or accurate information about the time that the Amtrak train is likely to arrive on CN's line (because other host railroad dispatchers have direct control over that train's authority to move over their territory). Thus, any information that Amtrak could provide to CN's dispatchers about the location and anticipated arrival of that train would be based on speculation.

each other's lines and numerous other matters. CN's proposal would insert Amtrak as a third party in this process, which would make communication less effective.[134]

In summary, CN's proposal to ignore existing communication protocols and resources and instead require Amtrak to act as an intermediary between CN's and other host railroads' dispatchers is impractical, inefficient and inconsistent with industry practice. Thus, CN's proposed relief item for late-arriving Amtrak trains should be rejected.

[redacted]

[redacted]

[redacted]

---

[134] CN's proposal increases the risk that CN's dispatcher might hear potentially conflicting information about Amtrak trains from multiple parties. If CN's dispatcher needs additional information besides what it can easily obtain by communicating with other host railroad dispatchers or viewing their dispatching screens, Amtrak already makes available to CN (and all host railroads) virtual private network ("VPN") access to Amtrak train status data.

[135] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.1.e.9. [redacted] This is not immediately apparent from Exhibit 15 of the Ladue/Kuxmann V.S. because CN omitted the existing provision from its redlined proposal.

[136] Ladue/Kuxmann V.S., 10, 67.

[137] Current Operating Agreement, Appendix V, Section A.2.

[138] Even apart from the program maintenance provision, Amtrak has agreed to 17 temporary schedule changes to accommodate various CN track work projects between 2010 - 2016, including canceling Amtrak trains, running buses in place of trains, truncating Amtrak service, lengthening train schedules and changing start times. See Exhibit 30.

[redacted]

CN also seeks relief for [redacted][139] Amtrak is entirely dependent on its host railroads to dispatch Amtrak's trains across their rail lines. This includes situations where the host railroad's line crosses the line of another railroad at interlockings controlled by the other railroad. It is the host railroad (not Amtrak) whose operating relationship with the other railroad governs the operations of the crossing. It is the host railroad whose dispatcher needs to notify the other railroad what trains are approaching the crossing and in what order, which track each train will occupy, and which [redacted] are for which trains.

[redacted] However, Amtrak does not know when the CN dispatcher plans to have Amtrak arrive at the crossing, what freight trains the CN dispatcher may route ahead of Amtrak at the crossing, when the CN dispatcher will be ready to line Amtrak across the crossing, or what [redacted] the CN dispatcher has or has not sent the controlling railroad's dispatcher. It is the CN dispatcher

[139] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.1.e.15.g.

who, for both efficiency and safety reasons, needs to coordinate with the dispatcher of the controlling railroad. Amtrak cannot dispatch itself across CN's railroad.[140]

I. Adopting Amtrak Delay Codes As Relief Items Would Necessitate Certain Refinements and Conforming Changes

[redacted]

140 [redacted]

141 Ladue/Kuxmann V.S., 56.

i. CN Proposes Adoption of Amtrak Delay Codes that are Inapplicable

CN proposes for inclusion in Appendix V the following five relief items based on Amtrak delay codes:[142]

Code	**Code Description**	**Explanation**
CTC	CETC System	Failure of CETC train control system.
UTL	Utility Company Failure	Failure due to utility company issue.
MTI	Disabled Train Ahead	Disabled train ahead due to mechanical failure.
BSP	Bridge Strike	Under grade bridge strikes by vehicle or boat
NOD	Unused Recovery Time	Wait for departure time

The Board should reject CN's proposed use of these five delay codes as relief items, the first four of which are used only on the Amtrak Northeast Corridor ("NEC"). The CTC code applies to failure of the Consolidated Electrification and Train Control System ("CETC") on the NEC. The UTL code is used for electric power failure on the NEC. The CN lines used for Amtrak services do not use Amtrak's CETC system or a catenary system. Likewise, MTI and BSP are used only as Amtrak delay codes on the NEC. Off the NEC, Amtrak delays due to a CN train ahead (whether or not it is disabled) are coded as FTI, delays due to a disabled commuter train are coded as CTI, and delays due to a disabled Amtrak train ahead are coded as SYS. Similarly, Amtrak delays due to a vehicle or boat striking a bridge off the NEC (whether undergrade or not) are coded as TRS.[143]

[142] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.1.e.1; CN Appendix IX, "Definitions of Delay Codes."

[143] TRS covers several things that do not literally involve trespassers, including road crossing accidents and vehicles stuck on tracks.

Code NOD represents time spent at a station because a train has arrived early and therefore must wait for its scheduled departure time. Incorporating NOD as a relief item would mean that early arrival at one station would allow CN to deliver the Amtrak train that many minutes later at all subsequent stations.

ii. CN's Proposal to Adopt Amtrak Delay Codes As Relief Items Makes Retention and Addition of Certain Other Relief Items Redundant

CN has retained or proposed to add certain relief items that are made redundant by its proposal to formalize the use of Amtrak's delay coding for relief. Exhibit 31 to this Rebuttal Verified Statement is a Table showing these relief items and the specific Amtrak codes that already address relief items that CN is proposing. One of these items requires additional explanation, beyond Exhibit 31, as described below.

[redacted]

iii. The Addition of Checkpoints and the Adoption of Delay Coding Make Many Provisions for Not Counting Trains in Quality Payment and Penalty Calculations Obsolete

Adding checkpoints and adopting delay codes would render obsolete a number of provisions in the current Operating Agreement that cause a train trip to not be counted for purposes of quality payments and penalty calculations. While CN may be granted additional

---

[144] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.1.e.15.

minutes through delay coding, CN should remain accountable for otherwise minimizing delay in such situations as on any other train. Table 2 below shows these obsolete provisions and the delay codes that would apply.

Table 2

Obsolete Items[145]	Delay Code	Description	Explanation
"The train has struck a pedestrian, animal or vehicle or is blocked by a vehicle (other than vehicles owned or operated by CN or its employees, agents, contractors, acting in their capacities as employees, agents, or contractors of CN, and which are not responding to an emergency)."[146]	TRS	Trespasser	Trespasser Incidents (includes crossing accidents, trespasser or animal strikes, vehicle on track ahead; "near-miss" delays; bridge strikes by vehicle or boat)
"The train is blocked by an emergency vehicle (including a vehicle owned or operated by CN or any of its employees, agents, contractors, acting in their capacities as employees, agents, or contractors of CN, and which are responding to an emergency) or fire hoses, or is held by civil authorities."[147]	POL	Police-Related	Police Related (DEA; police/fire department holds on right-of-way, bomb threat delays; can include on-train police activity)
"The trip of the train is delayed due to broken rails where the broken rail occurred in connection with severe weather and CN provides Amtrak with CN incident reports confirming same."[148]	WTR	Weather-Related	Weather (includes heat/cold orders; storms, floods, fallen trees, washouts, landslides; earthquake-related delays; slippery rail due to leaves; burning leaves caught under truck of car; snow-removal equipment working ahead; ice or snow under equipment, including wayside defect-detector actuations caused by ice;

[145] CN proposed utilizing Amtrak delay codes that were defined and in effect as of September 2015. For clarity, Amtrak describes the delay codes referenced above based on the definitions currently in effect.
[146] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.4.c.1.
[147] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.4.c.2.
[148] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.4.c.4.

Table 2			
Obsolete Items[145]	**Delay Code**	**Description**	**Explanation**
			flash-flood warnings; high-wind restrictions)
"The trip of the train arrives late due to being delayed by another Amtrak train experiencing delays from any of the foregoing two items or a force majeure event."[149]	Various	Various	Amtrak's delay reporting procedures specify that where the rail line ahead is completely blocked or closed due to a specific debris, drawbridge-opening, police/fire department hold, trespasser, or severe-weather incident, the delay will be coded based on the blockage (e.g., DBS, MBO, POL, TRS, or WTR) up until the time when the rail line is re-opened, even if there is another train between the Amtrak train and the rail line blockage.
"The trip of the train is delayed by more than 10 minutes due to acts of vandalism on the Rail Lines which require the Amtrak passenger train to stop or be operated at reduced speed for a portion of its trip."[150]	TRS	Trespasser	Trespasser Incidents (includes crossing accidents, trespasser or animal strikes, vehicle on track ahead; "near-miss" delays; bridge strikes by vehicle or boat)
"The trip of the train is delayed by (i) heat orders reducing the maximum speed of the train to 60 mph as a result of ambient temperatures at or above 95 degrees; (ii) cold orders reducing the maximum speed of the train to 60 mph as a result of ambient temperatures between minus 10 and minus 25 degrees F; or (iii) cold orders reducing the maximum speed of the train to 50 mph when the temperature is less than minus 25 degrees F; provided, however, that relief will not be granted	WTR	Weather-Related	Weather (includes heat/cold orders; storms, floods, fallen trees, washouts, landslides; earthquake-related delays; slippery rail due to leaves; burning leaves caught under truck of car; snow-removal equipment working ahead; ice or snow under equipment, including wayside defect-detector

[149] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.4.c.5.
[150] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.4.c.6.

Table 2			
Obsolete Items[145]	**Delay Code**	**Description**	**Explanation**
under this paragraph for delays resulting from a more restrictive heat or cold order, or from failure of CN to remove heat or cold restrictions once temperatures leave the temperature ranges in which restrictions are required, and that CN shall carefully monitor temperatures to minimize delays."[151]			actuations caused by ice; flash-flood warnings; high-wind restrictions)

[redacted]

iv. Relief for Westbound Amtrak Trains at Joliet is Not Necessary

[redacted]

[151] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.4.c.7.
[152] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.4.c.3.
[153] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.4.c.3.
[154] Ladue/Kuxmann V.S., Exhibit 15, CN Proposed Appendix V Section A.1.d.

[redacted]

v. CN's Proposed Provision for Consistent Failure to Meet Base Performance Standards Is No Substitute for an Effective Penalty System

CN proposes to develop a new provision for the Operating Agreement to assure that if CN performance under the Operating Agreement is so poor that it incurs performance penalties for six consecutive months for any train group (as categorized for purposes of performance payments and incentives), the parties would be required to work together to determine why and develop remedial measures to address the issue. The parties would be bound to use their best efforts and work in good faith to "determine if there are impediments to CN achieving the base level of performance and, if so, how those could be reduced or eliminated and what changes could be made to the Agreement to do so."[155]

In Amtrak's view, this proposed provision is not an adequate substitute for a penalty provision that motivates CN to minimize delays to Amtrak trains. The purpose of the penalty provision itself is to motivate CN to improve on-time performance in order to avoid incurring penalties.[156] There is no need for CN's proposal to change the Operating Agreement if CN starts incurring penalties. Similar to CN's position on the lookback provision, this proposal by CN would render the idea of a performance penalty meaningless if the host is not obligated to pay penalties when its performance handling Amtrak trains is poor.

[155] Ladue/Kuxmann V.S., 66.
[156] See Section IV.A., above.

V. The STB Should Deny CN's Binding Schedule Review Proposal

A. Summary of CN Schedule Review Proposal and Reasons It Should Be Denied

CN proposes that the Board require the parties to engage in binding, model-driven reviews of Amtrak schedules.[157] In support of this proposal, CN claims the Amtrak schedules have not been jointly examined for many years, have key elements that are inaccurate, have year-round application (lacking flexibility for seasonal events), that Amtrak refuses to lengthen the schedules and that the schedule adjustment process in the Operating Agreement is not conducive to schedule modification.[158]

There are several reasons why the Board should not adopt CN's proposal for binding and model-driven reviews of all Amtrak schedules. First, if the schedules are not inaccurate, then it is not important whether or not they have been jointly examined recently. However, CN has not submitted any reliable evidence of any inaccuracies in Amtrak's schedules. Even though CN's modeling proposal covers Amtrak schedules on all six of the relevant Amtrak services on CN, CN presents no evidence of inaccuracies in the schedules for four of the services and the purported evidence on the other two (the Illini/Saluki and City of New Orleans) is limited to a single issue of an alleged pure running time shortfall. The alleged shortfall is based on unreliable modeling conducted by CN.[159]

CN has never initiated the schedule adjustment procedure in the current Operating Agreement, but nevertheless says it "is not conducive to a productive joint process of schedule development" because the proposing party must include a proposed schedule at the outset.[160]

---

[157] Ladue/Kuxmann V.S., 10 and 66-67.
[158] Ladue/Kuxmann V.S., 9-10.
[159] See Williams/Roberts R.V.S., 72.
[160] Ladue/Kuxmann V.S., 66.

Never having initiated the process, CN has no basis to claim that submitting a schedule in advance is not conducive to schedule development.

CN also says it can be "difficult or impossible" to win Amtrak's agreement to a longer schedule.[161] Amtrak does not lightly agree to the lengthening of a schedule, because longer schedules generally make Amtrak service less attractive to passengers, increase Amtrak's costs and conflict with Congressional policy goals of fast and reliable Amtrak service.[162] In addition, the concession of a longer schedule comes with no assurance from CN that the longer schedule will lead to better on-time performance.[163] CN says its annual modeling and schedule review with Via Rail Canada ("VIA Rail") has improved VIA Rail's performance.[164] As explained below,[165] the facts tell a different story.

If the Board does decide to order any schedule review, it would not be reasonable for modeling to "drive" the schedule review process. Even when appropriate, modeling is merely a tool and neither side should be bound to automatically implement the results. In addition, the specific objectives of the modeling should be set by the parties, not prescribed by the Board.

---

161 Id. Amtrak has made at least two proposals to CN to redistribute recovery time in the schedules for the Illini/Saluki and City of New Orleans services. One Amtrak proposal was sent to CN in January 2011. CN indicated that the proposed reallocation did not work with CN freight train schedules. Amtrak followed up numerous times over the next five months seeking to discuss any CN concerns and reach resolution. However, CN did not respond to Amtrak's requests. Amtrak made another proposal in February 2017. See Exhibit 32, February 13, 2017 emails from Amtrak's Michael Azen to CN's Scott Kuxmann. Approximately six months later (after some back and forth between the parties), CN responded on August 18, 2017 with a proposal to lengthen the Illini/Saluki schedules by 32 to 54 minutes."

162 See 49 USC 24101 (c)(6) (specifying that one of Amtrak's goals is to "implement schedules based on a systemwide average speed of at least 60 miles an hour that can be achieved with a degree of reliability and passenger comfort").

163 This is especially true given the considerable variance from freight schedules of CN's actual operations.

164 Ladue/Kuxmann V.S., 65-66.

165 See 70-72.

Modeling is time consuming, expensive and, in this instance, unjustified. Amtrak is willing to conduct a field study with CN of the pure running time on the CN lines used for the Illini/Saluki and City of New Orleans services. This would allow resolution of any disputes about the pure running time on these two routes without the expenditure of time and money necessary for modeling. In addition, such field studies would be necessary even if modeling were conducted in order to validate any modeling-based PRT's before they were considered as an input to the schedule evaluation process.

B. CN's Only Support for its Binding Schedule Review Proposal is Unreliable Evidence of Alleged PRT Shortfalls on Two of Amtrak's Six Services on CN Lines

CN says schedule review is necessary because the schedules for certain Amtrak services "have not been jointly examined by the parties in many years, and CN's evidence shows that at least some key elements of those schedules are outdated and inaccurate."[166] Despite this broad claim, CN provides no evidence whatsoever regarding alleged inaccuracies with respect to four out of the six relevant Amtrak services operating on CN's lines.[167] Therefore, CN's scheduling proposal should be examined by the Board only with respect to the Illini/Saluki and City of New Orleans services. Even with respect to the schedules for the Illini/Saluki and the City of New Orleans services, CN makes only the single assertion that PRT's in the existing schedules for those specific services are too short. However, CN's evidence regarding PRT shortfalls is based on unreliable modeling.[168]

---

[166] Ladue/Kuxmann V.S., 66.
[167] Ladue/Kuxmann V.S., 33-34, summarizing the results of certain TPC simulations conducted by CN on the City of New Orleans and Illini/Saluki services only as described in the Krueger/Doyle/Rank V.S.
[168] See Williams/Roberts R.V.S., 70.

i. CN's PRT Modeling on the City of New Orleans Service is Unreliable

On the City of New Orleans service, CN claims that the PRT in Amtrak's schedule is deficient by 19 minutes on the northbound train and 36 minutes on the southbound train.[169] This alleged deficiency is based on the Train Performance Calculator ("TPC") simulations conducted by CN as summarized in the Krueger/Doyle/Rank V.S. For the reasons explained in the Williams/Roberts R.V.S., CN's TPC simulations with respect to PRT on the City of New Orleans service are not reliable.[170]

For example, the CN modelers used 1 locomotive and 9 passenger cars as the Amtrak consist size for the TPC simulations they ran to model the PRT's for the City of New Orleans service. However, they a different Amtrak consist size for the City of New Orleans service in their capacity modeling studies. The Kruger/Doyle/Rank V.S. does not contain any explanation for this discrepancy.[171] The CN modelers also replaced an actual 17-mile section of track used by Amtrak to access Memphis station with a fictitious Amtrak operation on a longer freight route around Memphis and through CN's Harrison Yard, and assumed a "station" stop inside Harrison Yard, due to limitations in CN's TPC model.[172] For these and other reasons specified in the Williams/Roberts R.V.S, CN's PRT modeling on the City of New Orleans service is unreliable.[173]

---

169 Ladue/Kuxmann V.S., 36-7, Table 4; Krueger/Doyle/Rank V.S., 36, Table 13.
170 See Williams/Roberts R.V.S., 71.
171 [redacted]
172 Krueger/Doyle/Rank V.S., 21.
173 See Williams/Roberts R.V.S., 71.

ii. CN's PRT Modeling on the Illini/Saluki Service is Unreliable

CN claims that the PRT in Amtrak's schedule is low by 15.5 minutes on the northbound Illini/Saluki service and 14.1 minutes on the southbound Illini/Saluki service.[174] This alleged deficiency is based on the TPC simulations conducted by CN as summarized in the Krueger/Doyle/Rank V.S. The 15.5 minute and 14.1 minute PRT shortfalls alleged by CN are based on TPC simulations using an Amtrak train consist of 1 locomotive and 7 passenger cars.[175] This consist used by the CN modelers in the TPC simulations for the Illini/Saluki trains incorporated minimum axle-count requirements imposed by CN to address a potential activation failure associated with CN's grade crossing equipment.[176] In other words, CN's PRT calculations inappropriately incorporated this delay factor as a component of PRT, which makes them inaccurate. For the reasons further explained in the Williams/Roberts R.V.S., CN's TPC simulation modeling for the Illini/Saluki service is unreliable as well.[177]

---

[174] Ladue/Kuxmann V.S., 38, Table 6. The table heading says City of New Orleans Schedules, but the table shows the Illini/Saluki service endpoints.

[175] Krueger/Doyle/Rank V.S., 36 n.33.

[176] Since approximately 2009, CN has imposed speed restrictions on Amtrak trains operating through CN grade crossings on the CN lines used for the Illini/Saluki service; and since approximately 2010, CN has required Amtrak trains to have a minimum of 30 axles on the line used for the Illini/Saluki service. See Exhibit 33, 15. To meet CN's axle requirement, Amtrak's train consist on the Illini/Saluki is one locomotive and seven passenger cars. Absent the axle requirement, Amtrak would run one locomotive and four passenger cars. These requirements were imposed by CN in order to address an activation failure issue on CN's grade crossing signal system. Amtrak and CN are working with the Federal Railroad Administration to determine whether the activation failures were caused by Amtrak's equipment or by CN's signal system. Depending on the outcome of that analysis by the FRA, the speed restriction and the axle requirement will be appropriately accounted for in the performance payment/penalty calculations. In either case, the restrictions should not be factored into the measurement of PRT. However, CN's TPC simulation modeling with respect to the Illini/Saluki incorporated the minimum axle count requirement by using an Amtrak train consist of seven passenger cars.

[177] See Williams/Roberts R.V.S., 73 - 75.

iii. CN's Average Schedule Speed Comparisons Provide No Credible Evidence that Amtrak's Illini/Saluki PRT is Insufficient

CN says a comparison of the average scheduled speed of other Amtrak services to that of the Illini/Saluki service demonstrates the "poor design" of the Illini/Saluki schedule.[178] However, CN's comparison is not valid because each territory, track structure, and hosts' speed limits vary. The Illini/Saluki route on CN, for example, is a comparatively straight, flat railroad with a maximum passenger speed of 79 mph for most of the route.[179] Nevertheless, CN compares the Illini/Saluki to The Pennsylvanian service,[180] which operates through mountainous terrain for much of its route, with many curves and steep grades. The Pennsylvanian is home to the Horseshoe Curve famous for its climb up the Allegheny Mountains. Based on terrain, one would expect The Pennsylvanian to have a lower average speed than the Illini/Saluki, regardless of how their schedules are built.

CN also compares the Illini/Saluki to the Capitol Corridor and the Pacific Surfliner.[181] The Capitol Corridor and the Pacific Surfliner both have many more passenger stops than the Illini/Saluki. The Illini/Saluki has 10 stops in 307 miles between Chicago and Carbondale. The Capitol Corridor trains make 13 stops in only 134 miles between San Jose and Sacramento, and the Pacific Surfliner makes 9 stops in only 129 miles between Los Angeles and San Diego.

---

[178] Ladue/Kuxmann V.S., 39-43. The discussion makes it clear that CN is presenting this as another way to evaluate allegedly insufficient PRT. Id. at 39.

[179] Illinois Central passenger trains at one time operated at speeds of up to 100 mph on portions of this route. The IC ran trains up to 100 mph from around 1950 through 1970 and continued at 90 mph after Amtrak was formed. The higher speeds were suspended when IC single tracked its main line and removed the Automatic Train Stop system in the late 1980s.

[180] See Ladue/Kuxmann V.S., 41-E, Table 8.

[181] *Id.* Although CN states that it excluded dwell in their calculation of the scheduled miles per hour figures reflected in Table 8 of the Ladue/Kuxmann V.S., it is not clear that CN made any adjustments for acceleration and deceleration at station stops.

Based on these factors, one would expect the Capitol Corridor and Pacific Surfliner to have a lower average speed than the Illini/Saluki, regardless of how their schedules are built.[182]

CN's attempt to represent the Illini/Saluki service as having an insufficient schedule by comparing its average speed to other dissimilar Amtrak trains is an apples-to-oranges comparison and should be disregarded.

iv. Amtrak Has Every Incentive For the PRT's In Its Schedules To Be Accurate and CN Would Not Be Prejudiced Under Amtrak's Delay-Based System or CN's Checkpoint/Relief-Based System For Any PRT Shortfalls

Even assuming that CN had provided reliable evidence that there were any inaccuracies in the PRT's reflected in Amtrak's schedules for the City of New Orleans or Illini/Saluki services, to the extent that Amtrak schedules did not include sufficient PRT any such shortfall would be accounted for under delay code OTH, which is an Amtrak Responsible Delay. Thus, Amtrak would have every incentive under both its delay-based system and CN's checkpoint/relief-based system to ensure that the PRT's in Amtrak's schedules are correct since Amtrak (and not CN) would be responsible for any delays resulting from PRT shortfalls, and under neither system would CN be penalized for such delays.

C. CN Has Not Invoked the Current Schedule Adjustment Procedure and Therefore Has No Basis to Claim It Does Not Work or Criticize Amtrak for Failing to Agree to Every Schedule Change Proposed Informally by CN

CN acknowledges that the current Operating Agreement allows either party to propose a schedule change, but CN says the proposing party must provide a "full revised schedule at the outset" and complains that doing so "is not conducive to a productive joint process of schedule

---

[182] The Ethan Allen route includes mileage on the Vermont Railway, a short line with maximum passenger train speeds between 30 and 59 mph due to curvature, track class, and a lack of automatic signals. See Ladue/Kuxmann V.S., 41. The Adirondack and Maple Leaf services must cross the U.S.-Canadian border and their schedules include time for Customs work at the border. The Adirondack, moreover, includes 70 miles in which the trains wind through mountainous territory along the edge of Lake Champlain generally between Ticonderoga, NY and Plattsburgh, NY. The maximum speeds on this segment range from 30 to 50 mph. Ladue/Kuxmann V.S., 41.

development."[183] This requirement to provide a full schedule (reflecting the proposed Amtrak arrival and departure times at all stations along the route, including those stations on other hosts) with any schedule change request was negotiated by the parties and added to the Operating Agreement in 2011. CN has not explained why submitting a full revised schedule at the outset of the process is burdensome.[184]

CN also has never tried to use the current Operating Agreement's schedule change procedure. Never having invoked the process, CN has no basis to claim that submitting a full schedule at the outset is not conducive to schedule development. Nonetheless, Amtrak is amenable to removing the requirement to provide, in conjunction with any schedule change request under the new Operating Agreement, a full revised schedule applicable to the portions of the Amtrak service that operates over the lines of other host railroads.

CN also says it "has learned from experience that it can be difficult or impossible to win Amtrak's agreement to a schedule modification that calls for any lengthening of the schedule."[185] Schedule lengthening proposals must be evaluated for the risk that Amtrak service will become less competitive than the other travel options available to Amtrak customers, such as automobile and intercity bus on our regional services and air travel on our longer routes.

Besides ridership risk, the concession of a longer schedule comes with no assurance or contractual commitment from CN that the longer schedule will lead to better on-time performance. As noted in the Crowley/Mulholland R.V.S., during the Analysis Period, CN actual freight train operations varied considerably from their schedules.[186] If Amtrak were to

---

[183] Ladue/Kuxmann V.S., 66.
[184] In fact, such a practice can save time during the schedule negotiation process because the party receiving the proposed schedule can begin to analyze it from the outset.
[185] Ladue/Kuxmann V.S., 66.
[186] See Crowley/Mulholland R.V.S., 34.

agree to accept a longer schedule in any particular situation, the considerable variance from freight schedule of CN's actual operations helps illustrate that there is no assurance of improved on-time performance or assurance that Amtrak trains would meet or pass CN trains at planned locations.

In particular, Amtrak has not agreed to CN's informal requests to lengthen Amtrak's schedules to account for seasonal increases in freight traffic and seasonal weather impacts.[187] Amtrak schedules on CN already include generous amounts of recovery time *all year* that are more than sufficient to account for any seasonal issues. For example, the United States has two wheat product harvest periods. To add additional time to Amtrak schedules to facilitate both harvests, Amtrak schedules would be lengthened even further from mid-May through mid-September. Combined with CN's request for longer schedules to account for seasonal heat and cold impacts, schedule adjustments for the harvest seasons would mean Amtrak would run longer "seasonal" schedules for eight out of twelve months in the year. Amtrak has been willing from time to time to implement schedule adjustments that were proposed by CN outside of the formal process set forth in the existing Operating Agreement.[188] The fact that Amtrak has not agreed to all proposed schedule changes does not justify CN's elaborate and expensive proposal to require the parties to engage in binding model-driven reviews of Amtrak's schedules.

D. Any Modeling Conducted in Connection with Schedule Review Should Be Based on Assumptions and Objectives Established by the Parties

If the Board does decide to order any schedule review, the objectives of the schedule review and the extent and uses of modeling should be determined by the parties, not prescribed by the Board. Modeling is merely a tool to provide information and neither side should be bound

[187] CN says Amtrak schedules lack flexibility for seasonal events. Ladue/Kuxmann V.S., 10.
[188] Amtrak and CN informally have agreed to implement permanent and temporary schedules changes approximately 60 times between 2010 and 2016. See Exhibit 30.

to automatically implement the theoretical output from modeling without conducting field verification.

CN proposes that the modeling "can and should take into account such things as (1) the specific Amtrak consists proposed to operate on the route; (2) the specific infrastructure and capacity constraints that exist on the route; and (3) the level of existing and projected freight and passenger traffic on the route." In addition, CN says "the parties may wish to consider seasonal factors, anticipated construction of new railroad capacity, and cyclical maintenance of way work."[189]

To the extent that the factors mentioned above by CN (such as train consist size and the applicable track infrastructure on the route) are appropriate inputs to PRT calculations, they would be reasonable inputs for the parties to discuss and agree upon prior to the initiation of any modeling studies. However, the other factors mentioned by CN (including passenger and freight traffic growth) would need to be considered only after the parties had determined the objectives of the modeling. If modeling were ordered, Amtrak would want to consider inexpensive operational and schedule changes that would improve the quality of service CN provides to Amtrak before addressing items such as construction of new railroad capacity, which even if modeled could not be mandated by the Board.

CN notes that CN and VIA Rail jointly review VIA Rail's schedules annually and that by employing modeling techniques with respect to VIA Rail trains, CN has had "great success improving their performance."[190] Although it is unclear which modeling techniques CN and

[189] Ladue/Kuxmann V.S., 67.
[190] Ladue/Kuxmann V.S., 65-66.

VIA Rail use or whether the modeling results are binding on both parties,[191] a VIA Rail 5-year plan summary[192] and published accounts of VIA Rail on-time performance challenges[193] tell a different story. The VIA Rail 5-year plan summary states that in 2009 VIA Rail added half a day to the schedule of the *Canadian* Service that operates almost exclusively on CN between Toronto and Vancouver. However, VIA Rail also reported that the on-time performance results on the *Canadian* service in the next six and one half years after lengthening the schedule declined precipitously, as shown in Table 3 below:

Table 3 On-Time Performance – Canadian							
Year	2009	2010	2011	2012	2013	2014	2015 (first 6 months)
OTP	84%	84%	74%	70%	60%	33%	24%

This information demonstrates that CN's modeling and scheduling lengthening process with VIA Rail did not improve performance on the *Canadian* service. CN has not offered any evidence supporting its claim that modeling has been successful in improving VIA's performance.

E. Amtrak is Amenable to Joint PRT Field Checks on the Illini/Saluki and City of New Orleans Routes

In addition to the schedule review procedure in the current Operating Agreement, Amtrak is amenable to field checks of the Pure Running Times on the Illini/Saluki and City of New

[191] CN lists all of its suggestions for binding modeling (Ladue/Kuxmann V.S., 65) and then says "[b]y employing such techniques with respect to VIA trains, CN has had great success improving their performance." Id. at 66. We do not take this to mean CN uses all of the listed suggestions with VIA Rail.
[192] See Exhibit 34, VIA RAIL CANADA, SUMMARY OF THE 2016 – 2020 CORPORATE PLAN AND 2016 OPERATING AND CAPITAL BUDGETS, 15 (2016)(published to the VIA Rail website on or about May 5, 2016).
[193] "Travelers from Australia and England… are baffled at the inability of VIA Rail to stick to the [*Canadian's*] schedule, even its lengthened one." See Exhibit 35, Glenn Cartwright, Op-Ed., *Passenger-Train Service Falling Off the Rails,* VANCOUVER SUN, Aug. 28, 2016.

Orleans routes.[194] Field checks can be completed quickly and inexpensively. Field checks also incorporate real-world conditions – a real train operating over the actual route.[195] Field checks are performed by an Amtrak or host railroad representative, or both, riding in the locomotive cab on one or more real trips and taking detailed notes about actual events and speeds at each location. If the Board decides to order fields checks of the PRT on the Illini/Saluki and City of New Orleans routes, the field checks should not delay implementation of a delay based quality payment/penalty system.

Amtrak has used the field check process successfully to evaluate the schedules for Amtrak services on lines of other host railroads. Recent joint field studies conducted by Amtrak with other Class I railroads have generated adjustments to the schedules on various Amtrak services. The field check process is inexpensive, easily understood by Amtrak and the other host railroads, devoid of controversy over modeling assumptions, and can be implemented quickly.

---

194 Amtrak also would be willing to conduct field checks with CN of the pure running times for the other Amtrak services over CN. However, if the Board requires the parties to conduct field checks or modeling in conjunction with field checks, these procedures should not delay implementation of the delay-based quality payment and penalty system.

195 See Exhibit 3, Krueger Dep. 260:10-25 (explaining that the TPC is just a computer simulation that does not replicate all real-world parameters).

[Insert Verification page]

VERIFICATION

I, Jason Maga, verify under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Rebuttal Verified Statement.

Executed on September 14, 2017

Jason Maga

LIST OF EXHIBITS

Exhibit 1	Paul Vilter and Jason Maga Resumes
Exhibit 2	Incentives Paid to CN Fiscal Year 2015 - 2017
Exhibit 3	Excerpts from Harald Krueger Deposition, July 7, 2017
Exhibit 4	Frank Malone, Why IC is Single-Tracking, 191 RAILWAY AGE 2, Feb. 1990
Exhibit 5	Paul D. Schneider, The Double-Track Dilemma – Is Single-Tracking a Sound Strategy? TRAINS, July 1991
Exhibit 6	1979 Illinois Central Gulf Railroad Champaign Yard Track Charts
Exhibit 7	1995 Champaign Yard Track Charts
Exhibit 8	[redacted]
Exhibit 9	[redacted]
Exhibit 10	[redacted]
Exhibit 11	[redacted]
Exhibit 12	[redacted]
Exhibit 13	[redacted]
Exhibit 14	[redacted]
Exhibit 15	[redacted]
Exhibit 16	Excerpt from Scott Kuxmann Deposition, June 7, 2017
Exhibit 17	[redacted]

Exhibit 18	Excerpt from Paul Ladue Deposition, June 7, 2017
Exhibit 19	[redacted]
Exhibit 20	[redacted]
Exhibit 21	[redacted]
Exhibit 22	[redacted]
Exhibit 23	[redacted]
Exhibit 24	[redacted].
Exhibit 25	[redacted]
Exhibit 26	[redacted]
Exhibit 27	Bill Stephens, Leading the Way, TRAINS, Mar. 2017.
Exhibit 28	Amtrak's Proposed Changes to Appendix V of the Current Operating Agreement
Exhibit 29	Amtrak Service Standards Manual (Version 10, effective April 30, 2017), Section K of Chapter 7
Exhibit 30	[redacted]
Exhibit 31	Redundant Relief Items
Exhibit 32	Amtrak Proposal to Redistribute Recovery Time for the Illini/Saluki and the City of New Orleans Services
Exhibit 33	[redacted]
Exhibit 34	VIA RAIL CANADA, SUMMARY OF THE 2016 – 2020 CORPORATE PLAN AND 2016 OPERATING AND CAPITAL BUDGETS, 15 *available at* http://www.viarail.ca/sites/all/files/media/pdfs/About_VIA/our-company/corporate-plan/Summary%20of%20the%202016-2020%20Corporate%20Plan.pdf
Exhibit 35	Glenn Cartwright, Op-Ed., *Passenger-Train Service Falling Off the Rails,* VANCOUVER SUN, Aug. 28, 2016.

EXHIBIT 1

Paul Evan Vilter

SUMMARY

Experienced, creative business professional and leader. Skilled at negotiations, managing complex cross-functional teams, and implementing process improvements. Experience in marketing, operations, logistics, planning, finance, and sales.

EXPERIENCE

1999 – Present National Railroad Passenger Corporation (Amtrak) Philadelphia, PA

2017 – Present **Assistant Vice President, Amtrak Services (Marketing Department)**

- Create a group to commercialize Amtrak's skills and capabilities to generate revenue.
- Initial projects include bidding to operate commuter rail service; forming partnerships with High Speed Rail operators; initiating a new Amtrak route; and simplifying multi-modal passenger travel.

2003 – 2017 **Deputy Chief, Host Railroads (Operations Department)**

- Manage business relationships with approximately 30 US "host" railroads whose tracks are used by Amtrak passenger trains.
- Negotiate and manage contracts governing $120 million in annual expenditures
- Negotiated tri-party intercity passenger rail investment agreements among host railroads, states, and Amtrak governing $3+ billion in public investments in private host railroad infrastructure.
- Negotiated 20 year comprehensive operations and maintenance agreements with the State of Michigan and Norfolk Southern.
- Created and helped implement comprehensive host railroad performance metrics, and the first redesign of host railroad performance incentives in 20 years.

2013 – 2014 **Chief Logistics Officer (Acting for 5½ months) (Finance Department)**

- Recruited by Chief Financial Officer to temporarily lead Amtrak's Procurement & Materials Management Department during search to replace previous incumbent.
- Led 500+ management and unionized employees executing a supply chain with $1.5 billion annual spend across 30 warehouses nationwide.
- Stabilized the department's operation and morale.
- Concurrently served as Deputy Chief Host Railroads.

2001 – 2003 **Senior Director, Route Profitability (Planning Department)**

- Led company-wide, cross-functional team which designed in nine months a Route Contribution Analysis system to identify and manage revenues, costs, and contribution from business segments.

1999 – 2001 **Director (Finance Department)**

- Redesigned a business unit as part of an intensive Strategic Design Team. Improved annual performance by $3 million.

1989 – 1999 Conrail, Inc. Philadelphia, PA

1997 – 1999 **Domestic Market Manager (Marketing Department)**

- Designed and implemented marketing, pricing, product development, and channel strategy for $290 million business unit.
- Generated growth by developing new products, enhancing existing services, improving asset utilization, and applying new yield management strategies.

1996 – 1997 **Regional Manager (Sales Department)**

- Built strong relationships with 40 shortline railroad partners in Mid-Atlantic and New England region, generating $150 million in annual revenue for Conrail.
- Member of award-winning team that designed the Local Area Management organization structure, which reduced costs while improving customer service and revenue.

1993 – 1996 **Account Executive (Sales Department)**

- Negotiated with national retail chains to establish major distribution centers for their products. Located facilities, oversaw leasing, and managed renovations. Opened three significant sites, the largest worth $10 million in new revenue.
- Strengthened customer relationships, uncovered opportunities, and built consensus within the company to meet customer needs. Exceeded growth targets each year.

1989 – 1993 **Business Development Analyst (Marketing Department)**

- Won Conrail Impact Award for entrepreneurial recycled paper strategy, attracting new customers and growing traffic in a mature market by 30% annually. Managed print media advertising campaign.

1984 – 1988 CSX Transportation **Baltimore, MD**
Assistant Manager (Planning Dept), Assistant Manager (Marketing Dept)

- Designed and implemented train network analysis and sales force bonus systems.
- Designed components of intra-company transfer pricing system.
- Designed and implemented trend analysis system.
- Forecast volumes and revenues.

1980 – 1984 (Summers) International Business Machines Corporation **Rochester, MN**
Watson Scholar

- Won IBM Thomas J. Watson Memorial Scholarship based on academic merit.
- Four years full-time summer employment in Finance and other functions.

EDUCATION

J. L. Kellogg Graduate School of Management, Northwestern University **Evanston, IL**
1988–1989 **Master of Management – MBA**

- Concentrations in Marketing, Finance, and Transportation in an accelerated program.

Michigan State University **East Lansing, MI**
1980–1984 **Bachelor of Arts – BA. Graduated with High Honors.**

- Numerous academic honors including Mortar Board, MSU Tower Guard, Beta Gamma Sigma, and Phi Beta Kappa Certificate of Scholarship.

ADDITIONAL EXPERIENCE AND AFFILIATIONS

- Speaker at industry forums, including Federal Railroad Administration Program Delivery Conference, Midwest Rail Conference, Passenger Trains on Freight Railroads, Transportation Research Board, Transportation Research Forum
- Lecturer at Michigan State University Railway Management Program
- Member, Board of Trustees, John W Barriger III National Railroad Library

Jason J. Maga

WORK HISTORY

AMTRAK, Washington, DC 2005-Present
Director/Senior Manager, Host Railroads (2010-Present)
Principal, Host Railroads (2009)
Senior Officer, Host Railroad Policy (2006-2009)

- Directed numerous collaborative initiatives to improve route on-time performance, in one case from 43% to 80%.
- Designed improved schedules for all Amtrak trains operating on one host railroad, in collaboration with Scheduling group. Oversaw technical analysis and led negotiations to secure host agreement to new schedules. Drafted and negotiated arbitration settlement language and contract amendment in collaboration with Law department.
- Led a successful multi-year effort across multiple departments to design and implement improved data collection procedures.
- Led or helped lead negotiation of Service Outcome Agreements with host railroads and state DOT's for fifteen Federally-funded capital projects totaling over $3B.
    - Worked with States to ensure agreements achieved their objectives while meeting FRA-mandated criteria.
- Negotiated agreements for multiple freight rail improvement projects on the NEC, in cooperation with Engineering, Finance, and Real Estate departments.

Acting Assistant Superintendent, Michigan (2015; Chicago, IL)
Managed train operations over 640 route miles. Supervised four Road Foremen/Trainmasters with 65 Agreement employees. Three-month rotation assignment.

- Collaborated with Mechanical, Engineering, Control Center, and Business Line managers to reduce train delays, improve customer service, and respond to requests from Michigan DOT.
    - Improved CSI score from 55% to 74%.
    - Reduced speed restriction delays due to trackwork by 12%.
- Increased revenue and reduced costs by identifying opportunities to adjust pricing on frequently sold-out trains and to better match train size to demand.
- Built relationships and used informal influence to achieve objectives due to temporary nature of role.

Operations Planning Consultant: (June-August 2005)

- Implemented a railcar fleet planning process to guide mechanical/capital plans. Collaborated with Transportation, Marketing, Mechanical, and Strategic Planning staff to reconcile separate planning processes and gain buy-in around integrated plan.

NORBRIDGE, INC., Concord, MA 2000-2004

Management consultant at a 15-employee firm specializing in the transportation industry.

- Implemented a new pricing methodology for a major US railroad, leading to annual revenue gain exceeding $10M.
  - Coached marketing managers in using analytical techniques to guide pricing decisions.
  - Overcame initial resistance to changes, building stakeholder support and confidence regarding new pricing practices.
- Developed a litigation strategy for two railroads, for submission to the Surface Transportation Board.
  - Estimated demand elasticities for railroad transportation, using two-stage least squares regressions and SAS statistical software.
  - Created Excel spreadsheet model to calculate maximum prices consistent with STB regulations.
- Conducted a locomotive fleet utilization analysis for a major US railroad, leading to power assignment and fleet-size recommendations.
- Created a competitive analysis and commercial forecast for a US port authority, leading to cancellation of an unwarranted $1B capital project.

EDUCATION

Master of Business Administration, Kellogg School of Management, Northwestern University, 2006, Evanston, IL

- Majors in Operations, Organizational Behavior, Strategy.
- Publication: *The Union Pacific-Southern Pacific Merger* MBA classroom case study.

BA, College of William & Mary, 2000, Williamsburg, VA

- Majors in Economics, Government.
- Selected as Student Commencement Marshal based on leadership and academic achievement.

VOLUNTEER

ONE ACRE FUND, Washington, DC 2006-2010

Treasurer of a startup nonprofit operating primarily in northern Africa.

- Managed financial operations, accounting, and audit for $2.2M in annual revenue.
- Established GAAP accrual accounting processes, created audited financial statements.
- Member, founding Board of Directors.

ADDITIONAL DATA

Member, TRB Rail Transit committee and APTA High Speed/Intercity Passenger Rail Committee.

Treasurer, Global Playground Inc.

September 12, 2017

EXHIBIT 2

[REDACTED]

EXHIBIT 3

BEFORE THE SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. SECTION 24308(A)

CANADIAN NATIONAL RAILWAY COMPANY

[redacted]

Deposition of Harald Krueger

Washington, D.C.

July 7, 2017

9:30 a.m.

Reported by: Bonnie L. Russo

Q. Any other inputs?
A. I can think and see fundamentally you need topography, you need the speeds, you need the -- a station stops or any stop/start locations. You need the origin destination, you need the consist. Generally, that would cover the majority of input information.
Q. Okay. In -- is it fair to say the TPC is designed to track the movement of one train over a piece of track?
A. I would describe it differently. It doesn't track any train. It does the physics calculation for the movement of a train over a track.
Q. Okay. And so that means you don't include other trains in the TPC run?
A. That is correct. TPC is an individual train moving over the defined topography on its own. That there was nothing else out there.
Q. And is the purpose of TPC to calculate how long it takes that train to go from point A to point B?
A. The purpose of the TPC is to define or calculate the minimum time that it would

take for that train to move over that route. It's a performance calculator. So it will calculate the absolute minimum transit time and for -- according to the consist, equipment capabilities to traverse the section.
Q. Okay. Can we refer to that minimum time as a minimum run time? MRT, is that a phrase that CN uses?
A. That is a phrase that we use.
Q. Okay. And, then, the -- going back to the equipment characteristics, you mentioned tractive effort and rolling resistance, and some other factors.
How are those determined? Is that based on the specs, the specifications of the --
A. The manufacturing specifications for that piece of equipment.
Q. Okay. The -- are you familiar with the acronym "HPT"?
A. Yes, I am.
Q. Okay. And does that stand for horsepower per ton?
A. That is correct.
Q. Okay. How is that measured?

Q. Okay. But in either -- I mean this -- this --
A. And a clear distinction that needs to be made is we are using a tool or -- the model is in no way or any model --
Q. Uh-huh.
A. -- to replicate the reality of the railroad.
Q. Right.
A. The model is a tool that you could set up and establish an experimental situation -- then you can control a change in the variable and get a measure of cause and effect. So just by the nature of the model it is not going to account for or incorporate every aspect of the real world or reality, nor are in our study did we use every aspect or component of the model. The model was simply a tool that of a variety of tools to assess the question that we were asked. And this is a outline of the significant simplifying assumptions that we made that are of importance. It is not complete and extensive. Definitely not in the connotation that you're -- this conversation's at times leads or you suggest to. So...

operations, when a train actually is launched and is moving through the system, operating officers can look at the TSP for that train. Though its time at a station is irrelevant, it will enable them to know how long it will take to get to the next location.

So in the equipment cycling, car cycling, crew cycling, there is a -- what's termed in the industry a zero-based schedule that you can manage and plan the assets for the movement of that traffic.

Q. Do you use TPC to calculate the TPS?

A. Fundamentally a lot. The majority of the schedules at CN are generated either through using ITS, recognizing all of the crudeness of it and errors of it, mixed with various or the high number of measures that we have of how long are these trains taking to get off the road and/or the management's -- whose -- who has authority over the territory of how much time will they allot for this train.

So it's -- you know, there is no hard detailed scientific or consistent approach to the freight schedule. There is a basis of

TPC as a start indication, but then that will adjust or be adjusted to the specific objectives and demands and realities of what they see.

Q. I would like to introduce exhibit marked as 15.

(Deposition Exhibit 15 was marked for identification.)

BY MR. FISHMAN:

Q. This document is -- is something that's on your LinkedIn account. It appears to be a presentation that -- that -- I will ask you. What is this document?

A. It's a general description of what is capacity.

Q. Okay. And, on the first page, it indicates presentations of Canadian rail research lab, U of A.

Is that the University of Alberta?

A. Yes, it is.

Q. Okay. By CN network planning, is this a presentation you gave?

A. It is.

Q. Okay. The date, February 13th, 2013, is that the date of that presentation?

see the minimum run time, the MRT. On top of that, there's operating delays, traffic delays, and plant delays?

A. Correct.

Q. Okay. Is a certain amount of delay inevitable in a railroad operation?

A. In any transportation system.

Q. On Page 13 of this presentation, it's entitled "Key Factors That Drive Capacity," and you've got listed here "Most significance capacity factors are speed, uniformity, and disruptions."

Can you talk a little bit about this? What are you trying to say here?

A. Similar to the parametric model document, the key driver's of capacity are velocity, the uniformity of any and all elements upon traffic operations, and, of course, if you have any significant disruptions.

Q. Okay. The last bullet point on this page, it's entitled "Operations." It refers to schedules, times, priorities, online switching, and also refers to disruptions, track maintenance, setoffs, lifts.

EXHIBIT 4

Why IC is single-tracking

IC is eliminating nearly 500 miles of track between Chicago and New Orleans and installing a new ctc system—a project designed both to cut costs and improve service.

By FRANK MALONE,
Contributing Editor

Imagine a 980-mile freeway between Chicago and the Gulf of Mexico with just one traffic lane, and you get some idea of how Illinois Central sees its major route. The "Main Line of Mid-America," as a 1950 history dubbed it, is employing virtually all of its 1990 capital budget to go from double to single track between Chicago and New Orleans.

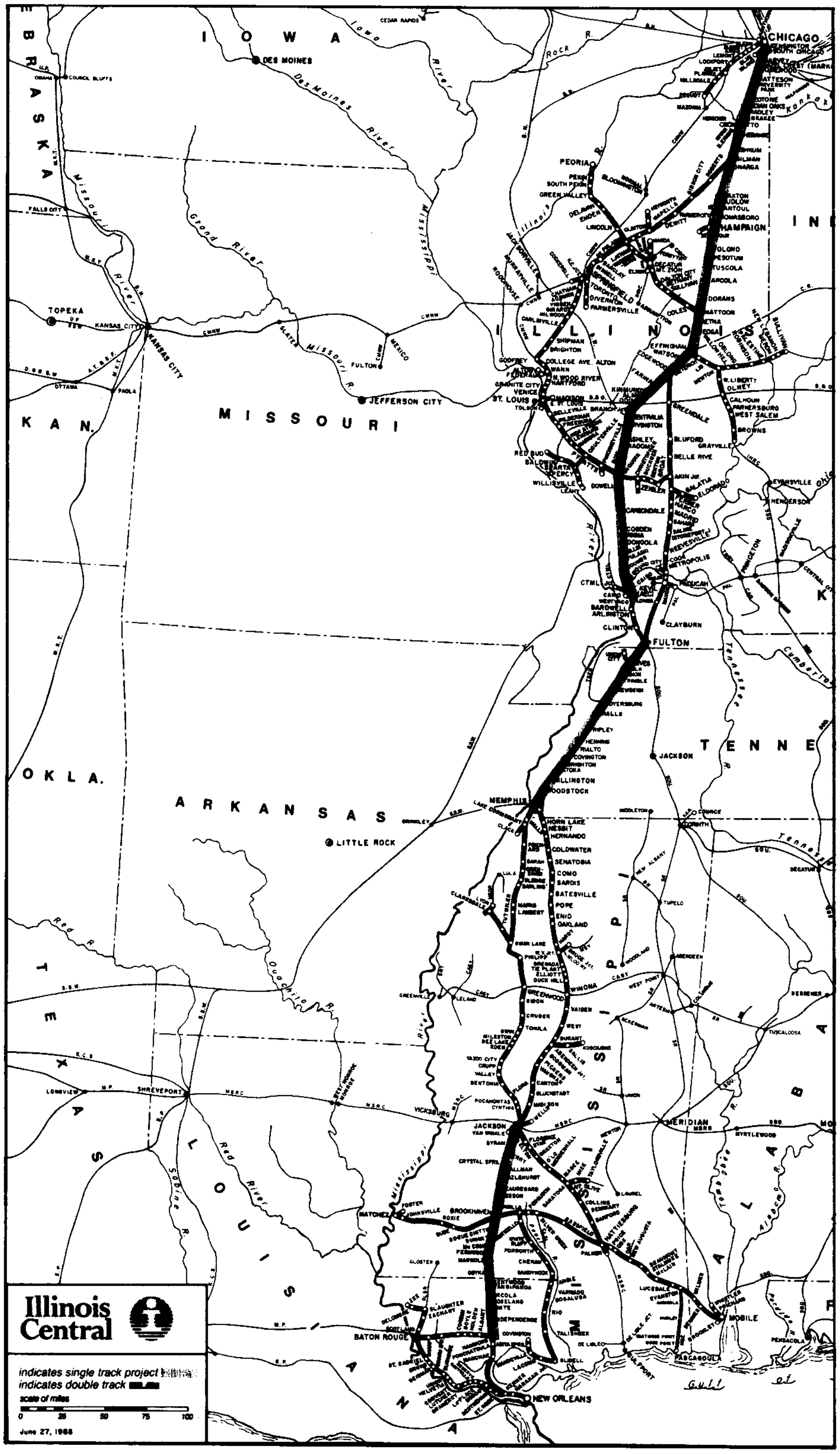
With new centralized traffic control and abundant long sidings, the line is expected to handle trains even better than when it had two lanes.

Considered the backbone of predecessor Illinois Central Gulf, once a 9,658-mile system, the Chicago-New Orleans line accounts for 33% of the 2,900 route miles operated by the "new" Illinois Central. Maximum traffic is about 35 million gross tons a year, compared with 38 million in 1984, when the line was part of a 6,700-mile system.

Shrinking through spinoffs, ICG became Illinois Central Transportation Co., which itself became a spinoff that was bought by New York City's Prospect Group in early 1989, after only 75 days as an independent. As IC president and chief executive officer, Prospect installed Edward L. Moyers, previously head of Prospect's MidSouth Corp., the operator of mostly ex-ICG trackage in Mississippi, Alabama, Tennessee, and Louisiana. Before joining MidSouth, Moyers had spent 12 years in the ICG engineering department and 10 years in various other departments. His father had been an IC section man for 45 years.

"I think I have an appreciation of track conditions and configurations that allows me to see clearly where we should go with capital and maintenance programs," he says.

• **From 100 trains to 25.** Moyers had watched the Chicago-New Orleans route handling about 25 trains a day with the same capacity as when it handled 100. Moving to IC, he saw a chance to cut trackage without hurting service. In fact, he promises better service from a massive conversion project that will have a significant



financial as well as operational impact.

Launched last summer, the project by late this year will have eliminated nearly 500 miles of train track and created 36 sidings up to four miles long at intervals of 12 to 15 miles.

With the exception of the 210-mile stretch between Memphis and Jackson, Miss., the Chicago-New Orleans route will come under control of a new ctc system. Between Memphis and Jackson, the main splits into two separate single-track lines, one with no signaling, the other with ABS. Also, the 169-mile "Edgewood cutoff" through southern Illinois to Fulton, Ky., will stay in operation along with a parallel 192-mile segment of converted main line to the west. The 53-mile stretch from Hammond, La., to New Orleans has been single-track with ctc for about 25 years.

Along with a major long-term saving in maintenance dollars, Moyers also sees a significant short-term gain in capital dollars. As a result of previous heavy main-line investment by ICG (an estimated $1.5 billion from 1976 to 1983), the main line generally is in good shape from rail through ballast. Sale of recovered rail alone will offset the conversion expense *and* pay for all the new ctc software and hardware, says Moyers.

As of Jan. 1, IC had buyers for 128 miles of rail. "There's a market," says Dave Kelly, chief engineer. "The only question is what the price is." Moyers says IC has been able to command prices "which were in our business plan."

Also to be recovered are more than 3 million tieplates, 1.6 million reusable main-line crossties, and more than 3 million tons of ballast. Besides paying for the conversion, recovered materials will give IC enough rail, ties, tieplates, and ballast for several years of capital programs.

IC projects 1990 capital spending at $40.6 million, up 145% from estimated 1989 outlays (*RA*, Jan., p. 26). The true value is higher, however, if cost of recovered usable materials is compared with cost of new materials. The capital budget carries crossties at $7 each, compared with the

". . . We think the core system that exists today has the ability to be much more profitable than the system did five years ago. We have a better fit today for the IC."

—Edward L. Moyers
President and CEO
Illinois Central

usual $18. This year, 325,000 ties will be installed. "If you multiply that by the $11 difference, you get a figure which you could add to the $40 million to see the real value of what we're doing," says Moyers.

This year's capital plan also contains 310,000 tons of ballast, carried at $2 a ton instead of the normal $6.

And it includes ten miles of rail, carried at $1.8 million, for a $300,000 savings over open market cost.

"If you look at what the free ties, ballast, and rail do for us, you see a capital program which, for the size of our railroad, is in the same ballpark with those of other railroads," says Moyers.

• **"Moving on schedule."** Last year, IC crews completed 67 miles of main-line conversion to ctc at sites between Chicago and Champaign, Ill., Fulton and Memphis, and Crystal Springs and Brookhaven in Mississippi. Work was set to resume in the South on Jan. 15. "It's a pretty straightforward process," says Kelly. "The scenario is driven by signal capabilities. It takes time to test and to do what's required for cutover. So far, it's moving on schedule."

Before the project started, about 15% of the route was under ctc. With a few leftover components, the new ctc includes software from Safetran and field equipment from Harmon. Kelly describes it as a state-of-the-art small system, with crt rather than projector displays in the Chicago control center. "For our needs and the size of the system, it certainly fits with what we're thinking of doing."

Mainly, IC is thinking of running a better railroad. With a new system service plan, the railroad is already operating as though it were entirely single track. Intermodal trains now run from Chicago to New Orleans in 26 hours, 45 minutes, compared with 30 hours before. Through train runs are seven and a half hours shorter.

Moyers sees better meets and runarounds improving operations over the previous practice of changing from one main track to the other, which caused delays. "The plan lets us choose the best bridges and operate on them, the track we want to operate so that we have more than 90% welded rail all the way, and the track with the best tie condition," he says.

Some observers have viewed the IC program as a form of cannibalization of assets designed primarily to provide cash to reduce debt, which totaled $850 million in late 1989. Moyers responds: "Five years ago, the Illinois Central had a total debt of $1.35 billion. If you look at the railroad then and as it is today, we think the core system that exists today has the ability to be much more profitable than the system did five years ago.

"We have a better fit today for the IC. I see us in a much better position today to handle our debt load than the Illinois Central has been in the past. We think the debt load is reasonable and that the company will generate a sufficient amount of money to pay our interest and to pay our debt.

"The single-tracking will cost us about 40% of the project's cash generation. The rest can go for our capital program or to reduce our debt or for whatever the need happens to be at that time.

"We have a plan for this company in which we have already made significant improvements in the operation and reductions in cost of the operation. At the same time, we have renewed a vigorous campaign to attract new shippers."

If the effort is successful, IC won't have any trouble handling the additional traffic. With the new ctc in full service, Moyers says, the main line still will have 45% extra capacity. ■

EXHIBIT 5

The double-track dilemma

Is single-tracking a sound strategy?

PAUL D. SCHNEIDER

NOT all railroad main lines are created equal. Certainly that's obvious to anyone who ever compared, say, the side-by-side main lines of the Milwaukee Road and Burlington Northern in Montana back in the 1970's. But there is more than just the appearance of good track (BN) and bad track (MILW) to consider. Also pertinent is the traffic capacity of a particular main line and how efficiently that traffic is managed.

At first glance, double track would seem to be the ideal way of moving the maximum number of trains. Single track requires opposing trains to meet at "passing sidings" located at intervals along the line, an operation that involves careful timing of train movements by a dispatcher and time-consuming "meets," in which one train "holds" (waits in) the siding until the opposing train "clears" (passes). Double track, on the other hand, means that traffic flowing in opposite directions has its own track.

When in 1988 Illinois Central and Soo Line revealed decisions to single-track their principal double-track main lines, some people were skeptical of the railroads' motives. If double track is more efficient than single track in handling large amounts of traffic, then did IC's decision to slim down its Chicago-New Orleans main and Soo's its ex-Milwaukee Road Milwaukee-St. Paul route imply that both roads were forsaking the long-term benefit of double track's efficiency and speed for the short-term benefits of track salvage and reduced maintenance-of-way costs? Further, were IC's and Soo's decisions to single-track their mains reflective of a downward spiral of traffic and a bleak future for both railroads? You could almost hear the voice of former TRAINS "Professional Iconoclast" columnist John G. Kneiling snarling that IC and Soo should just rip up both mains, get scrap value for the track material, and concede the traffic to truckers, barge lines, or anyone else who truly cared about making a buck in the transportation business.

On the other hand, consider the Florida East Coast Railway. After the Florida real éstate boom in 1924, FEC launched a major expansion program, the centerpiece of which was the double-tracking of its Jacksonville-Miami main. Seven years later the boom collapsed and the Depression bumped the railroad into receivership. When the 685-mile railroad was reorganized in 1960, FEC decided to modernize its physical plant by reducing its main to a single track and replacing the old Automatic Block Signal (ABS) system with Centralized Traffic Control (CTC). With ABS, traffic on a particular track is controlled by signals governed by the presence or absence of a train on that track segment (called a "block"). CTC, on the other hand, relies on a dispatcher who remotely controls switches and signals from a machine in his or her office.

Current FEC President R.W. Wyckoff shrugs off the notion that the company's decision to single-track the railroad foreshadowed the beginning of the end for the railroad. "We certainly had no idea of going out of business when we went from double track to single track," he says. "We did it because of the savings to be realized from the standpoint of maintenance and taxes." Indeed, FEC today is a 541-mile railroad boasting some 24 through freights per day, mainly manufactured goods, intermodal traffic, and northbound aggregates. Its single-track main line boasts 132-lb. continuous welded rail, concrete ties, 3-mile-long sidings placed every 10 miles or so the entire length of the line, and a CTC system based at New Smyrna Beach. Operating revenues in 1990 topped $159 million, and everything FEC buys—from paper clips to remanufactured EMD GP40-2's—is paid for with cash. If this was a preview of Soo's and IC's fates, you have to wonder if single-tracking was synonymous with success.

Mike Abalos.

ROLLING south on Illinois Central's newly single-tracked CTC main is train CHG at South Rantoul, Ill., on April 6, 1990.

NOT that Soo Line and IC seem to be fretting over their decision to follow FEC's lead. Soo is single-tracking almost 300 miles of former Milwaukee Road Chicago-Twin Cities double-track ABS main line between Hastings, Minn., 25 miles east of St. Paul, and Duplainville, Wis., 17 miles west of Milwaukee. "What triggered our initial approach to the project," said Warren Peterson, Soo's former vice president-production (recently retired), "was the fact that the existing two mains were in such a condition that we were faced with a substantial capital outlay to improve both lines to bring them up to what we felt was an acceptable standard." Rather than maintain the existing double-track plant (which previously carried 18 to 25 million gross tons per mile per year on the westward track), Soo consolidated all traffic on one track of 132-lb. continuous welded rail with remotely controlled power switches and new CTC. Rail from the abandoned main (a mix of welded and jointed rail) will continue to be cropped and welded as replacement rail (known as "relay rail"). Crossties, too, will be salvaged for reuse elsewhere.

According to Peterson, a single-track, CTC-controlled main line affords Soo Line direct economics in transportation by giving the railroad much more effective control of train operations. Amtrak runs on this line at 79 mph, intermodal trains at 55, and general freight trains between 40 and 50 mph. "With that kind of variety in speed," he said, "you have overtaking problems on double track, mainly because that particular configuration doesn't lend itself to fast trains passing slow trains." Soo's single track, though, will enable its dispatchers in Milwaukee to alter the priority of trains by allowing, say, an eastbound unit grain train to hold in a siding while a faster eastbound general freight train slips past on the main. With ABS, such a move involved running on the "wrong main" with specific permission, without benefit of lineside signals, and sometimes at restricted speeds.

Illinois Central found itself faced with a similar situation on its 921-mile Chicago-New Orleans main, a double-track ABS railroad primarily signaled, like Soo's, for traffic in one direction on each track. "Traditionally, on double track, what happened was that the high-priority trains generally got excellent handling and the slower, secondary trains got butchered," says IC's V.P.-Chief Transportation Officer E. Hunter Harrison. "The secondary train would be at an intermediate point on the railroad like Jackson, Mississippi, ready to go, but two hours later here comes Amtrak at 79 [mph] that will overtake him down the line. So the secondary train is held until he can follow the faster train."

IC's single-tracking project is transforming what Harrison calls "two one-way streets" into a single-track CTC-controlled main line with 2-

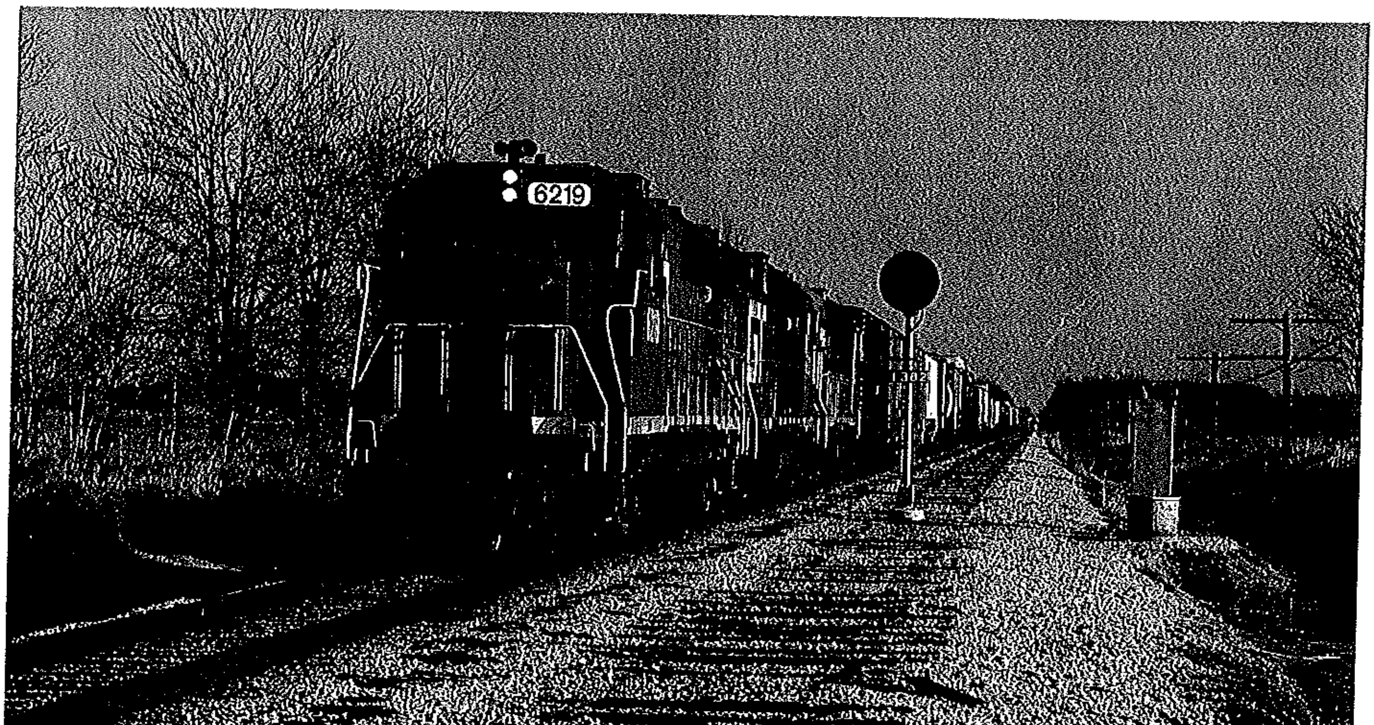
mile-long sidings (with power switches at both ends) placed strategically every 15 miles or so, as well as some 4- and 5-mile-long stretches of double track. Fast trains on the IC continue to get top priority, but the railroad, says Harrison, won't have to work out a self-defense for secondary freights and locals. "We'll operate a secondary freight out to a point where we can head him through a power switch and hold him until the faster train passes."

IC's goal, says Harrison, is to do a good job of moving both priority traffic and those "butchered" secondary freights. "We've lost market share in freight-all-kinds," Harrison says, referring to merchandise "FAK" freight that does not move in unit or intermodal trains. "This traffic, which did not get priority treatment previously, will now get better service." Locals will now be able to serve customers on both sides of the main on the same day instead of IC's previous out-one-day, back-the-next schedule.

Neither Harrison nor Peterson see much merit in adding CTC to existing double-track physical plants. "It's counterproductive," said Peterson. "You continue to have the cost of maintaining two tracks plus the cost of installing and maintaining the CTC." By single-tracking, the railroad eliminates roughly 80 percent of the second main, thereby reducing track maintenance costs.

Harrison says IC ruled out the idea of adding CTC to the double-track Chicago-New Orleans route because of the volume of business on the line and the capital investment required to CTC two main tracks. And by slashing track maintenance costs, single-tracking frees up assets to be used more efficiently. "In my view, it's better to put tonnage on two pieces of iron and maintain that compared to maintaining four pieces of iron," says Harrison in reference to the number of steel rails. Both Harrison and Soo's Peterson claim that their single-tracking projects allow for growth in traffic and train speeds.

Reaction to Soo's project, said Peterson, has been positive. "People see us striving to improve the quality of our service. The sense is



Mike Abalos.

GRAND TRUNK WESTERN train 393 hammers along next to abandoned westbound main near Marcellus, Mich., January 27, 1989.

UNION PACIFIC GE and EMD diesels converge at meet on soon-to-be-double-track UP main at Hanover, Kan., on February 25, 1991.

that by investing this kind of money we're attaining a far more effective railroad." Harrison, on the other hand, candidly admits that IC's project has met with a firestorm of criticism and doubt. Amtrak in particular has been less than thrilled with IC's decision; its *City of New Orleans* between the train's namesake city and Chicago was on time only 15 percent of the time during the early stages of IC's project (April 1989-February 1990). "Paul Getty once said that in changing times, experience is your worst enemy," Harrison says. "Some people have a hard time comprehending the fact that a one-way street is not conducive to operating trains of varying speeds with reduced crews and no cabooses. For people who've always worked with double-track ABS, it's a change, and people are always uncomfortable with change. And with all the line sales IC undertook in the last few years, people see the single-tracking as rationalization, a sign the IC is on the verge of going out of business." Illinois Central discussed the project with other railroads and followed up with traffic studies and computer simulations before finally judging that single-tracking was the way to go. "There may be flaws in the plan," concedes Harrison. "But when they surface we're ready to deal with them."

BUT single-tracking isn't always the way to go. Consider Grand Trunk Western, whose Vice President-Operations David Wilson describes GTW's decision several years ago to single-track what was essentially a 203-mile double-track ABS railroad between Chicago and Durand, Mich., as "a logical step to take." GTW single-tracked 18 miles of main line on the west end, between Penn and Schoolcraft, Mich., on the South Bend Subdivision, in 1988. But since then, GTW has had a change of heart.

"We were looking for a reduction in maintenance costs," says Wilson, "and an improvement in track usage by increasing tonnage over the remaining track." The eastbound main was relaid with 132-lb. welded rail; the interlocking at Penn was reconfigured; and 16 miles of the westbound main was torn up and used as relay rail at other locations. Two miles of the old westbound main were left in the middle of the segment at Marcellus, Mich., for use as a storage track.

Wilson claims GTW achieved what it wanted from a cost standpoint and is pleased with the project, but he doubts the company will undertake any more single-tracking projects soon. "Our traffic volume is just too great to support a single-track CTC railroad and still maintain our service commitments," he says. "That project was done out of the synergy at the time when we were going to longer trains that weren't particularly time-sensitive." A similar plan to single-track 9 additional miles between Stillwell and Wellsboro, Ind., was subsequently shelved when GTW's business surged. (The railroad now hauls about 32 million gross ton-miles per year between Chicago and Durand.)

According to Wilson, *all* of GTW's traffic today is time-sensitive. "We don't have the luxury of running heavy tonnage trains. Our operating philosophy is driven by the customers and the connections." The way GTW operates, traffic is released from eastern Michigan terminals in the afternoon and evening, and trains are "fleeted" to Western railroad connections in Chicago. Eastbound traffic, on the other hand, is spaced out throughout the night, which leaves the railroad with an uneven traffic flow.

Dan Munson.

Although Wilson says delays to trains on the single-track Penn-Schoolcraft segment have been minimal, he allows that time-sensitive eastbound trains on what would have been a single-track railroad all the way from Chicago to Durand could have been delayed as they battled a river of equally "hot" westbounds. From Wilson's point of view, scheduling track maintenance on single track was also a problem. "On double track you can run trains on the track adjacent to the maintenance work. But on single track you either have to clear the maintenance equipment out of the way or set 'windows' when you can't operate trains."

Grand Trunk will continue to monitor its single-track CTC installation, but Wilson says the railroad is looking at installing double-track CTC on certain segments. "With our volumes and schedule requirements," he concludes, "we'll have to stay with double track."

THE Monongahela Railway isn't concerned with single-tracking its railroad, mainly because it can't add double track fast enough. The 136-mile Monongahela (MGA) is a "dark" (*i.e.*, unsignaled) mostly single-track railroad tied to one commodity: coal. MGA loads about 17 million tons of Pennsylvania and West Virginia bituminous annually, and according to the company's Rail Transportation and Coal Mine Directory, that tonnage continues to grow as on-line mine operators increase production. In 1989 MGA decided to improve service by adding 1¼ miles of double track at Clarksville, Pa., on its busy Ten Mile Run Branch between Brownsville and Waynesburg, a 2-mile segment that handles 26 million gross ton-miles per year. Says MGA President Paul Reistrup (yes, the same man who was Amtrak's president 1975-1978): "Before we double-tracked, we had a 2-mile stretch there where we couldn't meet trains. They'd all follow each other in a fleet." For example, an empty train headed up the Manor Branch from the Ten Mile Run Branch would wind up pulling onto the Waynesburg Southern branch to let a loaded train off the Manor Branch, then back up the Ten Mile Run Branch again so it could finally head up the Manor Branch. "This is common in the streetcar business," Reistrup points out dryly, "but not with unit coal trains."

For the time being, MGA's double-track segment (called the "Clarksville Double Main" in MGA's current timetable) remains under computer-assisted block clearance control, essentially a track warrant control system managed by MGA dispatchers in Brownsville. Next year, though, MGA will double-track *and* CTC 1.3 miles of main line near Waynesburg, and Reistrup expects the Clarksville Double Main to be signalled for CTC by 1993. The Clarksville project rang up a bill of $1.25 million, money that Reistrup considers well spent considering the subsequent reduction in train delays. "The mines like to have trains at the beginning of their shifts," says Reistrup. "We plan to have an empty train waiting at the mine when a load pulls out."

Union Pacific also has coal trains and double track on its mind these days. The railroad is shelling out $250 million over the next five years for capacity expansion to protect its profitable unit coal business out of Wyoming's Powder River Basin ["Powder River Country," pages 40-63, November 1989 TRAINS]. This year alone UP will spend $70 million on projects involving the Marysville Subdivison, a single-track mainline segment on the North Platte (Nebr.)-Kansas City route. It links the eastern end of the North Platte Division transcontinental main line at Gibbon, Nebr., with an existing double-track portion between Kenefick, Kans. (near Topeka), and Kansas City. Central to the project is 30 miles of new double track and completion of 14 miles of CTC. By 1995, 200 of the Marysville Sub's 285 miles are to be double-tracked; UP expects virtually all its Powder River coal corridors to be under CTC control by 1993. When asked why UP is embracing double-track CTC at a time when railroads such as IC and Soo Line are choosing single-tracking, UP spokesman John Bromley chuckles. "Maybe they don't have enough business," he says. "But we do."

Its projects like Monongahela's and UP's, not to mention Grand Trunk Western's change of heart, that raise questions about the motives behind Soo's and IC's single-tracking projects. You can even argue that the success of Florida East Coast's single-tracking project hinges on the fact that FEC's traffic is 24 trains a day, about equal to the number IC and Soo each will be operating over their newly single-tracked lines. In the final analysis, you too may find yourself asking: Is single-tracking a sound strategy for success or simply a short-sighted view of a railroad's future? I

EXHIBIT 6

[REDACTED]

EXHIBIT 7

[REDACTED]

EXHIBIT 8

[REDACTED]

EXHIBIT 9

[REDACTED]

EXHIBIT 10

[REDACTED]

EXHIBIT 11

[REDACTED]

EXHIBIT 12

[REDACTED]

EXHIBIT 13

[REDACTED]

EXHIBIT 14

[REDACTED]

EXHIBIT 15

[REDACTED]

EXHIBIT 16

BEFORE THE SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(A) - CANADIAN NATIONAL RAILWAY COMPANY

CONFIDENTIAL

Deposition of SCOTT KUXMANN taken before TRACY L. BLASZAK, CSR, CRR, and Notary Public, at La Banque Hotel, 2034 Ridge Road, Homewood, Illinois at 1:48 p.m. on the 7th day of June, A.D., 2017.

There were present at the taking of this deposition the following counsel:

NOSSAMAN LLP by
MR. EDWARD J. FISHMAN
MR. HUBERT LEE
1666 K Street, N.W.
Suite 500
Washington, D.C. 20006
efishman@nossaman.com
hlee@nossaman.com
(202) 887-1400

on behalf of National Railroad Passenger Corporation;

[redacted]

Q How does SRS measure delays?
A Against the schedule.
Q Okay. So if the schedule is changed, does that mean that SRS would measure a delay against the revised schedule?

A I don't know that I would know that answer truthfully.

Q In your capacity as dispatcher, in the role between 2003 and 2009, did you have the authority to change train schedules?

A Between what time again was that, I'm sorry?

Q Between 2003 and 2009, which I believe is generally when you were serving in the dispatching role, did you have the authority to change train schedules?

A No, I don't believe I would have.

Q Who would have had that authority?

[redacted]

Q I'd like to direct your attention to the last page of that exhibit, Exhibit B. [redacted]

[redacted]

[redacted]

between 2003 and 2009, you were using SRS to some degree, weren't you?

A Yes.

Q Did you receive training on SRS before you started using it?

A If I did, it was very minimal and it was pick it up as you go.

(discussion had off the record)

THE WITNESS: I can add one thing to the training of SRS. There are SRS manuals. And we were given those and able to revert back to them, so there is a standardized training. But as I went, it was look through the manual and work at it, so.

[redacted]

EXHIBIT 17

[REDACTED]

EXHIBIT 18

C O N F I D E N T I A L

BEFORE THE SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(A) - CANADIAN NATIONAL RAILWAY COMPANY

CONFIDENTIAL

Deposition of PAUL LADUE taken before TRACY L. BLASZAK, CSR, CRR, and Notary Public, at La Banque Hotel, 2034 Ridge Road, Homewood, Illinois at 8:49 a.m. on the 7th day of June, A.D., 2017.

There were present at the taking of this deposition the following counsel:

NOSSAMAN LLP by
MR. EDWARD J. FISHMAN
MR. HUBERT LEE
1666 K Street, N.W.
Suite 500
Washington, D.C. 20006
efishman@nossaman.com
hlee@nossaman.com
(202) 887-1400

on behalf of National Railroad Passenger Corporation;

A I don't recall.

Q If I was to tell you I believe it stands for service reliability -- Actually, let me strike that question.

Let's just refer to it as SRS. What is SRS?

A It's CN's tool for managing rail traffic.

Q Do you know when SRS was created?

A No.

Q When did you first become aware of SRS?

A Sometime after I went on the job in 2003, but I don't remember when.

Q Okay. What was your first, even if you don't remember the exact date, what is your first recollection of SRS?

[redacted]

EXHIBIT 19

[REDACTED]

EXHIBIT 20

[REDACTED]

EXHIBIT 21

[REDACTED]

EXHIBIT 22

[REDACTED]

EXHIBIT 23

[REDACTED]

EXHIBIT 24

[REDACTED]

EXHIBIT 25

[REDACTED]

EXHIBIT 26

[REDACTED]

EXHIBIT 27

Of all of the six big railroads, only CN has grown its business: A northbound train rolls out of the fog at Duplainville, Wis., on Aug. 5, 2012. Craig Williams

Cut through all of the positive industry statistics and trends over the past decade and one stark fact emerges: Traffic peaked in 2006. The ugly reality is that, in terms of units of freight carried, railroads hauled 3 percent less traffic in 2015 than they did a decade ago.

Only one of the big six systems — just one — bucks this trend: Canadian National Railway. By any yardstick you put against it, CN has grown steadily. The most important measure is traffic carried, the basic building block of the business. CN handled 14 percent more cars and intermodal units in 2015 than in that peak year of 2006. Combined, the other five big systems lost 5 percent of their traffic in that period.

Or just look at 2010-2015, as railroads emerged from the Great Recession. The story's the same. CN's traffic surged 17 percent, versus 6 percent for the other big Class I railroads.

How, you may ask, did CN accomplish this? What is it doing differently? Of course, it helps that among the six big systems, CN is the least dependent on coal, and that it has gained market share from rival Canadian Pacific.

Over and above that, however, three things stand out, each built upon CN's industry-leading efficiency and the footprint of its 19,600-mile system.

The first is a wave of containers from Asia flowing into Canada's West Coast ports, including a containerport and global trade route through Prince Rupert, B.C., that CN helped create from scratch. The second is the upswing in petrochemical and related traffic in Alberta, where CN acquired feeder lines that are smack in the middle of the tar sands oil patch and shale gas fields. The third thing — and what really makes CN different — is the railway's intense focus on forming close partnerships with shippers. CN constantly talks with customers, burrows its way into their supply chains, and looks well beyond where its tracks end. "They view themselves as a supply-chain enabler, as opposed to simply a railroad," says analyst Jason Seidl, managing director at Cowen & Co.

"An ecosystem of collaboration," is what former CEO Claude Mongeau says of his supply chain approach, which aims to build trust while improving service and efficiency for railway and customer alike. "It's the gift that keeps on giving. ... It leads, eventually, to ideas you didn't know were possible."

Claude Mongeau

CN's evolution

Mongeau, who was CEO from 2010 to mid-2016 before health issues forced him to retire at age 54, wrote the third chapter in CN's transformation. In the span of two decades, the bloated Crown corporation became a lean, efficient, and growing railway. "It's no small feat," he says of CN's journey from laggard to leader.

The first chapter ran from 1995 to 2002 under CEO Paul Tellier. The railway was privatized, changed its culture, and began an operational turnaround. CN took the first and biggest step of its expansion strategy in 1998, when it acquired Illinois Central and landed its president and CEO, operations wizard E. Hunter Harrison, in the process. CN now reached deep into the U.S. and touched three coasts.

The 2000s belonged to Harrison, who became CN CEO in 2003. Hard driving and hands on, Harrison drilled his precision railroading principles into virtually everyone and everything at CN. The idea: Intense use of assets like cars, locomotives, and crews. If it has wheels, keep it moving. And bring balance to the network by flattening out peaks and valleys in traffic, whether customers like it or not.

CN also continued to expand, an effort led by Mongeau, then the company's strategic planner. The railway closed a gap in its system map by adding the Wisconsin Central (2001), linking its routes in Western Canada with Chicago. Other small acquisitions followed. It gobbled up BC Rail (2004), feeder lines in Alberta (2006-07), and the Elgin, Joliet & Eastern (2009). With the EJ&E, CN could now bypass Chicago congestion and seamlessly link its IC, WC, and Grand Trunk Western subsidiaries.

Under Harrison, CN became the most efficient railway in North America. Its operating ratio became the envy of the industry. But shippers weren't impressed. The pace of change, combined with Harrison's methods, like slapping penalties on cars that weren't loaded or unloaded on weekends, alienated customers. Harrison's relentless drive for efficiency ruffled more feathers than necessary, says independent analyst Anthony Hatch, a New York-based independent railroad analyst. "But you can't argue with the results of his disruptive force," he says.

A new perspective

Enter Mongeau. A consensus-builder and CN veteran — whose business card once read, "chief railroader in training" — Mongeau brought a new tone and new goals to the railway. He set out to mend fences with shippers and accelerate growth.

The CN of 2010 was proud of its service metrics, which showed cars moving faster, spending less time in yards, and consistently arriving on time. "We presumed that we had a great product," says Janet Drysdale, vice president of corporate development.

Imagine the shock when CN learned, from discussions with customers, that its key metrics didn't necessarily match what was important to shippers. And neither did its service.

The railway knew, for example, that it reliably hustled double-stack trains from Vancouver to Chicago. But what an international intermodal customer would notice — and that CN had no way of knowing — was that its container missed the train and was still at the port. Getting containers on the train was something CN didn't track since it was the

CN's acquisition of the Elgin, Joliet & Eastern in 2009 allows it to bypass Chicago congestion and link three subsidiaries. This was CN's first day of EJ&E operation in West Chicago, Ill. Mark Llanuza

terminal operator's responsibility. "Our measurement was from the time the train was ready to go until it got to Chicago," Drysdale says. "The way a railway defines service is not how a customer defines service." This type of disconnect prompted CN to change its management mindset. Rail-centric thinking was out. Thinking about the entire end-to-end move — not just the rail portion — was in.

Janet Drysdale

By early 2011, the railway had signed service agreements with all CN-served ports and intermodal terminal operators in Canada. For the first time, everyone was on the same page, sharing the same data, working off the same scorecard, and finding solutions to problems every day. Now if a container sits too long at the port, it glows on computer screens in Montreal and the terminal. "Supply-chain collaboration was a natural extension of that," Mongeau says. CN began to collaborate with bulk shippers and, eventually, its merchandise customers.

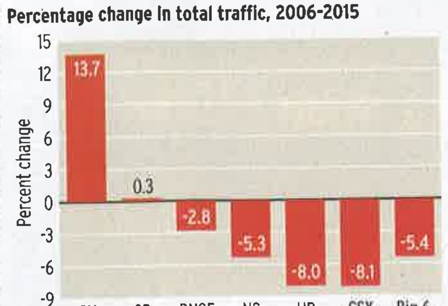
CN retained its bedrock precision railroading principles. But in a shift to "Operational and Service Excellence," CN married its operational fundamentals with metrics that are most important to customers, such as delivering empty cars when promised. CN calls this an "outside in" approach. Mongeau explains it this way: "Inside in looks at car velocity. More outside in looks at car velocity and order fulfillment."

Mike Cory

The concept behind supply-chain collaboration is simple: Through cooperation and a greater understanding of the customer's business needs, CN could gain traffic, boost efficiency, and increase profitability.

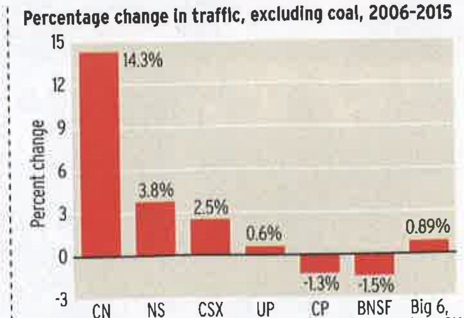
"We went from this extremely productive, very productivity-focused railway to one that said, 'Hey, we have a very good base so it is time we get in the customer's head and we figure out how to grow organically,'" Chief Operating Officer Mike Cory told investors. "And we developed a supply-chain mindset. Really it is all based on innovation and growing the pie with the customer."

Percentage change in total traffic, 2006-2015



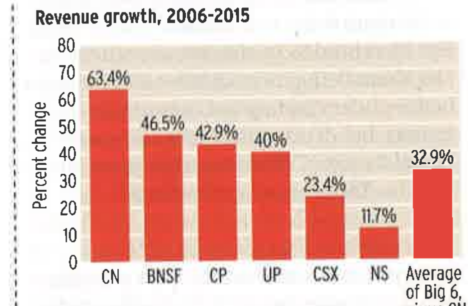
Source: Annual reports

Percentage change in traffic, excluding coal, 2006-2015



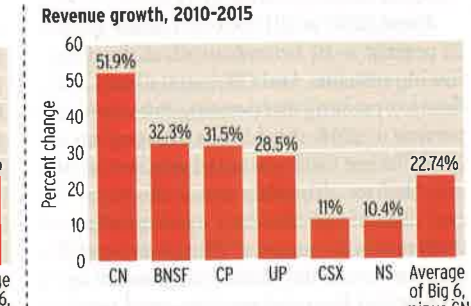
Source: Annual reports

Revenue growth, 2006-2015



Source: Annual reports

Revenue growth, 2010-2015



Source: Annual reports

CN helped develop the container port at Prince Rupert, British Columbia, and it has been reaping the benefits ever since. Two photos, Port of Prince Rupert

CN trains out of Prince Rupert, British Columbia, enjoy long hauls: 2,600 miles to Chicago, 3,100 miles to Memphis, 3,000 miles to Toronto, and 3,350 to Montreal.

The strategy worked

From 2010 to 2015, CN's revenue grew 52 percent — or twice as much as the other five big systems. And CN maintained its efficiency, pushing its operating ratio to 58.2 percent in 2015, down from 67.3 percent in 2009. "What I did not anticipate, to the degree that we ultimately saw, is the scope and scale of the efficiency opportunities that we would uncover," Mongeau says. "I was convinced the more collaborative approach and focus on service would pay dividends. And it did — big time."

Yet CN cannot say precisely how much collaboration has contributed to its growth. But it's central to its success, executives say. "It's about being more creative and having a better understanding not only of our customers, but of our customer's customers," Drysdale says. "When our customers win, we win. The economics flow back."

Intermodal opportunity

If you stood at Prince Rupert a decade ago, you'd never catch a CN double-stack train leaving tidewater. They didn't exist. Now two or three stack trains depart the port every day, weaving their way along the Skeena River as they head east. These trains, along with their counterparts from Vancouver, are the main reason CN's overall intermodal volume soared 68 percent between 2006 and 2015.

Over that span, Canada's West Coast containerports increasingly became gateways to the U.S. Today nearly half of the containers moving through Vancouver and Prince Rupert are bound for Midwestern destinations, a trend that CN helped create.

The Port of Prince Rupert — an isolated outpost on British Columbia's far north coast, a stone's throw from Alaska — did not handle a single container in 2006. Now it's responsible for more than a quarter of CN's international intermodal volume. And two-thirds of the port's containers are bound for U.S. markets.

You'd be hard-pressed to dream up a better port scenario. There's no truck competition. Not another railroad in sight. And there are incredibly long hauls to destination markets. From Prince Rupert, it's 2,600 rail miles to Chicago, 3,100 to Memphis, 3,000 to Toronto, and 3,350 to Montreal. These are the longest single-line intermodal hauls in North America, which is of no small importance in the relatively low-margin world of international intermodal.

The port historically was a regional gateway for coal, grain, and forest products. It happens to be two days' sailing time closer to Shanghai; Busan, South Korea; and Tokyo than the busiest West Coast ports at Los Angeles and Long Beach. Combine this with quick transfer of containers from ship to rail, and shipments can get to market several days faster than from other ports.

"We're the port of Chicago, the port of Memphis, the port of Detroit, the port of Montreal because we serve those markets so effectively," says Shaun Stevenson, port vice president of trade and public affairs.

Port officials worked with CN and operator Maher Terminals to design an efficient containerport to tap growing trade between Asia and North America. "We were all vested in creating a true gateway," Stevenson says.

Prince Rupert has been the fastest-growing containerport in North America since it welcomed its first vessel on Halloween 2007. CN, the port, and current terminal operator DP World are working on an expansion that will nearly double container capacity when it opens this summer. "It's a great example of how supply-chain collaboration works," Stevenson says.

CN has applied the Prince Rupert model to Vancouver, Canada's busiest containerport, making it a gateway to U.S. markets, too. CN also padded its growing volumes in 2013-14 by winning three major international contracts previously held by CP.

CN's service agreements with ports and terminal operators don't address a container's voyage back to port. So CN finds so-called match-back loads to fill containers that otherwise would return to Asia carrying nothing but air. "How it goes back to Asia matters a whole lot to the overseas shipping company. And so we started to think differently," Drysdale says.

Match-back loads reduce costs for the overseas shipping company, are a deal for shippers, boost CN's revenue, and help make CN-served ports more attractive. A container that brought electronics to Chicago might wind up hauling Midwestern or Canadian grain to export at Prince Rupert. Or a Detroit-bound container filled with Japanese auto parts might carry aftermarket auto parts from Michigan as far as Edmonton. Then CN may put forest products in the container and export it at Vancouver.

"That really is what's making the difference," Drysdale says, noting that all railroads offer roughly the same service on inbound moves. "Working harder on the back haul is what makes a difference in the intermodal segment."

How much of a difference? In the first nine months of 2016, 78 percent of export containers at Vancouver were loads, nearly double the rate of the Port of Los Angeles. "CN has made finding match-backs for terminating international containers a higher priority than most other railroads," says Larry Gross, an intermodal analyst at FTR, a transportation research firm.

Petrochemicals are the second leg of CN's growth formula. Empty crude oil train U711 moves near Brantford, Ontario, with CN 8016 and BNSF 5194 in the lead on Oct. 24, 2014. Joseph Bishop

Canadian National train U763 moves crude oil empties for Kinder Morgan's Edmonton South Rail Terminal into the Kinder Morgan facility in Edmonton, Alberta, on Oct. 22, 2016. A.J. Shewan

Mongeau says this would be impossible without close ties to shippers. "It takes connecting of the dots. ... It takes partnerships to make it happen," he says.

Alberta petrochemicals

Watch CN's manifest trains roll across the Prairies — 175 cars behind two big GEs up front and a distributed power unit spliced in way back — and you'll notice an abundance of covered hoppers and tank cars along with the odd flatcar load of steel pipe. You're witnessing the Alberta petrochemicals boom. It's why CN's petrochemicals traffic is up 17 percent from 2010 to 2015.

The oil sands deposits in northern Alberta are the world's third-largest reserves, and the resource-rich province also has shale gas plays. Edmonton and its outskirts, nicknamed Alberta's Industrial Heartland, have developed into Canada's largest hydrocarbon processing region. The area has attracted refineries, along with chemical and plastics plants.

Although the energy price crash of recent years has crimped investment in the Industrial Heartland — many projects were scrapped or put on hold — 14 projects worth $12.5 billion remain under construction or are ready to proceed, according to Alberta Industrial Heartland Association.

Inbound, CN hauls steel, pipe, equipment, machinery, frac sand, and other materials needed for tar sands infrastructure and natural gas drilling. CN also delivers tank-car loads of condensates, which are added to the tar sands' heavy crude so it can flow through pipelines. Outbound, crude oil shipments have been reduced significantly amid the oil glut. But CN still carries a range of petrochemical byproducts out of the Industrial Heartland, including sulfur, petro-

CN petrochemical business rose 17 percent from 2010 to 2015. An oil train rolls west of Independence, Iowa, on April 12, 2015. Craig Williams

leum coke, ethane, and propane, along with plastics like polyethylene.

It's a fluke of geography that CN's main line is adjacent to Alberta's Industrial Heartland. Not a fluke: CN's 2006-07 acquisition of 1,084 miles of feeder lines that reach into the tar-sands- and natural-gas-producing areas to the north and west, including Fort McMurray and the Peace River Valley. CN paid $76 million (Canadian) to acquire the four former CN branch lines. By 2011 it had spent $305 million to rehabilitate them to support new traffic. And in 2015 CN plunked down $100 million more for heavier rail and ballast.

The railroad also brought supply-chain collaboration into the mix. Petrochemical traffic is the domain of private freight cars. "Most railroads say, 'I'm going to wash my hands of that — not my cars, not my fleet,'" Drysdale says. Canadian National, however, has a small, Edmonton-based, private-car-management team that reduces dwell and improves velocity.

In another stroke of luck, the Wisconsin Central subsidiary sits atop the best deposits of sand that oil and gas companies use in hydraulic fracturing, or fracking. "But we did a lot of things to amplify that potential growth," Drysdale says. Canadian National looked at ways to accelerate permitting and construction of sand plants, helped markets develop once the mines were running, and upgraded feeder lines. "We played a lot of matchmaking in frac sand, introducing receivers to originators," she says.

Collaboration at work

Mark Thomson, general manager of transportation for West Fraser, says the Vancouver-based forest products company was intrigued when CN suggested that they develop closer ties. For years West Fraser had been butting heads with CN over its service and rates.

Over dinner in Montreal four years ago, Mongeau and Doug MacDonald, then CN's vice president of industrial products, asked Thomson and his CEO, Ted Seraphim, to consider collaboration. "It was a big leap of faith to move forward," Thomson says.

Luc Jobin

Mutual trust sprang from ongoing communication. "The relationship in the past four years has been phenomenal," Thomson says. So when CN had a customer seeking a site for a frac sand terminal — which requires a lot of space — the railway approached West Fraser about its large lumber and pulp mill complex in Hinton, Alberta.

"Ten years ago we would not have given it the time of day," Thomson says. But West Fraser gave CN the green light. A frac sand terminal or other industrial transload facility will be built at Hinton, and CN and West Fraser may also develop a multi-modal center. The project's ultimate shape will help CN find a home for sand while providing revenue and a better asset for West Fraser.

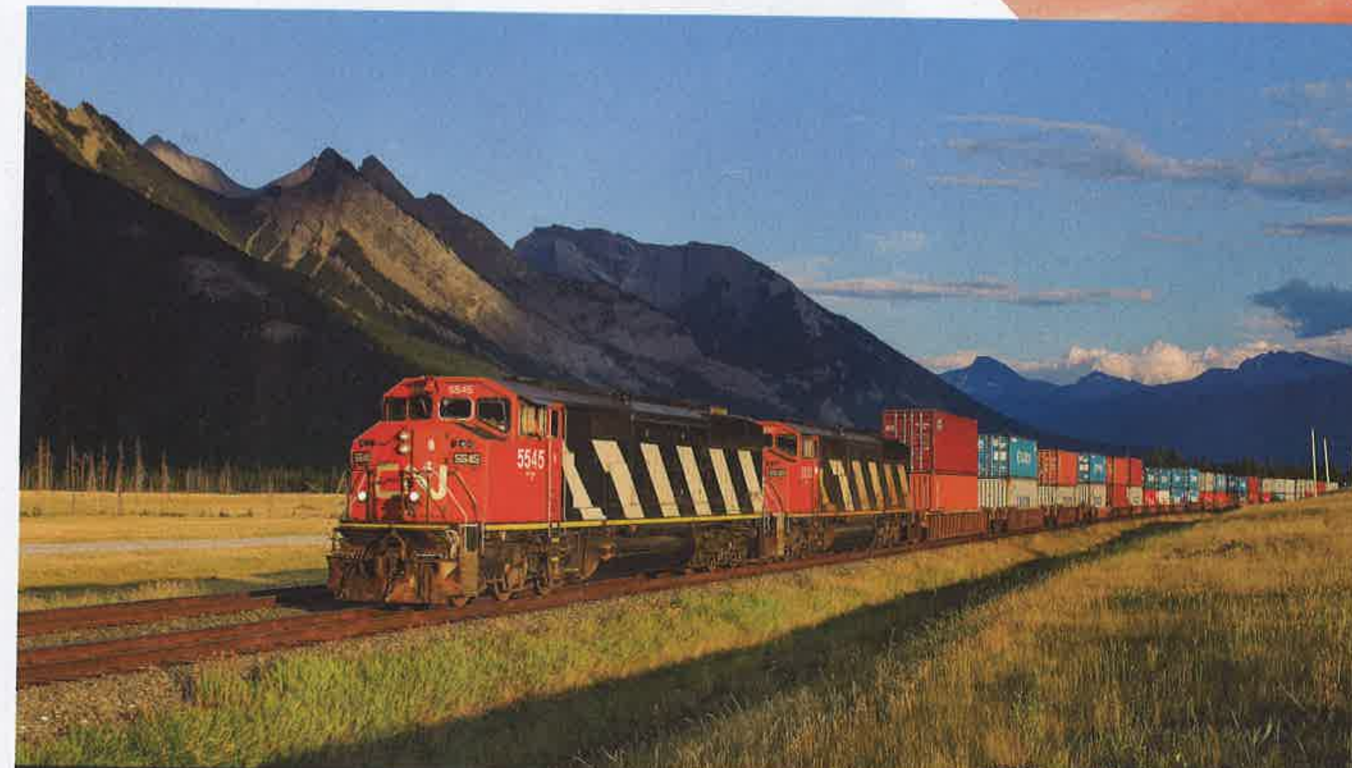
Thomson credits Mongeau, marketing chief Jean-Jacques Ruest, and current CEO Luc Jobin for a focus on innovation and communication. "They're constantly coming to us," Thomson says, "asking what do you think of this, what do you think of that?"

Collaboration is a two-way street. To avoid drayage and congestion issues in Vancouver, West Fraser is currently working with CN on a multi-modal "short sea" shipping move: Deliver product by rail to a distribution site, transfer it into containers, load the boxes on barges, and then take inland waterways to Vancouver for loading on ships bound for Asia.

Finding solutions like these are possible when companies work together. "It's not rocket science by any means," Thomson says. "It's a very basic concept. But instead of it being lip service, it's actually happening."

In Saskatchewan, CN has been a partner of AGT Food and Ingredients since the lentil-, bean-, and grains-processing company was founded in 2007. CN has doubled its share of AGT's business in the last seven years. "That's a credit to their desire to design service to fit the business plan that we have," says Murad Al-Katib, AGT's CEO. "It goes beyond collaboration into what I call supply-chain innovation."

AGT was among the first companies to ship grain in containers. Today it sends 90,000 loads annually to 120 countries from facilities around the globe. With half of AGT's products flowing out of Canada, CN plays a key role in its supply chain.



Container train Q19251 moves east at Henry House, Alberta, on Aug. 12, 2013. Origin: Prince Rupert; destination: Montreal. Tim Stevens

Some of CN's double-stack trains bound for Prince Rupert pause at Saskatoon. Empty containers are taken off the train, stuffed with AGT products, and catch the next train to Prince Rupert for export to Asia. "We used to be known as the breadbasket of Canada. Now we're the first stop on the protein highway," Al-Katib says.

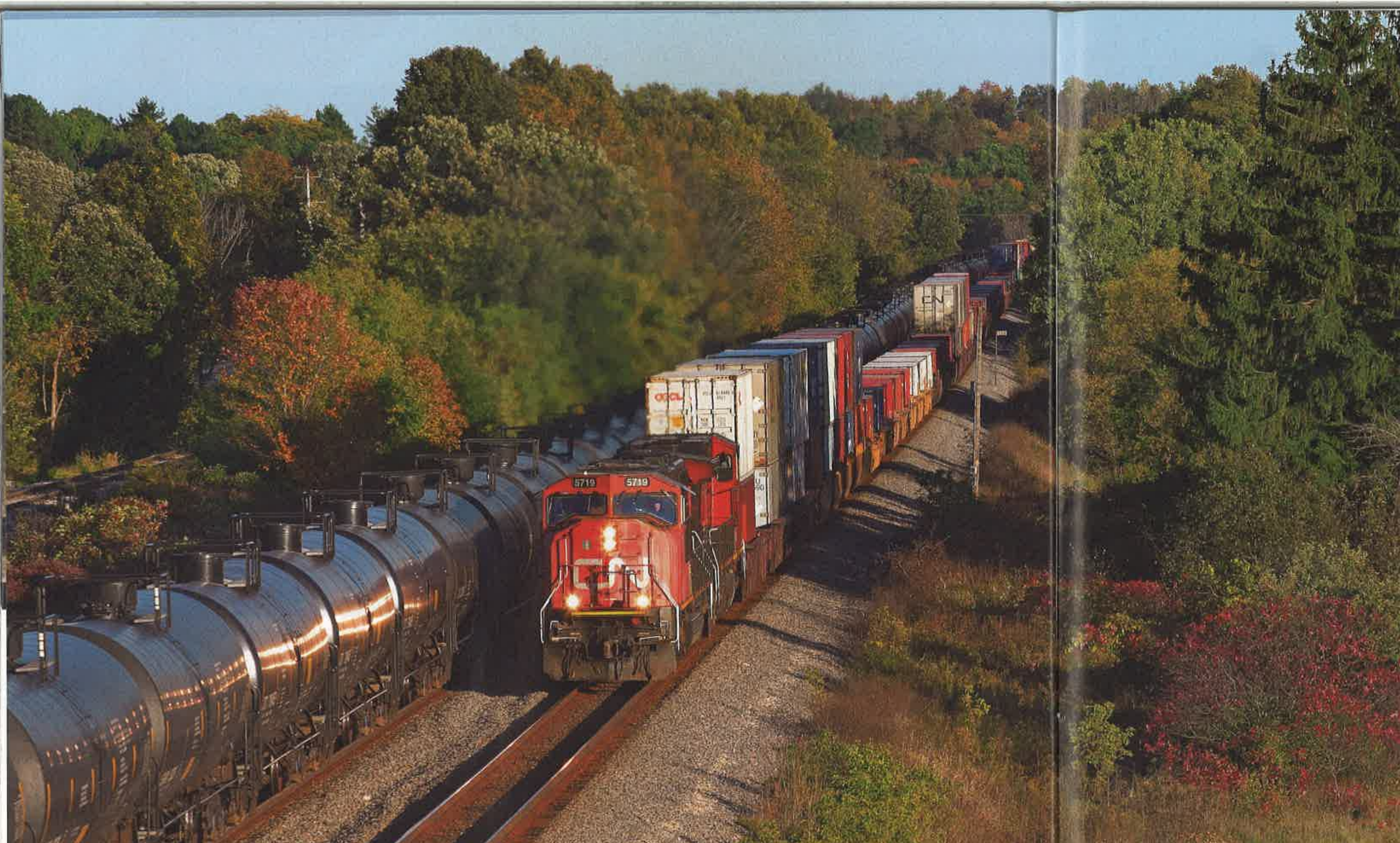
CN and AGT also cooperate on unit grain trains. In 2015, AGT purchased the parent company of two prairie short lines — Big Sky Rail and Last Mountain Railway — that serve key growing regions south of Saskatoon. The 334-mile Mobil Grain lines serve a dozen AGT processing centers. To connect the two railways, CN granted the short lines running rights over 70 miles of its Craik Subdivision. The short lines deliver grain to the AGT processing center adjacent to CN's Saskatoon yard. CN hauls some grain in unit trains to the Great Lakes port at Thunder Bay, Ontario. Thanks to close coordination, the grain train rolls up to the terminal as the lake boat is tying up at its berth, keeping everyone's assets moving.

Canadian National works with shippers to move loaded containers in both directions to the benefit of all. Northbound train A443 rolls through Trochu, Alberta, on Jan. 19, 2011. Gordon Smith

Efficiency seems to be wired into everything that CN does, for itself and its supply-chain partners. Consider the export coal business in Western Canada. Before collaborating with coal producers and ports, CN might have received simultaneous requests to supply four mines with unit trains of empties that could be loaded for delivery to Vancouver. The trains would arrive at the port only to find that the ship couldn't handle all that coal. Someone's train had to sit. Now, with visibility across the supply chain, CN knows the size of mine stockpiles and it knows when bulk vessels are going to call at West Coast ports. It can then allocate resources to filling the vessel — and divert that last train to Prince Rupert, where another vessel will be calling. This is more efficient for everyone: CN, mines, and ports.

Supply-chain collaboration is more complicated for merchandise business. CN continues to focus on improving service in the all-important first and last mile that railcars roll. Its suite of online tools — while not perfect — is more robust than other railroads' offerings, shippers say, which provides them with better visibility as their cars move through the system.

Canadian National also aims to be easier for shippers to deal with by selling all of its services through one point of contact. This allows the railway to propose a range of end-to-end transportation services, from rail and intermodal to bulk handling, trucking, and warehousing.



Two primary ingredients in CN's formula for success: Oil and intermodal. A meet takes place at Ackerville, Wis. TRAINS: Drew Halverson

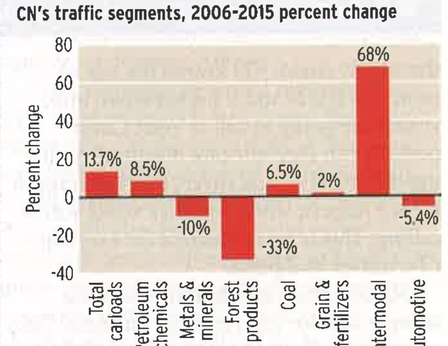
Tonnage growth

Compare CN's tonnage maps from 2006 and 2014 (the last year available) and you might wonder how its routes in Western Canada kept running smoothly. The railway's spine, from Edmonton to Winnipeg, carried 52 percent more tonnage in 2014 than in 2006. Although the unusually brutal winter 2013-14 crippled the railway's performance, under normal circumstances CN has been able to move its parade of intermodal, manifest, and bulk traffic. Cory says CN remained fluid for two reasons: It filled out existing trains and it gradually stretched the railroad from one built for 6,000-foot trains to one that can handle the 10,000-to-12,000-foot monsters of today.

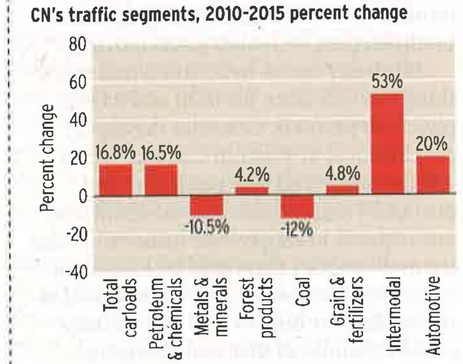
Running longer trains is a powerful tool. In 2015, CN extended sidings at strategic points on the Winnipeg-Toronto route, creating places for 12,000-footers to meet. CN now sends the same tonnage over the line — but it moves on 35 percent fewer trains, Cory says.

CN also deliberately tried to be "a touch behind" traffic growth, he says. Why? So officials could figure out ways to operate more efficiently. This minimizes capital expenses while making the railway more productive over the long term.

"We have very few bottlenecks on our railroad, if any," Cory says. "We have invested anywhere over the last four to five years — anywhere we found that volumes grew to the point that our speed or velocity was hampered, primarily in our Edmonton to Chicago gateway."

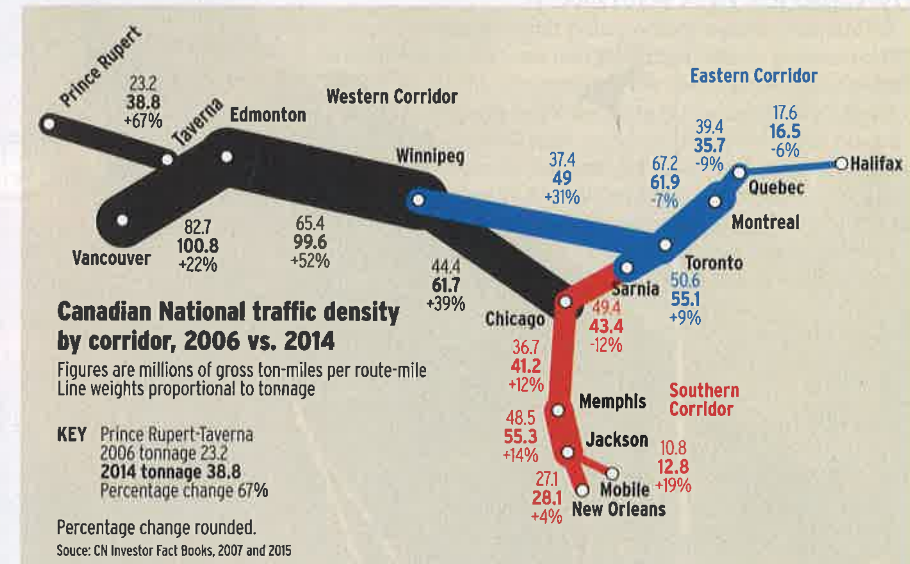


Source: CN Investor Fact Books and Annual Reports



Source: CN Investor Fact Books and Annual Reports

All signals are green for Canadian National: Train M331 gets a move on tank cars at Paris, Ontario, milepost 32.6 of the Dundas Subdivision, on Jan. 31, 2015. Jordan Friedrich



CN's capital budget swelled from $1.7 billion in 2010 to $2.75 billion in 2016. More than $200 million was spent on Western Corridor capacity between 2013 and 2015. This included installing sections of double track, extending sidings, and adding crossovers and high-speed switches on its Edmonton-Winnipeg-Chicago route. At the same time, it invested in additional support yards in Edmonton and Winnipeg to reduce workloads at major classification yards. Also part of the program: increasing capacity on the Prairie North Line, a relief valve for the parallel Edmonton-Winnipeg main.

CN spent a bundle — $270 million U.S. — to improve connections between its EJ&E and main routes into Chicago, as well as to upgrade Kirk Yard in Gary, Ind. CN trains now move more than twice as fast through Chicago. And CN's not done. This year CN plans to spend $12.1 million on EJ&E connections and $6 million in Kirk Yard to keep what it calls its "Chicago advantage."

Follow the leader

In their search for growth, the other Class I railroad systems are following portions of CN's playbook. "Other railroads have already taken notice of what CN has done," Hatch says. They are better at marketing than before. Operationally, they're closing the gap. And they are working more closely with customers, though not yet to CN's level.

Supply-chain collaboration requires a change in mindset and culture. Yet it's a not-so-secret sauce that every railroad can whip up. "It's about a culture of embracing change, it's about a culture of driving fundamental process innovation, and intense focus on execution," Mongeau says. "It's no secret but it's not easy to do."

John Larkin, an analyst at Stifel, says CN can continue to grow despite sluggish traffic trends over the past 18 months. "We have often cited CN for being the best railroad in the world," he says. "That hasn't changed. Once the headwinds exit stage left, CN should be in good shape." CN provides better service than CP, Larkin notes, and its recent partnership with trucker J.B. Hunt should propel its domestic and cross-border intermodal business. CN also has signed service agreements with the ports of Mobile, Ala., and New Orleans to tap the intermodal potential of Panama Canal shipments arriving at the Gulf Coast.

Jobin and his management team plan to build on the momentum created by Tellier, Harrison, and Mongeau. CN will follow the same strategy, Jobin says, but will strive to deploy more technology to improve safety, productivity, and service.

"It's all about going out there and with our supply-chain mindset continuing to innovate, continuing to operate in a way that balances the productivity and the service improvements," Jobin said on CN's third-quarter earnings call. "And to a large extent, I would say the journey continues." I

EXHIBIT 28

[REDACTED]

EXHIBIT 29

[REDACTED]

EXHIBIT 30

[REDACTED]

EXHIBIT 31

[REDACTED]

EXHIBIT 32

[REDACTED]

EXHIBIT 33

[REDACTED]

EXHIBIT 34

SUMMARY OF THE 2016 – 2020 CORPORATE PLAN

AND
2016 OPERATING AND CAPITAL BUDGETS

of their trips by passenger rails. Forty percent of these same passengers indicate that this low number, despite their preference for rail, is due to inadequate frequencies and scheduling.

In Ontario and Quebec, where VIA Rail operates the Quebec-Windsor Corridor business, real GDP has grown 2.0% per year for a total growth of 10.4% from 2010-2014. The population also grew by 1.0% per year for a total growth of 5.1% within the same period. Between 2010 and 2014, the average price of gasoline increased significantly. Congestion in the large city centers combined with a higher cost per trip should logically make the automobile a less attractive option.

This positive environment should have contributed to substantial growth in VIA Rail's ridership and revenues in the Corridor. Instead, between 2010 and 2014 in the Corridor, VIA Rail's:

- Ridership decreased from 3.8 million to 3.6 million total passengers;
- Revenues increased 4.2% thanks to a broad based fare adjustments and better capacity management in the second half of 2014, while revenue increased 5.2% over 2013;
- Operating ratio (revenues vs operating expenses) has declined from 107% to 104%.

One of the most common misconceptions is that VIA Rail's main competitor is the airplane. However, due to the distances between the three large city pairs within the corridor (Toronto, Ottawa, Montreal), VIA Rail's main competitor is in fact the car. Within the Corridor, if the total Car and Train trip time market is isolated, VIA Rail currently only captures 5%, which compares unfavorably to two other popular international corridors shown below:

Characteristics of popular international corridors

	Rail Share	Frequency	Avg. Speed	Equipment	Total Pop.	Distance	Infrastructure
Toronto-Ottawa-Montreal	5%	11 / day	98 km/h	Conventional	11 M	573 km	Shared
New York City - Washington DC	14% (in 2003)	40 / day	127 km/h	Conventional	29 M	361 km	Mostly Dedicated
Rome - Milan	69%	40 / day	200 km/h	High Speed	9 M	574 km	Dedicated

Long-Haul

VIA Rail's Long-Haul trains provide a hybrid product aimed at servicing the tourist sleeper market, which is akin to the Cruise ship tourism segment, as well as the intercity service aimed at connecting communities along the routes. VIA Rail operates two Long-Haul trains, the *Canadian* between Toronto and Vancouver and the *Ocean* between Montreal and Halifax.

The sleeper tourist class targets travelers who wish to discover Canada's scenery at a leisurely pace. Global conditions and the declining Canadian dollar currently provide favorable conditions for these services.

The *Canadian*

Unfortunately, VIA Rail also faces internal issues that make its unique offer unattractive. An aging fleet (despite 12 rebuilt cars), deteriorating track conditions and track access problems due to higher freight traffic have all led to deteriorating OTP and deteriorating trip times.

Punctuality is key for tourists, and VIA Rail's inability to meet its schedules is highly detrimental to Canada's brand abroad as well as to VIA Rail's costs and bottom line.

The following table outlines the on-time performance of the *Canadian* over the last several years:

Year	2009	2010	2011	2012	2013	2014	2015 Q2 YTD
OTP	84%	84%	74%	70%	60%	33%	24%

From 2010 to 2014, the *Canadian*'s OTP has deteriorated drastically with some delays being as long as 24 hours. This ultimately leads to substantial problems for tourists on tight schedules that often use the *Canadian* to connect with a cruise ship or to another leg of their vacation; unreliability is one of the major sources of negative comments on travel social media.

This is not the first time poor OTP has troubled the *Canadian*. In 2009, VIA Rail needed to add one additional night to the total journey, thus allowing more schedule "float" to ensure that connections were met.

Today, despite having lengthened the schedule by one additional night, OTP continues to deteriorate and has dropped to only 24%.

Despite a highly positive international tourist environment, the *Canadian* has seen its ridership decrease by 11.5%. However, with the addition of value added products, revenues increased by 3.5% and the operating ratio has improved from 71% to 76%.

With three frequencies per week during the peak season and two during the off-season, the *Canadian* does not provide adequate frequencies to deliver a viable travel alternative in the intercity and regional markets between and around Winnipeg, Saskatoon, Edmonton, Jasper and Vancouver. Nor does it serve Regina and Calgary.

<u>The *Ocean*</u>

Over the past decade, the rail infrastructure has degraded to the point where the service was threatened. In 2014, a 44-mile section of CN track on which the *Ocean* operates through New Brunswick (the Newcastle Subdivision) was in jeopardy of service discontinuance (due to CN deciding to abandon the track), which would have resulted in either re-routing or in cancellation of the service. This abandonment of track between Bathurst and Miramichi would have truncated the route of the *Ocean.* After a review and evaluation of alternatives, it was decided that VIA Rail would invest an estimated amount of $10.2 million on infrastructure and bridge repairs for that section. Work started in 2014 and will allow a reduction in the trip time of about 30 minutes.

Thanks to this investment, the *Ocean* has maintained a respectable OTP. Frequencies however have been reduced from six one-way departures per week to three one-way departures. With this reduction of frequencies, the Ocean does not have sufficient frequencies to deliver an adequate travel alternative in the intercity and regional markets serving between Quebec City and among Rivière-du-Loup, Campbellton, Moncton and Halifax. Additional frequencies, in response to consumer demand, were added during the Holiday season.

Regional and Remote services

While not intended to be commercially viable, these train services operate in hard-to-reach areas where travel options are limited. As such, the potential markets and competitive landscape are restricted. In some areas, roads were built providing access (permanent or seasonal) by car or truck and passenger

EXHIBIT 35

Opinion: Passenger-train service falling off the rails

GLENN CARTWRIGHT

More from Glenn Cartwright (HTTP://VANCOUVERSUN.COM/AUTHOR/GLENN-CARTWRIGHT)

Published on: August 28, 2016 | Last Updated: August 28, 2016 6:00 PM PDT

(http://vancouversun.com/author/glenn-cartwright)

Via Rail passengers trains are already slow and they can't keep to their extended schedules because freight trains get priorities in Canada. *TONY CALDWELL/SUN MEDIA*

There was a time when every schoolchild knew it took three days by train from Toronto to Vancouver.

In the 1970s, there were four trains per day between Montreal, Toronto and Vancouver. Today, VIA Rail's only service, the Canadian, has shrunk to one train, three times a week (during summer) and just two a week during the winter.

In the meantime, the number of freight trains has increased. They are becoming longer, with well over 150 cars the norm. While in the 1980s the average freight train in Canada was nearly 5,000 feet long and weighed 7,000 tons, today these trains stretch 12,000-14,000 feet – that's four kilometres – and weigh some 18,000 tons.

In addition to length, freight trains are carrying twice as much as they once did through the marvel of "double-stacking" – packing containers one on top of another.

Traveling across Canada on VIA Rail's Canadian, one encounters some 20 to 30 freight trains per day. Most of these trains are too long to fit the sidings and so the passenger train must pull in and wait. The railroads now give freight trains priority and the Canadian must play hopscotch, dodging freights all across Canada.

It was because VIA Rail could not keep their three-day schedule in the face of this onslaught of heavy freight traffic that they decided to opt for a four-night schedule with long stops at several stations (up to five hours in Winnipeg) to ensure on-time arrival. Further, compensation was offered for trains that were significantly late: VIA offered passengers a 50-per-cent credit on their next trip, though this was of little value to overseas visitors who would be unlikely to make the trip again.

However, VIA still could not keep to the four-night schedule, and the 50-per-cent credit became such a usual and expensive occurrence that it was cancelled. The dining car now routinely stocks hundreds of extra meals to cover inevitably late trains and VIA has added this note to their reservation system: "While VIA endeavours to operate on time, the realities of increased freight traffic on tracks that we do not own may give rise to significant delays. We suggest that you do not arrange connecting transportation on the day of your arrival." This at a time when VIA is actively recruiting upscale passengers with rebuilt luxurious sleepers featuring en-suite showers, a fully stocked bar, and a one-way price tag for two of $7,400.

On my trip to Vancouver, the train was late leaving Toronto. Originally scheduled for 10 p.m., the train left at 9 the next morning. This is a routine occurrence. Travelers, including me, were put up in a hotel at VIA's expense. With a 9:42 a.m. arrival scheduled for Vancouver some four nights later, I cautiously booked a 5:30 p.m. connection to Seattle. Surely a nearly eight-hour layover would be sufficient to guarantee the connection, especially with the five-hour layover in Winnipeg that could be used make up time.

Alas, somewhere east of Abbotsford, it became apparent that we would not make it. Further, the crew were "timing out": they would run out of hours to work legally and leave the passengers stranded.

I opted for a taxi from Abbotsford ($193 at my expense) to the VIA Rail station in Vancouver. Incidentally, VIA Rail will not cover a missed Amtrak connection (even though it was their fault) because it is Amtrak – a different railway. With the help of the taxi, I just made the connection.

The return trip was not much better and the train got later and later. One Mennonite couple visiting in Saskatchewan sat in their son's pickup truck for hours waiting for the train.

In a subsequent trip to a conference in Winnipeg, the train was also late leaving. And the return was even worse. Scheduled for a 10:30 p.m. departure from Winnipeg, I checked out of my hotel at 11 a.m. and was forced to sit with other passengers until the 3 a.m. departure.

The arrival at the Capreol station north of Sudbury found a woman whose husband had dropped her off the previous night and driven off. Because the train was significantly late, the staff didn't bother to open the station. The woman sat on her suitcase, outside, all through the night waiting for the train.

One man, due in to Toronto at 9:30 a.m., was unsure he would make an 8:30 p.m. flight to Germany with his family. The crew of the Canadian dispatched him by cab from the Capreol station to Sudbury airport to catch a connecting flight at a cost to him of more than $400.

When the train finally arrived at Toronto, VIA had to send passengers by taxi or van to their final destinations like Brampton, Guelph and Kitchener,

Little wonder that VIA Rail does little to advertise its product. Recently in England, I was surprised to learn that while most everyone had heard of the highly priced Rocky Mountaineer (a privately owned, summer-only service, few had heard of VIA or even knew that VIA still operated a regular train, even though it is rated as one of the top 25 trains in the world. Travellers from Australia and England who marvel at Canada's scenery are baffled at the inability of VIA Rail to stick to its schedule, even its lengthened one. Before the last federal election, a private member's Bill C-640, introduced by NDP MP Philip Tone, was defeated on second reading. Such a bill would have given VIA Rail the legislative authority it needs, and has operated without since its inception. Among other things, it gave passengers priority over freight traffic.

Does anyone care that without such legislation VIA is steadily diminishing? Passenger trains in Canada need government support, and protection from the onslaught of ever-growing freight traffic. Will the Liberals step up to the plate and make the passing of a VIA Rail bill their priority? Without it, the passenger train in Canada may well become extinct.

Glenn Cartwright is the former principal and vice-chancellor of Renison University College, an affiliate of the University of Waterloo.

PUBLIC VERSION - REDACTED

BEFORE THE SURFACE TRANSPORTATION BOARD

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(A) – CANADIAN NATIONAL RAILWAY COMPANY	: :	FINANCE DOCKET NO. 35743

REBUTTAL VERIFIED STATEMENT
OF

BENJAMIN SACKS

ON BEHALF OF

NATIONAL RAILROAD PASSENGER CORPORATION

September 14, 2017

TABLE OF CONTENTS

I. Identity of Expert 1
II. Executive Summary 1
III. KOTP Ignores How Late Trains Arrive 2
IV. KOTP Does Not Work When an Amtrak Train Runs on Multiple Hosts 3
V. KOTP Rewards CN for Matters Beyond its Control 6
V.A. The Common Pool in KOTP 6
V.B. Examples to Illustrate how the Common Pool Rewards CN for Matters Beyond its Control 8
V.C. Common-Pool Summary 10
VI. Comments on the Dubin Report 10
VII. 80% ASOTP Does Not Suffer from KOTP's Flaws 11
VIII. Explanation of KOTP 12
VIII.A. Performance Measurement 12
VIII.B. Within Tolerance 12

Appendix A: Resume of Benjamin Sacks A-1

I. Identity of Expert

1. I am the same Benjamin Sacks who filed a verified statement in this matter on September 4, 2015, in which I explained an incentive system proposed by Amtrak.

II. Executive Summary

2. Counsel for National Railroad Passenger Corporation ("Amtrak") has asked me to (i) analyze if CN's proposed Contractual On-Time Performance ("KOTP") system is part of a "well-designed structure for compensation and efficient incentives" as claimed in the Verified Statement of Ladue and Kuxmann[1]; and, if I find it is flawed, (ii) to evaluate if the incentive system proposed by Amtrak based on 80% all-stations OTP ("80% ASOTP System") has the same flaws; and (iii) to comment on the Dubin Report.[2]

3. In my opinion, KOTP is a seriously flawed measure of CN performance, and cannot form part of a "well-designed structure for compensation and efficient incentives". [3] KOTP – and hence the agreement that incorporates it - is conceptually flawed for three main reasons.

[redacted]

[redacted]

[redacted]

---

[1] "Joint Verified Statement of Paul E. Ladue and Scott Kuxmann," *Application of the National Railroad Passenger Corporation Under 49 U.S.C. § 24308(a) – Canadian National Railway Company*, September 3, 2015 (hereafter, "Ladue and Kuxmann").

[2] "Verified Statement of Jeffrey A. Dubin," *Application of the National Railroad Passenger Corporation Under 49 U.S.C. § 24308(a) – Canadian National Railway Company*, September 3, 2015 (hereafter, "Dubin" or "Dubin Report"). The Dubin Report contains on-time performance calculations which were used by other CN witnesses as the Amtrak service level targets for their capacity modeling studies.

[3] Ladue and Kuxmann, p11 (Heading II).

[redacted]

4. In my opinion the 80% ASOTP System does not suffer from KOTP's flaws.

   a. It contains incentives for CN to minimize delays both on trains that are on-time and that are late.

   b. It is calibrated to result in at least 80% OTP as experienced by passengers, even when trains run across multiple hosts.

   c. It rewards or penalizes CN based only on CN's minutes of Host-Responsible Delay (HRD). Delays (or a lack of delays) by Amtrak do not affect CN's compensation at all.

5. The Dubin Report suffers from two significant flaws that render its conclusions incorrect and unreliable.

   a. Dr. Dubin miscalculates his "Endpoint OTP" and, since all of his results depend on this input, all of his results are therefore incorrect and unreliable.

   b. Dr. Dubin does not test if his logistic functional form fits the data in the critical 80% to 90% Endpoint OTP range. Since the logistic function curves materially near 100%, the fit of the function may be extremely poor in the critical region, rending his estimates unreliable.

6. I explain each of these opinions in turn below.

III. KOTP Ignores How Late Trains Arrive

7. Amtrak and its customers care about how often trains are late and, when they are late, how late they are. [redacted]

8. Many trains have large CN-related delays, and those trains often arrive very late. For example, as Figure 1 shows, 1% of Amtrak trains on the City of New Orleans (CONO) route had more than 237 minutes of CN-related delay, and 10% had more than 160 minutes of CN-related delay. On average those trains were 195 and 83 minutes late at their endpoints, respectively.

Figure 1: Large Delays on Amtrak Trains Run on CN[4]

	The worst 1% or 10% of trains have more than this many minutes of CN delay		Average minutes late at endpoint of such trains	
	1%	10%	1%	10%
CONO	237	160	195	83
Blue Water	109	35	128	72
Lincoln	40	15	66	35
Texas Eagle	50	22	103	81
Wolverine	35	12	91	63
Illini / Saluki	116	67	128	65

Source: Analysis of Amtrak Data from July 1, 2011 to June 30, 2015.

9. Because KOTP does not penalize CN based on how late trains are on arrival, it provides almost no incentive for CN to minimize delays (and hence lateness) on trains like those in Figure 1.

IV. KOTP DOES NOT WORK WHEN AN AMTRAK TRAIN RUNS ON MULTIPLE HOSTS

10. Neither KOTP nor the 80% ASOTP System penalizes CN for delays that occur before a train arrives onto CN. However, because of the way KOTP implements this protection, [redacted] The 80% ASOTP System does not suffer from this flaw, but still does not penalize CN for delays beyond its control (e.g., delays that occur before a train arrives onto CN).

11. KOTP has this flaw because of how it deals with trains that arrive late to CN. [redacted]

---

4 See Workpaper to Figure 1.

5 See Section VIII for details on KOTP.

[redacted]

[redacted]

[redacted]

	[redacted]		[redacted]
	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	
[redacted]			[redacted]

[redacted]

6 [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

V. KOTP Rewards CN for Matters Beyond its Control

20. Ideally, a penalty/reward system should neither penalize nor reward CN for matters beyond its control. Ladue and Kuxmann would appear to agree, though they focus on the penalty, as opposed to the reward, side of the equation:

[redacted]

V.A. The Common Pool in KOTP

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

V.B. Examples to Illustrate how the Common Pool Rewards CN for Matters Beyond its Control

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Ladue and Kuxmann do not discuss the Common Pool aspect of KOTP that rewards CN for matters beyond its control.

V.C. Common-Pool Summary

[redacted]

[redacted]

VI. Comments on the Dubin Report

30. Dr. Dubin miscalculates his "Endpoint OTP." All of his results depend on this input, so all of his results are therefore incorrect and unreliable. Dr. Dubin states that he was asked to analyze the relationship between various kinds of minutes of delay and "endpoint on-time performance ("OTP")".[13] Dr. Dubin calculated OTP as follows:

> *… each individual train trip was categorized by whether the train arrived at its endpoint on time. This was determined by summing the minutes of delay for all categories of delay for each individual train trip and comparing that sum to the "allowable" minutes of delay that train could incur before it would be considered late. If the sum of minutes of delay for a train trip was less than or equal to the "allowable" minutes of delay for that train, the train was considered to be on-time.*[14]

31. This "OTP" does not correspond either to standard end-point OTP, or to KOTP. Standard end-point OTP is measured against a scheduled arrival time, not against minutes of delay.

[redacted]

[redacted]

13 Dubin, p2.

14 Dubin, p6.

The two can differ, primarily because recovery time occurs in different places along the route, not all at the end.[15] For example, a train with 30 minutes of total recovery time incorporated into the schedule - 15 minutes in the middle and 15 minutes at the end - that experienced 20 minutes of delay immediately after departure, and nowhere else, would be on-time under both Dr. Dubin's OTP and standard OTP. Another train on the same route that experienced this delay right before arrival at its end point would be on-time under Dr. Dubin's OTP but late according to standard OTP.

32. Since all of Dr. Dubin's results are based on regressions that take his calculation of OTP as an input, all of his results are incorrect and unreliable.

33. Dr. Dubin's results are also unreliable because he does not test if his logistic functional form fits the data in the critical 80% to 90% Endpoint OTP range. Since the logistic function curves materially near 100%, the fit of the function may be extremely poor in the critical region, rending his estimates unreliable.

VII. 80% ASOTP Does Not Suffer from KOTP's Flaws

34. The 80% ASOTP System does not suffer from the KOTP system's flaws identified in this report, or the flaws identified in Dr. Dubin's report. On each route separately, it calculates the minutes of HRD per month that have historically been consistent with 80% All Stations OTP (ASOTP) – the "80% Point." The system penalizes CN when it has more minutes than the 80% Point on a route, and rewards it when it has fewer. The penalties increase with the minutes of CN HRD, and the rewards increase as minutes of CN HRD decline. The penalties are calibrated to CN's self-reported costs to negate CN's perception that providing Amtrak service with HRD above the 80% Point (and hence expected All Stations OTP below 80%) creates a net cost savings for CN. [16]

35. The 80% ASOTP system provides incentives for CN to reduce delays on all trains, including those that are or will be late. By providing quality payments (i.e., incentives) and penalties based on CN-responsible minutes of delay, an extra minute of CN-responsible delay suffered will always (or almost always) translate into an extra penalty or reduced incentive – similarly a minute of delay avoided will translate into an increased quality payment or reduced penalty.[17]

---

15 It can also differ when Amtrak uses less dwell time than scheduled, which would tend to make trains Dr. Dubin's definition counted as "late" instead qualify as "on-time" under the conventional definition.

16 See Sacks Verified Statement, Section V.

17 The "almost" is because there are maximum penalties. If, in a given month, CN's performance is so poor that it is assured of receiving the maximum penalty, then it will no longer have an incentive to minimize delay.

36. The 80% ASOTP System accounts for the reality that when CN is not the only host railroad, trains will experience delays across other hosts too. It compares CN's performance (i.e., total minutes of CN attributable delay in a month) to the historical level of performance associated with 80% ASOTP on a given route. Performance targets are set so that – *given the actual historical performance of CN, Amtrak and all other hosts a train runs on* – if CN meets its targets then it is doing its part to achieve 80% ASOTP.

37. The 80% ASOTP System only penalizes or rewards CN based on CN's performance. It is based only on CN HRD so actions (or lack of action) by Amtrak or 3rd parties will have no impact on CN's penalty or reward.

38. The 80% ASOTP System is based on a regression that uses actual ASOTP – as measured against actual arrival times vs. schedule - as an input. It does not suffer from the flaw identified in Dr. Dubin's model where he used a definition of end-point OTP that does not correspond to either standard usage or KOTP. The 80% ASOTP System also uses a linear regression model, which fits the data around the 80% point - and everywhere else. This is evident from plots of the data in my Verified Statement.[18] In every case where there is data near the 80% point, the data appears to be linear in that region.

VIII. Explanation of KOTP

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[18] See Sacks Verified Statement, Figure 3; Figure 13; Figure 14; Figure 16; Figure 18; and Figure 20.

[19] With certain exceptions as provided in item 4 of Appendix V. Also, "Special Trains" are subject to a different incentive system, as per item 7 of Appendix V.

[redacted]

- [redacted]

- [redacted]

- [redacted]

- [redacted]

- [redacted]

- [redacted]

[redacted]

Signed,

Benjamin Sacks

September 14, 2017

Appendix A: Resume of Benjamin Sacks

BENJAMIN A. SACKS

Principal

Washington, DC | +1.202.419.3366 | Benjamin.Sacks@brattle.com

Mr. Benjamin A. Sacks has over fifteen years of experience providing expert advice and testimony on the application of economics, finance, and statistics to valuations, damages and determination of liability. Mr. Sacks has assisted corporations, investors, U.S. government agencies (such as the Department of Justice), and foreign governments, in developing and presenting economic and financial testimony in complex litigation and arbitrations. Notable engagements include deposition testimony on the complex relations between Hank Greenberg, AIG and the Starr Corporation; and supporting testifying experts in several RMBS related actions, voting rights litigation in Texas, and several Yukos-related international arbitrations.

Mr. Sacks is a principal in The Brattle Group's finance and litigation practice, having previously served as a vice-president at CRA and a partner at Bates White where he helped to found the firm's Corporate Finance and Environmental and Product Liability practices. Mr. Sacks has presented at the Securities and Exchange Commission on corporate governance and self-dealing, and at Credit Suisse First Boston and the Lex Mundi International Conference in Rome on asbestos liability, particularly in the context of mergers and divestitures. He has also taught CLE courses on damages at various law firms.

Mr. Sacks received his B.A. in mathematical economics from Columbia University and his M.A. in economics from the University of Chicago. At the University of Chicago he has also passed all of the exams and completed all of the coursework required for a Ph.D.

AREAS OF EXPERTISE

- International Arbitration
- Finance, Valuation & Securities Analysis
- Commercial Damages & Lost Profits
- Statistical Analysis

EXPERIENCE

International Arbitration

- Valuation of a controlling interest in a Korean Bank (BIT, International Chamber of Commerce).

- Valuation of a Telecommunications Company in a developing country (Bilateral Investment Treaty heard under UNICTRAL rules, Permanent Court of Arbitration).

r

- Damages expert for Mr. Jason Rezaian, who was taken hostage by Iran. U.S. District Court for the District of Columbia. Civil Action No. 1:16-cv-01960-RJL.

- Consulting expert on annulment and enforcement proceedings relating to the Yukos ECT arbitration award. Reports in various venues on matters of a "surprise decision" and errors in the Tribunals damages method, and on the origin of Claimants' holdings of Yukos shares stemming from Loans for Shares and other transactions.
- Consulting expert in ICC arbitration involving construction of oil platforms in Brazil.
- Consulting expert in ICDR arbitration involving allegations of breach of contract, theft of trade secrets and tortious interference in the telecom / mobile applications industry.
- Consulting expert on behalf of foreign investors in a Uranium mine located in the former Soviet Union (London Court of International Arbitration).
- Consulting expert for private equity investors in a Korean bank (Bilateral Investment Treaty, ICSID)
- Consulting expert on behalf of the Russian Federation in three parallel arbitrations under UNCITRAL Rules in The Hague brought by former majority shareholders of Yukos Oil Company. The claims allege unfair treatment and expropriation in violation of the investment provisions of the Energy Charter Treaty.
- Valuation of mining concessions in Latin America (Bilateral Investment Treaty heard under UNICTRAL rules, Permanent Court of Arbitration).
- Valuation of oil transshipment facility in Commonwealth of Independent States (London Court of International Arbitration).
- Valuation of an investment bank in the Commonwealth of Independent States (former Soviet Union).
- Lost profits and hypothetical licensing fee involving a Chinese chemical company (Bilateral Investment Treaty Dispute, Stockholm Chamber of Commerce).
- Valuations of shares in publically traded oil Russian company (Bilateral Investment Treaty Dispute, Stockholm Chamber of Commerce).
- Valuation of firm assets and lost profits of a Russian oil company (European Court of Human Rights).
- Valuation of shares in a Russian oil company (Bilateral Investment Treaty Dispute, Stockholm Chamber of Commerce).

Finance and Valuation

- In Re Facebook, Inc. Class C Reclassification Litigation, Delaware Court of Chancery, Consolidated C.A. No 12286-VCL. Testifying expert on the financial impact of the

Reclassification on Facebook, Inc.'s stockholders, including its public Class A stockholders.

- Confidential matter involving issuance of low voting stock.
- SEC Administrative Proceeding in the Matter of BioElectronics Corp, et. al., File No. 3-17104. Testifying expert on an event study related to a corporate disclosure.
- U.S. Securities and Exchange Commission v. Daniel Mudd, Enrico Dallavecchia and Thomas Lund, Civil Action No 11-CIV-9202. Rebuttal expert on impact on investors of Fannie Mae disclosures regarding credit characteristics of guarantee portfolio.
- Valuation of privately held telecommunications firm in U.S. arbitration. October 2015.
- National Credit Union Administration Board, as Liquidating Agent of Central Federal Credit Union v. RBS Securities, et. al, Case No. 11-cv-2340-JWL-JPO and National Credit Union Administration Board, as Liquidating Agent of Western Corporate Federal Credit Union v. RBS Securities CV 11-05887 GW (JEMx), Declaration of Benjamin Sacks Regarding Compilation and Summarization of RBS Due Diligence data. October 2015.
- National Credit Union Administration Board, as Liquidating Agent of Southwest Corporate Federal Credit Union and Members United Corporate Federal Credit Union, v. Morgan Stanley & Co., and Morgan Stanley Capital I Inc., Case No. 13-CV-6705 (DLC). Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- Consulting expert in a matter before the U.K High Court relating to the valuation of shares in a luxury hotel chain.
- State ex rel. McGraw v. Wells Fargo Insurance Services of West Virginia Inc, Circuit Court of Hancock County, West Virginia, Civil Action No. 05-C-115. Expert witness regarding damages from contingent commissions offered to insurance broker.
- Assured Guaranty (UK) LTD., in its own right and in the right of Orkney Re II PLC, v. J.P. Morgan Investment Management Inc, Index No. 603755/2008, Consulting expert. Portfolio management standards and damages from alleged lack of suitability of investments.
- Ambac Assurance UK LTD., in the name of Ballantyne Re PLC, v. v. J.P. Morgan Investment Management Inc, Index No. 650259/2009, Consulting expert. Portfolio management standards and damages from alleged lack of suitability of investments.
- National Credit Union Administration Board, as Liquidating Agent of Southwest Corporate Federal Credit Union and Members United Corporate Federal Credit Union, v. Credit Suisse Securities (USA) LLC, Credit Suisse First Boston Mortgage Securities Corp., Case No. 13-CV-6736 (DLC), Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.

- National Credit Union Administration Board, as Liquidating Agent of Southwest Corporate Federal Credit Union and Members United Corporate Federal Credit Union, v. UBS Securities LLC, Case No. 13-CV-6731 (DLC). Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- U.S. Securities and Exchange Commission v. Richard F, Syron, Patricia L. Cook and Donald J. Bisenius, Civil Action No 11-CV-9201 (RJS). Testifying expert. Quantitative analysis of the loans in Freddie Mac's single family guarantee portfolio, loans underlying non-agency mortgage-backed securities, analysis of various Freddie Mac models.
- Federal Home Loan Bank of Seattle v. Goldman Sachs & Co, et al., Case No. 09-2-46349-2 SEA. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- Federal Home Loan Bank of Seattle v. RBS Securities Inc., f/k/a Greenwich Capital Markets, Inc., et al., Case No. 09-2-46347-6 SEA. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities
- Federal Home Loan Bank of Seattle v. Bank of America securities LLC, et al., Case No. 09-2-46319-1 SEA. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- Federal Home Loan Bank of Seattle v. Merrill Lynch, Pierce, Fenner & Smith, Inc. et al., Case No. 09-2-46352-2 SEA. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- Federal Home Loan Bank of Seattle v. Morgan Stanley & Co, Inc., et al., Case No. 09-2-46348-1 SEA. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- Federal Home Loan Bank of Seattle v. Credit Suisse Securities USA LLC, et al., Case No. 09-2-46353-1 SEA. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- In Re: Countrywide Financial Corp. Mortgage-Backed Securities Litigation, MDL No. 11-ML-02265-MRP (MANx), Federal Deposit Insurance Corporation As Receiver For Franklin Bank v. Countrywide Financial Corp., et al., Case No. 12-CV-03279-MRP (MANx). Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- In Re: Countrywide Financial Corp. Mortgage-Backed Securities Litigation, MDL No. 11-ML-02265-MRP (MANx), Federal Deposit Insurance Corporation As Receiver For United Western Bank v. Countrywide Financial Corp., et al., Case No. 11-CV-10400-MRP (MANx). Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.

- The Western and Southern Life Insurance Company, et al. Plaintiffs, v. DLJ Mortgage Capital, Inc., et al., Defendants, Court of Common Pleas, Hamilton County, Ohio, Case No. A05352. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- National Integrity Life Insurance Company, Plaintiff v. Countrywide Financial Corp. et al, Defendants, United States District Court for the Southern District of new York, case No 11-CIV-8011. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- The Western and Southern Life Insurance Company, et al. Plaintiffs, v. Morgan Stanley Mortgage Capital, Inc., et al., Defendants, Court of Common Pleas, Hamilton County, Ohio, Case No. A1105563. Consulting expert. Statistical analysis of due diligence and underwriting regarding residential mortgages and mortgage backed securities.
- Curbow Family LLC v. Morgan Stanley Investment Advisors Inc., Index No. 651059/2010 (Sup. Ct. NY) and Rotz v. Van Kampen Asset Management, Index No. 651060/2010 (Sup. Ct. NY). Expert witness regarding damages stemming from the redemption of Auction Rate Preferred Securities.
- Navy Federal Credit Union v. Fiserv Solutions and XL Specialty Insurance Company, Index No. 09-601217-2009. Expert witness. Statistical analysis of automated valuation model usage.
- Howard M. Ehrenberg, Chapter 7 Trustee for the Estate of Ruderman Capital Partners, LLC v. Kevin L. Washington, James King and Knight Capital Group, et al., Superior Court of the State of California for the County of Orange, Case No. 30-2011 00450602. Expert witness. Statistical analysis of trading patterns in an alleged pump and dump scheme.
- ACS Shareholder Litigation, Delaware Court of Chancery, Consolidated C.A. No. 4940-VCP. Expert witness on differential merger consideration offered to different classes of stock in a merger.
- Teachers Retirement System of Louisiana v. Maurice R. Greenberg, Edward E. Matthews, Howard I. Smith, Thomas R. Tizzio, and C. V. Starr & Co. Inc, Delaware Court of Chancery, C.A. No 20106-VCS. Expert witness on economic evaluation of entire fairness.
- Delphi Financial Group Shareholder Litigation, Delaware Court of Chancery, Consolidated C.A. No. 7144-VCG. Expert witness on differential merger consideration offered to different classes of stock in a merger.
- Coleman (Parent) Holdings, Inc. v. Morgan Stanley & Co. Incorporated, Palm Beach County, Florida, Case No. 2003 CA 005045 AI. Economic and financial analysis of damages.

- Expert witness on lost profits and lost business value due to fraud (Chinese drywall). Matter is confidential.
- Consulting expert on impact of ratings downgrade and loss of reputation for Saudi real estate firm.
- Consulting expert on the impact of alleged non-disclosure of material information on the sale price of European pharmaceutical subdivision. Matter is confidential.
- Consulting expert on valuation of oil rigs. Matter is confidential.
- Evaluation of economic content in multiple alleged tax-shelter transactions.
- Estimation of the value of residual value of auto leases with claimed losses totaling more than $500 million for a coalition of insurance carriers.

Damages and Lost Profits

- Application of the National Railroad Passenger Corporation under 49 u.s.c. § 24308(a) – Canadian National Railway Company, Before the Surface Transportation Board, Finance Docket No. 35743, Verified Statement of Benjamin Sacks filed September 4, 2015. Expert testimony on a proposed penalty system for sub-standard service to Amtrak by host railroad.
- United States of America, ex rel., Michael Saunders, v. Unisys, Inc., United States District Court for the Eastern District of Virginia, Alexandria Division, Civil Action No 1:12 CV 379 GBL/TCB. Expert witness on damages from alleged billing fraud on a government contract.
- Wolfson-Verrichia Group, et al., v. Metro Commercial Real Estate, Inc., et al., United States District Court for the Eastern District of Pennsylvania, No. 08-CV-4997. Expert witness on damages, retail shopping center development and anchor site selection.
- Eastbanc, Inc. v. Georgetown Park Associates II Limited Partnership, Georgetown Park Partners, LLC, and Herbert S. Miller, Superior Court of the District of Columbia, 2006 CA 002291 B. Expert witness on lost profits from failure / delay in developing a retail mall.
- Norfolk Southern Railway Company v. Drummond Coal Sales, Inc., U.S. District Court, Western District of Virginia. Civil Action No. 7:08CV00340. Consulting Expert.
- PBM Products LLC v. Mead Johnson Nutrition Company and Mead Johnson & Company, Eastern District of Virginia, C.A. No. 3:09CV269. Consulting expert on lost profits from false advertising.
- National Railroad Passenger Corporation vs. ExpressTrak, LLC, United States District Court for the District of Columbia, Index No. 02-CV-1773. Consulting expert on lost profits and operational performance.

- Consulting expert on damages due to infringement of database security patents. Matter is confidential.
- Expert witness on compensable costs in multiple FIFRA data compensation arbitrations.
- Expert opinion on reasonable costs in PW 5672, Harrison County fee dispute with FEMA.
- Expert witness on liability and damages is a confidential arbitration (three judge panel AAA arbitration proceedings) regarding breach of contract.
- Modeled damages in a breach-of-contract dispute for a large supermarket chain.

Mass Tort and Environmental Liability

- W.R. Grace & Co., et. al., United States District Court for the District of Delaware, Case Nos. 11-1139 through 01-1200. Estimation of foreseeable contingent liability for Sealed Air.
- Estimation of asbestos liability for a large asbestos-product manufacturing firm in a fraudulent conveyance matter.
- Estimation of silica-related liability for a major auto parts manufacturer.
- Financial reporting requirements, insurance and access to capital markets for several major companies with asbestos liability, including a large asbestos defendant, a $15 billion (sales) manufacturer, and a $4 billion (sales) manufacturer.
- Kaiser Aluminum Corporation, United States Bankruptcy for the District of Delaware, Case No: 02-10429. Estimation of asbestos liability on behalf of official committee of unsecured creditors.
- Directed due diligence on asbestos liability issues for multiple M&A transactions ranging from $50 million to $7 billion in value.
- Porter-Hayden Company, United States Bankruptcy for the District of Maryland, Case No: 02-54152 and related insurance coverage litigation. Estimation of asbestos liability for a major insurance carrier.
- Owens Corning, a Delaware Corporation, United States Bankruptcy for the District of Delaware, Case No: 00-03837 and related insurance coverage litigation. Estimation of asbestos liability for coalition of insurance carriers.
- Estimation of asbestos liability for a major insurance carrier on asbestos liability in the Western MacArthur Bankruptcy.
- The Babcock and Wilcox Company, Diamond Power International, Inc., Babcock and Wilcox Construction Company, Inc., Americon Inc., United States Bankruptcy Court, Eastern District of Louisiana, New Orleans, Case No: 00-10992. Estimation of asbestos liability on behalf of insurance carriers.

- Plibrico Company and David Gerity, United States Bankruptcy for the Northern District of Illinois, Case No: 02-BK-09952 and related insurance coverage litigation. Estimation of asbestos liability for a major insurance carrier.
- Armstrong World Industries, Inc., United States Bankruptcy for the District of Delaware, Case No: 00-04471 and related insurance coverage litigation. Estimation of asbestos liability for a major insurance carrier.
- Estimation of asbestos liability for insurance buy-out and coverage acquisition negotiation support for a $15 billion (sales) manufacturer, CSX, a $4 billion (sales) manufacturer, and a $2 billion (sales) chemical company.
- Armstrong World Industries, Inc., United States Bankruptcy for the District of Delaware, Case No: 00-04471 and related insurance coverage litigation. Estimation of asbestos liability for a major insurance carrier.

Other

- United States of America, Plaintiff and Texas Leauge of Young Voters Education Fund; and Imani Clark, Plaintiff-Intervenors v. State of Texas, et al., United States District Court for the Southern District of Texas Corpus Christi Division, Civ. No. 2:13-vc-00263. Consulting expert supporting Dr. Coleman Bazelon on behalf of the NAACP Legal Defense Fund in Texas voter ID litigation.
- Consulting expert on matter involving claims under Section 1 and 2 of the Sherman Act.
- Developed a method, which was accepted by a regulatory agency, for monitoring the regulatory compliance of a large telecommunications company.
- Supported expert analysis and report in multiple '337 proceedings before the ITC

ACADEMIC PAPERS

- Sacks, B.A, J.V. Hotz, C. Mulligan, and A. Zellner: "Three Essays on Bayesian Methods for Analyzing Limited Dependent Variable and Multinomial Choice Models with Measurement Error and Missing Data."
- Sacks, B.A., and A. Zellner: "Bayesian Method of Moments (BMOM) Analysis of the Multiple Regression Model with Autocorrelated Errors." Presented paper at the 1996 summer conference of the International Society for Bayesian Analysis.

PRESENTATIONS

- Panelist at May 2016 Juris International Arbitration conference. Session entitled "Damages in investment arbitration – a revolutionary remedy or reward for rich corporations at the expense of the world's poor? A fundamental examination of Chorzow's children." May 12-13, 2016 in Washington D.C.

- Seminar on DCF valuation presented to Debevoise and Plimpton, New York City, March 19, 2015.
- CLE Presentation "Lessons for Attorneys from Damages War-Stories" at WilmerHale, Washington, D.C., June 22, 2011, Venable, Washington, D.C., October 18, 2011, Kramer Levin Naftalis & Frankel, New York City, November 10, 2011, White & Case, Washington, D.C., November 15, 2011, Cadwalader Wickersham & Taft, New York City, November 17, 2011; Dilworth Paxson, Philadelphia, November 30, 2011; Baker Botts, Washington, D.C., December 19, 2011; Bernstein Litowitz Berger & Grossmann, New York City, February 16 2012; New York County Lawyers Association, February 28, 2012; Cleary Gottlieb Steen & Hamilton, Washington, D.C., June 6, 2013; Day Pitney, Newark, NJ, December 6, 2013.
- Securities and Exchange Commission, Washington, D.C., June 17, 2010. Presented on corporate governance and self-dealing.
- Lex Mundi Conference, Rome, Italy, March 5, 2004. Presented "Economic experts and asbestos liability."
- Asbestos Alliance Teach-In (joint with Jefferies & Company, Inc., and Sonnenschein Nath and Rosenthal), via teleconference, December 16, 2002. Lecturer.
- Credit Suisse First Boston, New York, New York, April 2001. Presented "Asbestos liability and M&A and divestitures."

TESTIMONY and REPORTS

- In Re Facebook, Inc. Class C Reclassification Litigation, Delaware Court of Chancery, Consolidated C.A. No 12286-VCL. Reports and deposition 2017.
- Report on valuation of a telecommunications firm in a developing country for an in international arbitration. Bilateral Investment Treaty heard under UNICTRAL rules, Permanent Court of Arbitration
- SEC Administrative Proceeding in the Matter of BioElectronics Corp, et. al., File No. 3-17104. Testifying expert on an event study related to a corporate disclosure. Reports and Testimony, September 2016.
- Confidential Arbitration. Valuation of privately held telecommunications firm. Expert report. October 2015.
- State of West Virginia ex rel., Patrick Morrisey, Attorney General v. Wells Fargo Insurance Services of West Virginia , in, and Wells Fargo Insurance Services USA, Inc, Circuit Court of Hancock County, WV, Civil Action No. 05-C-115 W. Deposition January 21, 2016. Expert Affidavit and disclosure on opinions regarding existence and size of alleged overcharge for insurance policies, and related damages. September 2015 and November 2015.

- National Credit Union Administration Board, as Liquidating Agent of Central Federal Credit Union v. RBS Securities, et. al, Case No. 11-cv-2340-JWL-JPO and National Credit Union Administration Board, as Liquidating Agent of Western Corporate Federal Credit Union v. RBS Securities CV 11-05887 GW (JEMx), Declaration of Benjamin Sacks Regarding Compilation and Summarization of RBS Due Diligence data. October 2015.
- Application of the National Railroad Passenger Corporation under 49 u.s.c. § 24308(a) – Canadian National Railway Company, Before the Surface Transportation Board, Finance Docket No. 35743, Verified Statement of Benjamin Sacks filed September 4, 2015.
- United States of America, ex rel., Michael Saunders, v. Unisys, Inc., United States District Court for the Eastern District of Virginia, Alexandria Division, Civil Action No 1:12 CV 379 GBL/TCB. Expert report on damages. July 2014, September 2014; Deposition September 2014.
- Curbow Family LLC v. Morgan Stanley Investment Advisors Inc., Index No. 651059/2010 (Sup. Ct. NY) and Rotz v. Van Kampen Asset Management, Index No. 651060/2010 (Sup. Ct. NY). Expert report in support of Plaintiff's opposition to a motion for summary judgment, September 2012.
- Howard M. Ehrenberg, Chapter 7 Trustee for the Estate of Ruderman Capital Partners, LLC v. Kevin L. Washington, James King and Knight Capital Group, et al., Superior Court of the State of California for the County of Orange, Case No. 30-2011 00450602. Declaration filed in support of defendant's motion for summary judgment or adjudication of claims, July 2012.
- In re Delphi Financial Group Shareholder Litigation, Delaware Court of Chancery, Consolidated C.A. No. 7144-VCG. Expert report and deposition, February 2012.
- Wolfson-Verrichia Group, et al., v. Metro Commercial Real Estate, Inc., et al., United States District Court for the Eastern District of Pennsylvania, No. 08-CV-4997. Expert report October 2011, deposition November 2011.
- FIFRA data compensation matter, Testified at arbitration November 2010, Summary of Expert Opinions disclosed October 2010.
- Eastbanc, Inc. and Anthony M. Lanier v. Georgetown Park Associates II Limited Partnership, et al., Superior Court of the District of Columbia, 2006 CA 002291 B. Supplemental Expert Statement and Rule 26(b)(4) Statement filed October 2010, deposition December 2008, Rule 26(b)(4) Statement filed October 2008.
- Navy Federal Credit Union v. Fiserv Solutions and XL Specialty Insurance Company, Index No. 09-601217-2009. Affidavit Of Benjamin Sacks in Support of Plaintiff Navy Federal Credit Union's Motion for Partial Summary Judgment filed

October 2010, Expert Witness Disclosure filed pursuant to New York State CPLR § 3101(d) filed September 2010.

- In re ACS Shareholder Litigation, Delaware Court of Chancery, Consolidated C.A. No. 4940-VCP. Deposition April 2010, Expert reports March and April 2010.
- FIFRA data compensation arbitration: Summary of Expert Opinions disclosed in August 2009.
- Teachers Retirement System of Louisiana v. Maurice R. Greenberg, Edward E. Matthews, Howard I. Smith, Thomas R. Tizzio, and C. V. Starr & Co. Inc, Delaware Court of Chancery, C.A. No 20106-VCS. Deposition June 2008, Expert reports January and May 2008.
- Provided expert written opinion in PW 5672, Harrison County fee dispute with FEMA regarding reasonable costs. July 2007.
- Testimony before a three judge panel in AAA arbitration proceedings in a breach of contract matter. October 2006.

VERIFICATION

I, Benjamin Sacks, verify under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Rebuttal Verified Statement.

Executed on September 14, 2017

____

Benjamin Sacks

PUBLIC VERSION - REDACTED

BEFORE THE
SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(A) – CANADIAN NATIONAL RAILWAY COMPANY

REBUTTAL SUBMISSION OF NATIONAL RAILROAD PASSENGER CORPORATION

VOLUME II

Kevin M. Sheys
Edward J. Fishman
Justin J. Marks
Hubert T. Lee
Nossaman LLP
1666 K Street, NW, Suite 500
Washington, DC 20006
(202) 887-1400

William H. Herrmann
Christine E. Lanzon
National Railroad Passenger Corporation
60 Massachusetts Avenue, NE
Washington, DC 20002
(202) 906-3971

Counsel for National Railroad Passenger Corporation

September 14, 2017

TABLE OF CONTENTS

TAB

Volume I

JOINT REBUTTAL VERIFIED STATEMENT OF
PAUL VILTER AND JASON MAGA..........A

REBUTTAL VERIFIED STATEMENT OF BENJAMIN SACKS..........B

Volume II

REBUTTAL VERIFIED STATEMENT OF ALAN FRANKEL..........C

JOINT REBUTTAL VERIFIED STATEMENT OF THOMAS CROWLEY
AND ROBERT MULHOLLAND..........D

JOINT REBUTTAL VERIFIED STATEMENT OF JOHN WILLIAMS AND
JUDITH ROBERTS..........E

Volume III

REBUTTAL VERIFIED STATEMENT OF EDWARD FISHMAN..........F

BEFORE THE
SURFACE TRANSPORTATION BOARD

Docket No. FD 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER
49 U.S.C. § 24308(a) – CANADIAN NATIONAL RAILWAY COMPANY

VERIFIED STATEMENT OF ALAN S. FRANKEL
September 14, 2017

1. Introduction

1.1. Qualifications

I am Alan S. Frankel, President of Coherent Economics, LLC. I have been a full-time economic consultant since 1985. I am a Senior Editor of the Antitrust Law Journal, the leading law review devoted to economic and legal issues arising in antitrust, competition, and consumer protection disputes. I have served on the Editorial Board of the Journal since 1996. I am a member of the U.S. Advisory Board of the Loyola University Chicago Institute for Consumer Antitrust Studies, and I am an Adjunct Professor at the Loyola University Chicago School of Law where I teach a course on Law & Economics.

I received a B.A. in economics (with honors) in 1982, an M.A. in economics in 1985, and a Ph.D. in economics in 1986, each from the University of Chicago. My primary field of concentration in the Ph.D. program was Industrial Organization, which includes the analysis of economic issues arising in many legal, regulatory, and public policy disputes. I have analyzed economic issues arising in hundreds of such disputes. My current CV is attached as Exhibit 1 to this Verified Statement.

1.2. Background

National Railroad Passenger Corporation ("Amtrak") operates passenger rail service using the rail infrastructure of Illinois Central Railroad Company ("IC") and Grand Trunk Western Railroad Company ("GTW"), pursuant to an operating agreement dated May 1, 2011 (the "2011 Operating

Agreement").[1] I understand that Amtrak and CN were unable to agree on terms of a new operating agreement and that the Surface Transportation Board ("Board") therefore will set terms and compensation for Amtrak's use of certain lines of IC and GTW.

CN proposed revisions to the base compensation, and both parties proposed penalty and incentive payment (or quality payment) provisions. As part of its proposed base compensation, CN seeks payment of certain freight train delay costs it attributes to Amtrak's utilization of CN's line capacity.[2] Alternatively, CN suggests "the Board could order Amtrak, or Amtrak could agree, to modify its schedules, to run fewer trains, and/or to fund the capital projects necessary to restore the capacity Amtrak consumes on CN's lines."[3]

CN proposes that any penalties incurred be limited to the amount of incentive payments earned during a defined prior period.[4] CN and Amtrak both refer to this limitation, a cap on otherwise applicable penalty amounts, as a "lookback" provision.[5]

In support of its proposed terms and compensation, CN submitted the Verified Statement of Professor Robert D. Willig. Professor Willig says "Amtrak's consumption of CN's network capacity imposes incremental costs on CN for which CN is not compensated."[6] With regard to base compensation, he opines that the applicable law should be interpreted to define incremental costs to include "any costs of freight service capacity lost to Amtrak's presence."[7] This includes several categories Professor Willig refers to collectively as "delay and interference costs," namely "(i) increased operational costs; (ii) lost business; (iii) reduced demand for additional service; (iv) any resulting price

---

[1] Canadian National Railway Company ("CN") has owned the Grand Trunk Western Railroad since 1923 and acquired Illinois Central in 1999. See https://www.cn.ca/en/about-cn/who-we-are/history. I understand that the 2011 Operating Agreement has expired but that Amtrak and CN are continuing to operate under its terms during this proceeding.
[2] Joint Verified Statement of Paul E. Ladue and Scott Kuxmann ("Ladue") p. 51.
[3] Ladue, p. 52.
[4] Ladue, pp. 19-20.
[5] Ladue, pp. 19-20.
[6] Verified Statement of Robert D. Willig ("Willig Statement"), p. 3.
[7] *Id.*, p. 4.

suppression; and (v) the costs of additional capacity required to replace capacity utilized to accommodate hosting requirements."[8]

Professor Willig also contends it would contravene economic principles if a penalty for poor quality service could reduce a host railroad's base compensation, and therefore his opinion is that a "lookback" provision is appropriate.[9] Finally, Professor Willig opines that penalties should be set based on "public and private harms" to Amtrak, a term neither defined by Professor Willig nor contained in the statute governing penalties for untimely performance.[10]

Counsel for Amtrak has asked me to analyze Professor Willig's opinions regarding (1) the appropriateness of including the claimed "delay and interference costs" Professor Willig attributes to Amtrak's consumption of CN's line capacity as incremental costs in the determination of base compensation; (2) inclusion of a lookback provision limiting penalties; and (3) how to set penalty amounts, and to present my professional opinion concerning these issues.

1.3. Summary of Conclusions

In Part 2 of this Verified Statement, I explain that Congress relieved railroads of their obligation to operate passenger trains (along with the associated significant financial burden), and granted Amtrak preferential access to rail lines with the requirement that Amtrak pay only the incremental costs of its passenger operations to host railroads.

In Part 3, I explain that Professor Willig's use of the term incremental costs cannot be reconciled with the statutory cost framework implemented by the Rail Passenger Service Act ("RPSA"). Professor Willig appears to disagree with the compensation framework established by Congress, but rather than advocating a legislative expansion of compensation beyond incremental costs, he instead recharacterizes other costs as incremental costs to obtain the same result. Moreover, it is not sensible

---

[8] *Id*., pp. 4-5.
[9] *Id.*, p. 7.
[10] *See* 49 U.S.C. 24308(a)(1).

to evaluate the nature of the claimed "delay and interference costs" Professor Willig describes without considering the economic implications of Amtrak's statutory preference, which Professor Willig does not mention. I explain that if Congress intended incremental costs to include all of the delay and interference costs Professor Willig claims are associated with the provision of preferential access, Congress would have had no reason to codify preference, because the definition of incremental costs advocated by Professor Willig would make passenger service as profitable to railroads as freight service and preference therefore unnecessary.

In Part 4, I explain my view that the lookback limitation impairs the effectiveness of economic incentives created by penalties. Professor Willig concedes that the terms of an agreement between Amtrak and a host railroad require a penalty for untimely performance, but he contends penalties should be assessed at most to the extent that incentive payments have been earned.[11] Conditioning payment of penalties on CN's earning of incentive payments, however, can eliminate incentives to provide timely performance. I also address Professor Willig's opinion that penalties should be based on "public and private harms" from delays.[12] The RPSA seeks to incentivize a host railroad to provide timely performance, whereas Professor Willig's proposal would encourage CN to cause delays to Amtrak service if the additional profit CN could earn by prioritizing freight shipments exceeded the amount of the penalty. A penalty will only motivate a host to contribute to timely performance if the penalty amount exceeds the perceived costs incurred to provide timely performance.

2. Congress Granted Amtrak Preferential Access to Host Rail Lines and Required Payment by Amtrak of Only Incremental Costs, Defined as Short-Run Avoidable Costs

Economists undertake the analysis of costs, lost profits, damages, regulated prices or other tasks in legal or regulatory disputes in the context of the legal framework relevant to the dispute. As a first step in my analysis, I reviewed the legal and regulatory context in which the current dispute arises.

---

[11] Willig Statement, pp. 6-8.
[12] Willig Statement, p. 8.

Prior to the formation of Amtrak, railroads were obligated to operate intercity passenger rail service and did so mostly at a financial loss. Congress enacted the RPSA to relieve railroads of that obligation, but also to preserve passenger rail service for the public. In particular, in the original RPSA Congress found:

> that modern, efficient, intercity railroad passenger service is a necessary part of a balanced transportation system; that the public convenience and necessity require the continuance and improvement of such service to provide fast and comfortable transportation between crowded urban areas and in other areas of the country;[13]

Both of these points remain today in the RPSA.[14] Congress, moreover, added operational goals to the RPSA that reflect a continued statutory policy of reliable intercity passenger rail service.[15]

As the Interstate Commerce Commission ("ICC") noted, the creation of Amtrak "represent[ed] a public bargain . . . with the nation's freight railroads, whereby the freight railroads were relieved of any duty to provide passenger service in exchange for making their tracks available to Amtrak."[16] Railroad participation in Amtrak was voluntary. Railroads that agreed to pay cash (or contribute equipment or future services) to Amtrak and to give Amtrak access to their lines were relieved of their obligation to operate passenger trains.[17] Congress provided that if a host railroad and Amtrak could not agree on access and service terms and compensation for "using the facilities and providing the services," the ICC would order the host railroad to make the lines available and provide the services to Amtrak, and the ICC would set the compensation Amtrak would pay to the host.[18]

---

[13] Rail Passenger Service Act of 1970 ("RPSA"), Section 101.
[14] See 49 U.S.C. 24315(c); 24101(a)(1), (3).
[15] See 49 U.S.C. 24101(c)(4), (6) and (7). Congress included as goals to operate trains, to the maximum extent feasible, to all station stops within 15 minutes of the time established in public schedules; implement schedules based on a systemwide average speed of at least 60 miles an hour that can be achieved with a degree of reliability and passenger comfort; and to encourage rail carriers to assist in improving intercity rail passenger transportation.
[16] *Study of ICC Reg. Responsibilities Pursuant To § 210 (A) Of The Trucking Indus. Reg. Reform Act Of 1994*, 1994 WL 639996 at *41 (October 25, 1994).
[17] RPSA, Section 101.
[18] Today, the access language is found 49 U.S.C. 24308(a)(2)(A).

In 1973, the ICC interpreted the statutory compensation standard relatively broadly in the *Penn Central* case. One of the narrower standards not adopted by the ICC was "incremental costs," defined in *Penn Central* as "avoidable cost in the short run," which in turn was defined as consisting of "that amount of maintenance of way, maintenance of equipment, and transportation expenses which could be saved if a particular service were eliminated."[19] Congress responded by amending the RSPA to make clear that it intended Amtrak to pay only "incremental costs," adopting the term used in *Penn Central.* At the same time, Congress also enacted the provision giving Amtrak trains "preference over freight transportation in using a rail line, junction, or crossing."[20] In 1981, a penalty provision for untimely performance was added to the statute.

In short, Congress established a framework in which Amtrak took on responsibility for providing intercity passenger rail service; railroads were relieved of that responsibility in exchange for providing Amtrak preferential access on their lines, receiving from Amtrak only incremental costs, and paying a penalty for untimely performance or receiving incentive payments for high quality service.

3. Professor Willig's Definition of Incremental Costs Cannot Be Reconciled with the RPSA

The premise of Professor Willig's Verified Statement is that "Amtrak's consumption of CN's network capacity imposes incremental costs on CN for which CN is not compensated."[21] Professor Willig

---

[19] In *Determination of Compensation under Section 402(a) of the Rail Passenger Service Act of 1970* ("*Penn Central"*), ICC Finance Docket No. 27353 (Sub No. 1), 342 I.C.C. 820 (1973), the ICC held that the compensation standard required Amtrak to pay the fully allocated costs of intercity passenger operations on Penn Central's line between Boston and Washington and the long-run avoidable costs of operations on Penn Central's other lines. *Penn Central*, p 833. Amtrak had argued that "just and reasonable compensation" required only the payment of short-run avoidable costs, which the ICC also referred to as "incremental costs." *Penn Central,* pp. 831-832. Today, the incremental cost language is found 49 U.S.C. 24308(a)(2)(B) ("When prescribing reasonable compensation … the Board shall consider quality of service as a major factor when determining whether, and the extent to which, the amount of compensation shall be greater than the incremental costs of using the facilities and providing the services.").

[20] Now codified at 49 U.S.C. 24308(c).

[21] Willig Statement, p. 3.

refers to these claimed costs as "delay and interference" costs[22] and says they include "(i) increased operational costs; (ii) lost business; (iii) reduced demand for additional service; (iv) any resulting price suppression; and (v) the costs of additional capacity required to replace capacity utilized to accommodate hosting requirements."[23] He states that, to be economically efficient, CN's base compensation must permit CN to recover (as incremental costs) these claimed delay and interference costs in order to avoid "any cross-subsidization of [Amtrak] services either by the host carrier or by other users or beneficiaries of the rail network."[24] What Professor Willig suggests that Amtrak should pay varies throughout his report, and includes the equivalent of "all costs the host could avoid absent Amtrak … eliminat[ing] the net burden Amtrak's operations would otherwise impose on the host's freight service."[25] Professor Willig notes that some claimed delay and interference costs cannot be quantified and in such instances he proposes that they should be eliminated by "Amtrak (i) investing in additional CN capacity; (ii) reducing or modifying its use of CN's lines to eliminate its interference and limitation on CN's operations; or a combination of both."[26] Amtrak paying for these claimed delay and

---

[22] Willig Statement, p. 4. These costs are in addition to what he refers to as "more obvious costs" and lists as: added wear and tear on railroad infrastructure; services required by Amtrak's operations; CN-owned station facilities used by Amtrak; and CN personnel performing functions for Amtrak. *Id.* None of these costs are in contention.

[23] Willig Statement, pp. 4-5. Professor Willig also identifies what he describes as "more obvious costs" – including "added wear and tear on railroad infrastructure, services required by Amtrak's operations…, CN-owned facilities used by Amtrak, and CN personnel performing functions for Amtrak." Willig Statement, p. 4. If Professor Willig means CN personnel performing functions and providing facilities exclusively for Amtrak, then these costs could be incremental costs, to the extent they are not costs that flow from CN's decision to operate a profitable freight train or from Amtrak's Congressionally granted preference (see Section 3.1 below), because they could be avoided immediately or almost immediately after cessation of Amtrak service (see Section 3.2 below) and because they are actual expenses (see Section 3.3 below).

[24] Willig Statement, p. 2. See also, Willig Statement, p. 4 ("If Amtrak did not have to bear the full incremental costs it imposes on hosts, other parties – including the host carrier and its shippers – would have to subsidize Amtrak's operations.")

[25] Willig Statement, p. 4.

[26] Willig Statement, p. 3.

interference costs and capacity expansions, or curtailing or modifying its service, he opines, also will serve the "public interest … in the optimum amount and quality of intercity passenger rail service."[27]

In other words, Professor Willig contends that Amtrak's operations increase CN's operating costs and reduce CN's profits from providing freight services. He proposes that Amtrak compensate CN for all such alleged increased costs and alleged lost profits by having Amtrak pay for more capacity, reduce its service, or pay CN enough so that CN would in effect be indifferent concerning the level or timing of Amtrak passenger service.

In this section, I provide an economic analysis of Professor Willig's proposed definition of incremental costs and his call for additional remedies by Amtrak, including schedule changes, service reductions and capacity expansion at Amtrak's expense. I show that his definition of incremental costs is too broad, both in time-horizon and scope, and that the delay and interference costs he describes (and his call for Amtrak to adjust its schedules and level of service to accommodate CN and to invest in expansion of CN's capacity) ignore Amtrak's Congressionally mandated preference and the Congressional call for continuation and improvement in intercity passenger rail service.

While invoking the language of incremental costs, Professor Willig effectively proposes an entirely different policy framework in which freight traffic would have a preference over passenger traffic and Amtrak would have to contribute towards CN's common costs and profits.

Moreover, Professor Willig does not limit the amount that Amtrak might need to reduce its use of CN's lines, meaning that his proposal could imply that Amtrak eliminate its use of CN's lines altogether (which obviously would contravene the Congressional intent to maintain and improve intercity passenger rail service).

Finally, considering the significance of the Amtrak statutory preference, it is not economically reasonable to attribute to Amtrak a host's delay and interference costs, let alone include such costs in

[27] Willig Statement, p. 2.

the definition of incremental costs under the statute. At least one of Professor Willig's incremental cost definitions implies that Amtrak should pay the equivalent of market prices for the Congressionally mandated preferential access to CN's lines.[28] If incremental costs are construed to require Amtrak to pay market prices, the statutory preference would be superfluous because Amtrak would pay so much that CN would have no economic incentive to violate Amtrak's preference.

3.1. Professor Willig's Proposal for Amtrak to Compensate CN for Delay and Interference Costs Fails to Account for Amtrak's Preference

Professor Willig's premise that Amtrak imposes "delay and interference costs" on CN is arbitrary. It could as readily be said that CN causes the claimed costs to arise by operating a freight train at a place and time when Amtrak is operating a passenger train. Without a guiding principle or rule to govern such a conflict, each railroad could attribute at least some delay-related costs to the presence and operations of the other track user.

Importantly, the RPSA provides a guiding principle or rule: subject to exceptions not relevant here, intercity passenger transportation provided by Amtrak "has preference over freight transportation in using a rail line, junction, or crossing … ."[29] When a conflict arises between CN and Amtrak on a rail line, junction or crossing, Amtrak has a preference to such facility. CN may choose to operate a train that conflicts with an Amtrak train, but presumably when it does so the additional profit or other benefit to CN of increasing its freight service outweighs additional delay and interference costs (if any) associated with honoring Amtrak's preference. Thus, all of the claimed costs Professor Willig identifies as "delay and interference costs" (increased operational costs, lost business, reduced demand, and price suppression, to the extent they exist) are costs that flow from CN's own operational decisions, in the context of Amtrak's Congressionally granted preference. Such opportunity costs are not incremental costs.

---

[28] Willig Statement, pp. 4-5.
[29] 49 U.S.C. 24308(c).

It is in CN's power and discretion to reduce the claimed delay and interference costs allegedly arising from Amtrak's presence. CN could make a capital investment to increase its capacity to run freight trains without causing delays to those trains or to Amtrak trains, adjust its freight schedules to avoid causing delay to Amtrak trains, or appeal for relief from the Board.[30]

Consider a hypothetical example in which a host freight railroad owns and operates a stretch of track that has a capacity of ten trains per day. Amtrak operates passenger service on that stretch of track, and the host adheres always to the statutory preference. Initially, traffic consists of two Amtrak trains and eight freight trains and (because of the track's capacity) there are no delays to any trains.

The host increases freight service by one train per day, but continues to provide Amtrak preference. The freight trains will experience delays and incur delay-related costs. Under Professor Willig's reasoning, Amtrak's train would be the cause of the freight delay and Amtrak would be responsible for the freight train delay costs. He would have Amtrak pay the host for the delay costs, pay for creation of additional capacity, or reduce Amtrak service to one train per day.[31] Then the host railroad could operate its ninth train either without any delays or without any net delay costs. But in this example it was the expansion of freight service that caused the delay-related costs to be incurred.

Suppose Amtrak agreed to fund capacity improvements and suppose the host railroad then added another freight train. Under Professor Willig's reasoning, Amtrak must again mitigate any impacts on CN arising from CN's own action, which could include again paying for an increase to the host's capacity. By requiring Amtrak in this example to pay the cost of adding capacity for another train, Professor Willig would in effect adopt a compensation standard equivalent to fully allocated costs, not

[30] 49 USC 24308(c).

[31] "Many railroad incremental costs will depend upon the level of service required by Amtrak. Changes to Amtrak train schedules, train frequency, and desired levels of predictability of train performance can substantially change the host's incremental costs …" Willig Statement, p. 5

incremental (short run avoidable) costs. But labeling fully allocated costs as incremental costs does not make them so.

It is not clear at what point, if any, Professor Willig would cease attributing delay-related costs to Amtrak, for example, if the host added a third new train, causing renewed delay-related costs as the host honored Amtrak's preference.

Professor Willig's failure to take into account Amtrak preference – and the fact that the level and scheduling of host traffic determines the level of claimed host delay and interference costs – is compounded when one considers a host railroad's right to add freight trains without concurrence of Amtrak or to reduce rail line capacity in many instances without concurrence of Amtrak. Again, consider a hypothetical track with capacity for 10 trains, but this time initial traffic is two Amtrak trains and four freight trains. Suppose the host railroad decides to reduce the capacity of the track to six trains per day (perhaps to sell or redeploy track assets and reduce maintenance expenses). Later, the host increases freight service by one train per day. The host (still providing Amtrak preference) will incur delay-related costs. Under Professor Willig's reasoning, Amtrak (still operating the same two trains) would be the cause of the freight delay and Amtrak would be responsible for the freight delay costs, eliminating a train, or adding back the capacity CN had chosen to remove.

Professor Willig may advocate such an outcome, but it cannot be reconciled with the statutory framework in which Amtrak has a preference and is obligated to pay only for the incremental costs of its operations. Under Professor Willig's suggested approach, CN could choose to schedule its freight trains to run in the same place and time as Amtrak passenger trains, thereby increasing claimed delay and interference costs that CN could then fully recoup by charging those costs to Amtrak. Similarly, CN could also reduce its throughput capacity and recover the resulting alleged delay and interference costs from Amtrak. Insulating CN in this way from the cost-increasing consequences of its own decisions would exacerbate conflicts and inefficiency.

3.2. Professor Willig Applies an Overbroad Time Horizon for the Definition of Incremental Costs

Three of the claimed "delay and interference costs" categories described by Professor Willig – "lost [freight] business," "reduced demand for additional [freight] service," and "any resulting [freight] price suppression" – have an additional flaw: they depend on an overbroad time horizon for defining incremental costs. Professor Willig says the incremental cost standard for base compensation "has been interpreted by this agency and its predecessor as being equivalent to avoidable cost."[32] He adds that avoidable cost is "a term that economics applies to costs avoidable over any period of time."[33] Although economists *can* apply the concept of avoidable costs over different time horizons, the choice of time horizon depends importantly on the context – the economic question being addressed. Here, Professor Willig again ignores the legal and regulatory context relevant under the RPSA and espouses an overbroad incremental cost standard.

The RPSA was amended in 1973 to clarify Congressional intent that Amtrak pay host railroads their "incremental costs" of hosting Amtrak – which had been equated in *Penn Central* to "avoidable cost in the short run" -- as base compensation.[34] Professor Willig's opinion that incremental costs include "any costs of freight service capacity lost to Amtrak's presence"[35] ignores the *Penn Central* case and Congress' legislative response to that case. This is a critical omission, because in economics the distinction between avoidable costs over any period of time and short-run avoidable costs determines

---

[32] Willig Statement, p. 3.
[33] Willig Statement, p. 3.
[34] In the *Penn Central* case, the ICC considered but rejected a compensation standard it called "[a]voidable cost in the short run," which it also referred to as "incremental cost" and defined as "that amount of maintenance of way, maintenance of equipment, and transportation expenses which could be saved if a particular service were eliminated." *Penn Central*, at 832. The 1973 amendments to the RPSA in turn rejected and statutorily reversed the *Penn Central* case conclusion on the compensation standard and adopted the incremental cost (short-run avoidable cost) standard discussed in *Penn Central.*
[35] Willig Statement, p. 4.

which costs are avoidable and which costs are "sunk" costs.[36] As a general matter, in the short run some costs are sunk (as the capital base is fixed in the short run). As the time horizon lengthens, more costs are avoidable.[37]

As noted above, *Penn Central* identified "maintenance of way, maintenance of equipment, and transportation expenses" as short run avoidable costs. These costs all could be avoided immediately or almost immediately upon cessation of Amtrak service. Professor Willig ignores this and offers an opinion inconsistent with the Penn Central definition of incremental costs as short run avoidable costs and the specifically identified incremental costs. By suggesting that the incremental cost standard is equivalent to avoidable costs over any period of time, he is espousing the view that all costs are avoidable and no costs are sunk.[38] But the 1973 RPSA amendments specifically rejected such a broad interpretation.[39]

3.3. Professor Willig's Definition of Incremental Costs Includes More Than CN Expenses

The same three delay and interference cost categories have an additional definitional flaw. They relate to forgone revenue or profit,[40] rather than host railroad *expenses*. [41] The Congressionally-adopted incremental cost definition covers expenses, short run avoidable costs, which (as noted above) were found in *Penn Central* to be "that amount of maintenance of way, maintenance of equipment, and

---

[36] Wang, X. Henry and Bill Z. Yang, "Fixed and Sunk Costs Revisited." *Journal of Economic Education* Spring 2001: 178-185 at 180, 181 (If a cost is "irrevocably committed *over the relevant time period*" then it is a sunk cost, not an avoidable cost, and "[i]n the short run, by definition, at least some costs must be sunk.") (emphasis added).
[37] In the theoretical long run, *all* costs ultimately may be avoidable (because, for example, a railroad need not have been built in the first instance). *Id*.
[38] See also, Willig Statement, p. 4 ("Incremental costs in this context include all the direct and indirect costs that the host railroad experiences and incurs because of Amtrak's operations on its lines, *i.e.,* all the costs the host could avoid if Amtrak did not require service.")
[39] See, *infra*, at p. 6.
[40] If expenses are constant, compensation for lost revenue equates to lost profit.
[41] The first element of Professor Willig's enumerated delay and interference costs is "increased operational costs." Professor Willig does not express an opinion on what categories of cost this element entails or offer an opinion on how CN could avoid such costs in the short run, so there is nothing else about the element on which I can express a responsive opinion about time horizon.

transportation *expenses* which could be saved if a particular service were eliminated."[42] Professor Willig's description of foregone business, reduced demand for freight and price suppression, and the resulting lost or foregone profit refer to opportunity costs,[43] which are not "expenses." Indeed, Professor Willig acknowledges that it is not possible even to measure some of the costs he contends Amtrak should pay.[44] This is another reason why these three delay costs categories are not expenses and therefore not incremental costs.

It is unreasonable to include opportunity costs in the definition of incremental costs for purposes of determining Amtrak's payments to CN. Including opportunity costs is economically equivalent to requiring Amtrak to pay full arms-length market prices to induce CN to voluntarily provide Amtrak access to CN's facilities. But Congress specifically rejected even the ICC's determination that compensation should be based on fully allocated costs or long-run avoidable costs, let alone market rates including a profit to the host.

3.4. The Capacity Expansion Element of Professor Willig's "Delay and Interference Costs" Goes Well Beyond Incremental Costs

The fifth element of Professor Willig's list of claimed delay and interference costs is "the costs of additional capacity required to replace capacity utilized to accommodate hosting requirements."[45] This "delay and interference cost" is different than the other four because rather than an out-of-pocket payment to CN, Professor Willig identifies capacity additions funded by Amtrak as a method for Amtrak to avoid imposing delay and interference costs on CN not otherwise paid for (or eliminated by changes in Amtrak service), rather than a separate category of delay and interference costs.[46] Logically, it is only

---

[42] Penn Central, at 832 (emphasis added).
[43] In the context of capacity cost replacement, Professor Willig refers to delay and interference costs as "direct and opportunity costs of delay and interference." Willig Statement, p. 6.
[44] Willig Statement, p. 3.
[45] Willig Statement, pp. 4-5.
[46] Willig Statement, p. 3 ("Absent agreement on or acceptance of an estimated value of CN's full incremental costs, CN can be fully compensated for all incremental costs only if any practicably unquantifiable costs are reduced by Amtrak (i) investing in additional CN capacity; (ii) reducing or modifying its use of CN's lines to eliminate its

potentially relevant to the extent delay and interference costs to CN are compensable as incremental costs. I have explained above my opinion that delay and interference costs are not incremental costs and the same reasoning applies to explain why a capital contribution to alleviate alleged delay and interference costs is not within the bounds of the relevant definition of incremental costs. Moreover, advocating a requirement that Amtrak contribute towards CN's capacity, as I have explained, is essentially advocating for a fully allocated cost standard of the type rejected by Congress in 1973 or an even broader one (including profit).[47]

3.5. Professor Willig's Claims About Cross-Subsidies Ignore the RPSA and Are Unsupported

Professor Willig contends that Amtrak must compensate CN for all of his claimed delay and interference costs to attain economic efficiency and avoid any cross-subsidization of the costs of Amtrak's presence.[48] But Congress identified statutory goals other than economic efficiency as narrowly conceived by Professor Willig. [49] Moreover, Professor Willig provides no evidence that other CN customers pay more due to Amtrak's presence. Indeed, he claims CN may even reduce freight rates to other customers as a result of Amtrak's operations.[50]

3.6. Professor Willig's Opinions Regarding the Optimal Amount and Quality of Passenger Service Cannot be Reconciled with the RPSA

Professor Willig also says a combination of Amtrak service reductions or schedule changes and capacity additions (paid for by Amtrak) would serve the "public interest … in the optimum amount and quality of intercity passenger rail service." However, Congress determined in the RPSA that intercity

---

interference and limitation on CN's operations; or a combination of both. "); at 5 ("There will be an optimal mix of measures intended to compensate or eliminate all host costs caused by Amtrak's consumption of capacity, including (i) non-Host-funded capacity additions to replace lost capacity; (ii) adjustments to Amtrak schedules and service requirements to reduce or eliminate the costs of lost capacity; and (iii) payment by Amtrak for the freight delay and interference costs it causes.")

[47] In addition, CN controls its overall capacity. Even if Amtrak were to pay CN to increase capacity, nothing would prevent CN from reducing capacity through other changes (or then claiming Amtrak was responsible for the continued "delay and interference" costs).

[48] Willig Statement, p .2, 4.

[49] See 49 U.S.C. 24315(c); 24101(a)(1), (3). (See also discussion at pp. 5-6.)

[50] Willig Statement, p. 4.

railroad passenger service is required for the public convenience and necessity and a necessary part of a balanced transportation system.[51] Professor Willig's proposal, by contrast, could imply that Amtrak sharply reduce or even eliminate passenger service altogether to locations served using CN's lines.

3.7. Professor Willig's Proposed Compensation Framework in Effect Means that Amtrak Must Compensate CN at the Full Market Price of CN Voluntarily Relinquishing Capacity

The implication of Professor Willig's definition of incremental costs is that the host railroad has the right to use any or all of its capacity for freight traffic and to alter the level of freight capacity to suit its freight needs, and Amtrak must compensate the host to the same extent it would to induce the host to voluntarily make capacity available for Amtrak. In my opinion, inclusion of the claimed delay and interference costs enumerated by Professor Willig within the definition of incremental costs would make the base compensation Amtrak pays to host railroads equivalent to the market price of rail access, in contradiction of what the ICC called the "public bargain" that the freight railroads made at the creation of Amtrak.

4. Professor Willig's Proposals Regarding Penalties Would Lessen Incentives for CN to Provide Timely Service

As noted above in Part 1.2, CN proposes that any penalties incurred be capped at the amount of incentive payments earned during a prescribed "lookback" period so that CN's compensation net of penalties would not fall below base compensation.[52]

Professor Willig says it "would contravene essential economic principles" if the penalty could reduce a host railroad's base compensation below his measure of incremental costs (without explaining what those principles are, why they are essential, or why they would be violated).[53] Therefore, his opinion is that either a lookback provision must be used or else even more base compensation should

---

[51] See 49 U.S.C. 24315(c); 24101(a)(1), (3). (See also discussion at pp. 5-6.)
[52] Ladue, p. 19-20.
[53] Willig Statement, p. 7.

be paid in addition to his expansive definition of incremental cost, to cover the amount of penalties.[54] Penalties paid by CN to Amtrak that are in effect reimbursed by Amtrak to CN, of course, would be ineffective at incentivizing CN to avoid untimely performance. His view is that "host behavior can and should be induced with net positive incentives" rather than penalties.[55] But behavior can be induced with penalties as well. Moreover, penalties are the only remedy if, notwithstanding the availability of incentive payments, CN fails to provide adequate on-time performance.

Professor Willig also would set penalties at a level to encourage untimely passenger service when the profits from prioritizing freight service exceed what he refers to as the "public and private harms expected to result from [passenger] service shortfalls."[56] But the statutory penalty provision is for "untimely performance."[57] Professor Willig thus again substitutes his own policy preference for the existing statutory framework.

4.1. A Lookback Cap on Penalties Can Eliminate Economic Incentives to Provide Timely Performance

Professor Willig and I agree that a penalty will only motivate a host to contribute to timely Amtrak performance if the penalty amount exceeds the costs that would be incurred to avoid the penalty.[58] But he fails to acknowledge that a lookback cap on penalties can alter this calculus and may eliminate motivation to CN to provide on-time performance. In particular, if performance was poor so that CN had accrued little or no incentive payments over the lookback period, penalties incurred in the current period from poor performance could quickly exceed that amount. Thereafter, there would be no contractual deterrent to continued poor CN service and further degradation of Amtrak on-time performance.

---

[54] Willig Statement, p. 7.
[55] Willig Statement, p. 4.
[56] Willig Statement, p. 8.
[57] See 49 U.S.C. 24308(a)(1).
[58] Willig Statement, p. 8 ("the host will be motivated to incur the costs of avoiding the service deficit [i.e., below par Amtrak performance] when they are less than the penalty.").

Without an effective penalty for untimely performance, the base compensation amount would be guaranteed to the host railroad. And, with that guarantee in place, a host railroad would have an incentive to provide poor service to Amtrak if doing so raised the railroad's profits. Conditioning payment of penalties on CN's earning of incentive payments could eliminate incentives to provide timely performance. The lookback impairs the effectiveness of economic incentives created by penalties.

4.2. "Calibrating" Penalties to "Public and Private Harms" is Beyond the Statutory Penalty Language and Could Curtail Amtrak Service

Professor Willig also argues that penalties should be matched to "public and private harms expected to result from [Amtrak] service shortfalls."[59] Professor Willig does not explain what "public and private harms" he means or how they would be measured. He says, "[t]he host will be motivated to incur the costs of avoiding the [Amtrak] service deficit when [the costs] are less than the penalty, and welfare will be enhanced because the performance costs are less than the [public and private] harms resulting from substandard service."[60] Finally, he notes "[a]t times, the costs to the host of avoiding substandard service will outweigh the penalty, leading to the host underperforming the base level. This would be the economically efficient result because at such times the costs of providing better service would exceed the benefits."[61]

In other words, Professor Willig advocates a penalty regime that provides incentives to the host to degrade passenger service when the host can profit more from such degradation of service than what he might determine to be the public and private harms from that degradation. But the RPSA calls for penalties to induce host railroads to provide timely performance, not to provide them with an incentive to degrade passenger service when profitable freight shipment opportunities arise.[62]

---

[59] Willig Statement, p. 8.
[60] Willig Statement, p. 8.
[61] Willig Statement, p.8.
[62] See 49 U.S.C. 24308(a)(1).

Apart from being in conflict with the statutory penalty provision, Professor Willig's public and private harms formulation for penalties could curtail and ultimately displace established Amtrak services. This would contravene the original findings of the RPSA that that efficient Amtrak service is an essential part of a balanced transportation system and that the public convenience and necessity require the continuance and improvement of Amtrak service.

5. Conclusion

Professor Willig's Verified Statement offers his opinions about how access to host railroads by Amtrak *should be* regulated and priced. His view, in effect, is that Amtrak should pay the market price for its use of CN's capacity. However, Congress concluded that there were public policy considerations that justified preservation and promotion of passenger rail service. It established cost-based pricing principles and granted Amtrak preference. The Board is being asked how to determine host railroad compensation *in light of* Amtrak's statutory preference and requirement to pay only short-run avoidable costs for the assets and services it uses. Professor Willig disagrees with the wisdom of those public policies, but by simply ignoring them, his opinions are irrelevant to the question at hand. Additionally, linking penalty payments made by a host railroad with Amtrak's incentive payments to that railroad would likely generate counterproductive motivations for hosts to further degrade passenger service.

VERIFICATION

I, Alan Frankel, verify under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Rebuttal Verified Statement.

Executed on September 14, 2017

Alan Frankel

56122900.v1

EXHIBIT 1

Coherent Economics

430 Park Avenue | Suite 2B | Highland Park, IL 60035

ALAN S. FRANKEL

President

EDUCATION

UNIVERSITY OF CHICAGO, Chicago, IL.
Ph.D., Economics, December 1986
M.A., Economics, March 1985.
B.A., Economics, March 1982.

PRESENT POSITIONS

COHERENT ECONOMICS, Highland Park, IL.
Founder and President, 2008 – Present.

COMPASS LEXECON, Chicago, IL.
Senior Advisor, 2008 – Present.
Senior Vice President, 2004 – 2008.
Vice President, 1989 – 1996.
Economist, 1985 – 1989.

LOYOLA UNIVERSITY CHICAGO SCHOOL OF LAW, Chicago, IL.
Adjunct Professor, 2015 – Present.

ANTITRUST LAW JOURNAL
Senior Editor, 1999 –
Associate Editor, 1998 – 1999
Assistant Editor, 1996 – 1998

INSTITUTE FOR CONSUMER ANTITRUST STUDIES
U.S. Advisory Board, 2014 –

PROFESSIONAL AND ACADEMIC EXPERIENCE

LECG, Evanston, IL.
Director, 1998 – 2004.
Principal, 1996 – 1997.

UNIVERSITY OF CHICAGO, GRADUATE SCHOOL OF BUSINESS, Chicago, IL.
Research Assistant, 1983 – 1984.

UNIVERSITY OF CHICAGO, COMMITTEE ON PUBLIC POLICY STUDIES, Chicago, IL.
Teaching Assistant, 1983.

P • 847.861.3101 | F • 847.861.3131 alan.frankel@coherentecon.com

UNIVERSITY OF CHICAGO, DEPARTMENT OF ECONOMICS, Chicago, IL.
Research Manager for U.S. Environmental Protection Agency contract research project, 1980-1982.

Research Assistant, Various consulting work, including National Association of Realtors and Synergy, Inc., 1981 – 1983.

FIELDS OF SPECIALIZATION

Industrial Organization, Antitrust, Intellectual Property, Applied Econometrics, Regulation, Financial Institutions, Payment Systems, Retail, Damages.

PUBLICATIONS

"Towards a Competitive Card Payments Marketplace," in Reserve Bank of Australia, Payments System Review Conference, Proceedings of a Conference held in Sydney on 29 November 2007 (2008).

"Economic Effects of Interchange Fees," with Allan Shampine, 73 Antitrust Law Journal 627 (2006).

"Transaction Costs, Externalities, and 'Two-Sided' Payment Markets," with Dennis Carlton, 2005 *Columbia Business Law Review* 617 (2005).

"Interchange Fees in Various Countries: Comment on Weiner and Wright," in Interchange Fees in Credit and Debit Card Industries: What Role for Public Authorities?" Federal Reserve Bank of Kansas City (2005).

"The Control of Externalities in Sports Leagues: An Analysis of Restrictions in the National Hockey League," with Dennis Carlton and Elizabeth Landes, 112 *Journal of Political Economy* S268 (2004).

"Editor's Note: EFT Networks and the Canadian Experience" 67 *Antitrust Law Journal* 385 (1999).

"Monopoly and Competition in the Supply and Exchange of Money," 66 *Antitrust Law Journal* 313 (1998).

"Cash Machines: Fee Disclosure and Competition vs. Regulation," with James Langenfeld, *The Global Competition Review* (August/September 1997).

"'Sea-Change' or 'Submarkets?'" (Federal Trade Commission v. Staples, Inc. and Office Depot, Inc.), with James Langenfeld, *The Global Competition Review* (June/July 1997).

"Antitrust and Payment Technologies," with Dennis Carlton, 77 Federal Reserve Bank of St. Louis *Review* 41, December 1995.

"The Antitrust Economics of Credit Card Networks: Reply to Evans and Schmalensee Comment," with Dennis Carlton, 63 *Antitrust Law Journal* No. 3, Spring 1995.

"The Antitrust Economics of Credit Card Networks," with Dennis Carlton, 63 *Antitrust Law Journal* No. 2, Winter 1995.

Countervailing Effects of Automobile Emission Control Regulations, Ph.D. dissertation, University of Chicago, Department of Economics, 1986.

SPEECHES

"Designing Competitive Payments Markets," Centro de Estudios Públicos, Santiago, Chile, November 2015.

"Retail Payment Systems Conference," Harvard Law School Program on International Financial Systems, February 2015.

"Who May Be Steering Off Course: Updates on the Anti-Steering Rules Challenges," American Bar Association Section of Antitrust Law, Pricing Conduct and Economics Committees, January 2015.

"Antitrust Issues Arising out of Multiple Recent Class Actions by Merchants and Consumers Against Payment Card Networks," panelist, American Antitrust Institute, December 2014.

"Comments on Kay, Manuszak and Vojtech," The Economics of Payments VII, Federal Reserve Bank of Boston, April 2014.

"Interchange Regulation – A Pitched Battle of Ideas," panelist, The Clearing House annual meeting, November 2012.

"Payment Innovation: Competitive Impediments and Opportunities," presented at *Consumer Payment Innovation in the Connected Age*, Federal Reserve Bank of Kansas City, March 2012.

"Does Disclosure Matter?," American Bar Association Section of Antitrust Law, Panel on the Proposed Consumer Financial Protection Agency, Washington, DC, April 2010.

"The MasterCard Decision: An Economic Review," Organization for Economic Cooperation and Development, Paris, France, June 2008.

"Towards a Competitive Card Payments Marketplace," Reserve Bank of Australia and Melbourne Business School, Sydney, Australia, November 2007.

"Evaluating Self-Regulation of Interchange Fees," Organization for Economic Cooperation and Development, Paris, France, June 2006.

"A More Competitive, Deregulated Market Structure: The Role of Networks vs. the Role of Banks," International Cards & Payments Council, Rome, Italy, October 2005.

"House of Cards: The Economics of Interchange Fees," Presented at *Antitrust Activity in Card-Based Payment Systems: Causes and Consequences*, Federal Reserve Bank of New York, September 2005.

"Dysfunctional Competition in Retail Payment Systems," Presented at *Innovations, Incentives, and Regulation: Forces Shaping the Payments Environment*, Federal Reserve Bank of Chicago, May 2005.

"Interchange Fees in Various Countries: Comments on Weiner and Wright," Presented at *Interchange Fees in Credit and Debit Card Industries: What Role for Public Authorities?* Federal Reserve Bank of Kansas City, Santa Fe, New Mexico, May 2005.

Columbia University School of Law, *Conference on Two-Sided Markets*, April 2005.

Chicago Bar Association Antitrust Committee speaker, Credit Card Issues, February 2002.

"Anticompetitive Effects of Interchange Fees," Econometrics Society Australasian Meetings, Auckland, New Zealand, July 2001.

American Bar Association Antitrust Section, Financial Markets Committee *Brownbag Seminar* on interchange fees, Washington, DC, March 2001.

"The Economic Analysis of Intellectual Property Damages," Panel discussion moderator, Chicago, Illinois, October 1998.

Spring Antitrust Developments panelist, Vedder, Price, Kaufman & Kammholz, P.C., May 1997.

Credit Card Pricing and Competition: The Environment Today and Future Marketplace and Regulatory Trends, before the American Bar Association, Consumer Financial Services Committee, November 1995.

"Antitrust and Payment Technologies," presented at Antitrust and Payment Systems, Federal Reserve Bank of St. Louis, May 1995.

FELLOWSHIPS

Olin Foundation Fellowship, Center for the Study of the Economy and the State, Graduate School of Business, University of Chicago, 1984.

University of Chicago Graduate Economics Fellowship, 1982 - 1984.

PROFESSIONAL AFFILIATIONS

Member, American Economic Association, 1984 - present.

Associate Member, American Bar Association, (Section of Antitrust Law) 1991 - present.

TESTIMONY AND OFFICIAL PROCEEDINGS

Report, Rebuttal Report, deposition, and declaration, in Peter Kravitz, as Trustee for the RSH Liquidating Trust v. Sony Corporation, et al., and Alfred Siegel, as Trustee for the Circuit City Stores, Inc. Liquidating Trust v. Sony Corporation, et al.

Report, reply report, and deposition in Social Ranger, LLC v. Facebook, Inc.

Amicus Brief in Expressions Hair Design, et al. v. Eric T. Schneiderman, et al.

Report and Testimony in Recommendation Proceeding on Credit and Debit Card Acceptance Services (Transbank), (Santiago, Chile).

Amicus Brief in United States of America, et al. v. American Express Company, et al.

Report and Deposition in Wallach et al v. Eaton Corporation et al. and In Re: Class 8 Transmission Indirect Purchaser Antitrust Litigation.

Report in Ford Motor Company v. Carpenter Co., et al., In re Polyurethane Foam Antitrust Litigation.

Reports, supplemental reports, rebuttal reports and depositions in re: Cathode Ray Tube (CRT) Antitrust Litigation (cases: Best Buy Co., Inc. et al.; Interbond Corporation of America, d/b/a BrandsMart USA; Alfred H. Siegel, as Trustee of the Circuit City Stores, Inc. Liquidating Trust; Compucom Systems, Inc.; Costco Wholesale Corporation; Electrograph Systems Inc. et al.; Office Depot, Inc.; P.C. Richard & Son Long Island Corporation, MARTA Cooperative and ABC Appliance, Inc.; Sears, Roebuck and Co. and Kmart Corp.; Target Corp.; Tech Data Corporation, et al.; Schultze Agency Services, LLC on behalf of Tweeter Opco, LLC et al.).

Declaration and Reply Declaration, in re: American Express Anti-Steering Rules Antitrust Litigation and The Marcus Corporation v. American Express Company, et al.

Report, Deposition, and Supplemental Report in Marchbanks Truck Service, Inc. et al. v. Comdata Network, et al.

Report, Reply Report and Testimony in The Matter Between The Commissioner of Competition and Visa Canada Corporation and MasterCard International Incorporated.

Joint Report, Rebuttal Report, Deposition and Trial Testimony in Best Buy Co., Inc., v. AU Optronics Corp., et al., In Re LCD (Flat Panel) Antitrust Litigation, United States District Court, Northern District Of California, San Francisco Division.

Testimony before the European Commission in Visa Europe.

Brief of Evidence and Reply Brief of Evidence, in New Zealand Commerce Commission v. Cards NZ Limited and Others, DSE (NZ) Limited and Others.

Report to the Reserve Bank of Australia in its *Review of Payment Systems Reforms*.

Brief of Evidence, in New Zealand Commerce Commission v. American Express International (NZ) Incorporated.

Testimony before the European Commission in MasterCard.

Brief of Evidence, in New Zealand Commerce Commission v. Westpac Banking Corporation, District Court, Auckland, New Zealand.

Brief of Evidence, in New Zealand Commerce Commission v. Bank of New Zealand, Limited, District Court, Auckland, New Zealand.

Joint Report, In the Matter of the Decision of the Office of Fair Trading dated 6 September 2005 No. CA 98/05/05 of 6 September 2005 in Case CP/0090/00/S (MasterCard Multilateral Interchange Fee), Competition Appeal Tribunal (U.K.).

Declaration, Report, Rebuttal Report, Deposition and Declaration and Reply Declaration Regarding Proposed Class Settlement, In Re Payment Card Interchange Fee and Merchant Discount Antitrust Litigation, U.S. District Court, Eastern District of New York.

Brief of Evidence, in New Zealand Commerce Commission v. ANZ National Bank Limited, New Zealand Commerce Commission v. Bank of New Zealand, Limited, District Court, Auckland, New Zealand.

Declaration in David Salkin v. MasterCard International, Court of Common Pleas, Philadelphia County, Pennsylvania.

Report in CFS-Related Securities Litigation, U.S. District Court, Northern District of

Oklahoma, and District Court for Tulsa County, State of Oklahoma.

Report in Commercial Financial Services, Inc., v. Mayer Brown Rowe & Maw, P.A., f/k/a Mayer Brown & Platt, and J.P. Morgan Securities, Inc., f/k/a Chase Securities, Inc., Civil Action No. CJ 2002 03028, District Court of Tulsa County, State of Oklahoma.

Rebuttal Testimony and Affidavit in TDS Metrocom, LLC v. Wisconsin Bell, Inc. d/b/a SBC Wisconsin, Public Service Commission Of Wisconsin Docket No. 6720-TI-175.

Affidavit and Deposition in Elizabeth A. Fischer and Jennifer Herbst, on Behalf of Themselves and All Others Similarly Situated, v. MasterCard International, Inc.

Direct Testimony and Rebuttal Testimony on Behalf of SBC Illinois Before The Illinois Commerce Commission, Docket No. 03-0553.

Report in V.P. Intellectual Properties, L.L.C. v. Nobel Biocare USA, Inc., Implant Innovations, Inc. And Implant Innovations International Corporation v. Leonard I. Linkow, And Anthony W. Rinaldi.

Report and Trial Testimony in Enrique Calva-Cerqueira v. United States of America.

Report, Deposition, Amended Report, and Direct Testimony in Charter Federal Savings Bank v. United States of America.

Declaration, Deposition, Trial Testimony, and Rebuttal Testimony in Adam Schwartz vs. Visa International, Inc., Visa International Service Association, Inc., Visa USA, Inc., and MasterCard International, Inc.

Report in Cardiac Pacemakers, Inc., Guidant Sales Corporation, and Eli Lilly and Company v. St. Jude Medical, Inc., Pacesetter, Inc., and Ventritex, Inc.

Testimony before the European Commission in Visa International.

Declaration, Report, Deposition, and Supplemental Report in Columbia First Bank, FSB v. United States of America.

Affidavit in Century Shopping Center Fund I, Limited Partnership v. Frank Pio Crivello

Report and Deposition in Gregory F. Daniel, et al. v. American Board of Emergency Medicine, et al.

Report and Declaration in 1st Home Liquidating Trust v. Unites States of America.

Report and Deposition in Pi Electronics Corp. v. United States of America.

Report in WDP Limited v. Gelatin Products International, Inc. and R.P. Scherer Corp.

Joint Declaration, Joint Report, Deposition, Trial Testimony, and Rebuttal Testimony in C. Robert Suess, et al. v. United States of America.

Declaration and Supplemental Declaration in Robert Johnstone, et al. v. First Bank National Association, et al.

Testimony in Keisha Johnson, Shapearl, et al. v. Aronson Furniture Co. and Heilig-Meyers Co.

Report, Deposition and Trial Testimony in ProtoComm Corporation v. Novell Advanced Services (Formerly Fluent).

Joint Affidavit in Kahn v. Emerson Electric Co., Hazeltine Corporation and Motorola, Inc. et al.

Affidavit, Deposition and Trial Testimony in Masco Corporation of Indiana v. Price Pfister, Inc.

Deposition in Loomis Armored, Inc. v. City of Chicago.

Joint Declaration, Joint Reply Declaration, and Joint Supplemental Declaration in the Matter of Mahurkar Double Lumen Hemodialysis Catheter Patent Litigation.

Deposition in American Fidelity Fire Insurance v. General Railway Signal Corp.

Deposition in General Farebox, et al. v. Landa Corp., et al.

Affidavit in Lincoln Savings & Loan Association v. Federal Home Loan Bank Board and M. Danny Wall.

OTHER

FAA-certified private pilot

PADI-certified open water diver

September 2017

Public Version - Redacted

BEFORE THE

SURFACE TRANSPORTATION BOARD

	)	
	)	
	)	**Application of the National Railroad**
Docket No. FD 35743	)	**Passenger Corporation Under**
	)	**49 U.S.C. § 24308(a)**
	)	**Canadian National Railway Company**
	)	

Rebuttal Joint Verified Statement

Thomas D. Crowley
President

And

Robert D. Mulholland
Senior Vice President

L. E. Peabody & Associates, Inc.

On Behalf Of

Amtrak

Due Date: September 14, 2017

TABLE OF CONTENTS (1) | **PAGE** (2)

I. Introduction 1
II. Baranowski/Fisher's Flawed Analysis Results in Delay Minute Estimates that are Overstated and Unsupported 4
  A. Overview of SRS Delay Attribution Process 6
  B. [redacted] 7
  C. [redacted] 9
III. Baranowski/Fisher's Cost Quantification Stretches Far Beyond the Boundaries of the Short-Run Avoidable Cost Framework 12
  A. Train Crew Costs 13
    1. Direct Wages 14
      a. Basic Shift 14
      b. Overtime 15
    2. Additional Crews 16
    3. Constructive Allowances 18
    4. Fringe Benefits 19
  B. Fuel Cost Analysis 20
    1. Freight Train Stop/Restart Events Unrelated to Amtrak 21
    2. Unsubstantiated and Potentially Overstated Fuel Consumption Assumptions 22
  C. Equipment Costs 25
    1. Locomotive Cost Analysis 25
      a. Lack of Evidentiary Support for Additional Locomotive Costs 25
      b. Baranowski/Fisher's Flawed Assumptions Regarding Locomotive Utilization 26
      c. Additional Locomotive Costs are Not Short-Run Avoidable Costs 27
      d. Baranowski/Fisher's Cost Estimates for Foreign Locomotives Improperly Include Long-Run Costs 27
      e. Baranowski/Fisher's Cost Estimates for CN Locomotives Improperly Includes Opportunity Costs and Long-Run Costs 29
    2. Freight Car Cost Analysis 31
      a. Lack of Evidentiary Support for Additional Freight Car Costs 31
      b. Methodological Flaws 32
IV. CN Physical Plant Limitations 33
V. CN Freight Train Variance From Schedule 34
VI. Conclusion 36

LIST OF EXHBITS

Exhibit No.	Exhibit Description
(1)	(2)
1	Statement of Qualifications of Thomas D. Crowley
2	Statement of Qualifications of Robert D. Mulholland
3	Locomotive Operations and Utilization
4	SRS [redacted]

I. INTRODUCTION

We are Thomas D. Crowley and Robert D. Mulholland, the President and a Senior Vice President, respectively, of L. E. Peabody & Associates, Inc., an economic consulting firm that specializes in solving economic, transportation, marketing, financial, accounting and fuel supply problems. Mr. Crowley has spent most of his consulting career of over forty (40) years evaluating railroad economic and service issues, including railroad costs and profitability, financing, capacity and equipment planning issues. He has also presented expert testimony in a number of court and arbitration proceedings concerning the level of rates, rate adjustment procedures, service, capacity, costing, rail operating procedures and other economic components of specific contracts. His assignments in these matters were commissioned by railroads, producers, shippers of different commodities and government agencies. A copy of Mr. Crowley's credentials is included as Exhibit No. 1 to this Verified Statement ("VS").

Mr. Mulholland has spent most of his career of over twenty (20) years evaluating railroad operations, railroad costs, pricing and capacity issues. He has also analyzed the delivered price of fuel to electric utilities and conducted forecasts of the impact of Class I railroad mergers. He has conducted this work for shippers, producers, railroads and government agencies. A copy of Mr. Mulholland's credentials is included as Exhibit No. 2 to this VS.

Counsel for Amtrak asked us to review the Opening Verified Statement ("OVS") of Michael R. Baranowski and Benton V. Fisher ("Baranowski/Fisher") which was filed by Canadian National Railway Company ("CN") in this proceeding. Specifically, we were tasked with: (i) evaluating Baranowski/Fisher's estimate of freight train delay minutes associated with freight train delays allegedly caused by Amtrak's presence; (ii) evaluating Baranowski/Fisher's estimate of train crew, fuel and equipment costs purportedly incurred by CN in connection with those freight train delays, including expressing our opinion regarding whether

Baranowski/Fisher's estimates are based on short-run avoidable costs under railroad costing principles; (iii) identifying CN freight train delays during the Analysis Period involving freight trains that were longer than available siding lengths; and (iv) evaluating CN freight train variance from schedule during the Analysis Period.

Baranowski/Fisher's estimate of crew, fuel and equipment costs attributable to freight train delays allegedly caused by Amtrak relied on two (2) general steps.[1] The first step involved aggregating the minutes of CN freight train delay they claim were attributable to Amtrak based on their analysis of [redacted]. The second step involved estimating crew, fuel and equipment costs CN purportedly incurred as a result of the freight train delays Baranowski/Fisher claim are attributable to Amtrak.

Baranowski/Fisher's estimate of costs that they attribute to Amtrak delays is unsupported and unreliable. Their analysis rests upon an analytical framework that is deeply flawed and that relies on questionable assumptions and inputs.

The most notable problems with Baranowski/Fisher's analysis include:

(1) Gross overstatement of delay minutes they attributed to Amtrak by selectively ignoring and failing to adequately evaluate relevant information in the [redacted];

(2) Reliance upon unproven assertions that Amtrak delays resulted in CN's retention of extra crew personnel, and increased wages and other expenses;

(3) Improper inclusion of costs related to fuel consumption associated with delays that they acknowledge would have occurred in the absence of Amtrak and based on unproven fuel consumption estimates;

(4) Reliance upon unproven assertions that Amtrak delays resulted in CN's enlistment of additional locomotives to move its trains and increased payments to foreign railroads;

[1] Baranowski/Fisher estimate crew, fuel and equipment costs of $4,690,089 during the Analysis Period, which covered the period from August 1, 2013 through January 31, 2015. *See*, Baranowski/Fisher OVS at p. 26.

(5) Inappropriate inclusion of opportunity costs despite their pledge that they had not done so, and inappropriate use of market-based rates as a proxy for short-run avoidable costs incurred by CN; and

(6) Failure to acknowledge the operating realities resulting from CN management's decisions regarding freight train length and freight train variance from schedule.

II. BARANOWSKI/FISHER'S FLAWED ANALYSIS RESULTS IN DELAY MINUTE ESTIMATES THAT ARE OVERSTATED AND UNSUPPORTED

Baranowski/Fisher attribute 625,020 delay minutes, associated with 19,346 separate freight train delays, to Amtrak during the Analysis Period.[2] This attribution by Baranowski/Fisher was made based on [redacted] from CN's Service, Reliability and Strategy ("SRS") database.[3] We were asked to evaluate the analysis conducted by Baranowski/Fisher using the SRS data.[4] Regardless of whether CN's SRS data is reliable enough to use for measuring and attributing responsibility for delay to specific freight trains, methodological problems with Baranowski/Fisher's delay minutes analysis doom it to failure. Baranowski/Fisher applied two (2) different sets of flawed procedures to two (2) different groups of CN [redacted] in compiling the delay minutes that they attribute to Amtrak.

[redacted]

[redacted]

---

[2] *See,* Baranowski/Fisher OVS at p. 9, Table FTI-4.

[3] As explained further below, [redacted]

[4] However, we were not asked to opine on the reliability or accuracy of the data itself, or on the suitability of SRS data as a means for measuring delays to freight trains which CN seeks to attribute to Amtrak.

[redacted] As a result, the number of delay minutes Baranowski/Fisher attributed to Amtrak is both overstated and unsupported.

As we will discuss below in the following sections, Baranowski/Fisher's estimate of delay minutes that they have attributed to Amtrak during the Analysis Period is unproven and flawed. However, review of the SRS [redacted] included in Baranowski/Fisher's workpapers gives important context. [redacted] Thus, based on CN's own SRS data and Baranowski/Fisher's own interpretation of that data, the vast majority of CN freight train delay is attributed to non-Amtrak causes.

To the extent that the [redacted] included in the [redacted] does not indicate that the delay was caused by Amtrak, it is illogical for Baranowski/Fisher to presume that it was caused by Amtrak. Similarly, to the extent that the [redacted] in SRS [redacted] lists multiple factors contributing to a delay, it is illogical for Baranowski/Fisher to presume that the delay was caused solely by Amtrak. Finally, unless there is a clear indication in the [redacted] of a quantifiable number of minutes of delay that are attributable to any specific

5 [redacted]

cause, there is no reliable basis for Baranowski/Fisher to allocate specific portions of such minutes to Amtrak.

A. OVERVIEW OF SRS DELAY ATTRIBUTION PROCESS

The SRS system provides [redacted] CN's own witnesses in this proceeding have provided the following explanation for the [redacted]:

[redacted]

[redacted]

[redacted]

6 *See,* Summerfield/Girard/Morehouse Verified Statement at p. 18, footnote text in brackets.

[redacted]

[redacted]

[redacted] [redacted] [redacted]

[redacted]

---

7 [redacted]

8 *Id.*

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted].

[redacted]

[redacted]

[redacted]

[redacted]

III. BARANOWSKI/FISHER'S COST QUANTIFICATION STRETCHES FAR BEYOND THE BOUNDARIES OF THE SHORT-RUN AVOIDABLE COST FRAMEWORK

We were tasked with determining whether Baranowski/Fisher's cost estimates are based on short-run avoidable costs under railroad costing principles. Our opinion is guided by key elements of the Railroad Accounting Principles Board ("RAPB") – Final Report.

Avoidable costs are "costs that would be eliminated by the discontinuance of a particular activity over the relevant time frame."[14] The short-run is "the time period during which capacity-limiting input factors are fixed."[15] "In the short-run, production capacity is constrained by existing plant and equipment."[16] Thus, short-run avoidable costs are costs that would be eliminated after discontinuing an activity, but before capacity is changed.[17]

We evaluated Baranowski/Fisher's cost calculations to determine whether they are consistent with the RAPB short-run avoidable cost definition. We conclude that Baranowski/Fisher improperly included costs that do not comport with the definition of short-run avoidable costs in their quantification of costs that they attribute to Amtrak delays.

Baranowski/Fisher identify and quantify costs in three (3) distinct cost groups: (1) train crew costs; (2) fuel costs; (3) equipment costs (which include locomotive costs and railcar costs). Below we discuss each of the problems with the individual components of Baranowski/Fisher's analysis.

---

14 *See,* Railroad Accounting Principles Board – Final Report, September 1, 1987, Volume 2 – Detailed Report, at p. 115.

15 *Id.*, at p. 117.

16 *Id.*, at p. 10.

17 The RAPB definitions of "short run" and "avoidable cost" are consistent with how the Interstate Commerce Commission ("ICC") defined short-run avoidable costs in the 1973 *Penn Central* case, where the ICC defined short-run avoidable costs as follows: "Avoidable cost in the short run… represents that amount of maintenance of way, maintenance of equipment and transportation expenses which could be saved if a particular service were eliminated." Finance Docket No. 27353 (Sub-No. 1), *Determination of Compensation Under Section 402(a) of the Rail Passenger Service Act of 1970*, as amended, September 19, 1973; *342 I.C.C. 820*. ("*Penn Central").* Maintenance of way, maintenance of equipment and transportation expenses are the types of costs that often can be eliminated by discontinuing an activity before any change is made in fixed capacity.

A. TRAIN CREW COSTS

Baranowski/Fisher develop average direct wage rates for CN train crews during the Analysis Period and apply those average unit costs to their calculation of delay hours attributable to Amtrak to arrive at total "direct wage" expenses.[18] However, they do not provide any evidence that any additional train crew hours allegedly due to the presence of Amtrak caused CN to incur additional train crew wages. Thus, there is no evidentiary basis for Baranowski/Fisher to apply their average direct wage rates to any number of hours.

Even if Baranowski/Fisher had presented evidence establishing that CN had actually incurred additional train crew wages as a result of the presence of Amtrak, their estimate explicitly includes costs arising from additional crew hiring, which is a change in a capacity limiting input factor and not a short-run avoidable cost. Baranowski/Fisher's direct wage estimate is flawed and should be disregarded.

Baranowski/Fisher then developed a constructive allowance ratio which they applied to their direct wage expenses to arrive at constructive allowance expenses. Next, they developed a fringe benefit ratio which they applied to the sum of their direct wages plus constructive allowance expenses to arrive at fringe benefit expenses.[19] Because Baranowski/Fisher failed to prove CN incurred additional train crew wage costs, their application of a constructive allowance additive to wages and their application of a fringe benefit additive to the sum of train crew wages and the constructive allowance additive is invalid.

For the reasons described in further detail below, there is no evidentiary basis for Baranowski/Fisher's train crew cost calculation.

---

18 *See*, Baranowski/Fisher OVS at pp. 11-12.

19 Baranowski/Fisher's calculations result in estimated train crew costs of $1,432,081. This total is made up of $850,685 for direct wages, $195,785 for constructive allowances and $385,611 for fringe benefits. [redacted]

1. **Direct Wages**

Baranowski/Fisher claim that "[w]hen CN's freight trains are delayed, additional train crew hours are required to operate those trains."[20] Freight train delays that CN attributes to Amtrak may result in longer cycle times for those trains, which could require individual train crews to devote more hours to operating those trains on any given day, but Baranowski/Fisher's assumption that any such additional train crew hours necessarily mean that additional train crew wage costs were incurred is dubious and unproven.

a. **Basic Shift**

In railroad costing, an additional hour of work does not necessarily result in an additional hour of wage expense. Train crews typically are paid for a fixed shift even if they do not engage in productive work for the entire shift.[21] For example, a locomotive engineer would be paid for a 10-hour day even if his/her tasks on a given day required less than ten (10) hours of work, regardless of the number of jobs he/she completed or the number of train miles he/she accrued. On any given day, the locomotive engineer would earn the same basic day pay whether he/she: (a) did nine (9) hours of productive work; (b) did 10 hours of productive work; or (c) did nine (9) hours of productive work and sat idle during a one-hour train delay.[22]

In the real world, railroads anticipate incidents and delays and build slack time into crew schedules to accommodate them. This slack time can be thought of as idle capacity. "Where

---

[20] *See*, Baranowski/Fisher OVS at p. 11.

[21] Our explanations throughout this VS about railroad compensation, resource allocation and other operating practices is based on our understanding of typical industry practice for Class I railroads in the U.S. Baranowski/Fisher have failed to provide any evidence to suggest that CN's methodology for handling such issues differs in any material way from standard industry practice.

[22] A December 2, 2013 agreement between CN and the Brotherhood of Locomotive Engineers and Trainmen provides that ten (10) hours or less constitutes a basic day. *See*, page 3 of Agreement, which can be found at http://www.blet602.org/Agreements/2013%20BLET%20Agreement.pdf.

short-run idle capacity is used, no alternative use of the assets exists."[23] Baranowski/Fisher did not acknowledge the reality that capacity existed for regularly scheduled crews to absorb some amount of train delays, whether they were related to Amtrak, other freight trains or other factors. No additional crew costs can be included in Baranowski/Fisher's analysis because they have not provided any evidence of additional crew on-duty time resulting from delays.

b. Overtime

Railroad employees working under a fixed shift arrangement typically are paid an hourly overtime rate when their work exceeds the period of the fixed shift. For example, a locomotive engineer working under a 10-hour fixed shift arrangement would be paid overtime if his/her daily tasks required more than 10 hours of work (up to the applicable Hours of Service Act limit of hours before a rest period). So, if the locomotive engineer worked 11 hours, he/she would earn an hour of overtime pay.

However, Baranowski/Fisher provide no evidence that specific individual delays that they have attributed to Amtrak pushed individual crews over their 10-hour basic shift into their 2-hour overtime buffer, so there is no way to demonstrate that any individual delay led to CN incurring any overtime expense.

Even assuming CN crews could not have accommodated delays during their 10-hour basic day shifts, the crews could have worked an additional two (2) hours of overtime, until they reached the 12-hour service limit.[24] [redacted]

[23] *See,* Railroad Accounting Principles Board – Final Report, September 1, 1987, 1987, Volume 2 – Detailed Report, at p. 115.

[24] Crew members have a time of duty limit of 12 hours per the *FRA's Hours of Service Compliance Manual, Freight Operations, December 2013* at page 12. The manual can be found online at https://www.fra.dot.gov/eLib/details/L04876.

[redacted]

In summary, even assuming Baranowski/Fisher could demonstrate that particular delays were caused by Amtrak, in the absence of any evidence that additional train crew hours triggered additional wage expense because CN crews incurred overtime, Baranowski/Fisher's assertion that CN incurred additional crew wages is unsupported.

2. <u>Additional Crews</u>

Baranowski/Fisher claim that freight train delays allegedly due to the presence of Amtrak caused CN to hire additional train crews, but provide no evidence to support this claim. In any case, the costs of hiring additional crews and the wages paid to additional crews would not be short-run avoidable costs.

Baranowski/Fisher state:

> [S]ubstantial delays caused by Amtrak prevent CN train crew personnel from performing other required duties and therefore require CN to retain more train and engine crew personnel than would otherwise be required to meet its customers' demand.[26]

Even if delays allegedly caused by Amtrak occasionally prevented CN train crews from completing their work assignments in a more efficient manner or from performing other unspecified[27] duties, it does not follow that CN employed more train and engine personnel because of those delays. As discussed above, railroads are staffed and equipped to move

---

25 [redacted]

26 *See*, Baranowski/Fisher OVS at p. 11.

27 Baranowski/Fisher failed to identify what other "required duties" the CN train crews would be expected to perform as a result of train delays that they attributed to Amtrak. Their assertion also ignores the various limitations on what specific duties train crews can perform as a result of collective bargaining agreement restrictions, regulatory requirements (such as the Hours of Service Act), geographical limitations and safety rules.

variable levels of traffic on a day-to-day basis and their pay structures accommodate variable levels of production from shift to shift, both in their basic pay format and in their provisions for overtime. Baranowski/Fisher offer no proof for their claim that Amtrak delays resulted in CN retaining additional crew personnel.

Even assuming that Baranowski/Fisher could present such evidence, the costs of employing extra crews would not be short-run avoidable costs. As discussed above, a short-run avoidable cost is a cost that could be eliminated by discontinuing a service before any change is made to fixed capacity. Railroad capacity generally is a function of its physical plant, equipment and work force. Costs associated with changes to capacity limiting input factors (including crews) are not short-run avoidable costs. The end of the short-run time period is demarcated by changes to capacity-limiting input factors, which include labor.

Moreover, Baranowski/Fisher's claim that over $850,000 in direct crew wages resulted from "delays caused by Amtrak [which] prevent[ed] CN train crew personnel from performing other required duties"[28] belies their explicit statement at the outset of their VS that their cost calculation "does not include significant opportunity costs."[29]

Opportunity cost is a measure of the value of an alternative not taken when a decision between two (2) alternatives is required by scarcity of resources. In this case, Baranowski/Fisher claim that the action not taken was CN crews "performing other required duties." Baranowski/Fisher are therefore asserting that delays they attributed to Amtrak resulted in CN failing to do something else. But they point to no duty that went unperformed. Without

---

[28] *See*, Baranowski/Fisher OVS at p. 11.
[29] *See*, Baranowski/Fisher OVS at p. 1.

identifying a specific alternative not taken, there is nothing to which to assign a value, or opportunity cost.[30]

3. <u>Constructive Allowances</u>

Baranowski/Fisher develop and apply an allowance additive for vacation, training and other non-operating time expended by CN train crews for the Analysis Period based on a percentage of direct wages.[31] However, because they have not provided any evidence that additional train crew hours allegedly due to the presence of Amtrak caused CN to incur additional crew wages, there is no basis to apply the constructive allowance against any direct wages allegedly incurred by CN.

Even if Baranowski/Fisher had proven CN incurred actual direct wage expenses, their model for applying a constructive allowance additive is flawed for mechanical and theoretical reasons. First, constructive allowance expenses predominantly represent costs associated with non-working days, e.g., vacation, training. The amount of these expenses is determined by the position and seniority of specific employees. For example, assume CN hired two (2) new locomotive engineers on the same day, one with decades of experience and one with no experience. CN would incur constructive allowance expenses on a rolling basis as they both underwent training. Training expenses are based on the cost to train the new personnel (instructor pay, course materials, etc.) They are not a function of the salary of the two (2) new employees, who would presumably come on at different pay levels, so the cost of training two

[30] For example, if CN realized revenues of "X" resulting from one hour of crew time spent during a delay attributed to Amtrak, but believes it could have realized revenues of "Y" if that hour were spent performing some other duty which CN never performed, then the opportunity cost of not performing the other duty would be the differential between "Y" and "X" (net dollars of foregone revenues), even though the costs incurred to perform either of the two (2) alternatives are identical. Opportunity cost is a measure of the value of one alternative relative to another. It is not a measure of the cost incurred to perform either alternative.
[31] *See,* Baranowski/Fisher OVS at pp. 12-13.

(2) different people taking the same training course, if stated as a percentage of each person's salary, would produce two (2) different ratios.

Baranowski/Fisher's methodology is mechanically flawed because they applied a simple percentage-based formula that they derived from CN's quarterly Wage Form A&B reports filed with the STB, in which railroads report their total wages (from straight time and overtime) and total constructive allowances by employee category.

Constructive allowance payments are a function of the number, craft and seniority mix of railroad employees. Crew members receive training according to schedules determined by their job responsibilities and receive vacation and leave according to their position and seniority. These expenses generally do not change based on whether a crew worked nine (9) or ten (10) hours on a given basic shift, or whether a crew occasionally worked overtime to complete a job on a given day. Baranowski/Fisher's methodology is theoretically flawed because they make no distinction between extra hours allegedly worked by existing crews (which would not result in increased constructive allowances) and extra hours allegedly worked by extra crews they assert were required to be retained as a result of Amtrak related delays. Moreover, Baranowski/Fisher did not prove that any new crews were required because of delays allegedly caused by Amtrak. Even if they had made such a demonstration, changes in staffing levels would be changes to capacity-limiting input factors. Therefore, any costs related to new hires would not be short-run avoidable costs.

4. <u>Fringe Benefits</u>

Baranowski/Fisher develop and apply a fringe benefit additive for CN train crews for the Analysis Period based on a ratio of fringe benefits paid to total salary and wage expense (direct wages and constructive allowances) as reported in CN's Annual Report Form R-1, filed with the

STB.[32] Baranowski/Fisher's application of a fringe benefit additive is critically flawed for many of the same reasons their application of a constructive allowance additive is critically flawed. First, there is no basis to apply the fringe benefit additive to any compensation paid by CN to its train crews because Baranowski/Fisher did not demonstrate that additional train crew hours allegedly due to the presence of Amtrak caused CN to incur additional crew wages.

Second, Baranowski/Fisher did not demonstrate that their fringe benefit ratio fairly estimates the actual costs of providing fringe benefits to specific crew personnel. Returning to the example of two (2) new locomotive engineers with different levels of experience, CN would incur health care expenses for both employees which, if stated as a percentage of each person's salary, would produce two (2) different ratios.

Third, Baranowski/Fisher's estimate of additional crew hours attributable to Amtrak does not differentiate between hours worked by existing crews and hours worked by extra crews allegedly required to be retained due to Amtrak related delays. If a CN locomotive engineer worked an extra hour because of a delay, CN would not pay any more for his health benefits. Any new hires would represent changes to CN's capacity and all related expenses (base wages, constructive allowances and fringe benefits) would not be considered short-run avoidable costs.

B. <u>FUEL COST ANALYSIS</u>

There are several fundamental errors in Baranowski/Fisher's estimate of additional locomotive fuel costs incurred by CN that they claim result from Amtrak-related delays.[33] These errors render their estimate of additional fuel costs attributable to Amtrak delays grossly overstated and unreliable. Baranowski/Fisher improperly include fuel cost (and consumption)

---

[32] *See,* Baranowski/Fisher OVS at pp. 13-14.

[33] Baranowski/Fisher estimate $524,782 in fuel costs associated with allegedly unplanned stop/restart events and an additional $179,153 in fuel costs associated with locomotive idling related to delays that they attribute to Amtrak. [redacted]

associated with CN freight train stop/restart events that their workpapers show would have occurred even without the presence of Amtrak. In addition, their fuel cost estimates are based on unsubstantiated and potentially overstated fuel consumption rates.

1. Freight Train Stop/Restart Events Unrelated to Amtrak

Baranowski/Fisher estimate locomotive fuel consumed during CN freight train stop and restart events which occurred during the Analysis Period and which they claim "appeared to require an added train stop that would not have occurred but for Amtrak."[34] [redacted]

Baranowski/Fisher explicitly acknowledge that [redacted] CN freight train stop/restart events [redacted] that they included in their analysis would have occurred regardless of the presence of Amtrak trains.[36] Because these [redacted] trains would have stopped and restarted (and burned the fuel associated with that activity) regardless of the presence of Amtrak trains, all of them should have been excluded from Baranowski/Fisher's analysis.

Instead, Baranowski/Fisher attributed a portion of the estimated costs associated with multiple-cause stop/restart events to Amtrak.[37] Because the costs associated with such multiple-cause events would have been incurred in the absence of Amtrak trains, they plainly do not meet

---

34 *See,* Baranowski/Fisher OVS at p. 15.

35 [redacted]

36 [redacted]

37 Specifically, Baranowski/Fisher state that "for the set of unscheduled stops for which Delay Records indicate that Amtrak was one of two or more causes, we allocated to Amtrak a pro rata share of the stop." *See,* Baranowski/Fisher OVS at p. 16.

the definition of avoidable costs, i.e., costs that would be eliminated by the discontinuance of a particular activity. Therefore, Baranowski/Fisher's inclusion in their analysis of these freight train stop/restart events is improper.

Moreover, all of the remaining [redacted] stop/restart events for which Baranowski/Fisher attributed to Amtrak responsibility for the total estimate of fuel burned during the stop/restart event were related to FP/AO delays. However, as discussed above in Section II, many of these [redacted] stops were related to FP/AO events for which Baranowski/Fisher improperly allocated 100 percent of the delay minutes to Amtrak despite clearly identified non-Amtrak contributing factors [redacted] they would have acknowledged multiple non-Amtrak factors contributing to the delays, so an even greater number of the stop/restart events included in their fuel cost calculation should have been attributed to non-Amtrak trains or events.[39]

2. Unsubstantiated and Potentially Overstated Fuel Consumption Assumptions

In addition to the critical methodological flaws described above which resulted in Baranowski/Fisher including more than [redacted] stop/start events in their analysis without any reasonable justification for doing so, Baranowski/Fisher also relied on a fuel study conducted by CN using its proprietary Train Performance Calculator and unsupported idling fuel burn assumptions to develop their fuel cost estimates for stop/restart events.

38 [redacted]

39 [redacted]

In addition to estimated costs related to fuel allegedly consumed by CN during stop/restart events that they have attributed to Amtrak, Baranowski/Fisher assign additional fuel costs to the remainder[40] of freight train delay minutes allegedly caused by Amtrak based on the unproven assumption that the locomotives on the delayed CN freight trains remained active in the idle throttle position for the duration of all of the delays,[41] regardless of the length of the delay and consumed fuel at an idling fuel burn rate identified (without evidentiary support) by Baranowski/Fisher. However, by 2013, up to 40 percent of CN's locomotive fleet was equipped with Auto Engine Start Stop ("AESS") technology, which automatically shuts down an idle diesel engine when an equipped locomotive stops.[42] Any locomotive equipped with AESS can immediately shut down the engine to prevent it from burning fuel while idle.[43]

It is likely that an even greater percentage of CN's locomotive fleet was equipped with AESS at the time of the CN fuel study upon which Baranowski/Fisher rely. Baranowski/Fisher failed to mention CN's installation of AESS and it appears that they did not account for AESS in any way when making their idling fuel burn assumption. Rather, Baranowski/Fisher assumed that all CN freight locomotives continuously burned four (4) gallons of fuel per hour while idling. This assumption is both unsupported and unproven. As such, the additional fuel costs

---

40 [redacted]

41 The idle time calculation is based on an unproven assumption that certain trains stopped, idled, and then restarted. Baranowski/Fisher offer no proof of any train's actual operations and cannot know if and to what extent any locomotive on any train may have been idling in any particular situation based on the SRS data that was evaluated as part of their analysis.

42 CN announced publicly that up to 800 of its locomotives would be equipped with this technology by 2013. *See*, http://www.cn.ca/en/news/2011/06/media_news_fuel_efficiency_program_20110622. CN's 2016 Investor Fact Book shows that CN owned 2,029 Diesel locomotives in 2013. See workpaper "2016-IFB-Update-en.pdf" (800 ÷ 2029) = 40%.

43 *See*, Norfolk Southern's Mechanical department memo, workpaper "NS_Smart_Start.pdf".

associated with locomotive idling claimed by Baranowski/Fisher should be discarded from their analysis.

When available, data collected in the field is generally more reliable than model outputs, because data collected in the field reflects real world operations. Baranowski/Fisher relied on a fuel simulation study conducted by CN using its proprietary Train Performance Calculator ("TPC"). Baranowski/Fisher did not explain why they relied on a fuel simulation study rather than analyzing actual fuel consumption data from CN locomotives.[44] Nor did Baranowski/Fisher explain whether the TPC modeling exercise conducted by CN accounted for recent increases in locomotive fuel efficiency.[45]

In summary, although fuel costs may qualify in appropriate circumstances as short-run avoidable costs, Baranowski/Fisher's analysis: (1) improperly included thousands of stop/start events that would have occurred even in the absence of Amtrak trains; (2) failed to account for fuel-saving technology that is widely deployed on CN's locomotive fleet and that dramatically reduces fuel burn on idling locomotives; (3) relied on a proprietary simulation model when real-world fuel consumption data likely exists at CN; and (4) failed to demonstrate that its model inputs reflect the current fuel efficiency of the CN locomotive fleet. These critical flaws in Baranowski/Fisher's analysis render it completely unreliable.

44 CN has made wide deployment of Wi-Tronix technology, which can measure actual fuel consumption data from specific CN locomotives. *See*, http://www.cn.ca/en/news/2011/06/media_news_fuel_efficiency_program_20110622.

45 [redacted] Locomotive fuel efficiency has been a primary focus of all locomotive manufacturers for decades. A 2008 Federal Railroad Administration ("FRA") study showed that locomotive fuel efficiency improved by 18 to 26 percent during the 16-year period between 1990 and 2006. "*Comparative Evaluation of Rail and Truck Fuel Efficiency on Competitive Corridors*", November 19, 2009, p. 34. *See*, https://www.fra.dot.gov/eLib/details/L04317.

C. EQUIPMENT COSTS

Baranowski/Fisher's estimate of additional equipment costs allegedly incurred by CN as a result of freight train delays that they attribute to Amtrak is comprised of locomotive and railcar costs. Their estimate is unreliable because their methodology for estimating these additional equipment costs suffers from theoretical, analytical and mechanical flaws.

1. Locomotive Cost Analysis

Baranowski/Fisher's estimate of additional locomotive costs incurred by CN in connection with freight train delays allegedly caused by Amtrak's presence is flawed in numerous respects. It lacks evidentiary support, it is based on flawed assumptions which conflict with real-world railroad operating practices and it includes both long-run costs and opportunity costs that do not qualify as short-run avoidable costs.

a. Lack of Evidentiary Support for Additional Locomotive Costs

Baranowski/Fisher claim that when CN freight trains are delayed by Amtrak, CN must "acquire additional locomotives or enlist the services of locomotives owned by other carriers to move its trains."[46] However, they provide no evidence to support this assertion.

Freight train delays may cause increases in train cycle times and may result in extended running times for the in-service locomotives used to move the trains. However, this does not mean that CN must acquire additional locomotive power as a result of freight train delays that Baranowski/Fisher have attributed to Amtrak. Baranowski/Fisher provided no evidence that CN incurred additional costs for acquiring or leasing additional locomotives as a result of specific delays caused by Amtrak, nor have they provided any evidence that CN had to use locomotives

[46] *See,* Baranowski/Fisher OVS at p. 21.

owned by other carriers to move their trains specifically as a result of delays that they attribute to the presence of Amtrak.

b. Baranowski/Fisher's Flawed Assumptions Regarding Locomotive Utilization

Baranowski/Fisher assert, without proof, that "Amtrak caused delays to CN trains restrict the ability of CN owned locomotives to perform necessary services."[47] Similar to their unsupported argument regarding the need to retain extra crews, Baranowski/Fisher's estimate of additional locomotive costs is based on the false premise that CN's locomotive fleet is fully utilized at all times. They also seemingly presume that CN lacks the ability to reposition locomotive power as needed to handle delays and other operational challenges inherent in the railroad industry as a result of routine ebbs and flows in traffic. These presumptions conflict with real-world railroad operating practices.

No Class I railroad operates at (or even close to) a 100 percent locomotive utilization rate. Railroad locomotive utilization rates range from eight (8) percent to 62 percent[48] and are typically in the 25 percent to 35 percent range.[49] All railroads, including CN, structure their locomotive pools to account for efficient asset management, including accommodating down time, mechanical failures and operational delays.[50]

---

47 *Id.*

48 *See,* "*Duty Cycle Profile of 2007 Canadian Diesel Locomotive Fleet*", prepared for the Railway Association of Canada ("RAC") by Peter Eggleton and Robert Dunn, January, 2009, page 6. *See,* Exhibit No. 3 to this Rebuttal Verified Statement.

49 *See,* http://argoconsulting.com/content/wp-content/uploads/2014/12/Argo_EnterpriseAssetManagement_VF-FINAL-Dec-5-2014.pdf, accessed March 8, 2017.

50 If a locomotive is "available" for 12 hours it may, on average, be operating for 10 hours and shut down for two (2) hours. Within the 10 hours the locomotive is operating, it may be pulling a train for eight (8) hours and idled for two (2) hours. If that locomotive was pulling a train that was delayed for an hour, on any particular day, it would still be available for 12 hours and operating for 10 hours but it would be pulling the train for nine (9) hours and idled for one (1) hour. CN would not be required to purchase another locomotive to be available for that one hour, it would simply be part of the regular fluctuation in how "available" hours are distributed from day to day.

Furthermore, nearly all locomotives are interchangeable and CN owns hundreds of locomotives in a variety of models. For example, if locomotive A and locomotive B are both model ES44AC locomotives owned by CN and positioned in the vicinity of the scheduled train departure, it does not matter which one is used to do a job. If locomotive A could move train X on a particular day but is delayed, then locomotive B can move train X and provide equivalent service. CN would still not be required, as a result of periodic and isolated delays which might be attributed to Amtrak, to "acquire additional locomotives or enlist the services of locomotives owned by other carriers to move its trains"[51] as Baranowski/Fisher assert.

c. Additional Locomotive Costs are Not Short-Run Avoidable Costs

Even if Baranowski/Fisher could demonstrate that CN acquired or leased additional locomotive power as a result of freight train delays caused by Amtrak's presence, the costs incurred by CN to obtain that additional locomotive power would not be short-run avoidable costs. As explained above with respect to extra crews, short-run avoidable costs are costs that would be eliminated by discontinuing an activity within the time period before any changes are made to fixed railroad capacity. The CN equipment (locomotive and railcar) pools are capacity-limiting input factors. Therefore, any costs incurred by CN to acquire or lease additional locomotive capacity would not be short-run avoidable costs.

d. Baranowski/Fisher's Cost Estimates for Foreign Locomotives Improperly Include Long-Run Costs

Locomotives commonly run over the networks of other (foreign) railroads to maximize operating efficiency on interline shipments (shipments traversing more than one rail network between origin and destination). As such, railroads enter into bilateral agreements that govern

---

[51] *See,* Baranowski/Fisher OVS at p. 21.

the level of compensation one railroad pays to the other in the event that there is an imbalance in the horsepower hours ("HPH") that the respective railroads' locomotive fleets accrued on each other's networks during a specified period of time.

Baranowski/Fisher base their estimate of the purported additional costs CN incurs as a result of delays to foreign locomotives on the HPH balancing formulas included in these bilateral agreements. As a threshold matter, Baranowski/Fisher's explanatory statement that the agreement formulas are "used by CN to compensate foreign line carriers for use of their locomotives where CN's own locomotives are not available to offset accumulated horsepower hours"[52] is misleading. There are imbalances for many reasons, not just in instances where CN's own locomotives are not available. [redacted]

Even assuming Baranowski/Fisher provided evidence establishing that CN actually made HPH balancing payments to foreign roads as a result of specific delays caused by Amtrak, the "financial cost per HPH" formula used by Baranowski/Fisher to estimate the costs CN allegedly incurs when foreign locomotives are delayed is not a short-run avoidable cost. It includes both a railway operating expense component and an interest component. Under the HPH formula used by Baranowski/Fisher, [redacted]

[redacted]

---

52 *Id.*

53 [redacted]

[redacted] These long-run costs do not change in real time when a single delay is incurred on the rail network. Rather, they change when locomotive leases are entered into or terminated, or when locomotives are bought and sold. However, locomotive acquisition costs are not short-run avoidable costs that would be eliminated in the absence of Amtrak because such equipment is a capacity limiting input factor. This is an additional reason why Baranowski/Fisher's use of the HPH formula to estimate such costs is improper.

e. Baranowski/Fisher's Cost Estimates for CN Locomotives Improperly Includes Opportunity Costs and Long-Run Costs

Baranowski/Fisher expanded the scope of their analysis to include additional costs CN allegedly incurred during delays to trains with locomotives owned by [redacted] while moving on CN's US rail network.[54] Baranowski/Fisher applied a modified HPH balancing methodology similar to the one it applied for delays to trains moving under foreign power to make this estimate, with one important addition.

> [D]elays caused by Amtrak to CN-owned locomotives consume locomotive operating capacity that could otherwise be used to move other CN trains. To replace this lost capacity, CN incurs additional locomotive ownership costs, over and above locomotive operating and maintenance expenses. We therefore add an ownership cost component, in the form of lost return on investment ("ROI"), to account for the opportunity cost of the unproductive delay time.[55]

This component of Baranowski/Fisher's analysis is critically flawed for a number of reasons. First, they include an ownership cost component which they expressly identify as an "opportunity cost." This directly violates the up-front claim in their VS that their cost estimate is

54 [redacted]

55 *See*, Baranowski/Fisher OVS at p. 22.

limited to direct operating costs and that it "does not include significant opportunity costs."[56] As discussed in Section III above, opportunity costs are not short-run avoidable costs. Furthermore, CN points to no specific "other CN train" it was not able to move due to a lack of operating capacity. Absent any demonstration that some alternative was not taken, i.e., other CN trains that could not be moved, there is no opportunity cost.[57]

Next, the Uniform Railroad Costing System ("URCS") values used by Baranowski/Fisher to calculate the ROI-based opportunity cost component inappropriately include various long-run cost components.[58] These costs include roadway buildings, offices, engine houses, storage warehouses, locomotives and railcars. In the short run, these costs are fixed. Even if the delays that CN attributed to Amtak ceased to exist, CN would still be incurring these long-run costs. Baranowski/Fisher's inclusion of these long-run costs in their locomotive cost estimate is improper in this context.

Baranowski/Fisher's model with respect to CN locomotives implicitly assumes that HPH balancing unit costs from run through agreements with other railroads are a reasonable proxy for locomotive costs CN purportedly incurred as a result of such delays.[59] As described in the preceding section, the "financial cost per HPH" paid by one railroad to another when there is an HPH imbalance includes interest and other long-run cost components, it is not a short-run avoidable cost.

---

56 *See,* Baranowski/Fisher OVS at p. 1.

57 Also, within the construct proposed by Baranowski/Fisher, opportunity cost would be measured by the foregone revenue associated with the specific other CN trains not moved relative to the revenue earned on the specific alternate operations performed in lieu of (not in addition to) the foregone alternative. This is a flawed argument, as the costs of performing the alternate operations are the same as the costs of the selected operation.

58 The proposed ROI was developed by Baranowski/Fisher based on the STB's URCS program. URCS is a complex set of algorithms and formulas which transform annual reported railroad expense and activity data from annual R-1 reports into estimates of the cost of providing specific railroad services. The long-run variable costs developed by URCS fit into three general costs areas: (i) variable operating expenses; (ii) depreciation, rents and leases; and (iii) return on investment in both road and equipment property.

59 CN does not have a run-through agreement with itself. Even if Baranowski/Fisher could establish that certain CN locomotive delays are attributable to the presence of Amtrak, [redacted].

2. Freight Car Cost Analysis

Baranowski/Fisher's estimate of additional freight car costs incurred by CN in connection with freight train delays allegedly caused by Amtrak's presence[60] is largely unsupported, includes costs that are not short-run avoidable costs and is methodologically flawed.

a. Lack of Evidentiary Support for Additional Freight Car Costs

Baranowski/Fisher claim that CN incurs additional freight car costs due to delays allegedly caused by Amtrak in the form of increased per diem car hire payments "that CN makes to other railroads for the time that the foreign railroad's equipment is on CN's lines," and "that CN receives from other railroads for the time that CN's equipment is on the foreign railroad's lines."[61] Specifically, Baranowski/Fisher "determined the average cost per hour by individual piece of equipment"[62] and applied that cost to the aggregate delay minutes they developed from their delay record analysis and attributed to Amtrak.

However, Baranowski/Fisher provided no evidence to support the assumption that freight train delays allegedly caused by Amtrak resulted in foreign railcars remaining on CN's network for longer periods of time, which is what would trigger increased per diem payments to foreign railroads. Freight cars routinely sit idle in freight yards or at industry sidings for extended periods before they are redeployed. Longer transit times may have simply resulted in reduced yard time or less time in storage. Baranowski/Fisher provided no evidence that CN actually incurred or paid additional per diem charges to foreign railroads as a result of specific delays that they attribute to Amtrak.

---

[60] Baranowski/Fisher estimate $274,784 in freight car costs. *See*, Baranowski/Fisher OVS at pp. 24-25.
[61] *See*, Baranowski/Fisher OVS at p. 25.
[62] *Id.*

b. Methodological Flaws

Baranowski/Fisher's freight car cost analysis also improperly treats delays to CN freight cars the same as delays to foreign freight cars on its system. Specifically, Baranowski/Fisher use the per diem rates foreign railroads pay to CN for time CN cars spend on the foreign rail networks as a surrogate for the car costs CN purportedly incurs on its own system during a train delay. This is illogical. CN does not incur per diem charges when its own cars are on its own system. Moreover, Baranowski/Fisher's use of per diem charges as a proxy for costs CN allegedly incurs when its own cars are delayed on its own rail system is inappropriate because per diem rates incurred by other railroads and paid to CN when CN's cars are on other rail networks are negotiated, market-set rates. These market-based rates reflect prices. They are not a reasonable proxy for short-run avoidable costs.[63]

[63] Since 2004, per diem rates for virtually all rail cars have been determined by the market, established through negotiations between owners and users of the equipment. The hourly (and mileage) car hire rates table is published in RailInc Circular OT-10 which governs payments and receipt of monies exchanged for the use of railroad equipment. Before the 1990s, car hire charges were set using an ICC/STB-prescribed formula. However, the method for setting these charges changed when car hire rates were "deprescribed" in 1994.

IV. CN PHYSICAL PLANT LIMITATIONS

Amtrak has no control over CN's management of its network capacity or its operations. Amtrak has no input into which capital improvement projects CN elects to undertake. Amtrak does not configure, schedule or operate the freight trains that run over CN's rail network. CN management has decided to run freight trains over its network that are too long to fit into several of the sidings on the segments over which Amtrak trains operate. These long freight trains take significant operational flexibility out of the hands of CN dispatchers because many CN freight trains will not fit into a number of sidings.

[redacted]

Amtrak cannot be held accountable or required to pay CN for decisions that CN makes related to the trade-offs between physical plant limitations (i.e., siding length) and operating plan development (i.e., building, scheduling and running trains that are too long for many sidings) on the network segments over which Amtrak trains operate.

V. CN FREIGHT TRAIN VARIANCE FROM SCHEDULE

[redacted] [redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted]

[redacted]

---

64 [redacted]

65 [redacted]

[redacted] This evidence demonstrates that CN freight trains operate at a considerable variance from their schedules.

[redacted]

VI. CONCLUSION

For the reasons described above, Baranowski/Fisher's estimate of alleged additional costs incurred by CN from freight train delays that they attribute to Amtrak is unsupported and unreliable. It rests upon an analytical framework that is deeply flawed and those flaws are exacerbated by highly questionable assumptions and inputs.

First, Baranowski/Fisher grossly overstated CN freight train delay minutes that they attributed to Amtrak by selectively ignoring and failing to adequately evaluate relevant information in SRS [redacted]. Had they attempted to undertake a qualitative analysis of the SRS [redacted], their estimate of minutes attributable to Amtrak would have been drastically reduced.

Second, Baranowski/Fisher failed to provide evidence to substantiate their estimates of wage, fuel and equipment costs that CN purportedly incurred as a result of such delays, and failed to establish that many of these alleged costs (even if proven) would qualify as short-run avoidable costs under railroad accounting standards. More specifically, Baranowski/Fisher:

(i) Failed to prove that Amtrak delays resulted in CN's retention of extra crew personnel or caused base wages, overtime, constructive allowances, and fringe benefits expenses to be incurred;

(ii) Improperly included costs in their estimate related to fuel consumption associated with stopping and restarting freight trains for delays that they acknowledge would have occurred in the absence of Amtrak and relied on unproven and unsupported fuel consumption estimates;

(iii) Failed to prove that CN freight train delays which they have attributed to Amtrak required CN to acquire additional locomotive capacity, or incur additional costs related to HPH balancing payments; and

(iv) Failed to prove that CN freight train delays that they seek to attribute to Amtrak resulted in increased car hire payments to foreign railroads and improperly claim that CN incurred additional costs in connection with its own freight cars.

Finally, Baranowski/Fisher ignore the impact of CN management's decision to operate trains that exceed the length of its sidings on CN's ability to accommodate train meets and avoid or minimize any resulting delays. They also fail to acknowledge the significant variance of CN freight trains from schedule that is a normal part of CN's train operations.

VERIFICATION

I, Thomas D. Crowley, verify under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Rebuttal Verified Statement.

Executed on September 14, 2017

Thomas D. Crowley

VERIFICATION

I, Robert D. Mulholland, verify under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Rebuttal Verified Statement.

Executed on September 14, 2017

Robert D. Mulholland

EXHIBIT 1

THOMAS D. CROWLEY
STATEMENT OF QUALIFICATIONS

My name is Thomas D. Crowley. I am an economist and President of the economic consulting firm of L. E. Peabody & Associates, Inc. The firm's offices are located at 1501 Duke Street, Suite 200, Alexandria, Virginia 22314, 760 E. Pusch View Lane, Suite 150, Tucson, Arizona 85737, and 7 Horicon Avenue, Glens Falls, New York 12801.

I am a graduate of the University of Maine from which I obtained a Bachelor of Science degree in Economics. I have also taken graduate courses in transportation at George Washington University in Washington, D.C. I spent three years in the United States Army and since February 1971 have been employed by L. E. Peabody & Associates, Inc.

I am a member of the American Economic Association, the Transportation Research Forum, and the American Railway Engineering and Maintenance-of-Way Association.

The firm of L. E. Peabody & Associates, Inc. specializes in analyzing matters related to the rail transportation of all commodities. As a result of my extensive economic consulting practice since 1971 and my participation in maximum-rate, rail merger, service disputes and rule-making proceedings before various government and private governing bodies, I have become thoroughly familiar with the rail carriers and the traffic they move over the major coal routes in the United States. This familiarity extends to subjects of railroad service, costs and profitability, cost of capital, railroad capacity, railroad traffic prioritization and the structure and operation of the various contracts and tariffs that historically have governed the movement of traffic by rail.

As an economic consultant, I have organized and directed economic studies and prepared reports for railroads, freight forwarders and other carriers, for shippers, for associations and for state governments and other public bodies dealing with transportation and related economic

THOMAS D. CROWLEY
STATEMENT OF QUALIFICATIONS

problems. Examples of studies I have participated in include organizing and directing traffic, operational and cost analyses in connection with single car and multiple car movements, unit train operations for coal and other commodities, freight forwarder facilities, TOFC/COFC rail facilities, divisions of through rail rates, operating commuter passenger service, and other studies dealing with markets and the transportation by different modes of various commodities from both eastern and western origins to various destinations in the United States. The nature of these studies enabled me to become familiar with the operating practices and accounting procedures utilized by railroads in the normal course of business.

Additionally, I have inspected and studied both railroad terminal and line-haul facilities used in handling various commodities. These operational reviews and studies were used as a basis for the determination of the traffic and operating characteristics for specific movements of numerous commodities handled by rail.

I have frequently been called upon to develop and coordinate economic and operational studies relative to the rail transportation of various commodities. My responsibilities in these undertakings included the analyses of rail routes, rail operations and an assessment of the relative efficiency and costs of railroad operations over those routes. I have also analyzed and made recommendations regarding the acquisition of railcars according to the specific needs of various shippers. The results of these analyses have been employed in order to assist shippers in the development and negotiation of rail transportation contracts which optimize operational efficiency and cost effectiveness.

I have developed property and business valuations of privately held freight and passenger railroads for use in regulatory, litigation and commercial settings. These valuation assignments

THOMAS D. CROWLEY
STATEMENT OF QUALIFICATIONS

required me to develop company and/or industry specific costs of debt, preferred equity and common equity, as well as target and actual capital structures. I am also well acquainted with and have used the commonly accepted models for determining a company's cost of common equity, including the Discounted Cash Flow Model ("DCF"), Capital Asset Pricing Model ("CAPM"), and the Farma-French Three Factor Model.

Moreover, I have developed numerous variable cost calculations utilizing the various formulas employed by the Interstate Commerce Commission ("ICC") and the Surface Transportation Board ("STB") for the development of variable costs for common carriers, with particular emphasis on the basis and use of the Uniform Railroad Costing System ("URCS") and its predecessor, Rail Form A. I have utilized URCS/Rail form A costing principles since the beginning of my career with L. E. Peabody & Associates Inc. in 1971.

I have frequently presented both oral and written testimony before the ICC, STB, Federal Railroad Administration, Federal Energy Regulatory Commission, Railroad Accounting Principles Board, Postal Rate Commission and numerous state regulatory commissions, federal courts and state courts. This testimony was generally related to the development of variable cost of service calculations, rail traffic and operating patterns, fuel supply economics, contract interpretations, economic principles concerning the maximum level of rates, implementation of maximum rate principles, and calculation of reparations or damages, including interest. I presented testimony before the Congress of the United States, Committee on Transportation and Infrastructure on the status of rail competition in the western United States. I have also presented expert testimony in a number of court and arbitration proceedings concerning the level

THOMAS D. CROWLEY
STATEMENT OF QUALIFICATIONS

of rates, rate adjustment procedures, service, capacity, costing, rail operating procedures and other economic components of specific contracts.

Since the implementation of the *Staggers Rail Act of 1980*, which clarified that rail carriers could enter into transportation contracts with shippers, I have been actively involved in negotiating transportation contracts on behalf of shippers. Specifically, I have advised shippers concerning transportation rates based on market conditions and carrier competition, movement specific service commitments, specific cost-based rate adjustment provisions, contract reopeners that recognize changes in productivity and cost-based ancillary charges.

I have developed different economic analyses regarding rail transportation matters for over sixty (60) electric utility companies located in all parts of the United States, and for major associations, including American Chemistry Council, American Paper Institute, American Petroleum Institute, Chemical Manufacturers Association, the Chlorine Institute, Coal Exporters Association, Edison Electric Institute, the Fertilizer Institute, Mail Order Association of America, National Coal Association, National Grain and Feed Association, National Industrial Transportation League, North America Freight Car Association and Western Coal Traffic League. In addition, I have assisted numerous government agencies, major industries and major railroad companies in solving various transportation-related problems.

In the two Western rail mergers that resulted in the creation of the present BNSF Railway Company and Union Pacific Railroad Company and in the acquisition of Conrail by Norfolk Southern Railway Company and CSX Transportation, Inc., I reviewed the railroads' applications including their supporting traffic, cost and operating data and provided detailed evidence supporting requests for conditions designed to maintain the competitive rail environment that

THOMAS D. CROWLEY
STATEMENT OF QUALIFICATIONS

existed before the proposed mergers and acquisition. In these proceedings, I represented shipper interests, including plastic, chemical, coal, paper and steel shippers.

I have participated in various proceedings involved with the division of through rail rates. For example, I participated in ICC Docket No. 35585, *Akron, Canton & Youngstown Railroad Company, et al. v. Aberdeen and Rockfish Railroad Company, et al.* which was a complaint filed by the northern and mid-western rail lines to change the primary north-south divisions. I was personally involved in all traffic, operating and cost aspects of this proceeding on behalf of the northern and mid-western rail lines. I was the lead witness on behalf of the Long Island Rail Road in ICC Docket No. 36874, *Notice of Intent to File Division Complaint by the Long Island Rail Road Company*.

EXHIBIT 2

ROBERT D. MULHOLLAND
STATEMENT OF QUALIFICATIONS

My name is Robert D. Mulholland. I am an economist and a Senior Vice President of the economic consulting firm of L. E. Peabody & Associates, Inc. The firm's offices are located at 1501 Duke Street, Suite 200, Alexandria, Virginia 22314, 760 E. Pusch View Lane, Suite 150, Tucson, Arizona 85737, and 7 Horicon Avenue, Glens Falls, New York 12801.

I am a graduate of George Mason University's School of Public Policy, from which I obtained a Master's degree in Transportation Policy, Operations & Logistics, and Bowdoin College, from which I obtained a Bachelor of Arts degree in Government and Legal Studies. I have been employed by L. E. Peabody & Associates, Inc since 2008 and from 1995-2004. From 2004-2006, I was the staff economist for the Office of Freight Management and Operations of the Federal Highway Administration ("FHWA") of the United States Department of Transportation ("USDOT"). From 2006-2008, I worked for ICF International as a consultant in the transportation group.

L. E. Peabody & Associates, Inc. specializes in economic and operations analysis of the freight rail industry. I have directed and conducted economic studies and prepared reports for freight carriers, shippers, federal agencies, the U.S. Congress, various associations, and other public bodies dealing with transportation and related economic issues. I have organized and directed traffic operations and cost analyses in connection with single and multiple car movements and unit train shipments of various commodities, rail facilities analyses, rate and revenue division analyses, and other studies dealing with freight transportation markets for many commodities over various surface modes throughout the United States.

ROBERT D. MULHOLLAND
STATEMENT OF QUALIFICATIONS

I have developed evidence containing base year traffic, revenues, and revenue divisions, forecasts of those volumes and revenues, train lists supporting the movement of selected traffic, and operating statistics associated with their movement, for hypothetical stand-alone railroads ("SARR") in several Surface Transportation Board ("STB" or "Board") proceedings dealing with the calculation of maximum reasonable rail transportation rates for coal and chemical shippers.

I have presented written testimony before the STB in several Ex Parte proceedings, including: Docket No. EP 706, related to reporting requirements for PTC-related expenses and investments; Docket No. Docket No. Ex Parte 715, related to the inclusion of cross-over traffic and the development of revenue divisions for that traffic in rate reasonableness proceedings; Docket No. EP 431 (Sub-No. 4), related to proposed adjustments to the STB's Uniform Railroad Costing System ("URCS") mode, and Docket No. EP 661 (Sub-No. 2), related to the application of the "Safe Harbor" provision to railroad fuel surcharge programs.

I have developed evidence and presented written testimony containing fuel cost calculations for multiple commodities in an STB proceeding dealing with the determination of reasonable practices related to fuel surcharges.

As a result of my extensive experience since 1995, including participation in and support of various proceedings before the STB and other government bodies, I have become thoroughly familiar with the major rail carriers in the United States. This familiarity extends to subjects of railroad operations, accounting procedures, cost

ROBERT D. MULHOLLAND
STATEMENT OF QUALIFICATIONS

structure, pricing practices, revenue collection, and capacity utilization. I am also very familiar with the Class I railroads' traffic, revenue, and operations databases.

I developed a series of reports evaluating and critiquing the Federal Railraod Administration's ("FRA") benefit-cost analyses (BCA") related to the implementation of Positive Train Control ("PTC") systems on the Class I carriers' rail systems.

I have developed numerous variable cost calculations utilizing the various formulas employed by the STB for the development of variable costs for common carriers, with particular emphasis on the basis and use of the Uniform Railroad Costing System ("URCS"). I have utilized URCS costing principles since the beginning of my career with L. E. Peabody & Associates Inc. in 1995.

I have conducted multiple studies of rail fuel surcharge revenue collection formulae relative to fuel consumption and costs, and I have developed studies analyzing delivered fuel prices to electric utilities using Federal Energy Regulatory Commission ("FERC"), Energy Information Administration ("EIA"), and related data.

I have supported the negotiation of transportation contracts between shippers and railroads. Specifically, I have conducted studies concerning the relative efficiency and costs of railroad operations over multiple routes, transportation rates based on market conditions and carrier competition, movement-specific service commitments, and specific market- and cost-based rate adjustment provisions.

In the Western rail merger that resulted in the creation of the present Union Pacific Railroad Company, I reviewed the railroads' applications including their supporting traffic, cost and operating data and developed detailed evidence supporting

ROBERT D. MULHOLLAND
STATEMENT OF QUALIFICATIONS

requests for conditions designed to maintain the competitive rail environment that existed before the proposed merger. Following the merger, I developed studies analyzing its impact on system traffic flows and transit times.

I have inspected and studied railroad terminal facilities used in handling various commodities to collect data that were used as a basis for the determination of traffic and operating characteristics for specific movements handled by rail.

While employed at FHWA, I was a member of the USDOT inter-agency working group that drafted the National Freight Policy. In addition, I served on the USDOT Freight Gateway Team, a group headed by the Undersecretary for Policy and composed of one representative from each of the surface modal agencies.

While employed by ICF International, I directed and conducted numerous analyses of the rail and trucking industries for federal transportation agencies including the Federal Railroad Administration ("FRA"), the Federal Motor Carrier Safety Administration ("FMCSA"), and the FHWA, including analyses of the current rail and trucking industries and forecasts of future trends in both industries.

EXHIBIT 3

LOCOMOTIVE OPERATIONS AND UTILIZATION

A locomotive is considered "available" (or "in service" or "utilized") when it is located outside a locomotive maintenance facility (i.e., depot, shed, workshop, etc.) As a result, locomotives that are recorded as "available" may not be performing "necessary services," or any services at all. Locomotives that are "in service" may be heading trains, running light (repositioning), cold running (being hauled cold for repositioning in another train, also known as "deadheading"), moving between yards and maintenance facilities, or simply waiting in stations or yards before or after heading trains. Standby locomotives will generally not be considered "in service" although they will be recorded as "available."

A locomotive is considered "unavailable" or "out of service" only during the time it is not under the control of the railroad operating department. An unavailable locomotive will be either undergoing or awaiting service, maintenance or repair in a maintenance facility, or broken down outside maintenance facilities.

Data at this level of granularity required to know exactly what an available locomotive is doing at any given time, is generally not available on a railroad-wide basis. However, the distinction between "availability" and "activity" is recognized by the Railway Association of Canada ("RAC")[1] in its annual report on the Locomotive Emissions Monitoring ("LEM") program.

The LEM monitors the Emissions Factors ("EF") based on the amount of fuel consumed and the locomotive utilization profile. The locomotive utilization profile is the breakdown of locomotive activity within a 24-hour day (based on yearly averages for each railroad).

The elements of the RAC locomotive utilization profile are:

---

1 The RAC is responsible for measuring various emissions from locomotives operating in Canada pursuant to the LEM in accordance with an agreement between the RAC and Transport Canada ("TC").

LOCOMOTIVE OPERATIONS AND UTILIZATION

1. Locomotive Available: This is the time, expressed in percent of a 24-hour day, that a locomotive could be used for operational service.[2]

2. Locomotive Unavailable: This is the percentage of the day that a locomotive is being serviced, repaired and remanufactured, or in storage.

3. Engine Operating Time: This is the percentage of Locomotive Available time that the diesel engine is turned on.

4. Engine Shutdown Time: This is the percentage of Locomotive Available time that the diesel engine is turned off.

5. Idle: This is the percent of the operating time that the engine is operating at idle or low-idle setting. It can be further segregated into Manned Idle (when an operating crew is on-board the locomotive) and Isolate (when the locomotive is unmanned).

6. Duty Cycle: This profile is of the different locomotive power settings (Low-Idle, Idle, Dynamic Braking, or Notch levels 1 through 8) as percentages of Engine Operating Time.

A schematic of a typical locomotive utilization profile is shown in Figure No. 1, below.[3] The percentages shown in Figure No. 1 are for illustrative purposes only and will vary from railroad to railroad. However, Operation Time plus Shutdown Time will always equal Available Time. The Duty Cycle will always equal the range of idle positions as well as total Operating Time.

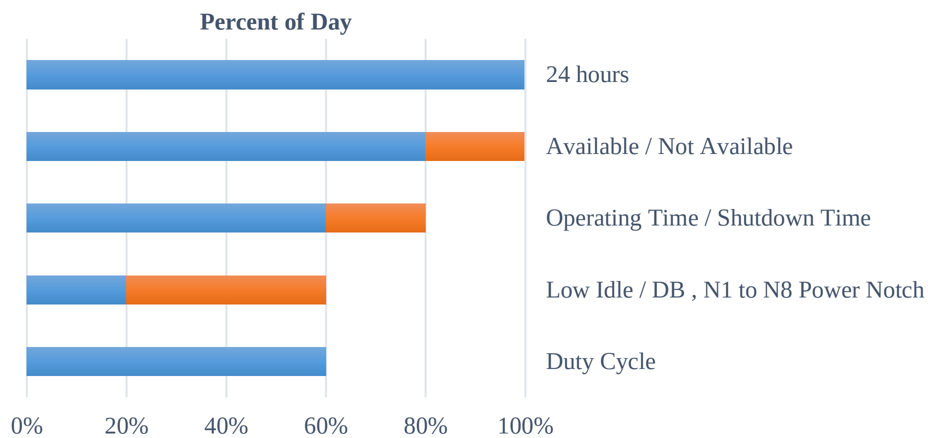
---

[2] Locomotive available time plus unavailable time equals 100 percent of time, or 24 hours.

[3] "*Duty Cycle Profile of 2007 Canadian Diesel Locomotive Fleet*", prepared for the RAC by Peter Eggleton and Robert Dunn, January, 2009, page i.

LOCOMOTIVE OPERATIONS AND UTILIZATION

Figure No. 1
Illustration of a Typical
Locomotive Daily Utilization Profile



The data used to create the locomotive utilization profile were obtained by RAC via downloads from locomotive on-board event recorders.[4] The RAC study includes locomotive utilization data from Canadian Class I freight railroads including CN.

From these data, fleet-specific duty cycles were established for several categories of service, including Class I mainline. During the study, the daily operations varied from 2.0 to 15.1 hours (8 percent to 62 percent utilization), with an average utilization of 10.2 hours per day (42 percent). When not in operation the engines are turned off.[5] This result is in line with recent independent studies. In the real world, "Class I railroads…face an operating environment where locomotive utilization rates typically fall in the 25 to 35 percent range."[6]

---

4 Locomotive event recorders are primarily used to record safety-related incidents. However, data on locomotive power notch setting on a basis of time, i.e., the duty cycle, are also recorded.

5 "*Duty Cycle Profile of 2007 Canadian Diesel Locomotive Fleet*", prepared for the RAC by Peter Eggleton and Robert Dunn, January, 2009, page 6.

6 *See*, http://argoconsulting.com/content/wp-content/uploads/2014/12/Argo_EnterpriseAssetManagement_VF-FINAL-Dec-5-2014.pdf, accessed March 8, 2017.

EXHIBIT 4

[REDACTED]

PUBLIC VERSION - REDACTED

BEFORE THE
SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER
49 U.S.C. § 24308(A) – CANADIAN NATIONAL RAILWAY COMPANY

**REBUTTAL JOINT VERIFIED STATEMENT OF
JOHN H. WILLIAMS AND JUDITH H. ROBERTS**

Table of Contents

I. Introduction and Overview ... 2

II. Summary of Our Conclusions. ... 3

A. Our Evaluation of CN's Capacity Modeling Studies. ... 3

B. Our Evaluation of CN's PRT Calculations. ... 8

III. Design Issues and Flaws in CN's Simulation Analyses Cast Substantial Doubt on the Reliability of CN's Model Results and Study Conclusions. ... 9

A. Use by the CN Modelers of CN's Proprietary RCM Model Hinders Full Evaluation of the Output. ... 9

B. CN's Failure to Model a Base Case of Current Freight and Passenger Operations Undermines the Validity of the Simulation Study Results. ... 11

C. The Design Flaw in CN's Capacity Modeling Studies Leads to Only One Possible Conclusion: The Studies Always Show A Need For More Infrastructure. ... 14

IV. The Results and Conclusions of CN's Simulation Study are Discredited by Significant Data Issues and Simplifying Assumptions. ... 20

A. CN's Conversion of Monthly Statistical Delay Targets to Daily Delay Targets Improperly Restricted Simulated Operations and Led to CN's Overstatement of Infrastructure Requirements. ... 20

B. CN's Sample Weeks Were Selected Arbitrarily. ... 30

C. Adjustments to Freight Train Traffic Data Reduced Real-World Relevancy. ... 31

D. CN's Modeling of Parallel Routes Understates Existing Capacity. ... 34

E. The RCM Model's Non-Branching Structure Calls In Question CN's Modeling of Freight and Passenger Operations Through Memphis. ... 35

V. CN's Infrastructure Proposals Lack Adequate Documentation. ... 36

A. CN's Subjective Judgments in Selecting Recommended Infrastructure Improvements Are Opaque. ... 37

B. The Estimated Costs of CN's Infrastructure Recommendations Lack Sufficient Detail. ... 40

VI. CN's Simulations for the IC Corridor Do Not Support the Locations Selected for, the Alleged Utility of, or the Stated Need for the Amtrak-Funded Infrastructure Improvements Proposed by CN. ... 41

A. New Infrastructure Locations. ... 42

1. Meets and Passes with Amtrak Trains (CN Scenario 2). ... 44

2. Meets and Passes with Other Freight Trains (CN Scenario 1). ... 48

3. Simulation Comparison (CN Scenarios 1 and 2). 50
VII. Conclusions. 54
A. Use and Need of the New Infrastructure. 54
1. Crossovers. 55
2. Double Track. 57
3. Sidings. 58
VIII. CN's GTW Corridor Infrastructure Proposals Far Outweigh the Perceived Harm to CN. 61
A. CN's Measurement of Delay Attributable to Amtrak is Small Relative to the GTW Corridor Infrastructure Investment Proposed by CN. 62
B. Need for the GTW Corridor Infrastructure Additions Proposed by CN is Not Supported by CN's Scenario 2 Simulations. 62
1. Lapeer-Imlay City. 63
2. Baron-Gord. 64
C. Need for the GTW Corridor Third Track Near Gord Proposed by CN is Not Supported by CN's Scenario 3 Simulations. 68
IX. CN's PRT Calculations Are Unreliable. 70
A. CN Used its Proprietary Train Performance Calculator. 70
B. CN's Evaluation of Amtrak PRT on the City of New Orleans and Illini Saluki Service Is Flawed. 71
1. CN Used Incorrect Amtrak Train Consists. 72
2. CN Used An Incorrect Route, Infrastructure, and Speeds Through the Memphis Area. 75
C. CN Calculated Shorter PRTs for Amtrak Services on the GTW Corridor in Prior Analyses Than the PRTs Reflected in Amtrak's Schedules. 77
D. CN's Claim About Crossovers Is Unsupported By Specific Evidence. 77
X. Summary of Conclusions. 77
A. Capacity Modeling Studies. 77
B. PRT Calculations. 80

I. **Introduction and Overview.**

My name is John H. Williams. I am President of The Woodside Consulting Group, a firm which specializes in railroad transportation consulting. I am also President of the Northwestern Pacific Railroad Co., a short line railroad in northern California, whose re-start I co-founded in 2006. I was educated at the University of Illinois, where I received a B.A. in Liberal Arts and Sciences in 1962, with a major in economics, and an M.B.A. in 1963, with finance as my area of specialization. During my fifty-plus-year career in railroading at Southern Pacific, Conrail, the Federal Railroad Administration, and as a railroad consultant and owner, my work has required me to consider most aspects of railroading, including marketing, operations, finance, economics, planning, capacity simulation modeling and public policy.[1]

My name is Judith H. Roberts. I am Vice President of The Woodside Consulting Group and also Vice President of the Northwestern Pacific Railroad Co. I graduated from Vassar College with a B.A. in Mathematics. Subsequently, I received an M.S. in Civil Engineering: Transportation and an M.S. in Operations Research, both from Stanford University. My work experience includes railroad mergers and acquisitions, economic and strategic analysis, marketing research and traffic studies, litigation support, contracts negotiation, computer programming, and numerous railroad simulation studies.[2]

Counsel for Amtrak have asked us to address Canadian National Railway Company's ("CN's") proposal that the Surface Transportation Board ("Board" or "STB") order Amtrak to pay between $377.5 million and $533.9 million for capacity improvements to CN's lines in order

---

[1] Further details of John H. Williams' background, experience and qualifications are provided in Attachment A.

[2] Judith H. Roberts' resume is provided in Attachment A.

to eliminate delay to CN freight trains allegedly attributable to Amtrak. We have been instructed to assume (strictly for the purposes of discussion) that there could be a legal basis to support CN's claim that Amtrak must pay for such improvements. In Sections III through VII of our testimony, we provide our professional opinion as to whether the operations simulation modeling undertaken by CN, as described in the Joint Verified Statement of Harald Krueger, Brian Doyle, and Nikola Rank (the "Krueger V.S."), supports CN's infrastructure improvement proposal.[3]

We were also asked by counsel for Amtrak to evaluate the reliability of the pure running time ("PRT") calculations developed by the CN modelers as described in the Krueger V.S. The inputs and assumptions used by the CN modelers to develop these PRT calculations are analyzed further in Section VIII of our testimony.

II. Summary of Our Conclusions.

A. Our Evaluation of CN's Capacity Modeling Studies.

The CN modelers were asked to answer two questions: "(1) what level of delay to CN's freight trains is attributable to Amtrak operating on CN's rail lines at specified service levels, and (2) what capacity improvements would be required to eliminate that incremental level of delay?"[4] To answer these questions, CN's modelers conducted capacity studies analyzing two corridors on CN's lines: 1) the "IC Corridor" between Chicago, IL, and New Orleans, LA, over which Amtrak operates the City of New Orleans service and (between Chicago and Carbondale, IL) the Illini/Saluki service, and 2) the "GTW Corridor" between South Bend, IN, and Port Huron, MI, over which Amtrak operates the Blue Water service between Battle Creek, MI, and

[3] Messrs. Krueger, Doyle and Rank are collectively referred to herein as the "CN modelers."
[4] Krueger V.S. at 2.

Port Huron.[5] According to CN, the goal of these capacity studies was "to quantify the effect of Amtrak on CN's freight operations and identify the infrastructure (track and signal plant) improvements required for those three Amtrak services to achieve specified on-time performance ("OTP") targets at their endpoints on CN's lines without Amtrak's trains causing net incremental delay to CN's freight traffic."[6]

The CN modelers' approach to these capacity studies first utilized CN's internal Train Performance Calculator ("TPC") to calculate the minimum run times of the trains included in the simulation, and then CN's Route Capacity Model ("RCM") to simulate 2013 corridor plant and specified traffic volumes on the IC Corridor and GTW Corridor.[7] Different simulation cases assessed impacts on infrastructure requirements of Amtrak endpoint OTP of either 80% or 85%/90%.[8] The CN modelers state that they adjusted train operations and added specific types and configurations of infrastructure within the model to meet targeted levels of Amtrak endpoint

---

[5] In addition to the Blue Water trains, CN's modelers included in their simulation of the GTW Corridor six daily trains of Amtrak's Wolverine service that operates over a 1.2-mile portion of the line between Baron and Gord, near Battle Creek, MI. *Id.* at 2 fn. 1.

[6] *Id.* at 2-3.

[7] *Id.* at 7-9.

[8] For the IC Corridor, one service goal required 80% Amtrak endpoint OTP for all Amtrak trains, while a second service goal required Amtrak endpoint OTP levels of 90% for Illini/Saluki trains and 85% for City of New Orleans trains. For the GTW Corridor, only a single service goal of 90% endpoint OTP for Blue Water trains was analyzed; an 80% endpoint OTP level was not analyzed for the GTW Corridor. The CN modelers concluded that it was "unlikely CN would have to delay its freight service significantly to meet the [80% endpoint OTP] goal" for the Blue Water service. *Id.* at 4 fn. 4. As described further below, the methodology used by CN to calculate endpoint OTP for purposes of their capacity studies differs from the methodology used by Amtrak.

OTP levels and freight delay.[9] Their recommendations for infrastructure additions are found in Exhibit 1 of the Krueger V.S.[10]

From the outset of the CN modelers' analysis, Amtrak is portrayed as a newcomer and an interloper to a freight-only railroad network. Enter Amtrak, the argument goes, and CN's smoothly functioning system gets bogged down. This is how the CN modelers define CN's track capacity "problem." Their simulation modeling is based on this premise and is designed to support CN's proposed remedy: that being for the "newcomer" to pay for extensive upgrades to CN's network. However, CN's framing of the track capacity "problem" ignores the operational reality that the daily fluctuations in CN's freight traffic levels and freight capacity needs create limitations and challenges for CN's lines that are entirely unrelated to Amtrak. As described more fully below, CN's analyses and CN's conclusions do not stand up to scrutiny and do not support CN's portrayal of the infrastructure needs of its system vis-à-vis Amtrak's passenger service operations.

There are three preliminary observations with regard to CN's capacity modeling process that are cause for concern:

- First, CN opted to use its CN-proprietary modeling software to run its simulations instead of either of the widely accepted and used Rail Traffic Controller ("RTC") or RAILSIM

[9] CN's Scenario 1 models CN freight operations on existing infrastructure assuming no Amtrak passenger service operations. CN's Scenario 2 models CN freight and Amtrak passenger services operating at specified endpoint OTP levels on existing infrastructure. CN's Scenario 3 simulates CN freight and Amtrak services performing at specified endpoint OTP levels with the addition of CN's proposed capacity improvements. *Id.* at 4.

[10] For convenience, we have included a copy of Exhibit 1 to the Krueger V.S. as Attachment B hereto. CN's cost estimates for the recommended additions in the IC Corridor total $470 million for the Amtrak 85%/90% endpoint OTP service goal and a lesser $378 million for the Amtrak 80% endpoint OTP service goal. The cost estimate for recommended additions in the GTW Corridor total $64 million for the Amtrak 90% endpoint OTP service goal. *Id.* at 45-47.

models, a decision that limits the ability of Amtrak and the Board to fully evaluate CN's analyses.

- Second, CN failed to calibrate its model with a base case based on current freight and passenger operations, thus detaching the study from reality.
- Third, CN's simulation is based on a design flaw such that, regardless of the number of freight trains and Amtrak trains or the level of infrastructure assumed, the only possible conclusion that can be reached from running the simulation is that additional infrastructure is required due to Amtrak.

Going beyond these preliminary observations, CN's modelers made several additional decisions that singularly and together cast significant doubt on the validity of their conclusions.

- Having opted for a one-week study period for each of the two subject lines (the IC Corridor and the GTW Corridor) as the basis for its modeling, CN chose to improperly convert the monthly Amtrak train delay statistical performance targets generated by another CN expert witness to daily targets. In doing so, CN grossly distorted and misapplied the statistical targets in a manner that overstates the effect of Amtrak trains on CN's freight operations.
- CN's two "sample weeks" – one for the IC Corridor and one for the GTW Corridor – were selected arbitrarily, merely because those happened to be the weeks that some of the CN modelers were in the field discussing operations with CN personnel, selections that had nothing to do with the suitability of the sample weeks for CN's analysis as representative of typical operations.

- CN made certain simplifying assumptions regarding traffic levels, freight operations, and existing line capacity – some based on the limitations of their selected model – that further detach the model from relevance to the real world.
- CN provided only the most generic of explanations regarding the reasons for choosing the location and type of proposed infrastructure improvements and no description of what, if any, alternative infrastructure improvements were considered. As one consequence, there is no way we or anyone other than CN can determine whether CN considered cost as a factor in selecting the recommended infrastructure improvements.
- In calculating the cost of the recommended infrastructure improvements, CN used aggregated unit cost estimates without source attribution, thereby undermining the reliability of CN's cost estimates.
- "Freight-on-freight" delay (freight train delays at meets and passes with other freight trains) appears to have played a greater role in CN's selection of certain locations for its proposed infrastructure improvements than alleged interference by Amtrak trains.
- Further undermining the credibility of CN's analysis, CN recommended that extensive and costly infrastructure improvements be installed even where CN's own computer simulations failed to show that such improvements would actually be used if constructed.

We do not know whether CN would spend its own money on their proposed infrastructure improvements based upon this level of analysis, but in our opinion, CN's ultimate conclusion that the Board should order Amtrak to pay between $377.5 million and $533.9 million for capacity improvements to CN's lines cannot be supported by the Krueger V.S.

B. Our Evaluation of CN's PRT Calculations.

As a preliminary step in conducting the capacity modeling studies, and in related analyses, the CN modelers utilized a proprietary TPC calculator unique to CN to simulate the pure run time ("PRT") for each Amtrak service that traverses the IC Corridor and GTW Corridor. The TPC calculator used by the CN modelers incorporates an internally-developed modification to the underlying physics equations and consequently produces PRT results that may differ from those of other train performance calculators.[11]

The PRT calculations developed by the CN modelers are dependent on the train consist sizes and other inputs to CN's TPC.[12] However, the PRT results summarized in the Krueger V.S. reflect the inclusion of faulty inputs to the TPC simulations. These inputs include incorrect Amtrak train consists, an unrealistic route through Memphis, and inaccurate train speeds, all of which serve to distort the PRT results. In addition, the CN modelers claim about the length of time required by Amtrak trains when using CN crossovers is unsupported by specific evidence.

Finally, CN workpapers demonstrate that CN calculated PRTs for Amtrak services on the GTW Corridor that are equal to or shorter than the PRTs in the Amtrak schedules for those services. The CN modelers did not mention these findings in the Krueger V.S.[13]

For the reasons summarized here and discussed further in Section VIII below, it is our opinion that the TPC simulations used by the CN modelers to generate the PRT results reflected in the Krueger V.S. are not reliable.

[11] Krueger V.S. at 7, 35. The Krueger V.S. refers to pure run time calculations derived from the TPC simulations as "minimum run time" or "MRT," rather than pure run time or PRT (which is the term for the equivalent concept used by Amtrak). *See id.* at 36.
[12] *Id.* at 12.
[13] *See generally*, Krueger V.S.

III. Design Issues and Flaws in CN's Simulation Analyses Cast Substantial Doubt on the Reliability of CN's Model Results and Study Conclusions.

A. Use by the CN Modelers of CN's Proprietary RCM Model Hinders Full Evaluation of the Output.

The computer simulations undertaken by the CN modelers in support of CN's request for Amtrak-funded infrastructure improvements utilized both CN's Train Performance Calculator and CN's Route Capacity Model.[14] The CN modelers describe RCM as "CN's primary line-simulation program," and indicate that it is used to "analyze the interaction of different infrastructure, traffic, and operational parameters."[15]

However, the CN modelers fail to mention that RCM is an internal CN simulation tool that is not widely known, utilized, or accepted elsewhere within the railroad industry (unlike certain other railroad capacity modeling tools, such as RTC).[16] The consequence of this lack of uniform acceptance is that RCM simulation inputs, methodology, and results are not readily able to be analyzed or replicated by others, including Amtrak and the Board, thus hindering full evaluation of CN's analyses and even introducing a substantial risk of bias. The CN modelers' conclusions regarding required infrastructure, which they claim to have drawn through their use of RCM, are undermined by the "black box" nature of CN's proprietary modeling tool.

Our views on this matter are supported by the overview of operations simulation and capacity modeling contained in the Transportation Research Board *2010 Guidebook for Implementing Passenger Rail Service on Shared Passenger and Freight Corridors*, Report

---

[14] The TPC is a computer program that calculates time, distance, and speed values for the train as it moves over a given track (without any other trains present) to calculate the Minimum Run Time ("MRT"). CN's modelers used the MRT and other outputs from TPC as inputs for the capacity modeling studies they performed using RCM. Krueger Deposition Transcript ("Krueger Transcript") at 90:25-93:1. It is our understanding that a copy of the Krueger Transcript is being filed separately as part of Amtrak's Rebuttal Submission.

[15] Krueger V.S. at 8.

[16] *See* Krueger Transcript at 65:12-67:15.

Number 657, by the National Cooperative Highway Research Program (the "Guidebook").[17] The Guidebook explains that effective modeling in many cases requires the use of one of two widely used rail operations simulation software packages, RTC and RAILSIM.[18] RTC, in particular, works especially well in capacity modeling involving North American freight rail operations,[19] such that "almost all the U.S. Class 1 railroads have standardized on RTC and have prepared infrastructure and operations data for entry into RTC for much of their route network."[20]

The extent to which CN's proprietary RCM simulation model has been used in contexts other than CN's own internal analyses is unclear.[21] However, from our experience, CN's RCM is not widely known in the North American railroad industry and we view the absence of any mention of CN's RCM in the Guidebook as corroboration of our own experience.

The design and scope of the CN modelers' studies suggest that the computer simulations were undertaken not merely as an internal study for CN management, but rather for the purpose

---

[17] The focus of the Guidebook is on adding service to a rail line. Even though we are not here dealing with adding service, the Guidebook's general discussion of operations simulation modeling is instructive. A copy of chapter 3 of the Guidebook was found in the workpapers of Professor Dubin, who provided a separate verified statement for CN (the "Dubin V.S."), discussed below.

[18] RTC was developed by Berkeley Simulation Software. For more information on RTC, *see* www.berkeleysimulation.com. RAILSIM was developed by rail consulting firm SYSTRA. For more on the RAILSIM simulation tool, *see* http://systraconsulting.com/railsim-x/enhancements-and-key-features/.

[19] Guidebook at 36. The Guidebook observes that RTC and RAILSIM "have been used in almost all recent passenger rail service developments where corridor operations were sufficiently complex to warrant the use of detailed modeling," and that "the firms responsible for [RTC and RAILSIM] have continually refined their products, added new features, and built a broad user base among passenger and freight railroads." *Id*. In addition, "RTC is specifically designed for application to North American freight railroads, with substantial unscheduled train movements and a range of signaling and train control methods." *Id*.

[20] *Id.* at 37. The Guidebook further states that "[t]he principal advantage of the RTC package for freight railroads is that it is specifically designed for North American freight operations and fully accounts for the characteristics of such operations. It has been adapted to user experience to make it the leader for U.S.-style freight operations." *Id.*

[21] In fact, Mr. Krueger testified during his deposition that CN has used RTC or similar commercially available models for other capacity studies it has done for third parties such as Amtrak and VIA because RCM is unable to model more than two tracks. *See* Krueger Transcript at 108:7-109:7.

of supporting CN's positions in this proceeding.[22] Yet, the CN modelers do not give specific reasons for relying on RCM in this non-internal context, despite the availability of alternative options that are more widely known.

For all of the reasons stated above, it is our opinion that CN's selection and use of its own proprietary RCM simulation modeling tool to support its request for a Board order to require Amtrak to fund substantial capacity improvements on CN lines not only are open to question, but also hinder full evaluation by Amtrak and the Board and even, because of the black box nature of the analytical process, introduce a substantial risk of bias.

B. CN's Failure to Model a Base Case of Current Freight and Passenger Operations Undermines the Validity of the Simulation Study Results.

As noted above, the CN modelers were asked to determine what level of delay to CN's freight trains is attributable to Amtrak and they purported to do so without a base case model run of current freight and Amtrak operations. In our opinion, it is not possible to accurately model freight delays attributable to Amtrak without a base case of current freight and passenger operations against which they could verify and calibrate model results. Absent such a verifiable, real world base case, CN has provided no basis for others, including the Board and Amtrak, to accept or rely upon conclusions based on the study results.

In our experience, the first step in carrying out any capacity modeling analysis is to create a base case representing current traffic operating over the existing physical railroad network. One of the primary purposes of a base case is to permit verification and calibration of the model results to those of the real world, to demonstrate clearly that the initial assumptions and inputs to the model are accurate and realistic and that the simulation analysis is beginning on a solid,

[22] Mr. Krueger confirmed that the capacity modeling reflected in the Krueger V.S. was performed for the specific purpose of this proceeding. *See id.* at 91:4-7; 122:20-123:10.

realistic foundation. In other words, to determine whether the model simulates current infrastructure and traffic, the model's results should closely resemble what happens in the real world.[23] This is a necessary step to ensure that there is an adequate basis for confidently measuring and judging the impacts of proposed changes. This methodology is endorsed by the NCHRP Guidebook, which states that following any required preliminary TPC-only analysis of selected trains, modeling should proceed to: "Analyses of present-day freight and passenger (if any) operations on the corridor to check that the analysis adequately represents the real world and also to establish a baseline for the current performance of trains using the corridor."[24]

A contrasting, non-real world approach to simulation modeling is evident in the following description by CN's modelers of the structure of their simulation model study in this proceeding:

"In order to isolate the effect of Amtrak on CN's freight trains, we constructed a model to assess the following three scenarios:

- Scenario 1: CN freight, without Amtrak, operating on existing infrastructure
- Scenario 2: CN freight, with Amtrak performing at 80% endpoint OTP (Scenario 2A) or 85/90% endpoint OTP (Scenario 2B), operating on existing infrastructure

[23] For example, in a time-distance graph of the model results, the movements of individual trains over the network, as well as times and locations of meets and passes with other trains, should be comparable to real-world operations of those same trains.

[24] Guidebook at 39 (emphasis added). [redacted]; *see also* "Parametric Modeling in Rail Capacity Planning" by Harold Krueger, Proceedings of the 1999 Winter Simulation Conference at 1199 (highlighting the "importance of ensuring the parameters reflect the real world").

- Scenario 3: CN freight with Amtrak performing at 80% endpoint OTP (Scenario 3A) or 85/90% endpoint OTP (Scenario 3B) and additional infrastructure to reduce net incremental freight delay caused by Amtrak to near zero."[25]

According to the CN modelers, "Scenario 1 was used to estimate the baseline amount of delay experienced by CN's freight traffic in the target corridor in the absence of Amtrak's passenger trains."[26] This statement indicates that CN intended that Scenario 1 be viewed and accepted as a base case for their study.

Clearly, however, the CN modelers failed to establish a realistic baseline for the current performance of trains using the corridor. Since both the IC Corridor Scenario 1 and the GTW Corridor Scenario 1 exclude Amtrak trains that currently operate on the modeled routes, they are not representative of present or past operations on either corridor.[27] Instead, in each instance, the CN modelers created an artificial "base case" in which only freight trains operated on the studied corridors.[28] Because of this, as well as the extensive alterations to freight trains in their selected traffic base (as discussed further herein), CN's model cannot be verified with a "reality check" to ensure that the traffic and infrastructure in the model would perform much the way they do in the real world. A fabricated reality such as that created in Scenario 1 provides no firm basis for

---

[25] Krueger V.S. at 4. For the 85%/90% OTP simulation, CN appears to use the terms "Scenario 3" and "Scenario 3B" interchangeably. We also use the terms interchangeably here.

[26] *Id.* at 4.

[27] In describing during his deposition a prior CN study involving proposed Amtrak trains, Mr. Krueger indicated that the base case for the prior study included current freight, Amtrak, and VIA trains operating over the relevant CN segment, demonstrating that in other situations CN has recognized that a base case should include existing freight and passenger service. *See* Krueger Transcript at 104:22-112:15.

[28] The CN modelers also elected not to include any Metra commuter rail trains in their simulation studies. *Id.* at 261:7-15. Although Metra does not share tracks with Amtrak on the CN portion of the City of New Orleans route, it is the predominant user of the Amtrak tracks between Chicago Union Station and Clark Street. This Amtrak-only portion of the City of New Orleans route was included in CN's capacity modeling study without accounting for the Metra trains.

subsequent analysis and no assurance that the model results are a reliable representation of actual real world conditions.[29]

C. The Design Flaw in CN's Capacity Modeling Studies Leads to Only One Possible Conclusion: The Studies Always Show A Need For More Infrastructure.

As described above, CN modeled three operations simulation scenarios "[i]n order to isolate the effect of Amtrak on CN's freight trains."[30]

CN's simulation is founded on a built-in design flaw that derives from its faulty base case: that is, regardless of the traffic and infrastructure on the line, CN's model will always lead to the conclusion that additional infrastructure is necessary to mitigate what CN asserts is the "incremental delay" that is "attributable to Amtrak." Put another way, CN's study is designed such that it is impossible to conclude that no infrastructure is needed. This is because the level of delay in Scenario 2, which includes Amtrak trains, will always be greater than in Scenario 1, which excludes Amtrak trains and thus has fewer trains than Scenario 2. By starting with a freight-only railroad assumption (in Scenario 1), CN's model incorporates within it the conclusion that additional infrastructure (for which Amtrak is presumed to bear full responsibility) is necessitated by Amtrak's operations on CN's network.

The effect of this design flaw becomes apparent if we consider how CN's simulation results would be affected by applying CN's methodology to different infrastructure and traffic volume assumptions. To do so, we examine some alternatives to the 2013 infrastructure and traffic volume assumptions that the CN modelers incorporated into their simulations.

---

[29] Scenario 2 includes freight and passenger traffic, but it cannot be considered a base case (nor did CN treat it as such) because it does not show Amtrak trains operating at current on-time performance levels. Instead, it was designed by the CN modelers to show Amtrak operating at specified endpoint OTP levels which do not reflect historical performance.
[30] Krueger V.S. at 4.

For example, assume an analysis in which the infrastructure network and the Amtrak trains to be modeled were exactly the same as those modeled by CN's modelers, but that the number of CN freight trains on the network was half the actual 2013 volume. In accordance with the CN modelers' study procedure, the first step, which we'll refer to as Scenario FH-1 (for the "Freight Halved" alternative), would have simulated the 2013 network with the reduced volume of CN freight trains, but no Amtrak trains. According to CN's simulation theory, this would have established a base level of freight train delay in the absence of Amtrak operations.

The second step, which we'll refer to as Scenario FH-2, would have added Amtrak trains into the mix on the same 2013 infrastructure network. Due to the increase in the overall volume of trains in Scenario FH-2 as compared with Scenario FH-1 – and whether or not Scenario FH-2 was further constrained by an increased Amtrak "service standard" (*e.g.*, 85%/90% Amtrak endpoint OTP) – the recorded delay to freight trains would almost certainly have been greater in Scenario FH-2 than in Scenario FH-1. The reason for the larger freight train delay is that the increase in the number of trains on the network in Scenario FH-2, as contrasted with Scenario FH-1, would also result in an increase in the number of meets and passes between pairs of trains on the network.[31] The larger freight train delay in Scenario FH-2 would have led to the conclusion in the capacity modeling study that additional infrastructure was needed in a Scenario FH-3 in order to bring the level of freight train delay down to the level of freight train delay in Scenario FH-1.

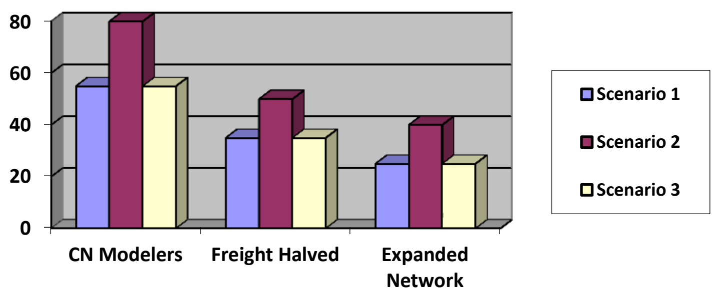
[31] The level of overall freight train delay in Scenario FH-1 would probably be lower than in the CN modelers' Scenario 1, due to the reduced freight train volumes and the relatively fewer meets and passes between freight trains in Scenario FH-1. Likewise, freight train delay in Scenario FH-2 would probably be lower than in the CN modelers' Scenario 2. However, just as freight train delay in the CN modelers' Scenario 2 was higher than in their Scenario 1, we would also expect freight delay in a Scenario FH-2 to be higher than in Scenario FH-1.

Alternatively, assume for the moment that the expanded infrastructure on the IC Corridor that CN is asking Amtrak to pay for had already been in place in 2013 and had served as the basis for CN's simulation analysis. Also assume that the volume of both freight and Amtrak trains was unchanged from the 2013 volumes in the CN modelers' analysis. We will refer to this as Scenario EN-1 (for the "Expanded Network" alternative). In accordance with the CN modelers' theory and methodology, "Scenario EN-1" would have simulated the operation of CN freight trains, but no Amtrak trains, on the "expanded 2013" network in order to establish a base level of freight train delay in the absence of Amtrak operations. "Scenario EN-2" would have added Amtrak trains along with the 2013 freight trains on the same expanded 2013 network. Because of the increase in the overall volume of trains and the resulting increase in the number of meets and passes in Scenario EN-2 as compared with Scenario EN-1 -- and whether or not Scenario EN-2 was further constrained by an increased Amtrak service standard -- the recorded delay to freight trains would have been greater in Scenario EN-2 than in Scenario EN-1.[32] This would have led to the conclusion that additional infrastructure was needed in a Scenario EN-3 in order to bring the level of freight train delay down to the level of freight train delay in Scenario EN-1. Thus, with no difference in freight and Amtrak volumes, the level of freight train delay in Scenario EN-2 would lead to the conclusion in the capacity modeling study that the very same level of infrastructure now being proposed by the CN modelers as Scenario 3 was not adequate.

Figure 1 below illustrates the previous discussion of relative freight train delay under three different sets of network and train volume assumptions:

[32] Due to the increased level of double track and sidings assumed from the infrastructure additions, along with no change in train volumes, the level of freight train delay in Scenario E-1 would probably be lower than in the CN modelers' Scenario 1. Likewise, freight train delay in Scenario E-2 would probably be lower than in the CN modelers' Scenario 2. However, just as freight train delay in the CN modelers' Scenario 2 was higher than in their Scenario 1, we would also expect freight delay in Scenario E-2 to be higher than in Scenario E-1.

Figure 1
Illustrative Example of Relative Minutes of Freight Train Delay



Each set of three bars shown represents one of the three alternative sets of assumptions discussed above:

1) CN Modelers (Scenarios 1, 2, and 3): The CN modelers' simulation, as described in the Krueger V.S.;

2) Freight Halved (Scenarios FH-1, FH-2, and FH-3): Starting with the existing network[33] (in Scenario FH-1) and simulating half of the 2013 freight train volume plus actual Amtrak train volume;

3) Expanded Network (Scenarios EN-1, EN-2, and EN-3): Starting with an expanded network[34] (in Scenario EN-1) and simulating actual 2013 freight and Amtrak train volumes.

In the CN modelers' simulations, the level of freight train delay in Scenario 2 is greater than in Scenario 1, while the level of freight delay in Scenario 3 has been purposely lowered to the same level as that of Scenario 1 through selective additions by the CN modelers of network infrastructure.[35]

In the "Freight Halved" simulations, although the level of freight delay in Scenario FH-1 is less than that of the CN modelers' Scenario 1 (due to the lower volume of freight trains in

[33] This is assumed to be the same network as the CN modelers' Scenario 1 network.
[34] This is assumed to be the same network as the CN modelers' Scenario 3 network.
[35] The minutes of freight train delay shown on the vertical axis are included here for illustrative purposes only and do not represent actual values.

Scenario FH-1), the freight train delay in Scenario FH-2 is higher than in Scenario FH-1. Following infrastructure additions, the freight delay in Scenario FH-3 has been brought down to the level of Scenario H-1.

Also note that, although "Expanded Network" Scenario EN-1 has the same expanded infrastructure as the CN's modelers' Scenario 3, the lower train volumes (due to the absence of Amtrak trains) in Scenario EN-1 results in lower freight train delay in Scenario EN-1 than in the CN modelers' Scenario 3. However, the higher freight train delay in Scenario EN-2 relative to that of Scenario EN-1 triggers the requirement for additional infrastructure in Scenario EN-3 in order to bring the level of freight train delay back down to that of Scenario EN-1.

As two further examples, suppose that the CN modelers had run a simulation of the IC Corridor network and traffic volumes that were in place in the 1980's, just before the IC's management elected to remove large segments of double track.[36] For reasons similar to the prior examples, running the equivalent of CN's Scenarios 1 and 2 (without and with Amtrak trains, respectively) on that largely double track network would again have indicated a "need" for additional network capacity – a conclusion that was clearly opposite to the one reached by the railroad's management at that time. Alternatively, suppose that the CN modelers' simulation theory and methodology had been applied instead immediately following the removal of large segments of double track by IC's management. As with the previous examples, such a simulation would surely have demonstrated a need for reinstating portions of infrastructure that

[36] See "IC's Single-Minded Maintenance Strategy," *Railway Track & Structures*, April 1993. In fact, CN's infrastructure request in this proceeding would require Amtrak to pay for the re-installation of significant portions of the double-track that the IC removed between 1989 and 1991. [redacted]

had just been removed. It is unlikely that IC's management would have implemented such a finding at the time.

A further effect of CN's design flaw on its simulations becomes apparent if the study process described in the Krueger V.S. is repeated, as follows: Assume that the extensive Scenario 3 infrastructure additions recently modeled and proposed by CN (in simulations that we will refer to as "Phase I") were to be constructed. Then suppose CN were to undertake exactly the same modeling exercise, but with the higher level of infrastructure (a new, "Phase II" run of Scenario 1). This would establish a new "base" level of freight delay in the absence of Amtrak trains. Taking the next step, adding back the unchanged Amtrak operations (a new, Phase II run of Scenario 2) would, because there are more trains in Scenario 2 than in Scenario 1 (and thus more meets and passes), result in some increased measure of freight delay in the model. As described in the preceding paragraphs, the differential in freight delay between Scenarios 2 and 1 will occur regardless of the level of infrastructure in place at that time. Having observed the greater level of delay in Scenario 2 vs. Scenario 1, CN could then determine a set of infrastructure improvements that would reduce net incremental freight delay in a new, Phase II run of Scenario 3.

Assuming construction of that additional Phase II infrastructure, even with no change in Amtrak operations and whether or not there is growth in freight traffic[37], the process could go on and on. CN's study design effectively establishes a potential infinite loop of delay allegedly attributable to Amtrak, the logical consequence of which would seem to assure that Amtrak pay for infrastructure – indefinitely. Regardless of whether or not CN chooses to rerun the model in

[37] Growth in freight traffic would result in an even larger impact on freight delay and thus on perceived need for additional infrastructure.

this fashion in the future, the "infinite loop" potential inherent within CN's study design is a further demonstration of its weaknesses.

The examples above illustrate the sizable flaw in CN's study design. As such, CN's study provides no support for their claims that Amtrak creates the need for and, therefore, should pay for, added infrastructure on the CN network.

IV. <u>The Results and Conclusions of CN's Simulation Study are Discredited by Significant Data Issues and Simplifying Assumptions.</u>

Every model makes simplifying assumptions. But in our opinion, in the context of the CN modelers' failure to calibrate using an appropriate base case, the selection of a non-representative study period, and the assumptions the CN modelers made about delay targets, freight traffic, freight operations and line capacity further compromise the integrity of their model and undermine the validity of their results. As we explain in this section, the CN modelers' simplifying assumptions further detach the model from relevance to the real world.

A. CN's Conversion of Monthly Statistical Delay Targets to Daily Delay Targets Improperly Restricted Simulated Operations and Led to CN's Overstatement of Infrastructure Requirements.

In an effort to lend statistical legitimacy to the "Amtrak service quality"[38] component of their analysis, the CN modelers sought to incorporate statistical delay targets developed by another CN witness, Professor Jeffrey Dubin. However, in doing so, they grossly distorted and misapplied those targets. As described and demonstrated more fully below, the conversion by the CN modelers of Professor Dubin's monthly statistical delay targets to the daily delay targets used in their own simulation studies distorted CN's modeling results, with the consequence being that:

[38] CN lays out two measures of Amtrak service quality included in the modeling: the first assumed a monthly average endpoint OTP of 80%, while the second assumed a monthly average endpoint OTP of 90% for corridor trains and 85% for long-distance trains. *See* Krueger V.S at 3.

- CN's Scenario 2 overstates the delay to CN's freight operations allegedly attributable to Amtrak running at certain specified endpoint OTP levels; and
- CN's Scenario 3 overstates the infrastructure requirements that CN claims are necessary to meet the modeled Amtrak endpoint OTP levels without increasing freight train delays.

As noted earlier, CN's Scenario 2 models CN freight operations together with Amtrak passenger operations on CN's existing infrastructure (at the time of the modeling exercise), with Amtrak operating at specified endpoint OTP levels. Before being able to "reduce net incremental freight delay caused by Amtrak to near zero" by adding infrastructure[39] – the modeling generated in CN's Scenario 3 simulation – CN had to quantify the delay to its freight trains allegedly caused by Amtrak operating at those specified endpoint OTP levels.[40] To generate these measurements of freight train delay, the CN modelers were provided with statistically-derived estimates of the average monthly number of delay minutes Amtrak trains could experience before Amtrak OTP would fall below such specified OTP levels.[41] These monthly average estimates, referred to as "statistical delay targets," were developed by Professor Dubin.[42]

Since the CN modelers started with Professor Dubin's monthly delay targets, we will summarize Professor Dubin's approach. Professor Dubin states in his Verified Statement that he "was asked by CN to generate inputs for use in CN's line capacity modelling for the six Amtrak trains that operate on CN's rail lines between Chicago, IL and New Orleans, LA, and the two

---

[39] *Id*. at 4.
[40] *Id.* at 3.
[41] *Id.*; *see also* Verified Statement of Jeffrey A. Dubin ("Dubin V.S.") at 6-7.
[42] Professor Dubin calculates these endpoint OTP service target levels by aggregating historical minutes of delay to each Amtrak train from all sources and comparing those aggregated delay minutes to the total time (including PRT and recovery time) available in Amtrak's schedule for that train. *Id.* at 5-7. In cases where a sufficient level of delay occurs in a later segment of the route following unused recovery time from earlier segments, this aggregation method will result in counting those trains as "on-time" at the endpoint even though they would be considered late under Amtrak's methodology for calculating endpoint OTP. It is our understanding that this flaw in Professor Dubin's calculation of endpoint OTP is described further in the Rebuttal Verified Statement of Benjamin Sacks.

Amtrak trains that operate over CN's lines between Battle Creek, MI and Port Huron, MI."[43] He was asked to estimate for each of the eight trains the statistical relationship between total minutes of delay to the Amtrak train due to the combination of passenger and freight train interference, on the one hand, and the train's specified endpoint on-time performance levels, on the other. As he describes it, the results of his analysis provided the modelers with an estimate of the total number of delay minutes per month due to freight and passenger train interference the Amtrak trains could experience before they would be expected to exceed the specified endpoint OTP levels, thereby allowing the modelers to determine whether the output of their simulations produced results consistent with the specified Amtrak endpoint OTP levels.[44]

Professor Dubin began his analysis with daily delay data (separate for each train number: 58, 59, *etc*.).[45] He then aggregated the daily data for each train number on a monthly basis, stating that "this decision was driven by the fact that CN's Operating Agreement with Amtrak measures performance based on monthly results and the fact that monthly data (unlike the data if aggregated quarterly) provide a sufficient number of data points for the analysis to produce robust results."[46] As the principal product of his regression analysis, Professor Dubin produced a table (Dubin V.S., p. 17, Table 2, "Dubin Regression Models") that purports to show, in average minutes per month for each train number, the predicted number of delay minutes due to passenger and freight train interference to meet the selected Amtrak endpoint OTP levels.[47]

---

[43] Dubin V.S. at 2.
[44] *Id*. at 3.
[45] *Id.*
[46] *Id.* at 6-7.
[47] The estimated passenger and freight train delay minutes ("PTI_FTI") are shown by target endpoint OTP levels (80% and either 85% or 90%) for each train number, at the 95% confidence interval. For example, at the 85% target endpoint OTP level for train #58 (northbound City of New Orleans train), the predicted PTI_FTI is 1154.20 average minutes per month, with lower and upper bounds of the 95% confidence interval at 912.84 and 1359.61 minutes per month, respectively. *Id.* at 17, Table 2.

The CN modelers state that, while freight patterns vary throughout the year, "modeling an entire year's worth of operations would be prohibitively burdensome."[48] Therefore, they reasoned, modelers must choose an "adequately representative period" of traffic to model.[49] The CN modelers claim to have used the results of Professor Dubin's statistical analyses "to set the 'target' minutes of delay that a given Amtrak train could experience over the course of the model run."[50] Given the monthly statistical delay targets produced by Professor Dubin, the CN modelers could have elected to model train operations over a corresponding one month period.

Instead, for reasons of their own, the CN modelers chose to model only a single week of operations.[51] In an attempt to reconcile the selection of a one-week study period with Professor Dubin's monthly delay targets, the CN modelers opted for a crude fix, dividing the monthly delay targets by 30.4 days per month in order to create estimated average daily delay targets.[52] And while this simple division may appear logical, that computation actually so distorts the statistical test as to render it meaningless. As we demonstrate below, it is harder, from a railroad

---

[48] Krueger V.S. at 22.
[49] *Id.*
[50] *Id.* at 41.
[51] The CN modelers stated, "We have found that use of a week's worth of traffic as a base, including operational variability of train times and consists, is sufficiently representative for our modeling purposes here, and we proceeded on that basis. A week of traffic is also consistent with CN's train service plans and the RCM model's traffic input requirements, both of which are based on a seven day period." *Id.* at 22. The latter point suggests that modeling a one-month period might be difficult with the RCM Model. If so, this would be yet another reason that use of the RTC Model or RAILSIM would have been more appropriate.
[52] The CN modelers used the results of Professor Dubin's monthly analysis "to set the 'target' minutes of delay that a given Amtrak train could experience over the course of the model run." *Id.* at 41-42, Tables 14 and 15. The target minutes in Tables 14 and 15 were derived by simply dividing the number of minutes per month in Professor Dubin's testimony by 30.4, the average number of days per month, to create the CN modelers' version of a daily target. For example, at the Amtrak 85% target endpoint OTP, Professor Dubin's Table 2 shows 1154.20 average minutes per month for Train #58. Dubin V.S. at 17, Table 2. Dividing that midpoint of Professor Dubin's 95% confidence interval by 30.4 average days per month produces the resulting 37.95 delay minutes per day shown in the CN modelers' Table 15 for Train #58 for the Amtrak 85% endpoint OTP simulation. Krueger V.S. at 42, Table 15.

operations standpoint and from a railroad simulation standpoint, to meet a daily delay target derived as a daily average of a monthly target than to meet the monthly delay target itself.

Moreover, the CN modelers' self-created daily targets erased the recognition of statistical variance contained in the monthly statistics. Professor Dubin supplied monthly statistical delay targets defined as the midpoint in a range set at a probability of 95 percent.[53] Accordingly, these monthly delay targets recognized a statistical possibility of variance.[54] In contrast, the CN modelers treated their daily delay targets as upper bounds on delay minutes, thereby erasing an accounting for statistical variance.[55]

Taken together, these two alterations to the monthly delay targets resulted in lower, more restrictive delay limits for each of the specified endpoint OTP levels. The consequence of these more restrictive delay limits is that CN's Scenario 3 overstates the infrastructure requirements that CN claims are necessary to meet the modeled Amtrak endpoint OTP levels without increasing freight train delays.

Further, it should be noted that the modifications proposed by Amtrak to the CN-Amtrak Operating Agreement would measure delay by Amtrak service,[56] not by train number. Thus, for example, monthly performance for trains #58 and #59 would be aggregated for the City of New Orleans service. In contrast, the modeling approach selected by CN's modelers measures delay minutes separately for each Amtrak train number.[57] This additional requirement further constricts the permitted variability within the data and is likely to have resulted in an additional

---

[53] Dubin V.S. at 15-17.
[54] *Id.*
[55] *See* Krueger V.S. at 40-41.
[56] The Amtrak services simulated by the CN modelers include City of New Orleans and Illini/Saluki services, on the IC Corridor, and Blue Water and (to a limited degree) Wolverine services, on the GTW Corridor.
[57] *See Id.* at 41-42, Tables 14 and 15.

overstatement of the freight delay and the resulting infrastructure "required" to mitigate that delay.

To demonstrate the distortive effect of CN's statistical sleight of hand, consider a hypothetical one month (30-day) period in which the aggregate delay for a given Amtrak train ("Amtrak train AT1") with daily operations during that period is 600 minutes. Table A below presents three of many different possible distributions for Amtrak train AT1 of 600 delay minutes across a 30-day period.

Table A:
Example of Daily Delay Minutes
Within Three Alternative 30-Day Delay Distributions

	Amtrak Train AT1 Delay Minutes Per Day		
Day	Alternative A	Alternative B	Alternative C
1	20	10	0
2	20	10	0
3	20	10	0
4	20	10	0
5	20	10	0
6	20	10	0
7	20	10	0
8	20	10	0
9	20	10	0
10	20	10	0
11	20	10	0
12	20	10	0
13	20	10	0
14	20	10	0
15	20	10	0
16	20	30	0
17	20	30	0
18	20	30	0
19	20	30	0
20	20	30	0
21	20	30	0
22	20	30	0
23	20	30	0
24	20	30	0
25	20	30	0
26	20	30	0
27	20	30	0
28	20	30	0

29	20	30	0
30	20	30	600
Total Delay	600	600	600
Average Daily Delay	20	20	20

As shown in Table A, Alternatives A, B, and C each have the same 600 minutes of total delay over the 30-day period and the same 20-minute average daily delay. If a monthly delay target for Amtrak train AT1 had been established by Professor Dubin at 630 minutes, Alternatives A, B, and C would all meet that monthly target. However, a daily target of 21 Amtrak delay minutes calculated using CN's methodology[58] generates varying results for the three different alternatives, as follows:

- Only Alternative A would also meet a daily delay target of 21 minutes on each of the 30 days.
- Alternative B, with 15 days of 10-minute delays and 15 days of 30-minute delays, would fail to meet a daily delay target of 21 minutes on Days 16-30 – half of the 30-day period, and thus would fail the daily delay target test.
- Alternative C is a more extreme distribution, with 29 days of no delay and one day of 600 minutes of delay. Alternative C would fail to meet a daily delay target on Day 30, and thus would fail the daily delay target test.

As explained above, the CN modelers used their daily delay targets to limit delays to Amtrak trains within Scenario 2 (freight and Amtrak with no change from existing infrastructure) and Scenario 3 (freight and Amtrak with selectively added infrastructure to reduce freight delay to Scenario 1 levels). The consequence of applying this approach to Alternatives A, B, and C

[58] As described earlier, the CN modelers calculated their daily delay targets by dividing Professor Dubin's monthly targets by 30.4. Solely for purposes of clarity in this example, we have made a slight modification to that formula; the "daily target" in Table A was calculated by dividing the monthly target by 30.

above is that, for either Alternative B or Alternative C, the delays to Amtrak train AT1 that exceeded 21 minutes would signal to the CN modelers that further modeler intervention would be required to meet the Amtrak daily delay target.

The examples in Table A clearly illustrate the fallacy in the CN modelers' substitution of their daily delay targets for the monthly Amtrak delay targets calculated by Professor Dubin. If the two standards were statistically equivalent, the CN modelers' daily targets would produce the same results as the monthly targets. However, when applied to the delay data in Alternatives B and C in Table A, the daily and monthly targets produce different outcomes: Alternatives B and C "pass" the monthly target test, but "fail" the daily target test. Table A clearly demonstrates that the CN modelers' daily target is not equivalent to the monthly target from which it was derived and is, in fact, more restrictive.

For their own simulation analyses, the CN modelers chose not to use a 30-day study period, but instead limited their study period to seven days.[59] They used as their delay targets daily averages of Professor Dubin's monthly Amtrak delay minutes targets[60], even though the daily delay targets they devised are no more valid for a seven-day period than for the hypothetical thirty-day period discussed above. Below we describe what implications their use of flawed Amtrak delay targets had for their measurement of freight delay over the 7-day study period and their recommendations for added infrastructure.

Table B below provides a theoretical example of results for Amtrak train AT2 over a seven-day study period.

[59] *See Id.* at 22.
[60] *Id.* at 41.

Table B
Example of Delay Minutes for 7-Day Study Period

	Amtrak Delay Minutes Per Day
Day	Amtrak Train AT2
1	10
2	10
3	10
4	20
5	30
6	30
7	30
Total Delay	140
Average Daily Delay	20

Assuming the same daily delay target of 21 minutes as in the Table A example (calculated according to the CN modelers' methodology as a daily average of a monthly target), the Amtrak train AT2 simulation data shown in Table B would fail the daily delay target test on Days 5 through 7. This failure would signal that operational adjustments to trains within the model run were needed to force the Amtrak train AT2 delay minutes for each day within the 7-day period to be at or below 21 minutes.[61]

Despite the CN modelers' self-described capability to tweak meets and passes within the Scenario 2 and Scenario 3 simulations to reduce delays to Amtrak trains,[62] meeting daily delay targets for a single Amtrak train on each consecutive day of the 7-day simulation period might take some effort, as tweaks to a train at one time and location may have unintended consequences elsewhere within the simulation. This balancing act is further complicated when applied simultaneously to meeting delay targets for multiple Amtrak trains within the same simulation run. The more restrictive the constraints on delays to Amtrak trains (resulting from

[61] *See id.* at 41 (indicating that "[a]s we ran the model, we kept a running tab of the number of minutes of delay each train experienced, and we adjusted some meets and overtakes in order to have an end result that closely matched the target.")
[62] *See id.*

the imposition of daily, rather than monthly, delay targets, for example), the more adjustments of train meets and passes would be required to meet those constraints The implications for freight train delay and infrastructure requirements are discussed below.

Of course, CN's ultimate objectives for its simulation analyses at a specified Amtrak service quality level were to quantify the relative freight train delay in Scenario 2, as contrasted with Scenario 1, and then to translate that relative Scenario 2 incremental freight train delay into requirements for additional infrastructure in Scenario 3. Operational adjustments made in Scenario 2 to reduce delays to Amtrak trains would have the effect of increasing delays to non-Amtrak (i.e., freight) trains. This is because adjustments of meets and passes within the model to reduce delay to specific Amtrak trains would, in most cases, cause increased delay not to other Amtrak trains, which would be subject to their own modeler-imposed daily delay targets, but to freight trains forced into sidings or slowed in other ways. This greater freight train delay in Scenario 2 relative to Scenario 1 would generate a demand for additional infrastructure in Scenario 3 in order to reduce Scenario 3 freight train delay to Scenario 1 levels.

As a consequence of the use by the CN modelers of their own daily delay targets instead of the monthly delay targets provided to them, the level of freight delay in Scenario 2 (relative to Scenario 1) that is required to be mitigated with the addition of infrastructure in Scenario 3 is amplified. (CN's Scenario 3 simulation, which begins with and grows from the Scenario 2 simulation, experiences similar effects from the daily cap on Amtrak delay.) In sum, the standard used by the CN modelers to assess delay to Amtrak trains impacts the operational adjustments necessary to eliminate such delay, which affects both the measure of freight train delay and the level of new infrastructure required to ameliorate that freight train delay in the model. Use by CN's modelers of their own imposed daily delay targets, rather than Professor

Dubin's monthly delay targets, has inflated the measured freight delay within the model and led to a greater purported demand for infrastructure improvements.

B. CN's Sample Weeks Were Selected Arbitrarily.

Having determined that no single week of traffic in 2013 (the latest complete year of available train history data) "precisely matched 2013 average train volumes,"[63] the CN modelers chose their two "sample" weeks – one for the IC Corridor and one for the GTW corridor – in an arbitrary manner.[64] The CN modelers selected the one week period commencing on April 29, 2013 for the IC Corridor and the one week period commencing on October 21, 2013 for the GTW Corridor because those happened to be the respective weeks that some of the CN modelers[65] were in the field discussing operations on each corridor with CN local and regional operating departments – an event that has nothing to do with the suitability of the selected weeks for CN's analysis.

In fact, we were informed by Amtrak that, during the sample week the CN modelers modeled for the GTW Corridor, Amtrak trains operated on a modified schedule due to scheduled maintenance activities that were being conducted by other host railroads that impacted the same Amtrak trains. This makes the selected week unrepresentative of the 52-week year. In our opinion, the reliance on arbitrarily selected weeks unrepresentative of the studied year discredits CN's RCM simulations, which are the basis for CN's infrastructure recommendations.

---

63 *Id.* at 24.
64 *See Id.*
65 Mr. Krueger testified that he himself did not conduct the field visits, but relied on the consultants from Iron Road (Messrs. Doyle and Rank) to perform that part of the project. Krueger Transcript at 122:23-124:23. [redacted]

C. Adjustments to Freight Train Traffic Data Reduced Real-World Relevancy.

The CN modelers resorted to using system averages and plan targets in lieu of actual train data for each selected week. Conceptually, the CN modelers initially rejected the creation of "an artificial idealized traffic package based solely on annual averages" which they said "likely would be unrepresentative of an actual week."[66] Although the CN modelers claim to have "sought to increase the accuracy and realism" of their "traffic package," by basing it on the characteristics of the specific trains that ran during an actual week in 2013, the traffic for that week was then adjusted, according to the CN modelers, "with minor additions or subtractions to the trains as necessary to match the average weekly volumes of the sample week train types with the average 2013 volumes on the corridor."[67] After making some adjustments to train counts, the CN modelers made further adjustments by removing "unusual" moves and adding or subtracting trains of various types to match the 2013 average.[68] [redacted]

---

[66] Krueger V.S. at 22.

[67] *Id.* at 22-23.

[68] The CN modelers state as follows: "Second, we reviewed the data for anomalies or exceptions and made minor adjustments to "clean" the raw data. Unusual moves or moves not reflective of typical main line corridor operations were removed, added, or adjusted in the count. For example, if a train took a different routing on a particular day that deviated from its normal service plan, we assumed instead that it ran according to plan on that day. Likewise, if a daily train terminated early on one of its runs during the week, we assumed the train operated according to its full service plan. It was found that Amtrak volumes, in particular on the GTW Corridor, were lower during the sample week than the regular scheduled service; this was likely due to cancellations caused by construction, missed reporting, or other unknown reasons. For simulation purposes, we assumed all Amtrak trains operated pursuant to their schedule…Once we had clean data for the sample week, we added or subtracted trains in order to more closely match the 2013 Average. Decisions regarding which trains should be added or removed were based on an analysis of the traffic volumes by train type." *Id.* at 25-26.

[redacted]

The effect of these adjustments and manipulations was to alter the sample week traffic to render it even less representative of real world actual operations. Thus, despite the CN modelers' explicit rejection of "an artificial idealized traffic package based solely on annual averages"[70], their 11-page description of adjustments to the "Sample Week" data shows that this is exactly what their lengthy adjustment process produced.[71]

According to the CN modelers, when this "average trains" approach called for subtracting or adding trains, certain trains were removed "at random" and random start times were assigned to added trains.[72] The added trains were introduced in Scenario 1, in which only freight trains operated, so there could have been no interference in Scenario 1 between the added trains and Amtrak trains. But there appears to have been no attempt to verify that the randomly assigned start times for the added trains would not cause interference in Scenarios 2 and 3 with Amtrak trains known by the modelers to be operating on the two routes in 2013. The CN modelers seem to have ignored whether, in the real world, the operating times of these added trains would be planned in part based on when Amtrak and other trains are scheduled to run.[73]

---

[70] Krueger V.S. at 22.
[71] *Id.* at 22-33.
[72] The CN modelers state as follows: "Any new train added to the simulation traffic package was randomly assigned a start time from 00:00 to 24:00, consistent with the principle that bulk and other trains do not have consistent start times, and could operate over the corridor at any time." *Id.* at 32. The new trains added to the simulation traffic package for the IC Corridor were one Q-type intermodal train, eight G-type grain trains, and two C-type coal trains. The CN modelers did not add any new trains to the simulation traffic package for the GTW Corridor. *Id.*
[73] Mr. Krueger testified that these new trains were added to the simulation "randomly" because they are "zero-based schedule" trains that do not have scheduled departure times, since their activation may depend on customer release. *See* Krueger Transcript at 295:4-297:3. However, it is not clear to us that Mr. Krueger's explanation would apply to all of the new trains that were added randomly to the model. It is our understanding that the Q-type intermodal train is not considered a "zero-based schedule" train in CN's system and would generally have a scheduled departure time that would be designed to avoid conflicts with other trains, given the relative time-sensitivity of the intermodal traffic. [redacted]

CN's modeling approach would attribute to Amtrak any freight train delays in Scenarios 2 and 3 resulting from interference with such randomly added trains and CN would have Amtrak pay for additional infrastructure to mitigate that freight delay.

In determining what they claimed were "representative" train operations, the CN modelers followed a pattern of excluding usual but irregular freight train movements. In general, they "assumed operations proceeded according to the plan in place at the time."[74] The CN modelers then "smoothed" train consists "[i]n order to reduce the complexity and coding burden" by "assum[ing] that trains that operated on multiple days in the model operated with the same operational parameters each day."[75] They further excluded "secondary variables," explaining that "secondary variables (such as train performance, consist, and length) . . . generally play a much less important role in determining delays, and were not included in the modeling (other than using averages where applicable)."[76]

In our modeling experience, variations in train consist characteristics can have significant consequences. For example, short trains generally require less line capacity than longer trains, and our experience is that heavy, long freight trains present the most difficult delays to be accommodated. For any given train type, the CN modelers opted generally to use identical consists on each day of the simulation, with train lengths for core, bulk and other trains set at "the 66.7 percentile of trains (i.e., the average plus one standard deviation) that operated in 2013."[77] Use in the model of fixed consist lengths and weights may reduce the perceived delay to freight trains that are actually longer and heavier, but will also increase the perceived delay to freight trains that are actually shorter and lighter than the "average" figures plugged into the

---

[74] Krueger V.S. at 33.
[75] *Id.* at 34.
[76] *Id*. at 38 fn. 34.
[77] *Id.* at 34.

model.[redacted] Smoothing consist data to average levels obscures and distorts the effects on freight train capacity demands.

D. CN's Modeling of Parallel Routes Understates Existing Capacity.

CN's modeling tools (TPC and RCM) create a linear representation of a rail corridor and require a linear (i.e., "non-branching") route description.[79] The IC Corridor, on the other hand, has sections of parallel subdivisions.[80] In order to model locations with multiple subdivisions with common endpoints, the CN modelers used junctions to allow freight trains to enter and exit the simulation at branch points.[81] However, because the alternative route is represented in the RCM model network as two endpoints without a continuous line segment connecting those junction points, CN's model is unable to select a parallel route without manual intervention by the modelers to direct a train to exit the network via one junction point and, separately, to reenter the model at the second junction point.

In a different context and for a different purpose, the CN modelers did employ at least one other modeling method that could have better replicated the true capacity of parallel track, even within the constraints of the RCM software. To address the south side of Memphis Harrison Yard, where there is a double track with two mains that are not parallel and have different distances, they modeled the lines such that "all trains operated on it as if it were double

---

[redacted]

[79] Krueger V.S. at 9.

[80] *See, e.g.*, *id.* at 9 (noting CN's Bluford Subdivision has instances of parallel/branching routes).

[81] *Id.* at 9-10.

track . . . ."[82] Using the same technique to address parallel track would have provided a more accurate assessment of current line capacity than manual inputs. The CN modelers gave no explanation as to why they did not use a similar approach to addressing other parallel track segments.

The CN modelers' approach to modeling parallel routes via use of junctions limits the routing options available in the model in the absence of direct intervention by the modeler. It is our opinion that the "workaround" for parallel routes that CN describes fails to adequately capture the capacity made available by CN's parallel routes and, as a consequence, the model understates current line capacity. All else being equal, the understatement of current capacity will lead (in the comparison cases in the model) to an overstatement of requirements for additional infrastructure. Here again, with understated capacity in Scenarios 1 and 2, the model overstates the amount of additional infrastructure needed to reduce net incremental freight delay CN alleges is attributable to Amtrak.

E. The RCM Model's Non-Branching Structure Calls In Question CN's Modeling of Freight and Passenger Operations Through Memphis.

The CN modelers incorporated a simplifying assumption into their model that had an effect on the RCM's modeling of operations through the Memphis area.[83]

As noted above, the RCM model is incapable of simulating branching. As a consequence, the CN modelers omitted from the model a 17-mile section of track used by Amtrak to access the Memphis station – a segment of track that is not used by freight trains (which use an alternative route through the Memphis area). Instead, they attempted to approximate Amtrak's use of the Memphis station and the 17-mile track segment "by having

[82] *Id.* at 21, paragraph no. 7.

[83] This simplifying assumption also had an effect on the TPC's calculation of the minimum run times for the Amtrak City of New Orleans trains through the Memphis area. This issue is discussed in further detail in Section VIII below.

Amtrak stop within the terminal area of CN's Memphis Harrison Yard on the IC Corridor… and depart Harrison Yard at the scheduled time."[84] However, in so doing, the model did not fully account for the characteristics of the 17-mile track segment used by Amtrak and the differences between the freight route through Memphis and the Amtrak route through Memphis.

The CN modelers explain that the south side of Harrison Yard in Memphis, where the two mains are not parallel and are of different lengths, "was not capable of being accurately replicated in the model."[85] The CN modelers chose to represent that area as if it were double track, and they admit that doing so resulted in an inaccuracy in run times for the route not correctly modeled. The CN modelers do not explain how these inaccuracies might have impacted the RCM capacity modeling of trains operating through the Memphis area.

V. CN's Infrastructure Proposals Lack Adequate Documentation.

In our experience, capacity improvements are typically selected by testing alternative infrastructure additions through a model. Lists of potential alternatives are typically generated by an operations department and other departments of a railroad, and a party that might be asked to pay for such infrastructure improvements, such as Amtrak in this case, would be consulted in developing these alternatives. With regard to post-modeling evaluation by a third party, we would expect that any subjective judgments made on the part of the modeler in selecting the type of improvements to test, as well as cost-benefit considerations (i.e., expensive improvements vs. less-expensive improvements that might generate the same or similar benefits), would be explained as support for the recommendations made.

As described more fully in the sections that follow, the CN modelers' approach to selecting capacity improvements is contrary to our experience as we have described it herein.

[84] Krueger V.S. at 21.
[85] *Id.*

We conclude from this that CN's recommended infrastructure additions have no documented basis.

A. CN's Subjective Judgments in Selecting Recommended Infrastructure Improvements Are Opaque.

A simulation model such as RCM does not itself identify, select, or recommend infrastructure additions to mitigate train delay.[86] These limitations of a model's role must be recognized and acknowledged by those either proposing or evaluating infrastructure improvement recommendations that are based on simulation modeling. The model can assist in identifying choke points for the modelers to address and also provides a means for comparing infrastructure improvement alternatives.[87] However, it is the modelers themselves (often with input and suggestions by other railroad departments and other stakeholders) who prepare the model for testing of specific infrastructure improvements.[88] This is a subjective process that relies, in part, on the modeler's judgment. The infrastructure improvements that meet the modeling objective and may ultimately become the modeler's recommendations depend substantially on the subjective process of selecting infrastructure improvements to test.

Significantly, there may be many sets of infrastructure improvements that meet the modeling objective – many possible "solutions" to a capacity issue. A recommended solution is seldom the only solution; other solutions are often possible and, depending on circumstances, may even be preferable (e.g., lower-cost). Changes in railroad operations (e.g., adjustments in train schedules to avoid conflicts), which can be tested through the modeling process, may

---

[86] Mr. Krueger explained in his deposition that the infrastructure additions considered by the CN modelers are not automatically generated by RCM but instead came from options developed by the CN modelers themselves outside of RCM. *See* Krueger Transcript at 245:9-246:8 (describing the process as a combination of RCM and "manual analysis"). He also acknowledged that RCM does not have a "build siding here button" that would enable modelers to ascertain exactly where a plant or siding should be built merely from running the simulation. *Id.* at 309:17-310:3.
[87] *See id.* at 245:16-24 (models can be used to identify "pinch points, or areas of congestion").
[88] *See id.* at 245:24-246:8.

reduce or eliminate the need for infrastructure enhancements in order to achieve the modeling objective. In addition, alternative infrastructure modifications (such as changes in the type of signal system or the spacing of signals on a line segment) can increase potential capacity.[89] Thus, any proper evaluation of the modeler's recommended infrastructure improvements requires a full understanding of the subjective judgments made in selecting infrastructure improvements to run through the model.

We reviewed the Krueger V.S. and the associated workpapers and were unable to find an explanation of why the CN modelers chose the specific infrastructure improvements they are recommending.[90] We also attempted to follow and review the iterative process the CN modelers claim to have used to identify the locations of the most significant "Amtrak-caused" congestion.[91] [redacted] although we found locations where infrastructure additions were recommended, we found no basis for the recommendations.[redacted]

Furthermore, there is no information in the Krueger V.S. about the alternative mixes of infrastructure improvements the CN modelers considered or whether they at any point considered operational changes as part of any set of model inputs. Mr. Krueger testified that he

---

[89] *See id.* at 246:3-5 (acknowledging that changes in the signal system can increase capacity).
[90] Refer to our analysis of CN's time-distance plots in Section VI below.
[91] "We reviewed the time-distance plots generated by the RCM and performed a simple return-grid analysis, and analyzed the simulation results on a day-by-day and segment-by-segment basis to determine the locations with the most significant Amtrak-caused congestion." Krueger V.S. at 43.
[redacted]

was not asked to consider schedule changes or other operational alternatives to infrastructure improvements as part of the capacity studies.[93]

Finally, although the CN modelers described their iterative process ("Using our knowledge and understanding of the likely most cost-effective infrastructure improvements…") to add infrastructure to alleviate freight delays,[94] [redacted] We believe it is unlikely CN would invest its own money with this level and quality of analysis. We consider these omissions to be significant - the absence of this information precludes a comprehensive evaluation of CN's proposed infrastructure improvements.

---

[93] *See* Krueger Transcript at 132:3-7, 16-20. Although Mr. Krueger testified that he considered whether any signal changes would alleviate delays on the IC Corridor, he did not specify whether he engaged in any similar analysis for the GTW Corridor. Krueger Transcript at 312:21-313:21.

[94] "After we determined the incremental freight delay in Scenario 2, we used an iterative process to add infrastructure to the existing plant in order to return freight delay levels as closely as possible to Scenario 1 levels while still meeting the specified Amtrak OTP target. We reviewed the time-distance plots generated by the RCM and performed a simple return-grid analysis, and analyzed the simulation results on a day-by-day and segment-by-segment basis to determine the locations with the most significant Amtrak-caused congestion. Using our knowledge and understanding of the likely most cost-effective infrastructure improvements to alleviate freight delays, we added pieces of infrastructure in strategic locations. We then re-ran the simulation, and calculated the amount of Amtrak and freight delay. Finally, we fine-tuned the model by selectively adding and removing marginal pieces of new infrastructure until we reached our desired result: a [*sic*] reasonably cost-effective infrastructure additions that would allow Amtrak to operate at specified service levels without freight delays in excess of Scenario 1 levels." Krueger V.S. at 43-44 (emphasis added).

[redacted]

B. The Estimated Costs of CN's Infrastructure Recommendations Lack Sufficient Detail.

To estimate the cost of the recommended infrastructure improvements, the CN modelers applied "estimated unit costs" in various locations and terrains.[96] In so doing, they used aggregated unit costs from an unstated source. For example, the $4 million per mile main track cost they assumed has no breakdown among signals, track structure, grading, tunnels, culverts, or any other elements.[97] In addition, they failed to use any site-specific unit costs. Also, the CN modelers do not specify in the Krueger V.S. who made the cost estimates or the source for the unit costs.[98]

As with respect to the lack of information about alternative mixes of infrastructure improvements, CN's failure to provide detailed cost information and supporting assumptions undermines the reliability of CN's cost estimates for the infrastructure additions that CN has proposed. Moreover, the CN modelers did not engage in any detailed cost-benefit analysis relating to the infrastructure improvements that they are asking Amtrak to pay for in this proceeding.[99] Some level of cost-benefit analysis would be a standard part of any railroad's evaluation of the need for constructing infrastructure improvements, particularly improvements (such as proposed here by CN) which would cost hundreds of millions of dollars to construct.

---

[96] Krueger V.S. at 45-47.

[97] *See id*.

[98] Mr. Krueger testified that the cost estimates came from actual recent expenditures provided by "CN Engineering" for similar infrastructure improvements. Krueger Transcript at 253:18-254:5. However, no workpapers were provided to support these cost estimates.

[99] *See id.* at 268:16-268:19 (acknowledging that no detailed cost-benefit analysis was performed with respect to the proposed infrastructure improvements).

VI. CN's Simulations for the IC Corridor Do Not Support the Locations Selected for, the Alleged Utility of, or the Stated Need for the Amtrak-Funded Infrastructure Improvements Proposed by CN.

The infrastructure improvements that CN proposes the Board require Amtrak to pay for[100] are based on a two-part premise: first, that there is a level of delay to CN's freight trains "attributable to Amtrak operating on CN's rail lines at specified service levels;" and second, that some level of capacity improvements is "required to eliminate that incremental level of delay."[101] CN's modeling efforts, therefore, purport to "quantify the effect of Amtrak on CN's freight operations" and "identify the infrastructure (track and signal plant) improvements required" so that Amtrak services may achieve specified OTP targets at their endpoints on CN's lines "without Amtrak's trains causing net incremental delay to CN's freight traffic."[102]

Counsel for Amtrak asked us to review CN's RCM simulations in order to evaluate the relationship between CN's claimed need for capacity improvements on their lines and the scope and nature of the proposed improvements. As described in detail below, our analysis of the CN modelers' Scenarios 1, 2 and 3 simulations[103] shows the following:

- **Locations:** Notwithstanding the CN modelers' assertion that their proposed capacity improvements will "reduce net incremental freight delay caused by Amtrak to near zero,"[104] CN's proposed locations for capacity improvements do not correlate well to

[100] *See* Attachment B, which includes a schematic diagram prepared by CN that summarizes CN's proposed infrastructure improvements for the IC Corridor at the Amtrak 85%/90% OTP level. Krueger V.S. Exhibit 1.
[101] Krueger V.S. at 2.
[102] *Id.* at 2-3.
[103] As noted above, CN's Scenario 1 models CN freight operations on existing infrastructure assuming no Amtrak passenger service operations. CN's Scenario 2 models CN freight and Amtrak passenger services operating at specified endpoint OTP levels on existing infrastructure. CN's Scenario 3 simulates CN freight and Amtrak services performing at specified endpoint OTP levels with the addition of CN's proposed capacity improvements. CN's Scenario 3 simulation models the locations CN selected for infrastructure upgrades. *Id.* at 4.
[104] *Id.*

the locations of the most significant alleged delays to CN freight trains resulting from meets and passes with Amtrak trains. Of note, some of CN's proposed locations for capacity improvements appear to address delays to CN freight trains experienced at meets or passes with other freight trains.

- **Need and Use:** If constructed, some components of the new infrastructure proposed by CN would be used infrequently or not at all. Infrequent use of CN's proposed capacity improvements, as modeled by CN's simulations, suggests that those proposed investments are not needed. Moreover, CN's simulations demonstrate that, for other components of CN's proposed new infrastructure, even the fact that such improvements may be used does not mean that those improvements are needed or that they ameliorate any simulated delays.

A. New Infrastructure Locations.

1. Our Approach and Analysis.

As discussed previously, the CN modelers did not adequately document the method used to select the specific locations for the proposed new infrastructure included in their Scenario 3 simulation. They claim to have used an iterative process of review and analysis of time-distance plots generated by the RCM "to determine the locations with the most significant Amtrak-caused congestion."[105] (As noted earlier, we were unable to corroborate within CN's workpapers the CN modelers' use of an analysis process using RCM-generated time-distance plots.) Beyond that, the CN modelers explain only that "[u]sing our knowledge and understanding of the likely most cost-effective infrastructure improvements to alleviate freight delays, we added pieces of

[105] *Id.* at 43.

infrastructure in strategic locations"[106] and further indicate that they "fine-tuned the model" to reach the "desired result" by "selectively adding and removing marginal pieces of new infrastructure."[107]

Given this generic explanation of CN's modeling process, we cannot definitively determine how CN selected specific locations for installation of infrastructure improvements. However, in our own modeling experience, a key to selecting potential locations for new infrastructure is to identify, through a review of simulation results, those locations where train delays are the longest or the most frequent. (The CN modelers' description of their own process endorses this approach, despite lack of evidence that they actually used it.[redacted]) Logically, this approach pinpoints the locations where added infrastructure is likely to be most beneficial in reducing delays. Using this method to focus on areas where delays are lengthy or frequent is useful for evaluating whether CN's simulations support CN's claim that the proposed infrastructure improvements target and eliminate delays to its freight trains attributable, allegedly, to Amtrak's operations on CN lines.[109]

The CN modelers' workpapers include a Stringline Viewer program that can be used to read certain of CN's RCM Model output files and to create a graphic display of the model's representation of the movement of trains over time in a time-distance (or "stringline") format. The diagrams produced using the Stringline Viewer tool allowed us to undertake a more detailed

---

[106] *Id.*
[107] *Id.*
[redacted]
[109] Use in our analysis of CN's simulation output is not meant to imply acceptance of CN's simulation approach nor CN's modeling results, but is intended solely to address whether the CN modelers' own work product demonstrates the alleged need for the infrastructure additions that CN has proposed the Board order Amtrak to fund.

analysis of CN's simulated train movements.[redacted] In the following paragraphs, we describe how we used this approach to analyze CN's simulations.[111]

1. ***<u>Meets and Passes with Amtrak Trains (CN Scenario 2).</u>***

As the focus of CN's RCM simulations is "delay to CN freight trains caused by Amtrak's presence on CN's lines,"[112] we began our analysis by identifying those locations in CN's Scenario 2 where CN freight train delay is alleged to occur at meets or passes with Amtrak trains.[113] In order to develop the delay statistics shown below in **Table C**, we analyzed stringline diagrams that we produced by applying CN's Stringline Viewer to CN's Scenario 2 simulation output files.[redacted] These stringline diagrams, which we annotated to identify sites of relevant train

---

[redacted]

[111] For purposes of performing our detailed analysis, we selected the IC Corridor segment (from Chicago to New Orleans) under CN's 85%/90% endpoint OTP simulations (Scenarios 2B and 3B), because the cost estimate ($470 million) associated with the aforementioned endpoint OTP level is the most expensive of CN's infrastructure proposals. At 80% endpoint OTP on the IC Corridor segment (CN's Scenario 3A), CN proposes the Board require Amtrak to invest $378 million in infrastructure improvements. CN also simulated 90% endpoint OTP on the Port Huron to South Bend segment that generated a proposed infrastructure investment of $64 million. CN's explanation of their approach and presentation of their simulation results give us no reason to believe that CN developed these other simulations on the IC Corridor and the GTW Corridor any differently than the 85/90% endpoint OTP simulations that we analyzed in detail on the IC Corridor.

[112] Krueger V.S. at 47.

[113] *See* Attachment D, at D1-D5.

[redacted]

delays and other useful information, are provided in Attachment D (D1-D5)[115] to this statement. From these stringline diagrams, we developed Attachments E through K[116], each of which presents certain delay-related data derived from our analysis of Attachment D.

In **Table C** below, we show the average daily delays and delay minutes at each of the eleven line segments where CN has proposed the construction of new double track.[117] **Table C**

---

[115] Collectively, the stringline diagrams provided in Attachment D (workpapers D1, D2, D3, D4, and D5) represent the entire IC Corridor from Chicago to New Orleans: Chicago-Champaign Subdivisions (workpaper D1), Centralia-Cairo Subdivisions (workpaper D2), Fulton Subdivision (workpaper D3), Yazoo Subdivision (Workpaper D4), and McComb Subdivision (workpaper D5). The subdivision groupings correspond to CN's groupings, as shown in Attachment B. Within its relevant geographic territory, each of these five Workpapers contains seven stringline diagrams, representing Days 2 through 8 in CN's 7-day simulation period. [redacted]

[116] Summary descriptions of Attachments E through K are as follows:

- Attachment E presents a tally of estimated delay minutes derived from our analysis of Attachment D. Because CN seeks to justify its infrastructure proposals on the basis of delays to freight trains, Attachment E does not include delays to Amtrak trains or meets/passes with no delay.
- Attachment F is drawn from the data contained in Attachment E and presents a summary of freight train delays and delay minutes, by subdivision group and day.
- Attachment G is a resorting of the Attachment E data that lists the Scenario 2 freight train delays and delay minutes in location order, by RCM milepost (north to south between Chicago and New Orleans).
- Attachment H is a summary of the detailed data presented in Attachment G. Attachment H shows the number of freight train delays at each location where such delays occurred, as well as the locations, types, and estimated costs of infrastructure additions CN proposes the Board order Amtrak to fund. CN-proposed additions of double track have been indicated at both ends of each added segment and between those end points.
- Attachment I is a summary of the detailed data in Attachment G, and shows the minutes of delay at each location where freight train delays occurred. Attachment I also shows the locations, types, and estimated costs of infrastructure additions proposed by CN. CN-proposed additions of double track have been indicated at both ends of each added segment and between those end points.
- Attachment J shows the average daily number of freight train delay incidents at meets or passes with Amtrak trains in CN's Scenario 2. Attachment J presents this delay data next to the locations, types and estimated costs of infrastructure additions for the eleven double track segments proposed by CN.
- Attachment K shows the average daily number of freight train delay minutes at meets and passes with Amtrak trains in CN's Scenario 2. Attachment K presents this delay data alongside the locations, types and estimated costs of infrastructure additions for the eleven double track segments proposed by CN.

[117] These eleven segments of proposed double track are shown in Attachment B, discussed above. We have highlighted these eleven CN-proposed double track segments, because these segments are the most costly of the infrastructure additions proposed by CN for the IC Corridor, comprising $357.5 million, or 76%, of the total estimated cost of $470.3 million. For clarity, we have labeled the discrete segments of proposed double track as "DT 1" through "DT 11", as shown in Table C.

identifies these delay statistics and the type of infrastructure and level of investment CN recommends for the designated segments.

Table C[118]
CN Scenario 2 Freight Train Delays and Delay Minutes at Meets/Passes with Amtrak Trains, By CN-Proposed Double Track Segment (Dollars in Millions)

Subdivision	Segment	[redacted]	[redacted]	DT Seg	DT Mi.	Full Xo	Part Xo	CN $ Est
Chicago-Champ.	Kankakee W-Gar Creek E	[redacted]	[redacted]	DT 1	2.2	1	1	$12.1
	Ashkum W-Gilman Jct	[redacted]	[redacted]	DT 2	3.8		1	$16.2
	Paxton W-Rantoul E	[redacted]	[redacted]	DT 3	9.4	1	2	$41.9
	Rantoul W - Leverett Jct	[redacted]	[redacted]	DT 4	8.3		2	$35.2
	Champaign-Tolono E	[redacted]	[redacted]	DT 5	9.3		2	$39.2
	Tolono W-Tuscola Jct	[redacted]	[redacted]	DT 6	9.0	1	1	$39.3
	Neoga W-Effingham E	[redacted]	[redacted]	DT 7	12.5	1	1	$53.3
	Laclede-Tonti E	[redacted]	[redacted]	DT 8	6.3	1		$27.5
Centralia-Cairo	Bois W-St Johns	[redacted]	[redacted]	DT 9	9.2		2	$38.8
Fulton	Curve W-Rialto E	[redacted]	[redacted]	DT 10	7.7		1	$31.8
Yazoo	Delta W-Yazoo City	[redacted]	[redacted]	DT 11	5.3		1	$22.2
	Total, DT segments	[redacted]	[redacted]		83.0	5	14	$357.5
	Total, All segments	[redacted]	[redacted]		83.0	11	17	$470.3

The CN modelers indicated that they selected locations for capacity improvements for the purpose of reducing delays to CN's freight trains allegedly attributable to Amtrak.[119] Accordingly, we would expect our analysis of CN's Scenario 2 to show significant infrastructure improvements being proposed at locations where CN freight trains experience relatively frequent and/or lengthy delays at meets or passes with Amtrak trains and low to no proposed improvements being proposed at locations where CN freight trains experience relatively minimal delays at meets or passes with Amtrak trains. However, our stringline analysis of CN's Scenario

[118] Abbreviations in Tables B and C: "DT" refers to double track and "xo" to crossover.
[119] Krueger V.S. at 4 and 47.

2 shows little direct connection. CN's proposed improvements do not, in fact, correlate strongly to alleged Amtrak-caused delays.

For example, at the Neoga W-Effingham E location (DT 7), where CN proposes that the Board require Amtrak to spend over $50 million to construct 12.5 miles of double track, a full crossover and a partial crossover, [redacted][120] Additionally, CN would have the Board require Amtrak spend over $40 million within the Paxton W-Rantoul E segment (DT 3) [redacted][121] In fact, as **Table C** shows, at nine of the eleven locations where CN proposes construction of new double track, [redacted] – not the frequent or lengthy delay experience one might reasonably expect would be required to prompt the level of investment CN proposes.[122]

What we conclude from our analysis of CN's Scenario 2 simulation shown in **Table C** is that the frequency and duration of alleged Amtrak-caused freight train delay incidents within the eleven track segments for which CN proposes the construction of double track provide little support for CN's proposed $357.5 million investment at those locations. Accordingly, it is our opinion that CN's Scenario 2 fails to justify or explain the "strategic locations" CN selected for infrastructure investment.[123]

---

[120] *See* Attachments J and K.
[121] *See id.*
[122] *Id.*
[123] Krueger V.S. at 43.

2. ***Meets and Passes with Other Freight Trains (CN Scenario 1).***

Having failed to find in CN's Scenario 2 simulation analysis any support for a meaningful correlation between CN's selected locations for infrastructure investment and alleged Amtrak-caused freight train delay, we turned our focus to CN's Scenario 1 – CN's simulation of CN freight operations on existing infrastructure assuming no Amtrak passenger service.

As above for CN's Scenario 2, we performed a detailed stringline analysis of CN's Scenario 1.[124] The resulting delay statistics are presented in **Table D** shown below, along with

---

[124] In order to develop **Table D**, we analyzed stringline diagrams that we produced by applying CN's Stringline Viewer to CN's Scenario 1 simulation output files. We counted the number of incidents of delay to freight trains at meets or passes with other freight trains and added the estimated number of minutes of delay associated with each such incident to a tally of freight train delay for that location. We then divided the totals for CN's seven-day RCM simulation (which CN identifies as Days 2-8) by seven in order to produce daily averages of both the number of train delays (i.e., the delay count) and the minutes of delay at each location. **Table D** presents a summary of the delay data developed through this multi-step analysis. A more detailed description of the stringline diagrams we developed and an explanation of how each of our workpapers (Attachments S through W) relates to and was generated from our analysis of the Attachment R stringline diagrams is as follows:

- Attachment R (workpapers R1 through R5) contains annotated versions of stringline diagrams produced by applying CN's Stringline Viewer to the relevant CN Scenario 1 simulation output file. As for Attachment D (workpapers D1 through D5), Attachment R's workpapers R1 through R5 are divided into the five division groupings shown in Attachment B. Each of the five sets of workpapers includes seven days, representing Days 2 through 8 of CN's Scenario 1 simulation. Trains are color-coded according to CN's priority designations. The annotations on Workpapers R1 through R5 were added during our analysis to provide train labels and identify sites of relevant train delays.
- Attachment S is drawn from our analysis of Attachment R's stringline diagrams and shows delay minutes associated with freight trains delays at meets or passes with other freight trains.
- Attachment T is a summary of freight train delays and delay minutes in CN's Scenario 1, shown by subdivision group and day.
- Attachment U is a resorting of the Attachment S data that lists the Scenario 1 freight train delays and delay minutes in location order, by RCM milepost (north to south between Chicago and New Orleans). As in Attachment G, delays to northbound trains are usually at north (or "east") ends of double track or sidings, while delays to southbound trains are usually at south (or "west") ends of double track or sidings.
- Attachment V is a summary of the detailed data in Attachment U. Attachment V shows the number of freight train delays at each location where such delays occurred, as well as the locations, types, and estimated costs of infrastructure additions proposed by CN. As with Attachments H and I, CN-proposed additions of double track have been indicated at both ends of each added segment and between those end points.
- Similar to Attachment V, Attachment W is a summary of the detailed data in Attachment U, except that Attachment W shows the minutes of delay at each of the locations where freight train delays

the level of investment CN recommends for the designated locations.[125] Because CN's Scenario 1 specifically excludes Amtrak trains, the delay statistics in **Table D** reflect freight train delays at meets or passes only with other freight trains.

<u>Table D</u>
CN Scenario 1 Freight Train Delays and Delay Minutes at Meets/Passes with Other Freight Trains, By CN-Proposed Double Track Segment (Dollars in Millions)

Subdivision	Segment	Avg/[126] Day	Avg Delay Min/Day	DT Seg	DT Mi.	Full Xo	Part Xo	CN $ Est
Chicago-Champ.	Kankakee W-Gar Creek E	[redacted]	[redacted]	DT 1	2.2	1	1	$12.1
	Ashkum W-Gilman Jct	[redacted]	[redacted]	DT 2	3.8		1	$16.2
	Paxton W-Rantoul E	[redacted]	[redacted]	DT 3	9.4	1	2	$41.9
	Rantoul W - Leverett Jct	[redacted]	[redacted]	DT 4	8.3		2	$35.2
	Champaign-Tolono E	[redacted]	[redacted]	DT 5	9.3		2	$39.2
	Tolono W-Tuscola Jct	[redacted]	[redacted]	DT 6	9.0	1	1	$39.3
	Neoga W-Effingham E	[redacted]	[redacted]	DT 7	12.5	1	1	$53.3
	Laclede-Tonti E	[redacted]	[redacted]	DT 8	6.3	1		$27.5
Centralia-Cairo	Bois W-St Johns	[redacted]	[redacted]	DT 9	9.2		2	$38.8
Fulton	Curve W-Rialto E	[redacted]	[redacted]	DT 10	7.7		1	$31.8
Yazoo	Delta W-Yazoo City	[redacted]	[redacted]	DT 11	5.3		1	$22.2
	Total, DT segments	[redacted]	[redacted]		83.0	5	14	$357.5
	Total, All segments	[redacted]	[redacted]		83.0	11	17	$470.3

What the data presented in **Table D** show is a strong correlation between certain locations where freight trains delay each other and locations where CN proposes to make significant infrastructure improvements. [redacted]

---

occurred. Attachment W shows the locations, types, and estimated costs of infrastructure additions proposed by CN. As with Attachments H and I, CN-proposed additions of double track have been indicated at both ends of each added segment and between those end points.

125 *See* Attachment B.

126 The "Avg Day" column reflects the average number of freight trains delays per day caused by meets with other freight trains which occurred on the applicable segment during the Scenario 1 simulation period, and the "Avg Delay Min/Day" column reflects the average minutes per day associated with all such delay events during the same period. The other columns reflect the specific infrastructure improvements – double-track ("DT") and cross-overs (Xo") that CN is proposing on the relevant segments and the associated cost as estimated by the CN modelers.

[redacted][127] Consistent with these average delay statistics, CN proposes to double track this segment and install a full crossover as well as a partial crossover at a cost of $53.3 million. CN proposes an investment of $31.8 million for a new double track segment (DT 10) [redacted] Rather than supporting CN's claim that its proposed investment would "reduce net incremental freight delay caused by Amtrak,"[128] this tracking of dollars to delays in CN's Scenario 1 simulation demonstrates a link between freight train delays at meets or passes with other freight trains and, thus, suggests that CN selected at least some of its locations for investment to reduce freight train delay at meets or passes with other freight trains.

3. ***Simulation Comparison (CN Scenarios 1 and 2).***

Next, for the 11 double track segments CN proposes the Board order Amtrak to construct on CN's line between Chicago and New Orleans, we compared the total freight train delays and delay minutes at meets/passes with other freight trains over the seven-day simulation period in CN's Scenario 1 with the freight train delays and delay minutes at meets/passes with Amtrak trains from CN's Scenario 2.[129] **Table E** below shows a comparison of Scenario 1 and Scenario 2 with respect to total and average daily numbers of trains delayed and total and average numbers of daily delay minutes.[130]

---

[127] *See* Attachment X and Y.
[128] Krueger V.S. at 4.
[129] *See* Attachment Z (summarizing the average daily freight train delay incidents and average daily delay minutes in CN's Scenario 2 and CN's Scenario 1 for the 11 CN-proposed double track segments).
[130] *See* Attachments X, Y and Z. Attachment X shows, for each of the eleven CN-proposed double track segments, the average number of freight train delays per day at meets or passes with other freight trains in

Table E
Freight Train Delay Comparison of Scenario 2 Meets/Passes with Amtrak
With Scenario 1 Meets/Passes with Other Freight Trains,
By CN-Proposed Double Track Segment
(Dollars in Millions)

Scenario 2: Freight Delays at Meets/Passes with Amtrak

DT Seg	Segment	[redacted]	[redacted]	[redacted]	[redacted]
DT 1	Kankakee W-Gar Creek E	[redacted]	[redacted]	[redacted]	[redacted]
DT 2	Ashkum W-Gilman Jct	[redacted]	[redacted]	[redacted]	[redacted]
DT 3	Paxton W-Rantoul E	[redacted]	[redacted]	[redacted]	[redacted]
DT 4	Rantoul W - Leverett Jct	[redacted]	[redacted]	[redacted]	[redacted]
DT 5	Champaign-Tolono E	[redacted]	[redacted]	[redacted]	[redacted]
DT 6	Tolono W-Tuscola Jct	[redacted]	[redacted]	[redacted]	[redacted]
DT 7	Neoga W-Effingham E	[redacted]	[redacted]	[redacted]	[redacted]
DT 8	Laclede-Tonti E	[redacted]	[redacted]	[redacted]	[redacted]
DT 9	Bois W-St Johns	[redacted]	[redacted]	[redacted]	[redacted]
DT 10	Curve W-Rialto E	[redacted]	[redacted]	[redacted]	[redacted]
DT 11	Delta W-Yazoo City	[redacted]	[redacted]	[redacted]	[redacted]
	Total, DT segments	[redacted]	[redacted]	[redacted]	[redacted]
	Total, All segments	[redacted]	[redacted]	[redacted]	[redacted]

CN's Scenario 1. Similar to Attachment X, Attachment Y shows, for CN's Scenario 1, the average daily minutes of freight train delay at meets or passes with other freight trains. The number of delayed trains and minutes of delay at both ends of double track have been summed to produce a total daily average corresponding to that segment of CN-proposed infrastructure.

[131] The "Avg Day" column reflects the average number of freight trains delays per day caused by meets with other trains (as specified above) which occurred on the applicable segment during the simulation period for each specified scenario, and the "Avg Delay Min/Day" column reflects the average minutes per day associated with all such delay events during the same period.

Scenario 1: Freight Delays at Meets/Passes with Other Freight Trains

DT Seg	Segment	
DT 1	Kankakee W-Gar Creek E	[redacted]
DT 2	Ashkum W-Gilman Jct	
DT 3	Paxton W-Rantoul E	
DT 4	Rantoul W - Leverett Jct	
DT 5	Champaign-Tolono E	
DT 6	Tolono W-Tuscola Jct	
DT 7	Neoga W-Effingham E	
DT 8	Laclede-Tonti E	
DT 9	Bois W-St Johns	
DT 10	Curve W-Rialto E	
DT 11	Delta W-Yazoo City	
	Total, DT segments	
	Total, All segments	

Comparing the delay data from **Table E** above reveals the following:[132]

- The total freight train delay at meets or passes with other freight trains in Scenario 1 [redacted] was approximately double the total freight train delay at meets or passes with Amtrak trains in Scenario 2 [redacted]
- The total number of freight train delays across all 11 CN-proposed double track segments combined is 93% **higher** at meets or passes with other freight trains in Scenario 1 [redacted] than at meets or passes with Amtrak in Scenario 2 [redacted].
- The total number of freight train delay minutes across all 11 CN-proposed double track segments combined is 85% **higher** at meets or passes with other freight trains in Scenario 1 [redacted] than at meets or passes with Amtrak in Scenario 2 [redacted].

[132] All of the comparison data below are provided in Attachment Z.

- For 9 of the 11 CN-proposed double track segments, the average number of delays per day at meets or passes with other freight trains in Scenario 1 is **higher** than the average at meets or passes with Amtrak in Scenario 2.
- For 8 of the 11 CN-proposed double track segments, the average number of delay minutes per day at meets or passes with other freight trains in Scenario 1 is **higher** than the average at meets or passes with Amtrak in Scenario 2.

As demonstrated by the above statistics, over the IC Corridor as a whole, as well as at most of the locations CN proposes to double track, CN freight trains were delayed more often and for longer periods by other freight trains in CN's Scenario 1 than by Amtrak passenger trains in CN's Scenario 2.

Drilling down to compare specific segments further demonstrates a strong relationship between certain locations where CN proposes to install improvements and the incidences at those locations of delay to CN freight trains at meets or passes with other freight trains. Recall from the Scenario 2 discussion above that the incidents of delay CN attributes to Amtrak [redacted][133] Under Scenario 1, for delays at meets or passes with other freight trains, that same segment averaged nearly four times the average number of delays per day [redacted] and over 15 times the average delay minutes per day [redacted] (see **Tables D and E**).[134] This segment-specific comparison suggests that the $53.3 million infrastructure

[133] Attachments J and K.
[134] Attachments X and Y.

investment CN proposes to have the Board order Amtrak make at this location would disproportionately address freight-to-freight related interference on the line.[redacted]

Our comparative analysis of CN's Scenarios 1 and 2 indicates that CN's own modeling provides more support for the proposition that CN is seeking infrastructure investments at locations where its freight trains experience delays at meets or passes with other freight trains, rather than at meets or passes with Amtrak trains.

VII. Conclusions.

Our stringline analysis shows CN's claim that locations for proposed capacity improvements were selected for the purpose of reducing delay alleged to be due to Amtrak interference is not convincingly supported by CN's Scenario 2 simulation. But when evaluated using the same approach, CN's Scenario 1 demonstrated a greater correlation between delay and dollars for delays from freight-to-freight meets and passes. Comparing CN's Scenario 1 against CN's Scenario 2 reveals that CN's simulations provide support for the proposition that CN's proposed investments would better ameliorate delays caused by other freight trains, rather than purported Amtrak-caused delays. All told, this suggests that CN's selection of its various locations for proposed capacity improvements was influenced more by freight-to-freight delays rather than alleged Amtrak-to-freight delays.

A. Use and Need of the New Infrastructure.

Next, we evaluated whether the results of CN's Scenario 3B simulation on the IC Corridor demonstrate that CN's proposed new infrastructure would actually be used, and we found that some of the new infrastructure proposed by CN would be used infrequently or not at

---

[redacted]

all. We also evaluated, to the extent CN's proposed new infrastructure is used within the model, whether model results show that the new infrastructure was needed in order to improve train performance. In that regard, CN's simulations demonstrate that, for some components of CN's proposed new infrastructure, even the fact that improvements may be used does not mean that those improvements are needed.

That CN's own simulations reveal that numerous components of the CN-proposed infrastructure additions would be used infrequently or not at all is an important observation, because it undermines the credibility of CN's entire modeling exercise. The details of the particular findings that lead to that conclusion are discussed separately for crossovers, double track, and sidings in the paragraphs below.

1. ***Crossovers.***

To evaluate the use and need for crossovers, we used CN's Stringline Viewer tool (with the aid of a color code that identifies the track used by each train[136]) to review the proposed new crossovers included in CN's Scenario 3B. [redacted][138]

---

[136] According to CN's color code, Black=Track 1, Red=Track 2, and Green=Track 3.

[137] CN's five designated subdivisions groups on the IC Corridor are: Chicago-Champaign Subdivisions, Centralia-Cairo Subdivisions, Fulton Subdivision, Yazoo Subdivision, and the McComb Subdivision. [redacted] (See CN's proposed infrastructure additions in Attachment B.)

[138] This segmentation was done solely for the purpose of viewing and printing enlarged images of the proposed crossover locations. To ascertain crossover usage, we identified changes of track color from black to red (or vice versa) and observed the direction of the track change at locations of new crossovers. The absence of a change in track color at a particular location indicated that the new crossover was not used. [redacted] Further details regarding our analysis of the usage of crossovers proposed by CN can be found in Attachments L (workpapers L1 through L6), M and N.

[redacted][139] Of the 17 new crossover legs that experienced any usage at all, all averaged less than one use per day and more than half were used only once or twice per week.[140] From this relatively limited usage of the new infrastructure within Scenario 3B, we conclude that CN's Scenario 3B simulation provides only minimal support for CN's proposed investment in new crossovers.

Even the relatively limited **use** of new crossovers in CN's Scenario 3B simulation overstates the **need** for building the added infrastructure. Our analysis of need for the new crossovers revealed that, during the entire week-long simulation period, only one of the 24 crossover legs proposed by CN was even arguably needed to avoid a meet with an opposing train on the same track (assuming the conflict could not have been avoided altogether through a freight schedule adjustment).[141] In all other cases, had the new crossovers not existed in the model, the freight trains that used them could just as easily have used an existing crossover, or even no crossover, largely without deterioration in train performance.

---

[139] *See* Attachment M (showing the day-by-day details of the use in Scenario 3B by Amtrak trains and freight trains of CN-proposed crossovers); Attachment N (summarizing the results of our analysis regarding the use of new crossovers in CN's Scenario 3B simulation).

[140] *See* Attachment M.

[141] *See* Attachment N. To ascertain need for the new crossovers, we reviewed the Scenario 3B stringlines, focusing on the crossovers proposed by CN, and identified where opposing trains were operating at the same location. Where CN's simulation indicated that a freight train made use of a crossover in the absence of opposing trains operating in the same location, we concluded that such use was not, in fact, needed. [redacted]

As discussed earlier, the CN modelers claim to have used an iterative process to reach their conclusions regarding needed infrastructure additions.[142] Even if we assume that this was done by CN in a reliable and thorough manner, our review of CN's crossover recommendations in Scenario 3B has demonstrated that removal from the model of unneeded infrastructure does not appear to have been a priority. As a result, the CN modelers' own modeling results fail to support the crossover additions in CN's proposal.

2. Double Track

It is clear from our review of CN's Scenario 3B that CN's modeling inflates the true use and need for CN's proposed double track. Clearly, double track is not needed on a route segment during a period when only a single train is operating. [redacted]

CN's overstatement of the need for double track is exposed in our analysis of CN's Scenario 3B. [redacted]

---

[142] "Finally, we fine-tuned the model by selectively adding and removing marginal pieces of new infrastructure until we reached our desired result…." Krueger V.S. at 43 (emphasis added).

[redacted]

[redacted] The results of our analysis of CN's Scenario 3B call into question CN's conclusion that Amtrak should spend $27.5 million for 6.3 miles of double track and one full crossover [redacted].

3. Sidings.

CN's infrastructure proposals for the IC Corridor 85%/90% endpoint OTP case modeled in CN's Scenario 3B include 12 new sidings and 6 siding extensions. These 18 proposed siding enhancements are estimated by CN to cost $96 million. In order to assess the extent to which CN simulations demonstrate the use of the proposed new sidings, we again utilized CN's Stringline Viewer tool, color-coded to show track usage.[145] The results of our Scenario 3B sidings analysis are summarized in **Table F** below:[146]

[144] Attachment L at L6.

[145] *See* Attachment O. Attachment O contains four sets of workpapers, marked O1 through O4. Workpapers O1 through O4 each include 7 stringline diagrams, one for each day of the study period, Day 2 through Day 8. The stringline diagrams focus on the CN-proposed sidings improvements incorporated in CN's Scenario 3B. [redacted] For each of the stringline diagrams in Attachment O, we have identified use of the proposed new or enhanced sidings. [redacted]

[146] All of the sidings analysis data below is presented in Attachment Q.

Table F

Use of CN-Proposed Siding Extensions and Additions for Meets and Passes in CN's Scenario 3B and in CN's Scenario 2

Subdivision	CN-Proposed Siding Enhancements	New/ Ext[147]	[redacted]
Chicago-Champaign	Effingham (second siding track)	New	
	Laclede (second siding track)	New	
Centralia-Cairo	None proposed		
Fulton	Between Rives & Trimble	New	
	Between S. Dyersburg & Curve	New	
	Between Covington & Tipton	New	
Yazoo	Crenshaw	Ext	
	Lambert	Ext	
	Phillipp	New	
	Yalobusha	New	
	Gwin	Ext	
	Between Gwin & Delta	New	
	Anding	Ext	
	Ragin	New	
	Cynthia	Ext	
McComb	Between Elton Jct & Crystal	New	
	J Paul	New	
	Bogue Chitto	New	
	Osyka	Ext	

[147] This column designates whether the siding improvement proposed by CN would be a new siding ("New") or would be an extension of an existing siding ("Ext").
[148] This column reflects the average uses per day of the specified siding improvements proposed by CN in Scenario 3B ("Sc. 3B") and Scenario 2 ("Sc. 2").

Table F shows the following results from Scenario 3B:

- Of the 18 siding enhancements, one [redacted] was not used even a single time during the 7-day simulation period.
- Of the remaining 17 siding enhancements, one [redacted] was used only one time during the week [redacted]
- Of the remaining 16 siding enhancements, five were used an average of once per day or less.
- All but four of the 18 siding enhancements were used fewer than two times per day.
- The most that any one of the proposed siding enhancements was used [redacted]

In addition, as noted above, 6 of CN's proposed sidings enhancements are extensions to existing sidings.[149] CN includes these 6 existing sidings within the "existing infrastructure" modeled in its Scenarios 1 and 2.[redacted] As part of our analysis, we compared the use of these 6 extended sidings in Scenario 3B against their use as they exist at present (without the extensions) in Scenario 2. The results of our comparison analysis, shown also in **Table F**, are as follows:[151]

- Four of the six sidings [redacted] were used **less** frequently in Scenario 3B (after construction of the siding extensions) than in Scenario 2 (with existing structures only).

---

[149] Attachment P. Attachment P contains workpapers P1and P2, which are two sets of stringline diagrams showing the 6 locations CN proposes for siding extensions. [redacted] Attachment P's stringline diagrams are annotated where these 6 existing sidings have been used for meets or passes.

[redacted]

[151] All of the sidings comparison data is presented in Attachment Q.

- With respect to the two sidings that were used more frequently in Scenario 3B than in Scenario 2, average daily usage increased only modestly – [redacted].

Thus, CN's own RCM simulations demonstrate that CN's proposed siding enhancements – both the new sidings and the extensions – would receive minimal use if constructed. CN's RCM simulations also show that, of the relatively few meets and passes at the proposed new and expanded sidings, many are between two or more freight trains, rather than between freight and Amtrak trains. These simulation results call into question CN's proposal that Amtrak pay for such infrastructure additions.

VIII. CN's GTW Corridor Infrastructure Proposals Far Outweigh the Perceived Harm to CN.

CN proposes that the Board require Amtrak to fund $63.6 million in infrastructure improvements to the GTW Corridor, where Amtrak operates the Blue Water service.[152] The proposed improvements include 12.9 miles of double track and two additional crossovers between Lapeer and Imlay City, at a cost of $53.6 million, together with a third track on the western end of the 1.2-mile segment between Baron and Gord, at Battle Creek, MI, at a "fixed cost" of $10 million.[153]

The CN modelers stated that they "used an iterative process to add infrastructure to the existing plant in order to return freight delay levels as closely as possible to Scenario 1 levels while still meeting the specified Amtrak OTP target."[154] They added that this process enabled

---

[152] Amtrak also operates the Wolverine service over the Baron-Gord segment that was included in CN's modeling of the GTW Corridor. *See* Krueger V.S. at 2.
[153] *See* Attachment B at p. 5 (showing Port Huron to South Bend – Overview Schematic. The third track shown in Attachment B is located on the north side of CN's Track #1, near the Battle Creek Amtrak station).
[154] Krueger V.S. at 43.

them "to offset almost all the marginal net freight delay attributable to Amtrak in Scenario 2 and … to achieve Amtrak performance closely aligned with our OTP goals."[155]

A. CN's Measurement of Delay Attributable to Amtrak is Small Relative to the GTW Corridor Infrastructure Investment Proposed by CN.

Some details of the simulation analysis that purportedly led to CN's infrastructure proposals for the GTW Corridor are provided in the CN modelers' testimony.[156] [redacted] Table 17 shows that, in accordance with the CN modelers' intent, the freight delay in Scenario 3, after the introduction into the model of the infrastructure proposed by CN, was reduced to 9.4 hours, the same level as in Scenario 1.

The CN modelers have proposed a $63.6 million package of infrastructure additions for the GTW Corridor for the stated purpose of reducing the aggregate Amtrak caused delay to all CN freight trains along the 158-mile Blue Water [redacted] This strikes us as a level of investment that few who were investing their own money would take seriously.

B. Need for the GTW Corridor Infrastructure Additions Proposed by CN is Not Supported by CN's Scenario 2 Simulations.

CN's simulation modeling for the GTW Corridor does not present a convincing case that the $63.6 million package of infrastructure improvements proposed by CN are needed to mitigate delays to CN freight trains caused by Amtrak. This is revealed by a review of the CN model's output.

---

[155] *Id.* at 44. As noted above, on the GTW Corridor, CN modeled the Amtrak service only at 90% endpoint OTP.
[156] *See* Tables 15, 16, and 17 of the Krueger V.S. at 42-44.
[redacted]

In our analysis of CN's GTW Corridor simulations, we again utilized CN's Stringline Viewer tool, which was described earlier in our discussion of freight train delays and proposed infrastructure improvements for the IC Corridor. As described there, CN's Stringline Viewer program can be used to read certain of CN's RCM Model output files and to create a graphic display of the model's representation of the movements of trains over time in a time-distance format. In our review of CN's GTW Corridor modeling results, we focused on the two locations where CN has proposed the construction of additional infrastructure: the Lapeer-Imlay City segment and the Baron-Gord segment.

1. *Lapeer-Imlay City.*

An enlarged view of the Lapeer-Imlay segment for each of the seven days (Days 2 through 8) of CN's GTW Corridor Scenario 2 simulation[158] is presented in Attachment AA. The simplified track diagram along the left axis shows sidings at both Lapeer and Imlay[redacted] and single track between them. The trains shown as lines in Attachment AA are color-coded to indicate train priority: blue (Amtrak trains), red (Q trains), black (M and A trains), green (C trains), and gray (L trains). Two daily Amtrak Blue Water trains operate within this segment, P365 (westbound at about 7 a.m.) and P364 (eastbound at about 10:30 p.m.). Horizontal lines are indicative of delays.[160] For purposes of considering need for double track between the two sidings, we focus on "Amtrak caused" freight train delays at Lapeer E (usually to eastbound trains) and Imlay W (usually to westbound trains), because train delays reflected in the model at

[158] As described earlier, the CN modelers' Scenario 2 included freight trains and Amtrak trains operating on the existing network. Of their own analysis of simulation results, the CN modelers stated: "In our analysis, we used the time-distance plots to visually identify locations of conflict where additional infrastructure could be useful in reducing delay between freight and passenger operations." Krueger V.S. at 8.

[redacted]

[160] The mid-day local train that turns back near the Lapeer Amtrak station is an exception.

these two locations would be alleviated most directly through construction of the proposed double track between those points.

I[redacted]

[redacted], it is clear that the CN modelers' simulation results provide no support for CN's proposal that Amtrak fund construction of double track and two crossovers between those points in order to alleviate delays allegedly caused by Amtrak.

2. ***Baron-Gord.***

The $10 million third track proposed by CN at Gord would serve as an additional connector between the CN tracks at the Battle Creek Amtrak station and the Norfolk Southern ("NS") tracks that are used by all Amtrak Blue Water and Wolverine trains west of Gord. A sketch of the track layout in the vicinity of the Baron-Gord segment is shown in Attachment AB.[161]

Attachment AC presents views of the Baron-Gord segment on Days 2 through 8 of CN's GTW Corridor Scenario 2 simulation. The track diagram along the left axis displays the existing

[161] *See also* Michigan Division Timetable No. 6, Effective June 5, 2011; Google Earth. As shown in Attachment AB, CN's two tracks are aligned in a generally east-west orientation, with NS's two tracks connecting toward the southeast at Baron and toward the northwest at Gord. The Battle Creek Amtrak station is on the north side of the CN tracks between Rose and Gord, and CN's Battle Creek Yard is on the south side of CN's tracks east of Baron.

double track throughout this portion of the GTW Corridor.162 Trains shown in Attachment AC are color-coded to indicate track number: Track #1 is black and Track #2 is red.163 In addition to the two Blue Water trains that operate between Port Huron and Gord, Amtrak operates six daily Wolverine trains over the 1.2-mile segment between Baron[164] and Gord.[165] These eight daily Amtrak trains are identifiable on the stringlines as the only trains that do not extend westward beyond Gord.[redacted]

[redacted]

[redacted]

[162] The CN Michigan Division Timetable confirms the existing double track between Schoolcraft, at milepost 146.8, and Walton, at milepost 197.0. Gord, Rose, and Baron are located at mileposts 175.5, 175.9, and 176.7, respectively. A left hand crossover is located at Baron and right hand crossovers are located at Rose and Gord. Universal crossovers are located at Max, west of Gord, and also at Emmett St. and McAllister, both east of Baron.

[163] Attachment AC shows that, in accordance with directional running operations, Track #1 is used almost always by westbound trains and Track #2 is used almost always by eastbound trains.

[164] At this magnification, CN's Stringline Viewer tool omits the label for Baron, which is located between Michigan and Rose.

[165] CN connects with NS at Gord and Baron. All Amtrak trains operate over the NS route west of Gord, and all Amtrak Wolverine trains operate over the NS route east of Baron.

[redacted]

Most, if not all, of the eight delays to CN freight trains listed above could be avoided by a more judicious use within the simulation of the available track space on the existing double track. Discussions of the delays and possible "solutions" follow:

<u>Q149 delays</u>: [redacted]

<u>M397 delays</u>: [redacted]

[redacted] Therefore, there should be no conflict between M397 and P353.

<u>M393 delay</u>: [redacted] There should not be a conflict between these trains, or delays to either train, on these two separate tracks.

<u>M399 delay</u>: [redacted] Again, there should not be a conflict between these trains, or delays to either train, operating on these two separate tracks.

In summary, a review of the stringline diagrams for CN's Scenario 2 provides no credible evidence of conflict between Amtrak and freight trains that would support the need for a third track near Gord.

[redacted]

C. Need for the GTW Corridor Third Track Near Gord Proposed by CN is Not Supported by CN's Scenario 3 Simulations.

As discussed above, CN's Scenario 2 simulation of the GTW Corridor does not support the need for a $10 million third track near Gord, as proposed by CN. Nor is a third track supported by CN's GTW Corridor Scenario 3 simulation, which purportedly includes and measures the impacts on freight train delay of the infrastructure improvements proposed by CN.

Stringline diagrams of CN's Scenario 3 produced using CN's Stringline Viewer program and color-coded to display track numbers are contained in Attachment AD. As in Attachment AC above, [redacted]

CN's third track proposal between Baron and Gord also includes a reconfiguration of the crossovers within that track segment, with the replacement of the left hand crossover at Baron with a right hand crossover and the removal of the right hand crossover at Gord. [redacted]

[redacted]

[redacted]

Table G below presents a comparison between the Scenario 2 and Scenario 3 delays to freight trains at conflicts with Amtrak trains on CN's Baron-Gord segment.

Table G
Scenarios 2 and 3 Freight Train Delays on CN's Baron-Gord Segment

	[redacted]		[redacted]	
[redacted]	[redacted]		[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

In summary, both CN's Scenario 2 and CN's Scenario 3 simulations fail to demonstrate the need for the proposed third track near Gord.

[redacted]

IX. CN's PRT Calculations Are Unreliable.

A. CN Used its Proprietary Train Performance Calculator.

As a preliminary step before using RCM to conduct the capacity modeling studies discussed above, and in related analyses[172], the CN modelers used CN's proprietary Train Performance Calculator ("TPC") to calculate the pure run time ("PRT") for each Amtrak train that traverses the IC Corridor and GTW Corridor.[redacted] The CN modelers describe TPC as "a computer program that: precisely models the physics of the movement of a single train over a piece of track; calculates time, distance and speed values for the train as it moves over that track; and produces a table of information containing the train's speed and time at regular intervals as it moves over the track."[174]

CN uses its own proprietary version of TPC which contains a physics formula (known as the "Davis equation") that has been modified from the formula used in commercially available versions of the TPC.[175] CN does not make its TPC available to the public because of the proprietary nature of the modified algorithm.[176] Although CN produced workpapers for the Krueger V.S. that appear to reflect output from the PRT calculations that the CN modelers performed using CN's TPC, these workpapers do not reveal how CN's TPC may differ from commercially available versions. In other words, it is difficult for us to discern from the workpapers how the CN version of the Davis equation, which calibrates CN's TPC modeling

---

172 The Rebuttal Verified Statement of Edward J. Fishman ("Fishman R.V.S.") explains the background regarding the prior TPC simulations that CN conducted with respect to the PRTs for the Amtrak services that operate over CN in connection with CN internal efforts to evaluate schedule options for those Amtrak services.

[redacted]

174 Krueger V.S. at 7.

175 Mr. Krueger testified that he was unfamiliar with the exact manner in which CN had modified the Davis equation. Krueger Transcript at 57:18-25.

176 *See id.* at 38:18-39:10.

tool, was derived or whether the PRT results reflected in the Krueger V.S. are based on appropriate TPC inputs for infrastructure and train speeds.[redacted]

B. CN's Evaluation of Amtrak PRT on the City of New Orleans and Illini Saluki Service Is Flawed.

The Krueger V.S. asserts that the PRTs in Amtrak's schedules for the City of New Orleans and Illini/Saluki trains are "too short" based on the following TPC calculations which are reflected in Table 13 of the Krueger V.S:

Table 13 from Krueger V.S.
Comparison of schedule and TPC-based run times

				Difference	
Train(s)[33]	Segment endpoints	Minutes of PRT in Amtrak schedule	Minimum run time from TPC	Minutes	Percentage
58	Southport Jct – Clark St.	914.0	933.0	(19.0)	-2.1%
59	Clark St. – Southport Jct.	892.0	928.0	(36.0)	-4.0%
390 / 392	Carbondale – Clark St.	265.0	280.5	(15.5)	-5.8%
391 / 393	Clark St. – Carbondale	265.0	279.1	(14.1)	-5.3%

The major inputs required to run CN's TPC simulation are (i) the length, weight and tractive characteristics of the train (which determines the Horsepower Per Ton or "HPT" of the train consist), (ii) the physical plant of the track over which the train will traverse in the model (including elevations and grades for the main track, turnouts and any other physical plant incorporated into the model), and (iii) the applicable maximum authorized speeds the relevant train is allowed to travel across the trackage.[178] These inputs can have a significant impact on

[redacted]

[178] Krueger Transcript at 43:22-45:7 (describing major inputs to running a TPC simulation).

the PRT results that are generated by the TPC simulation. [redacted]

1. ***CN Used Incorrect Amtrak Train Consists.***

As explained further below, the CN modelers improperly used 2 extra passenger cars when they modeled the PRT for the City of New Orleans service and 3 extra passenger cars when they modeled the PRT for the Illini/Saluki service. The inclusion of these extra cars lowers the HPT of the train consist used in the TPC simulations, which in turn (as noted above) produces a longer PRT because the train has less tractive power. The inclusion by the CN modelers of these extra cars in their TPC simulations undermines the reliability of their claim that the PRTs in Amtrak's schedules are "too short" for the City of New Orleans and Illini/Saluki services.

The CN modelers calculated the PRTs reflected above for the City of New Orleans trains using 1 P42 locomotive and 9 Superliner cars. The CN modelers calculated the PRTs reflected above for the Illini/Saluki trains using 1 P42 locomotive and 7 Amfleet/Horizon cars. However, our review of the workpapers that were provided by CN in connection with the Krueger V.S. indicate that CN ran multiple TPC simulations for these trains using different Amtrak consists of varying HPT. The results from the TPC simulations with these different HPT inputs produce very different results, particularly for the City of New Orleans train.

[redacted]

[redacted]

[redacted]

CN obtained PRT results for the City of New Orleans trains that were substantially <u>shorter</u> than the PRTs reflected in the Amtrak schedule.[180]

Moreover, the consist of 1 locomotive and 9 cars used by CN in its final calculation of the PRTs that are reflected in the Krueger V.S. for the City of New Orleans trains differed from the consist of 1 locomotive and 7 cars used by CN in its RCM capacity model.[181] The car weights used in the models also differed.[182] As a result of these changes in the train consist configuration, the PRTs for the City of New Orleans trains that the CN modelers used in their RCM capacity modeling studies were substantially lower (in the case of the northbound P58) or roughly equal (in the case of the southbound P59) to the corresponding PRTs set forth in Amtrak's schedules.[183]

In addition, the 1 locomotive and 7 car consist that the CN modelers used in the RCM capacity modeling is consistent with CN's own analysis of the average Amtrak consist on the

[redacted]

City of New Orleans trains for the relevant period.[184] CN has provided no rational explanation for why it increased the length of the consist of the City of New Orleans trains that was used for the TPC simulation results reflected in Table 13 of the Krueger V.S. (which addition of 2 Superliner cars had the effect of lowering the resulting HPT of the trains and producing longer PRT results).[185] We can only surmise that, in the absence of any reasonable explanation, this was done to improve the modeling outcome in order to support CN's claim that Amtrak's PR's on the City of New Orleans are too short.

Similarly, CN used a consist of 1 locomotive and 7 Amfleet/Horizon cars for its final calculation of the PRTs that are reflected in the Krueger V.S. for the Illini/Saluki trains. However, it is our understanding that Amtrak runs these Illini/Saluki trains with 7 cars only because of the axle restriction between Chicago and Carbondale on the IC Corridor that CN has imposed as a result of grade crossing activation failures associated with its signal equipment. It is also our understanding that there is an ongoing dispute between Amtrak and CN over responsibility for these failures, that the FRA is involved in trying to resolve the dispute, and that Amtrak would run the Illini/Saluki trains with 1 locomotive and only 4 Amfleet/Horizon cars if CN had not imposed the minimum axle count requirement. Therefore, any TPC modeling

---

[redacted] Therefore, we believe that Mr. Krueger's response to this question in the deposition was incorrect.

conducted by CN for the Illini/Saluki trains should have used the 1 locomotive and 4 car consist (which would have resulted in a higher HPT and correspondingly lower PRT results).[redacted]

2. ***CN Used An Incorrect Route, Infrastructure, and Speeds Through the Memphis Area*.**

The TPC simulations run by the CN modelers also incorporated various assumptions they made about the physical plant of the IC Corridor and the applicable speeds of the Amtrak trains operating on that corridor. For example, as noted in Section IV.E above, the TPC simulation (like RCM) could not model the approximately 17-mile stretch of track that Amtrak uses to access Amtrak's passenger station in Memphis. Therefore, the CN modelers assumed that the City of New Orleans trains would traverse over the freight route through CN's Harrison Yard in Memphis instead of the actual passenger route to Amtrak's Memphis passenger station. The CN modelers acknowledge that this assumed reconfiguration of the route through Memphis resulted in run times which are "slightly off" due to the differences in distance between the actual Amtrak passenger route through Memphis and the simulated route created by the CN modelers in their TPC.[187]

Although it is not entirely clear from the workpapers produced by CN, it appears that the CN modelers used a distance of approximately 18.7 miles to represent the fictitious Amtrak routing over the CN freight route through Harrison Yard in Memphis between Woodstock on the Fulton Subdivision and West Junction on the Shelby Subdivision. The actual route of the City of

---

[redacted]

[187] Krueger V.S. at 21, paragraph 7. The CN modelers do not define what they meant by "slightly off" run times. Given the other flaws in the TPC calculations conducted by CN, a difference of a few minutes in the PRT calculation as a result of the Memphis simulation could result in a material difference in the PRT calculated by CN for the City of New Orleans trains.

New Orleans trains via the separate passenger route between Woodstock and West Junction, which is mostly over the Memphis Subdivision, is approximately 16.4 miles in length.[redacted] This discrepancy in the length of the Amtrak route through Memphis that was modeled in TPC, coupled with the other flawed or questionable TPC assumptions made by the CN modelers, could have a material impact on the overall PRT calculations made by CN for the City of New Orleans route.

Similarly, it appears that the Amtrak train speeds used in the TPC modeling through the Memphis area are inconsistent with the actual speeds that Amtrak travels over its separate route through Memphis because of the different routing configuration through Harrison Yard and because of an extra stop at CN Junction (separate from the scheduled stop at Amtrak's Memphis Station) that was included in the TPC simulation by the CN modelers.[redacted] Since CN modeled a different route through Memphis than the actual route used by Amtrak, we do not know the extent to which their TPC simulation results differ from the actual PRT for the City of New Orleans trains. It is not clear to us, from our review of CN's workpapers, whether there may have been other material impacts to the TPC simulation results for the City of New Orleans trains as a result of the fictitious simulation used by CN to replicate Amtrak service through Memphis.[redacted]

[redacted]

C. CN Calculated Shorter PRTs for Amtrak Services on the GTW Corridor in Prior Analyses Than the PRTs Reflected in Amtrak's Schedules.

Although not mentioned in the Krueger V.S., CN also ran TPC simulations of the PRT for the Amtrak trains on the GTW Corridor (as a necessary first step to its capacity modeling studies on that corridor). [redacted] The CN modelers fail to mention any of these results in the Krueger V.S.

D. CN's Claim About Crossovers Is Unsupported By Specific Evidence.

The Krueger V.S. also asserts that, based on the TPC simulations conducted by the CN modelers, Amtrak trains should take no more than 2 minutes when using a crossover on CN.[192] However, we have not been able to identify any CN workpapers that support this conclusion or the associated calculations (if any) that the CN modelers did to reach this conclusion.

X. <u>Summary of Conclusions.</u>

A. Capacity Modeling Studies.

As we have explained, counsel for Amtrak asked us to review and evaluate the capacity simulation modeling undertaken by CN, and to offer our professional opinion as to whether those simulations, described in the Krueger V.S., support CN's infrastructure investment proposal.

[redacted]

[192] *See* Krueger V.S. at 37.

For the reasons described in detail above and summarized below, we have concluded that they do not.

A summary of our observations and conclusions with respect to CN's capacity modeling studies is as follows:

- Design issues and flaws in CN's simulation analyses cast substantial doubt on the reliability of CN's model results and study conclusions.
    - Use by the CN modelers of CN's propriety RCM model hinders full evaluation of the output;
    - CN's failure to model a base case of current freight and passenger operations undermines the validity of the simulation study results; and
    - The design flaw in CN's capacity modeling studies leads to only one possible conclusion: the studies always show a need for more infrastructure.
- The results and conclusions of CN's simulation studies are discredited by significant data issues and simplifying assumptions:
    - CN's conversion of monthly statistical delay targets to daily delay targets improperly restricted operations and led to CN's overstatement of infrastructure requirements;
    - CN's sample weeks were selected arbitrarily;
    - Substantial adjustments to freight train traffic data made by the CN modelers reduced the real-world relevancy of the output;
    - CN's modeling of parallel routes understates existing capacity; and
    - The RCM model's non-branching structure calls into question CN's modeling of freight and passenger operations through Memphis.

- CN's infrastructure proposals lack adequate documentation.
  - CN's subjective judgments in selecting recommended infrastructure improvements are opaque; and
  - The estimated costs of CN's infrastructure recommendations lack sufficient detail, and CN did not conduct any formal cost-benefit analysis.
- CN's simulations for the IC Corridor do not support the locations selected for, the alleged utility of, or the stated need for the Amtrak-funded infrastructure improvements proposed by CN.
  - CN's simulations do not support the locations selected for new infrastructure and suggest that some locations were selected to alleviate freight train delay by other freight trains rather than by Amtrak trains; and
  - CN's simulations do not support the use or need for the proposed new infrastructure:
    - In several cases, CN's simulations failed to use the proposed infrastructure;
    - In some cases, the proposed infrastructure was used only due to routing logic in CN's model; and
    - In some cases, it was uncertain why the proposed infrastructure was used as there was no apparent conflict between trains at those locations.
- CN's GTW Corridor infrastructure proposals far outweigh the perceived harm to CN.
  - CN's measurement of freight train delay attributable to Amtrak is small relative to the magnitude of the GTW Corridor infrastructure investment proposed by CN;
  - Need for the GTW Corridor infrastructure additions proposed by CN is not supported by CN's Scenario 2 simulations; and

- Need for the GTW Corridor third track near Gord proposed by CN is not supported by CN's Scenario 3 simulations.

B. PRT Calculations.

In addition, counsel for Amtrak asked us to evaluate the reliability of CN's PRT calculations for the City of New Orleans and Illini/Saluki services as set forth in the Krueger V.S. Our conclusions with respect to these calculations are summarized below.

- CN used a proprietary train performance calculator to develop its PRT estimates.
- CN's evaluation of Amtrak PRT on the City of New Orleans and Illini/Saluki service is flawed for numerous reasons relating to incorrect inputs used by the CN modelers in the TPC simulations used to generate those PRT results;
  - CN used incorrect Amtrak train consists; and
  - CN used an incorrect route, infrastructure, and speeds through the Memphis area of the IC Corridor simulation.
- CN calculated shorter PRTs for Amtrak services on the GTW Corridor in prior analyses than the PRTs reflected in Amtrak's schedules.
- CN's claim about crossovers is unsupported by specific evidence.

VERIFICATION

I, Judith H. Roberts, verify under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Rebuttal Verified Statement.

Executed on September 14, 2017

Judith H Roberts

Judith H. Roberts

VERIFICATION

I, John H. Williams, verify under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Rebuttal Verified Statement.

Executed on September 14, 2017

John H. Williams

LIST OF EXHIBITS

Attachment A	Resumes of John H. Williams and Judith H. Roberts.
Attachment B	Krueger V.S. Exhibit 1 – CN recommendations for infrastructure additions.
Attachment C-1	[redacted]
Attachment C-2	[redacted]
Attachment C-3	[redacted]
Attachment D	[redacted]
Attachment E	[redacted]
Attachment F	[redacted]
Attachment G	[redacted]
Attachment H	[redacted]
Attachment I	[redacted]
Attachment J	[redacted]

	[redacted]
Attachment K	[redacted]
Attachment L	[redacted]
Attachment M	[redacted]
Attachment N	[redacted]
Attachment O	[redacted]
Attachment P	[redacted]
Attachment Q	[redacted]
Attachment R	[redacted]
Attachment S	[redacted]
Attachment T	[redacted]
Attachment U	[redacted]

	[redacted]
Attachment V	
Attachment W	
Attachment X	
Attachment Y	
Attachment Z	
Attachment AA	
Attachment AB	Sketch of the track layout in the vicinity of CN's Baron-Gord segment.
Attachment AC	[redacted]
Attachment AD	
Attachment AE	

	[redacted]
Attachment AF	[redacted]
Attachment AG	[redacted]
Attachment AH	[redacted]
Attachment AI	[redacted]
Attachment AJ	Handwritten map prepared by Amtrak of the approximate mileage on the CN freight route and the Amtrak passenger route through the Memphis area.
Attachment AK	[redacted]
Attachment AL	[redacted]

ATTACHMENT A

JUDITH H. ROBERTS

Expertise in railroad mergers and acquisitions, economic and strategic analysis, marketing research and traffic studies, litigation support, contracts negotiation, and Rail Traffic Controller (RTC) computer simulation.

EXPERIENCE

Woodside Consulting Group (1983-present). Vice President.
Economic analysis, traffic studies, marketing research, litigation support, contracts negotiation, and computer analyses. RTC simulation of train operations, network capacity, and infrastructure improvements. Principal projects:

- Simulation Analyses:
  - Commuter Rail Feasibility Analysis – for Norfolk Southern Corp. (NS), North Carolina Railroad, and Triangle Transit Authority (TTA). RTC assessment of infrastructure requirements for potential operation of a commuter rail system in the Raleigh-Durham region.
  - Alexandria-Lynchburg Passenger Train Study - for NS and the Virginia Department of Rail and Public Transportation. Analysis of impacts and infrastructure requirements for proposed passenger service between Alexandria and Lynchburg, VA.
  - Pacific Northwestern Railroad (PNWR) - for Genesee & Wyoming Railroad. Simulation of potential changes in railroad operations and required infrastructure.
  - Crescent Corridor Capacity Study – for NS and the Commonwealth of Virginia. RTC analysis of capacity requirements for shifting truck traffic from highways to parallel rail routes.
  - Detroit-Ann Arbor Commuter Service Capacity Study – for the Southeast Michigan Council of Governments and NS. RTC assessment of Conrail and NS infrastructure needs for operation of commuter rail passenger service.
  - 3C Corridor Railroad Capacity Study – for Ohio Rail Development Commission. RTC analysis of a proposed intercity rail passenger service in the Cleveland-Columbus-Cincinnati (3C) rail corridor and recommended infrastructure improvements.
  - Meridian-New Orleans Corridor Study – for NS and CSXT. RTC simulation of possible re-routing of CSX trains to joint usage of NS's Meridian-New Orleans corridor.
  - Keystone West Rail Capacity Study – for Pennsylvania Department of Transportation and NS. RTC study of proposed added Harrisburg-Pittsburgh passenger service.
- Shared Assets Areas Review and Evaluation – for NS and CSX Transportation. Market studies and operational analyses.
- Split of Conrail – for NS. Marketing studies and litigation support of NS's acquisition of a portion of Conrail.
- Contract operator selection – for San Francisco Peninsula Commuter Rail Service (Caltrain).
- Commuter rail service right-of-way purchase negotiations – San Francisco and Los Angeles areas.
- Regional railroads business plans appraisals/development – for MidSouth Rail; Dakota, Minnesota, and Eastern; Montana Rail Link; Illinois Central Railroad; and others.

Northwestern Pacific Railroad Company (2011-present). Vice President.
Traffic records, revenue assessment, special projects.

Southern Pacific Transportation Company. Transportation Analyst, Executive Department. Economic analysis, policy planning, and litigation support in furtherance of strategic goals of top management. Principal projects: Tucumcari Line acquisition case; commuter service litigation leading to public financing and operation.

Stanford Research Institute (SRI International). Transportation Analyst.
Principal projects: Computer analysis of shipping commodity flows for rate modification; economic and social impacts of railroad relocation within urban areas; decision history of San Francisco Bay Area Rapid Transit District.

Columbia University Computer Center. Computer Programmer.

Western Electric Company, Bell Telephone Laboratories. Information Systems Designer.

EDUCATION
B.A., Mathematics, Vassar College.
M.S., Civil Engineering: Transportation, Stanford University.
M.S., Operations Research, Stanford University.

Attachment A
Resume of John H. Williams

My name is John H. Williams. I am President of The Woodside Consulting Group, Inc., 250 Cambridge Avenue, Suite 104, Palo Alto, CA 94306, a firm which specializes in railroad transportation consulting. I am also President of the Northwestern Pacific Railroad Co., a shortline in northern California, whose re-start I co-founded in 2006.

I was educated at the University of Illinois, where I received a B.A. in Liberal Arts and Sciences in 1962, with a major in economics, and an M.B.A. in 1963, with finance as my area of specialization; my educational training included courses in these fields as well as in marketing and operations. Although transportation was not a recognized area of emphasis for either degree, that was my interest throughout college; as a result, I completed almost every transportation course, either in the College of Commerce and Business Administration or in the Department of Civil Engineering, offered by Professors D. Philip Locklin (transportation economics), W. W. Hay (railway engineering), and K. U. Flood (distribution).

During my fifty-plus-year career in railroading at Southern Pacific, Conrail, the Federal Railroad Administration, Manalytics, and The Woodside Consulting Group, my work has required me to consider most aspects of railroading, including marketing, operations, finance, economics, planning and public policy. As President of The Woodside Consulting Group, I have an extensive background in all aspects of the railroad industry, with special expertise in litigation support, mergers and acquisitions, regional and short line formation, operations simulation modeling, railroad finance, economics, marketing, and policy analyses.

In 1963, I joined the Southern Pacific Transportation Company as a Transportation Analyst in the Bureau of Transportation Research. Following a year of introductory training, I was transferred to the Total Operations Processing System ("TOPS") project, which was responsible for designing and obtaining the adoption of a real-time, computerized information system for planning, controlling, and evaluating railroad operations. This was a pioneering project in computerized management and control of railroads, which was subsequently adopted by numerous other carriers.

In 1966, I joined the Operating Department of Southern Pacific, working initially as a brakeman on the Western Division and subsequently as an Assistant Trainmaster in El Centro, California. In early 1967, I was promoted to Trainmaster at Lordsburg, New Mexico, where I was responsible for supervising train operations over some three hundred miles of Southern Pacific's main line track, plus branch lines, between Tucson and El Paso.

In 1968, I was granted a three-year leave of absence to join the Department of Transportation's newly formed Federal Railroad Administration in Washington, D.C. As a Transportation Specialist in the Office of Policy and Planning, I provided economic and operational analyses, and evaluated, proposed, and assisted in the development of various public policies affecting the railroads. I specialized in rail network restructuring (where I developed FRA's first rail network model) and mergers, freight car supply, and other rail operational issues, in addition to formulating FRA's economic research and development program. During that time, I also represented FRA as a member of Assistant Secretary Charles D. Baker's interdepartmental team which proposed deregulation of the railroads; many of the concepts and policies that we debated then have now been implemented through the 4-R Act, the Staggers Act, and through subsequent Interstate Commerce Commission and Surface Transportation Board initiatives.

In 1972, I returned to Southern Pacific as a Special Assistant in the Executive Department, with responsibility for coordinating the preparation of Southern Pacific Company's corporate ten-year financial plan. Later that year, I was promoted to Manager of the Bureau of Transportation Research, the organization in which I began my railroad career in 1963. In that capacity, I managed a staff of some twenty individuals, reporting directly to the senior executive management of Southern Pacific. We were responsible for analyses of commodity and route profitability, cost-of-service calculations, evaluations of possible line abandonments, and analyses of prospective investments and acquisitions- -both railroad and non-railroad. In addition, we were responsible for presentations before regulatory authorities; I appeared before the Interstate Commerce Commission on several such issues.

In late 1977, I was promoted to the position of Assistant to the Vice President in the Executive Department of Southern Pacific. In that position, I managed the Office of Special Projects, which was created in order to permit me to concentrate on those matters of particular importance to the senior executive management of Southern Pacific. At that time, those special projects included transfer of responsibility for funding and operation of SP's San Francisco rail commuter service to the public sector (a transition successfully begun in 1980), as well as Southern Pacific's prospective acquisitions of the Chicago, Rock Island & Pacific's Tucumcari Line (successfully completed in 1979) and of the Seaboard Coast Line System (now part of CSXT).

In August 1980, I left Southern Pacific to become Assistant Vice President – Strategic Analysis for Consolidated Rail Corporation in Philadelphia. I reported directly to the Chairman, Mr. Edward G. Jordan, and my responsibilities continued to be focused in the mergers and acquisitions area. I directed the preparation of Conrail's position on the Norfolk Southern merger - - and testified before the Interstate Commerce Commission in that case - - as well as the preparation of Conrail's merger studies and policy position in the Union Pacific/Missouri Pacific/Western Pacific merger case. In both instances, I participated in the negotiated settlements that resulted. I was also responsible for designing and evaluating structural alternatives to Conrail as a corporate entity.

In late 1981, I returned to San Francisco as Vice President/Land Transportation of Manalytics, Inc., a transportation consulting firm. There, I was responsible for the business development and conduct of land transportation activities.

In October 1983, I became President of The Woodside Consulting Group, Inc. In this capacity, I am responsible for all of the business conduct and policy decisions of our firm. We offer a broad range of transportation consulting services, both to public agencies and private sector clients, dealing primarily with railroad transportation issues.

In March 1985, representing both the California Public Utilities Commission (CPUC) and the California Department of Transportation, I presented testimony before the Interstate Commerce Commission in the Southern Pacific/Santa Fe merger proceeding. My testimony - - which was cited in the Commission's *Decision* - - analyzed the market impacts of that proposed merger on California and its shippers, and recommended the imposition of conditions in order to mitigate the anticompetitive effects of that merger, as proposed.

In May 1988, representing the Kansas City Southern, I presented testimony before the Interstate Commerce Commission, including a substantial portion of the required Exhibit 12 - - Impact Analysis, in support of that carrier's application for control of the Southern Pacific Transportation Company. My testimony analyzed the market impacts of a consolidated Kansas City Southern/Southern Pacific System on shippers, competition, efficiency, and other carriers. I also submitted testimony in opposition to the proposed Denver and Rio Grande Western/Southern Pacific combination, in which I characterized those applicants' Exhibit 12 **–** Impact Analysis as being unrealistic in the marketplace.

During 1996, I provided consulting advice and analyses to the CPUC with regard to the Union Pacific's proposed acquisition of Southern Pacific. My recommendations toward ensuring the preservation of adequate and effective competition were included in the CPUC's presentation to this Board.

During June 1997, in support of Norfolk Southern's application to acquire control of certain portions of Conrail, I presented a Rail Traffic Diversion Study to the Surface Transportation Board. See Finance Docket No. 33388, *Conrail Transaction*, Williams VS, CSX/NS-19 at 61-96 (June 1997). The Board accepted the results of that Study in its *Decision* approving the Conrail Transaction.

In October 1998, I provided a Market Impact Study to the Surface Transportation Board concerning the effects on Norfolk Southern of the proposed consolidation of the Canadian National Railway and the Illinois Central Railroad Companies.

As a part of our consulting practice, The Woodside Consulting Group has undertaken more than three dozen regional railroad analyses, including due diligence studies, the preparation of Business Plans, and assessments of the operating entities when the Business Plans were not being met. Included among the railroads we have studied are MidSouth Rail Corporation, Paducah & Louisville Railways, Inc., Dakota, Minnesota & Eastern Railroad Corporation, and Montana Rail Link. For each such analysis, my responsibility has been either to prepare a marketing plan or to evaluate whether the marketing plan being presented was realistic. I also served as Chairman of the Board of Directors of the Dakota, Minnesota & Eastern Railroad Corporation and, from 1993 to 1995, as Executive Director of the North Coast Railroad Authority.

In the past eleven years, Woodside has gained substantial experience in RTC operations simulation modeling experience. I have directed Woodside's RTC Modeling efforts for numerous train operations modeling and infrastructure modification and improvements studies.

Several examples of the numerous RTC projects completed by The Woodside Consulting Group since 2004 are listed below:

<u>3C Corridor Railroad Capacity Analysis</u>
On behalf of the Ohio Rail Development Commission, Woodside conducted an analysis of the proposed Intercity Rail Passenger Service in the Cleveland-Columbus-Cincinnati (3C) Rail Corridor using the RTC Model. Woodside provided infrastructure recommendations and estimated costs.

<u>Detroit-Ann Arbor Commuter Service Capacity Study</u>
On behalf of NS and the Southeast Michigan Council of Governments, Woodside determined both Conrail's and NS's infrastructure needs and costs to operate commuter rail passenger service along a Detroit-Ann Arbor 38-mile route.

<u>Crescent Corridor Capacity Study</u>
For NS and the Commonwealth of Virginia, Woodside determined the feasibility and costs of shifting significant volumes of truck traffic from I-81 and other principal highways to NS's parallel Crescent Corridor rail routes. Infrastructure additions to main line capacity were recommended and evaluated using the RTC Model.

<u>Meridian – New Orleans Corridor Study</u>
For NS and CSX Transportation, Inc., Woodside conducted a Route Utilization Project between Meridian and New Orleans that analyzed the potential effect of rerouting daily about 20 CSX trains away from storm-damaged areas.

<u>Keystone West Rail Capacity Study</u>
For NS and PENNDOT, Woodside analyzed the proposed operation of additional passenger service between Harrisburg and Pittsburgh by determining the impacts on NS's freight trains and existing Amtrak train operations. The project included infrastructure improvements recommendations and cost estimates.

<u>Central Ohio Transit Authority Study</u>
On behalf of Central Ohio Transit Authority, Woodside performed a Freight Railroad Capacity Analysis of the Columbus region. The effects on the impacted freight lines, primarily owned by NS and CSX, were quantified, and Woodside recommended infrastructure improvements and estimated the associated costs to mitigate those impacts.

EDUCATION

B.A., Liberal Arts & Sciences, University of Illinois, Urbana
M.B.A., Specializing in Finance and Transportation, University of Illinois, Urbana

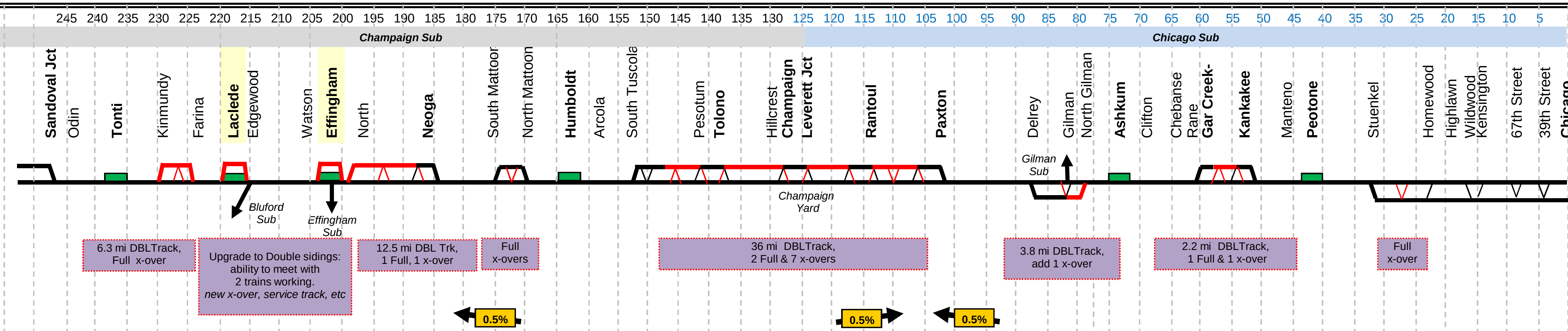
ATTACHMENT B

Chicago to New Orleans Corridor

Required Plant: Scenario 3, 95% 90% OTP

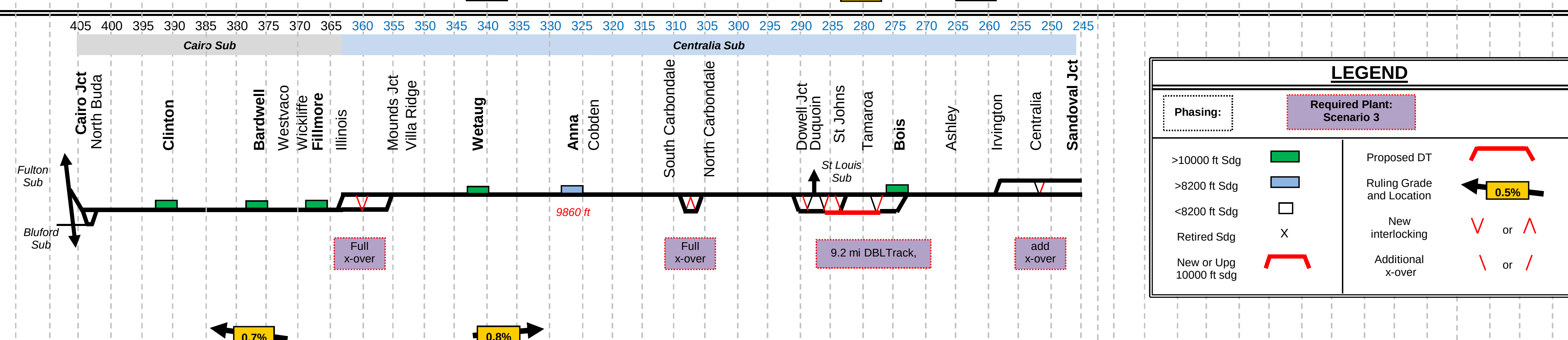
Chicago and Champaign Subs

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	60.8	$ 243 M
New Siding, R&D:	$ 6 M	2	$ 12 M
Extend Siding:	$ 4 M	0	$ 0 M
Full X-overs:	$ 2.3 M	7	$ 16 M
Addt'l X-over:	$ 1 M	10	$ 10 M
SUM:			$ 281 M



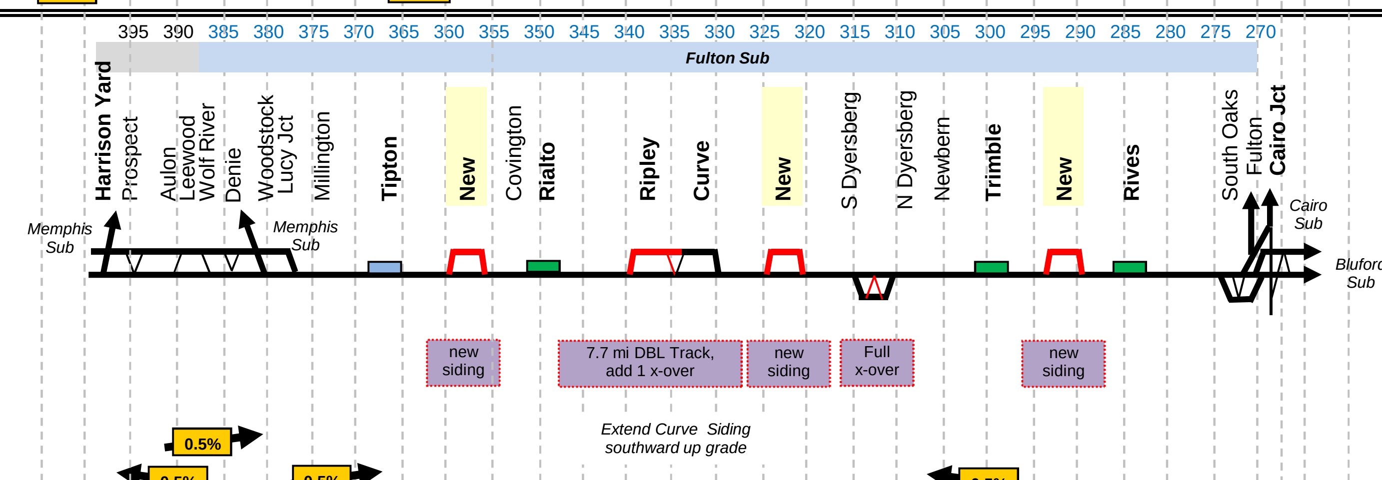
Centralia and Cairo Subs

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	9.2	$ 37 M
New Siding, R&D:	$ 6 M	0	$ 0 M
Extend Siding:	$ 4 M	0	$ 0 M
Full X-overs:	$ 2.3 M	2	$ 5 M
Addt'l X-over:	$ 1 M	5	$ 5 M
SUM:			$ 46 M



Fulton Sub.

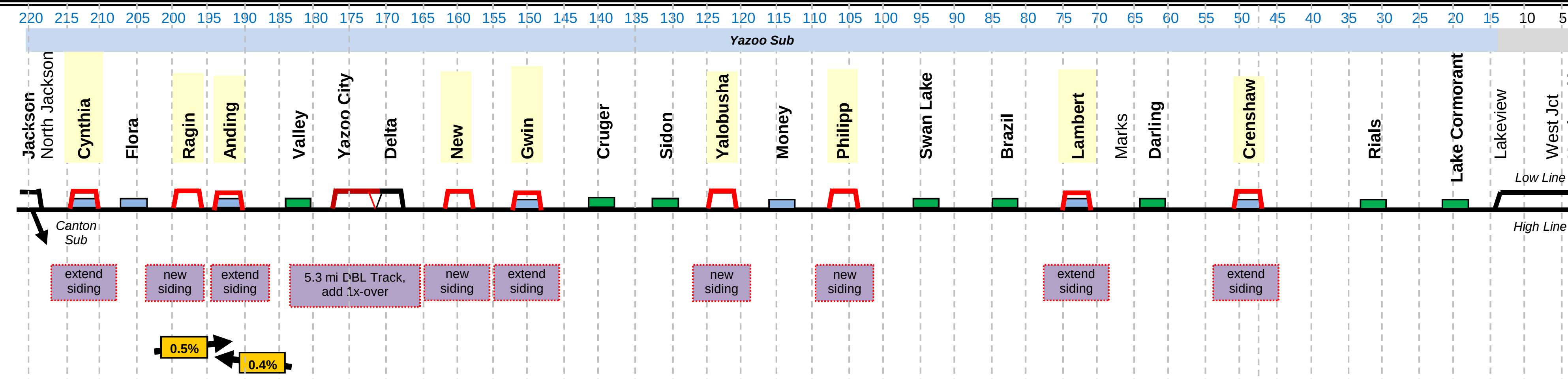
NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	7.7	$ 31 M
New Siding, R&D:	$ 6 M	3	$ 18 M
Extend Siding:	$ 4 M	0	$ 0 M
New Interlocking:	$ 2.3 M	1	$ 2 M
Addt'l X-over:	$ 1 M	1	$ 1 M
SUM:			$ 52 M



Revised: July 2015
CN Network Planning

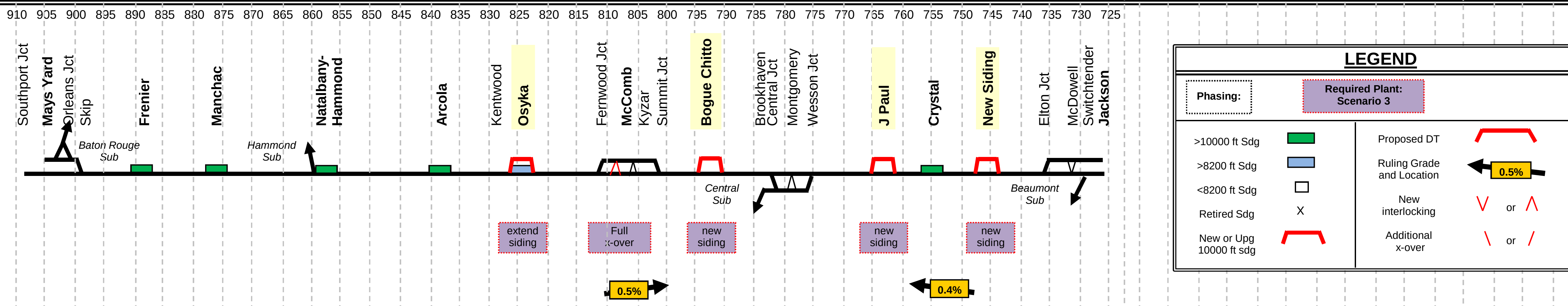
Yazoo Sub.

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	5.3	$ 21 M
New Siding, R&D:	$ 6 M	4	$ 24 M
Extend Siding:	$ 4 M	5	$ 20 M
New Interlocking:	$ 2.3 M	0	$ 0 M
Addt'l X-over:	$ 1 M	1	$ 1 M
SUM:			$ 66 M



McComb Sub

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	0	$ 0 M
New Siding, R&D:	$ 6 M	3	$ 18 M
Extend Siding:	$ 4 M	1	$ 4 M
New Interlocking:	$ 2.3 M	1	$ 2 M
Addt'l X-over:	$ 1 M	0	$ 0 M
SUM:			$ 24 M



CHICAGO to NEW ORLEANS CORRIDOR

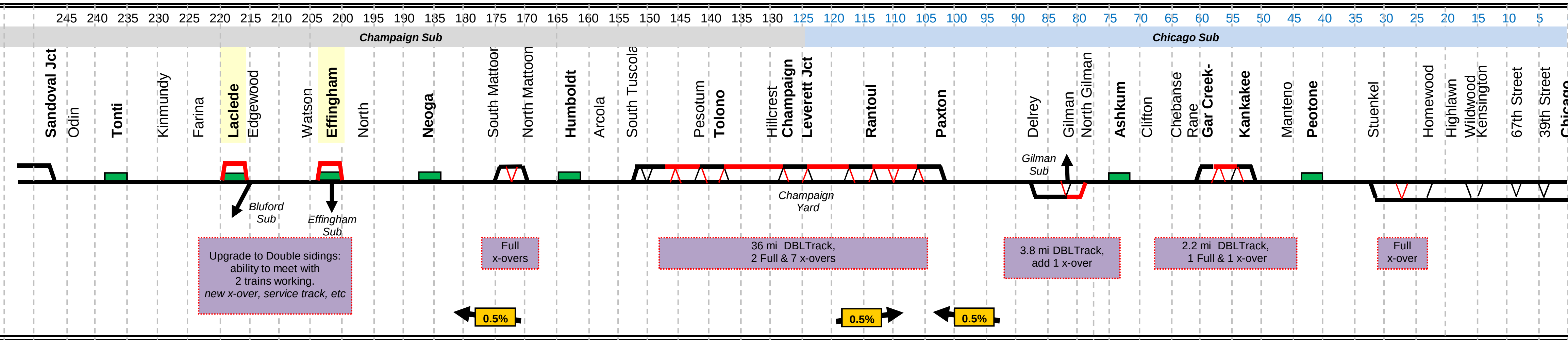
NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	83.0	$ 332 M
New Siding, R&D:	$ 6 M	12	$ 72 M
Extend Siding:	$ 4 M	6	$ 24 M
New Interlocking:	$ 2.3 M	11	$ 25 M
Addt'l X-over:	$ 1 M	17	$ 17 M
SUM:			$ 470 M

Required Plant: Scenario 3, 80% OTP

Chicago to New Orleans Corridor

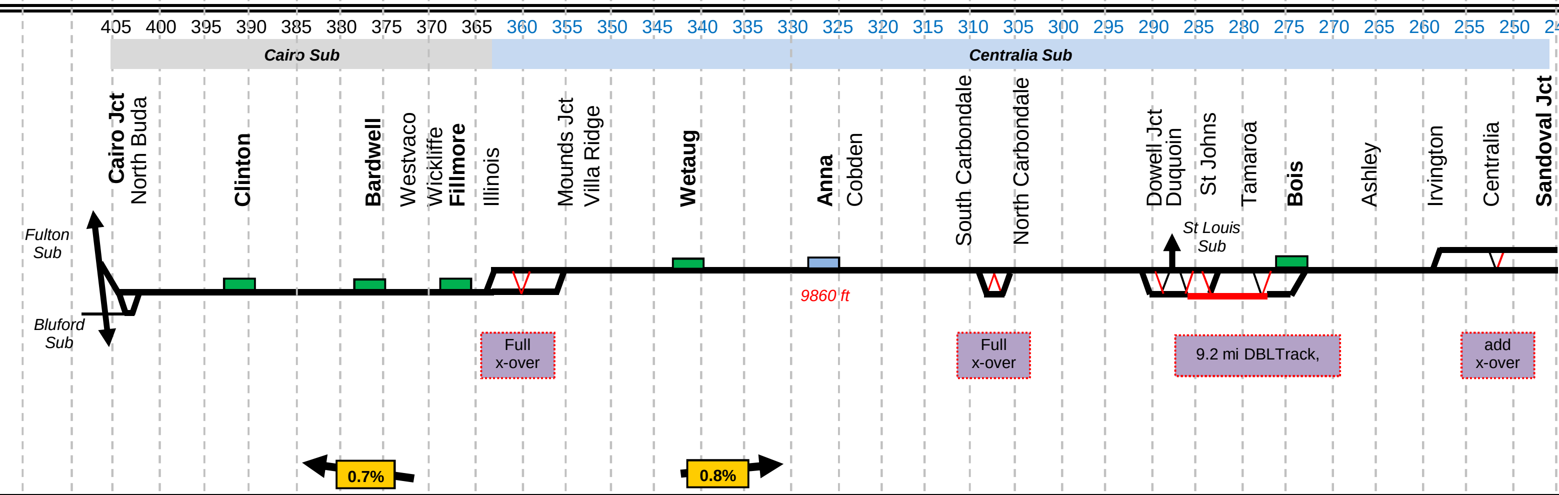
Chicago and Champaign Subs

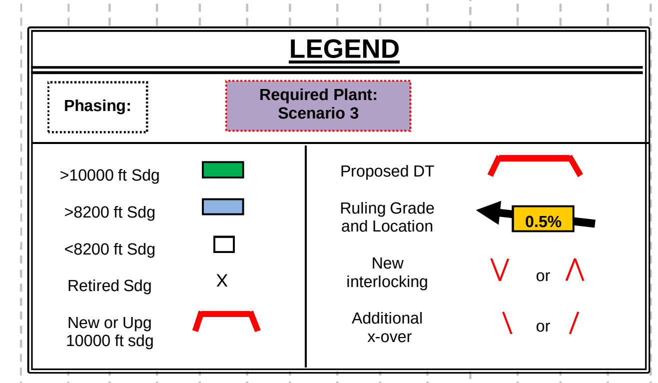
NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	42.0	$ 168 M
New Siding, R&D:	$ 6 M	2	$ 12 M
Extend Siding:	$ 4 M	0	$ 0 M
Full X-overs:	$ 2.3 M	5	$ 12 M
Addt'l X-over:	$ 1 M	9	$ 9 M
SUM:			$ 201 M



Centralia and Cairo Subs

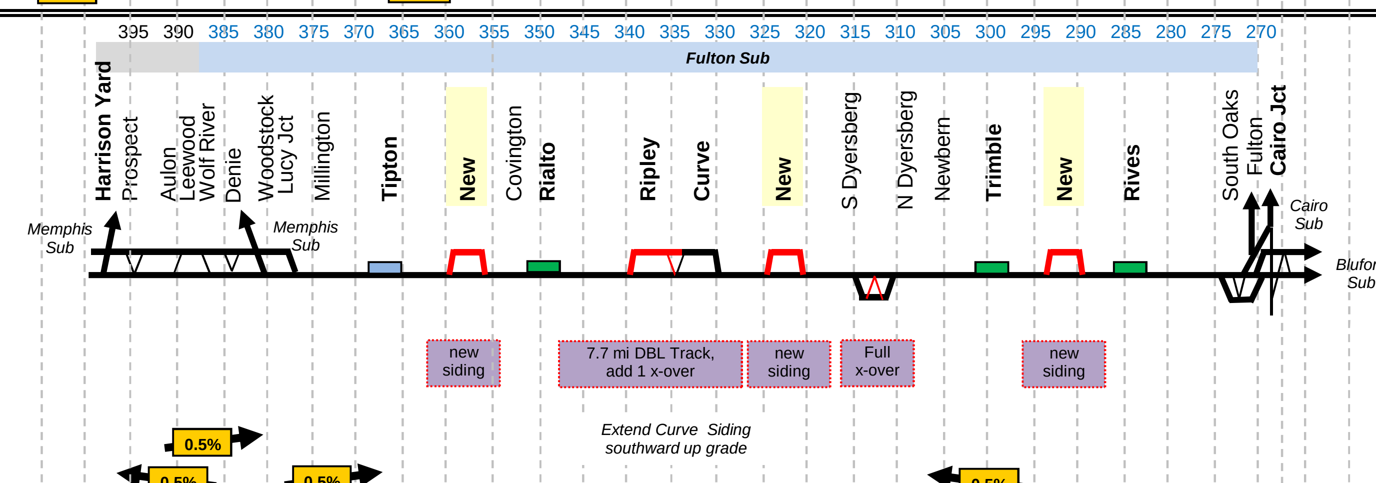
NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	9.2	$ 37 M
New Siding, R&D:	$ 6 M	0	$ 0 M
Extend Siding:	$ 4 M	0	$ 0 M
Full X-overs:	$ 2.3 M	2	$ 5 M
Addt'l X-over:	$ 1 M	5	$ 5 M
SUM:			$ 46 M





Fulton Sub.

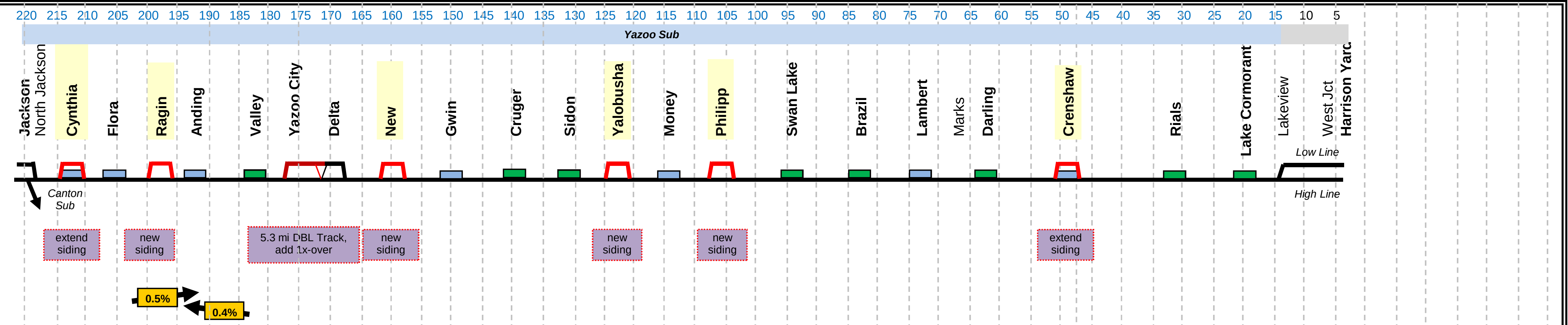
NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	7.7	$ 31 M
New Siding, R&D:	$ 6 M	3	$ 18 M
Extend Siding:	$ 4 M	0	$ 0 M
New Interlocking:	$ 2.3 M	1	$ 2 M
Addt'l X-over:	$ 1 M	1	$ 1 M
SUM:			$ 52 M



Revised: July 2015
CN Network Planning

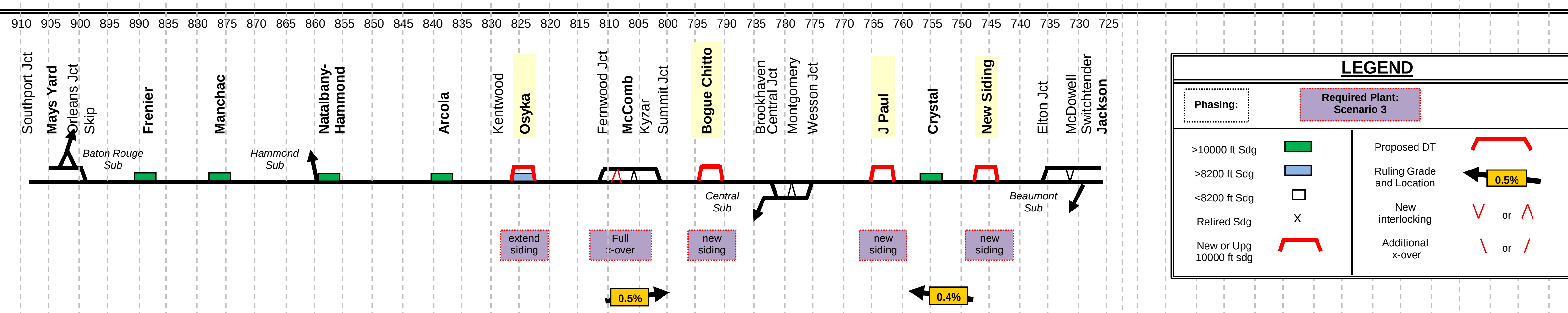
Yazoo Sub.

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	5.3	$ 21 M
New Siding, R&D:	$ 6 M	4	$ 24 M
Extend Siding:	$ 4 M	2	$ 8 M
New Interlocking:	$ 2.3 M	0	$ 0 M
Addt'l X-over:	$ 1 M	1	$ 1 M
SUM:			$ 54 M



McComb Sub

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	0	$ 0 M
New Siding, R&D:	$ 6 M	3	$ 18 M
Extend Siding:	$ 4 M	1	$ 4 M
New Interlocking:	$ 2.3 M	1	$ 2 M
Addt'l X-over:	$ 1 M	0	$ 0 M
SUM:			$ 24 M



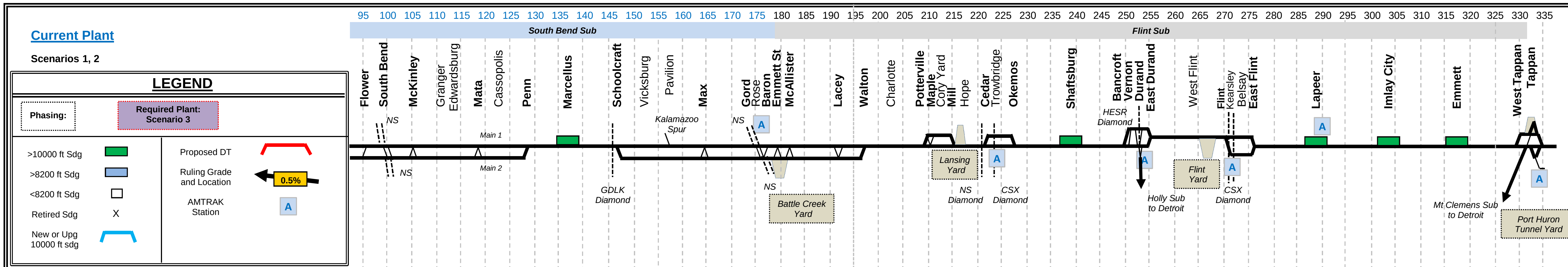
CHICAGO to NEW ORLEANS CORRIDOR

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	64.2	$ 257 M
New Siding, R&D:	$ 6 M	12	$ 72 M
Extend Siding:	$ 4 M	3	$ 12 M
New Interlocking:	$ 2.3 M	9	$ 21 M
Addt'l X-over:	$ 1 M	16	$ 16 M
SUM:			$ 378 M

Port Huron to South Bend - Overview Schematic
(Flint and South Bend Subdivisions)

Current Plant

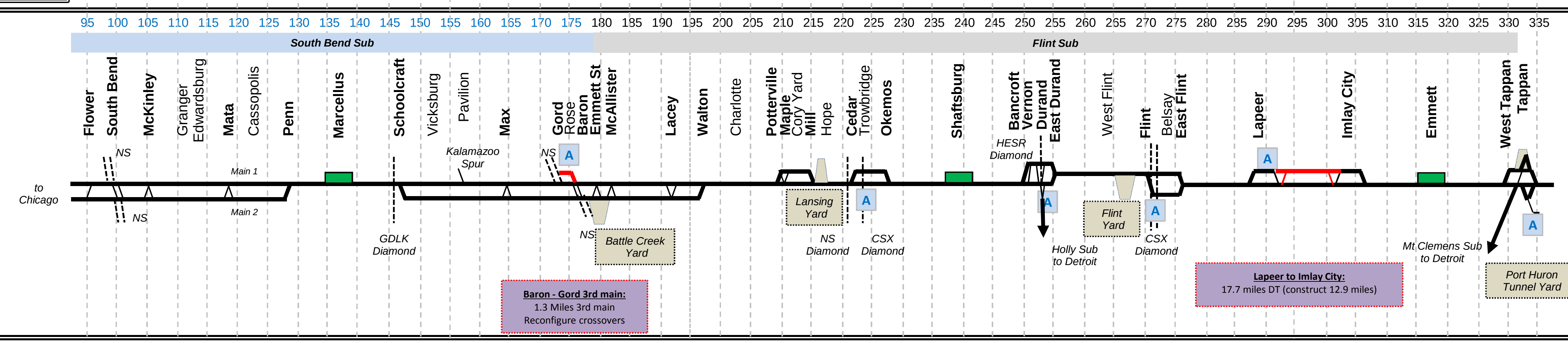
Scenarios 1, 2



Proposed Plant

Scenario 3

NEW PLANT	Unit $'s	NEW	$
Baron-Gord Track:	fixed cost		$ 10 M
Double Track:	$ 4 M / mi	12.9	$ 52 M
New Siding, R&D:	$ 6 M	0	$ 0 M
Extend Siding:	$ 4 M	0	$ 0 M
Full X-overs:	$ 2.3 M	0	$ 0 M
Addt'l X-over:	$ 1 M	2	$ 2 M
SUM:			$ 64 M



ATTACHMENT C

ATTACHMENT C-1

[REDACTED]

ATTACHMENT C-2

[REDACTED]

ATTACHMENT C-3

[REDACTED]

ATTACHMENT D

[REDACTED]

ATTACHMENT D1

[REDACTED]

ATTACHMENT D2

[REDACTED]

ATTACHMENT D3

[REDACTED]

ATTACHMENT D4

[REDACTED]

ATTACHMENT D5

[REDACTED]

ATTACHMENT E

[REDACTED]

ATTACHMENT F

[REDACTED]

ATTACHMENT G

[REDACTED]

ATTACHMENT H

[REDACTED]

ATTACHMENT I

[REDACTED]

ATTACHMENT J

[REDACTED]

ATTACHMENT K

[REDACTED]

ATTACHMENT L

ATTACHMENT L1

[REDACTED]

ATTACHMENT L2

[REDACTED]

ATTACHMENT L3

[REDACTED]

ATTACHMENT L4

[REDACTED]

ATTACHMENT L5

[REDACTED]

ATTACHMENT L6

[REDACTED]

ATTACHMENT M

[REDACTED]

ATTACHMENT N

[REDACTED]

ATTACHMENT O

ATTACHMENT O1

[REDACTED]

ATTACHMENT O2

[REDACTED]

ATTACHMENT O3

[REDACTED]

ATTACHMENT O4

[REDACTED]

ATTACHMENT P

ATTACHMENT P1

[REDACTED]

ATTACHMENT P2

[REDACTED]

ATTACHMENT Q

[REDACTED]

ATTACHMENT R

ATTACHMENT R1

[REDACTED]

ATTACHMENT R2

[REDACTED]

ATTACHMENT R3

[REDACTED]

ATTACHMENT R4

[REDACTED]

ATTACHMENT R5

[REDACTED]

ATTACHMENT S

[REDACTED]

ATTACHMENT T

[REDACTED]

ATTACHMENT U

[REDACTED]

ATTACHMENT V

[REDACTED]

ATTACHMENT W

[REDACTED]

ATTACHMENT X

[REDACTED]

ATTACHMENT Y

[REDACTED]

ATTACHMENT Z

[REDACTED]

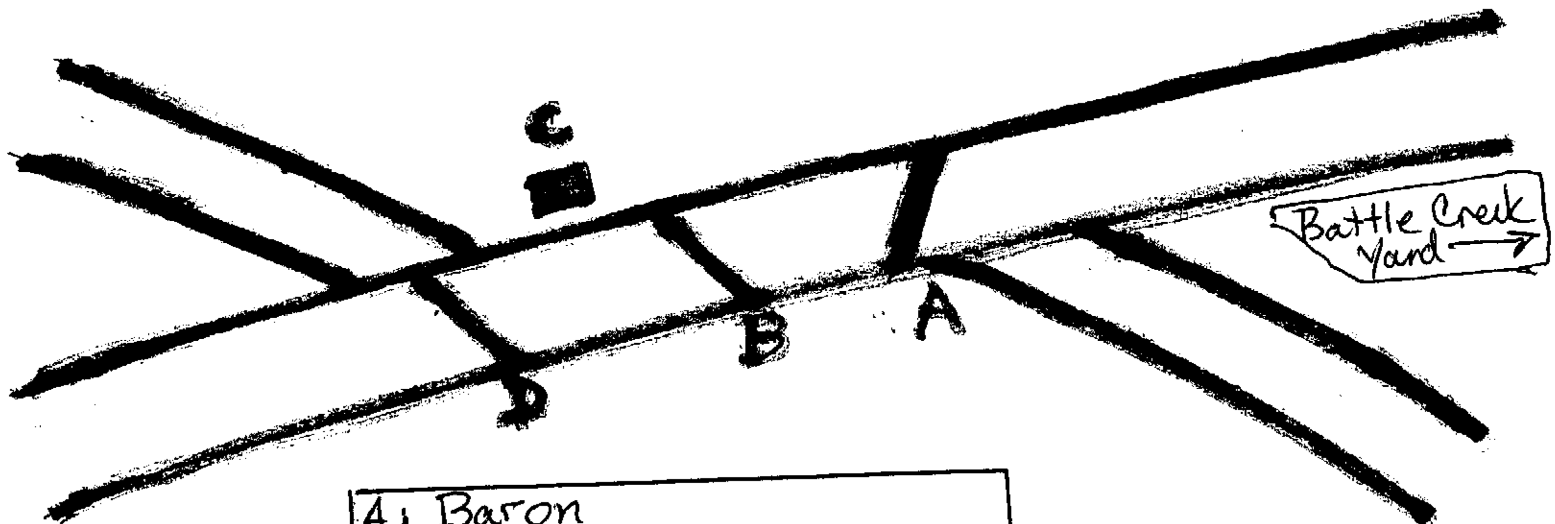
ATTACHMENT AA

[REDACTED]

ATTACHMENT AB

Attachment

Sketch: Baron-Gord



A: Baron
B: Rose
C: Battle Creek Amtrak Station
D: Gord

Distance, Baron-Gord: 1.2 miles
(Not to scale)

ATTACHMENT AC

[REDACTED]

ATTACHMENT AD

[REDACTED]

ATTACHMENT AE

[REDACTED]

ATTACHMENT AF

[REDACTED]

ATTACHMENT AG

[REDACTED]

ATTACHMENT AH

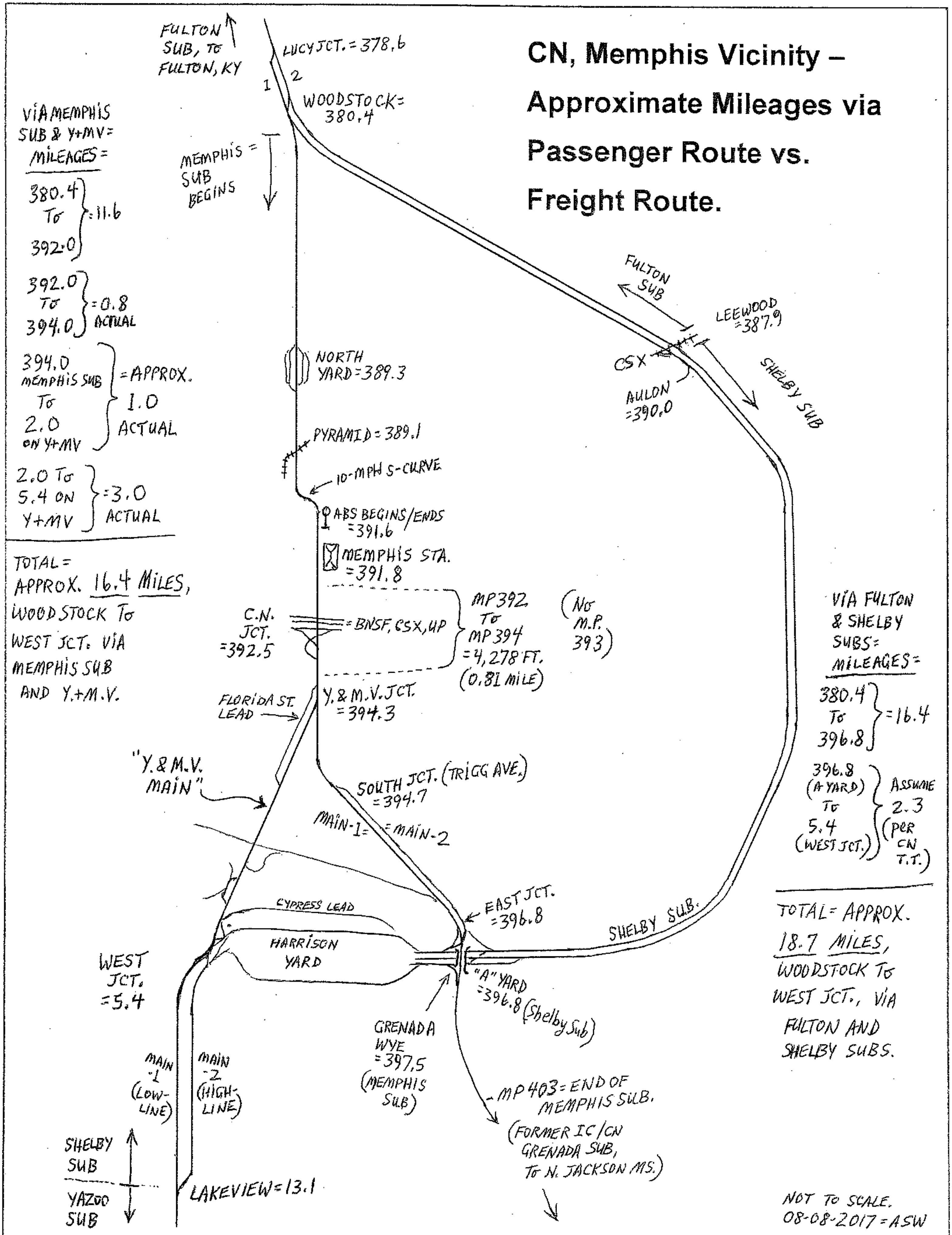
[REDACTED]

ATTACHMENT AI

[REDACTED]

ATTACHMENT AJ

CN, Memphis Vicinity – Approximate Mileages via Passenger Route vs. Freight Route.



ATTACHMENT AK

[REDACTED]

ATTACHMENT AL

[REDACTED]

PUBLIC VERSION - REDACTED

BEFORE THE
SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(A) – CANADIAN NATIONAL RAILWAY COMPANY

REBUTTAL SUBMISSION OF NATIONAL RAILROAD PASSENGER CORPORATION

VOLUME III

Kevin M. Sheys
Edward J. Fishman
Justin J. Marks
Hubert T. Lee
Nossaman LLP
1666 K Street, NW, Suite 500
Washington, DC 20006
(202) 887-1400

William H. Herrmann
Christine E. Lanzon
National Railroad Passenger Corporation
60 Massachusetts Avenue, NE
Washington, DC 20002
(202) 906-3971

Counsel for National Railroad Passenger Corporation

September 14, 2017

TABLE OF CONTENTS

TAB

Volume I

JOINT REBUTTAL VERIFIED STATEMENT OF
PAUL VILTER AND JASON MAGA....................A

REBUTTAL VERIFIED STATEMENT OF BENJAMIN SACKS....................B

Volume II

REBUTTAL VERIFIED STATEMENT OF ALAN FRANKEL....................C

JOINT REBUTTAL VERIFIED STATEMENT OF THOMAS CROWLEY
AND ROBERT MULHOLLAND....................D

JOINT REBUTTAL VERIFIED STATEMENT OF JOHN WILLIAMS AND
JUDITH ROBERTS....................E

Volume III

REBUTTAL VERIFIED STATEMENT OF EDWARD FISHMAN....................F

PUBLIC VERSION – REDACTED

BEFORE THE
SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(A) – CANADIAN NATIONAL RAILWAY COMPANY

REBUTTAL VERIFIED STATEMENT OF EDWARD J. FISHMAN

I. Introduction

My name is Edward J. Fishman. I am a partner with the law firm Nossaman LLP and serve as outside counsel for the National Railroad Passenger Corporation ("Amtrak") in this proceeding. I submit this Rebuttal Verified Statement in support of Amtrak's Rebuttal Submission.

II. Krueger Deposition Transcript and Exhibits

As counsel for Amtrak, I took the deposition of Mr. Harald Krueger on July 7, 2017. Mr. Krueger is the Senior Manager of Network Planning for Canadian National Railway Company ("CN") and one of the sponsors of the Joint Verified Statement of Harald Krueger, Brian Doyle, and Nikola Rank ("Krueger J.V.S.") that was filed by CN in September 2015 as part of its Opening Submission in this proceeding. The certified transcript of the July 7, 2017 deposition of Mr. Krueger (the "Krueger Transcript"), the accompanying deposition exhibits, a workpaper supporting the Krueger J.V.S. that was provided by CN to Amtrak, and post-deposition correspondence from CN's counsel regarding some of those deposition exhibits are attached to this Rebuttal Verified Statement.

The primary purpose of this Rebuttal Verified Statement is to submit the Krueger Transcript and its exhibits into the evidentiary record and to explain the significance of certain workpapers that were produced by CN and discussed during the Krueger deposition.

The Krueger Transcript (including its exhibits) has been certified in accordance with 49 C.F.R. § 1114.24(g) by the court reporter who transcribed the deposition. A complete copy of the Krueger Transcript (including its exhibits) is attached to this Rebuttal Verified Statement as **Attachment 1**. Mr. Krueger provided his changes in form and/or substance to the deposition transcript along with his signature verification on August 8, 2017. A true and correct copy of this errata sheet from Mr. Krueger is attached hereto as **Attachment 2**. Our review of the deposition transcript revealed that there were numerous other transcription errors not addressed by Mr. Krueger's errata submission. Therefore, we prepared a supplemental list of corrections to clarify the record and submitted that supplemental correction list to CN's counsel on August 20, 2017. A true and correct copy of our supplemental correction sheet is attached hereto as **Attachment 3**. Also attached to this Rebuttal Verified Statement as **Attachment 4** is a workpaper supporting the Krueger R.V.S. that CN provided to Amtrak relating to Amtrak's Wolverine service. Lastly, a true and correct copy of a letter we received on July 19, 2017 from CN's counsel relating to the workpapers discussed during the Krueger deposition is attached hereto as **Attachment 5**.

The certified transcript for Mr. Krueger's deposition and accompanying deposition exhibits are being submitted by Amtrak as evidence in this proceeding pursuant to 49 C.F.R. § 1114.24(b)(2). Portions of the Krueger Transcript and its exhibits (**Attachment 1**), and **Attachments 2, 3, 4** and **5** to this Rebuttal Verified Statement have been designated as "Confidential" or "Highly Confidential" pursuant to the parties' December 16, 2013 Stipulated

Protective Order. The documents attached to this Rebuttal Verified Statement have otherwise not been altered in any way and remain in the form in which they were provided to Amtrak.

This Rebuttal Verified Statement shall also serve as notice to CN that Amtrak is filing the Krueger Transcript (and its exhibits) as evidence in this proceeding in accordance with 49 C.F.R. § 1114.24(i).

III. Krueger Workpapers Produced by CN

The foundation for much of my questioning of Mr. Krueger during his deposition was based on certain workpapers produced by CN to Amtrak. In conjunction with the filing of the Krueger J.V.S. as part of its Opening Submission in this proceeding, CN provided to Amtrak a DVD containing a multitude of files that were described as the workpapers supporting the Krueger J.V.S. (collectively, the "Krueger Workpapers").[1] Within the "Amtrak" subfolder of the DVD containing the Krueger Workpapers produced by CN, there are numerous Excel spreadsheets and PDF documents which contain information relating to simulations that CN conducted using its proprietary Train Performance Calculator ("TPC") for the various Amtrak services which operate over CN.

Mr. Kruger testified during his deposition that "the purpose of the TPC is to define or calculate the minimum time [MRT][2] that it would take for that train to move over that route. It's a performance calculator."[3] Mr. Krueger further acknowledged that the MRT results from the TPC simulations conducted by CN with respect to the Amtrak services are necessarily affected by the inputs and assumptions used in the simulation, including the train consist assumption used

---

[1] These Krueger Workpapers are referenced at least 15 times in the footnotes to the Krueger J.V.S. *See, e.g.*, Krueger J.V.S. at 6 ("These documents can be found in the folder "Manuals, TT's, etc." on the DVD containing the workpapers that support this statement").

[2] The "minimum run time" or "MRT", which Amtrak refers to as pure running time ("PRT"), is intended to reflect the travel time of a given train between two points at maximum authorized speed, without delays. *See* Krueger Transcript. at 45:21-46:9.

[3] *Id.* at 45:24-46:2.

for each Amtrak service.[4] Amtrak train consist assumptions included in CN's TPC simulations included (i) the type of locomotive, (ii) the number and type of passenger cars, (iii) the locomotive horsepower, (iv) the head end power ("HEP")[5], (v) the total weight of the train, and (vi) the resulting HPT.[6] Once the Amtrak train consist information and any other relevant assumptions are plugged into the TPC simulation, it produces an MRT "output" or calculation for the relevant Amtrak service over CN.[7]

The Krueger Workpapers produced by CN to Amtrak reflect that numerous TPC simulations were conducted by CN using varying Amtrak train consists and resulting HPT assumptions, which resulted in different minimum run time/MRT calculations for the relevant Amtrak services over CN. During his deposition, Mr. Krueger was shown several of these workpapers in an attempt to understand the basis for the MRT calculations reflected in Table 13 of the Kruger J.V.S.[8] That table reflects MRT results for the City of New Orleans service[9] and the Illini/Saluki service[10] that were determined by CN through these TPC simulations.[11] The Krueger J.V.S. asserts that based on the MRT results reflected in Table 13 for the City of New Orleans and Illini/Saluki services, "it appears the PRT in Amtrak's schedule is insufficient for

[4] *Id.* at 46:2-5. In addition to the train consist information, the TPC also must be calibrated with the track infrastructure, authorized speeds and other physical characteristics (including grade and elevation) on the applicable route. *Id.* at 43:22-45:7.
[5] Mr. Krueger testified that the HEP reflects the tractive power available to the locomotive at the wheel after accounting for any power drawn for electrical or other systems on the train. *Id.* at 48:17-49:5.
[redacted]
[7] *Id.* at 45:24-46:2.
[8] *See* Krueger J.V.S. at 36.
[9] *See id.* (noting that Table 13 reflects different MRT results for the southbound City of New Orleans train between Chicago and New Orleans (Amtrak train P59) and the northbound City of New Orleans train between New Orleans and Chicago (Amtrak train P58)).
[10] *See id.* (noting that Table 13 reflects different MRT results for the southbound Illini/Saluki trains between Chicago and Carbondale (Amtrak trains P391 and P393) and the northbound Illini/Saluki trains between Carbondale and Chicago (Amtrak trains P390 and P392)).
[11] The Krueger J.V.S. also notes that the MRT results reflected in Table 13 were calculated using a consist of one P42 locomotive and nine Superliner passenger cars for the City of New Orleans trains, and a consist of one P42 locomotive and seven Amfleet/Horizon passenger cars for the Illini/Saluki trains. *Id.* at 36 fn. 33.

some trains."[12] A substantial portion of Mr. Krueger's deposition focused on our effort to understand which workpapers produced by CN actually supported the MRT results reflected in Table 13 and why other workpapers produced by CN reflected different (and, in some cases, substantially different) MRT results for the same Amtrak service.

However, when presented with various workpapers reflecting MRT outputs from TPC simulations during his deposition, [redacted]

[redacted] CN's counsel also made a statement on the record during the deposition declaring that CN was unsure if or to what extent the workpapers provided to Amtrak and presented to Mr. Krueger during the deposition were "actual workpapers" supporting the Krueger J.V.S.[16] Given this confusion, this Rebuttal Verified Statement is being submitted to clarify the record. Below, I will describe various

---

[12] *Id.* at 36.
[redacted]
[16] *See id.* at 201:14-202:6.

workpapers presented to Mr. Krueger during the deposition relating to the MRT calculations developed by CN and Mr. Krueger's relevant testimony regarding each document.

IV. CN's MRT Calculations for the City of New Orleans

During his deposition, Mr. Krueger was presented with various workpapers containing information relating to TPC simulations that CN conducted with respect to Amtrak's City of New Orleans service between Chicago and New Orleans.[17] Below is a summary of the information about the MRT calculations reflected in those workpapers and Mr. Krueger's related testimony.

[redacted]

[redacted]

[redacted]

---

[17] Amtrak's City of New Orleans service operates over CN between Clark Street in Chicago and Southport Junction in New Orleans. The entire route of the City of New Orleans service is over CN except for the short segments of Amtrak-controlled track between Chicago and Clark Street and between Southport Junction and New Orleans.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted] [redacted] [redacted]

[redacted]

[redacted]

[redacted]

V. CN's MRT Calculations for the Illini/Saluki Trains

The workpapers provided to Amtrak by CN in support of the Krueger J.V.S. also included TPC MRT calculations for Amtrak's Illini/Saluki service (P390, P391, P392, and P393).[redacted] [redacted]

VI. CN's MRT Calculations for the Blue Water and Wolverine Trains

CN also provided workpapers in support of the Krueger J.V.S. that included TPC MRT calculations for Amtrak's Blue Water and Wolverine services (P364/365 and P350/P352/P353/P355 respectively).[redacted] [redacted]

[redacted]

[redacted] [redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted]

VII. Post-Deposition Letter from CN's Counsel

As explained above, Mr. Krueger could not identify during his deposition the specific workpapers that supported the MRT results reflected in Table 13 of the Krueger J.V.S. filed with CN's Opening Submission.[redacted] Indeed, CN's counsel stated on the record during the deposition that some of the workpapers shown to Mr. Krueger during his deposition may not have been

---

[redacted]

"truly workpapers" and that CN would endeavor to identify the specific workpapers that supported the MRT calculations reflected in Table 13.[59] I stated on the record that Amtrak had received those documents from CN designated as Mr. Krueger's workpapers in support of the Krueger J.V.S. and that Amtrak, in addition to awaiting the results of CN's further analysis, would reserve the right to interpret the significance of these documents as it deemed appropriate.[60]

On July 19, 2017, I received a letter from CN's counsel which is attached hereto as **Attachment 5**. [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] Moreover, the uncertainty about whether the MRT calculations set forth in **Exhibit 11** actually support the MRT results set forth in Table 13 of the Krueger J.V.S. raises additional questions about the reliability of CN’s MRT calculations.

VERIFICATION

I, Edward Fishman, verify under penalty of perjury that the foregoing is true and correct. Further, I certify that I am qualified and authorized to file this Rebuttal Verified Statement.

Executed on September 14, 2017

Edward Fishman

ATTACHMENT 1

[Note – the Krueger Transcript was initially designated as “confidential” but has since been re-designated as “public” in part, “confidential” in part, or “highly confidential” in part]

BEFORE THE SURFACE TRANSPORTATION BOARD

FINANCE DOCKET NO. 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER
CORPORATION UNDER 49 U.S.C. SECTION 24308(A)
CANADIAN NATIONAL RAILWAY COMPANY

- CONFIDENTIAL -

Deposition of Harald Krueger
Washington, D.C.
July 7, 2017
9:30 a.m.

Reported by: Bonnie L. Russo

Deposition of Harald Krueger held at:

Harkins Cunningham, LLP
1700 K Street, N.W.
Washington, D.C.

Pursuant to Notice, when were present on behalf of the respective parties:

APPEARANCES:

On behalf of the Plaintiff:
EDWARD J. FISHMAN, Esq.
HUBERT LEE, Esq.
NOSSAMAN, LLP
1666 K Street, N.W.
Suite 500
Washington, D.C. 20006
202-887-1400
efishman@nossaman.com
hlee@nossaman.com

On behalf of the Defendants:
DAVID A. HIRSH, Esq.
HARKINS CUNNINGHAM, LLP
1700 K Street, N.W.
Washington, D.C. 20006
202-973-7606
dhirsh@harkinscunningham.com

Also Present:
Kathryn Gainey, CN, Counsel, Regulatory Affairs

C O N T E N T S

EXAMINATION OF HARALD KRUEGER	PAGE
BY MR. FISHMAN	6

EXHIBITS

Exhibit 1	Joint Verified Statement of Harald Krueger, Brian Doyle, and Nikola Rank	128
Exhibit 2	Train 59 Schedule Version 1	139
Exhibit 3	Train 59 Schedule Version 2	149
Exhibit 4	Train 59 Schedule Version 2A	152
Exhibit 5	Train 59 Schedule Version 2B HK	158
Exhibit 6	Amtrak & Metra Consists Summary 1-1-13 - 10-28-13	169
Exhibit 7	Train 59 Schedule Version 3	173
Exhibit 8	Train 59 Schedule Version 4	188
Exhibit 9	E-Mail Chain dated 5-7-10	193
Exhibit 10	ITS Train P05801-01	205
Exhibit 11	Draft Potential Amtrak Schedules	214
Exhibit 12	Amtrak Schedule Comparison	234
Exhibit 13	Route Capacity Model	278

EXHIBITS (CONTINUED):

Exhibit 14 Spreadsheets 280
Exhibit 15 Track Capacity 300

(Exhibits included with transcript.)

P R O C E E D I N G S

HARALD KRUEGER,
was called for examination by counsel and, after having been duly sworn by the Notary, was examined and testified as follows:

MR. FISHMAN: Okay. So this is the deposition of Harald Krueger being taken pursuant to a notice issued by Amtrak and Surface Transportation Board, Finance Docket 35743, application of the National Railroad Passenger Corporation under 49 USC 24308(A), Canadian National Railway Company.

The parties have agreed to designate the deposition as confidential pursuant to the protective order in this proceeding.

EXAMINATION BY COUNSEL FOR PLAINTIFF.

BY MR. FISHMAN:

Q. Mr. Krueger, good morning.

Can you state your name -- complete name and spell it for the record?

A. Harald Otto Krueger. Spelled, H-A-R-A-L-D, K-R-U-E-G-E-R. Middle name, O-T-T-O.

MR. FISHMAN: Great.

Why don't we have Counsel introduce themselves? I'll start.

I'm Ed Fishman from Nossaman on behalf of Amtrak.

MR. LEE: Hubert Lee for -- with Nossaman, LLP on behalf of Amtrak.

MR. HIRSH: David Hirsh from Harkins Cunningham, LLP representing Illinois Central Railroad Company and Grand Trunk Western Railroad Company and subsidiaries of Canadian National Railway Company.

I -- I also want to note before Kathy introduces herself that we reserve the right to review the transcript.

MS. GAINEY: Kathryn Gainey with CN.

MR. FISHMAN: Great.

BY MR. FISHMAN:

Q. Mr. Krueger, have you ever been deposed before?

A. No, I have not.

Q. Okay. Well, in that case, I'll go over some of the ground rules just so we have a full understanding of how this process works.

The court reporter has placed you under oath which means you're testifying today under penalty of perjury as if you were in a courtroom.

Do you understand that?

A. Yes, I do.

Q. Okay. To make life easier for the court reporter and all of us, it's very important that we be cognizant that we're creating a record and so make sure that to the extent you give any nonverbal responses we try to avoid those, nodding your head or shaking your head, and so we either give a yes-or-no answer, and that will make life easier for the court reporter.

Do you understand that?

A. Yes, I do.

Q. Okay. Great.

And, then, similarly, when I'm asking questions, I'll do my best to let you respond before I ask another question and I just ask the same of you. You let me finish my question before you start to respond and that will create a cleaner transcript.

Does that make sense?

A. That makes sense.

Q. Great, great, great.

Is there any reason either mentally or physically that you're not prepared to testify truthfully and fully today?
A. No, there is not.
Q. Okay. Great, great.
Okay. Why don't we get started and just go over your -- your educational background.
Are you -- what -- what is your educational background?
A. I have a BSC, Bachelor of Science in Civil Engineering from the University of New Brunswick.
Q. Okay. Do you have any professional licenses?
A. I have a professional license with the Alberta Professional Engineer -- Engineer's Association.
Q. Okay. Is that specific to civil engineering?
A. I'm not aware of how the Alberta engineering profession designates it. It's PEng, professional engineering.
Q. Okay. What's required to maintain that status as a licensed professional

engineer?

A. In Alberta, the requirements are that every three years you would -- within a three-year period, you need to have so many hours or days of a variety of professional work, mentoring, other means or other -- other things of practicing your profession. And they require to fill out every three years a form of where you have spent the time and activity exercising or doing those activities.

Q. Okay. Does that include speaking at engineering conferences, for example?

A. That would be one area that would count toward the -- the hours or the -- the score card of practicing your profession, yes.

Q. What about writing articles, is that another way to satisfy those requirements?

A. That is also another way that could be a contributing fact -- contributing means for maintaining your PEng status.

Q. Okay. Had your -- had your status ever been suspended, denied, or revoked for any reason?

A. No, it has not.

Q. Okay. Do you have any other

professional license or certification?
A. Not that I'm aware of, no.
Q. Okay. Great.
When did you start working in the railroad industry?
A. In 1981.
Q. Okay. And did you join Canadian National at that time?
A. Yes, I did.
Q. I should just confirm, are you still currently an employee of the Canadian National Railroad?
A. Yes, I am.
Q. And where are you based?
A. Edmonton, Alberta.
Q. Okay. When you joined CN in 1981, what was your position?
A. Junior transportation engineer.
Q. Okay. Where were you based?
A. Montreal, Quebec.
Q. Okay. What were your responsibilities as a junior transportation engineer?
A. I'm not sure what all of them were for that length of time, but basically any work

of working on transportation planning related issues, gathering data for others, doing calculations, doing modeling, doing designs of a variety of transportation planning, engineering activities at a junior level.
Q. Okay. And what was your next position with the railroad?
A. Next position would have been a -- again, a junior transportation engineer, but in the terminal planning group.
Q. Okay. When did that change occur?
A. Not sure of the exact date. That would have occurred around '82, '83.
Q. Okay. Which group were you in prior to that?
A. In the line planning.
Q. Okay. What's the difference -- what was the difference between line planning and terminal planning?
A. Line planning was looking at the line segment, line component of the rail network. So the subdivisions, the -- the infrastructure between the terminals.
Q. Okay.
A. The signal system, the speeds, the

track, the signs.
Q. And what was terminal planning?
A. That was focused on the terminal side. So looking at the yards, designing yards, analyzing yards. So the other fundamental component of a freight railroad.
Q. Okay. So you started -- just to clarify, you started as a junior transportation engineer in the line planning group and then, roughly, a year later you were transferred over to the terminal planning group; is that accurate?
A. Well, that sounds reasonable. It may be longer than a year.
Q. Okay.
A. You know, a year-and-a-half or so.
Q. What was your next position with CN?
A. Next position at CN was, to the best of my recollection, the regional transportation engineer in Toronto, Ontario.
Q. When did that change occur?
A. Best of my knowledge, it occurred roughly around 1984, '85.
Q. And how did your responsibilities change when you became a regional

transportation engineer?
A. They changed in that it was more focused on the Toronto region. So it's relative to system assessment than analysis. My skills and expertise were applied to the regional level and focused on the commuter-passenger service expansion in Toronto.
Q. Okay. What was your next position with the railroad?
A. Next position -- I was there until '90 -- 1990, then came back to headquarters as a transportation engineer back in the planning group on -- on the system -- system transportation planning group, similar role and responsibility, but covering more the system, as well as the -- the region and division.
Q. Okay. And when you say "came back to headquarters," you're talking about back to Montreal?
A. Montreal.
Q. Okay. Were you working with the models when you started at CN?
A. When I started at CN, yes. The CN -- the group that I came was part of -- were

developing models and tools within the railway industry as a ground corporation, and, I mean, worked with that in development internally to CN, as well as, externally with other the Class 1s, and with the variety of industry leading consultants and soft quarter developers.

Q. Okay. Did your responsibility with respect to modeling change over time?

A. Yes, they did.

Q. Okay. In what ways?

A. Changed in becoming more involved in the development. The development and greater application of the models and tools.

Q. Okay. Let's take you from 1990 forward. So 1990 transportation engineer and system planning group, what was your next position with CN?

A. Potentially a variety of different titles, fundamentally the same work. So the title of my job would have changed a number of times as the organization changed, as my bosses and managers changed, but basically it continued to having the same role and responsibility of the capacity operational assessment of freight and passenger service on a system basis.

Q. Okay. That fundamentally same work you just referred to, did that continue from 1990 until today, or did your responsibilities change significantly at some other point in the future?

A. I'm not sure what you mean by "responsibilities significantly changed." Being responsibilities became -- I became more responsible for things. I also -- with the privatization of CN, the responsibility expanded to include the -- the various other elements of acquisitions of CN. So, in '81, as a prime corporation, the layout or what CN was at that time was different than what it is now. So responsibilities would have covered whatever area of CN was expanded or -- yeah. Expanded or purchased or however you would put that.

Q. Okay. Did you -- at what point did you wrote -- relocate to Edmonton?

A. That was August in 2000.

Q. Okay. And why did that occur?

A. The -- that's where the job was. So network operations or the department moved to Edmonton and the associated positions were

relocated to Edmonton.
Q. Okay. So between 1990 and 2000, is that the period you referred to earlier where you were doing fundamentally the same work with different titles?
A. Correct.
Q. Okay. And that was all in Montreal?
A. That was all in Montreal.
Q. Okay. Great.
So let's start with August of 2000, you moved to Edmonton. What was your title at that point?
A. I can't recall the title. It would have been some form of transportation planning, transportation engineer, capacity planner.
Q. Okay. And you mentioned the department was called "Network Operations;" is that correct?
A. I don't recall what it was called at that time. I do not believe it -- the department I was in was called that. We -- I have always been under CN operations. The name of CN operations and my function changed numerous times.
Q. Okay. From your move to Edmonton

until today, did you change roles?
A. I would say I did change roles. Roles and responsibility of change in staff, not change in roles of the type of work that I did. I was still, again, continuing doing the same work of capacity analysis, transportation planning, facility design. My role changed from being a transportation engineer to being a manager. So fundamental change in role was inclusion of staffing, becoming a manager of others.
Q. Okay. When did that occur?
A. The first staff I got would have been in the area of around 2004, 2005.
Q. Okay. And that was while you were in Edmonton?
A. In Edmonton, yes.
Q. Okay. And so you -- did you -- were you a manager, then, at that point? Is it fair to say your title included the word "manager"?
A. Manager may have been included in the previous positions, but I had no -- no staff or resources. Definitely when I gained staff -- gained an individual, then they changed the title to manager.

Q. Okay. And so that occurred, you said, in 2004, you became a manager --
A. A manger.
Q. -- of employees?
A. Right. Around that time. I'm not certain of the exact time frame.
Q. Okay. From that point forward, please describe how your department changed.
A. The work role responsibility was similar. The expectations were similar, was still responsible for assessing, evaluating, and answering capacity-related questions. The fundamental change was having staff and in undertaking more work with more bodies. The big change was with the staff in trying to train and gain them -- develop their skills and experience in the -- the tools and/or the science of capacity planning.
Q. Okay. When you first became a manager, how many employees did you have reporting to you?
A. One.
Q. Okay. How many employees, ultimately, reported to you over the course of time from that point until today?

A. Four.
Q. Okay. What's your current title?
A. I believe it's in my statement if I can't remember it --
Q. Okay.
A. -- but I believe it's senior manager network planning.
Q. Okay. Do you recall when that became your title?
A. Around 2010.
Q. Okay. And from that point in 2010, when you became the senior manager of network planning, how many people were in your group?
A. In 2010?
Q. Yes.
A. That would have been two to three --
Q. Okay.
A. -- to the best of my knowledge.
Q. Okay. And what does that group look like today?
A. Four people.
Q. Okay. Who's in your group today? Who are the four people that -- that report to you?
A. They are Lloyd Reed.

Q. Uh-huh.
A. Shane Allam, Kevin Trieu, and Tim Robinson.
Q. Are they all based in Edmonton?
A. Yes, they are.
Q. Okay. And who do you report to today?
A. I believe today it's to Joe Bekavac.
Q. Okay. And what is his title?
A. Director of something. I would have to look. The company is going through a reorg. So he has a -- position is -- we -- I do not know specifically. I have to look at the org chart to see what it is.
Q. Okay. I believe Mr. Bekavac submitted a verified statement in this proceeding. And in that verified statement he describes his title -- now, this would be as of September 2015, describes his title as the director of system network operations asset optimization.
Does that sound like that could be his current title or you're just not sure?
A. I'm pretty sure that it is not his title because CN has gone through a reorg. He

has taken on more role responsibility.
Q. Okay.
A. It may still be his title on his business card. I have no idea.
Q. Okay. But you report to Joe. The bottom line, regardless of his title he is your manager?
A. In the org chart, that is the direct line of my connection to my boss.
Q. Okay. And, then, is it fair to call your group the network planning group?
A. I wouldn't word it like that just because the terms have so many different meanings. So we're basically, I would say, the transportation planning group.
Q. Okay. So you and the four people that report to you would be the transportation planning group. And then what -- what department do you fall into?
A. Network operations.
Q. Okay. Network operations.
And is Joe the head of network operations?
A. No, he's not.
Q. Okay. Who's the head of network

operations?
A. To the best of my knowledge, I believe that is Mac Barker.
Q. Okay. Okay. And -- and you -- you do not report directly to Mac?
A. On paper, I do not.
Q. Okay.
A. I do have a line of communication to Mr. Barker for questions and inquiries as I do to a number of other people, but no. On paper, my boss is Joe Bekavac.
Q. Okay. What other groups fall under network operations?
A. You're testing my memory. I'm --
Q. To the best of your recollection.
A. To the best of my recollection, which would not be complete, means service design falls under that, corporate measures, mode of power, crew, cars -- car group. I believe inter-model. So, basically, any function under operations would fall under the network operations.
Q. Okay.
A. The dispatching. So their RTCs, which is network operations, and there's

probably others that I can't -- that I'm missing.

Q. Okay. And is network operations, then, part of the larger operations group?

A. Network operations falls under Mike Corey, who is the Chief Operating Officer. So I'm not sure what your question is or how -- how to answer that. I -- I don't know what the other group of operations. It would be in -- under the Chief Operating Officer.

Q. Okay. So it's not like there's network operations and then there's all kinds of other operations that fall under Mike Corey?

I'm just trying to get a sense of -- so where you fit in CN.

A. There -- you know, there definitely are regional functions and departments that you'll have the -- you know, the general manager of Western Canada, general manager of Eastern Canada, you know. And that all falls under Mike Corey. I believe, they are independent from network operations, but network operations, to the best of my knowledge, is a -- looks at the system and will give the direction of how the system operations are to be executed or objectives, or managed or -- so it's the network operation looks after the network, the regional look after the regions.

There is lines of communication responsibility between those two. I am not familiar enough with the politics or the hierarchy to get any more specific; or, if I have a clear understanding exactly, how that management organization works.

Q. Okay. You -- you mentioned some of the groups that you believe fall under network operations, including your -- what I'll call transportation planning group. That's the term you used. Service design, you mentioned corporate measures, mode of power, and a few others.

What -- what is Joe Bekavac's role? Is he the head of one of those groups?

A. He is the head or the director of some of those groups. I believe that corporate measures would report to him. Transportation planning reports to him. Crew management reports to him. There is a change, part of the org change of mode of power that -- I believe there's a change in the responsibility on the mode of power mechanical side that Joe is now -- has some role in.

Q. Okay.

A. And there's likely also other -- there are other functions that report to Joe.

Q. Okay. Does Joe report to Mac Barker?

A. Yes, he does.

Q. Okay. Today, in your role as the senior manager of network planning, what are your main responsibilities?

A. I would like to refer to my statement because it's the best.

Q. Okay.

A. I have many roles and responsibility. Main role and responsibility would cover the assessment evaluation of capacity -- line capacity and yard capacity on the CN network. It also includes the passenger scheduling for the Canadian Via rail service. Also, includes any third-party new service request on our network to evaluate the -- the capacity impacts or issues. But, primarily, it's a review and assessment of the network line capacity over the entire CN network.

Q. Okay. And, in that role, do you use capacity models?

A. In that role, a variety of capacity tools are used.

Q. Okay. Which tools do you use?

A. Which tools?

A variety of tools. Be the line simulators, be the braking distance calculators, signal -- signal weight tools, speed zone tools, various other unique created tools. I mean, I would -- I would not be able to give you an entire list of all of the various tools that -- that I use or that are available.

Some tools -- we will make tools specific to the question and issues at hand. So it's -- we'll utilize tools that are off the shelf or available. We'll also create tools as needed.

Q. Okay. Do the four people reporting to you also work with those same tools?

A. They work with some of the tools. I mean, my -- yes. Not all of them.

Q. Okay. What's the division of labor, so to speak?

A. Really isn't. I'm attempting to make everyone a jack of all trades. Some are a master of a few. So no -- the challenge is that very few of the individuals are fully competent in or have even experienced all of the tools or the majority of the tools. So the division of labor would be based on a combination of the skillset of the individual, as well as the needed requirement for expanded skills and experience.

So I endeavor them to get them to use things that are -- that they haven't used, but I also rely on them for their -- for their areas of expertise and where their skills are strongest.

Q. Okay. You mentioned as part of your role being to evaluate capacity?

A. That is correct.

Q. Okay. How do you define capacity?

A. To a large degree, I rely or leave it to the person asking the question to describe to me what they mean or expect of capacity.

Q. Okay. So is it fair to say capacity is, then, defined by the question that's being asked?

A. To a degree. I mean, capacity is a nebulous or has many meanings and it depends on the context.

Q. Okay. Now, how does CN model capacity?

A. That's a broad question. There is no one answer to that. It, again, depends on the issue, depends on the question. There are different ways of modeling capacity.

Q. Okay. You mentioned the various tools that your group uses. Let's -- let's talk specifically about those. So -- so what tools are used to model capacity?

A. Okay. Again, depending on what the capacity is. I mean, we -- line simulation tools are -- the RAILS model, the RAILS 2000 model, the RCM model, the RTC model, as well as a variety of Excel-based developed cueing models. Relative to line capacity or capacity, but has a signal component. There is a braking distance, signal weight model.

Q. What's that model called? Does that

have a particular name?
A. Signal weight model.
Q. Okay. That's the actual name, signal weight model?
A. Right.
Q. Okay.
A. And another level or type of capacity is speed. So there is a -- not so much a model as a process and pre -- predefined calculations and iterations for establishing track speeds. So to look at gaining change in capacity on increased or modified track speeds or corridor.
Q. Do you use some kind of software to do that?
A. There -- we used to have a software on the mainframe. We now developed that as a variety of Excel sheets.
Q. Okay.
A. Or Excel models.
Q. Do those models have a name?
A. Generally, they're called the speed zone model.
Q. Okay. Okay. So you mentioned line simulation models, line capacity models, signal

weight, the speed zone model.
What other tools do you typically use?
A. We'll use time distance blocks.
Q. Okay.
A. We'll use track occupancy charts. We'll use track occupancy -- I would use the word "model," but, again, model has many meanings as "capacity" does, so there are a variety of track consumption or track occupancy "models" that are tools, iterations, calculations. You know, the -- not in what the general layman would think of as a model. So there's a variety of classes and types of models.
Q. Okay.
A. So --
Q. Help me understand what you mean when you use the term "model." I mean, what -- what does that term mean to you?
A. Generally, a model is a experiment. It's a test condition where you establish the parameters, the factors at play, and you hold as many of them constant and look at the cause and effect, the stress-strain relationship

about the fact or characteristic of interest.

Q. You -- you just used the term -- well, did you say stress-strain relationship?

A. Correct.

Q. Okay. What does that mean?

A. You put a load --

Q. Uh-huh.

A. -- on a system or an element and you attempt to measure what the effect is of that load. Similar to -- or best analogy in my civil engineering case is concrete design that you'll subject the sample of concrete to a -- to a load -- crush load and look at what load is it that the concrete fails at.

Q. Okay.

A. You have an experiment of a concrete and steel, and designing the apartment building, concrete building. You'll have loads and you can calculate that, but the material that you are using or you need to assess what strength that needs to have. So you subject it to a stress-strain experiment.

Q. Okay. And how does the stress-strain experiment relate to the railroad

industry? I'm trying to understand what --
where the analogy fits in.
A. The analogy is similar to the railway or transportation that you'll put a load on it, be it a traffic load or be it a disruption or inability to move. And your strain would be -- be it delay, be it velocity, be it reliability, whatever item of interest in the query of capacity investigation you're looking for.
Q. Okay. And -- I apologize.
A. Yeah, I'm done. I'm done.
Q. Okay. The -- so, then, the model is designed -- is it fair to say the model is designed, then, to measure those delays, velocity impacts, reliability impacts?
MR. HIRSH: I'm -- I'm going to object. So that's vague and unintelligible since you're referring to "the model," and I don't think we're talking about a single model.
BY MR. FISHMAN:
Q. You still can answer the question when your counsel objects, unless he instructs you not to answer.
A. Could you repeat the question?

Q. Sure. Sure.
So -- so we're talking about models, generally, and you mentioned that there are, essentially, experiments, and that they evaluate the stress-strain relationship, and -- and then you mentioned how in the railroad industry the load you would be looking at as traffic load and it's impact on delay, velocity, and reliability.
So I was asking, is the model, then, designed to measure the impact of certain level of traffic on, for example, delay? Is that, you know, one of the functions of -- of a model?
A. Two points if I can.
Q. Uh-huh.
A. Your description of what we talked --
Q. Uh-huh.
A. -- is -- is specific on what the models and the tools, and the capacity issues are. I just want to clarify that I'm being general.
Q. Okay.
A. And I heard what your description

was -- would be too specific to how I would say it.

Second, to answer your -- give an answer to your specific question at the end, the model is a tool that is -- can be used a number of ways to come up with information that then the user and the scientific approach can gain insight to a variety of issues. It's not so definitive or clear-cut as I was hearing your description.

Q. Fair enough.

You mentioned "track consumption models." What are those?

A. Fundamentally, it's a measure of track availability. So it's looking at the time and space that a train movement consumes in its movement over a piece of railway. And its simplest sense, its physical equipment occupies the track, but on the railway the equipment occupies a portion of track ahead of it and a portion of track behind it.

So unlike your car or what your highway is used to. Given that a train takes longer to stop than you actually see, there's other parties involved in the management and movement of that train. So a train movement on a piece of track takes far greater space, both in time and distance, than the physical length of the equipment.

So the track consumption is looking at given 24 hours of the day available for movement, how much of the 24-hour of track time would the -- a movement consume or utilize on the various portions of track.

Q. What are the track consumption models that you use?

A. Two is there are variety of python models or Excel models.

Q. Do those differ from the line simulation models?

A. They're a -- can you clarify what you mean by "differ"? I mean, they are a different model. They -- by nature, they're different.

Q. Okay. In what way?

A. Well, one is a line model. The other is a other model that you physically have. That bottle of water or this cup. I mean, they're -- they're physically different models.

Q. So --
A. They may do different things. They may do similar things.
Q. Okay. Is it fair to say the one -- one looks at the line capacity and one looks at track capacity? Is that a -- a simplistic way to put it?
A. I don't believe there is a simple way of putting it. It's the elements at play in moving a train through a system are constant, and the models and tools incorporate some of those elements and features and some do not incorporate it. It's a different tool. Like a word processor and Excel sheet, they're both computer programs.
Q. Okay. Are you familiar with the CN's train performance calculator?
A. For the TPC, yes, I am.
Q. Okay. So we'll refer to that as TPC.
What is TPC?
A. TPC is another model.
Q. What type of model is TPC?
A. TPC is a physics model that is modeling the physics of a train over a defined

topography.

Q. Okay. Is TPC a software program?

A. It can be. It also can be a paper exercise and it's defined in the or -- it's a mathematical formula. So how you wish to do the -- the mathematics is a different way. That's the different forms that that model can be in.

Q. Different forms meaning it can either be a software program or a paper exercise?

A. It could be a paper exercise. Generally, in the industry it is a software program.

Q. Okay. How does CN use TPC today?

A. It's a software program that resides on the mainframe.

Q. Okay. And is TPC a proprietary CN tool?

A. Yes and no.

Q. Okay. What do you mean by that?

A. Well, the physics is not proprietary. In fact, CN has -- in the one sense, CN has improved on the physics involved of the Davies equation and the CN TPC is known as the modified Davies equation. And proprietary is that the plant information that is CN's network is proprietary. We do not release that information or make that publicly available.

CN also has testing or refined coefficients that are used in the physics based on a variety of controlled scientific test car runs that a -- that would be proprietary or reluctant to -- to give out. Second, the locomotive specifications are proprietary in that they are third party, but CN is not -- CN has to protect that information. General GE, et cetera, give us the information for the locomotives, but under a strict confidence that is not to be shared.

Q. Is there an office shelf version of TPC that's available to the public?

A. There's a variety of off-the-shelf calculators that do various types of these calculations.

Q. So there are -- is it fair to say there're similar tools that one could obtain publicly?

A. Yes.

Q. Okay. But CN -- your -- I think what I heard you say is in addition to the infrastructure specifics, CN infrastructure information, and the proprietary locomotive information, CN has also taken what you refer to as the Davies equation and -- and enhanced and changed the coefficients to some degree?

A. Well, I described that CN has changed the formula, enhanced the physics formula.

Q. Okay.

A. That physics formula requires another level of input, another level of coefficients. So the simplest form is you have Isaac Newton F equals MA. That's what the Davies equation drives from. So it would be a modification on F equals MA that through science and experiment that we found, here is a slightly better mathematical representation of the physics involved.

And that is publicly available. It's in the arena. And which formula a individual wishes to use or create, i.e., or reference to, you can buy a different software out there. You will definitely have available different "TPCs." Key thing that just -- I would like to highlight to you is unlike a calculator you buy at Walmart or Staples, if you punch one plus one, you will always going to get two.

The issue with the various TPCs that are out there, one plus one does not equal two in all of those different programs. So...

Q. So you can get different results with the same inputs?

A. Correct.

Q. Okay. Did you start working with TPC when you joined CN?

A. Yes, I did.

Q. Okay. And does that mean over time you have helped to develop TPC into what it is today?

A. The physics, no. The -- I developed it -- have attempted to refine the TPC in its --

THE REPORTER: I'm sorry. The what?

THE WITNESS: Pardon?

THE REPORTER: I'm sorry. "The physics, no," and then?

MR. HIRSH: He said he has attempted

to refine.

THE REPORTER: Oh, okay.

THE WITNESS: Have attempted to refine the manner of use of the TPC.

BY MR. FISHMAN:

Q. In what way?

A. The TPC is built on punch cards. So the refinement of -- off of the mainframe and disuse of punch cards or a punch card text data format to make it more 21st-century useable by my staff or others in the -- in the company.

Q. And is that something you've -- you've completed that process, or you're still in that process of trying to convert it from punch cards to 21st-century technology?

A. Still in the process.

Q. Okay. What would be the advantages of completing that process?

A. Well, the general advantages would be just time and effort.

Q. Meaning what?

A. The -- the time and effort to -- to run -- to set up and run the TPC. You'd be able to do it on your PC instead of on a mainframe.

Q. So, currently, CN is still running the TPC on the mainframe?
A. That is correct.
Q. And is that something that you do yourself or does your staff do that?
A. Primarily, it's my staff that does that. I can and have run the TPC; but, generally, it's work that I leave to my staff.
Q. Okay. And -- and how -- how long does it take to set up a TPC run, if that's the right term to use? What was it -- I guess I'll -- I'll first ask the question like: When you're going to run a model in TPC, what do you call it? Would you call it a run or --
A. That would be a term.
Q. Oh, okay.
So how -- so how long does it take to set up TPC for a particular situation?
A. It varies. It depends if the information is already there or if you have to code the information.
Q. Okay. What are the inputs to TPC?
A. The inputs to the TPC program are the grade. So over the territory that you're looking to run the TPC A to Zed, you would have

to have a table that identifies each and every milepost where there is a change in elevation. So all of the elevation changes for the route has to be coded.

Second, is similarly all of the mileages of begin curve and end curve require to be coded. In addition to the begin curve, end curve, the degree of curve would have to be coded. So, fundamentally, you're coding in the TPC that all of the information regarding the topography of the route that you're running on. You then need to code all of the track speeds and the track speeds need to be contiguous from beginning to end.

Lastly, you need to code the equipment characteristics. So whatever locomotive -- locomotives and/or cars that you want to define in your consist, all of those -- each individual piece of equipment, all of it's tractive effort, characteristics, it's role in resistance, it's weight, it's tons, it's rotational inertia, it's winds resistance, it's cross-sectional area. So all of the physical characteristics of the car, the length, the weight, number of axles required to be coded.

Q. Any other inputs?
A. I can think and see fundamentally you need topography, you need the speeds, you need the -- a station stops or any stop/start locations. You need the origin destination, you need the consist. Generally, that would cover the majority of input information.
Q. Okay. In -- is it fair to say the TPC is designed to track the movement of one train over a piece of track?
A. I would describe it differently. It doesn't track any train. It does the physics calculation for the movement of a train over a track.
Q. Okay. And so that means you don't include other trains in the TPC run?
A. That is correct. TPC is an individual train moving over the defined topography on its own. That there was nothing else out there.
Q. And is the purpose of TPC to calculate how long it takes that train to go from point A to point B?
A. The purpose of the TPC is to define or calculate the minimum time that it would

take for that train to move over that route. It's a performance calculator. So it will calculate the absolute minimum transit time and for -- according to the consist, equipment capabilities to traverse the section.

Q. Okay. Can we refer to that minimum time as a minimum run time? MRT, is that a phrase that CN uses?

A. That is a phrase that we use.

Q. Okay. And, then, the -- going back to the equipment characteristics, you mentioned tractive effort and rolling resistance, and some other factors.

How are those determined? Is that based on the specs, the specifications of the --

A. The manufacturing specifications for that piece of equipment.

Q. Okay. The -- are you familiar with the acronym "HPT"?

A. Yes, I am.

Q. Okay. And does that stand for horsepower per ton?

A. That is correct.

Q. Okay. How is that measured?

A. You take the horsepower -- or first -- first requirement is to define the consist. So the locomotives and trailing cars. So with that defined or specified set of locomotives and specific trailing cars, you -- you sum the total horsepower of the equipment, and divide that by the total tons of the equipment and cars.
Q. Is there any other aspect of the calculation?
A. Not that I'm aware of. Depending on what piece of equipment you have in horsepower, if there is any head and power, the horsepower that you use is the horsepower available to the axle at the -- at the wheel. So, again, the nomenclature use of terms or such in a general sense, in my description, is not covering every permutation, combination or nuance of -- of use.
Q. Okay. Are you familiar with the term -- the acronym "HEP"?
A. Say that again.
Q. HEP.
A. HEP. I'm not sure.
Q. Does that -- does that refer to head

end power?
A. That could.
Q. Okay. And that's what you just referred to that -- could you just describe that again? What -- what is head end power?
A. If any of the horsepower from the locomotive is being used to drive any of the electrical needs of the -- the cars that the train is pulling or any electrical needs of the locomotive, it would be horsepower that is not available to the track at the drive wheel at the rail.
Q. Okay. And does the TPC calculate the HEP?
A. That is an input to the TPC as a equipment specification for that locomotive.
Q. So the input to TPC, then, would be the horsepower per ton number?
A. No.
Q. What would it be?
A. As I described before, the input to the TPC is the topography, the track speeds. On the equipment side, it's the equipment characteristics. So you would put in the relative to your query on horsepower and HEP.

It would be the available tractive effort for that piece of equipment. If there is a horsepower reduction due to HEP, then the tractive effort would reflect what tractive effort is available at the rail.

Q. Okay. And as it -- as we -- I think we just discussed the TPC. One of the functions is to calculate minimum run time; is that correct?

A. That is correct.

Q. What other functions does the TPC have?

A. You can use the TPC to estimate fuel burn.

Q. How is that done?

A. With the -- again, equipment characteristics for the locomotive, what the fuel burn rate is for various amounts of tractive effort. Again, supplied by the manufacturer, again, highly proprietary.

Q. Okay. What is the actual output of the TPC run?

A. Output would be fundamentally a table of incremental mileposts that the user would specify tenth of a mile, quarter mile, half mile, whatever increment of interest, and what it would identify to the output starting from a time of zero at what time the train was at that incremental milepost, and at what speed that train was traveling at that moment.

Q. And -- and the -- what is the physical output of running it on your mainframe? Running TPC on your mainframe, what -- what do you get as a result?

A. We get a text table of that detailed output. We will have a table in text format that would have -- starting at milepost zero. Regardless what the field timetable milepost is, but the starting point of the TPC is zero. And for every increment that you specify, for that increment, you would have a time and the speed.

And there is likely some other more detailed info for use of other functions like our transportation engineering function that may identify throttle position or horsepower rate that's being used.

Q. Does that output -- this text table you just referred to, does that also calculate a total time over the designated route?

A. It would have the total time. As it has the accumulative time at every increment -- mileage increment that is specified. So by definition the accumulative time would be the total time to that point.

Q. And is that, then, specified as the minimum run time, the MRT in the -- in the output itself?

A. That's what we would use or as minimum run time.

Q. Okay. When you get that text table, do you -- do you work within that text table or do you take those results and transfer them into an Excel spreadsheet? How -- how do you actually use the output from TPC?

A. Well, a variety of different ways. The TPC would -- output would be brought into an Excel table or we would just pull the piece of information at a point of interest for the query question at hand. The -- to clarify, to go back -- discussion so far has been the mainframe TPC.

Q. Yes.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Q. Okay. You said that you, yourself,
would not supply that information.
Is there someone else at CN that
works directly with Mr. Ruffings?
A. Someone in service design.
Q. Okay. So service design is really
the main department?
A. It's a service design tool.
Q. Okay. And is -- is one of the main
functions of service design is scheduling?
A. That is their function.
Q. Okay. Okay. And -- and -- does Mr.
Ruffings have a company?
A. Yes, he does.
Q. What's that company called?
A. I believe it is called Intelligent

Training Service, ITS.
Q. Okay. Is he a former CN employee?
A. Not that I'm aware of.
Q. Okay. Are you familiar with the RCM model?
MR. HIRSH: Can we suggest -- we've been going over an hour. If you're going to move on to another model there maybe we can take a couple of minutes to refresh our drinks and things, if that's okay?
MR. FISHMAN: Sure. Why don't we go off the record and -- and then we'll continue.
(A short recess was taken.)
BY MR. FISHMAN:
Q. I had just asked a question about the RCM model, but before I get to that I just wanted to go back to the TPC model. You mentioned that CN has modified the formula that's in that model; is that correct?
A. I had said that CN had developed a modified Davies equation.
Q. And -- and just to clarify, Davies, is that D-A-V-I-E-S or --
A. I'm --
Q. -- D-A-V-I-S?

A. I'm not sure on the spelling. I would have to look at it.
Q. Okay. So it's either Davies or Davis?
A. Right.
Q. Okay. All right.
So CN has developed -- and I'm sorry -- CN has modified the formula -- the Davies formula that's in the TPC model?
A. CN has developed a modified Davies physics formula.
Q. Were you, yourself, involved in developing that modified formula?
A. No, I was not. That was way before my time.
Q. That was before you joined CN?
A. Correct.
Q. Okay. Now, do you understand the details behind the Davies formula and its modification by CN?
A. In a general sense, I understand the Davies equation is a physics formula. I know that CN has improved on the physics. I am not familiar with exactly what that modification was of the physics involved.

Q. Okay. Are you familiar with the route capacity model?

A. No, I am not.

Q. Is -- does RCM stand for something else?

A. Route capacity model.

Q. Did I say route?

MR. HIRSH: Just a different pronunciation.

MR. FISHMAN: Yes. Okay. Fair enough.

So let's agree on RCM as route capacity model.

BY MR. FISHMAN:

Q. Do you say project, right? Not project?

A. I am both American and Canadian so I am a master of whatever it is that's wrong in both countries for me.

Q. Good enough. Fair enough. So I'll just say RCM.

A. Okay.

Q. Which I understand to be the -- the route capacity model.

What -- what is RCM?

A. Generally, described RCM is a line simulation model.

Q. And what does a line simulation model do?

A. A line simulation model is a tool that will model a piece of a railroad or a section of single track railroad from beginning to end that you can replicate a plant topography, the trains, the operations. So that -- that's in its general sense.

Q. Okay. And -- and what's the purpose of replicating plant topography, trains, and operation?

A. The purpose is to provide the -- or a means to analyze a rail network or analyze a railway. It's a tool that allows you to set up test conditions and evaluate the cause and effect.

Q. What does CN use the RCM for?

A. We use the RCM for line simulations for analyzing questions on line capacity, operations, service.

Q. Is RCM a tool that you started using when you joined CN?

A. RCM is a tool that was developed

when I joined CN.

Q. Did you have a role in developing RCM?

A. I had a role in developing it as a junior engineer and testing it, and providing feedback to the team and the programmers, and the senior individuals that were developing that tool.

Q. Okay. Is RCM a software program?

A. RCM is a software program.

Q. Okay. Is it run on CN's mainframe or is it run on individual PC?

A. It is PC based.

[redacted]

[redacted]

[redacted]

[redacted]

Q. Okay. Is it fair to say, then, that you would run the TPC first and then use the output from TPC in RCM?

A. The TPC is a input to the RCM.

Q. Okay. And the RCM you mentioned is a software program; is that correct?

A. That is correct.

Q. Okay. And it's a PC-based software program?
A. That is correct.
Q. Okay. What is the output from RCM?
A. Output from RCM is numerous. Fundamental output is a time distance plot. Second fundamental output are a variety of operating train delay track occupancy reports.
Q. Are those reports automatically created by RCM, or do you have to generate them?
A. They are automatically generated if you specify in the input that you wish to generate them.
Q. Okay. And -- and just so I understand, so the output from RCM, you mentioned the time distance plot.
What does that actually look like? Is that a -- is that a table, a text table? What kind of output is it?
A. The time distance information --
Q. Uh-huh.
A. -- from the RCM is a table of train, time -- train location and time.

[redacted]

[redacted]

Q. Okay. And what is a string line viewer program?

A. String -- the string line viewer program is a software program that CN developed specifically to portray or to show time and distance information.

Q. Okay. Is RCM proprietary to CN?

A. Yes and no.

Q. Okay.

A. You see, it is not commercially available in the industry. It is available and used by other Class 1 railroads. It is also licensed to the University of Illinois, and I believe it is licensed to either the FRA or the

STB. Some U.S. regulatory agency has a license to it, Transport Canada. Canada, our agency has the license and the rights to use it.

Q. Why is it licensed to the University of Illinois?

A. University of Illinois has a relation -- CN has a relationship with the University of Illinois railway engineering function department.

Q. Are -- are there other line simulation models available in the commercial market?

A. I would imagine that there -- or I believe there are multitudes of line simulation models in the industry.

Q. Okay. All right. Does CN from time to time use those commercially available models?

A. Yes, CN does.

Q. Why would CN use a commercially available model instead of its own proprietary model?

A. We would use it because it would either be specifically specified by the third party that we're doing the work for or that commercially available product is the appropriate tool to use for the question and issue at hand.

Q. Okay. And you said that you, yourself, started working with the RCM when you joined CN?

A. RCM came into existence shortly after I started with CN. It was a tool that I used extensively as my first job in CN, as that tool is specifically built and made for the project and issues, and capacity expansion goals of CN.

Q. Is it -- is RCM the main line simulation tool that CN uses today?

A. I believe that is true.

Q. Okay. What's a parametric model?

A. How many days do you have?

Q. Seven hours. So I'll defer to your judgment.

A. Basically, in a general sense, a parametric model is a mathematical relationship between the primary factors that affect capacity, and it is a mathematical means to derive or create through a -- the stress-strain curve of a rail blind segment or line

territory.
So, fundamentally, it's a tool between the line simulation, dynamic interactive model's world, of which there are many of those, and the simple return grid calculation. So it is a means of approximating the cause and effect of a variety of specific plant traffic and operating parameters on the ability to move traffic over a rail line -- rail line territory.
Q. Okay. What are the primary factors that affect capacity?
A. Primary factors are plant traffic operations.
Q. And is it fair to say that operations in -- in -- include schedule?
A. I think that's a complex issue with -- I'm not sure that it can be that simple an answer. Schedules are either a part or a component, but it's -- it can be a chicken and egg issue in that fundamentally the schedule is how you wish to account or what your expectation is versus the capacity is your ability to run or to achieve.
Q. Okay. What -- what are the

operational factors that are, in effect, track capacity?

A. There are many full -- high-level ones are the priority of the trains, the scheduling of the trains, i.e., the time of day of the trains, the -- the characteristic of the train, i.e., the length, the weight or the HPT of the train, the work locations, the stop locations, the track -- track availability for moving the trains.

So track -- track maintenance, work blocks, the class of track that you wish to run the train on. I mean, you may have weight limitations on a piece of track that would limit your -- the tonnage of what you can run on it, the train control.

Q. Would that include signal system?

A. Signal systems would -- well, signals would go into the plant side of things, but the operating rules that your signal system is governed by would be under operations. That's just a sample of the multitude of elements and factors.

Q. Okay. Did you develop a parametric model?

A. Yes, I did.
Q. Okay. Does that have a name?
A. CN parametric model.
Q. Okay. Fair enough.
Is that also sometimes referred to as a capacity management system?
A. It is a tool or a component of what CN described as a capacity management system.
Q. Okay. In what way?
A. It was one piece.
Q. So what is the capacity management system?
A. In the mid '90s, CN looked to manage the core assets of the company, the crews, the locomotives, the cars and the track capacity. And they wished to get a push-button measure of the state of -- that each of those key assets.
And whether they were being effectively utilized. So how close were you to exceeding your crew assets, your locomotive assets, your car assets. And they wished to have a measure of what the plant asset utilization in terms of capacity was.
Q. Okay. So were you involved in developing that capacity management system?

A. I was involved in developing the track capacity component of it which is why we developed a parametric model.

Q. Okay. How does that parametric model work?

A. You would -- for -- for a given plant, which is pretty static of what the plant is today, you would have a variety of fundamental measures of the plant, be it percent double track, uniformity of siding/spacings, number of meet pass planting points.

So some key plant parameters were defined and then we would be measured. The operating and the traffic parameters would be measured based on what the current service plan was at that time. So we would -- the intention was to tap into the surface design service plan, and from that information crunch the various traffic parameters, i.e., the mix of traffic, the peaking of traffic, the HPT of the traffic.

We would also pull key operating or calculate key operating parameters, like, stop locations, work online track outages. In general, that's the sense I would refer you to my paper on parametric modeling that goes into far more detail and clarity on what those parameters were.

Q. The -- the paper you referred to is that the one written in -- I think it was 1990? Does that sound right?

A. In that area, '90, '95, in that time period.

Q. Okay. How many papers have you written?

A. I believe it's one.

Q. Okay. And that's the one on parametric modeling?

A. Yes.

Q. Okay. And -- and what does the parametric model do that the RCM does not do?

A. A variety of things in combination. Fundamentally, the parametric model would create with the push of a button a approximated stress-strain curve for the parameters that -- that traffic operating parameters that you specified.

Q. And what does that stress-strain curve reveal?

A. On the Y axis, you would have traffic volume.
Q. Uh-huh.
A. On X axis is traffic volume. The Y axis is train delay or train time -- trip time -- sorry.
Again, going by memory, the -- likely it is transit time. So you would have a curve --
Q. Uh-huh.
A. -- from zero trains and zero transit time to one train, two trains, three trains, whatever range of X axis you specify, and it would show a transit time curve for those input plant traffic operating parameters. So if you changed the parameter, you would get a change in the stress strain curve.
Q. So one of the purposes of the parametric model is to evaluate the impact of additional traffic on train time?
A. Can you repeat?
Q. I'm just trying to understand what's the purpose of developing the stress-strain curve. Is it to evaluate the impact of certain parameters on transit time?

A. The fundamental requirement was to identify for a target transit time for the parameters, how close or far were you was the actual traffic that's running out there to the ability -- capability of that line segment. So it would identify how many -- how much traffic -- how much traffic volume you could run of that generic macro mix and achieve a prespecified transit time.

So you, basically, draw your line and the parameter would give you that stress strain curve and you'd see where do I cross the target transit timeline. Relate that volume to what you're actually running out there or planning to run to identify for that segment, are we above or below the capacity number. And it would give a simplistic indication of pinch points over the whole network.

Q. So is it -- is it fair to say that it, in part, would reveal places where you have track capacity to add traffic and places where you don't have track capacity to add traffic?

A. Really too general a question --

Q. Uh-huh.

A. -- or term of capacity.

Q. Uh-huh.
A. Fundamentally, what it did is give you an indication of -- relative to all of the other segments of the rail network. Are there areas that are more or closer to the expected capacity limit, or is it relative comparison to what highlight pinch points?
There was no way related or detailed enough to specific train, specific time, specific schedule.
Q. Are there -- implicit in this -- in this parametric model, there's -- are there different levels of capacity that are defined?
A. Within the parametric model and my paper I simplistically defined three.
Q. Uh-huh.
What are those three categories?
A. You have theoretical. You have theoretical, practical, those are the two that I remember. There may be a third.
Q. What is "theoretical capacity"?
A. It's the mathematical modes that you're going to be able to get through there.
Q. Okay. And what is practical capacity?

A. Practical is what you practically should strive for to get through there on a sustained basis.

Q. Okay. And the difference between practical and theoretical capacity is what?

A. If I could use an analogy?

Q. Yes, please.

A. Theoretical is how fast you can run, which -- how fast can you sprint to the bathroom. Theoretical is how fast can you run, jog, walk to Baltimore, or do a marathon, like, if you're doing a 50-yard dash or you're going to do a 20K marathon. Your practical capacity is your jogging speed to do a long run to go 20 -- to do a long distance. You have the ability to sprint in burst at times, but that's not sustainable.

Q. Okay. So it is fair to say that -- that practical capacity is sort of the -- the reasonable level at which the network can -- can handle certain amount of traffic. And theoretical would be, you know, what's possible in theory, but not realistic? Is that a simple way of distinguishing between these two terms?

A. Simply theoretical is the best that

you're ever going to achieve, and practical is an indication or an estimate of what would be more sustainable.

Q. Okay. And does the parametric model you're talking about calculate how much capacity is actually being used at the time?

A. As I described, the parametric model will tell you how much time it would take to traverse the section or your average transit time for your traffic over the territory, as before mentioned. You know, if that is your definition for capacity, it would give it. It would match that, but if capacity is a different meaning than different aspect, it would not -- there is no one definition or description of what is capacity.

Q. Let's go back to the RCM model for a moment.

Does that have dispatching logic in it?

A. As a line simulation model, it has dispatching logic in it.

Q. Okay. And how does that work?

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Q. Okay. Does RCM calculate train delay?
A. That is what RCM calculates.
Q. Okay. So, in these validation exercises we're talking about, was there a comparison of -- of train delay of calculating the model versus the real-world train delay?
A. I'm sorry. You said in the development?
I'm assuming that they had gone through that.
Q. Do you know what the results were with respect to the differences?
A. I believe that the results were acceptable or they were close and they were meaning -- meaningfully similar.
Q. Okay. Do you know if there was a margin of error, like, what the -- when you say

similar, was there a differentiation?
MR. HIRSH: Objection. This was asked and answered.
THE WITNESS: As I said before, I wasn't involved. I'm assuming what the group had gone through and had done.
BY MR. FISHMAN:
Q. Okay. What are the limitations of RCM?
A. Limitations.
MR. HIRSH: Again, I'll object as to form. These -- these questions are so vague. They're almost unintelligible, but you can answer if you can.
THE WITNESS: Limitations. It doesn't handle subway systems. It doesn't handle electrification. It does not handle a -- it is not a network model.
BY MR. FISHMAN:
Q. What do you mean by that?
A. If you wanted to -- network is something other than A to B, to C to D, a linear representation of a line segment. If you had a offshoot spider web of track, it would handle -- you would have to set up each

segment of the network as a linear portion. So
you can't -- you can't do parallel or
adjourn -- adjoining subdivisions. So you --
you cannot put in a map the railway or it is a
linear simulation A to Z.
Q. Okay. Does it model double track
segments?
A. It models double track -- single
track and double track.
Q. Okay. Are there any limitations on
its ability to model double track segments?
A. It is weak if you're modeling a
hundred percent double track.
Q. Why is that?
A. Because, fundamentally, it's in a
pure double track network. The model will move
trains directionally on each track.
Q. I see.
[redacted]

[redacted]

[redacted]

Q. How does it handle yards?
A. It will handle a yard either as a number of receiving departure tracks. So as a augmented siding. You can use, quote, "siding or sidings" as a yard. As a terminal, it is a point of infinite capacity that you can have as many trains there at a time as -- as what the pattern and nature of the model would require to put into that location.
So it is a line model, and in the line model the terminals where switching activity and train make up, break up, and massively different types of rail infrastructure exists, that aspect of capacity is no longer a line issue. It's now a yard issue. The model was specifically built to simplify those terminals or yard complexities, and focus on the line aspects of the modeling and the simulation information.
Q. So if the -- if the yards are considered to have infinite capacity, what -- what does that mean for purposes of the model?
A. That is a place that you can have as many trains waiting and holding to -- for their time to get online as -- as the numbers and the

modeling it creates.

Q. Okay. And how does that differ from real-world operations?

A. The real world has a physical yard there. So the real world has a yard level of infrastructure, and management, and control that may have a different amount of resources or operations to manage and deal with the interface of line movements versus the yard movements. It's a different -- there's a coordination between the two.

Q. Okay. You also said that the RCM is not a TPC.

What did -- what did you mean by that?

A. What I meant was, as described earlier, a TPC is a specific model which is the mathematical calculations of the physics involved in moving a defined consist over a defined territory. So it's dealing with the fundamental theoretical physics of attractive effort acceleration, deceleration, grades, and gravity. And, basically, RCM is not that level. There is not that type of model.

Q. Does that mean -- or I think we --

we talked about this earlier, but basically you take the input from TPC and use that in RCM?
A. That is correct.
Q. Okay. In -- in this proceeding, you did capacity modeling studies as reflected in your verified statement.
A. That is correct.
Q. Okay. Is it accurate to say that you used TPC and then RCM to do those capacity modeling studies?
A. The capacity modeling study utilized a variety of tools. TPC was one of them and that was processed into useable input for the RCM.
Q. What other tools were used in this -- in these capacity modeling studies?
A. Excel. Tools. Any tool that we used to pull data.
Q. Uh-huh.
A. Our field trips used a variety of tools to document information from the field.
Q. Uh-huh.
A. Your use of tools is broad like is a camera a tool to take pictures.
Q. Sure. Fair enough.

We've been talking about modeling line simulation tools. I'm just trying to understand whether you used anything other than TPC and RCM in -- in that nature of tool simulation, a computer simulation?

A. If I recall, primary one was the RCM and the TPC.

Q. Okay. Is that a standard approach at CN to use those two tools together?

A. By -- by definition --

MR. HIRSH: Objection as to form. The term "standard" is undefined.

THE WITNESS: RCM needs TPC input. Input to the RCM is, you have to define the minimum run times of the trains that you're going to model over the different segments. So by definition, you have to use the two.

BY MR. FISHMAN:

Q. Okay. So every time you use RCM, you're using TPC on the front end?

A. Well, it's part of the preprocessing of information which is input to the RCM, like you input the plant. You use the timetable. You use the track charts, but you use that external information to populate or provide the

RCM with the information that it needs.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Q. Okay. And who -- who do you get those queries and questions from?

A. They can be from anybody in the company or external to the company.

Q. For internal queries, who do they usually come from?

A. Usually someone in the transportation function, or the operating function, or somebody from the engineering function, or the corporate development function.

Q. Are you involved in CN capital improvement projects?

A. I am involved with them.

Q. What's your involvement?

A. My involvement is to assess, evaluate the line capacity of the network, identify the pinch points and develop a phased plan to increase that capacity.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Q. Okay. When did you first start working on Amtrak projects?
A. Early '90s.
Q. Okay. Tell me about those.
What was the first Amtrak project you worked on?
A. It was increase service to

Vancouver.

Q. Was that a capacity study?

A. Yes, it was.

Q. And was that a proposal for new Amtrak service to Vancouver?

A. Yes, it was.

Q. Okay. How did you do that study?

A. Similar to this study, it was established, the objective, which was an addition of more Amtrak trains. They used a line simulator, they established the pertinent scenarios, and the scenarios were without them and without the new service than with the new service, then modification with the new service, and then the new service with the infrastructure.

Q. Okay. But just to clarify, you said -- you said this was new Amtrak service?

A. Correct.

Q. So it's not more trains. It would be new Amtrak trains.

A. It was new trains above and beyond what they were running there at the time.

Q. Okay. So it was -- it was additional trains as opposed to new -- new trains?

MR. HIRSH: I think it's -- I'll object as to form since --

MR. FISHMAN: I'm just trying to clarify.

MR. HIRSCH: Whatever distinction you're trying to make is not clear.

MR. FISHMAN: Well, there's a difference between adding Amtrak and a line that didn't have Amtrak, and adding trains -- Amtrak trains in a line that already has Amtrak. So that's --

MR. HIRSH: It may be a difference depending on what your point is.

MR. FISHMAN: Right.

Well, that's what I was just trying to clarify.

BY MR. FISHMAN:

Q. So this -- this Vancouver service, was it new Amtrak trains or was it additional Amtrak trains on existing Amtrak service over that track?

A. My language terminology cannot answer that because fundamentally it's a new train, whether there is current service there or not. If you are going to park your chair in the middle of the track, you're going to get hit by a train that did not run there. So that is -- from my only way I can look at it is, it is a new train. It is not a new service. Because, to answer the question, it's -- the service was there and from capacity analysis, or such, it doesn't really matter if what's there or not. It's -- there's something going to be there that was not there before.

Q. Well, it certainly matters that there is -- wouldn't it matter that there is existing Amtrak service and you're adding a new Amtrak train as opposed to new Amtrak service, just from the volume of trains that would be on that segment?

A. That would be an addition of X trains.

Q. Fair enough.

But just to clarify -- so this -- this first project, the Vancouver service, there was existing Amtrak service and the proposal was to increase the number of Amtrak trains in that service?

A. To the best of my recollection, I

believe that there were already Amtrak trains to Vancouver. I could be mistaken, but definitely there were Via trains to Vancouver. The study was specifically new, and quote/unquote in my terminology was an Amtrak train that did not currently run.

Q. And which line simulation program did you use for that study?

A. For that study, we used the RAILS line simulation model.

Q. And is that an off-the-shelf version?

A. Uh-huh. Yes.

Q. What's the -- is there a name for that particular software?

A. Yes, RAILS, R-A-I-L-S.

Q. Okay. So the actual software is called RAILS?

A. Correct.

I believe the long name of it is Railway Analysis and Interactive Line Simulator.

Q. And which company provides that software?

A. That was developed by Corporate

Strategy, Inc. in Springfield, Virginia.
Q. And RAILS is a line simulation program similar to RCM?
A. Similar, yes.
Q. Why didn't you use RCM for that study?
A. There was more than two tracks.
Q. And what were the end points?
You mentioned service to Vancouver. What was the -- what was the other end point of the service?
A. Best of my recollection, the end point was either the Fraser River bridge in Vancouver or it may have been slightly toward the U.S. border.
Q. Okay. But it was service from the U.S. Canadian border into Vancouver on Amtrak; is that right?
A. I am.
Q. I'm just trying to understand the end points of this.
A. From Vancouver?
Q. Yes.
A. From --
MR. HIRSH: Objection as to form.

Let's just -- it is a bit ambiguous whether you are now talking about the service or you're talking about his study. Are you talking about --

BY MR. FISHMAN:

Q. Well, I presume their service -- the study was -- was the same alignment as the study; is that fair to say?

A. The study was Vancouver Via stations. The Via station in Vancouver, down the freight network or railway, which, at the time was owned by BN, over the Fraser River bridge in Vancouver. And I can't recall how far down that line towards the U.S. border did that analysis carry on. I have no idea where Amtrak, this train came from or...

Q. Right.

Okay. I was just trying to understand the -- the -- the end points of your study.

MR. HIRSH: Well, that was my point, was that they were not necessarily the same.

MR. FISHMAN: As the service which could originate in Seattle. Okay. That is right. Fair enough.

BY MR. FISHMAN:
Q. Okay. So you used the RAILS line simulation program.
Did you provide RAILS with TPC information?
A. I can't recall if we externally provided the TPC information or used its internal TPC.
Q. Okay. What was RAILS used to model?
A. RAILS was used to model the rail network and the train traffic on that defined segment of the corridor. So, basically, the railway and the traffic.
Q. Were there different scenarios that were run through the RAILS model?
A. As I mentioned before, we did do different scenarios. We did a scenario of current which would have been the current freight and/or, in inclusion, the current passenger --
Q. Yes.
A. -- if there was a current Amtrak service. We then would have done assimilation with the addition of the Amtrak service. We actually did two simulations of the addition of

the Amtrak service and then we did a third simulation of the Amtrak service with the recommended infrastructure capacity enhancements.

Q. Did you include the Via trains in that model?

A. If Via was running we would have included them.

Q. And you would have included those in the -- in what I will call the base case, the Scenario 1?

A. Correct.

The base case would have included all current service, all current traffic trains that were operating.

Q. Do you recall what the capacity improvements were that were recommended through that study?

A. I vaguely remember it was sections of triple track and additional double track and crossovers.

Q. Do you recall what the total cost estimate was for those improvements, order of magnitude?

[redacted]

Q. Were those improvements built?
A. Some of those improvements were built.
Q. Who paid for those improvements?
A. I have no idea.
Q. Was the Amtrak service implemented that you studied?
A. I am not sure -- not sure if it was or if a different version than what was proposed implemented.
Q. At what point did your involvement in that project end?
A. My involvement ended when I presented the results to CN and BN, and to the City of Vancouver and Amtrak.
Q. Were those results summarized in a report?
A. Yes, they were.
Q. That report was provided to the four parties you just mentioned?
A. Correct.
Q. Okay. What other Amtrak projects have you worked on?
A. What other Amtrak projects?
I will endeavor to try and remember

them.
Q. Actually, let me help you.
So before CN acquired the Illinois Central, had you worked on any other Amtrak projects?
A. Likely may have. I mean, Amtrak was and did run into Toronto or the Niagara Falls. So on the bus side of the segment of the GTW, Amtrak ran on that. So likely there was -- you know, I may have.
Q. Do you remember doing a specific capacity modeling study on Amtrak service on the GTW?
A. I can't recall. I can't say that I didn't, but, I mean, it's -- I have got thousands and thousands of simulation and studies that I've done. It's -- it does not jump to mind.
Q. Okay. Just curious, do you have sort of ongoing studies that you're doing where you just basically keep the results and -- and refer back to assimilation that you might have run?
MR. HIRSH: Objection as to form. I think it's, you know, very hard to understand

what you're asking in that question.

BY MR. FISHMAN:

Q. If you understood, if not, I can rephrase it.

A. Okay. Could you rephrase?

Q. Sure.

I'm just trying to understand, do you do discrete projects? Did you do a study, you're done, you put it away, or do you also have sort of ongoing modeling that you're doing of CN's network?

MR. HIRSH: Objection as to form. It's a compound question.

THE WITNESS: As described in the network capacity, that's ongoing. As for identifying the pinch points of capacity in terms of global train volume, i.e., X number of trains per day on this subdivision, that subdivision, that's ongoing. Discrete studies are a specific question, whether it's increased commuter service, increased co-production with CP, or those are discrete studies that are set up and done specific to the question and the objective at the time. They're finished, they're done. I keep them as either they generally may come up again. I have been doing the same thing since 1981. So issues do come back up, so I will keep the work in the files as either reference or as an example of how it was handled in the past. But to answer your question, it's both.

Q. Okay. So going back to Amtrak, you mentioned this Toronto -- Vancouver study?

A. Right.

Q. And I'll -- fair to characterize that as a discrete study --

A. Yes.

Q. -- that we just -- along the lines of what we just talked about?

Any other Amtrak studies of that nature that you conducted?

A. Yes, I imagine that I have. There are likely some, but I can't remember. There are some that I do remember.

Q. Okay. Which ones do you remember?

A. Dubuque. Amtrak service to Dubuque.

Q. Okay. Tell me about that study.

What did that involve?

A. That was a request from Amtrak to add new service to and from Chicago and

Dubuque.

Q. And is that all on CN?

A. There is a portion of joint rail with BN just coming into Dubuque. So the majority of it is CN. There is a portion that we have running rights on, if I recall correctly.

Q. And, roughly, when was that study done?

A. Somewhere this century.

Q. Okay. Fair enough.

Was that done with Iron Road Consulting?

A. I believe that it was.

Q. Okay. Do you recall how that study was structured?

A. I understand it in a general sense how it was structured. So, yes.

Q. And -- and how was that in a general sense, structured?

A. General sense of structure was to identify or measure, quantify the -- the loss of operating opportunity for CN, and to identify the infrastructure required to attempt to keep CN's ability to operate freight on that

corridor whole to what it was or it would be prior to the Amtrak train.
Q. And who -- who -- who defined that objective of the study?
A. CN executive.
Q. Was there something specific particular to this line that -- that made you focus on the opportunity loss?
A. No.
I mean, general objective of the franchise of the freight railroad is to maintain our ability to continue our franchise.
Q. Was RCM used to conduct this study?
A. I can't recall if -- if modeling was done. If so -- if there was no modeling. Fundamentally, the requirements or issues were self-evident from very simplistic analysis.
Q. Whatever happened with that project?
A. We presented our results and it was provided to CN on the division and I have no idea what transpired.
Q. Are you aware of whether Amtrak operates that service today?
A. I don't believe they do.
Q. Okay?

A. Or let me correct that.
I think that they have a service to Dubuque. I am not sure how or where if they are doing that on us or somewhere else.
Q. Okay. What other discrete projects for Amtrak have you worked on that you recall?
A. What I recall discrete is the addition of a siding on a new station stop on the Yazoo sub.
Q. Azoo [sic]?
A. Yazoo.
Q. Oh, Yazoo. Y-A-Z-O-O?
A. Correct.
I believe that's where that station is. I mean, the name "money" is in my mind, but I don't know if that is the new station that they added. Amtrak was part of or involved with a variety of Joliet sub-capacity studies that I have undertaken for a variety of different passenger/freight issues and questions.
Q. And you said Joliet?
A. Joliet, yes.
Q. J-O-L-I-E-T.
Let's go back just for a second to

the Yazoo sub study.
Can you tell me more specifically what -- what that involved?
A. A request from Amtrak to add a new station stop.
Q. Uh-huh.
A. And the question was, what, if any, impact or infrastructure requirements would be required for that.

[redacted]

[redacted]

[redacted]

Q. Any other discrete projects relating to Amtrak that you have worked on?

A. As I said, likely yes. Nothing jumps to mind, but, I mean, it's -- definitely nothing is jumping to mind of a distinct Amtrak. I mean, the purpose of this deposition or such is definitely, yes, but I'm answering your question and they appear to all be separate from what this is, so my apologies if I -- didn't want to misspeak, but I didn't do this one.

Q. Fair -- fair enough. I'm not trying to trip you up. Obviously, you did -- you did a model study in this proceeding, and we're very well aware of that.

Let me ask you about Iron Road quickly. So they worked with you on the capacity modeling study for this proceeding; is

that correct?
A. That is correct.
Q. Okay. And what was their level of involvement?
A. They were -- they supported me. They worked with me in undertaking the study. They were given some specific tasks that they undertook on their own, and they also worked in conjunction with me and my staff to perform a variety of steps and processes of the study.
Q. Okay. What specific tasks were they given?
A. In a general sense -- again, I don't know every individual thing, but the main specific task that they had was to go in the field and do the field -- field interviews, and the fieldwork. Fundamentally go out and meet and talk with the local operating people and look at, kick the rails, traverse the territory, get an understanding of the plant, the traffic and the operations.
Q. Is that part of the validation process?
A. That is part of the data gathering process.

Q. Did you also participate in those field visits?
A. I did not.
Q. Okay. Did anyone from CN, your group at CN, participate in those field visits?
A. In my group, I do not believe so.
Q. Okay. So the Iron Road people did the field visits?
A. With local -- I -- I would expect -- I know that they were coordinated through Homewood. So individuals that I was doing the study for or working with had an involvement and coordinated, and they may have been in the field with them.
Q. Okay. And let's just define. Iron Road, I can't remember the full name, is an outside consulting company?
A. Yes, they are.
Q. Okay. And the -- the -- who is the principal of Iron Road?
A. There is only two people.
Q. Okay. Who are those two people?
A. Nick Rank and Brian Doyle.
Q. Okay. And whose -- whose company is it? Is it Brian's company?

A. It's -- my understanding is it's both.
Q. Okay. And is either of them a former CN employee?
A. Mr. Doyle is a former CN employee.
Q. Okay. Did you work with him?
A. Yes, I did.
Q. Okay. Was he in the transportation planning department?
A. He was my boss when I hired on in 1981.
Q. Okay. When did he leave CN?
A. That, I am not sure of. It would have been in the last century. So somewhere in the '90s.
Q. Okay. Was he your boss up until the time that he left?
A. No, he was not.
Q. Okay. Did Iron Road actually work with TPC and RTC to do the capacity modeling studies in this proceeding?
MR. HIRSH: Objection. It lacks foundation. You said RTC. I don't think we established that RTC was used.
MR. FISHMAN: I misspoke. I said --

I meant to say TPC and RCM.

BY MR. FISHMAN:

Q. So did -- did Iron Road actually work with TPC and RCM in this -- in the modeling studies that were done in this proceeding?

A. Yes, they did.

Q. Okay. And you, yourself, also worked with those modeling studies?

A. Yes, I did.

Q. Just -- I mean, physically, how does this work? Did Iron Road have access to the same software that -- that you had?

A. Iron Road did.

Q. Okay. What aspects of the modeling did they do?

A. I mean, we -- Nick and I physically sat at the same computer and worked through the model. They were involved with documenting and developing the input information, the traffic information, so they were working with my staff and with myself as part of the team to process and develop and gather the data and process it into meaningful, useful, usable input.

Q. And where do you --

A. Doing the work and analyzing or crunching the results out of it.

Q. Okay. Why do you use Iron Road from time to time?

A. Fundamentally, it's because third-party external activity is not the role and responsibility of my department. Our department and size is to focus on CN-related work. External work we undertake at the expense of whoever is asking the question, and we'll bring in added resources to handle the workload as needed.

Q. Okay. And you -- you stated earlier, you don't have a budget for your department?

A. Correct.

Q. So the Iron Road hiring these different projects doesn't come out of your budget?

A. Correct.

Q. Okay. Have you only worked with Iron Road on -- on Amtrak-related studies?

A. No.

As I mentioned earlier, we used Corporate Strategy, Inc. for the Vancouver project. So we'll use the -- you know, the resource or -- that's appropriate, available or at the time.

MR. HIRSH: We have hit 12:30.

MR. FISHMAN: Yeah, why don't we go off the record for lunch and then we'll reconvene.

MR. HIRSH: Until 1:30?

MR. FISHMAN: Yes, thank you.

(A short recess was taken.)

(Deposition Exhibit No. 1 was marked for identification.)

MR. HIRSH: Are we going to go back on the record?

MR. FISHMAN: Why don't we go back on the record.

BY MR. FISHMAN:

Q. And I would like to introduce and mark as Exhibit 1 a copy of the joint verified statements that was submitted in this proceeding by Harald Krueger, Brian Doyle, and Nicole Rank.

Harald, are you familiar with this document?

A. Yes, I am.

Q. Okay. And I can represent -- feel free to look through it. I can represent, I believe, it's a full copy of your verified statement including the exhibits that was attached thereto.

Are there specific parts of this document that Iron Road worked on exclusively?

A. There are specific parts that Iron Road would have had -- or more involvement in. I do not recall if there are specific sections of verbiage or chapters that was -- only Iron Road had written up. It was a joint document.

Q. And did you provide your counsel with all the work papers supporting the conclusions that are set forth in this document?

A. I believe that I did.

Q. Okay. Did any of those -- were any of those work papers generated by Iron Road?

A. I can't recall what all of the work papers are, but there would have been papers that Iron wrote themselves would have created. I don't know if that forms in the paper, in the document, but it was always a joint -- well, joint effort.

Q. Okay.
A. There are some -- not familiar with all of the work papers, but some of the programs, the python script was. Only Iron Road created that. I don't know if that's in the work papers.
Q. The -- the -- what was the python script used for?
A. Processing of the data. Simplification of dealing with the data in or out of the capacity models.
Q. I would like to direct your attention to Page 2 of the verified statement in front of you, which we have marked as Exhibit 1. On Page 2 and Section 2, the section is entitled -- Section 2 is entitled "Overview of Study Methodology, Work Performed and Objectives."
Do you see where I am?
A. I see where you are at.
Q. Great.
And I'll just read for the record that first sentence which states as follows: "We were asked to answer two questions. What level of delay to CN's freight trains is

attributable to Amtrak operating on CN's rail lines at specified service levels, and two, what capacity improvements would be required to eliminate that incremental level of delay?"

Who defined the questions that you were asked to answer in your study?

A. I can't say specifically who, but that was provided to us either by Counsel or by the other CN officers involved with the project.

Q. The second part of that statement I just read states that you -- you looked at what capacity improvements would be required to eliminate that incremental level of delay.

Did you consider any other factors in your study to eliminate incremental delay?

A. I believe, if I understand, or what we have in this statement is the question that we were answering was what specific infrastructure was required to eliminate the delay.

Q. So your capacity study was focused on infrastructure improvements?

A. It was focused on what the impact on freight is, keeping all things equal, what capacity improvements, infrastructure improvements would eliminate that delay.

Q. Okay. So that means, then, that you did not consider, for example, whether schedule changes would have an impact on delay?

A. Well, that was not the task that we were given.

Q. Okay. It also means you didn't consider whether any operational improvements could eliminate that delay?

A. That was --

MR. HIRSH: I'll object as to form, the undefined term "operational improvements."

THE WITNESS: Repeat the question.

BY MR. FISHMAN:

Q. You did not, in your study, consider whether there could be any operational improvements made to eliminate that incremental level of delay?

A. No, we did not.

Q. Okay. I would like to direct your attention to Page 4 of the verified statement. And, on Page 4, in the -- what I'll call the second full paragraph, which starts with "our modeling" --

A. Okay.
Q. -- second sentence it describes the scenarios -- it starts to describe the different scenarios that you modeled. Perhaps, maybe it would be helpful for you to -- to -- to describe those scenarios for me first.
So what were the different scenarios you modeled?
A. The different scenarios, as in the line point bullets above, were scenario of freight only, next scenario was freight with Amtrak, and Amtrak service at 80 percent end point OTP. Scenario 2, again, with the same freight and same Amtrak trains, but at a different end point OTP. Third was the same freight, same Amtrak, same different end point OTPs, but with additional infrastructure.
Q. Okay. Let us focus first on Scenario 1. And that second sentence of that second full paragraph on Page 4 states: "Scenario 1 was used to estimate the baseline amount of delay experienced by CN's freight traffic in the target corridors in the absence of Amtrak passenger trains."
Did you include the -- the Metro

trains in Scenario 1?
MR. HIRSH: Objection. Lacks foundation. We haven't discussed whether there are any Metro trains.
BY MR. FISHMAN:
Q. Are there any Metro trains on the Illinois Central corridor?
A. Not that I'm aware of.
Q. You're not aware of there being Metro trains on the -- the IC corridor?
A. Metro runs on IC.
Q. Right.
Okay. Did you include those in the model in Scenario 1?
A. I don't believe that Metro runs on these freight routes.
Q. Metro doesn't use the same tracks at any point?
A. To my recollection, I don't believe that they do.
Q. Okay. You did, though, include -- did you include in that Scenario 1 other railroads that have trackage rights over the corridors?
A. As explained in the section of the

report, trackage right trains that ran on the CN corridor -- I believe there were some NS trains, they were included.

Q. Okay. And just to set the foundation, you modeled two different corridors, the IC corridor and the Grand Trunk Corridor; is that correct?

A. That is correct.

Q. Okay. Did you take any steps to validate whether the Scenario 1 base case that was modeled was consistent with real-world operations?

A. Yes.

Q. And what were those steps?

A. That the traffic that was in our model reflected a historical average 2013 train volumes. The mix of the freight trains was representative of the average 2013 traffic. The consist characteristics of the trains that were in the model represented the average 2013. The time that the trains were scheduled to originate and depart reflected the train service of the two -- the two weeks of field survey.

Q. Let me ask you about that.

So the -- when were the two weeks of field survey?
A. I believe I've identified it in the document.
Q. I can actually help you. So I believe one was in April and one was -- was in October.
Does that sound correct?
A. That sounds correct for two different dates.
Q. Okay.
A. Page 36 would have it. Nope.
Q. I believe Page 24, at the bottom Table 3, reflects that for the IC corridor that the field visit was probably that week of April 29th through May 5th.
A. Correct.
Q. And for the GTW corridor, on the next page on Page 25, the field visit week was October 21st through 27th.
A. Correct.
It's also in the verbiage above Table 3.
Q. Yes, on Page 24. I see that.
The -- so the field visits took

place during those two weeks that we just mentioned?

A. Yes.

Q. Right. And your -- testified earlier that Iron Road was the -- the entity -- or Iron Road participated in those field visits.

A. Correct.

Q. What year did those field visits take place?

A. I don't recall. I would assume -- no. 2013. I would have -- if the dates are of the weeks of October and November, that would be of 2013.

Q. Are you sure about that?

Or -- I thought you were using 2013 data but actually visiting the field --

A. Yeah.

Q. -- on a later --

A. I don't recall -- I don't recall the -- the year of the field survey.

Q. Okay. It is possible they actually went out the next year because you're looking at 2013 data. You wouldn't have that week data, I mean, at least at the outset. As it

wasn't clear to me, I know that you used 2013 data, my presumption was the field visits actually occurred in 2014 or 2015.
I am just asking whether you recall when those occurred?
A. I don't recall. I know that the project spanned many months so -- I'd have to look into more detail of exactly when that was -- what year it was.
Q. Okay. What -- when did you start working on this project?
A. I don't recall.
Q. Do you -- can you give me any sense of boundaries?
Or was it -- was -- was it before the current CN operating agreement with Amtrak was signed in May of 2011?
A. I have no -- no familiarity with Amtrak operating agreement or any of that processor.
Q. Do you remember when you first hired Iron Road for this project?
A. I don't recall that.
Q. Do you remember when you might have run your first -- built -- built the first

model to simulate the capacity on -- on these
two corridors?
A. Some time in 2014. I'm not clear on what the date is. It would be prior to when I signed this document and after 2013.
Q. And you say after 2013 because you're using 2013 data --
A. Right.
Q. -- to do analysis.
A. Correct.
Q. I want to introduce into the record some of your work papers. So we'll start with this document, which we'll mark as Exhibit 2.
(Deposition Exhibit No. 2 was marked for identification.)
BY MR. FISHMAN:
Q. Organized.
This -- this document was part of the work papers that you provided to Amtrak in support of your joint verified statement. [redacted]

[redacted]

[redacted]

Q. Okay. Who could -- who would have creat -- who created this document; do you know?

A. I don't know specifically, but I believe that it was created out of my department.

Q. Would it have been one of your employees?

A. One of my employees, yes.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

MR. FISHMAN: Okay. Let me mark as Exhibit 3 another work paper. You put that one away, and I'm going to give you -- you have that one.

(Deposition Exhibit No. 3 was marked for identification.)

BY MR. FISHMAN:

[redacted]

[redacted]

[redacted]

MR. FISHMAN: I'm going to mark as Exhibit 4 -- you can put that one aside and we'll give you another one here.

(Deposition Exhibit No. 4 was marked for identification.)

BY MR. FISHMAN:

[redacted]

[redacted]

[redacted]

Q. So you said that you weren't

involved in -- in gathering the work papers.
Who was?
A. I think it was electronic.
Q. But did you identify the work papers then that were transmitted electronically?
A. Some of the work papers I identified, but I think I'm -- I was not involved in gathering and -- all of the work papers.
Q. Okay. Who was involved in gathering the work papers?
A. I -- I do not know specifically. I would assume that it is the -- the lawyers.
Q. Okay. But you didn't say here are the work papers supporting my verified statement and provide them to the counsel?
A. I provided file -- all of the files and documents that I used or that was used that we had in doing work.
[redacted]

[redacted]

[redacted]

Q. Do you recall yourself working on analyzing Amtrak schedules on the city of New Orleans route in connection with this capacity project?

A. In connection with capacity project in this thing, this study did not deal with developing different passenger schedules or Amtrak schedules. We have an idea and my group have been involved numerous times of developing and answering questions regarding Amtrak as well as other passenger trains on the CN network.

Q. As part of your study you also calculated the MRTs for the city of New Orleans and the -- Illini/Saluki trains, right?

A. For the studies in my verified statement, we did run TPCs and determine the MRTs for that equipment, on the road, on the railroad, based on the state of the railroad at that time.

MR. HIRSH: I want to defer for a moment. Go off record. Chat for a second.

(A short recess was taken.)

BY MR. FISHMAN:

Q. And we were on Exhibit 4. Let me introduce and mark for the record another document. So we can put down Exhibit 4 for the moment. We're going to mark this as Exhibit 5. And...

(Deposition Exhibit No. 5 was marked for identification.)

BY MR. FISHMAN:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

I'd like to draw your attention to Exhibit 1, your verified statement. And on Page 36, Table 13 of Exhibit 1, there's a comparison of schedule and TPC run times. That's the title of the table. It's Page 36.

And can you read, for the record, what the minimum run time for P -- from the TPC for the train P58 is as reflected in this table?

A. On Page 36, Table 13, first row, train 58 m -- minutes of PRT and Amtrak is 914. Minimum run time from TPC is 933.

Q. Okay. And the Footnote -- Footnote 33 on that page, reflects that the consist you used in this TPC run was for that train 58 was 1P42 locomotive and nine superliner cars; is that correct?

A. That is what is stated in the footnote.

Q. Okay. The -- the minimum run time from TPC that you just read for P58 was 933.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Q. We talked about that consist that's used on the TPC and it appears that for your final calculations, as reflected in Table 13, you used for -- for P58 and P59, which are the City of New Orleans trains used, 1242 locomotive and nine superliner cars; is that correct?

A. That is what is documented here, yes.

Q. Okay. Do you recall using that

consist in your study?
A. I believe that is the consist -- that it can be accurate and concise I would refer to the work paper to the actual consist file that's provided in the TPC work paper info.
Q. Okay. Now, we might just do that. Let me -- bear with me one second here. Yes. Let me mark as Exhibit 6, I believe we're up to -- here we go -- document -- that at the top [redacted]
(Deposition Exhibit No. 6 was marked for identification.)
BY MR. FISHMAN:
[redacted]

[redacted]

Q. Okay. Did you create this document?

A. No, I did not.

Q. Do you know who did?

Who created this document?

A. I believe a member of my staff created the document.

Q. Okay. Who would that be specifically?

A. I believe that was Kevin Trieu.

[redacted]

[redacted]

[redacted]

[redacted]

So let me mark -- introduce another document and we'll mark that as Exhibit 7.

(Deposition Exhibit No. 7 was marked for identification.)

BY MR. FISHMAN:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

You -- you mentioned the length of the route -- the over 900 miles.

How is that relevant on the IC corridor?

A. It's relevant that today, versus tomorrow, versus yesterday, versus five years ago, did anything change in 900 miles of the railroad.

Q. And -- and how is the length relevant?

Is it...

A. Probability of a change in something on the railroad. The probability of one mile -- something in one mile changing versus 900 miles is 900 times more probable that change may have occurred.

Q. Okay. Are you aware of specific changes in infrastructure on the IC corridor during the time you did the study?

A. Yes.

Q. And what was that -- what specific changes occurred in infrastructure?

A. Sightings were -- changes -- there were changes down in Memphis to do with the -- whatever that -- there's a Spillway bridge that, I know, that has been degrading and been issues -- I don't exactly recall but there had been storms that have gone through New Orleans and caused washouts and havocs in some of the territory.

Q. Is that the territory Amtrak runs on because that's our focus?

A. Yes. So in New Orleans, any storms you have come through there have been washouts and track outages and -- and, you know, four or five years I know that any variety of changes can occur on the territory of a change in the switch, changing of just track maintenance.

Q. What -- makes it a little difficult for me to ask these questions because you don't -- you testified you can't remember when you started this process so I'll just kind of ask you again.

Just to give us a -- parameters, do you know -- do you have a sense of when you started working on this; we'll refer to as the capacity study?

A. Well, I would tell you that I started some time during or after 2013 and completed prior to September 2015.
Q. Okay.
A. Definitely the data input -- the fundamental pieces of information of track speed topography would have been done early on as that's the first piece of the work data processing required to do anything.
Q. As we talked about earlier, the TPC is kind of the front-end piece of this, right?
A. Correct.
Q. Okay. So you would have to, by definition, have done that first before running the RCM.
A. Correct.
Q. Okay. So if you're saying you -- you could have started this in 2013 and then it's likely, I take it that that TPC part of this was done in the early stages of that process?
A. (Witness nodding head.)
Q. Let's go back to the exhibit that we were just looking at, which was marked as Exhibit 7. [redacted]

[redacted]

MR. FISHMAN: Okay. Well, in the interest of clarifying, we will look at Page 23.

Are you referring to --

MR. HIRSH: Our first step was to obtain train history data at 2013 which the time we began our modeling was the latest complete year --

MR. FISHMAN: Right. That's why I asked earlier --

MR. HIRSH: -- which implies --

MR. FISHMAN: -- that they started in 2014.

MR. HIRSH: Right.

MR. FISHMAN: Okay. But I'm just confused about -- and, obviously, I'm trying to understand the origin of these documents.

MR. HIRSH: No, and -- and -- we

will -- yeah, we'll -- we'll be looking at it as such, but, you know, obviously a testimony like this may have just been overproduced and wasn't actually part of the study and -- thus, I can see why that's creating confusion.

BY MR. FISHMAN:

Q. Okay. But -- but -- but going back to that point, because I had asked earlier about when Iron Road was in the field, is it more likely that Iron Road was in the field in 2014?

A. It is more likely --

Q. Okay.

A. -- they were in 2014.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Let me introduce another exhibit.
This one we'll mark Exhibit 8.
Thank you.
(Deposition Exhibit No. 8 was marked
for identification.)
BY MR. FISHMAN:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Q. Okay. I'd like to introduce and mark as Exhibit -- are we up to --

THE REPORTER: Nine.

MR. FISHMAN: Nine?

A copy of an e-mail.

(Deposition Exhibit No. 9 was marked for identification.)

BY MR. FISHMAN:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

MR. HIRSH: I'd like to take ten --

MR. FISHMAN: Uh-huh.

MR. HIRSH: If it's possible. It's been a while, but -- we'll try --

MR. FISHMAN: Sure. We'll go off the record and take a ten-minute break. Sounds good.

(A short recess was taken.)

MR. HIRSH: I -- I -- I want to state for the record that as the deposition transcript will reflect, it appears that some documents were produced that were not truly work papers as we would define and they weren't used in the production of the study that was submitted as part of Mr. Krueger's verified statement. And we are going to endeavor as quickly as possible to instead go through the documents produced on the label of work papers and delineate those that -- that are -- are the actual work papers and we will also try to be very clear about the work papers that support the TPC analysis which, you know, is -- is particularly confusing with these other documents so that you can see the actual basis for the TPC analysis as submitted by Mr. Krueger.

MR. FISHMAN: And I'll just note for the record that we will await the results of your analysis and I will neither agree or disagree with his characterization of those documents until such time as we've sorted it out because we did receive those as work papers and --

MR. HIRSH: Right. And --

MR. FISHMAN: -- reserve the right to interpret them as we may.

MR. HIRSH: You -- you can interpret them. I think it's up to us to tell you what we relied on and didn't rely on --

MR. FISHMAN: Uh-huh.

MR. HIRSH: -- but certainly you can -- can interpret them as you wish.

BY MR. FISHMAN:

Q. Okay. Let's mark as Exhibit 10,

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

MR. FISHMAN: If you put that one away and let me introduce and mark for the record Exhibit 11.

(Deposition Exhibit No. 11 was marked for identification.)

BY MR. FISHMAN:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Q. Put that one away. Your verified statement on Page 36, Table 13 reflects, as we have been talking about, the MRT calculations from TPC for city of New Orleans and the Illini/Saluki train?

A. Correct.

Q. Did you run TPC calculations to determine the MRTs for the Blue Water and Wolverine trains?

A. Likely would have done that because that is a fundamental input to the model.

Q. Okay.

A. There may be -- there's likely a comment in the report of what consist were used for the different -- different routes.

Q. Okay. Do you recall what those MRT

results were compared to the Amtrak PRT?
A. No, I do not.
Q. Okay. You don't mention them in the report.
Is there any reason why?
A. Likely it wasn't a significant anomaly.
Q. Okay. I'd like to mark as Exhibit 12 a document that's similar to the format we were looking at earlier.
(Deposition Exhibit No. 12 was marked for identification.)
BY MR. FISHMAN:
Q. This document, Exhibit 12, is marked at the bottom --
MR. HIRSH: Can I get an extra copy?
MR. FISHMAN: Okay. You can have that one.
Thank you.
BY MR. FISHMAN:
[redacted]

[redacted]

[redacted]

[redacted]

BY MR. FISHMAN:

Q. Let's go back to your verified statement. So on Page 4 of that verified statement in your description of Scenario 2 -- so it's in the second full paragraph, third sentence states: "By subtracting the Scenario

1 baseline freight delay from Scenario 2, we're able to quantify the total incremental delay to CN freight trains caused by the presence of Amtrak passenger trains at the specified service levels as well as identify the specific locations on the corridor where those incremental delays occurred."

Do you see where that is?

A. I do see where that is.

Q. Okay. And I'd just like to focus on the latter half of that sentence where it states you were able to identify the specific locations on the corridor where the incremental where -- where those incremental delays occurred.

How are those specific locations identified?

A. Where the delay occurred?

Q. Yes.

A. By subtracting the delay that train time per segment of Scenario 1 for various locations on the corridor from those same segments on Scenario 2.

Q. And so Scenario 1 was freight only -- CN only, right?

A. Correct.
Q. CN plus traffic, rights, freight trains?
A. Correct.
Q. Okay. Scenario 2 was freight plus Amtrak.
A. Scenario 2 was freight plus Amtrak.
Q. And you just said you were comparing delay time.
A. Train time.
Q. And so how is that actually done; you do that on a per train basis?
A. It is per train. You have the arrival-departure time of every train at every station as defined in the input of the route -- of the -- the -- of the model. The simulation will do its dispatching and move the train and if the train does not encounter any delay or any different routing, it will match the input MRT TPC time so you will have a arrival-departure time for every train at every location so per train which is the essence of the time-distance plot or the Spring Line plot so you sum up the times between stations for Scenario 1 and you sum up the times for the

identical trains at the identical locations for the other scenario and you subtract the two.

Q. You do that on an aggregate base or a train-by-train basis?

A. Train-by-train.

Q. And only for the freight trains, right?

A. For this study as the objective was to identify the impact on freight only the freight trains are included.

Q. Okay. And schedules are an input to the RCM model; aren't they?

A. In schedule is an input in -- yes.

Q. Okay. Isn't that a -- a significant input in terms of when the trains are going to be running?

A. Yes, it is.

Q. Okay. And how did you determine the schedule you used for the freight trains?

A. Schedules for the freight trains were based on what the core plain was from the results or information from the field survey and from the historical analysis of 2013.

Q. Okay.

A. So I have to believe that I explain

that in there -- in the statement that there's a section on how we gathered the -- the traffic and the characteristics of the traffic. I'd have to refresh myself and reread this section to give you more specifics.

Q. I think on Page 38 you explained that at the top of 38 I think this gets to the point you were making. In order to simulate real-world operations involving scheduled trains which may be operating earlier or later compared to their schedules and unscheduled change, trains departure and times in the model must include a certain level of variability from the schedule.

Is that part of what you were just referring to?

A. That is correct.

Q. Okay. And to -- so how did you do that?

How -- how did you account for that variability?

A. We looked at the historical variability of the trains at their origin and at their work locations.

Q. And did you calculate a percent

early; percent late is that -- isn't that part of your calculations?
A. That is what we did in review of how the historical operator -- historical actual times we developed or identified a reasonable characteristic of the variability for the trains at origin of how often the train would be early versus late and what -- how early and how late the trains are -- we've seen historically for that train.
Q. And you did that to reflect real-world operations of the freight?
A. Correct. Real-world variability.
Q. Okay. What did you do with the passenger trains?
Did you assume they all operated on schedule?
A. That they operated on schedule at origin.
Q. Okay. Was there any consideration given to accounting for variability in the passenger train schedules?
A. We decided not to do that because the specific question was the impact of the passenger on Amtrak.

Q. Okay.

MR. HIRSH: I think you misspoke. You said of the passenger on Amtrak.

THE WITNESS: Oh. Passenger on freight.

Thank you.

BY MR. FISHMAN:

Q. Uh-huh.

Okay. Going back to Page 4 of your verified statement, you indicate at the bottom of Page 4 so it's the last sentence on Page 4 it states -- maybe I should go one before that. So let's build up to that. Let's go to the sentence that starts with "once" in that same paragraph. "Once we had identified how much and where the incremental freight delay occurred due to the presence of Amtrak, we conducted a capacity analysis on the current corridor plant, i.e., the plant used in Scenario 1 and 2 simulation. To identify pinch points areas of congestion and other areas of freight Amtrak conflict that could be improved or mitigated to additional infrastructure, i.e. additional double checks, sidings or crossovers."

How did you conduct that capacity analysis?
A. That was conducted a variety of ways. I think it's later described in the statement. In general terms it was using the simulated results of the model and getting the train times over segments and comparing it between scenarios to see where the additional tran -- additional freight train time was occurring. We had looked at the time distance plots with visual -- visual analysis of the movement of flow of trains through the corridor and where the conflicts and congestions were occurring. We also used the -- my return -- my capacity Excel sheet to identify the specific area -- pinch point areas where the infrastructure, in general, has a lower capacity for handling traffic volume.
Q. And was that capacity analysis done through the RCM model?
A. The simulation was through the RCM.
Q. Were there aspects of that done outside of RCM?
A. As I said, yes, the time-distance plot visualization, the outside of the RCM, the

post processing of train times and nothing mating into train delay, i.e., how much freight time was spent on the Yazoo sub with Amtrak service or without Amtrak service, and identifying the using as I said, the -- my capacity Excel sheet of which track segments of the corridor had stronger or weaker ability to handle traffic volume.
Q. So it's a combination of using RCM and then using what I'll call manual analysis.
Is that a fair statement?
A. Well, I would -- considering your terminology and use up until this date I would say it's a variety of modeling --
Q. Okay.
A. -- because even the mathematical calculations in Excel from your previous comment is modeling and -- but it's a -- other forms of analysis including the route capacity model, as again, in my verified statement we would use the different analytical approaches, tools, processes, models to identify the pinch points, or areas of congestion, or possible infrastructure improvements. We would take that added infrastructure, put it into the

route capacity model. We would run the route capacity model. We'd run the scenario -- Version 3 scenario. The final version was a result of more than one simulation with incrementally different infrastructures to work up to the recommended infrastructure to mitigate or minimize the freight to lay back to the level of it and Amtrak was not there.
Q. It -- it sounds like this was a process that took some time.
A. Yes.
Q. Did it -- did it take a year or two years to do all of this analysis?
How long did it take?
A. A lot of time. I don't recall. That's the difficulty from this time answering some of your questions when did we start; when did we end. It's, you know, a number of years ago, but it took a long time.
Q. Okay. I started to say you're working on different projects during this whole time you're doing this capacity study as well?
A. I had my regular job to do as well.
Q. Fair enough.
The next sentence on Page 4 goes to,

I think, something you just mentioned was supposed to be additional infrastructure so it says on Page 4 at the bottom: "The additional infrastructure was added to the model incrementally in the Scenario 3 simulation until we had mitigated the incremental freight delay caused by Amtrak's passenger trains.

In other words, until the del -- the level of delays CN freight trains measured in Scenario 3 was approximately equal to the level of delays to CN's freight trains measured in Scenario 1."

You see where I am?

A. Yes.

Q. I wanted to ask you about the additional infrastructure.

How is that additional infrastructure identified?

A. As I just described as well as what's further described in the paper it was through a variety of analysis including review of the time-distance plots, including the post processing of the Scenario 1 and Scenario 2 simulations to -- that would quantify where the additional freight delay was occurring, on what segment portion of the corridor as well as through application of my Excel capacity sheet that would identify if infrastructure was added here or at different locations to what extent would it increase the train volume capacity of that segment of the corridor.

Q. Okay. And when we talk about additional infrastructure that was considered here, is it fair to say we're either talking about additional track, sidings, or crossovers?

A. As we had just read on a previous page, it was additional double-tracks, sidings; crossovers.

Q. Okay. So that's kind of a menu of options of -- of the additional infrastructure you're considering?

Is that a fair statement?

A. The options considered were railway track infrastructure.

Q. Okay. Which would be additional track, sidings, and crossovers?

A. Right.

Q. Okay. Would not include, for example, signal system changes.

A. Signal system changes it did not.

The territory has a -- signals and it has intermediates.

Q. Okay. But changing signal spacing can have an impact on capacity; can it?

A. It can.

Q. Uh-huh.

All right. What about siding spacing?

Doesn't that also have an impact on capacity?

A. Siding spacing does --

Q. Uh-huh.

A. -- but as I had mentioned --

Q. Uh-huh.

A. -- that that was one of the infrastructure elements that we considered and looked at.

Q. Okay. In terms of extending sidings; is that a fair statement?

MR. HIRSH: Ob- -- objection. You're mischaracterizing --

MR. FISHMAN: Uh-huh.

MR. HIRSH: -- what he just said. He said spacing --

MR. FISHMAN: Okay. Why, would

it -- it --
MR. HIRSH: -- not distance.
BY MR. HIRSH:
Q. Just clarify. Did you actually look at changing where the sidings are or do you look at either adding new siding and extending?
A. As described in the verified statement as well as --
Q. Uh-huh.
A. -- provided in the work papers and mentioned I used my capacity Excel sheet which with specifically look at the benefit of the additional; the extension of the siding or section of double-track.
Q. Okay. Are you familiar with the proposal that CN made to Amtrak in August of 2011 about specific infrastructure improvements that potentially could improve long-time performance on the Chicago, New Orleans corridor?
A. You'd have to be more specific for me to -- answer your question. No, it's too -- too general.
Q. Did you have any involvement in helping CN develop infrastructure pro- --

proposal to Amtrak in 2011?
A. Again, it's too generally [sic]. Somewhere in that time period I had undertaken a study as we mentioned before Amtrak's service to Dubuque and in that --
Q. Uh-huh.
A. -- there was --
Q. Okay.
A. -- infrastructure in there. So there's a number of projects that I would be involved with to answer a question of --
Q. Uh-huh.
A. -- someone locally or such -- of -- what about this or that?
Q. And what about on the Chicago, New Orleans corridor -- the north central corridor?
Did you participate in any efforts to identify improvements separate from this proceeding -- any improvements that would perhaps help Amtrak's on time performance?
A. Yes.
Q. Okay. What was your level of involvement?
A. I would be asked a question of -- I don't recall the specifics of it, but my

involvement generally would be a question of we have a probably with this, resolve it, or what would -- what benefit would this plant change, or issue be, or there's a problem, it's in this area; what would your recommendation be to help resolve or the conflict? I need a lot more specifics to try to recall something in six years ago.

Q. Okay. Do you recall ever seeing this sort of final proposal that CN made to Amtrak in that regard?

A. No, I don't.

Q. Okay. Is that something you consulted when you did the capacity modeling analysis in this proceeding?

A. Not that I recall. Could be possible. I don't recall.

Q. In your verified statement you mention on Page 5 -- in the first in the full paragraph on Page 5, the last sentence as the final step in our analysis, we estimated cost for the -- specified infrastructure improvements. And then I believe you have at the end of your verified statement on -- starting on Pages 45 continuing on 46 and 47

you have cost information.
Are you familiar with that?
A. I'm familiar with it and the comment on Page 5, I believe you'd have to add following comments and sections talking about those cost estimates and the numbers for costs to the level of cost estimating that we had provided or undertook.
Q. Okay. Where did you get those cost estimates?
A. Those cost estimates were from CN. It was the, I believe, described in either the -- this document.
MR. HIRSH: Page 45.
THE WITNESS: Page 45.
BY MR. FISHMAN:
Q. Page 45 has the -- in Table 19 you have the actual estimates that you used. The unit cost for this -- different types of infrastructure improvements.
And so my question is really where did you get those numbers?
A. Based on recent actual expenditures of like infrastructure improvements.
Q. Okay. And is that information you

had or did you get that from CN engineering, for example, or another department?
A. What I, through CN engineering, would have -- or what we would have through CN engineer.
Q. Let's go back to Page 5 of your verified statement. And on Page 5, in Footnote 5, first two sentences state as follows: "We did not model minor unpredictable matters such as weather disruptions, track equipment failures, unplanned activities or work blocks, nor did we model detailed the yard operations, or other work off the main line."
Let me ask you was that not done because RCM is not capable of doing that?
A. No that is not correct.
Q. Okay. Why wasn't that done?
A. It was not done because we deliberately took an approach of trying to be as conservative as we could be in having the maximum amount of capacity available on the corridor. So we did not want to include other elements that would consume capacity.
Q. Okay. I believe you testified earlier that -- that RCM is not set up to model

yards.

It's a line simulation program, right?

A. That's correct.

Q. Okay. And I guess I don't understand -- trying to understand is RCM capable of modeling any of these issues that are mentioned here?

MR. HIRSH: Let me object. There's an ambiguity here of about what modeling is. As this statement explains it deals with things like yards in the model --

MR. FISHMAN: Okay.

MR. HIRSH: -- and when he talks about modeling a yard I think he means does he get into specifics of operating within a yard --

MR. FISHMAN: Okay. But --

MR. HIRSH: -- for example.

BY MR. FISHMAN:

Q. So going back to the statement that says "we did not model different things," and I guess I'm just asking you does RCM have the capability to model --

A. Yes.

Q. -- the things mentioned here?
A. It has the capability of modeling track and equipment failures; work blocks. So it has that capability and again, within the work papers that we supplied with the documentation on the RCM it clearly outlines those elements and components that it is able and -- to undertake.
Q. Okay. And you just elected not to model those factors here in this case?
A. We were trying to be as conservative as we could be and did not want to include detail and elements that would be consuming capacity.
Q. Okay. Let's go to Page 20, of your verified statement and the Section D which is entitled: Simplifying assumptions.
If you could just look at those beginning on Page 20 and continuing on 21, there are nine specified simplifying assumptions.
A. Okay.
Q. I'd like to ask you about those.
So on Page 20, it states in Section D: "No model of complex real operations can

hope to account for every possible detail of the real-world operation. Building our representative plant our model included a number of simplifying assumptions. Some of these simplifications were necessary due to limitations in data sources of the modeling software where others avoided unnecessary added complexity that would not have significantly changed or improved the simulation results."

So focusing on that last sentence that I just read: "Some of the simplifications were necessary due to limitations in the data sources of the modeling software, others avoided unnecessary added complexity that would not have changed -- that would have not significantly changed or improved the simulation results."

I'm trying to understand which of these assumptions fall into those two different buckets?

So if you can help me -- let's kind of look through this and start with the first one. First one relates to turnout speed --

MR. HIRSH: Can you be clear what buckets you're referring to because --

BY MR. FISHMAN:
Q. So that sentence breaks the --
MR. HIRSH: What -- what are your two buckets?
MR. FISHMAN: The simplifications necessary due to limitations in the data sources or modeling software would be one category.
And others --
MR. HIRSH: That is compound itself because it has an "or" in there.
MR. FISHMAN: Sure.
And I'll -- that's fine. And if it's data source or modeling that'll be one category. Others -- other simplifications -- avoided unnecessarily -- unnecessary added complexity. That's the other category.
BY MR. FISHMAN:
Q. So for the first one --
A. Okay.
Q. -- which category would that be in?
A. I'd like to clarify your --
Q. Uh-huh.
A. -- your comment or your statement.
The sentence or the paragraph leading up to the

specific points are a general informative verbiage for outlying -- outlining the generalities at play similar to the very first no-model complex real operations can hope.

Q. Uh-huh.

A. Now, that's not specific to the work that we did, or to this model, or any specific model. So likewise, simplifications were necessary et cetera. These points on the next page is not a complete all-encompassing. So the linking of that sentence and even the segmentation of the pieces of that sentence to these points further, you know, that follow are not necessarily a link that's there.

Q. Okay. Are you also saying that this -- this is not a complete list of simplifying assumptions; that there may be other assumptions that the model makes?

MR. HIRSH: I'll object as to form. Now, you've added "that the model makes" and I think there may be a difference between embedded assumptions and the model and assumptions with respect to inputs and the way the model's manipulated.

BY MR. FISHMAN:

Q. Okay. But in either -- I mean this -- this --
A. And a clear distinction that needs to be made is we are using a tool or -- the model is in no way or any model --
Q. Uh-huh.
A. -- to replicate the reality of the railroad.
Q. Right.
A. The model is a tool that you could set up and establish an experimental situation -- then you can control a change in the variable and get a measure of cause and effect. So just by the nature of the model it is not going to account for or incorporate every aspect of the real world or reality, nor are in our study did we use every aspect or component of the model. The model was simply a tool that of a variety of tools to assess the question that we were asked. And this is a outline of the significant simplifying assumptions that we made that are of importance. It is not complete and extensive. Definitely not in the connotation that you're -- this conversation's at times leads or you suggest to. So...

Q. Okay. Let me focus then on some of the specific simplifying assumptions. I'd like to focus first on No. 5, which is on Page 21. And relates to Markham Yard.

Could you help me understand how that was modeled?

A. Fundamentally, we just modeled from Clark Street through Markham Yard to, I believe it's Stuenkel as double-track with the existing in -- crossover plants that are there. We did not model the yard or the other yard related activity or complexities and that's likely from very early on in your conversation why there are no Metro trains in our analysis. We only looked at the freight corridor.

Q. Simplifying assumption No. 6 relates to Amtrak's station in Memphis and I think you may have referred to some of this earlier.

Can you help me understand how that was modeled?

A. Basically, we modeled Memphis that 17-mile section is just a terminal. So when -- and I can't recall what the specific station and mile post is on the north end, but when Amtrak or freight -- entered -- went beyond that point, it was in the quote, "terminal of Memphis" and had a time duration reflective of how long it would take to traverse that terminal area and show up at the opposite end at West junction. So all of the intricacies of the different foreign routes, and network, and yard, and et cetera were simplified into strictly -- you will take this amount of time from entry to exit.

Q. Okay. And then No. 7 re- -- relates to Harrison Yard.

How is that modeled?

A. Coming out of Harrison Yard there are two routes. The high line and the low line. So there is effectively operationally double-track, but one route has a slightly different topography and a slightly different distance. So we modeled that portion of effective double-track as strictly double-track for the -- of the shortest of the two routes. So we did not have a different grade curve distance for the north track versus the south track. They were the same in the model.

Q. And we -- we talked earlier about RCM being a line simulation program not a yard simulation program.

Is that part of the reason why these assumptions were made?

A. That is part of the reason.

Q. Okay. Going back to the previous Page 20 in Section D, in the sentence I read earlier where that compound sentence about some of the implication are necessary due to limitations and data sources of the modeling software others avoided unnecessary added complexity that would have not significantly changed or improved the simulation results.

I wanted to ask you about the last part of the sentence.

So -- so -- so what in your experience would be a significant change in the results?

Is there a percentage difference?

A. That it would have resulted in a fundamental change in a major infrastructure component.

Q. Okay. So you wouldn't evaluate that based on the delay time analysis?

A. That comes into it if there is a significant change in delay or if there's a significant change in the location of the delay.

Q. Okay. And how would you interpret -- how would you define "significant" in that context; is what I'm trying to figure out?

A. Would it have driven more infrastructure? Would we have -- have put in more double-track or more sidings?

Q. Okay. Was there a certain amount of time that -- that drove that kind of decision -- like percentage-wise or -- or just time-wise?

A. Um...

Q. So you're calculating delay time, right?

In terms of -- and so I'm just trying to understand.

You said the -- the threshold would be -- that required more infrastructure, what was that sort of threshold point in terms of delay to require more infrastructure?

MR. HIRSH: I would -- ob- -- objection. It lacks foundation because he did- -- didn't say that his final decisions on infrastructure were driven by specific, you know, every minute delay.

MR. FISHMAN: Uh-hum. Well, how -- well, what we're --

MR. HIRSH: He has been clear what he focused on was would it change the infrastructure.

BY MR. FISHMAN:

Q. But what were -- what was the basis for making those infrastructure changes?

A. The infrastructure changes were based on where conflict occurred and what was required to eliminate that conflict back to a level of the Scenario 1.

Q. Okay. Was there a certain amount of delay associated with that conflict that you were looking at?

A. Between the two scenarios, you know, was a level of delay to freight without Amtrak and a level of delay of with Amtrak and infrastructure was added to eliminate or mitigate that delay, not as a -- yeah, to mitigate the delay back toward the base case scenario.

Q. I see. So you're just

essentially -- you weren't looking for -- you weren't looking to reduce the -- the delay by a certain amount you were -- looking to reduce it back to the base case level No. 1 scenario?

A. Correct.

Again, I'll reference the -- the wording that is there in the sentence is a general -- you know, it's an explanation of the process. It is not specific to any -- one decision that was made. The key thing is that if you would have modeled the Memphis area in detail that would not have changed the result of the -- of the analysis other than it would have had a lot more detail of what's going on in Memphis. So things that did not affect the line capacity of move over the corridor those items we decided to simplify and omit in the sake of being as simple and conservative as we can.

Q. Okay. Let me direct your attention to Page 43 of your verified statement and in the second full paragraph which starts below the table, Table 16, second full paragraph starts with the word "after." I'd like to go to the third sentence of that paragraph which

states: "Using our knowledge and understanding of the likely most cost effective infrastructure improvements to alleviate freight delays, we added pieces of infrastructure in specific locations in strategic locations."
How did you do that?
A. Again, that was through as explained earlier, through the use of other analysis tools and processes be it the post processing of the results of the simulation to identify where the delay was occurring on the territory. It was review of the time-distance plots to look at where from a train movement pictorial picture, where the delays and the congestions were occurring, and what was causing those delays. Also in conjunction with the capacity Excel sheet that identified where the -- capacity of individual segments were and if the infrastructure was put in how that would improve the capacity of that segment in handling -- being able to handle more freight trains to decrease the -- the standoff for that segment.
Q. What cost effectiveness analysis did

you do?
A. The cost effectiveness was looking at if we were going to put infrastructure in being cognizant through experience and that the topography and -- sort of not infrastructure but elements that were out there is it better to extend the siding east or west over a bridge versus not over a bridge. Would it be more prudent to build a new siding versus extend a siding or extend double-tracks. We looked at what the nature of the territory -- what was out there in the field and applied our experience and what was buildable or easy to build, difficult to build; costly to build from a macro level.
Q. Okay. But you didn't do any detailed cost effectiveness analysis?
A. As I said before, no.
Q. Okay.
A. To the extent the cost effectiveness is, you know, we would not build a siding where there -- there would be more level road crossings and have to incur the cost of closing or relocating road crossings versus slightly different area that you could build a -- a

siding without road crosses. So, you know, there's cost effectiveness involved with that decision but it's more, you know, mental obviousness.

MR. FISHMAN: Shall we take a quick break? Go off the record.

(A short recess was taken.)

MR. FISHMAN: Let's go back on the record.

MR. HIRSH: We're back on the record.

I want to state for the record that, as I have advised Amtrak's counsel, we are willing to extend the end time for the deposition an additional hour in large part to account for the fact that some time was spent on various exhibits that were not, in fact, work papers and we appreciate that that, you know, consumed some time. So...

MR. FISHMAN: Why don't we proceed and we'll appreciate your patience, Harald. Actually, it's been a long day for me, too.

BY MR. FISHMAN:

Q. So I would like to direct your attention to Page 8 of the verified statement.

AND at the top of Page 8, in the second sentence, it's referring to RCM. I'll read. The first sentence says: "The RCM stands primary line simulation program and is used to analyze the interaction of different infrastructure traffic and operational parameters."

Second sentence goes on to state: "Is this a controlled reproducible event-based computer simulation tool used to measure the operational impact (in terms of train delay) of changes in a certain parameter while holding other parameters constant"?

I would like to ask you about that second sentence that I just read.

What does it mean to be an event-based computer simulation tool?

A. For a simulation tool it's a cause and effect. So a -- it responds to an event. So the -- you know, it's not an addition and subtraction. It's actually a -- it deals with an event, makes a decision; creates another event, make a decision. So it deals with handling events.

Q. And what is the relevant event that

it handles?
A. Pardon?
Q. What is the event that it handles?
MR. HIRSH: Objection as to form.
You're suggesting it's a single event.
BY MR. FISHMAN:
Q. What is the event or what are the
events that it's dealing with RCM?
A. With the input of the input data. I
mean, simple terms, it would be the -- dealing
with the berth of the train. It would be the
initial departure of the train to origin, and
then it would be the variety of events
associated with that train and any other train
in its movement from specified origin to
specified destination be it events of plant or
events of traffic or events of the input
operating parameters.
Q. So the events would include the
train meets?
A. Correct, that is an event.
Q. Okay. I see.
And if it's not an event-based
computer simulation tool, what other kinds of
commute -- computer simulation tools are there?

A. Say that again.
Q. I'm just trying to understand what's the difference between an event-based tool and another type of tool. So what is another type of tool that's not event based? Have we talked about one today?
A. Yes, we have.
Q. And which would that be?
A. Parametric model.
Q. Okay. And that's not event-based?
A. It's mathematical.
Q. Okay. Okay. That's helpful. Thank you.
The sentence also refers to changing a certain parameter while holding other parameters constant?
A. Correct.
Q. And I'm trying to understand here what is that parameter that's being changed in RCM?
A. The parameter in RCM in our study are three fundamental parameters. First is with or without Amtrak trains. Second is Amtrak trains operating through the system with an end point, OTP; end point OTP in terms of

allowable delay at destination. And the third or second is that again with a different end point except for target delay. And third is all of those scenarios again with a change in infrastructure.

Q. So those are all parameters that were changed while you ran the RCM model for this study?

A. Correct.

Q. Okay. You mentioned the second factor or the second parameter you mentioned was end point OTP, which stands for on-time performance; is that correct?

A. I believe that's what it stands for.

Q. Okay. And how is that actually adjusted in the model?

A. It was adjusted -- it was achieved in the model through manual interaction of the dispatch of the train. So through user specified dispatch commands to modify, adjust, specify what events, what decisions and event located -- as events occurred to manage the events.

Q. So, effectively, you're -- is it fair to say you were overriding the dispatch decision of the model in those cases?

A. I would not say it like that. I would say that we are -- the user is specifying.

Q. But by user specification, you mean that it's not the fault of the dispatch command. It's an actual input from the user?

A. It would be specifying a different decision than what the model would -- may have -- or may have decided to do or a decision that you, the user, would want to tell the model to do. At this location, do this. At this location, take this track instead of that track.

Q. Okay. And how is that actually done? Is that done by trial and error?

A. No.

That's an input. I mean, you're working with the model.

Q. Okay.

A. So RCM can -- you know, has the ability that you interact with the model so you can -- when you run the model you can put a command in and the model then follows that. I mean, the whole modeling exercise is, you know,

interactive, iterative in its nature.
Q. And how does one -- the user in this case, how does one -- how does the user know what commands to use in a particular situation?
A. You use the string line. You take a look at the dispatch of the train or you know the -- the dispatch movement flow of the train and you can tell -- give the model that instruction that it then uses.
Q. So if the goal is to improve end point on-time performance in the model, wasn't that part of the goal of what we're talking about with respect to these commands that are issued?
A. I wouldn't put it in terms of improve. The objective of the commands were to achieve that goal.
Q. Okay. So the objective of the commands was to achieve a specified service level?
A. Our objective in the simulation was to achieve a specified end point delay level of the train.
Q. Okay. For Amtrak?
A. For Amtrak.

Q. Right.
So, to do that, I'm just trying to understand how this works, the -- the commands that you would be issuing would include what? What types of dispatching commands, for example?
A. For example, it would be take route on this track, would be wait at this station; hold at this station for this train; or hold that train for this train; or hold until time at this location.
Q. And that's with respect to both freight and passenger trains?
A. Correct.
Q. Okay. So the model has its own dispatching logic and it dispatches according to that logic, right?
A. And the input parameters --
Q. And the input --
A. -- that you specify.
Q. Okay. And these overrides we're talking about are user commands would change the dispatching logic of the model in those particular events?
A. I would not describe it as change

the logic. The RCM has the unique feature as well as some of our other models that we have that you can interact with the model to create or to model the specific operation of interest versus totally relying on the pre -- the one preprogrammed algorithm that is in whatever model it is. You're not at the mercy of the model's algorithm that the programmer who, at whatever time, developed. So you have the ability to customize your dispatching decisions to fit the question, the objective, the operations of interest for addressing the question, do the analysis that is required.
Q. Okay. That dispatching algorithm in RCM is based on priority, in part?
A. Priority comes into the dispatch decision. It's part of the input.
Q. Is that algorithm something that's understandable to sort of a layperson?
MR. HIRSH: Objection. Calls for speculation.
MR. FISHMAN: I'll --
THE WITNESS: I'm not a programmer.
BY MR. FISHMAN.
Q. Okay. So it's the code; is that a

fair statement?

A. I would say in our work papers uniquely we have provided the architecture and flow chart decision process, the design elements of the route capacity model.

Q. Okay.

A. So we provided more than just the user manual. We also provided the functional design documents of the model that describes the -- what that algorithm and components elements are.

Q. Okay. Do you know which work papers those were in specifically?

A. It should be RCM supplemental. It would be a text -- likely a text file or a Word document.

Q. Okay. Let me just see if I can find, perhaps, what you're referring to.

MR. FISHMAN: I'm going to introduce and mark as Exhibit 13.

(Deposition Exhibit No. 13 was marked for identification.)

BY MR. FISHMAN:

[redacted]

[redacted]

[redacted]

MR. FISHMAN: I would like to introduce another exhibit. We can kind of put that one aside. And we've got 14.

(Deposition Exhibit No. 14 was marked for identification.)

BY MR. FISHMAN:

Q. So we have just marked as Exhibit 14

another document as part of your work papers,

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

THE WITNESS: My statement.

So starting on Page 22, "Selecting And Inputting Traffic Package." Page 23 identifies the observation points which are the -- [redacted] and then on the other pages you will have what the traffic volume is and what that volume is per segment per train class, and how the sample compares to -- or how the sample is claimed Step 1 and then how the cleaned sample is adjusted to match or attempt to match or correlate to the 2013 average.

[redacted]

[redacted]

[redacted]

Q. I would like to direct your
attention to -- back to your verified statement

so we can put away this document, the exhibit we were just looking at. If you go to Page 30, in the section you were just referring to where it describes the various changes to the traffic packager that were made, there's a table on the top of Page 30 entitled "Bulk Trains Per Week."

Do you see where that is?

A. Yes, I do.

Q. And it appears that this table reflects that the adjustment in the middle of that table there is a column entitled "Adjustment to Sample Week Cleaned."

Do you see that column?

A. I see that column.

Q. Okay. If you -- if you add up those trains two, five, four and five, that equals 16 -- and so am I reading this correct to say that there were 16 bulk trains added to the model on that segment?

A. None of this is at this point -- okay. In terms of -- for the simulation versus the 2013 average, we needed to adjust various trains on various segments to come up, get to or try to get as close to the 2013 average, yes.

Q. So 16 bulk trains appeared to have been added to the model for the IC corridor?

A. Not -- not necessarily added to the model. Some of these trains could be the same train, just also reporting at different locations, i.e., that to Coventry trains could be part of the five -- four, five trains on the rest of the corridor. Because, again, these are just observation points.

Q. Okay. What's the impact of adding a bulk train -- all else being equal, you're adding a bulk train to RCM. Wouldn't that create more delay than an intermodal train?

MR. HIRSH: Object as to form. That's vague and unintelligible.

BY MR. FISHMAN:

Q. Still answer the question.

A. Could you repeat the question?

Q. Sure.

So if you're looking at sort of a model RCM, you're running RCM, and you add a bulk train, all else being equal, doesn't that create more delays than if you were to add, say, an intermodal train?

A. Not necessarily. I mean, adding a

train takes time and space on the corridor. So you have less time and space for the remaining trains to move.

Q. Okay. Doesn't a bulk train take up more time and space than an intermodal train, for example?

A. I don't know how you would come to that conclusion. A bulk train is different than an intermodal or it's similar. It's -- I mean, it -- A, it's a train. It may -- may or may not add more or less time to what's -- what's out there. I don't know that there can be an answer to the question without analyzing it further or more -- more specifics.

Q. Don't bulk trains have a much lower priority than intermodal trains?

MR. HIRSH: Objection as to form.

Are you asking him the model?

MR. FISHMAN: The model.

THE WITNESS: I believe bulk had lower priority.

BY MR. FISHMAN:

Q. Okay. Are bulk trains typically slower than intermodal trains?

A. Yes, each PT, I believe, is lower.

Q. Okay. So doesn't that translate into train that takes up more time and space, the bulk train versus intermodal train, generally speaking?

A. Generally, I couldn't -- I can make the opposite argument generally equally as well.

Q. How is that?

A. Well, a fast high Ferrari of a train through the system also creates or consumes more capacity.

Q. In what way?

A. It creates a difference, so you increase or change the uniformity of your traffic. If all trains were equal, you would get the maximum capacity once you change the characteristics or the mix of the traffic, then you consume more capacity.

Q. Have you analyzed uniformity of trains on the Illinois Central corridor?

A. Only to the extent that the uniformity of traffic on the IC we replicated to the best of our abilities as the traffic input. So the historical 2013 average of the average traffic mix, we looked to replicate that in our simulation input traffic.

Q. Okay. I would like to direct you to Page 32 of your verified statement. And, on Page 32, in the first full paragraph after the table at the top, and it is the third, fourth, fifth sentence, I believe, if I've got that right. One, two, three, four, five. So the fifth sentence begins "Any new train added to the simulation traffic package was randomly assigned a start time from 00.00 to 2400 hours consistent with the principle that bulk and other trains do not have consistent start times and could operate over the corridor at any time."

Is that sentence consistent with what you did in the model?

A. That sentence describes what we did in the model.

Q. Okay. So, basically, to the extent there are any new trains added, the start time was randomly assigned?

A. We -- yes.

Q. Is that the way CN would normally handle a new train that it adds to its operation?

MR. HIRSH: I'm going to object as the form because I am afraid you're probably confused also about what a start time means. And you said add to its operation, it sounds like you might be thinking it's out on the line.

THE WITNESS: The intention or what is being described here is the time that a train that has no specific schedule that would originate at some other location on the system, but would have no schedule time on this corridor, that train can and historically, in reality, enter the limits of our study area at any time.

BY MR. FISHMAN:

Q. Okay. But in the real world, would CN ever add such a train at any time or would it do some kind of analysis through service design of the best time for that train to get out on the line?

MR. HIRSH: I'll renew the objection because for sake of clarity -- because I don't think he's trying to tell you that -- if I'm wrong, I'm sorry -- but that when the train is assigned to start time in the model, that that means it gets out on the line versus just being created in the model. You know, unless I'm wrong about that.

THE WITNESS: Key point distinction, all of the times of the trains within the model is strictly Step 1. When the train is born, i.e., when the model has a train that it has to deal with but the train is offline, this description of non-schedule trains is the nature of a nonscheduled train will originate somewhere. It will proceed through the system, and if that train -- you have seasonality of bulk trains, grain trains, coal trains, and they're -- they have what is called a zero-based schedule, so they will have a schedule from origin. Their origin day and time is zero, but they will have a schedule developed of how long does it take to get to the next crew change point, et cetera, et cetera.

When the coal facility releases the train to the railroad to move to destination, when that facility releases that bulk train can be any day any time. When that train then proceeds through the system where he would show up at whatever the limits of our simulation are, again, can be at any time. So there is no schedule to the train that's a bulk train.

It is random day of -- from one day to the next, they could show up at any time for our scheduling purpose, for adding a bulk train of the unique idea of bulk train one on day one we needed to assign a time. So instead of having the model assign a time, which would have been noon, 50 percent early, 50 percent late, 12 hours early, 12 hours late, which would have randomly generated a time from midnight to midnight, but it would statistically have been preferenced toward noon.

We external to the model, randomly generated based on zero to 24, a start time or a berth time for that train so that we would have, within the model, the replication of the variability of these are nonscheduled trains that can run at any time. There are X number of these trains that we need to account for in our model. We need to provide a time for those trains, but there is no schedule time. There is no historical time. So we created, for the modeling purpose, a time for the train that matched, mirrored, was reflective of how they do operate and show up on the territory.

BY MR. FISHMAN:

Q. And how was the randomness determined?

A. For these trains?

Q. Yes.

A. In Excel. So just random number times 24.

Q. So you just picked numbers, your -- you and your team, or is it the model itself calculate numbers?

A. As we said, these times -- the times for these trains --

Q. Uh-huh?

A. -- we randomly selected a time using Excel, from 0 to 24. Likely, it was using the formula at rand bracket bracket times 24 or times 1,444. If we needed to generate eight times for eight different trains, we generate eight. Do the calculation eight different times.

Q. Did the zero-based trains that you mentioned -- zero-based scheduled trains --

A. Zero-based schedule.
Q. Do those have TSPs, do you know?
A. Yes, they do.
Q. Okay. And that's -- the TSP is calculated by service design?
A. The TSP is a train service plan --
Q. Uh-huh?
A. -- which is also synonymous with a train schedule, which is also synonymous of your ITS schedule.
Q. Okay.
A. So it is the schedule of the train.
Q. Okay. The discussion we were just having about random starts, how does that relate to the TSP for those trains?
A. It doesn't. The TSP for the train recognizes that there is no start time. It starts at zero.
Q. So the TSP reflects -- whenever it starts, it will reflect when it's expected to reach destination?
A. The TSP for a zero-based train will only -- the only pertinent piece is how long does it take to get from this crew change to that crew change. So, in the day-to-day

operations, when a train actually is launched and is moving through the system, operating officers can look at the TSP for that train. Though its time at a station is irrelevant, it will enable them to know how long it will take to get to the next location.

So in the equipment cycling, car cycling, crew cycling, there is a -- what's termed in the industry a zero-based schedule that you can manage and plan the assets for the movement of that traffic.

Q. Do you use TPC to calculate the TPS?

A. Fundamentally a lot. The majority of the schedules at CN are generated either through using ITS, recognizing all of the crudeness of it and errors of it, mixed with various or the high number of measures that we have of how long are these trains taking to get off the road and/or the management's -- whose -- who has authority over the territory of how much time will they allot for this train.

So it's -- you know, there is no hard detailed scientific or consistent approach to the freight schedule. There is a basis of

TPC as a start indication, but then that will adjust or be adjusted to the specific objectives and demands and realities of what they see.

Q. I would like to introduce exhibit marked as 15.

(Deposition Exhibit 15 was marked for identification.)

BY MR. FISHMAN:

Q. This document is -- is something that's on your LinkedIn account. It appears to be a presentation that -- that -- I will ask you. What is this document?

A. It's a general description of what is capacity.

Q. Okay. And, on the first page, it indicates presentations of Canadian rail research lab, U of A.

Is that the University of Alberta?

A. Yes, it is.

Q. Okay. By CN network planning, is this a presentation you gave?

A. It is.

Q. Okay. The date, February 13th, 2013, is that the date of that presentation?

A. That sounds right.
Q. Okay. Good.
A. Not that long ago.
Q. Let's go to the sixth page. So up at the top right corner, the -- you will see the page numbers. So Page 6 of 41.
A. Okay.
Q. And the heading on this page is "Importance Of Capacity." And the first bullet point: "Traditional Solution Is Just To Add Plant," and the sub point under that "Risk Spending Money In The Wrong Place For The Wrong Reasons."
What did you mean by that?
A. What I meant was a traditional approach prior to modeling engineering analysis was the local officer in the field would say I've got a problem, build something. So no thought or analysis.
Q. And -- and how is the approach different today?
A. Well, part of the -- my experience at CN is that we have developed a variety of tools and methodologies to bring engineering principles and practice to the operational

capacity analysis, the railroad. The industry has moved to modeling and a variety of analytics to look at more than just the knee-jerk reaction of building a plant.

Q. Okay. And if you go to Page 10 of this presentation, that page entitled "Capacity, What Is It," and also indicates under that "Types Of Capacity." And there's three bullet points: "Theoretical Capacity," "Practical Capacity," and "Available Capacity."

I believe we were talking about that earlier; is that correct?

A. Correct.

Q. You mentioned earlier theoretical and practical capacity. What is available capacity?

A. As it clearly states in the bullet, it's the mathematical difference between what you're running and what the practical capacity measurement you have conducted for that segment.

Q. Okay. If you go to the next page, Page 11 of 41.

A. Am I allowed to point something out?

Q. Sure.

A. Let's go to Page 7. From the beginning, and I would like to highlight on Page 7 the significance of what is capacity and how it depends on a -- who you ask or what you're trying to achieve, and that it's a combination of a variety of factors. That there is no -- there's no one definition. No one answer.

Q. Right.

On that Page 7, under the second bullet point, there's a sub point that says "Tradeoff Between Competing Interests," what are those competing interests?

A. Different assets of the railroad. Back to the discussion on parametric, it's the locomotive assets, the crew assets, the car assets, the physical plant assets. It's the combination between are you -- the marketing, the engineering, the whatever function or department has a stake in the running of the -- the railway.

Q. And what's the tradeoff that you're referring to?

A. Well, capacity basically is balancing a plate. So depending on what it is that you're trying to achieve, you can increase capacity in one sense but you can also diminish capacity in another sense.

Q. What do you mean by that?

A. Well, if I'm after engineering desire for capacity to do track work, we can give them track time to go out and do their maintenance and do their facility upgrades, et cetera. And, you know, if it was for engineering, they would not run a train on the track after they had maintained it and polished it and got it clean. The operational side, you don't have 24 hours to move the trains. You have less time.

So you can achieve or increase capacity for engineering to do their work at the detriment of a variety of other stakeholders.

Q. I see.

So, in other words, the work block might help the engineering department or the maintenance department upgrade the track, but at the expense of the operating department which can't run during that work block?

A. Correct.

Q. Okay. Is cost another competing interest in which there's a tradeoff here?
A. Is cost?
Q. Yes.
A. All of these elements and components and competing interest have a cost component to it.
Q. Okay.
A. Cost engineering more to do their maintenance without a 24-hour work block than with.
Q. And is delay also -- train delay also a component of the competing interest here?
A. Delay is a component, but it's meshed with a variety of other issues.
Q. Okay. Going back to Page 11 of this presentation, 11 to 41, there is a graph, I guess, you call it. And this appears -- what does this show, this illustration on Page 11?
A. I'm attempting to illustrate just a fundamental building block of the components that come up or drive or make up practical capacity or...
Q. Okay. And that would include -- I

see the minimum run time, the MRT. On top of that, there's operating delays, traffic delays, and plant delays?

A. Correct.

Q. Okay. Is a certain amount of delay inevitable in a railroad operation?

A. In any transportation system.

Q. On Page 13 of this presentation, it's entitled "Key Factors That Drive Capacity," and you've got listed here "Most significance capacity factors are speed, uniformity, and disruptions."

Can you talk a little bit about this? What are you trying to say here?

A. Similar to the parametric model document, the key driver's of capacity are velocity, the uniformity of any and all elements upon traffic operations, and, of course, if you have any significant disruptions.

Q. Okay. The last bullet point on this page, it's entitled "Operations." It refers to schedules, times, priorities, online switching, and also refers to disruptions, track maintenance, setoffs, lifts.

Did you account for any of those
factors in your capacity modeling for purposes
of this proceeding?
A. Accounted for?
MR. HIRSH: Well, I'll object. That
is vague when you say "accounted for." We
talked extensively about schedules, about
priorities. We've talked about many of these
items. So maybe you can be clear what you mean
by "accounted for."
BY MR. FISHMAN:
Q. Do you feel like you've accounted
for all of these different factors?
MR. HIRSH: Same objection.
"Accounted for" is vague and ambiguous.
THE WITNESS: In a general sense,
for that last point, as in my verified
statement, we specified that we did not include
disruptions and track maintenance.
BY MR. FISHMAN:
Q. Okay. What about online switching?
A. Yes.
Q. How is that accounted for in the --
in the -- in the model?
A. Where a train stops to work, there

is a dwell time.
Q. And that dwell time was, I believe, based on you had like a 10 percent average calculation; is that right?
A. Well, the online work was based on a combination of what was gathered during the field survey of the review of the actual operations on the corridor, a combination with what is the service plan for the trains, and in combination of review of -- for 2013, how long had trains -- the individual train at that location spent simplifying assumptions were made to apply a representative dwell time with a representative variation, and to be consistent through both the days or different scenarios that were simulated.
Q. If you go to Page 19 of this presentation, 19 of 41, the page is entitled "How To Measure Capacity," and the first bullet is "Computer Simulation." And in parens you've referred there to RTC, SYSTRA, RCM, and RAILS.
Are those the line simulation models we were talking about earlier?
A. Those are line simulation models that we had discussed earlier. I think SYSTRA

is the first time that we brought up that specific model name.

Q. Okay. But RCM here refers to the CM model we've been talking about extensively today; is that right?

A. That is correct.

Q. Okay. Your first sub point here is complex labor and data extensive.

A. Yep.

Q. What did you mean by that?

A. The computer simulation is complex. You have a number of variables. You're doing a dynamic interactive modeling of plant traffic and operations, and it takes time and effort to set up, to conduct, and to get an answer out of it.

Q. Okay. The last sub point under that same bullet says: "Questionable results still need the fundamentals. No built siding here button."

What did you mean by that?

A. Well, specific to RTC at the RTC user conference, the users of RTC have requested time and again that Eric Wilson include in his line simulation a build siding

button here so that they can ascertain where a plant or siding should be built from running the RTC simulation.
Q. Who is Eric Wilson?
A. He is the owner and developer of RTC.
Q. Is this that Berkeley outfit?
A. The Berkeley.
Q. Okay. Does RCM have a build siding here button?
A. No, it does not.
Q. Okay. What did you mean by "still need the fundamentals"? What fundamentals are you talking about there?
A. All of the fundamentals related to what is capacity.
Q. And what would that include?
A. It would include the fundamental, the basics of moving a train over a piece of territory, and what are the factors involved with that, and what are the issues and items that are at play, whether it's the -- you know, understanding the time and motion, understanding fundamental track consumption utilization, understanding the fundamental

conflict issues that arise. So all of the fundamental basic problem-solving, identification, and assessing and analyzing a rail system.

Q. Don't take this question the wrong way, but you've been with CN 35 years, approximately?

A. 36.

Q. 36.

Is there a retirement policy at CN?

A. Yes.

Q. Okay. Are you scheduled to -- to retire at some point in the near future?

A. I am able to retire now.

Q. Okay. And how does that work? So you can elect to retire now?

A. Correct.

Q. Are you forced to retire at some point?

A. No.

Q. Okay. Do you have a scheduled retirement date?

A. No.

Q. Okay. Just wanted to clarify. For purposes of this proceeding wanted to know if

you would still be around as an employee of CN.
So you do not, at this point, have a scheduled retirement date?
A. At this moment in time, I do not. Give it an hour.
MR. HIRSH: After this experience.
MR. FISHMAN: Thank you for -- for indulging me on that question. I really didn't mean to be -- I've actually enjoyed our discussion today.
I don't think I have any further questions.
David?
MR. HIRSH: We'll take a break and consider whether we have redirect.
MR. FISHMAN: Okay. Let's go off the record, and then we'll conclude after that.
(A short recess was taken.)
EXAMINATION BY COUNSEL FOR DEFENDANTS
BY MR. HIRSH:
Q. Okay. Mr. Krueger, you noted in your prior testimony that you did not make any adjustments to signals in trying to return the level of delay in -- you know, from scenario -- the difference in delay that was created

between Scenario 1 to Scenario 2. You made other changes in infrastructure but you didn't change signals.

Can you explain why you did not make any changes in signals?

A. The reason that we did not change the -- or look at changes to the signal system is because the IC territory currently has signals that is CTC territory. It also currently has intermediate signals. The exhibit extensive work that CN had done in the past had looked quite extensively at the benefits of intermediate signals and growing capacity, and with the space -- the spacing of the signals on the IC, it was our -- it's currently at a level that provides good -- good capacity to further squeeze capacity through signals would have been likely not cost effective because, I mean, they're roughly -- would have put them much closer with minimal -- minimal gain.

Q. You just referenced cost effective. When you use -- use the term "cost effective" in this context, do you mean as compared to the other infrastructure solutions you propose?

A. That is correct.
Cost effective in dollars that you spend to gain capacity. The CTC system with tight closely spaced signals, as it currently is, would require respacing of the existing signals which is costly of having to relocate signals, relocate power lines, relocate all of the -- the circuitry and the wiring for the existing signal system that's out there. So you would be basically tearing up an existing signal system and putting in a new signal system.
MR. HIRSH: Okay. We have no further redirect.
MR. FISHMAN: Great. Thank you.
I think we have moved to close the deposition. We'll go off the record.
(Whereupon, the proceeding was concluded at 6:45 p.m.)

CERTIFICATE OF NOTARY PUBLIC

I, Bonnie L. Russo, the officer before whom the foregoing deposition was taken, do hereby certify that the witness whose testimony appears in the foregoing deposition was duly sworn by me; that the testimony of said witness was taken by me in shorthand and thereafter reduced to computerized transcription under my direction; that said deposition is a true record of the testimony given by said witness; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this deposition was taken; and further, that I am not a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of the action.

Bonnie L Russo

Notary Public in and for
the District of Columbia

My Commission expires: June 30, 2020

ACKNOWLEDGMENT OF DEPONENT

I, HARALD KRUEGER, do hereby certify that I have read the foregoing transcript of my testimony taken on 7/7/17, and further certify that it is a true and accurate record of my testimony (with the exception of the corrections listed below):

Page	Line	Correction
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________
____	____	____________________

____
HARALD KRUEGER

SUBSCRIBED AND SWORN TO BEFORE ME
THIS _____DAY OF ________________, 2017.

____________________ ________________________
(NOTARY PUBLIC) MY COMMISSION EXPIRES:

-

---l
156:6

0

0
297:18

00.00
293:10

0b-
249:20

1

1
65:23 112:11 128:11,19 130:15 133:19,21 134:1,14,22 135:10 139:24 142:2 151:18 159:20 161:15 162:15, 16 163:23 164:1 168:5 169:12 173:22 188:14 210:1,20,21 238:1,21, 24 239:25 243:20 247:12,23 265:14 266:4 279:16 283:1,6 286:3 295:6

1,444
297:20

10
202:24 203:5 205:11,15 302:5 308:3

10.11
229:16

10.8
146:8,16

10.9
146:8,9

100
87:11 220:7 221:14 230:21 231:3

10th
197:12,13

11
214:6,7,10 302:23 305:17,18,20

11.2
146:16

1140
225:14

12
234:9,11,14 296:11

1242
168:20

12:30
128:4

13
162:16,23 168:18 191:5 200:16 211:8 229:18 233:11 278:20,21 306:8

133
227:13 228:8

136
227:7

13th
300:24

14
280:21,22,25 283:2 287:25

15
300:6,7

150
227:14,19,20 228:7

159
235:20

16
225:11,12 230:19 266:23 289:17,18 290:1

16.5
149:14 161:6,7

17
224:12 225:12

17-mile
261:22

17-page
214:13

17th
234:25

18.8
177:17

183
235:21

188
286:21

19
188:22 199:16 253:17 308:17,18

1981
11:6,16 116:2 125:11

1984
13:23

1990
14:12 15:14,15 16:4 17:2 72:6

19th
174:1 199:4 203:18 206:16 214:18

1:30
128:8

1P42
146:21 163:4 174:6,12 185:14 189:2 205:19 225:21

1s
15:5 52:2

2

2
130:13,15,16 133:13 139:13,14 145:8 148:14 150:3,15 151:14 153:1 160:1 173:22 175:8,11 177:13 188:14 190:16 207:22 217:11 219:20 221:1,2 224:11,19 234:23,24 235:18 237:23 238:1,23 239:5, 7 243:20 247:23

2.05
151:10,12

2.5
147:2

2.5-minute
160:6

20
76:14 256:15,19,24 263:6

2000
16:21 17:2,10 29:19 121:23

2004
18:14 19:2

2005
18:14

2010
20:10,11,14 142:2,14 143:7 151:18 174:1 188:22 193:22 195:24 197:13 198:8,10,17 199:4,16 203:18 206:4, 13,16 212:1,3 234:25

2011
138:17 250:17 251:1

2013
135:16,18,20 137:12, 14,16,24 138:1 139:5,6, 7 169:12 181:2,18 182:13 183:16,21 184:4,7,8,15 214:18 240:23 285:5 286:5,9 289:22,24 292:24 300:25 308:10

2014
138:3 139:3 153:5 161:16,20 182:20 183:11,14

2015
21:19 138:3 181:3

20K
76:13

21
142:2 151:18 256:19 261:3

21.1
229:17

21st
136:20

21st-century
42:10,15

22
161:15 281:18,20 285:20

23
182:7,10 206:4 231:24 285:21

230000
159:12

23rd
153:5 206:4,13 211:25

24
36:6 136:13,24 235:21 281:17 296:17 297:10, 18,19 304:13

24-hour
36:7 305:10

2400
293:10

24308(A)
6:11

25
136:19

26
231:24

27th
136:20

28
169:12

29th
136:16

2A
152:24 153:5

2B
159:11

2BHK
158:20

2HK
173:22 188:15

3

3
136:14,23 144:11 148:13 149:20,23 160:9,23 161:4 173:21, 23 174:1,13,15 175:9 182:2 185:12 188:15 190:16 246:3 247:5,10 287:24

30
289:2,6

309
220:24

32
293:3,4

33
163:2 281:19,20

334
227:10

337
227:8

35
311:6

35743
6:10

36
136:12 162:16,18,23 200:16 229:19 233:11 311:8,9

38
241:6,7

385
144:11

4

4
132:22,23 133:20 149:1 152:17,19,22 158:10,12 161:4 163:23 164:2 168:5 188:15,21 217:18,25 237:22 243:9,11 246:25 247:3

4.52
226:24 227:1 230:10

4.99
189:6 190:6

41
301:6 302:23 305:18 308:18

4250
144:10

43
266:21

45
252:25 253:14,15,17

46
252:25

47
252:25

49
6:11

4B
188:13,19

5

5
158:13,15,18 160:16,20 163:11 185:23 186:5 211:2 217:7,13,16 252:19,20 253:4 254:6, 7,8 261:3

50
195:12,20 197:22 200:11 205:21 296:10

50-yard
76:12

519.3
177:16

538.1
177:18

58
160:11,24 162:24 163:3 190:15,18 207:23

583
144:15

59
142:1 159:25

5CXLXS
214:16

5th
136:16

6

6
169:9,13 261:16 301:6

6,300
104:16,17,18

6.04
160:13

6.40
144:15 159:20 186:1

6.46
190:5

6.56
205:23

6th
145:4

7

7
173:14,15,19 181:25 185:10 186:6 262:10 303:1,3,10

7.01
174:9 185:15 190:5

74
196:21 197:25 200:11 226:12

77
189:4 191:15 198:13 199:3 226:7,15

7th
193:22

8

8
185:17 188:6,8,11 190:23 208:22 269:25 270:1

80
133:12 206:23 207:1

81
16:13 280:10

82
12:13 280:10

83
12:13

85
13:23 196:21

867
207:24 208:22

876
208:21

889.5
185:17

89.5
174:17

894.5
146:10,17,22 160:1

897.5
149:8 161:1 163:12

9

9
145:24 161:8 193:9

90
14:12 72:8

900
145:24 179:5,10,18

900-mile
178:1

905-mile
163:17

908.8
149:4

90s
70:13 104:21 125:15

914
161:8 162:24

916.5
145:11,16,17,19,24 146:9,16

919
189:23 190:25

923
190:25 208:22

923.3
190:19

927.0
150:18

928
191:6 229:13,17

929.85
150:20

933
162:25 163:9 172:24 191:5

949
229:17

949.1
228:20

95
72:8 94:3

A

abilities
292:23

ability
68:9,24 74:5 76:15 86:11 117:25 118:12 171:19 217:24 245:7 274:22 277:10

able
27:13 42:24 75:23 94:5 154:17 227:6 238:2,12 256:7 267:22 311:14

absence
133:23

absolute
46:3 196:6

absolutely
176:18 197:2 209:4,18

acceleration
90:22

acceptable
84:22

acceptably
83:6

access
54:18 126:12 204:20 287:22

accommodations
196:24 197:6

account
68:22 165:16,19 217:1 241:20 257:1 260:15 269:16 296:22 300:11 307:1

accounted
307:4,6,10,12,15,23

accounting
242:21

accounts
218:2

accumulative
51:2,4

accuracy
192:4

accurate
13:12 53:17,25 91:8 169:3 170:24 210:1 212:24

accurately
207:4

achieve
68:24 74:8 77:1 275:17, 19,22 303:5 304:1,15

achieved
273:17

achieving
94:7

acknowledge
228:11

acquired
114:3

acquisitions
16:13

acronym
46:20 47:21 147:14,16

acronyms
52:14 167:14

activities
10:10 12:5 254:11

activity
10:9 89:12 127:6 261:12

actual
30:3 49:21 74:4 82:3 108:17 153:6 169:4 172:21 175:17 184:10 201:25 202:4 242:4 253:18,23 274:7 308:7

ad
97:3

add
74:21,22 100:2 103:16 116:25 120:4 121:6 216:24 217:18 218:11 219:24 220:3 221:18,25 253:4 289:15 290:21,23 291:11 294:4,17 301:10

added
119:17 127:11 245:25 247:4 248:3 257:7,14 258:16 259:20 263:10 265:21 267:4 289:18 290:2,3 293:8,20

adding
103:21 106:9,10 107:13 186:21 250:6 290:10, 12,25 296:6

addition
40:2 44:7 105:10 107:17 111:24,25 119:8 270:20

addition-subtraction
223:15

additional
73:20 101:23 105:25 106:20 112:20 121:11 133:17 218:15 243:23, 24 244:8,9 247:2,3,16, 17,25 248:8,10,12,15, 20 250:13 269:15

additions
99:10 224:16 282:15

address
194:4,17

addressing
215:7 277:12

adds
293:24

adjacent
98:13

adjoining
86:3

adjourn
86:3

adjust
184:14 192:24 273:20 289:22 300:2

adjusted
184:3 273:16,17 281:15 286:4 300:2

adjustment
289:10,12

adjustments
282:15 312:23

adjusts
55:7

advantages
42:17,19

advised
226:12 269:13

affect
67:22 68:12 266:15

afraid
294:2

agency
66:1,2

aggregate
240:3

ago
179:10 246:19 252:8 301:3

agree
58:12 79:23 199:16 202:9 208:21,25

agreed
6:13

agreement
138:16,19

ahead
35:20

al
194:6

al-
217:7

Alberta
9:17,21 10:2 11:15 195:7 300:19

algorithm
78:1,7 83:24 87:13,14 277:6,8,14,18 278:10

algorithms
79:5,7

alignment
110:7

all-encompassing
259:10

Allam
21:2 284:2

alleviate
267:3

allocate
99:20

allot
299:21

allow
103:14 217:19

allowable
273:1

allowance
216:24 217:8,18 220:6, 12,15,24 221:14,16,25 230:21 231:2,19

allowances
217:13 218:12

allowed
302:24

allows
59:16

alternatives
103:24 165:7

ambiguity
255:10

ambiguous
110:1 307:15

American
58:17

Amfleet
196:1 225:22

amount
76:21 90:7 133:22 221:19 254:21 262:8 264:10 265:15 266:3 306:5

amounts
49:18

Amtrak
6:8 7:4,6 104:20,23 105:5,10,18,21 106:9, 10,11,12,20,21 107:13, 14,22,23 108:1,5 109:17 110:16 111:22, 24 112:1,2 113:6,15,22, 24 114:4,6,9,12 116:7, 15,21,24 118:2,22 119:6,17 120:4 121:13 122:9,13 131:1 133:12, 14,16,24 138:16,19 139:19,23 142:1 143:6 145:1 147:3,6,7,14 148:17 149:15 150:2 151:16 152:23 157:12, 18,20 158:19 159:10 160:7 161:8,14 162:11, 12,24 166:12,17,22 167:7,8 168:13,15 169:11 171:25 173:20, 25 174:6 175:17 176:2, 25 178:12,22 180:9 182:1 185:11 188:12,21 192:11,20 193:23 195:11,19 196:7,9,16 197:22,24 198:24 199:9 214:11,15 215:1,13 219:13 220:16 222:1,5, 10 223:24 225:15 228:17 234:1,22,24 235:2,5,20 238:4 239:6, 7 242:25 243:3,17,22 245:3,4 246:8 250:16 251:1 252:11 261:25 265:19,20 272:23,24 275:24,25

Amtrak's
153:4 212:10 247:7 251:4,20 261:17 269:13

Amtrak-related
127:22

an-
176:15

analogy
32:11 33:2,3 76:6

analysis
14:4 18:6 97:7 98:16 99:16 100:14,16,20 107:7 108:21 110:15 118:17 120:13 139:9 202:2,5,9 212:10 240:23 243:18 244:2, 11,19 245:10,19 246:13 247:21 252:15,21 261:14 263:23 266:13 267:9,25 268:17 277:13 294:18 301:16,19 302:1

analytical
245:21

analytics
302:3

analyze
59:15 270:5

analyzed
292:19

analyzing
13:5 59:21 127:1 157:12 291:13 311:3

and/or
19:17 44:17 111:19 299:19

annual
95:25 96:3

anomaly
178:18,20 234:7

answer
8:12 24:8 29:10 33:22, 24 35:3,4 68:19 81:10 85:14 88:14,15 94:15 101:13 106:24 107:6 116:5 130:24 131:6 154:15 174:23 175:1 207:4 235:8 250:22 251:11 290:17 291:13 303:8 309:15

answered
85:3

answering
19:12 122:14 131:19 157:20 162:2 176:17 214:23,24 246:16

anybody
94:15 97:14

Anything's
172:20

Anyway
228:8

apartment
32:18

apologies
122:16 162:11

apologize
33:11 154:6 231:12

apparently
151:4

appear
122:15 150:5 158:20 159:13 178:21 186:11

187:19 205:5 219:21 226:1 280:16

appeared
290:1

appears
139:22 145:10,25 146:2,19 148:4,9,15,22 149:14 151:5,8 154:22, 23 157:1 160:5,10,13, 17 161:1 163:11 168:17 169:20 170:16,19 172:7 174:4 177:19 178:6 186:9 188:14,25 189:2, 21 190:24,25 194:19 201:16 202:25 203:16 205:15 207:21,22 225:13 228:8 278:25 283:6,10,14 288:5 289:9 300:11 305:19

application
6:10 15:13 248:2

applied
14:5 268:12

applies
171:13

apply
171:21 220:9 308:13

appreciate
176:22 269:18,21

approach
35:7 92:8 254:19 299:24 301:16,20

approaches
245:21

appropriate
67:2 97:8 103:11 128:2 140:6 196:12 216:17 224:8,9

approximated
72:20

approximately
247:10 311:7

approximating
68:6

April
136:6,15 174:1 198:10 203:18 206:16

architecture
278:3

area
10:13 16:17 18:14 44:23 72:8 221:18 244:16 252:5 262:4 266:11 268:25 294:13

areas
28:16 75:5 102:16 243:21 244:16 245:23

aren't
236:16 240:12

arena
40:22

argument
292:6

arrival-departure
239:14,21

arriving
177:15,18

articles
10:16

artificial
95:19

ascertain
310:1

aside
152:17 188:4 280:21

asked
29:3 56:15 85:3 130:24 131:6 168:11 182:17 183:8 192:19 193:2 195:9 196:15 197:23 251:24 260:20 279:21

asking
8:18 28:23 34:10 115:1 127:10 138:4 142:25 196:13 255:23 280:18 291:18

asks
96:12

aspect
47:9 77:14 89:14 95:3 260:16,17

aspects
89:18 126:15 244:22

aspirations
95:22

assess
32:21 98:2 165:6 260:19

assessing
19:11 311:3

assessment
14:4 15:25 26:19 27:1 198:4,7 199:13

asset
21:20 70:22

assets
70:14,17,20,21 299:10 303:14,16,17

assign
296:8,9

assigned
293:10,21 294:25

assimilation
111:23 114:22

assisted
279:20

associated
16:25 265:16 271:14

Association
9:18

assume
83:24 137:11 150:10 155:13 188:17 242:16 287:4

assuming
84:17 85:5 151:2

assumption
153:19 261:16

assumptions
176:10 256:17,21 257:4,19 259:17,18,22, 23 260:21 261:2 263:3 308:12

attached
129:5

attempt
32:10 78:9 117:24 169:23 209:5 284:20 286:4

attempted
41:19,25 42:3

attempting
28:3 143:23 305:21

attention
130:13 132:22 162:14 174:3 182:3 185:13 188:23 190:15 225:11 230:19 266:20 269:25 288:25

attractive
90:21

attributable
131:1 227:16

augment
237:18

augmented
89:4 184:3

August
16:21 17:10 250:16

author-derived
79:6

authority
78:18 299:20

automatically
64:9,12

automotive
62:11

availability
35:15 69:9

available
27:16,20 36:6 39:5,18 40:21,25 47:14 48:11 49:1,5 65:22 66:11,17, 21 67:1 99:23 128:2 254:21 302:10,15

avenue
102:6

average
77:9 135:16,18,20 184:5,8,14 281:16 285:5 286:5,9 288:23 289:22,24 292:24,25 308:3

avoid
8:10

avoided
257:7,14 258:16 263:10

await
202:8

aware
9:21 11:2 47:11 56:3 101:6 118:22 122:22 134:8,9 166:11 179:20

axis
73:1,4,5,13

axle
47:15 171:10,19

axles
44:25 172:1

Azoo
119:10

B

Bachelor
9:11

back
14:12,13,18,19 46:10 51:21 55:7 56:17 77:17 98:19 114:22 116:3,7 119:25 128:13,15 163:10 166:20 167:4,6, 17 172:2 181:23 183:7 185:9,18 229:10 237:21 243:9 246:7 254:6 255:21 263:5 265:13,23 266:4 269:8,10 281:25 288:25 303:15 305:17

background
9:8,10 176:16,21 177:25 178:3

balancing
303:25

Baltimore
76:11

Barker
23:3,9 26:9

Baron
236:25

base
112:10,13 135:10 178:12 240:3 265:23 266:4 286:9

based
11:14,19 21:4 28:9 39:7 46:15 60:13 71:16 88:13 158:4 194:23 207:11 227:7 231:4 240:21 253:23 263:23 265:12 272:5 277:15 285:5 296:17 308:3,5

baseline
133:21 238:1

basic
311:2

basically
11:25 15:22 22:14 23:20 67:20 74:10 90:23 91:1 111:12 114:21 176:17 187:3 216:13 223:23 261:21 293:19 303:24

basics
310:19

basis
16:1 76:3 97:3 202:4 239:12 240:4 265:9 299:25

Bates
193:14

bathroom
76:10

bear
169:8

bearing
154:20 156:7

becoming
15:11 18:10

began
182:14

beginning
44:14 59:7 96:7 256:19 303:2

begins
293:8

behalf
7:4,6

Bekavac
21:8,15 23:11

Bekavac's
25:18

believe
17:20 20:3,6 21:8,15 23:3,20 24:21 25:12,21, 25 37:8 54:7,8 55:25 60:18 65:25 66:14 67:15 72:12 84:21 108:1,20 117:14 118:24 119:14 120:20 121:21 122:2,7 124:6 129:3,17 131:17 134:15,19 135:2 136:3,6,13 140:4 141:19 142:4 143:5 146:15 147:13 153:6 162:9 164:15 167:1 169:2,9 170:7,11 171:9, 13 173:23 177:18 185:4 188:16 189:5 203:23 211:12 214:13 215:17 220:1,21 226:23 229:3, 17 236:9,12,21 240:25 252:23 253:4,12 254:24 261:8 273:14 280:11 281:4,23 282:20 283:7 291:20,25 293:6 302:11 308:2

beneficial
101:5

benefit
101:14 103:21 250:12 252:3

benefiting
103:25

Berkeley
310:7,8

berth
271:11 296:18

best
8:18 13:18,22 20:18 23:2,15,16 24:23 26:15 32:11 76:25 78:1 107:25 109:12 166:24 184:4 192:25 285:14 292:23 294:19

better
40:19 268:6

beyond
105:22 184:25 216:18 261:25

bidirectional
86:19

big
19:15 166:18

bit
110:1 226:13 306:13

black
166:18 192:6

blind
67:25

block
304:20,24 305:10,22

blocks
31:4 69:12 254:11 256:3

Blue
233:17 235:3,6 236:20

BN
110:12 113:14 117:4

BN'S
210:20

BN/CN
121:13

Board
6:9 190:18

bodies
19:14

border
109:15,17 110:14

born
295:6

boss
22:9 23:11 96:16 125:10,16

bosses
15:21

bottle
36:23

bottom
22:6 136:13 139:22 140:23,24 145:9 149:6 150:1,17 152:23 158:18 161:4 173:19 174:14 182:1 185:11 188:12 189:20 193:15,19 203:14,15 206:15

214:14,17 228:19 234:15,21 243:10 247:3

boundaries
138:14

box
143:12,13 145:12 146:1 149:6 150:16,22,25 151:5,15 153:3 159:10 173:25 174:3 188:24 192:6 225:18,21 226:5 235:19,22,23

bracket
297:19

brake
217:5

braking
27:10 29:23

break
89:12 177:13,19 201:11 219:8 269:6 312:14

breaks
258:2

Brian
124:23 128:21

Brian's
124:25

bridge
101:2 109:13 110:13 180:3 268:7,8

bring
94:16,23 95:4,19 127:11 175:8 301:24

broad
29:9 91:23 100:19 187:24

brought
51:17 309:1

Brunswick
9:13

BSC
9:11

bucket
101:25 102:21

buckets
257:20,25 258:4

budget
94:13 95:25 96:3 127:14,19

build
216:21 221:9 237:18 243:13 268:9,14,21,25 301:18 309:25 310:9

buildable
100:23 268:13

building
32:19 53:19 83:23 214:3 257:2 302:4 305:22

built
42:7 67:10 89:16 113:1, 3 138:25 213:22,24 222:1 232:2 280:14 309:19 310:2

bulk
63:6 289:6,18 290:1,11, 12,22 291:4,8,15,20,23 292:3 293:11 295:13,23 296:3,6,7

bullet
301:9 302:9,17 303:11 306:21 308:19 309:18

bullets
133:10

burn
49:14,18

burst
76:16

bus
114:8

business
22:4 100:7 210:23

button
72:20 309:20 310:1,10

buy
40:24 41:3

bypass
98:9

C

calculate
32:20 45:22,25 46:3 48:14 49:8 50:24 55:8 71:24 77:5 84:8 146:2 207:21,22 230:7 241:25 297:13 299:12

calculated
146:20 148:25 157:24 167:19 190:7,18 237:1 298:5

calculates
84:10 167:7,8

calculating
84:13 264:15

calculation
45:13 47:10 53:20 68:6 144:4 174:15 177:20 187:24 192:17 205:19, 22 210:10,11 217:1 227:5 229:7 236:11 297:22 308:4

calculations
12:3 30:10 31:12 39:21 90:18 103:12 153:23 154:5,8 168:18 171:4 178:21 192:12 198:17 199:11 213:5 226:2 233:12,16 242:2 245:17

calculator
37:17 41:3 46:2 188:2 223:10,11,12 227:6

calculators
27:11 39:20

call
22:10 25:13 43:14 52:24 53:1 82:13 112:10 132:23 143:12 145:3 186:10 231:8,16 245:10 305:19

called
6:3 17:17,19,21 29:25 30:22 55:24,25 63:1,15 108:18 141:3 228:23 295:14

Calls
277:20

camera
91:24

can't
17:13 20:4 24:1 86:2 87:6 88:6,8 110:13 111:6 114:14 116:18 118:14 120:14 124:16 129:20 131:7 156:6 167:21 175:4 180:19 186:15 191:10 211:4,18 261:23 304:24

Canada
24:19,20 66:2 94:10 195:1

Canadian
6:12 7:10 11:7,11 26:22 58:17 109:17 194:1,23 223:19,20 300:17

capabilities
46:5 165:23

capability
53:11 74:5 102:24 255:24 256:2,4

capable
254:15 255:7

capacity
15:24 17:15 18:6 19:18 26:20,25 27:2,4,5 28:19,21,25 29:1,4,8, 12,16,18,22 30:8,12,25 31:9 33:9 34:21 37:5,6 58:2,6,13,24 59:21 61:21 67:11,23 68:12, 23 69:2 70:6,8,11,15, 23,25 71:2 74:16,21,22, 25 75:6,13,21,25 76:5, 13,19 77:6,12,13,16 89:6,14,21 91:5,9,11,16 96:24 98:3,5,8,9 99:4,8 100:22 101:5,19,21 102:8,20 103:4,6,13,19 105:2 107:7 112:3,16 114:12 115:15,16 122:25 125:20 130:11 131:3,13,22 132:1 139:1 157:13,15 165:2 178:9,11 180:25 200:2 204:11 236:3 243:18 244:1,15,18,19 245:6, 19 246:1,2,22 248:2,5 249:4,10 250:11 252:14 254:21,23 256:14 266:16 267:17,19,21 278:5 279:2 280:14 292:11,16,18 300:15 301:9 302:1,7,8,9,10, 15,16,19 303:3,24

304:2,3,6,16 305:24 306:10,11,16 307:2 308:19 310:16

capacity-related
19:12

capital
97:23 99:19,20,23 100:1,8 101:20 102:7, 13

capture
142:7

car
23:19 35:22 39:8 44:24 70:21 144:24 163:25 164:19 186:22 187:4 191:22,24 299:7 303:16

Carbondale
214:12

card
10:15 22:4 42:9 93:19

cards
42:7,9,15 94:3

career
93:24 94:19

careful
152:4,6 236:17

carry
94:18 110:15

carryover
221:8

cars
23:19 44:17 47:3,5,8 48:8 70:15 143:17 144:24 146:22 163:4,24 168:21 170:21 171:25 172:5,10 173:5 174:7, 13 185:15 186:1 189:3, 13,14 192:11 195:12,19 196:2 197:22,24 199:9 205:20,22 216:12 225:25 226:3

case
7:21 32:12 100:3,7 112:10,13 135:10 144:6 256:10 265:23 266:4 275:3 280:12

cases
121:19 274:1

categories
75:17

categorization
63:10

category
258:8,15,17,21

cause
31:24 59:17 68:7 260:13 270:18

caused
180:7 238:3 247:7

causes
81:14

causing
267:16

caution
168:14

cell
151:25 152:9,14

central
7:8 114:4 134:7 175:12 177:1,16 251:16 292:20

century
93:25 117:10 125:14

certain
19:6 34:11 73:24 76:21 241:13 264:10 265:15 266:3 270:12 272:15 287:21 306:5

certainly
107:11 194:15 195:17 199:6 202:21 203:2 206:16

certification
11:1

cetera
39:14 54:19 259:9 262:7 295:19,20 304:9

chair
107:1 283:22 284:2,6 285:2,4,8,23 286:15,18

Chairs
283:17

challenge
28:5 176:7

challenges
177:23

change
12:11 13:21,25 15:8 16:5 18:1,2,3,4,9 19:13, 15 25:24,25 26:1 30:11 44:2 53:21 54:17 73:16 88:8 103:17 163:18,19, 22 165:10 166:5,8,16 179:10,15,19 180:15 186:11,21,25 187:11 207:9 218:18,19 219:11 241:12 252:3 260:12 263:16,20,25 264:1 265:6 273:4 276:22,25 292:14,16 295:19 298:24,25

changed
14:2 15:11,20,21,22 16:8 17:23 18:7,25 19:8 40:7,9 73:16 192:15 193:3 199:9 257:9,15, 16 263:12 266:12 272:19 273:7

changes
44:3 54:18 132:5 141:8 152:12 164:23 165:13 166:11 179:21,25 180:1,2,14 248:24,25 265:10,11 270:12 282:9,22 289:4

changing
103:15 179:17 180:16 249:3 250:5 272:14

chapters
129:11

characteristic
32:1 69:6 242:6

characteristics
44:16,20,24 46:11 48:24 49:17 54:12 135:19 183:24 241:3 292:17

characterization
199:15 202:10 208:7

characterize
116:10

chart
21:14 22:8 217:12 278:4 279:14,20

charts
31:6 78:4 92:24

Chat
158:7

Check
145:12

Checking
281:3,6

checks
243:24

Chica
229:10

Chicago
116:25 139:23 145:2,23 146:8 148:17 150:2 152:23 158:19 166:3 173:20 182:1 184:19 185:11 188:12 207:24 214:12 215:18 225:15 228:18 250:19 251:15 288:7

chicken
68:20

Chief
24:6,10

circumstances
80:1 87:9

city
113:15 145:1 154:9 157:12,24 159:25 160:12 166:12,17 168:20 170:19 171:14 172:4 189:1 212:11 215:21 233:13 235:13

civil
9:12,19 32:12

claimed
286:3

clarified
211:25

clarify
13:8 34:22 36:16 51:20 52:8 56:22 104:4 105:17 106:5,17 107:20 192:24 203:15 219:3 222:16 237:11 250:4 258:22 311:24

clarifying
182:9

clarity
72:3 294:22

Clark
146:3,8 149:1,4,7 150:18,20 160:2 161:2 174:16 189:22 190:19 261:8

class
15:4 52:2 61:1,22 62:1, 3,5,13,17,18 63:4,5,9, 12,15 65:23 69:12 210:1,20,21 286:1

classes
31:14 55:6

classification
63:6,8

clean
304:12

cleaned
286:3 289:12

cleaner
8:22

clear
25:9 101:12 106:7 138:1 139:3 164:7 166:20 202:1 212:13,17 222:6 236:15 257:24 260:3 265:5 307:9

clear-cut
35:9

clearly
256:6 302:17

close
70:19 74:3 81:1,4 84:22 198:13 289:24

closer
55:8 75:5

closing
268:23

CM
309:3

CN
7:15 11:16 13:17,18 14:23,24,25 15:4,17 16:11,13,14,17 17:22, 23 21:25 24:15 26:21 27:2 29:7 38:15,18,23, 24,25 39:6,12 40:1,3,5, 8 41:13 43:1 46:8 51:24 52:18,20 54:11 55:12 56:2,18,20 57:7,8,10, 16,20,23 59:19,24 60:1 65:15,18 66:7,16,19,20 67:6,8,9,12,14 70:3,8, 13 92:9 93:22 94:1,9 97:23 113:14 114:3 117:2,5,23 118:5,20 120:22 124:4,5 125:4,5, 12 131:9 135:2 138:16 140:24 142:1 146:2 147:16 151:16 156:16 157:4,5,21 161:15 165:4 185:2 193:25 194:6,8,9,14,22 195:12 196:12,15 204:19 207:9 210:3 212:23 213:1 215:6,13,24 216:1,16 222:21 223:20 227:23 228:2 238:3,25 239:2 247:9 250:16,25 252:10 253:11 254:1,3,4 280:4 284:7 287:18,22 293:23 294:17 299:14 300:21 301:23 311:6,10 312:1

CN'S
37:17 39:3 53:12,25 60:11 63:5 115:11 117:25 130:25 131:1 133:22 151:1 210:20 222:18 247:11

CN-RELATED
127:8

CN-TYPE
215:11

co-production
115:21

coach
196:22

coal
295:13,21

code
43:21 44:12,15 277:25

coded
44:4,7,9,25

coding
44:9

coefficients
39:7 40:7,14

cognizant
8:7 101:6 268:4

coincidence
158:22

colleague
198:2

column
145:3,4,10 148:6 150:4, 11 170:13 187:21 207:14,15 219:20 228:15,20 229:6 230:20 231:2,18 235:17 283:3, 15,17 285:10,11 286:11 289:11,13,14

columns
103:15 150:5,7,12 224:8 283:19

com-
166:21

combination
28:10 47:18 72:18 82:2 165:5 245:9 303:6,18 308:6,8,10

combinations
80:13 176:8 282:12,24

combine
284:24

come
35:6 55:9 80:10 93:8 97:17 99:12 102:14 116:1,2 127:18 144:20 151:23 165:23 180:12 196:7 224:21 289:23 291:7 305:23

comes
79:17 218:13 263:24 277:16

coming
99:17 102:1 117:4 262:13

command
86:20 274:7,24

commands
86:23,24 273:20 275:4, 13,16,19 276:3,5,22

comment
192:4 210:14 233:23 245:18 253:3 258:24

comments
221:5 253:5

commercial
66:11

commercially
65:21 66:17,20 67:1

common
63:13 152:2 169:25

commonly
172:3

communication
23:8 25:5 192:23

commute
271:25

commuter
115:21

commuter-passenger
14:7

company
6:12 7:9,10,11 21:11 42:11 55:22,24 70:14 97:15 99:18,20,22 108:23 124:17,24,25 156:20 162:3 194:5,21, 24

compar-
192:5

comparability
192:5 209:2,4,6

comparable
175:20 186:19

comparative
178:14

compare
81:20 82:6 178:4 187:10

compared
82:4 83:2 234:1 241:11

compares
286:2

comparing
150:25 175:18 239:8 244:7

comparison
75:6 83:5,21 84:5,13 153:4 159:11 162:17 173:25 175:5 185:19 186:5,8 188:21 210:13 234:24

comparison-
159:11

comparisons
83:25

compatible
212:25

competent
28:7

competing
303:12,13 305:1,6,13

complete
6:20 23:17 166:21 175:20 182:15 212:24 259:10,16 260:23

completed
42:13 181:3 199:5

completely
81:4 212:19

completing
42:18

complex
68:17 223:10 256:25 259:4 309:8,11

complexities
78:15 89:17 261:12

complexity
257:8,14 258:17 263:11

component
12:21 13:6 29:23 61:15 68:20 70:7 71:2 78:14 147:7 260:17 263:21 305:6,13,15

components
143:24 256:7 278:10 305:5,22

compound
115:13 258:10 263:7

computer
37:15 79:6 80:25 92:5 95:1 126:18 270:10,17 271:24,25 308:20 309:11

Computer-generated
80:23

concept
219:1

concern
83:8

concise
166:21 169:3

conclude
312:17

concluded
236:16

conclusion
175:23 235:25 291:8

conclusions
129:15 200:18

concrete
32:12,13,15,17,19

condition
31:22

conditions
59:17

conduct
118:13 244:1 309:15

conducted
116:16 243:18 244:3 302:20

conference
309:23

conferences
10:12

confidence
39:15

confidential
6:14

confir-
196:6

confirm
11:10 203:3

confirmation
196:7,8,16

conflict
77:25 78:7 80:6 243:22 252:6 265:12,13,16 311:1

conflicts
79:7 80:13 244:13

confused
182:23 294:3

confusing
202:3

confusion
183:5

congestion
243:21 245:23

congestions
244:13 267:15

conjunction
123:9 267:17

connect
168:7

connecting
63:16

connection
22:9 157:13,15 204:10

connotation
260:24

conservative
254:20 256:11 266:18

consider
131:15 132:4,9,16 312:15

consideration
242:20

considered
89:21 104:17,18 248:8, 18 249:16

considering
245:12 248:16

consist
44:18 45:6 46:4 47:2 88:9 90:19 135:19 143:14 144:23 145:20 146:21 148:20 159:19 160:13 163:2,22 168:16 169:1,2,4,11,16,21 170:1,16 172:4,9,12,15, 17 174:3,6 182:4 185:13,24 186:9 188:24 189:2 191:12,22 199:10 218:18,19 219:9 221:7 226:3 231:4 233:23

consistent
135:11 146:5 171:16 187:2 293:11,12,15 299:24 308:15

constant
31:24 37:11 186:20 270:13 272:16

constantly
94:8,18

constructability
101:6,15

construed
176:14

consultants
15:6

consulted
252:14

consulting
117:13 124:17 194:5,21

consume
36:8 254:23 292:18

consumed
269:19

consumes
35:16 292:10

consuming
256:13

consumption
31:10 35:12 36:5,10 310:24

contains
235:16

context
29:6 79:11 162:5 168:4 176:16,21 178:2 186:16 191:10 192:1 199:24 209:1,7 264:5

contiguous
44:13 175:16,23

continue
16:3 56:12 118:12 157:10 201:3

continued
15:23

continuing
18:5 252:25 256:19

contract
150:17,18 151:7 225:14

contractor
151:3

contributing
10:19

control
65:10 69:16 90:6 260:12

controlled
39:8 270:9

conversation
200:23 261:13

conversation's
260:24

conversations
191:20

convert
42:14 65:5,7,8

converted
172:25

coordinated
124:10,13

coordination
90:11

copy
81:18 128:19 129:3 193:8 224:6 234:16

copy-paste
221:9

core
63:7 70:14 240:21

Corey
24:6,13,21

corner
140:24 141:25 153:2 159:10 161:14 173:24 188:20 214:17 301:5

corporate
23:18 25:16,21 55:9 97:21 101:9 108:25 127:25 195:2

corporation
6:11 15:2 16:14

correct
17:6,18 28:20 32:5 41:11 43:3 45:17 46:24 49:9,10 52:17 56:19 57:17 63:24,25 64:3 91:3,7 98:24 105:19 108:19 112:12 113:21 119:1,13 123:1,2 127:16,20 135:7,8 136:8,9,17,21 137:8 139:10 144:13,16,18,22 145:24 148:21 149:11 152:3 156:14 160:4 162:13 163:5 167:25 168:22 172:11 178:24 181:12,16 189:17 190:12 197:17,20 204:22 213:23 215:19 217:10 225:16 229:8 233:15 239:1,4 241:17 242:13 254:16 255:4 266:5 271:21 272:17 273:9,13 276:14 283:8, 9 286:13 289:17 302:12,13 304:25 306:4 309:6 311:17

correctly
117:7 143:21 146:23 170:12 189:10

correctness
153:16,17

correlate
286:5

corresponded
183:16

corridor
30:13 99:14 102:9,18 104:7 111:12 118:1 121:7,12 134:7,10 135:2,6,7 136:14,18 179:7,21 184:19 207:7 214:12 215:18 219:14 220:17 238:6,13,22 243:19 244:12 245:7 248:1,6 250:20 251:16 254:22 261:15 266:16 283:12 288:9,23 290:2, 8 291:1 292:20 293:13 294:12 308:8

corridors
133:23 134:24 135:6 139:2 185:5

cost
101:7,13,15 112:22 252:21 253:1,6,7,9,11, 19 267:2,25 268:2,17, 20,23 269:2 305:1,3,6,9

cost-benefit
99:15 100:14,16,19

costly
268:14

costs
101:9 253:6

couldn't
288:14 292:5

counsel
6:3,16 7:1 33:23 129:13 131:8 155:16 269:13 312:19

count
10:14 171:19 220:11

countries
58:19

counts
171:10

couple
56:9

course
19:24 164:24 192:16,22 210:22 218:3 306:19

court
7:24 8:6,13

courtroom
8:2

Coventry
290:6

cover
26:19 45:7 60:17

covered
16:16 288:18

covering
14:16 47:17

CP
115:22

creat
141:16

create
8:22 27:20 40:23 55:8 67:24 72:20 170:3 224:13,24 277:3 290:13,23

created
27:12 64:10 87:14 129:22 130:5 140:14 141:16,19 142:10,19 143:2,21 147:24 148:1, 2 151:21 153:7 156:22 159:2 170:6,8 174:5 192:8 204:15,18 206:13 225:1,3 280:2,9 295:2 296:25 312:25

creates
54:16 90:1 270:22 292:10,13

creating
8:8 61:19 158:25 159:4 183:5 280:5

creation
156:25 199:18 216:14

credit
167:16

Creek
234:22

crew
23:19 25:23 70:20 218:17 295:19 298:24, 25 299:8 303:16

crews
70:14

cross
74:12

cross-sectional
44:23

crosses
269:1

crossing
219:24 231:5

crossings
218:14 268:23,24

crossover
220:6,24 221:13 230:21

231:2,19 261:10

crossovers
61:3 112:21 220:3 222:1 243:25 248:10, 13,21

crudeness
299:16

crunch
71:19

crunching
120:13 127:2

crush
32:14

CSX
219:23

cueing
29:21

Cunningham
7:8

cup
36:23

curious
114:19

current
20:2 21:23 71:16 95:14 106:25 111:18,19,22 112:14 121:12 138:16 178:12,13 225:14 243:18 287:22

currently
11:11 43:1 96:23 102:12 108:6

curve
44:6,7,8 67:25 72:21,25 73:9,14,17,24 74:12 164:19 262:21

customize
277:10

cycling
299:7,8

D

D-a-v-i-e-s
56:23

D-a-v-i-s
56:25

daily
218:3

dash
76:12

data
12:2 42:9 54:19,21 78:11 91:18 95:19 120:13 123:24 126:23 130:9,10 137:17,24,25 138:2 139:7 151:1 153:10 169:20 181:5,8 182:13 183:16,22,24 221:15 224:9 257:6,12 258:6,14 263:9 271:9 282:25 285:6 286:8 288:20 309:8

date
12:12 139:4 142:2,5,7, 9,18,22 151:18 152:11 153:5,7,16,18 159:12, 13 161:15 173:24 174:1 188:22 199:16,18 203:17 206:3,7,18 211:24,25 214:17 234:24 245:13 280:17 300:24,25 311:22 312:3

dated
198:10 199:4,17

dates
136:10 137:12 152:5

David
7:7 236:23 312:13

Davies
38:25 39:1 40:6,16 54:9 56:21,22 57:3,8,10,19, 22 88:10

Davis
57:4

day
36:6 69:5 99:9 101:22, 24 102:11 115:18 142:18 197:11 269:22 295:16,24 296:4,7

day-month-year
152:10

day-to-day
298:25

days
10:5 61:7 67:17 197:12 199:4 206:21 308:15

de-
78:3

deal
90:8 95:18 157:16 295:8

dealing
78:11 87:14 90:20 130:10 151:24 165:14 236:18 271:8,10 282:13 284:12

deals
255:11 270:21,23

deceleration
90:22

decide
102:18

decided
242:23 266:17 274:10

deciding
287:15

decision
65:10 78:5 79:18 101:8 264:12 266:10 269:3 270:22,23 274:1,9,10 277:17 278:4

decisions
82:11 87:8 264:25 273:21 277:10

decrease
267:23

deemed
81:12 288:21

defect
217:22

DEFENDANTS
312:19

defer
67:18 158:6

define
28:21 44:18 45:24 47:2 92:14 99:7 104:9 124:15 201:18 264:4

defined
29:2 37:25 38:4 45:18 47:4 63:4,5 71:14 75:13,15 90:19,20 111:11 118:3 131:5 239:15

defining
98:18

definitely
18:23 24:16 40:25 108:3 122:11,14 176:12 181:5 186:19 199:22 210:3 221:3 260:23

definition
51:4 77:12,15 92:10,17 181:14 303:7

definitions
61:12

definitive
35:9

degrading
180:4

degree
28:22 29:4 40:7 44:8 100:17,18

del
247:8

delay
33:7 34:8,12 64:8 73:5 84:9,13,14 101:18 102:5 103:25 130:25 131:4,14,16,21 132:2,5, 10,19 133:22 238:1,2, 18,20 239:9,18 243:16 245:2 247:7,25 263:23, 25 264:2,15,22 265:2, 16,19,20,22,23 266:2 267:12 270:11 273:1,3 275:22 290:13 305:12, 15 306:5 312:24,25

delays
33:15 238:7,14 247:9, 11 267:4,15,17 290:23 306:2,3

deliberately
254:19

delineate
201:24

delta
160:6

demands
97:11 300:3

denied
10:22

depart
135:22

department
16:24 17:17,21 19:8 22:19 55:16 66:9 125:9 127:7,8,15 141:3,4,9,20 165:6 197:16 254:2 303:20 304:21,22,23

departments
24:17 215:6

departure
89:3 241:12 271:12

depend
79:15

depending
29:17 47:11 80:1 106:14 152:12 173:9 219:6 303:25

depends
29:5,10,11 43:19 303:4

deposed
7:19

deposition
6:7,14 122:13 128:11 139:14 149:23 152:19 158:15 169:13 173:15 188:8 191:21 193:9 201:15 205:11 214:7 234:11 269:15 278:21 280:22 300:7

derive
67:24

describe
19:8 28:24 45:11 48:4 52:24 78:9 80:24 121:2, 3 133:3,6 276:25 284:10

described
40:8 48:21 52:15 59:1 63:1 70:8 77:7 90:16 103:3 115:14 183:21 244:4 247:19,20 250:7 253:12 281:14 282:14 294:8

describes
21:18,19 133:2 278:9 283:23 289:4 293:17

description
34:17,25 35:10 47:17 77:16 78:3 237:23 284:3 285:16 295:9 300:14

design
18:7 23:18 25:15 32:12 52:4 53:2 55:14,15,17, 19 71:18 157:5 162:2 198:22 204:18,25 214:23 215:3 223:24 232:19,21 233:1 278:4, 9 287:21 294:19 298:5

designate
6:13

designated
50:25

designates
9:22

designation
62:6

designed
33:14,15 34:11 45:9 156:18 229:6

designing
13:4 32:18

designs
12:3

desire
94:8,14 304:6

destination
45:5 53:19 61:6 80:12, 17 271:16 273:1 295:22 298:21

destinations
284:11

detail
72:3 78:4 138:8 256:13 257:1 266:12,14

detailed
50:10,19 75:8 172:22 254:12 268:17 299:24

details
54:4 57:19 88:9 207:3 210:10

determine
78:15 96:10 158:2 192:7 211:7 233:17 240:18

determined
46:14 297:6

determining
143:8

detriment
103:21 304:17

Detroit
184:21,25

develop
19:16 41:16 69:24 96:18 98:4 126:23 165:7 200:5 214:1 216:9 250:25

developed
29:21 30:17 41:18 56:20 57:7,10 59:25 65:15 71:3 94:20 98:22 103:4,7 108:25 200:8 229:24 242:5 277:9 295:18 301:23

developer
310:5

developers
15:6

developing
15:1 57:13 60:2,4,7 70:25 71:1 73:23 83:23 126:20 157:17,19 159:7 183:25 211:21 214:24 281:13

development
15:3,12 81:23 82:3 83:19 84:16 97:21

develops
157:5

diamond
218:14 219:24

dictated
97:10

did-
264:25

didn't
106:10 109:5 114:15 121:24 122:17 132:8 150:5 155:14 171:21 202:19 264:25 268:16 312:8

differ
36:14,17 90:2 178:22 228:12

difference
12:17,18 76:4 106:9,13 150:12 151:12 160:6 163:16,20 167:18,22 173:2 189:6 191:8 192:2 235:21 259:21 263:18 272:3 283:18 292:13 302:18 312:25

differences
84:20 217:1

different
15:18 16:15 17:5 22:13 29:12 36:18,19,24 37:2, 13 38:6,7,9 40:24 41:1, 8,9 51:16 53:12 55:4 58:8 61:18,25 63:7 75:13 77:14 87:8 89:13 90:7,10 92:16 111:14, 17 113:9 119:20 127:18 133:4,7,9,15,16 135:5 136:10 147:21,22 150:12 157:17 163:14 164:2 174:6,7,20 175:24 177:3 178:7 185:23 186:1,3,12,22 189:11 191:22,24 192:3,15 195:25 196:5 205:7 207:6 208:23 209:8,20 210:15 214:15 225:24 228:9 233:24 239:19 245:21 246:5,21 248:4 253:19 255:22 257:19 262:6,17,21 268:25 270:5 273:2 274:8 290:5 291:8 297:21,22 301:21 303:14 307:13 308:15

differential
227:17 236:7

differentiation
85:1 104:13

differently
45:11

difficult
180:17 268:14

difficulty
246:16

diminish
304:2

dining
196:23 197:6

direct
22:8 78:2 96:17 130:12 132:21 174:2 190:14 220:18 225:10 230:3,18 266:20 269:24 288:24 293:2

directed
182:3 196:12

directing
185:13

direction
24:25 87:1,3,4 100:25 101:1

directionally
86:17

directly
23:5 55:13 224:21

director
21:10,20 25:20

disagree
202:10

discrepancy
151:6,10 178:18

discrete
77:25 78:6,10 79:7 115:8,19,22 116:11 119:5,7 122:8

discretion
87:7,10

discussed
49:7 62:25 134:3 308:25

discussion
51:21 52:9 298:13 303:15 312:10

dispatch
79:4,17 84:1 86:25 87:13,14 273:19,20,25 274:6 275:6,7 277:16

dispatcher
87:7

dispatches
276:16

dispatching
23:24 77:19,22 79:14, 20 80:8 82:6 86:20,22 239:17 276:5,16,23 277:10,14

display
65:9,11 151:25

displays
205:10

disposed
200:2

disruption
33:6

disruptions
254:10 306:12,20,24 307:19

distance
27:10 29:24 31:4 36:3 53:7 64:6,17,21 65:17 76:15 120:14 244:10 250:2 262:18,22

distinct
122:12

distinction
106:6 260:3 295:4

distinguished
152:24

distinguishing
76:24

disuse
42:9

divide
47:6 144:14

divided
144:5

division
14:17 28:1,9 118:20 120:23

Docket
6:9

document
91:21 128:24 129:7,12, 16,24 136:4 139:5,13, 18,22,23,25 140:3,10, 13,16,19,23 141:16 142:14,17 143:1,5,11, 21 144:25 145:9 148:3, 4,14 149:17 150:1,8,16 151:11,14 152:22,25 153:3,7,11 155:23,25 156:22,25 158:12,19,24 159:1,12,20 160:7,10, 17 161:9,20,22 167:21 169:10,19 170:3,6,8,25 172:2,7 173:14,18 174:5 178:19 181:25 185:10,17 186:15 189:20 190:16,22 191:14 193:20 199:15, 17 202:25 203:4,5,7,15, 23 204:16,17 205:15 207:14 209:17 214:13, 19,21 217:12 221:24 222:25 223:3 224:25 225:11 226:17,21 228:15 232:2,17 234:9, 14 235:1,9,11,16 253:13 278:16,24 279:3,7,9,11,12,15,19, 22 280:3,6,9,16 281:1, 4,8 282:8,18 283:2 285:14 286:6,22 287:24 288:1 289:1 300:10,13 306:16

documentation
256:6 280:15 282:21

documented
168:23

documenting
126:19

documents
151:20 153:17 155:18, 21 159:4,6,14 163:22 182:24 185:20 186:9 191:15 192:3 198:9,23 201:17,23 202:4,11 207:16 208:4,14 222:22 225:6 226:14 227:21 228:6 235:12 278:9

doesn't
45:12 85:16 86:22 87:6, 23 88:12 107:8 127:18 134:17 159:12,13 161:24 165:16 171:23 177:1 230:12 232:4 249:9 280:16 290:22 291:4 292:1 298:16

doing
10:10 12:2,3 17:4 18:5 66:25 76:12 83:8 114:11,20 115:10 116:1 119:4 124:11 127:1 151:22 155:19,23 167:15 171:4 177:23 186:5 187:23 192:12 200:6 225:4 246:22 254:15 309:12

dollars
112:25

don't
7:1 9:6 17:19 24:8 33:20 37:8 45:15 52:23 54:6,8 56:11 74:22 80:4 88:14 93:4 94:13 96:18, 20 101:2 118:24 119:16 120:24 123:13 125:23 127:14 128:5,15 129:23 130:5 134:15,19 137:11,20 138:6,12,23 141:18 143:3 148:10 153:15,17 156:24 159:3,17 160:19 161:21,22 166:15 167:22 168:4,6 175:4, 15 180:5,19 185:1 194:25 195:1 204:23 207:2 210:7 219:15,18 222:8 227:4 230:11 234:3 246:15 251:25 252:12,17 255:5 269:20 279:6 281:17 288:7 291:7,12,15 294:22 304:13 311:5 312:11

DOS
94:3

DOS-BASED
94:24

double
71:10 86:6,8,9,11,13,16 87:2,11,15,16,24 99:5 112:20 220:11 243:24

double-track
250:14 261:9 262:16,19 264:9

double-tracks
248:12 268:10

Doyle
124:23 125:5 128:21

draft
141:25 148:4 151:16 157:1 161:14 213:13,23 214:11,15 221:20

draw
74:10 162:14 188:23

drinks
56:9

drive
48:7,11 305:23 306:9

driven
264:7 265:1

driver's
306:16

drives
40:16

drove
264:11

Dubuque
116:21 117:1,4 119:3 251:5

due
49:3 243:17 257:5,12 258:6 263:8

duly
6:4

duplicate
224:6

duration
262:2

dwell
53:21 61:2 308:1,2,13

dynamic
68:3 97:10 309:13

E

e-mail
193:8,12,16,21,22 194:2,4,10,12,15,16 195:4,8,15,18 197:21 198:5 199:5 226:11

eagerness
286:25

earlier
17:3 90:17 91:1 93:19 127:14,24 137:5 141:7 143:17 144:2 174:22 177:14 181:10 182:17 183:8 185:20 189:12 197:14 203:2 211:24 226:11,18 228:6 234:10 235:13 241:10 254:25 261:18 262:24 263:7 267:9 287:13 302:12,14 308:23,25

early
104:21 143:6 181:7,20 242:1,8 261:13 296:10, 11

early-
226:11

earmarked
99:23

easier
8:5,12

easily
168:12 176:18

east
268:7

eastbound
235:3

Eastern
24:20

eastward
62:9

easy
185:22 268:13

Ed
7:3

Edmonton
11:15 16:20,25 17:1,11, 25 18:16,17 21:4 140:25

educational
9:7,10

effect
31:25 32:10 59:18 68:7 69:1 81:14 121:9 260:13 270:19

effective
262:19 267:2

effectively
70:19 262:15 273:24

effectiveness
267:25 268:2,17,20 269:2

effort
42:20,22 44:20 46:12 49:1,4,5,19 88:2 90:22 129:25 309:14

efforts
251:17

egg
68:21

eight
174:7,13 185:14,25 189:3,13 191:12 297:20,21,22

eight-passenger
205:20

either
8:11 9:1 38:10 57:3 65:25 66:24 68:19 89:2 102:15 109:13 115:25 116:4 125:3 131:8 156:3 165:11 171:5 176:10 219:18 248:9 250:6 253:12 260:1 285:9 299:14

EJ
288:9

elaborate
103:9

elect
311:16

elected
256:9

electrical
48:8,9

electrification
85:17

electronic
155:3 281:5

electronically
155:5

element
32:9 78:13,19 79:16,20, 21,24

elements
16:13 37:9,12 61:21 69:23 78:16 79:25 80:2, 7,9 101:7 249:16 254:23 256:7,13 268:6 278:5,11 305:5 306:18

elevation
44:2,3 164:20

eliminate
99:11 131:4,14,16,20 132:2,10,18 265:13,21

embedded
259:22

emphasize
209:2

employee
11:11 56:2 125:4,5 193:25 194:9,11 312:1

employees
19:4,20,23 141:22,23 204:19

en
219:11

enable
299:5

encounter
218:16 239:18

encountering
171:11

endeavor
28:13 94:10 95:16 113:25 201:21

endeavoring
93:6,18 94:18

ended
113:13

engineer
9:17 10:1 11:18,23 12:9 13:9,20 14:1,13 15:15 17:15 18:8 60:5 254:5

Engineer's
9:17

engineering
9:12,20,22,23 10:12 12:5 32:12 50:20 66:8 97:20 99:24 187:1 190:9,13 194:1 217:19, 20 218:2 254:1,3 301:16,24 303:19 304:5,10,16,21 305:9

enhanced
40:6,9

enhancements
93:3 102:19 103:8 112:4

enjoyed
312:9

ensure
169:23 175:2

enter
294:13

entered
261:25

entire
27:2,14 185:5 207:1 236:21

entities
79:9

entitled
130:16 143:13 214:11 231:18 235:17 256:17 281:6 283:3,16,17 289:6,11 302:6 306:9, 22 308:18

entity
78:20 137:5

entry
262:9

equal
41:7 131:25 190:10 247:10 290:11,22 292:15

equally
200:9,10 292:6

equals
40:15,17 146:10 289:16

equation
38:25 39:1 40:6,16 54:9 56:21 57:22 88:10

equip
193:23

equipment
35:18,20 36:4 44:16,19 46:4,11,18 47:6,7,12 48:16,23 49:2,16 61:8 158:3 165:23 205:19 217:2 225:20 228:3 254:10 256:3 299:7

equipments
205:17

Eric
309:24 310:4

erroneous
200:10

error
83:11 84:25 274:16

erroring
168:14

errors
299:16

especially
93:25 178:1 209:3

essence
239:22

essentially
34:4 61:23 229:5 266:1 284:19

establish
31:22 99:19 260:11

established
105:9,11 125:24

establishing
30:10 178:12

estimate
49:13 77:2 112:23 133:21

estimated
252:21

estimates
253:6,10,11,18

estimating
253:7

et
39:14 54:19 259:9 262:7 295:19 304:8

evaluate
26:24 28:19 34:5 59:17 73:19,24 83:11 98:3 165:6,7 263:22

evaluating
19:11

evaluation
26:19 100:11

evaluations
84:5

event
77:25 78:6,10 270:19, 22,23,25 271:3,5,7,21 272:5 273:21

event-based
270:9,17 271:23 272:3, 10

events
270:24 271:8,13,16,17, 19 273:21,22,23 276:24

Eventually
141:5

exact
12:12 19:6 53:1

exactly
25:9 57:24 138:8 180:5 184:8 185:1 217:5

examination
6:3,16 312:19

examined
6:5

example
10:12 34:12 80:19 116:4 132:4 142:6 166:5 170:18 208:22 220:23 221:13,20 224:20 248:24 254:2 255:19 276:6,7 291:6

examples
216:20

exceed
217:25

exceeding
70:20

Excel
30:18,20 36:13 37:14 51:14,18 65:1,5,7 91:17 98:8 103:4,6,7 120:13 140:14,16,19 148:11 150:14 151:22,24 152:2,5,11 187:22 223:15 224:6,15 225:8 244:15 245:6,17 248:2 250:11 267:18 297:9,18

Excel-based
29:21

exchange
199:5

Exclude
286:12

excluded
236:25 286:9

exclusively
129:7

excuse
163:21 190:7 197:12

executable
95:1

executed
25:1

executive
96:15 118:5

exercise
38:4,11,12 102:23 103:1 178:7,16 187:18 232:24 274:25 287:14

exercises
84:12

exercising
10:10

exhibit
128:11,19 130:15 139:13,14 148:14 149:20,23 152:17,19,22 158:10,12,13,15,18 162:15,16 163:11 169:9,13 173:14,15,19 175:7 181:23,25 185:10,23 186:5,6 188:5,6,8,11 190:23 193:5,9 198:11 199:2 202:24 203:5 205:11,15 212:16 214:6,7,10 226:14 234:8,11,14 235:4 278:20,21 279:17 280:20,22,25 283:2

287:25 289:1 300:5,7

exhibits
129:4 163:23 164:1 168:5 213:12 221:5 269:17

existence
67:7

existing
106:21 107:13,22 261:9

exists
89:14

exit
262:9

exiting
177:11

expanded
16:12,17 28:11

expansion
14:7 67:11

expect
28:24 55:4 124:9 154:16 175:4 282:23

expectation
68:23

expectations
19:10

expected
75:5 298:20

expenditure
100:8 102:13

expenditures
100:1 253:23

expense
127:10 304:23

experience
19:17 28:12 84:7 263:16 268:4,13 301:22 312:6

experienced
28:7 82:8 133:22 152:4

experiment
31:21 32:17,23,25 40:18

experimental
260:11

experiments
34:4

expertise
14:5 28:16

explain
167:22 191:8 240:25

explained
134:25 177:14 191:9, 11,20 241:6 267:8 285:14

explains
255:11

explanation
266:8

explanations
219:21

extend
101:8 268:7,9,10 269:14

extending
100:25 249:18 250:6

extension
250:13

extensive
260:23 309:8

extensively
67:9 307:7 309:4

extent
8:9 187:22 248:4 268:20 292:21 293:19

external
92:25 97:15 127:6,9 296:16

externally
15:4 111:6

extra
234:16

F

facility
18:7 295:21,23 304:8

fact
10:19 32:1 38:23 54:8 182:3 221:19 269:16,17

factor
80:7 144:6 273:11

factors
31:23 46:13 67:22 68:11,13 69:1,23 131:15 256:10 303:6 306:9,11 307:2,13 310:20

fails
32:15

failures
254:11 256:3

fair
18:19 22:10 29:1 33:14 35:11 37:4 39:22 45:8 58:10,20 63:19 68:15 70:4 74:19 76:18 82:13 91:25 97:2 100:9 107:19 110:8,25 116:10 117:11 122:19 141:13 167:24 186:13 188:3 198:4,6 219:17 230:4 245:11 246:24 248:9,17 249:19 273:25 278:1 280:1

fairly
196:6

fall
22:19 23:12,21 24:13 25:12 257:19

falls
23:18 24:5,20 114:7

familiar
25:7 37:16 46:19 47:20 56:4 57:24 58:1 128:23 130:2 214:19 235:9 250:15 253:2,3 281:7

familiarity
138:18

far
36:2 51:21 54:2 72:3 74:3 110:14 150:4,5 221:6

fast
76:8,9,10 292:9

fault
274:6

feature
277:1

features
37:12

February
300:24

feedback
60:6

feel
129:1 307:12

feet
104:15,17 196:21

Ferrari
292:9

field
50:13 91:20,21 123:16 124:2,5,8,14 135:23 136:2,15,19,25 137:6,9, 17,21 138:2 183:9,10, 17,19,21 184:1,10,17 240:22 268:12 301:17 308:7

fieldwork
123:17

fifth
293:6,8

figure
142:12 195:18 222:15 264:5

file
65:1,2,3,5,7 144:23,24 150:14 152:13 155:17 164:20,22 169:5,16 207:10 225:6 230:3 278:15 281:2 285:4 286:20 287:10

files
95:17 116:3 154:18 155:17 162:6 163:17 164:17,19 172:21,22,23 200:24

fill
10:8

filling
224:8

final
168:18 190:17 200:17 230:8 246:3 252:10,21 264:25

finance
6:9 99:24 100:4

financial
100:6 101:10,12

find
55:2 83:1 164:18 278:18

find/confirm
195:11

fine
61:14 258:13

finish
8:20

finished
115:24

first
18:13 19:19 43:12 47:1, 2 63:20 67:9 104:19,23 107:21 130:23 133:6,18 138:21,25 143:11 145:9 153:3 162:23 181:8,14 182:12 195:4 198:12 199:3 214:2,18 216:8 223:5 224:1 235:1 252:19 254:8 257:22,23 258:19 259:3 261:3 270:3 272:22 282:1 283:6 286:12 293:4 300:16 301:9 308:19 309:1,7

First-page
224:11

FISHER
205:13

FISHERMAN
82:22

Fishman
6:6,18,25 7:3,16,17 33:21 42:5 56:11,14 58:10,14 62:16 81:6 82:25 85:7,19 88:25 92:18 93:16 95:9,12 106:4,8,15,18 110:5,23 111:1 115:2 125:25 126:2 128:5,9,15,17 132:15 134:5 139:16 142:20,24 149:19,25 152:16,21 153:21 158:9,17 160:21,25 164:9 167:5,12 169:15 173:17 182:8,16,19,22 183:6 188:10 193:7,11 197:2,4 199:20 200:14 201:7,10 202:7,15,20, 23 208:9,20 212:9,18 213:2 214:4,9 221:2,22 222:7,11,15,18,24 227:20,25 230:4,5,14, 16,17 231:7,12,13 234:13,17,20 236:20,25 237:5,9,12,20 243:7 249:22,25 253:16 255:13,18,20 258:1,5, 12,18 259:25 265:3,8 269:5,8,20,23 271:6 277:22,24 278:19,23 279:25 280:19,24 282:5,7 284:17 286:10 290:16 291:19,22 294:15 297:4 300:9 307:11,20 312:7,16

fit
24:15 277:11

fits
33:2

five
179:9 180:14 289:16 290:7 293:7

five-gallon
101:25

flip
279:6

flow
78:4 87:2 187:7 244:12 275:7 278:4 279:14,20 284:14

focus
89:18 118:8 127:8 133:18 178:25 180:10 238:10 261:1,3

focused
13:3 14:3,6 131:22,24 265:6

focusing
200:16 257:10

follow
62:12 259:13

following
183:17 190:2 253:5

follows
6:5 130:23 254:8 274:24

footnote
163:1,7 254:7

forced
311:18

foreign
262:6

form
10:8 17:14 40:14 52:2, 19 62:14 81:3 82:16,21 85:12 92:11 93:14 106:3 109:25 114:24 115:12 132:12 210:5 212:22,25 222:4 259:19 271:4 290:14 291:17 294:2

formal
96:19

format
42:10 50:11 93:7 147:24 148:3 151:20,25 152:1,10 160:11 191:2 203:8 204:6 205:4,8 223:20,22 234:9 235:12

formatting
152:9

former
56:2 125:4,5

forms
38:7,9 129:23 245:19

formula
38:5 40:9,10,12,22 56:18 57:8,9,11,13,19, 22 152:14 297:19

formulas
103:10 148:12

formulate
157:6

formulation
152:13

forth
129:15 281:25

forward
15:15 19:7 197:10

forwarded
197:13

found
40:18 83:5 279:14

foundation
125:23 134:3 135:5 153:14 214:2 264:24 283:5

four
20:1,21,23 22:16 27:22 113:19 145:4 153:10 156:13 180:13 289:16 290:7 293:7

fourth
293:5

FRA
65:25

frame
19:6 183:22

franchise
118:11,12

Fraser
109:13 110:12

free
129:2

freight
13:6 15:25 81:13 99:8 110:11 111:19 117:25 118:11 121:13 130:25 131:25 133:11,14,16,22 134:16 135:17 178:14 191:23 218:25 219:2 238:1,3,24 239:2,5,7 240:6,9,10,19,20 242:12 243:5,16,22 244:9 245:2 246:7 247:6,9,11,25 261:15, 25 265:19 267:4,22 276:13 281:13 288:23 299:25

French
229:3

Friday
206:22

front
92:20 130:14 154:19

front-end
181:11

fuel
49:13,18

full
7:23 69:3 124:16 129:3 132:24 133:20 177:19 237:24 252:19 266:22, 23 287:19 293:4

fully
9:3 28:6 175:6

function
17:23 23:21 50:20 55:20 66:9 97:19,20,21, 22 141:13 152:11 165:6 196:12 303:19

functional
278:8

functions
24:17 26:6 34:13 49:8, 11 50:19 55:19 162:3

fundamental
13:6 18:9 19:13 64:6,7 71:9 74:1 90:21 178:17 181:6 218:19 233:20 263:20 272:22 305:22 310:18,24,25 311:2

fundamentally
15:19 16:2 17:4 35:14 44:9 45:2 49:23 60:22 68:2,21 72:19 75:2 77:25 78:9 80:11 86:15 88:13 101:24 106:24 118:16 123:17 127:5 154:19 178:6 223:10 261:7 299:13

fundamentals
309:19 310:13,15

further
104:9 209:5 247:20 259:13 291:14 312:11

future
16:6 311:13

G

gain
19:16 35:8

gained
18:23,24

Gainey
7:15

gaining
30:11

gallons
102:1

gather
126:23 154:13

gathered
241:2 308:6

gathering
12:2 123:24 155:1,8,10 200:4 283:25

GE
39:13

general
24:18,19 31:13 34:23 39:13 42:19 47:16 57:21 59:10 61:20 67:20 72:1 74:23 117:17,19,21 118:10 123:13 154:11 187:25 190:13 244:5,17 250:23 259:1 266:8 300:14 307:16

generalities
259:3

generally
30:22 31:21 34:3 38:13 43:8 45:6 59:1 104:16 116:1 204:7 251:2 252:1 292:4,5,6

generate
53:6,18 64:10,14 297:20,21

generated
64:12 129:19 201:1 296:12,17 299:14

generating
186:17

generic
74:8 186:20

getting
98:18 101:9 103:19 244:6

give
8:9,11 24:25 27:14 35:3 39:10,14 53:7 74:11,17 75:2 77:12 138:13 149:21 152:18 159:13 180:22 205:16 209:1 210:7,12,24 227:5 236:9 241:5 275:8 304:7 312:5

given
35:23 36:6 71:6 123:7, 12 132:7 242:21

gives
182:6 195:24,25 199:22

global
115:17

go
7:21 9:7 45:22 51:21 56:11,17 69:19 76:14 77:17 88:8 100:5,22 101:7 119:25 123:15,17 128:5,13,15 144:22 145:8 148:13 149:5,6 150:15 158:7 160:9,16 163:10 165:12 169:10 172:21 174:13 176:9 177:1 181:23 184:20,23 185:9,18 189:19 197:10 200:5 201:10,22 207:22 230:20 232:24 235:18 237:21 243:12,13 254:6 256:15 266:24 269:6,8 284:4,16 289:2 301:4 302:5,22 303:1 304:7 308:17 312:16

goal
275:10,12,17

goals
67:12

goes
72:2 99:22 175:11 176:6 216:19 246:25 270:8 284:23

going
21:11 33:17 41:4 43:13 46:10 56:7 73:7 75:23 76:12 77:1 92:16 100:18 107:1,2,9 116:7 128:13 142:16 149:21 152:16 158:13 167:17 172:2 175:2 177:7 183:7 184:11,12 187:5, 13 188:17 190:11 193:17 201:21 217:4,21 237:14,16 240:15 243:9 255:21 260:15 263:5 266:14 268:3 278:19 281:19 285:1 286:16 294:1 305:17

good
6:19 58:20 143:20 175:3 201:12 279:24 301:2

Gord
235:3,7,19 236:22 237:1

Gord-battle
234:22

gotten
166:20

governed
69:21

governs
80:16

grade
43:24 262:21

grades
90:22

grain
295:13

Grand
7:9 135:6

granularity
54:5

graph
305:18

gravity
90:23

great
6:25 7:16 8:16,25 9:5 11:3 17:9 130:21

greater
15:12 36:2 102:21 104:18

Greed
197:11

grid
68:5 98:7,9,10,11,15 99:5,7,13 103:12

grids
99:4

ground
7:22 15:2

group
12:10,14 13:9,11 14:14, 15,25 15:16 20:13,19, 22 22:11,15,18 23:19 24:4,9 25:14 29:14 61:17 63:10,12 85:5 95:25 96:7 124:5,6 156:13 157:18 178:8 210:15 284:1

grouping
62:8

groups
23:12 25:12,19,21 100:4

grow
102:15

grown
102:15

GTW
114:8,13 136:18 184:18 185:5 236:16

guess
43:11 255:5,23 283:4 305:19

guessing
153:18 185:6

H

H-a-r-a-l-d
6:23

half
50:1 238:11

hand
27:18 51:20 67:3

handle
76:21 85:16,17,25 87:19,23 89:1,2 102:11, 22 104:5,8 127:11 245:8 267:22 293:24

handled
116:5

handles
271:1,3

handling
244:18 267:22 270:24

Hang
182:5

happened
81:18 118:18 120:24 233:6

happening
183:20

happens
219:16

Harald
6:2,7,22 128:21,23 143:1 203:3 225:8 269:21 281:7

hard
81:10 114:25 299:24

Harkins
7:7

Harrison
262:11,13

haven't
28:14 134:3

havocs
180:7

he'll
220:21

he's
22:24 194:9 212:13 231:6 285:18 294:23

head
8:10,11 22:22,25 25:19, 20 47:13,25 48:5 181:22

heading
301:8

headings
150:11 176:13

headquarters
14:12,19

heard
34:25 40:2 62:20 284:8

hearing
35:9

heavier
189:14,15 196:25 197:5,18 198:1,3

help
31:18 114:2 136:5 163:13 220:22 251:20 252:5 257:21 261:5,19 285:11 304:21

helped
41:16

helpful
133:5 272:12

helping
250:25

HEP
47:21,23,24 48:14,25 49:3 143:18 144:6,7

hesitate
208:25

hesitation
221:4

hierarchy
25:8

high
61:20 262:14 292:9 299:17

high-level
61:20 69:3

higher
96:16 102:17 173:9 174:8 189:13,23 190:8, 12 191:7 196:22 197:1 209:16

highest
170:17,22

highlight
41:2 75:7 303:2

highlighted
170:13 178:18

highly
49:20

highway
35:23

hill
80:4

hire
157:10

hired
122:3 125:10 138:21 157:9

hiring
127:17

HIRSCH
106:6

Hirsh
7:7 33:17 41:25 56:6 58:8 62:14 81:3 82:20, 23 85:2,11 88:22 92:11 93:14 95:6,10 106:2,13 109:25 110:21 114:24 115:12 125:22 128:4,8, 13 132:12 134:2 142:16,21 153:13 158:6 160:19 164:7 182:5,12, 18,21,25 196:25 199:14 201:6,8,14 202:14,17, 21 208:6,15,17 212:5, 12 221:1 222:4,8,14,16 227:18 230:2,12,15 231:6,10 234:16 236:15,24 237:3,8 243:2 249:20,23 250:2, 3 253:14 255:9,14,19 257:24 258:3,10 259:19 264:23 265:5 269:10 271:4 277:20 279:19,24 282:3 284:8 285:17 290:14 291:17 294:1,21 307:5,14 312:6,14,20

historical
120:12 135:16 240:23 241:22 242:4 281:16 288:20 292:24 296:25

historically
242:10 294:12

history
182:13

hit
107:3 128:4

HK
158:24

hoc
97:3

hold
31:23 88:21 276:9,10

holding
89:24 270:12 272:15

hole
166:19

Homewood
124:11 184:21,25 214:24

hope
257:1 259:4

horizon
196:2

horsepower
46:23 47:1,6,12,13,14 48:6,10,18,25 49:3 50:21 143:18 144:3,5, 10 185:15 187:4 227:10

horsepowers
159:21

hour
56:7 206:24 269:15 312:5

hours
10:5,14 36:6 67:18 293:10 296:11 304:13

HP
144:7

HPT
46:20 63:13 69:7 71:21 80:4 143:18 144:3,9 160:13 173:7 174:8,9 186:1,11 189:6,13,16 190:3,5,6,11 205:22 226:22,24 227:7,15 230:7,10

HTP
144:12,15 228:9,10

Hubert
7:5

human
87:7

hundred
86:13 217:2 220:4,13, 25 231:20

Huron
234:22 235:4,6,19 236:22

I

I'd
138:7 146:10 153:12 154:17 162:14 163:16, 25 172:15,20 174:2 193:4 201:6 225:10 234:8 238:10 241:3 256:23 258:22 261:2 266:24

I'll
7:2,21 8:18 25:13 43:11,12 52:24 58:20 67:18 85:11 106:2 116:10 130:22 132:12, 23 143:12 145:3 147:12 158:22 159:8,18 167:4, 18 174:23 175:8 180:20 186:10 188:23 191:7 199:1 202:7 203:2 212:9 214:16 215:25 229:15 231:8,16 245:10 258:13 259:19 266:6 270:2 277:22 294:21 307:5

I'm
7:3 8:17 9:21 11:2,24 16:7 19:5 21:24 23:14 24:1,7,14 28:3 33:1,12, 17 34:22 41:21,23 47:11,24 54:23,25 56:3, 24 57:1,7 62:12 68:18 73:22 78:8 84:15,17 85:5 88:11,15,20 92:2 93:5,9 94:12,13,21 100:18 101:11 106:4 109:20 115:7 122:14,19 134:8 139:3 142:12,16, 25 146:7,10,11 149:21 151:2 152:16 153:19,20 154:12 155:7 156:6 160:23 164:12 167:6 170:12,20 171:24 174:24 176:17 177:6,22 182:22,23 185:8 186:7 193:17 195:9 200:1 206:2 208:18 219:15 222:11 225:3,23 228:23,24 230:14 231:7,15 233:4 253:3 255:23 257:18 264:5,17 272:2,18 276:2 277:23 278:19 279:9,12 280:17,18 284:10 285:7 286:13 294:1,23,24 295:2 304:5 305:21

I've
114:17 136:3 151:23 178:2 206:1 284:8 293:6 301:18 312:9

i.e.
40:23 69:5,7 71:20 100:2 115:17 243:19,23 245:2 290:6 295:7

IC
134:10,11 135:6 136:14 176:3 179:6,21 185:5 219:13 220:16 283:12 290:2 292:22

ID
288:13

idea
22:4 110:15 113:5 118:21 142:11 153:8,9 157:18 166:14 175:19 177:6 178:2 186:16 187:16 199:24 209:6 233:9 236:8 280:8 296:7

ideal
87:23

identical
240:1

identification
128:12 139:15 149:24 152:20 158:16 169:14 173:16 188:9 193:10 205:12 214:8 234:12 278:22 280:23 300:8 311:3

identified
102:20 136:3 155:7 238:17 242:5 243:15 247:18 267:18

identifies
44:1 285:22

identify
50:2,21 53:3,7 74:2,6, 15 98:4 99:3 100:1,20 102:16 103:12 117:22, 24 121:10 154:18 155:4 163:23,24,25 201:4 211:11 216:22,24 238:5,12 240:9 243:20 244:15 245:22 248:3 251:18 267:11

identifying
61:19 99:6 102:8 115:16 217:21 245:5

ignore
176:10

Illini/saluki
154:9 157:25 171:14 215:21 233:14

Illinois
7:8 65:24 66:5,6,8 94:17 114:3 134:7 184:19 292:20

illustrate
305:21

illustration
305:20

imagine
66:13 116:17

impact
34:8,11 73:19,24 101:18 102:4 120:8 121:9,10,11 131:24 132:5 240:9 242:24 249:4,9 270:11 290:10

impacting
218:5

impacts
26:25 33:16

impediment
218:15

implemented
113:6,10

implication
263:8

implicit
75:11

implies
182:18

imply
199:17

importance
260:22 301:9

important
8:7

impose
217:24

improve
95:16 103:20 250:18 267:21 275:10,16

improved
38:24 57:23 243:22 257:9,16 263:12

improvement
97:24

improvements
99:21,23 102:5 112:17, 23 113:1,2,4 131:3,13, 23 132:1,2,9,13,18 245:24 250:17 251:18, 19 252:23 253:20,24 267:3

improving
101:5 103:24

inability
33:6

inaccurate
142:5

inappropriate
140:5

include
10:11 16:12 45:16 68:16 69:17 112:5 133:25 134:13,21,22 215:20 232:1 241:13 248:23 254:22 256:12 271:19 276:4 287:6 305:25 307:18 309:25 310:17,18

included
18:20,21 60:19 112:8,9, 13 135:3 155:20 164:16 240:10 257:3 286:8,16, 22 288:18

includes
26:21,23 213:8,11,16, 18 235:4 236:21

including
25:13 129:4 245:19 247:21,22

inclusion
18:10 111:19

incorporate
37:11,13 260:15

incorporated
218:6

incorporating
53:20

incorrect
140:5

increase
98:5 99:12 100:21 102:20,22 104:25 107:23 248:5 292:14 304:1,15

increased
30:12 115:20,21

increases
187:4

increment
50:1,15,16 51:2,3

incremental
49:24 50:4 131:4,14,16 132:18 238:2,7,13,14 243:16 247:6

incrementally
246:5 247:5

incur
268:23

independent
24:22 186:10

indicate
177:21 206:2,21 231:25 243:10

indicated
198:12

indicates
141:25 142:14,18 189:23 194:3 196:21 300:17 302:7

indicating
210:18

indication
74:17 75:3 77:2 175:25 182:6 191:16 214:14 300:1

individual
18:24 28:10 40:23 44:19 45:18 60:12 62:7 99:4 123:14 223:7 224:5 267:19 308:11

individually
88:3

individuals
28:6 60:7 83:5 124:11 156:20 168:11 215:6

indulging
312:8

industry
11:5 15:2,5 33:1 34:7 38:13 52:22 65:22 66:15 284:5 299:9 302:1

inertia
44:22

inevitable
306:6

inferring
170:21

infinite
80:12 89:6,21

info
50:19 169:6 198:23 211:19 224:5

information
35:6 39:2,4,13,14 40:4, 5 43:20,21 44:10 45:7 51:19 52:11 54:23,24 55:6,11 60:19 61:1,8,16 64:21 65:10,11,17 71:19 88:4 89:19 91:21 92:22,25 93:1 99:25 103:11 111:5,7 126:20, 21 140:17 143:19 146:12 148:16 150:13, 23 151:3 152:10 156:17 157:6 160:11 165:14,22 166:21,25 175:18 177:25 178:3 181:6 183:19 184:1,10,13 185:14 191:10 192:6,9, 20,25 193:2 196:9,11, 13 199:8 200:4,6,8 201:2 204:8,9,14 205:8, 9 207:13 211:13,15,17, 20 213:7,8,11,14,15,17 216:19 221:7,10,13,21 224:16,20 235:2,5 237:17 240:22 253:1,25 283:25 284:13 286:25

informative
259:1

informed
197:25

infrastructure
12:23 40:3 54:11 80:15 89:14 90:6 98:23 99:10, 21 100:3 101:4,23 102:5,10,19 103:22 105:16 112:3 117:24 120:8 121:14 131:20,23 132:1 133:17 179:21,25 243:23 244:17 245:24, 25 246:6 247:2,4,16,18 248:3,8,15,19 249:16 250:17,25 251:9 252:22 253:20,24 263:20 264:8,20,22 265:1,7,10, 11,21 267:3,5,20 268:3, 5 270:6 273:5

infrastructures
246:5

initial
271:12

initials
158:21

input
40:13 45:7 48:15,17,21 54:11 60:22 62:5 63:4, 17,22 64:13 73:14 91:2, 13 92:13,14,22,23 100:10 126:20,24 143:22 144:21 162:5 163:17 164:17 165:25 169:24 172:16,21,22, 23,25 178:12,17 181:5 199:8 200:12 205:16 207:7,10,11 209:7 210:10 221:11 224:22, 23 228:2 233:20 239:15,19 240:11,13,15 271:9,17 274:7,18 276:18,19 277:17 283:21 286:20 287:10 292:24 293:1

inputs
41:10 43:22,23 45:1

60:14,16 143:16 164:1, 3,5,8,11,14,24 167:23 192:2,3 200:11 210:13 213:19 216:14 259:23

Inputting
285:21

inquiries
23:9 223:24

inquiry
194:18

insight
35:8

inspection
218:3

instruction
275:9

instructs
33:23

intelligence
95:20

Intelligent
52:1,16 55:25 203:1

intended
216:15

intention
71:17 294:7

inter-model
23:20

interact
86:24 274:22 277:3

interaction
270:5 273:18

interactive
68:4 108:21 275:1 309:13

interest
32:1 33:8 50:1 51:19 53:9 95:22 182:9 277:4, 12 305:2,6,13

interested
284:10

interests
303:12,13

interface
90:9

interlocking
219:23

intermediates
249:2

intermodal
121:8 283:7 290:13,24 291:5,9,16,24 292:3

internal
53:6,17,25 86:25 97:16 111:8 222:13

internally
15:3

interpret
195:21,22 202:16,17,22 206:5 264:4

interpretation
170:24 186:13 220:22

interpreting
206:3

interviews
123:16

intricacies
262:5

introduce
7:1 128:18 139:11 158:11 173:13 188:5 193:4 214:5 278:19 280:20 300:5

introduces
7:13

intuitive
284:14

invest
102:18

investigation
33:9

investment
101:10

involve
116:23

involved
15:11 35:25 38:24 40:20 54:25 57:12,25 60:20 70:24 71:1 83:19 85:5 90:19 97:23,25 100:7 119:18 120:3,15 126:19 131:9 155:1,8, 10 157:19 158:25 165:3 168:11,13 186:17 225:4 251:11 269:2 280:5 310:20

involvement
93:23 98:1,2 113:11,13 123:4 124:12 129:9 250:24 251:23 252:1

involving
241:9

Iron
117:12 122:1,23 124:7, 15,20 125:19 126:3,12, 14 127:3,17,22 129:7,8, 11,19,22 130:4 137:5,6 138:22 156:10 183:9, 10,18 184:16

irrelevant
299:4

Isaac
40:15

isn't
28:3 79:19 194:5 240:14 242:1

issue
29:11 41:6 67:3 68:17, 21 81:17 83:7 89:15,16 102:13 156:24 177:19 219:24 252:4

issued
6:8 275:14

issues
12:2 26:25 27:18 34:21 35:8 67:11 116:2 118:16 119:20 180:5 212:3,6 255:7 305:16 310:21 311:1

issuing
276:4

it's
8:6 9:22 14:3 20:3,6 21:8 24:11 25:2 26:15 27:1,19 31:22 34:8 35:8,14,15 37:9,13 38:4,16 40:22 43:6,8 44:19,20,21,22 46:2 48:23 52:16 53:2,3 54:2,21 55:17 57:3 59:16 62:2,8 63:7,16 64:1 68:2,20 72:12 75:22 78:11,24 80:10, 22 86:15 87:13,23 88:7, 13,16 89:15 90:10,20 92:21 94:12,25 95:20 96:15 100:9 102:9,22, 23 103:7,9 104:12,16 105:20 106:2,24 107:6, 9 114:15,17,25 115:13, 20 116:6 122:11 125:1 127:5 129:3 136:22 140:8 142:25 143:20,22 147:7 152:2,9 156:18 160:21,23 162:18 165:21 171:24 173:19 175:19,24 177:7,9,13 179:1,8 181:19 184:7 186:19 192:5 193:20 194:23 199:4,22 200:3 201:8 202:18 204:6,8 205:2 207:10,17 208:23,24 209:7,8,15, 19,20 210:16,18 211:2 214:2,13 218:6 221:23 223:9 225:11 227:3 228:23,25 229:5,6,17 230:24 231:1 234:21 237:24 243:11 244:4 245:9,14,18 246:18 250:22 251:2 252:4 255:2 258:14 261:9 266:8 269:3,22 270:2, 18,20,21 271:5,8,23 272:11 274:6,7 277:17, 25 279:22 281:3,22 282:11,23 283:4 284:9 288:7,17 291:9,10 294:5 298:20 299:23 300:14 302:18 303:5, 15,17 305:15 306:9,22 310:22

item
33:8

items
266:17 307:9 310:21

iterations
30:10 31:11

iterative
275:1

its
35:17,18 41:19 45:19 51:25 52:14,18 53:5,11, 16,19,24 54:10,12,22

56:1 57:19 59:10 66:21 78:11 81:14,15,16 86:11 111:7 167:7 203:1,11,16 204:3,4,6, 7,10,20,21 205:5,7,9,18 206:12 207:3,5,10 210:2,18 211:6,9,10,15, 19 218:16 227:21,23 239:17 271:15 275:1 276:15 287:12,13,14,17 293:24 294:4 298:10 299:4,15

J

J-o-l-i-e-t
119:24

jack
28:4

January
169:12

Jim
52:25 228:3

job
15:20 16:23 67:9 246:23

Joe
21:8 22:5,22 23:11 25:18 26:2,7,8

jog
76:11

jogging
76:14

join
11:7 88:3

joined
11:16 41:13 57:16 59:24 60:1 67:6

joint
117:3 128:19 129:12, 24,25 139:20

Joliet
119:18,22,23 121:2,4

judgment
67:19 210:13

jump
114:18

jumping
122:12 281:25

jumps
122:11

junction
61:12 146:4 149:1,7 160:2 161:2 174:16 175:15 176:5 177:2,17 189:22 190:19 262:5

junior
11:18,22 12:5,9 13:8 60:5

K

K-r-u-e-g-e-r
6:23

Kankakee
232:8

Kathryn
7:15

Kathy
7:13

keep
114:21 115:25 116:3 117:25

keeping
131:25

Kevin
21:2 170:11

key
41:1 70:17 71:13,23,24 266:10 295:4 306:9,16

kick
123:19

kilowatts
144:11

kind
30:14 64:20 86:20 96:8 103:8 141:12 180:20 181:11 207:17 235:25 248:14 257:21 264:11 280:20 294:18

kinds
24:12 271:24

Kingston
220:10

knee-jerk
302:4

know
13:16 21:13 24:8,16,18, 20 31:12 34:13 52:13, 23 54:4,8 57:22 76:22 77:11 83:22 84:19,24 88:14 93:4,18 94:25 95:22 97:9 114:10,25 119:16 120:25 121:7 123:14 124:10 128:1 129:23 130:5 138:1,6 141:6,17,18 142:13 147:9,24 148:11 150:7, 22 151:23 153:15,17 154:11 155:12,24 159:17 161:24 162:4 166:18,20,22 167:13,22 168:4 170:5 171:23 172:12 176:2,4 177:6 180:4,13,14,23 183:2 184:16 185:1,22 187:17 191:13,18,19 192:10, 14,19,21,22 193:1 194:13,25 195:2,6 196:15,18 199:24 200:19 202:2 203:20 204:1 206:25 207:2,5,9 210:16 219:13,15,18 220:23 222:8,12 227:3, 4,5 229:1,2 230:6,10, 11,12,15 232:22 233:6 235:8 236:18 246:18 259:13 265:2,18 266:8 268:21 269:1,3,19 270:20 274:21,25 275:3,6 278:12 280:2 281:17 288:7 291:7,12 295:2 298:2 299:5,23 304:9 310:22 311:25 312:24

knowing
176:15 177:23

knowledge
13:22 20:18 23:2 24:24 94:19 166:24 237:2 267:1 284:6

known
38:25

knows
143:1

Krueger
6:2,7,19,22 7:18 128:21 202:6 225:8 312:21

Krueger's
201:20

L

lab
300:18

label
201:23

labeled
145:5 150:2 153:1 158:19 160:21 173:19, 22 182:1 188:11 207:15

labor
28:1,9 309:8

lacks
125:22 134:2 153:13 264:24

Ladue
233:2,4

language
106:23

large
28:22 269:15

larger
24:4

Lastly
44:15

late
242:1,8,9 296:11

latest
182:14 188:18 191:1

latitude
100:18

launched
299:1

lawn
283:17,22 284:2,6 285:2,4,7,23 286:15,17

lawyers
155:13

lay
246:7

layman
31:13

layout
16:14

layperson
277:19

leading
15:5 258:25

leads
260:25

leave
28:22 43:8 125:12

leaves
176:3

Lee
7:5

left
125:17 150:17 160:14 174:4 188:24 194:7 225:18,21

left-hand
140:24

legacy
93:10 94:1

length
11:25 36:3 44:24 61:9 63:14 69:7 103:14,16 179:4,12 195:11,19 196:21 197:24

lengths
196:1

let's
15:14 17:10 29:14 58:12 77:17 110:1 119:25 124:15 173:11 181:23 185:9 193:19 197:10 201:3 202:24 205:14 224:18 237:21 243:13 254:6 256:15 257:21 269:8 301:4 303:1 312:16

letter
103:15

level
12:5 14:6 30:7 34:11 40:13 76:20 90:5,24 99:13 102:23 103:1 123:3 130:25 131:4,14 132:19 241:13 246:8 247:9,10 251:22 253:7 265:14,19,20 266:4 268:15,22 275:20,22 312:24

levels
75:13 131:2 238:5

library
228:3

license
9:16 11:1 52:20 54:10 66:1,3

licensed
9:25 65:24,25 66:4

licenses
9:15 51:25 52:18

licensing
54:17

life
8:5,12

lift
218:17,25

lifts
306:25

likewise
259:8

limit
69:15 75:6 95:23 102:17

limitations
69:14 85:8,10,15 86:10 87:17,21 257:6,12 258:6 263:9

limited
80:14,15

limits
294:13 296:1

line
12:16,18,20,21 13:9 22:6,9 23:8 26:20 27:2, 9 29:18,22 30:24,25 36:14,21 37:5 59:1,3,5, 20,21 65:8,12,14 66:10, 14 67:13,25 68:3,9,10 74:5,10 77:21 79:4 80:19 85:23 87:24 89:10,11,15,18 90:9 92:2 98:3 101:21 105:11 106:9,11 108:7, 10,21 109:2 110:14 111:2 118:7 120:11 121:16 133:10 193:22 221:15 232:7 239:23 254:13 255:2 262:14, 15,25 266:16 270:4 275:5 294:6,20 295:1 308:22,24 309:25

linear
85:23 86:1,5

lines
25:5 116:13 131:2 191:17 216:16 236:16

link
99:7 259:14

Linkedin
300:11

linking
259:11

list
27:14 259:16

listed
306:10

little
180:17 226:12 306:13

Lloyd
20:25 197:11,14

LLP
7:6,8

load
32:7,11,14 33:5 34:7,8

loads
32:19

local
62:11 123:18 124:9 301:17

locally
251:13

located
273:22

location
63:3 64:24 89:9 100:24 102:14 177:7 239:22 264:1 274:12,13 276:11 294:10 299:6 308:12

locations
45:5 61:2,11 69:8,9 71:25 216:18 238:6,13, 16,22 240:1 241:24 248:4 267:5,6 290:6

locomotive
39:11 40:4 44:17 48:7, 10,16 49:17 70:20 143:17 144:11 146:22 163:4,24 164:19 168:21 170:21 172:5,10 174:7, 12 185:14,25 189:3,13 205:19 216:12 226:3 227:13,14 303:16

locomotives
39:15 44:17 47:3,4 70:15 228:7

logic
77:19,22 78:14 79:5,14, 20 80:8 86:21,22 87:1 190:3 276:16,17,23 277:1

long
43:9,17 45:22 76:14,15 104:12,14,18 108:20 246:14,19 262:3 269:22 295:18 298:23 299:5,18 301:3 308:10

long-time
250:18

longer
13:14 35:24 89:15 147:2 173:5,6

look
20:19 21:11,13 25:3 30:11 31:24 32:14 57:2 64:18 82:9,10 99:1,2 100:20 101:17 107:4 123:19 129:2 138:8 143:10 154:2,8,11 161:13 172:16 173:10, 11 177:13 182:7,9 185:21 190:17 200:23 205:14 215:12,15 219:19 224:18 226:6 228:14 229:22 231:22, 23 235:19 250:4,6,12 256:18 257:22 267:14 275:6 283:3 284:23 286:20 299:3 302:3

looked
70:13 83:7 131:12 152:25 153:11 154:17 159:14 173:21 174:9 185:20 188:13 189:24 190:4,5 191:16 198:9, 11 209:13 226:10,13,18 228:6 232:7 235:12 241:22 244:10 249:17 261:15 268:10 292:25

looking
12:20 13:4 33:10 34:7 35:15 36:5 43:25 84:1 93:9 94:1 95:4,15 100:22 101:4,20 137:23 175:7 177:6 181:24 183:1,15 207:16 208:4 221:24 223:17 234:10 265:17 266:1,2,3 268:2 282:1 287:9 289:2 290:20

looks
24:24 25:2 37:5 150:25 171:1 220:2 286:12

lookups
103:10

loss
117:22 118:8 154:13

lot
52:14 93:8 167:14 187:9 246:15 252:6 266:14 299:13

low
195:13 262:14

lower
102:12 173:8 186:1 189:16 190:3,11 208:2, 12,22,24 209:8,12,16 226:23 227:3,15 228:10 244:17 291:15,21,25

lunch
128:6

M

MA
40:15,17

Mac
23:3,5 26:8

macro
52:24,25 74:8 101:21 102:9,23 103:1 268:15

magnitude
112:24

main
26:13,18 55:16,18 67:13 123:14 231:8,17 254:13

mainframe
30:17 38:17 42:8,25 43:2 50:8 51:22 60:11 93:9,21

maintain
9:24 118:12

maintained
304:11

maintaining
10:20 220:14

maintenance
69:11 180:16 217:20 304:8,22 305:10 306:25 307:19

major
60:14,16 263:20

majority
28:8 45:7 117:5 299:13

making
82:10 153:19 159:7 164:23 176:7,9 241:8 265:10

manage
70:13 90:8 273:22 299:10

managed
25:1

management
25:10,23 35:25 70:6,8, 11,25 90:6

management's
299:19

manager
18:9,10,19,20,21,25 19:2,20 20:6,12 22:7 24:19 26:12 96:6

managers
15:22

manger
19:3

manifest
63:6

manipulated
259:24

manipulations
120:14

manner
42:4

manual
60:19 140:21,22 143:22 224:22,23 245:10 273:18 278:8

manually
140:13 144:21 221:10

manufacturer
49:20

manufacturer's
217:3

manufacturing
46:17

map
86:4

marathon
76:11,13

March
142:2,14 143:7 151:18 153:5 161:16,20 198:10 206:4,13 211:25

margin
83:11 84:25

mark
128:19 139:13 149:19 152:16 158:11,13 169:9 173:13,14 188:6 193:5 202:24 214:5 234:8 278:20

marked
128:11 130:14 139:14 148:14 149:23 152:19, 22 158:15 163:10 169:13 173:15,19 181:24 185:11 188:8 193:9 203:4 205:12,15 214:8 234:12,14,21 278:22 279:17 280:23, 25 283:2 287:25 300:6, 7

market
66:12

marketing
303:18

Markham
261:4,8 288:2,6,11,15

marking
158:24

massively
89:13

master
28:5 58:18 156:18

match
77:13 184:4,14 191:3 239:19 286:4

matched
297:2

material
32:20

math
228:5

mathematical
38:5 40:19 67:21,23 75:22 84:4 90:18 187:23 210:11 245:16 272:11 302:18

mathematics
38:6 210:14

mating
245:2

Matson
288:3,8,11

matter
107:8,12

matters
107:11 254:9

maximum
254:21 292:16

mean
15:2 16:7 27:13,25 28:24 29:4,18 31:18,19, 20 32:6 36:17,24 38:21 41:15 69:13 78:6 82:24 83:14 85:20 87:22

88:17 89:22 90:14,25 93:7 95:19,20 101:3 103:8 114:6,15 118:10 119:15 122:11,13 126:11,17 137:25 146:10 152:1 153:18 154:14 161:24 163:17 164:8 171:8 173:7 184:22 199:21 206:12 209:4,7 211:9 221:9 223:12 260:1 270:16 271:10 274:5,18,25 284:9 288:4,5 290:25 291:10 301:14 304:4 307:9 309:10,21 310:12 312:9

meaning
38:9 42:21 77:14 84:23 96:14 100:19

meaningful
100:24 126:24 175:20 192:25

meaningfully
84:23

meanings
22:14 29:5 31:9

means
7:25 10:6,19 23:17 45:15 52:10 59:15 65:9 67:23 68:6 80:22 132:3, 8 170:21 206:25 220:5 232:9 255:15 286:13,16 294:3 295:1

meant
90:16 126:1 167:2,7,9 225:24 301:15

measure
32:10 33:15 34:11 35:14 55:4 70:16,22 98:8 102:4,9 103:20 117:22 260:13 270:10 308:19

measured
46:25 71:14,16 247:9, 11

measurement
302:20

measures
23:18 25:16,22 71:9 299:17

measuring
78:24

mechanical
26:2

meet
71:11 98:12,13 123:17

meets
218:13 271:20

member
170:7 197:15

memory
23:14 73:7 279:24

Memphis
166:5,18 175:11 176:4, 5 177:1,10,11,16 180:2 210:4 261:17,21 262:2 266:11,15

mental
269:3

mentally
9:1

mention
198:18,19 234:3 252:19

mentioned
17:16 25:11,15 28:18 29:13 30:24 34:3,6 35:12 46:11 52:14 56:18 61:22 63:23 64:17 77:11 82:19 104:6 109:9 111:16 113:20 116:8 127:24 137:2 144:1 164:10 165:1 178:6 179:4 191:1 200:22 210:17 211:23 219:22 227:22 247:1 249:13 250:11 251:4 255:8 256:1 273:10,11 297:25 302:14

mentoring
10:6

menu
248:14

mercy
277:7

merely
178:11

meshed
305:16

methodologies
301:24

methodology
130:17 215:14,25 216:2,4,7,8

metric
121:13 169:11

Metro
133:25 134:4,6,10,11, 15,17 198:24 261:14

mid
70:13

middle
6:23 107:2 207:17 217:12 289:10

midnight
296:13

Mike
24:5,13,21 237:3

mile
49:25 50:1 179:17 261:24

mileage
51:3 151:1,2,6,7

mileages
44:6

milepost
44:2 50:4,12,13

mileposts
49:24

miles
150:18,20 151:10 179:5,10,18 206:23 220:4,7,25 221:14 230:22 231:3,20

millions
112:25

mind
87:22 114:18 119:15 122:11,12

minimize
246:7

minimum
45:25 46:3,6,7 49:8 51:7,10 53:15 92:15 98:19 162:20,25 163:8 208:3 306:1

minor
254:9

minus
209:24 210:19 211:2 229:17

minute
219:23,25 265:2

minutes
56:9 145:24 146:8 147:2 149:4,15 150:17 161:7 162:24 172:24 177:17 220:25 225:14 230:21 231:3,20,24 232:1,6,8,13 235:21

mirrored
297:2

mis-format
152:8

mischaracterized
95:7

mischaracterizing
249:21

misleading
200:11

missing
24:2

misspeak
122:17 154:6

misspoke
125:25 243:2

mistaken
108:2

mistakenly
281:24

mitigate
121:14 246:7 265:22,23

mitigated
243:23 247:6

mix
71:20 74:8 135:17 170:1 184:15 292:17,25

mixed
299:16

MOD
206:3,9

mode
23:19 25:16,25 26:2

model
29:7,16,19,20,24,25 30:2,4,9,23 31:1,8,13, 19,21 33:13,14,19,20 34:10,14 35:5 36:18,21, 22 37:22,23,24 38:7 43:13 51:25 52:1,18,21, 22 53:11 54:10,17,22 55:7 56:5,8,16,17,19 57:9 58:2,6,13,24 59:2, 4,5,6 61:19,21 62:5 63:12 66:21,22 67:16, 21 69:25 70:3 71:3,5 72:17,19 73:19 75:12, 14 77:4,7,17,21 78:21 80:20,25 81:14,17,24 82:4,7,10 83:8,23 84:6, 14 85:18 86:6,11,16,25 88:2,7,14,16,18 89:8, 10,11,16,22 90:17,24 92:16 97:7 108:10 111:9,10,15 112:6 121:7,20,23 122:21 126:19 134:14 135:16, 20 139:1 140:2,5 143:16 147:18 172:13, 19 173:1 178:17 187:11,17,20,23,25 188:1,2 207:8 223:4,9, 13 233:20 239:16 240:12 241:12 244:6,20 245:20 246:1,2 247:4 254:9,12,25 255:12,22, 24 256:10,25 257:3 259:7,8,18,20,22 260:5, 10,14,18 261:11 262:23 272:9 273:7,16,18 274:1,9,12,19,22,23,24 275:8,11 276:15,23 277:3,4,7 278:5,9 280:15 283:16,20,21 286:15,17 288:12,15 289:19 290:2,4,21 291:18,19 293:16,18 294:25 295:2,5,7 296:9, 16,19,23 297:12 306:15 307:24 309:2,4

model's
53:25 54:12 68:4 86:25 259:24 277:8

model-system
279:2

modeled
133:4,8 135:5,11 261:6, 7,20,21 262:12,18 266:11

modeling
12:3 15:8 29:12 37:25 55:2 72:2,14 79:8 86:12 87:11 89:18 90:1 91:5, 10,11,16 92:1 96:18,21, 24 97:3,6 114:12 115:10 118:14,15 122:25 125:20 126:5,9, 15 132:25 143:5 164:25 182:14 187:10,14,18 204:11 206:3,10 236:1 245:14,18 252:14 255:7,10,15 256:2 257:6,13 258:7,14 263:9 274:25 297:1 301:16 302:2 307:2 309:13

models
14:23 15:1,13 27:4 29:22 30:20,21,25 31:11,15 34:2,21 35:13 36:11,13,15,25 37:11 66:11,15,18 79:4 81:18 86:8 121:17 130:11 207:1 245:22 277:2 308:22,24

modern
93:7 94:2,6,16 95:5,8

modes
75:22

modification
40:17 57:20,24 105:14 206:7,10,14 211:25

modified
30:12 39:1 56:18,21 57:8,10,13 206:8

modify
103:18 273:20

moment
50:5 77:18 158:7,13 312:4

Monday
206:21

money
119:15 301:12

months
138:7

Montreal
11:20 14:20,21 17:7,8

morning
6:19

motion
310:23

move
17:25 33:6 46:1 56:8 68:9 80:3,11 86:16 87:1 101:22,23 239:17 266:16 291:3 295:22 304:13

moved
16:24 17:11 302:2

movement
35:16,17 36:1,7,8 45:9, 13 78:11,20 79:8 80:16 82:8 88:11 218:4 244:12 267:14 271:15 275:7 288:17,18 299:11

movements
79:12 90:9,10 288:2,6, 10

moving
37:10 45:18 69:10 90:19 103:22 299:2 310:19

MRT
46:7 51:7 52:9 53:19 61:7 62:2,13,17,21,22 63:1,13,17,18 145:5,10, 19,23 146:2,20 147:2, 16 148:25 149:8 154:5, 8 160:1,17 161:1 165:23 167:18 171:4 174:16 178:21 185:16 186:3,12,20 189:21 190:7,12,17,24 191:5,6 200:19 201:1 207:15,23 208:12 213:4 216:9,21, 24 228:15,25 229:3,7, 14 230:8 233:12,25 235:17 239:20 306:1

MRTS
157:24 158:3 179:2 211:7 233:17

multiple
79:9 80:11

multitude
69:22 200:12 216:20 282:24 286:23

multitudes
66:14 282:12

N

name
6:20,21,23 17:22 30:1, 3,21 70:2 108:14,20 119:15 124:16 207:16 223:11 279:21 281:2 309:2

national
6:10,12 7:11 11:8,11 194:1

nature
36:18 89:8 92:4 103:18 116:16 224:4 229:4 260:14 268:11 275:1 295:10

near
311:13

nebulous
29:5

necessarily
52:10 110:22 213:4 259:14 284:14 290:3,25

necessary
257:5,12 258:6 259:9 263:8

need
10:4 32:21 44:12,13,15 45:3,4,5,6 252:6 296:22,23 309:19 310:13

needed
27:21 28:11 100:21 127:12 289:22 296:8 297:20

needs
32:22 48:8,9 92:13 93:1 101:25 217:22 260:3

neither
202:9

network
12:22 16:24 17:17 20:7, 12 21:20 22:11,20,21, 22,25 23:13,22,25 24:3, 5,12,22,23 25:2,3,12 26:12,21,24 27:1,2 39:3 53:5 54:16,19 59:15 74:18 75:4 76:20 85:18, 21 86:1,16 87:25 88:1,2 98:3 102:16 110:11 111:11 115:11,15 140:25 141:11 157:22 210:3,8 262:6 300:21

networking
200:3

never
166:19,20

new
9:12 26:23 105:4,13,14, 15,18,21,22,25 106:20, 24 107:5,13,14 108:4 116:25 119:8,16 120:4 121:7 139:23 145:1,2, 23 148:17 150:2,19,20 152:24 154:9 157:12,24 158:19 159:25 160:12 166:4,12,17 168:20 170:19 171:14 172:4 173:20 180:6,11 182:1 185:11 188:12 189:1 207:23 212:11 214:12 215:18,21 219:16 225:16 228:18 233:13 235:13 250:6,19 251:15 268:9 293:8,20,24

Newton
40:15

Niagara
114:7

Nick
124:23 126:17

Nicole
128:22

nine
144:24 146:22 163:4 168:21 171:3 172:10 173:4 185:25 191:12 193:6,7 199:4 225:21 226:3 256:20

no-model
259:4

nodding
8:10 181:22

nomenclature
47:16 63:16

non-cn
229:11

non-schedule
295:9

nonhuman
223:14

nonscheduled
61:17 295:10 296:20

nonverbal
8:9

noon
296:10,15

nope
136:12 220:8

normal
210:21 217:19 218:3

normally
293:23

north
251:16 261:24 262:22

northbound
148:17 160:12

Nossaman
7:3,6

Notary
6:4

notation
286:16 288:1

notations
231:14

note
7:12 159:8 199:1 202:7 206:1 214:16 221:3,19

noted
312:21

Notepad
95:18

notes
219:20,21 220:23 230:20,25 231:1,10,15, 18

notice
6:8 226:22

noticed
219:19

November
137:13

NS
135:2

nuance
47:18

number
15:20 23:10 35:6 44:25 48:18 71:11 74:16 89:3 104:2,3,4,7 107:23 115:17 121:6 141:8 144:9 145:13,15 146:25 149:3 162:7 171:25 172:1 184:9 186:18,23 192:7,8,15,16 198:14 203:19,20 204:24 208:12,23,24 209:8,12, 14,15,16 210:24 221:6 227:15 228:9,10 229:10,18,21 232:14 246:18 251:10 257:4 296:21 297:9 299:17 309:12

numbers
89:25 174:21 176:12 186:14,15 191:3,7 208:7,11 209:6 228:12 231:23 232:15 253:6,22 297:11,13 301:6

numerous
17:24 64:5 157:19

O

O-t-t-o
6:24

oath
7:25

ob-
264:23

object
33:18 85:11 106:3 132:12 142:17 199:14 208:6 255:9 259:19 290:14 294:1 307:5

objection
62:14 81:3 82:20 85:2 92:11 93:14 95:6 109:25 114:24 115:12 125:22 134:2 153:13 208:15 212:5 222:4 249:20 264:24 271:4 277:20 291:17 294:21 307:14

objective
105:9 115:24 118:4,10 240:8 275:16,18,21 277:11

objectives
25:1 130:18 300:3

objects
33:23

observation
285:22 290:9

obtain
39:23 182:13

obtaining
52:11 183:19 204:2

obtains
78:16

obviously
122:20 182:23 183:2

obviousness
269:4

occupancy
31:6,7,10 64:8

occupies
35:19,20

occur
12:11 13:21 16:22 18:12 180:15

occurred
12:13 13:22 19:1 138:3, 5 179:19,25 238:7,15, 18 243:17 265:12 273:22

occurring
52:12 244:10,14 247:25 267:12,16 288:21

October
136:7,20 137:13 169:12

off-ramp
288:8

off-the-shelf
39:19 108:11

office
39:17

officer
24:6,10 301:17

officers
131:9 156:16 287:22 299:3

offline
295:8

offshoot
85:24

Oh
42:2 43:16 54:20 78:22 119:12 156:16 178:25 231:12 243:4

okay
6:6 7:21 8:5,16 9:5,6, 14,19,24 10:11,21,25 11:3,7,16,19,21 12:6, 11,14,17,24 13:7,15 14:9,18,22 15:7,10,14 16:2,19,22 17:2,7,9,16, 25 18:12,15,18 19:1,7, 19,23 20:2,5,8,11,17, 19,22 21:6,9,15 22:2,5, 10,16,21,25 23:4,7,12, 23 24:3,11 25:11 26:4, 8,11,16 27:3,7,22 28:1, 18,21 29:1,7,13,17 30:3,6,19,24 31:5,16 32:6,16,24 33:11,13 34:24 36:20 37:4,16,19 38:2,15,18,21 40:1,11 41:12,15 42:2,17 43:9, 16,22 45:8,15 46:6,10, 19,22,25 47:20 48:3,13 49:6,21 51:11 52:13,18 53:24 55:10,15,18,21 56:2,4,10 57:3,6,18 58:1,10,22 59:11 60:9, 11,14,21 61:22,25 62:12,20 63:19,23 64:1, 4,15,25 65:4,12,18,20 66:16 67:4,16 68:11,25 69:24 70:2,4,9,24 71:4 72:10,13,16 75:24 76:4, 18 77:4,23 79:11,13,19 80:18 81:1,20 82:17 83:1,10,18 84:8,11,24 85:8 86:6,10 87:6,21 88:19 90:2,12 91:4,8 92:8,19 93:2,12 94:4,21 95:3,9 96:10 97:2,12 98:10,21,25 99:15 100:9,13 102:3 103:23 104:3,19,22 105:7,17, 24 108:17 109:16 110:18,24 111:2,9 113:22 114:19 115:5 116:7,20,22 117:11,15 118:25 119:5 121:1 123:3,11 124:4,7,15,19, 22,24 125:3,6,8,12,16, 19 126:8,15 127:3,13, 21 129:1,18 130:1 132:3,8,21 133:1,18 134:13,21 135:4,9 136:11 137:22 138:10 140:2,6,9,18,22 141:6, 15,24 142:12,20 143:4, 10 144:1,17,25 145:8, 22 146:1,18 147:1,5,9, 12,15,20,23 148:13,24 149:5,14,18,19 150:15 151:4,9,13 152:15 153:9,22 154:1 155:10, 14,20 156:8,15,21 159:3,8,18,24 160:5,9, 16 161:5,12,19 163:1,8 164:21 166:15 167:1,13 168:1,25 169:7,19 170:3,9 171:2 172:2,12 174:12,20 177:12 179:20 181:4,13,17 182:8,22 183:7,13 185:7,9 187:19 188:3, 11 189:9,19 190:2,14, 22,24 191:13 192:14,19 193:4,18 194:2,9,15,20, 23 195:3,8,17,23 196:19 197:9,18,21 198:8 199:1,20 201:3 202:24 203:8,10,13,23 204:15,19,23 205:4,14 206:1,9,12,15,20 207:5, 14,21 208:2 209:10 210:17 211:6,23 213:3, 16 214:21 215:2,16,20, 24 216:6,10 217:11 218:10,21 219:3,12,17 220:2,15 221:23 222:14,25 223:22 224:10,18,24 225:7,10, 18 226:6,10,22 227:2 228:5,14,23 229:5,9,16 230:4,14,16 231:22 232:4,12,16 233:6,21, 25 234:3,8,17 235:11, 16,24 236:6,13 237:9 238:10 239:5 240:11, 14,18,24 241:18 242:14,20 243:1,9 245:15 246:20 248:7, 14,20,23 249:3,18,25 250:15 251:8,22 252:9, 13 253:9,25 254:17,24 255:5,13,18 256:9,15, 22 258:20 259:15 260:1 261:1 262:10 263:5,22 264:3,10 265:15 266:20 268:16,19 271:22 272:10,12 273:10,15 274:15,20 275:18,24 276:15,21 277:14,25 278:6,12,17 279:6,16 280:5,16 281:11,20,23 282:6,17,20 283:1,10, 15 284:18,22 285:4,10 286:11 287:3,8,11 288:14 289:15,21 290:10 291:4,23 292:1 293:2,19 294:16 298:4, 11,13 300:16,21,24 301:2,7 302:5,22 305:1, 8,17,25 306:5,21 307:21 309:3,7,17 310:9,12 311:12,15,21, 24 312:16,21

omit
266:17

on-ramp
288:8

on-time
273:12 275:11

once
243:14,15 292:16

one-page
193:20

ones
69:4 116:20 174:9 190:4 228:10 286:8

ongoing
114:20 115:10,15,19 217:20

online
71:25 89:25 306:23 307:21 308:5

Ontario
13:20 220:10

open
152:12

operate
117:25 293:13 297:3

operated
242:16,18

operates
118:23

operating
24:6,10 64:8 68:8 69:20 71:15,23,24 72:22 73:15 97:19 112:15 117:23 123:18 131:1 138:16,19 217:4,8 241:10 255:16 271:18 272:24 287:21 299:2 304:23 306:2

operation
25:2 59:13 184:2 216:16 257:2 277:4 293:25 294:4 306:6

operational
15:24 69:1 132:9,13,17 270:6,11 301:25 304:12

operationally
262:15

operations
16:24 17:17,22,23 21:20 22:20,21,23 23:1, 13,21,22,25 24:3,4,5,9, 12,13,22,23,25 25:13 59:9,22 68:14,16 69:21 81:2,8,13,22 83:3 90:3, 8 99:25 123:21 135:12 214:24 241:9 242:12 254:12 256:25 259:4 277:12 288:23 299:1 306:18,22 308:8 309:14

operative
185:2

operator
242:4

opinion
54:7 84:3

opportunity
94:9 117:23 118:8

opposed
105:25 107:14 159:14

opposite
262:4 292:6

OPR
217:13,16

optimal
217:5

optimization
21:21 140:25 141:12

options
248:15,18

order
6:15 102:20 112:23 171:10 188:17 218:8,9 241:8

org
21:13 22:8 25:25

organization
15:21 25:10

Organized
139:17

origin
45:5 53:18 61:6 80:12 182:24 241:23 242:7,19 271:12,15 284:11 295:16

original
225:2

originate
110:24 135:22 294:10 295:10

Orleans
139:24 145:2,23 148:17 150:2,19,21 152:24 154:9 157:13,24 158:20 159:25 160:12 166:4, 12,17 168:20 170:19 171:15 172:4 173:20 180:6,11 182:2 185:12 188:12 189:1 207:23 212:11 214:12 215:18, 21 219:16 225:16 228:18 233:13 235:13 250:19 251:16

OTP
133:13,15 272:25 273:12

OTPS
133:17

Otto
6:22

outage
79:2

outages
71:25 180:13

outfit
310:7

outline
260:20

outlined
281:14

outlines
256:6

outlining
259:2

outlying
259:2

output
49:21,23 50:2,7,11,23 51:8,15,17 62:23 63:21 64:4,5,6,7,16,20 81:1 140:10,11,17,18 147:17 148:7 154:22,24 187:12,20 202:25 203:11 204:2,5,7,21 215:4 223:1,4 230:1

outputs
237:15

outset
137:25

outside
124:17 244:23,25

outward
177:25

overall
207:23

overproduced
183:3

overrides
276:21

overriding
273:25

Overview
130:17

owned
110:12

owner
310:5

owns
52:25

P

P05801
203:16

P364
235:2,18

P42
144:10,23

P58
148:16 160:11 162:21 163:9,11 167:20 168:19 190:25 191:5 203:12

P59
143:6 145:1,23 168:19 174:14 176:25 185:16 189:1 190:24 191:6 225:15 228:17 229:13 230:8

P65
235:5

package
282:10 285:21 287:7 293:9

packager
289:5

page
130:13,15 132:22,23 133:20 136:12,13,19,24 143:11 145:8 148:13 149:1 150:15 151:14 153:3 159:20 160:1,9, 16,23 161:4,13 162:16, 18,23 163:2 174:13,15 175:8,11,14,25 177:13, 19 182:7,9 189:20 190:15,16 200:16 207:22 214:18 217:11 219:20 221:1,2,6 223:5 224:1,19 225:11,12 229:19 230:19 233:11 235:1,18 237:22 241:6 243:9,11 246:25 247:3 248:12 252:19,20 253:4,14,15,17 254:6,7 256:15,19,24 259:10 261:3 263:6 266:21 269:25 270:1 279:16 281:17,18,19,20 283:1, 6 285:20,21 287:24 289:2,6 293:3,4 300:16 301:4,6,8 302:5,6,22,23 303:1,3,10 305:17,20 306:8,22 308:17,18

pages
176:12 224:5,11 252:25 285:24

pagination
160:22

paid
113:4

paper
23:6,10 38:3,10,12 72:2,5 75:15 129:23 146:25 148:23 149:20 168:8 169:4,5 183:22 206:17 225:17 229:20 236:2 247:20 281:14 282:14

papers
60:18 72:10 78:2 129:14,19,21 130:3,6 139:12,19 153:22 154:2,3,4,7,12,14,17 155:1,4,6,9,11,15 164:4,13,15,18 188:19 191:2,11 193:14,16 201:18,23,25 202:1,12 211:13 229:23,25 236:10 250:10 256:5 269:18 278:2,12,25 281:1,24 282:2 286:21

paragraph
132:24 133:20 237:24 243:15 252:20 258:25 266:22,23,25 293:4

parallel
86:2

parameter

73:16 74:11 187:11 270:12 272:15,19,21 273:11

parameters
31:23 68:8 71:13,15,20, 24 72:4,21,22 73:15,25 74:3 81:10 165:10 180:22 187:6 200:13 270:7,13 271:18 272:16,22 273:6 276:18

parametric
67:16,21 69:24 70:3 71:3,4 72:2,14,17,19 73:19 75:12,14 77:4,7 272:9 303:15 306:15

Pardon
41:22 165:18 213:10 223:2 271:2

parens
308:20

parenthesis
189:4

park
107:1

part
14:25 24:4 25:24 28:18 68:19 74:20 92:21 99:16 119:17 123:22,24 126:22 131:11 139:18 157:2,23 166:3 176:7,8 178:7 181:19 183:4 188:18 190:16 191:19 193:13,15 198:19 201:20 211:7 214:1,2 231:11 241:15 242:1 263:2,4,14 269:15 275:12 277:15,17 278:24 280:17 281:1,12 282:9,18 290:7 301:22

participate
122:3 124:1,5 251:17

participated
137:6

particular
30:1 43:18 103:5 108:15 118:7 170:18 275:4 276:24

particularly
202:3

particulars
165:12

parties
6:13 35:25 113:20

parts
129:6,8 227:16

party
39:12 66:25 209:21

pass
71:11 98:12,13

passenger
6:11 15:25 26:21 111:20 133:24 148:5 150:19,21 157:1,3,4,17, 21 159:7 165:4 198:20 205:22 206:23 212:22, 25 215:13 216:1,5,16 218:21 219:5,6,8,10 220:12 222:23 223:18, 19,21 224:7 227:23 238:4 242:15,22,25 243:3,4 247:7 276:13

passenger/freight
119:20

passes
284:18

path
175:17

patience
176:22 269:21

pattern
89:8 184:1

Paul
233:2,4

PC
42:24 60:12,13 94:6 95:8

PC-BASED
64:1

PDF
203:24 204:5 205:6

peaking
71:21

penalty
8:1

PENG
9:23 10:20

people
20:13,21,23 22:16 23:10 27:22 82:7 84:1 96:16 123:18 124:7,21, 22 156:4,8,10,13,22 185:3 192:23

percent
71:10 86:13 87:11 133:12 209:24 210:19, 25 211:2 217:2,7,13,16, 18,25 220:13 241:25 242:1 296:10 308:3

percentage
170:17,22 263:18

percentage-wise
264:12

perform
123:9

performance
37:17 46:2 218:5 223:11,12 250:19 251:20 273:13 275:11

Performed
130:17

period
10:4 17:3 72:9 170:23 172:5 251:3

perjury
8:1

permutation
47:18 165:4

permutations
80:13 176:8 214:25 282:12,24

person
28:23 143:21 232:23

personally
154:13 196:10

perspective
187:1 190:9

pertinent
105:11 298:23

phased
98:4

phrase
46:8,9 205:16

physical
35:18 36:3 44:23 50:7 88:10 90:4 303:17

physically
9:2 36:22,24 126:11,17 284:15

physician
217:6

physics
37:24,25 38:22,24 39:7 40:9,12,20 41:18,24 45:12 57:11,22,23,25 90:18,21 223:13

pick
185:21,23

picked
184:2 297:11

pictorial
211:14 267:14

picture
169:21 211:11 267:15

pictures
91:24

piece
35:17 36:2 44:19 45:10 46:18 47:12 49:2 51:18 59:6 69:14 70:10 88:2 151:3 181:8,11 193:1 206:17 216:19 217:23 298:23 310:19

pieces
181:6 259:12 267:4

pinch
74:17 75:7 98:4 99:12 102:8 115:16 243:20 244:16 245:22

place
80:5 89:23 137:1,10 301:12

placed
7:24

places
74:20,21

plain
240:21

PLAINTIFF
6:17

plan
71:16,19 96:8,18,21,24 98:5,22,25 99:2,9,18,19 103:17 287:20,23 298:6 299:10 308:9

planner
17:15 101:11

planning
12:1,4,10,16,18,19,20 13:2,9,11 14:13,15 15:16 17:14 18:7 19:18 20:7,13 22:11,15,18 25:14,23 26:12 74:15 95:24 98:9,12,13 100:15 125:9 141:11 300:21

plant
39:2 59:8,12 60:23 61:3,15 68:8,13 69:19 70:22 71:7,9,13 73:15 92:23 123:20 178:13 243:19 252:3 257:3 271:16 301:11 302:4 303:17 306:3 309:13 310:2

planting
71:11

plants
261:10

plate
303:25

platform
94:2,6,17 95:11,15

platforms
93:10

play
31:23 37:9 79:17 102:14 103:16 259:3 310:22

please
19:8 76:7 121:3 164:8

plot
53:8 64:6,17 211:16 239:23 244:25

plots
120:14 244:11 247:22 267:13

plus
41:4,7 144:23 170:20 171:3 172:18 173:3,4 209:24 210:19 211:2 239:2,5,7

point
16:5,19 17:12 18:19 19:7,25 20:11 45:23 50:14 51:5,19 65:6 89:6 98:13,19 99:12 104:13 106:14 109:10,13 110:21 113:11 133:10, 13,15,16 134:18 173:5 183:8 195:10 228:10 236:23 241:8 244:16 262:1 264:21 272:25 273:3,12 275:11,22 283:11 284:19,21 289:20 295:4,19 301:10,11 302:24 303:11 306:21 307:17 309:7,17 311:13,19 312:2

pointing
200:3

points
34:15 71:12 74:18 75:7 98:4 102:8 109:8,21 110:19 115:16 243:21 245:23 259:1,9,13 283:24,25 284:24 285:22 290:9 302:9

policy
311:10

polished
304:11

politics
25:7

Pontiac
237:7

populate
92:25

Port
234:22 235:3,6,19 236:22

portion
35:20,21 86:1 117:3,5 176:11 210:8 248:1 262:18 282:21

portions
36:9 166:6 219:9 229:11

portray
65:16

posed
97:4

position
11:17 12:7,8 13:17,18 14:9,11 15:17 21:12 50:21 222:18

positions
16:25 18:22

possible
76:22 137:22 156:4 172:18,20 199:22 201:8,22 227:15 245:23 252:17 257:1 286:7

possibly
176:14

post
245:1 247:22 261:24 267:10

potential
214:11,15,25

potentially
15:18 250:18 279:5 286:19

power
23:19 25:16,25 26:2 47:13 48:1,5

PP
164:18 234:22

PPC
237:15

Pr
190:12

practical
75:19,24 76:1,5,13,19 77:1 102:10,17 104:6 302:10,15,19 305:23

practically
76:1

practice
216:4,6,8 301:25

practices
215:14 216:1 217:8

practicing
10:7,15

pre
30:9 53:21 277:5

pre-existing
142:7

predefined
30:9

preferenced
296:14

prepared
9:2

preparing
215:7

preprocessing
92:21

preprogrammed
277:6

presence
238:3 243:17

presentation
300:12,22,25 302:6 305:18 306:8 308:18

presentations
300:17

presented
113:14 118:19 209:3 213:6

prespecified
74:9

presume
110:6

presuming
228:24

presumption
138:2

pretty
21:24 71:7 167:6,15 279:24

previous
18:22 174:8,21 189:24 190:4 199:2 208:4 221:11 245:17 248:11 263:5 288:18

previously
173:21 188:13 191:9 207:17 227:13,19 228:10

primarily
26:25 43:6 62:2 98:7 121:5 213:25 225:3

primary
67:22 68:11,13 92:6 270:4

prime
16:14 221:20

principal
124:20

principle
293:11

principles
301:25

print
150:6

printed
146:25 203:17,18 206:16,18 211:19 226:5

prior
12:14 118:2 139:4 181:3 212:16 301:16 312:22

priorities
96:11,17 306:23 307:8

priority
61:8,23 69:4 79:15,16, 23 277:15,16 291:16,21

privatization
16:11

pro-
250:25

pro-con
101:14

probability
179:15,16 199:23

probable
179:18

probably
24:1 121:18 136:15 252:2 294:2

problem
252:4 301:18

problem-solving
311:2

proceed
269:20 295:11

proceeding
6:15 21:17 91:4 122:21, 25 125:21 126:6 128:21 204:12 251:19 252:15 307:3 311:25

proceeds
295:25

process
7:23 30:9 42:13,14,16, 18 78:5 82:14 83:22 93:23 99:16,17,22 100:11 101:3,17,19 123:23,25 126:22,23 140:22 143:23 180:20 181:21 246:10 266:9 278:4 281:12

processed
91:13 172:25

processes
123:10 245:22 267:10

processing
130:9 181:9 245:1 247:23 267:10 282:25

processor
37:14 138:20

produce
204:7,20 215:12 223:21

produced
140:3 157:9 169:24 193:13 201:17,23 205:6 209:25 211:19 278:24

produces
166:22 205:9

producing
168:13 177:24 178:10 183:23 216:5 222:23

product
67:1

production
201:19

profession
9:22 10:7,15

professional
9:14,16,17,23,25 10:5 11:1

program
38:2,10,14,16 43:23 52:25 54:18 60:9,10 63:24 64:2 65:8,13,15 77:24 94:24 108:7 109:3 111:3 255:2 262:25 263:1 270:4

programmer
78:8 94:12 277:8,23

programmers
60:6

programs
37:15 41:8 130:4

progress
166:23

progression
177:15

project
58:15,16 67:11 104:23 107:21 113:12 118:18 128:1 131:10 138:7,11, 22 156:5,7,9,17 157:14, 15

projects
97:24 104:20 113:22,24 114:5 115:8 119:5 122:8 127:18 246:21 251:10

pronunciation
58:9

proper
178:2 216:14

proposal
105:4 107:23 250:16 251:1 252:10

proposed
113:10 142:1 151:16 161:15 222:1,5,10 233:7

proprietary
38:18,23 39:2,3,9,11 40:4 49:20 65:18 66:21

protect
39:13

protective
6:15

provide
54:13 55:5 59:14 92:25 111:4 129:13 155:16 157:7 163:23 168:11,15 286:25 296:23

provided
78:3 111:7 113:19 118:20 131:8 139:19 154:16 155:17 164:13 168:8 169:5 175:19 192:9 203:24 221:6 229:24 236:10 250:10 253:8 278:3,7,8 286:21

provides
108:23

providing
60:5 171:19

PRT
147:3,6,9,14 149:15 160:7 161:8 162:24 167:2 190:6 234:1 235:20

PRTS
178:22

prudent
268:9

PT
291:25

public
39:18

publicly
39:4,24 40:21

publishing
221:12

pull
51:18 71:23 91:18 103:10 184:12 287:19

pulled
169:20

pulling
48:9 288:19

punch
41:4 42:7,9,15 93:19

94:2

purchased
16:18

pure
86:16 87:2,16 147:13 167:9

purpose
45:21,24 59:11,14 73:23 81:15,16 122:13 162:6 168:5 296:6 297:1

purposes
73:18 89:22 147:25 157:8 178:14 192:12 205:18 212:16 237:18 307:2 311:25

pursuant
6:8,14

push
72:20

push-button
70:16

put
16:18 32:7 33:4 37:7 48:24 86:4 89:9 96:8 100:2 115:9 142:13 149:20 152:17 158:12 177:5 188:3 196:4 214:4 233:10 245:25 264:8 267:20 268:3 274:23 275:15 280:20 289:1

putting
37:9 218:2

python
36:12 130:4,7

Q

quantify
117:22 238:2 247:24

quarter
15:6 49:25

quasi
52:2,19

quasi-model
223:9

Quebec
11:20

queries
97:10,13,16

query
33:9 48:25 51:20 162:1 165:5 214:23 215:3,5

question
8:19,21 24:7 27:18 28:23 29:2,9,11 33:22, 25 35:4 43:12 51:20 56:15 62:15 67:2 74:23 81:11 88:15 94:14 95:10,21 96:13,20 97:9 101:13 102:6 107:6 115:1,13,20,23 116:6 120:7 122:15 127:10 131:18 132:14 162:1 199:25 207:4 208:19 209:10 215:8,9,10 216:12 222:20 242:24 250:22 251:11,24 252:1 253:21 260:19 277:11, 13 280:18 290:17,18 291:13 311:5 312:8

Questionable
309:18

questions
8:18 19:12 23:9 59:21 85:12 97:3,11,13 119:21 130:24 131:5 157:20 162:8 174:24 175:1,3 176:17 180:18 214:25 246:17 312:12

quick
269:5

quickly
103:18,19 122:24 201:22 287:19

quite
151:23

quote
63:14 89:4 262:1

quote/unquote
108:5

R

R-a-i-l-s
108:16

rail
12:21 26:22 48:12 49:5 59:15 67:25 68:9,10 75:4 89:13 111:10 117:3 131:1 165:8 300:17 311:4

railroad
6:10 7:9,10 11:5,12 12:7 13:6 14:10 32:25 34:6 54:16 59:6,7 81:13 118:11 158:4 165:14 166:6 179:11,16 210:20,21 260:8 284:12 295:22 302:1 303:14 306:6

railroads
65:23 134:23 209:24

rails
29:19 108:9,16,18 109:2 111:2,4,9,10,15 121:22,23 123:19 308:21

railway
6:12 7:11 15:1 33:4 35:17,19 59:16 66:8 86:4 108:21 110:11 111:13 145:21 165:13 248:18 303:21

ran
114:9 135:1 169:23 273:7

rand
297:19

random
61:18 296:4 297:9 298:14

randomly
293:9,21 296:12,16 297:17

randomness
297:5

range
73:13

Rank
124:23 128:22

rate
49:18 50:22

ratio
185:15

rational
162:5

rationale
162:7

raw
144:23

RCM
29:20 56:5,16 58:4,12, 21,25 59:1,19,20,23,25 60:3,9,10,15 63:8,9,14, 21,22,23 64:4,5,10,16, 23 65:18 67:5,7,13 72:17 77:17 78:24 79:1, 12 80:19 81:2,7,9,12,21 83:12 84:1,8,10 85:9 86:23 90:12,23 91:2,9, 14 92:4,6,13,14,19,22 93:1,3,12 94:11,16 95:3 109:3,5 118:13 121:24 126:1,4 172:13,15,19 173:1 181:15 240:12 244:20,21,23,25 245:9 254:15,25 255:6,23 256:6 262:25 270:2,3 271:8 272:20,21 273:7 274:21 277:1,15 278:14 279:23 286:20 287:6,10 290:12,21 308:21 309:3 310:9

re-
148:15 262:10

reach
175:22 298:21

reached
200:18

reaching
235:24

reaction
302:4

read
130:22 131:12 162:19 163:9 167:4,5 193:16 221:15 248:11 257:11 263:6 270:2,15

reading
146:7,11,23,24 170:12 189:9 195:9 197:9,21 289:17

reads
225:17

real
81:2,19 82:5 83:9,21 90:4,5 256:25 259:4 260:16 294:16

real-world
81:8,10,21 83:2 84:14 90:3 135:11 241:9 242:12,13 257:2

realistic
76:23

realities
300:3

reality
260:7,16 294:13

really
28:3 53:10 55:15 74:23 107:8 253:21 312:8

reason
9:1 10:23 142:4 147:23 150:6 158:23 159:16 162:5 191:25 209:11 234:5 263:2,4 280:18

reasonable
13:13 76:20 196:6 199:12 242:5

reasons
162:7 163:15 301:13

rec-
203:6

recalculate
227:6

recall
17:13,19 20:8 92:6 110:13 111:6 112:16,22 114:14 117:6,15 118:14 119:6,7 120:15 129:10, 20 137:11,20 138:4,6, 12,23 142:15 154:1,7 157:11 159:5 161:19, 21,22 164:23 166:16 168:25 180:5 211:4,18 215:5 226:17,19 232:25 233:25 236:6 246:15 251:25 252:7,9,16,17 261:23 282:17

receive
202:12

received
188:18 191:2 193:15 281:6

receiving
89:3 215:3

recess
56:13 128:10 158:8 201:13 269:7 312:18

recognize
139:25 140:2 203:5,7,8

recognizes
298:17

recognizing
299:15

recollection
13:19 23:15,16 107:25 109:12 134:19 143:9 168:6 198:16 212:1

recommendation
252:5

recommended
112:3,17 246:6

reconvene
128:7

record
6:21 8:8 56:12 128:6, 14,16 130:22 139:11,21 143:23 147:13 158:7,11 159:9,19 162:13,19 167:6 199:2 201:11,15 202:8 214:6 237:13 269:6,9,11,12 285:17 312:17

redirect
312:15

reduce
99:12 266:2,3

reduction
49:3

Reed
20:25 197:14

refer
26:14 37:19 40:5 46:6 47:25 60:18 72:1 114:22 169:4 180:24 203:16 283:6

reference
40:24 116:4 141:2 142:21 152:13 266:6

referenced
199:3 283:12

references
231:15 287:11

referred
16:3 17:3 48:4 50:24 70:5 72:5 147:3 148:7 162:9 169:17 219:25 224:13 261:18 279:13 281:23 282:22 308:21

referring
33:19 78:17 141:12 178:20 182:11 212:7,15 216:3 217:9,14 231:16 232:14 241:16 257:25 270:2 278:18 279:4,8, 10,13 282:3 285:18 289:3 303:23

refers
220:24 272:14 279:9,11 306:22,24 309:3

refine
41:19 42:1,4

refined
39:6 53:1 54:9

refinement
42:8

reflect
49:4 139:21 143:15,19 145:14 146:19 147:2 148:15 153:10 154:23 160:5 164:5 170:16,20 172:3 174:4,15 187:19 188:25 189:2,21 198:15 201:16 208:5 223:1,4 225:13 226:2 228:8 229:7 242:11 282:21 283:11 298:20

reflected
91:5 135:16,22 144:9 151:6,7 160:1,17 161:8 162:21 164:14 167:19, 20 168:18 171:5,6 185:16 186:2 211:8 224:21 229:18 233:7 281:3,5

reflecting
222:12

reflective
143:24 166:9 216:15 262:2 288:22 297:2

reflects
136:14 149:8 150:23 151:5,17 154:21 161:6 163:2 188:21 190:19 205:18,20 228:16 233:11 235:1,20 289:10 298:19

refresh
56:9 198:15 212:1 241:4

regard
252:11

regarding
44:10 157:20

regardless
22:6 50:13

region
14:3,17

regional
13:19,25 14:6 24:17 25:3

regions
25:4

regular
246:23

regulatory
66:1

rehost
94:11

reiterate
199:23

relate
32:25 62:17 74:13 168:7 285:13 298:15

related
12:1 75:8 212:14 261:11 310:15

relates
62:13,19 199:25 200:1 257:23 261:4,16 262:10 287:14

relating
122:8 198:23 215:3 235:2 285:8

relation
66:7 170:1

relationship
31:25 32:4 34:5 66:7 67:21 199:7

relative
14:4 29:22 48:25 62:6 75:3,6 83:25 186:14,19 209:18

release
39:4

releases
295:21,23

relevance
175:5

relevant
179:6,8,13 270:25

reliability
33:8,16 34:9

reliable
142:8,9

relied
202:19

relocate
16:20

relocated
17:1

relocating
268:24

reluctant
39:10

rely
28:15,22 202:19

relying
277:5

remaining
291:2

remember
20:4 75:20 112:19 113:25 114:11 116:18, 19,20 124:16 138:21,24 159:3 180:19 195:14 215:2 235:24

remove
287:4,5 288:2

removed
288:11

renew
294:21

reorg
21:11,25

repeat
33:25 73:21 132:14 290:18

rephrase
96:22 115:4,5

replacement
210:1

replical
83:4

replicate
59:8 81:7,16 166:24 260:7 292:25

replicated
292:22

replicating
59:12

replication
296:19

report
20:23 21:6 22:5,17 23:5 25:22 26:6,8 113:17,19 120:19 122:6 135:1 233:23 234:4

reported
19:24 284:25

reporter
7:24 8:6,13 41:21,23 42:2 88:20,24 167:4 193:6

reporting
19:21 27:22 283:24 284:19,20,24 290:5

reports
25:23,24 64:8,9 198:2

represent
129:1,2 145:19 147:12 150:8

representation
40:19 85:23

representative
81:13 135:18 169:25 178:13 257:3 287:15 288:22 308:13,14

represented
135:20

representing
7:8

reproducible
270:9

request
26:24 116:24 120:4 157:6 165:11 196:11 199:7

requested
232:24 309:24

requesting
78:15

requests
79:3,8 80:14

require
10:8 44:6 89:8 162:4 264:22

required
9:24 44:25 99:11 101:4, 23 117:24 120:9 121:14 131:3,13,20 171:7,8 181:9 264:20 265:13 277:13

requirement
28:11 47:2 74:1

requirements
10:2,17 118:16 120:8 171:10

requires
40:12

reread
241:4

research
300:18

reserve
7:13 202:15

resides
38:16

resistance
44:21,22 46:12

resolution
78:1,7 283:3 285:10 286:11 287:4

resolve
79:7 252:2,6

resolved
80:6

resource
78:12,16,17 79:2,8 128:2

resources
18:23 80:14 90:7 127:11

respect
15:8 54:3 84:20 98:22 143:17 200:19 205:17 235:13 259:23 275:13 276:12

respond
8:19,21 223:23

responded
194:18

responds
195:23 270:19

response
194:3 195:25 196:3,20 197:10,11,14

responses
8:9

responsibilities
11:22 13:24 16:4,8,9,16 26:13 157:3

responsibility
14:16 15:7,24 16:11 18:3 19:9 22:1 25:6 26:1,18 127:7 159:6 178:8 198:19

responsible
16:10 19:11 83:25 165:3 222:23

rest
96:25 290:8

restored
198:1

restriction
171:12 217:25

restrictions
231:5

restrictive
217:23

restricts
80:16

result
50:9 120:18 122:5 200:18 213:18 214:22 246:4 266:12

resulted
186:2 263:19

resulting
174:7

results
41:9 51:13 54:21 81:21 82:4,17,24 83:12 84:19, 21 113:14,16 114:21 118:19 120:21 127:2 189:5,6 202:8 205:5 208:12 234:1 235:19 237:15 240:22 244:6 257:9,17 263:12,17 267:11 309:18

retire
311:13,14,16,18

retirement
311:10,22 312:3

return
68:5 98:7,10,11,14,15 101:10 103:11 244:14 312:23

reveal
72:25 74:20

review
7:14 27:1 120:12 242:3 247:21 267:13 308:7,10

revoked
10:22

right
7:14 19:5 30:5 43:11 57:5,6 58:15 63:2 66:16 72:7 78:25 80:20,21 95:13 106:15 109:18 110:17,25 116:9 134:12 135:1 137:4 139:8 146:11,24 150:4,5,9 151:13,15 153:2 156:11,12 157:25 165:24 168:9 172:6 173:24 175:13 177:8 178:23 181:11 182:16, 21 183:15 185:24 186:18,24 187:8,10 188:20 197:2 202:14,15 203:13 206:11,19 212:12 213:9,20 214:17 215:18 218:9,22,24 220:24 225:18,25 226:8 228:13 231:9,17,18 234:23 235:14,15 237:6 238:25 240:7 248:22 249:7 255:3 260:9 264:16 276:1,17 283:4 287:25 293:7 301:1,5 303:9 308:4 309:5

right-hand
141:24 159:9 161:14 220:13

rights
66:3 117:6 134:23 239:2

Risk
301:11

River
109:13 110:12

road
117:12 122:1,23 124:7, 16,20 125:19 126:3,12, 14 127:3,17,22 129:7,9, 12,19 130:5 137:5,6 138:22 156:10 158:3 183:9,10,18 184:16 268:22,24 269:1 299:19

Robinson
21:3

Robitaille
193:21,24 197:23

Robitaille's
196:20

role
14:15 15:23 18:7,9 19:9 22:1 25:18 26:3,11,18 27:3,5 28:19 44:20 60:2,4 100:10,14 127:6 159:6 165:2 222:21

roles
18:1,2,3,4 26:17

rolling
46:12

rotational
44:22

roughly
13:10,23 117:8

rounding
223:15

route
44:3,11 46:1 50:25 58:2,6,7,12,24 61:21 145:20 157:13 163:20 164:22 166:2,7 175:16 176:10 178:1 179:5 190:8 207:1 216:11,15 219:11 239:15 245:19 246:1 262:16 276:7 278:5 279:1 280:13

routes
134:16 166:25 176:6 233:24 262:6,14,20

routing
163:18 166:4,9,12,16 216:13 239:19

row
162:23 170:13 232:15 286:12 287:3

rows
231:18

RTC
29:20 84:1 121:22 125:20,23,24 308:21 309:22,23 310:3,6

RTCS
23:24 82:7

Ruffings
52:25 54:14 55:13,22 207:11 209:22 210:18 228:3

rules
7:22 69:20

run
42:23 43:7,10,13,14,25 45:16 46:7 49:8,22 51:7,10 53:15 60:11,12 61:7 63:11,20 68:24 69:12,15 74:7,15 76:8, 10,14 82:6 92:15 94:5 95:1 98:19 99:9 107:3 108:6 111:15 114:7,23 138:25 145:22 147:13 149:8 157:9 158:2 162:17,20,25 163:3,8, 18 167:9 170:2 171:6,7, 10 178:16 191:23,24 195:12 196:3 206:13 208:3 216:14 218:17 233:16 246:1,2 274:23 296:21 304:10,24 306:1

run-time
212:11

running
43:1 44:11 50:7,8 74:4, 14 102:12 105:23 112:7 117:6 142:15 154:20 171:22 173:3 181:14 211:12 220:13 228:19 240:16 290:21 302:19 303:20 310:2

runs
39:9 134:11,15 180:9 200:21 210:9 211:3 226:24

S

safe
237:4

sake
266:18 294:22

sample
32:13 69:22 183:16 213:13 216:21 281:16 285:6 286:2,3 289:12

sat
126:18 284:15

satisfy
10:17

Saturday
206:23

saw
174:21 227:13,19,20

saying
176:25 177:2,22 181:17 259:15

says
140:24 142:2 145:12 149:6 150:17,18 151:15 159:10,11 161:13,15 173:25 174:1 189:3 196:4 203:17 206:15 220:6 225:13,22 226:7 230:12 231:2,24 247:3 255:22 270:3 288:1 303:11 309:18

scenario
111:17 112:11 133:10, 11,13,19,21 134:1,14, 22 135:10 178:15 237:23,25 238:1,21,23, 24 239:5,7,25 240:2 243:20 246:2,3 247:5, 10,12,23 265:14,24 266:4 281:13 312:24

scenarios
105:12 111:14,17 133:3,4,6,7,9 244:8 265:18 273:4 308:16

schedule
53:6,18 61:5 62:7 63:17 68:16,21 75:10 132:4 139:24 142:1,23 143:23,24 147:8 148:5 150:3 151:16 153:4 157:1,4,7 158:20 159:10 161:14,23 162:17 166:3,25 167:11 173:20,25 175:16 176:3,9 177:4,23,24 182:2 185:12 188:12,21 213:7,11,13,21 214:3, 25 215:7,11,13 216:5 218:11 221:9,17 223:8 225:14 226:2 232:1,13 234:22,24 240:13,19 241:14 242:17,18 294:9,11 295:15,16,17 296:3,24 298:1,9,10,12 299:9,25

scheduled
135:21 241:9 297:25 311:12,21 312:3

Scheduler
203:1

schedules
53:8 60:25 68:19 157:8, 12,17,18 159:7 161:25 165:8,9,10 168:13 175:7 176:7 178:10,22 198:24,25 205:9 213:13,24 214:1,11,16 216:21 218:6,22 222:2, 6,19,23 223:21,25 224:7 225:4 233:7 240:11,20 241:11 242:22 299:14 306:23 307:7

scheduling
26:22 52:1,4,16 53:2, 11,14,16 55:19 63:11 69:5 157:3,8 162:10 165:4,17,20,21,25 178:15 179:1 198:20 209:21 210:5 212:8,16, 23 213:1,4,8,15 215:14, 25 216:1 223:18 227:24 296:6

science
9:11 19:18 40:18

scientific
35:7 39:8 84:4 299:24

score
10:15

screen
204:5

script
130:4,8

seasonality
295:12

Seattle
110:24

second
35:3 39:10 44:5 64:7 119:25 131:11 132:24 133:2,19,20 143:12 158:7 169:8 190:17 193:16 195:9 210:2 237:24 266:22,23 270:1,8,15 272:23 273:2,10,11 287:3 303:10

section
46:5 59:7 62:25 77:9 130:15,16 134:25 145:21 166:6 210:3 241:2,4 250:14 256:16, 24 261:22 263:6 281:18 283:23 289:3

sections
87:15 112:19 129:10 253:5 281:15 285:15

see
21:14 35:24 45:2 65:21 74:12 84:6 86:18 130:19,20 136:24 144:8 145:6 147:4 148:11 159:22 160:3,14 161:3, 10,17 163:16 164:1 168:12 172:16,23 174:10,18 175:4 183:5 186:4 187:12 189:7,25 190:20 195:1 196:19 197:7 202:4 205:24 207:19,25 221:10 226:25 227:1,2,12 228:21 230:23 231:4,5 232:10 235:22,23 238:8,9 244:8 247:13 265:25 271:22 278:17 279:7 284:4,16 286:21 288:1 289:7,13,14 300:4 301:5 304:19 306:1

seeing
152:1,2 208:13 252:9 282:17

seek
196:8

seen
143:4 151:19 226:24 242:9 285:3

segment
12:21 67:25 74:5,15 85:23 86:1 104:7 107:16 111:12 114:8 146:3 236:22 238:21 248:1,6 267:21,24 286:1 288:11 289:19 302:21

segmentation
259:12

segments
75:4 86:7,11 92:16 236:19 238:23 244:7 245:6 267:19 289:23

select
54:14

selected
297:17

Selecting
285:20

selection
151:24 183:22

self-developed
98:8

self-evident
118:17

sending
195:14

senior
20:6,12 26:12 60:7

sense
8:23,24 24:14 35:18 38:24 47:17 57:21 59:10 67:20 72:1 100:2 117:17,20,21 123:13 138:13 175:2 180:23 190:10,13 304:2,3 307:16

sent
195:3

sentence
130:23 133:2,19 195:9 196:3 237:25 238:11 243:11,14 246:25 252:20 257:10 258:2,25 259:11,12 263:6,7,14 266:7,25 270:2,3,8,15 272:14 293:6,8,15,17

sentences
254:8

separate
122:16 165:2 251:18

separately
88:3

September
21:19 181:3 214:18

sequentially
188:16

service
14:7 15:25 23:17 25:15 26:22,23 53:4,8 55:14, 15,17,19 56:1 59:22 71:16,18 104:25 105:5,

13,14,15,18 106:19,21, 25 107:5,7,13,14,21,22, 24 109:9,11,16 110:2,6, 23 111:23,24 112:1,2, 14 113:6 114:12 115:21 116:21,25 118:23 119:2 121:5,11 131:2 133:12 135:23 157:4,5 162:2 165:11,12 166:13 170:18 171:24 178:13 198:22 204:18,25 206:21 211:16 214:23 215:3,22 218:16 219:6 223:24 232:18,21 233:1 238:5 245:4 251:4 275:19 287:20,21,22 288:19 294:18 298:5,6 308:9

services
196:2 219:13 223:21

set
42:23 43:10,18 47:4 59:16 81:15 85:25 88:1 103:9 115:22 129:15 135:4 187:11 190:17 219:10 254:25 260:11 283:5 309:15

setoff
218:17,25

setoffs
306:25

settings
207:6

seven
67:18 101:25 170:20,21 172:5,19 173:3 231:18

seventh
231:2

several-
196:5

shade
150:13

shaking
8:10

Shane
21:2 284:2

shape
210:4

shared
39:16 120:22,23 232:18,20

Shawn
193:21,24 194:3,6 195:4 196:19 197:23

Shawn's
197:11,14

sheet
37:14 103:4,6,7 140:16 148:11 150:13 177:7,9 244:15 245:6 248:2 250:11 267:18

sheets
30:18 223:8

shelf
27:20 39:17

short
56:13 104:12,14,17 128:10 158:8 201:13 269:7 312:18

shorter
149:15 161:7 187:5 208:3 235:21

shortest
262:20

shortly
67:7

show
53:21 65:16 73:14 151:8 172:8 262:4 295:25 296:5 297:3 305:20

showed
204:16

shown
145:17

shows
177:15 217:12

shunt
171:19

shunting
171:20

sic
83:4 119:10 150:13 168:14 176:19 205:17 216:25 251:2

side
13:4 26:2 48:23 69:19 100:6 101:11,12,16 102:7 114:8 150:9 168:14 188:24 231:17 283:4 284:4,15 287:25 304:12

siding
89:4 99:5 100:2,23,25 101:8 103:17 119:8 249:7,11 250:6,13 268:7,9,10,21 269:1 309:19,25 310:2,9

siding/spacings
71:11

sidings
89:5 243:24 248:10,12, 21 249:19 250:5 264:9

sightings
61:13 180:1

signal
12:25 27:11 29:23,24 30:2,4,25 69:17,18,20 248:24,25 249:3

signals
61:4 69:19 79:1 249:1 312:23

signed
138:17 139:5

significance
303:3 306:11

significant
79:19,24,25 234:6 240:14 260:21 263:16, 25 264:1,4 306:19

significantly
16:5,8 257:8,16 263:11

signifies
285:12

signify
285:13

signs
13:1

SIM
287:4

similar
14:15 19:10 32:11 33:3 37:3 39:23 53:22 62:9 63:10,13 82:11 83:4 84:23 85:1 105:8 109:3, 4 160:10 207:15 221:4, 7 234:9 259:3 286:24 291:9 306:15

similarly
8:17 44:5 232:7

simple
37:8 68:5,18 76:23 174:23 223:15 266:18 271:10

simpler
54:2

simplest
35:18 40:14 284:10

Simplification
130:10

simplifications
257:5,11 258:5,15 259:8

simplified
262:7

simplify
89:17 266:17

simplifying
256:17,20 257:4 259:17 260:21 261:2,16 308:12

simplistic
37:6 74:17 118:17

simplistically
75:15

simply
76:25 98:11 175:8 260:18

simulate
139:1 241:8

simulated
82:3 244:6 308:16

simulation
29:18 30:25 36:15 59:2, 3,5 66:11,14 67:14 68:3 77:21 80:19,22,23 83:21 86:5 87:25 88:5 89:19 92:2,5 108:7,10 109:2 111:3 112:2 114:16 121:16 239:16

243:20 244:21 246:4 247:5 255:2 257:9,17 262:25 263:1,12 267:11 270:4,10,17,18 271:24, 25 275:21 287:5 289:21 293:1,9 296:1 308:20, 22,24 309:11,25 310:3

simulations
59:20 79:4 111:25 120:11,17 247:24

simulator
105:11 108:22

simulators
27:10

single
33:20 59:7 86:8 87:24 271:5

site
101:20

situation
43:18 80:1 81:15 83:6 260:11 275:4

six
252:7

sixth
301:4

size
102:21 127:8 170:1

skills
14:5 19:16 28:12,16

skillset
28:10

sleeping
196:23 197:6

slightly
40:19 100:19 109:14 196:22,25 197:5 198:1 262:16,17 268:24

slow
218:8,9

slower
291:24

soft
15:6

software
30:14,16 38:2,10,13,16 40:24 60:9,10 63:24 64:1 65:15 108:15,17, 24 126:13 257:7,13 258:7 263:10 287:18

Solution
301:10

somebody
97:20 222:21

sorry
41:21,23 57:7 73:6 84:15 88:20 197:3 294:24

sort
76:19 83:10 86:19 114:20 115:10 143:12 159:8 190:2 252:10 264:21 268:5 277:19 290:20

sorted
202:11

sought
78:13

sound
21:22 72:7 136:8

sounds
13:13 102:3 136:9 195:13,17 197:21 201:11 246:9 294:4 301:1

source
183:24 211:20 258:14

sources
196:5 204:14 257:6,13 258:7 263:9

south
190:18 262:22

southbound
145:2 159:25 174:14 189:1 225:15 228:18

Southport
146:3 149:1,7 160:2 161:2 174:16 189:22

space
35:16 36:2 291:1,2,5 292:2

spacing
249:3,8,11,24

spanned
138:7

speak
28:2 208:7 209:19

speaking
10:11 292:4

spec
217:3

specific
9:19 25:8 27:18 34:20 35:1,4 47:5 54:11 55:1 61:14 62:18,19 63:17 68:7 75:9,10 79:3 81:16 83:13 90:17 93:12 96:12 103:2,13 104:1 114:11 115:20,23 118:6 123:7,11,15 129:6,8,10 131:19 142:22 146:21 148:8 159:13 179:20,24 191:21 193:1 199:25 203:7 210:9 211:17 212:10 215:9,25 216:12 225:20 227:18 238:5, 12,16 242:24 244:15 250:17,21 259:1,6,7 261:2,23 265:1 266:9 267:5 277:4 294:9 300:2 309:2,22

specifically
21:13 29:15 65:16 66:24 67:10 78:24 81:11 89:16 108:4 120:2 131:7 140:1 141:18 155:12 159:5 161:21,22 166:16 170:10 184:20 191:18 192:21 198:13 203:6 212:21 215:2,17 226:15 227:4 229:2,25 230:1 235:10 250:12 278:13 281:9

specification
48:16 274:5

specifications
39:11 46:15,17

specifics
40:3 241:5 251:25 252:7 255:16 286:19 291:14

specified
47:4 51:3,6 66:24 72:23 86:24 131:2 191:11 198:14 216:17 225:20 238:4 252:22 256:20 271:15,16 273:20 275:19,22 307:18

specifies
191:14 211:4

specify
49:25 50:15 64:13 73:13 273:21 276:20

specifying
274:4,8

specs
46:15 193:23

speculation
277:21

speed
27:12 30:8,22 31:1 50:4,17 76:14 163:19 166:8 181:7 206:23 217:24 231:5 257:23 306:11

speeds
12:25 30:11,12 44:12, 13 45:3 48:22 207:6,10

spell
6:21

Spelled
6:22

spelling
57:1

Spending
301:12

spent
10:9 245:3 269:16 308:12

spider
85:24

Spillway
180:3

spit
209:17

spread
164:20

spreadsheet
51:14 140:15 142:8

203:25

Spring
239:23

Springfield
109:1

sprint
76:9,16

staff
18:3,13,23,24 19:13,15 42:11 43:5,6,8 123:9 126:21 168:12 170:7 225:1 282:13 286:24

staffing
18:10

stage
82:3

stages
181:20

stake
303:20

stakeholders
304:18

stall
80:5

stand
46:22 58:4

standard
83:10 92:8,12 215:24 220:9 284:5

standing
284:3

standoff
267:23

stands
52:15 147:10,13 218:8 229:1 270:3 273:12,14 287:5

Stantec
194:7,11,17,20,22 197:23 226:11

Stantec.com
194:16

Stantec.com.
194:4

Staples
41:3

start
7:2 8:21 11:4 17:10 41:12 104:19 138:10 139:12 193:19 246:17 257:22 293:10,12,20 294:3,25 296:17 298:17 300:1

started
9:6 13:7,8 14:23,24 59:23 67:5,8 159:2 160:22 166:13 180:20, 24 181:2,18 182:7,19 192:14 246:20

starting
50:2,12,14 121:2 159:4 172:22 252:25 281:18 285:20

starts
53:4,14,15 132:24 133:3 175:14 193:20 216:17 243:14 266:22, 24 298:14,18,20

state
6:20 70:17 158:4 201:15 254:8 269:12 270:8

stated
98:21 127:13 149:16 160:7 163:6 167:3 168:2

statement
20:3 21:16,17 26:15 91:6 129:4 130:13 131:11,18 132:22 139:20 141:13 142:17 153:24 155:16 157:2 158:2 162:15 164:6,16 167:20 182:5 191:5 198:18 200:17 201:21 204:13 208:16 229:19 233:11 236:3 237:22,23 241:1 243:10 244:5 245:11,20 248:17 249:19 250:8 252:18,24 254:7 255:11,21 256:16 258:24 266:21 269:25 278:1 281:21 282:4,5 283:22 285:18,19 288:25 293:3 307:18

statements
128:20 191:4

states
130:23 131:12 133:20 153:4 169:11 209:22 234:23 237:25 238:12 243:12 256:24 267:1 286:12 302:17

static
71:7 165:15

station
45:4 110:10 119:8,14, 16 120:5 175:12 176:4, 5 177:1,16 216:18,23 239:15 261:17,23 276:8,9 299:4

stations
60:24 61:10 110:10 216:22 239:24

statistical
84:4

statistically
296:14

statistics
196:4,17

status
9:25 10:20,21

staying
161:12

STB
66:1

steel
32:18

step
166:19 182:12 252:21 286:3 295:6

steps
123:10 135:9,14

stop
35:24 61:2,10,11 69:8 71:24 119:8 120:5 216:23

stop/start
45:4

stops
45:4 53:4 216:17 307:25

storms
180:6,11

strain
33:7 73:17 74:12

strategic
267:6

Strategy
109:1 127:25

Street
146:3,9 149:2,4,7 150:19,20 160:2 161:2 174:16 189:22 190:19 261:8

strength
32:22

stress
73:17 74:11

stress-strain
31:25 32:3,23,25 34:5 67:24 72:21,24 73:23

strict
39:15

strictly
102:9 224:2 262:8,19 295:6

string
65:8,12,14 275:5

strive
76:2

stronger
245:7

strongest
28:17

structure
117:21 195:2 230:3

structured
117:16,18,20

struggling
88:12,15 174:24

studied
113:7

studies
82:18 91:5,10,16 114:17,20 115:19,22 116:15 119:19 121:2,4 122:2 125:21 126:5,9

127:22 158:1 200:19 204:11

study
91:11 105:2,7,8 108:4, 8,9 109:6 110:3,7,8,9, 20 112:18 114:12 115:8 116:8,11,22 117:8,15 118:4,13 120:1,10,16, 18,21 121:9,17 122:1,4, 5,21,25 123:6,10 124:12 130:17 131:6, 16,22 132:16 157:16,23 164:3 165:2 166:13 168:7,9 169:1,24 178:9, 11 179:22 180:25 183:4 192:22 200:2 201:19 211:7,21 212:14 221:12 236:3,4,17 240:8 246:22 251:4 260:17 272:21 273:8 294:13

Stuenkel
261:9

sub
119:9 120:1 245:3 288:7 301:11 303:11 309:7,17

sub-capacity
119:18

sub-southwestern
220:10

subdivision
99:3,6 103:19 115:18, 19

subdivisions
12:22 86:3

subject
32:13,22 193:22

submit
154:14

submitted
21:16 128:20 201:20 202:5 212:15

subsidiaries
7:10

subtract
144:11 146:9,15 240:2

subtracted
144:7

subtracting
186:22 237:25 238:20

subtraction
146:12 270:21

subtractions
224:17 282:15

subway
85:16 87:16

successful
94:7,12

suggest
56:6 222:9 260:25

suggesting
271:5

suggests
194:16 206:17

sum
47:5 232:15 239:24,25

summarized
113:16

summarizing
224:4

summary
167:24 169:11 223:7 224:1,2,11

summation
62:4 210:14

summations
224:17

superintendent
156:19

superliner
163:4 168:21 189:4 191:23 192:11 196:1,20 199:3

superliners
191:12,15 197:25 198:12 200:20 225:22 226:7,16

supplement
279:15,23

supplemental
278:14

supplied
49:19 54:25 200:24

201:2 256:5

supply
54:20,23,24 55:11 201:5 211:13

supplying
207:12

support
139:20 153:23 154:4,8 202:1 282:9

supported
123:5

supporting
129:14 155:15 198:22

supports
229:21

supposed
247:2

sure
8:8 11:24 12:12 16:7 21:23,24 24:7 34:1 47:24 54:24 56:11 57:1 62:12 68:18 83:15 91:25 113:8 115:6 119:3 125:13 137:15 141:6 153:20 167:6 173:12 176:23 177:20 185:7,8 201:10 208:10 219:4,15 225:23 228:23 233:3,4 258:12 285:7 290:19 302:25

surface
6:9 52:3 71:18

surprised
171:21

survey
135:24 136:2 137:21 184:10 240:22 308:7

suspended
10:22

sustainable
76:17 77:3

sustained
76:3

switch
180:16

switching
89:11 306:23 307:21

sworn
6:4

synonymous
285:23 298:8,9

system
12:25 14:4,14,16 15:16 16:1 21:20 24:24,25 32:9 37:10 69:17,20 70:6,8,12,25 79:10 87:16 93:20,23 95:2 171:23 211:12 223:4 248:24,25 272:24 279:14 292:10 294:10 295:11,25 299:2 306:7 311:4

systems
69:18 85:16

SYSTRA
308:21,25

T

table
44:1 49:24 50:10,11,23 51:11,12,18 64:19,23 136:14,23 150:9 162:16,18,22,23 165:13 168:18 191:5 200:16 207:18 211:8 216:20 224:15 229:18 231:8,17 233:11 253:17 266:23 285:24 289:5,9,11 293:5

tables
61:13 207:12 285:15

take
15:14 43:10,17 46:1 47:1 51:13 56:9 77:8 91:2,24 94:8 95:21 100:18 135:9 137:10 144:8,10 165:19 181:19 193:16 201:6,11 204:23 229:10,15 245:24 246:12,14 262:3,8 269:5 274:13 275:5 276:7 291:4 295:18 298:24 299:5 311:5 312:14

taken
6:7 22:1 40:5 56:13 128:10 158:8 201:13

269:7 312:18

takes
35:23 36:2 45:22 55:6 62:24 98:12 291:1 292:2 309:14

talk
29:15 103:23 123:18 156:10 248:7 306:13

talked
34:18 91:1 93:19 116:14 168:16 181:10 190:8 203:2 262:24 272:5 287:13 307:7,8

talking
14:19 33:20 34:2 77:5 78:22,23 84:12 92:1 103:25 110:2,3 143:16 159:24 190:23 213:3 215:16 218:21 228:17 232:17 233:12 235:18 248:9 253:5 275:12 276:22 302:11 308:23 309:4 310:14

talks
255:14

tap
71:18

target
74:2,13 133:23 184:9 273:3

task
123:15 132:6 178:7,15 196:13

tasks
123:7,11

team
60:6 126:22 197:15 297:12

technology
42:15

tell
77:8 104:22 116:22 120:2 148:24 181:1 202:18 274:11 275:8 281:2 286:13 294:23

tells
196:2

template
223:18 224:6,12 225:9

temporary
217:24 218:8,9

ten
201:6

ten-minute
201:11

tend
87:1

tenth
49:25

term
25:14 31:19,20 32:2 43:11,15 47:21 74:25 92:12 132:13 140:4,7 167:18 187:25 284:1,5 285:7

termed
299:9

terminal
12:10,19 13:2,3,11 88:7,16 89:5 150:19,21 261:22 262:1,4

terminals
12:23 89:11,17 163:21

terminology
106:23 108:5 245:13

terms
22:13 47:16 70:23 76:24 99:8 104:11,14 115:17 240:15 244:5 249:18 264:17,21 270:11 271:10 272:25 275:15 289:21

territories
82:4

territory
43:24 53:9,23 54:15 68:1,10 77:10 82:9,12 84:2 90:20 99:24 123:20 171:11 180:8,9, 15 185:2 210:6 211:16, 18 218:20 220:11 223:13 249:1 267:12 268:11 297:3 299:20 310:20

test
31:22 39:8 59:17 81:15

testified
6:5 93:17 137:4 167:21 180:19 197:15 222:12 254:24

testify
9:3

testifying
7:25

testimony
95:7 183:2 212:19 312:22

testing
23:14 39:6 60:5 237:1

text
42:9 50:10,11,23 51:11, 12 64:19 65:2,3 95:17 151:25 278:15

thank
128:9 188:7 234:19 243:6 272:12 312:7

that'll
258:14

theoretical
75:18,19,21 76:5,8,10, 22,25 90:21 302:9,14

theoreticalness
216:25

theory
76:23

there're
39:23

there's
23:25 24:11,12 26:1,5 31:14 35:24 39:19 75:12 86:19 90:10 106:8 107:9 145:3,11 153:3 162:16 165:13,25 173:24 176:11 177:20 180:3 191:16 213:14 214:17 217:13 226:14 231:19 232:5 233:22 236:16 241:1 251:10 252:4 255:9 263:25 269:2 283:15,16 289:5 302:8 303:7,11 305:2 306:2

thereto
129:5

they're
30:22 36:16,18,24 37:14 85:13 93:10 115:24,25 168:8 175:2, 3 191:6 205:5 295:14

thing
41:1 116:2 123:14 157:16 209:17 227:7 266:10

things
10:7 16:10 28:14 37:2,3 53:20 56:10 69:19 72:18 87:23 100:6,22 131:25 186:20 218:12, 13 219:22 237:15 255:11,22 256:1 266:15

think
31:13 33:20 40:1 45:2 49:6 52:15 68:17 72:6 78:3 90:25 95:6 106:2 114:25 119:2 125:23 142:9 155:3,7 160:19, 22 167:2,9,15 175:15 177:12 202:18 212:13 219:22 226:13 227:13 228:5,6 229:9,16 235:8 236:15,17,22 237:3 241:6,7 243:2 244:4 247:1 255:15 259:21 261:17 279:22 294:23 308:25 312:11

thinking
294:5

third
39:12 66:24 75:20 112:1 133:15 189:20 209:20 237:24 266:25 273:1,3 293:5

third-party
26:23 127:6

thoroughness
200:4

thought
62:20 137:16 162:12 195:20 197:19,22 198:3 301:19

thousands
114:16

three
10:3,8 20:16 73:12

75:15,17 145:4 151:17 197:12 220:25 230:21 231:3,19 232:1,6 272:22 293:7 302:9

three-minutes
220:4,6 221:14,17,25

three-year
10:4

threshold
264:19,21

throttle
50:21 217:5

throwing
52:13 167:14

Thursday
206:22

Tim
21:2

time
10:9 11:8,25 15:8 16:15 17:20 19:5,6,25 31:4 35:16 36:3,7 41:15 42:20,22 45:25 46:3,7 49:8 50:3,16,25 51:1,2, 4,5,7,10 53:7,15,21 55:3 57:15 61:2 62:24, 25 63:3 64:6,17,21,24 65:16 66:16,17 69:5 71:17 72:8 73:5,6,8,12, 14,20,25 74:2,9 75:9 77:6,8,10 88:1 89:7,25 92:19 97:11 98:11,19 105:23 110:12 115:24 120:14 125:17 127:4 128:3 135:21 139:3 141:3 147:13 151:24,25 152:1,4 158:5 161:23 162:20,25 163:8 164:24 165:13 166:13 167:9 170:22,23 172:5 173:6 177:4,5 179:22 181:2 182:14 183:20,22 194:10 195:3 202:11 207:12 208:3 216:23 218:1,12,15 221:12,18 228:19 238:21 239:9, 10,14,20,21 244:9,10 245:3 246:10,15,16,19, 22 251:3,20 262:2,8 263:23 264:11,15 269:14,16,19 276:10 277:9 291:1,2,5,11 292:2 293:10,14,20 294:3,8,11,14,17,19,25 295:17,24 296:2,5,8,9, 12,17,18,21,23,24,25 297:1,17 298:17 299:4, 21 304:7,14 306:1 308:1,2,13 309:1,14,24 310:23 312:4

time's
187:5

time-distance
211:15 239:23 244:24 247:22 267:13

time-wise
264:13

timeline
74:13

times
15:21 17:24 61:6,11 76:16 92:15 100:17 151:17 157:19 162:17 167:10 169:22 179:18 225:14 239:24,25 241:12 242:5 244:7 245:1 260:25 293:12 295:5 297:10,14,19,20, 21,23 306:23

timetable
50:13 92:23

title
15:20 17:11,13 18:20, 25 20:2,9 21:9,18,19, 23,25 22:3,6 139:23 150:10 162:18 214:15 279:1

titled
152:23

titles
15:19 17:5 141:8 176:13

today
7:25 9:3 16:4 18:1 19:25 20:20,22 21:7,8 26:11 38:15 41:17 67:14 71:8 94:22 118:23 179:8 191:20 272:6 301:21 309:5 312:10

tomorrow
179:9

ton
46:23 48:18 144:4 159:21 185:15

tonnage
69:15 144:18,19,22 226:7

tons
44:21 47:7 61:9 63:14 144:15 189:4 191:15 195:12,20 196:21 197:23 198:1,13 199:4 200:11,12 205:21 226:8,12,15 227:7

tool
35:5 37:13 38:19 52:10 53:2,16 55:3,17 59:5, 16,23,25 60:8 67:2,8, 10,14 68:2 70:7 91:17, 24 92:4 97:8 98:9 209:21 210:5 260:4,10, 18 270:10,17,18 271:24 272:3,4,5 287:18,20

tools
15:1,13 19:17 27:6,7,8, 9,11,12,13,15,17,19,20, 23,24 28:8 29:14,16,19 31:2,11 34:21 37:11 39:23 91:12,15,17,21, 23 92:2,9 93:6,8,18 94:1,19 98:6 103:2 245:22 260:19 267:10 271:25 301:24

top
143:13 145:5 159:9,22 160:14 161:13,14 169:10 205:14 206:1,20 214:10 216:24 218:11 221:7 225:13 241:7 270:1 279:1 289:6 293:5 301:5 306:1

topic
196:14

topography
38:1 44:11 45:3,19 48:22 54:6 59:9,12 88:9 181:7 262:17 268:5

Toronto
13:20 14:3,8 114:7 116:8

total
47:6,7 50:25 51:1,5 112:22 144:5,14 145:10 189:15 227:7 228:16,19 229:13 231:23 232:15 238:2

totally
147:21,22 176:19 277:5

TP
139:24 146:20

TPC
37:18,20,21,22,23,24 38:2,15,18,25 39:18 41:13,16,19 42:4,7,23 43:2,7,10,13,18,22,23, 25 44:10 45:9,16,17,21, 24 48:13,15,17,22 49:7, 11,13,22 50:8,14 51:15, 17,22,24 52:2,9,19 53:6,12,15,17,25 54:1, 5,12,21 55:9 56:17 57:9 62:4,19,23 63:3,15,16, 20,21,22 88:8 90:13,17 91:2,9,12 92:4,7,13,20 93:19 98:17,18 103:11 111:4,7,8 125:20 126:1, 4 140:8,10,12,14,17,18 142:15 143:5,16,20 145:5,10,22 146:20 147:18 148:1,7,25 149:8 150:2,20 151:1,7 152:24 153:23 154:5, 18,20,22,23 158:20 159:20 160:1,17 161:1 162:17,20,25 163:3,9, 11 164:1,11,25 165:16, 19,21,22 166:1,10,22 167:1,8,19 168:17 169:5 171:4 172:9,15, 16,22,23,25 173:3,20 174:16 175:16 177:19 179:3 181:10,19 182:2 185:12 187:20 188:12 189:21 190:17,24 191:19,21 192:12,16 200:21,24 202:2,5 207:15,23 210:1,10,20, 21 211:3 212:21 213:16,18,25 216:14, 19,25 218:19 223:11 224:20,22 228:25 229:25 230:1 233:13,16 235:17,20,25 237:15,17 239:20 299:12 300:1

TPC-BASED
61:1

TPCS
41:1,6 53:17 54:14 55:1,5 158:2 164:17 178:17 229:24

TPM
228:15,19,24 229:1

TPS
299:12

track
13:1 30:11,12 31:6,7,10 35:12,15,19,20,21 36:2, 5,7,9,10 37:6 44:12,13 45:9,10,12,14 48:11,22 59:7 64:8 69:1,9,11,12, 14 70:15 71:2,10,25 74:21,22 78:18 79:2 85:24 86:6,8,9,11,13, 16,17 87:2,4,5,11,15, 16,24 92:24 99:5 104:5 106:22 107:2 112:20 151:1 163:19 164:20 165:22 166:1,8 171:22, 23 180:13,16 181:6 207:12 217:21,23 220:11,14 245:6 248:10,19,21 254:10 256:3 262:22,23 274:13,14 276:8 284:4, 16 304:6,7,11,22 306:24 307:19 310:24

trackage
60:23 134:23 135:1 210:7

tracks
87:20 88:6 89:3 109:7 121:25 134:17

tractive
44:20 46:12 49:1,4,19

trade
183:23

tradeoff
303:12,22 305:2

trades
28:4

traditional
301:10,15

traffic
33:5 34:8,12 61:15 68:8,9,13 71:15,20,21, 22 72:22 73:2,4,15,20 74:4,6,7,21,22 76:21 77:10 82:3,9 87:1 101:21 102:10,11,15,17 104:1 111:11,13 112:14 123:21 126:20 133:23 135:15,18 178:14 183:25 184:13,15 211:21 239:2 241:2,3 244:18 245:8 270:6 271:17 281:13 282:10 283:21,25 284:23 285:15,21,25 286:9 287:6,15 289:4 292:15, 17,22,23,25 293:1,9 299:11 306:2,18 309:13

trailing
47:3,5

train
19:16 35:16,23 36:1 37:10,17,25 45:10,12, 13,18,22 46:1 48:9 50:3,5 52:1,16 53:3,4,7, 8,10,18,22 55:3,6 62:1, 3,4,6,24 63:3,6,15,17 64:8,23,24 69:7,8,13,16 73:5,12,20 75:9 78:20 79:3,12,15,16 80:3 84:8,13,14 88:9,11 89:12 99:8,13 102:5 103:13 104:12,14,16 106:25 107:3,5,14 108:6 110:16 111:11 115:17 118:2 135:16,22 142:1 143:6,13 145:1 146:21 148:5,8,16 156:18 159:19,25 160:11,13,24 162:21,24 163:3,18 166:1,2,4 171:25 173:5 174:3,14 175:17 177:1,15,24 178:1 182:4,13 184:12 185:13 186:9 189:1 190:15,18 203:1,11,16 207:6,23 208:13 210:6, 8 211:16 212:11 216:11,13,16,22 217:5 218:4,7,16,20 219:8,10, 16 220:12 223:11,12,13 232:2 233:14 235:2,5, 14 236:1 238:20 239:10,12,13,14,17,18, 21,22 242:7,10,22 244:7,9 245:1,2 248:5 267:14 270:11 271:11, 12,14,20 273:19 275:6, 7,23 276:9,10 284:14, 16,18 285:3,6 286:1 288:13,19 290:5,11,12, 13,22,24 291:1,4,5,8,10 292:2,3,9 293:8,24 294:9,12,17,19,24 295:6,7,8,10,12,22,23, 24 296:3,6,7,18 297:1 298:6,9,12,16,22 299:1, 3,22 304:10 305:12 307:25 308:11 310:19

train-by-train
240:4,5

trained
82:8

Training
56:1

trains
45:16 52:4 53:22 54:14, 15 55:1 59:9,12 61:1,6, 9,10,17,18,19,23 62:7, 8,9,10,11 63:6,7,11 69:4,5,6,10 73:11,12 78:22,24 79:9 80:11,17 86:17 87:3,4 88:4 89:7, 24 92:15 99:9 101:22, 24 102:11,22 104:2,4,7, 10 105:10,20,21,22,25 106:1,10,11,20,21 107:15,18,24 108:1,3 112:5,14 115:18 130:25 133:14,24 134:1,4,6,10 135:1,3,17,19,21 154:10 157:21,25 168:20 169:22,23 170:19 171:14,15,22 184:2 211:11,17 215:17 218:1,6 220:16 223:19 233:18 238:3,4 239:3 240:1,6,10,15,19,20 241:10,12,23 242:7,9, 15 244:12 247:7,9,11 261:14 267:23 272:23, 24 276:13 281:15 283:7,8,11 284:12 286:7,14 289:6,16,18, 23 290:1,4,6,7 291:3, 15,16,23,24 292:15,20 293:12,20 295:5,9,13 296:20,22,24 297:7,15, 21,24,25 298:15 299:18 304:13 308:9,11

trains'
60:25

tran
244:9

transcript
7:14 8:22 201:16

transfer
51:13

transferred
13:10 140:14

transit
46:3 55:3 73:8,11,14,25 74:2,9,13 77:9 173:6 218:1

translate
292:1

transmitted
155:5

transpired
118:21

Transport
66:2 94:10

transportation
6:9 11:18,22 12:1,4,9 13:8,19 14:1,13,15 15:15 17:14,15 18:6,8 22:15,17 25:14,22 33:4 50:20 95:24 97:19 100:15 101:11 125:8 193:25 306:7

travel
98:12

traveling
50:5

traverse
46:5 62:24 77:9 123:19 262:3

traversed
185:2,4

traverses
177:24

trial
274:16

Trieu
21:2 170:11

trip
73:5 122:20

triple
112:20

trips
91:20

true
67:15 145:12

truly
201:17

Trunk
7:9 135:6

truthfully
9:3 94:15

try
8:9 113:25 166:23 169:21 200:5 201:4,9, 25 252:7 289:24

trying
19:15 24:14 33:1 42:14 73:22 80:11 92:2 94:21 106:4,7,16 109:20 110:18 115:7 122:19 142:12 164:12 179:1 182:23 186:7 192:24 195:18 209:1 222:9 254:19 255:6 256:11 257:18 264:5,18 272:2, 18 276:2 294:23 303:5 304:1 306:14 312:23

TSO
217:18 218:8

TSOS
218:2

TSP
298:4,6,15,16,19,22 299:3

TSPS
298:2

Tuesday
206:22

tune
61:14

turn
93:25

turnout
257:23

twice
145:17 165:9

two
20:16 25:6 34:15 36:12 41:5,7 73:12 75:19 76:24 87:19 88:6 90:11 92:9,17 109:7 111:25 121:25 124:21,22 130:24 131:2 135:5,23 136:1,9 137:1 139:2 145:4 146:13 225:24 231:14,15 232:8,13 240:2 246:12 254:8 257:19 258:4 262:14,20 265:18 283:19 289:16 293:7

type
18:4 30:7 37:23 62:1,2 63:7,13 88:13 90:24 96:24 100:13 148:15 151:19 163:25 165:11 212:22 272:4

typed
226:9

types
31:14 39:20 54:15 55:1, 5 62:9 63:11 89:13 104:10 159:6 169:21 212:2,6 225:25 253:19 276:5 302:8

typical
147:17 183:25 204:5 205:4 215:11 231:4 288:22

typically
31:2 65:6 99:1 218:16 220:3 291:23

U

U.S.
66:1 109:15,17 110:14

Uh-huh
21:1 32:8 34:16,19 52:7 64:22 73:3,10 74:24 75:1,16 79:22 82:22 87:12 91:19,22 102:25 108:13 120:6 141:1 142:3 145:18 146:14 148:19 160:8 168:3 170:15 174:25 175:10 184:6 187:15 198:21 200:15 201:7 202:20 217:17 219:7 223:6 224:3 227:9,11 228:1 237:12 243:8 249:6,12, 14,22 250:9 251:6,12 258:23 259:5 260:6 297:16 298:7

Uh-hum
229:12 265:3

ultimately
19:24

Um
264:14

Um--hum
200:25

Un-hum
222:7

unclear
142:25

uncommon
198:25

uncomparable
176:19

undefined
92:12 132:13

underlying
54:18 148:11

understand
8:3,14 31:18 33:1 57:18,21 58:23 64:16 73:22 92:3 94:22 96:20 109:20 110:19 114:25 115:7 117:17 131:17 163:13 164:12 173:12 176:21,24 179:2 182:24 186:7 209:11,14 224:10 255:6 257:18 261:5,19 264:18 272:2,18 276:3 281:9 282:6 285:11 287:12

understandable
277:19

understanding
7:23 25:9 54:13 123:20 125:1 146:6 147:5 171:17,18 175:6 187:3 192:1 221:23 267:1 283:13 310:23,24,25

understood
115:3 219:4

undertake
127:9 256:8

undertaken
119:19 178:10 251:3

undertaking
19:14 99:18 120:15 121:8 123:6

undertook
123:8 253:8

unexpected
198:25

uniformity
71:10 292:14,19,22 306:12,17

unintelligible
33:18 85:13 290:15

unique
27:12 79:6 277:1 296:7

uniquely
278:3

unit
253:19

University
9:12 65:24 66:4,6,8 94:17 300:19

unknown
213:19

unlimited
95:23

unnecessarily
258:16

unnecessary
257:7,14 258:16 263:10

unplanned
254:11

unpredictable
254:9

unrelated
212:19

unscheduled
241:11

update
93:6,9,18,24 94:1,16 165:8,9

updated
93:20,22 143:22 193:2

updating
93:13,15 157:9

upgrade
304:22

upgrades
304:8

upper
141:24 151:14 153:2 173:24 174:4 188:20 225:21 234:23

usable
126:24

usage
83:17

USC
6:11

use
27:3,7,15 28:14 30:14 31:3,4,6,7,19 36:11 38:15 40:23 42:4 43:11 46:9 47:14,16,19 49:13 50:19 51:9,15 53:16 59:19,20 61:16 63:18, 20 66:3,17,20,23 67:2 76:6 78:14 81:24 88:1 89:4 91:2,23 92:9,17, 19,23,24 95:17,18 97:5, 7,8 98:6 99:25 103:2,3 108:8 109:5 121:6,16, 24 127:3 128:1 134:17 154:23 155:24 167:11, 18 170:17 183:21 189:14 192:24 204:2,6, 10 205:16 210:22 211:6,10 220:15 245:13,21 260:17 267:9 275:4,5 284:1 299:12

useable
42:10 91:13 95:8

useful
126:24

user
35:7 49:24 65:10 86:23 103:14 203:18,20 204:24 273:19 274:3,5, 7,11 275:2,3 276:22 278:8 279:15 309:23

user's
60:19

users
121:12 309:23

uses
29:14 46:8 67:14 140:11 147:14,16 165:22 228:4 275:9 284:2 287:18

usual
204:1,6

usually
97:17,18

utilization
70:23 310:25

utilize
27:19 36:8 53:5

utilized
70:19 91:11

utilizes
194:22

V

vague
33:18 81:4 82:23 85:12 290:15 307:6,15

vaguely
112:19

validate
135:10

validation
82:13,16,18 83:14,16, 17 84:11 123:22

Vancouver
105:1,5 106:19 107:21 108:2,3 109:9,14,17,22 110:9,10,13 113:15 116:8 127:25

variability
241:13,21,23 242:6,13, 21 296:20

variable
186:10 260:13

variables
309:12

variation
308:14

variations
162:8

varies
43:19

variety
10:5 12:4 15:5,18 27:5, 9 29:21 30:18 31:10,14 35:8 36:12 39:8,19 51:16 64:7 68:7 71:8 72:18 78:14 80:9 91:12, 20 119:18,19 121:4 123:10 156:19 161:25 162:1 163:15 165:3 176:6 180:14 191:24 192:23 200:10 205:7 244:3 245:14 247:21 260:19 271:13 301:23 302:2 303:6 304:17 305:16

various
16:12 27:12,15 29:13 36:9 39:20 41:6 49:18 52:11 71:20 156:16 168:10 169:22 238:21 269:17 285:15 289:4, 22,23 299:17

velocity
33:7,16 34:9 306:17

verbiage
129:11 136:22 259:2

verified
21:16,17 91:6 128:19 129:3 130:13 132:22 139:20 153:24 155:15 157:2 158:1 162:15 164:16 167:20 191:4 200:17 201:20 229:19 233:10 236:3 237:21,22 243:10 245:20 250:7 252:18,24 254:7 256:16 266:21 269:25 281:21 287:9 288:25 293:3 307:17

version
39:17 108:12 113:9 139:24 142:2,22 150:3 151:18 152:24 153:1,4 158:20 159:11 160:24 161:15 173:21,22,23 174:1,5 182:2 185:12 188:13,14,15,19,21 190:3 191:1 199:19 214:16 221:11 224:14 229:3 234:23,24 246:3 281:5

versions
174:21 188:17 189:12, 24 196:22,23 197:5 209:12 225:5 286:23

versus
68:23 83:8 84:2,6,14 90:9 100:25 151:2 173:3 179:8,9,17 200:11 242:8 262:22 268:8,9,24 277:5 289:21 292:3 295:1

viewer
65:8,13,14

Vinewood
237:7

Virginia
109:1

visit
136:15,19

visiting
137:17

visits
124:2,5,8 136:25 137:7, 9 138:2 184:17

visual
84:5 244:11

visualization
204:8 244:25

visualize
287:19

visually
53:21

volume
73:2,4 74:7,13 99:14 102:10 107:15 115:17 183:23 184:5,9,15 244:18 245:8 248:5

281:3,6 283:16,17,20, 22 285:25 286:1

volumes
135:17 285:5

W

wait
216:23 276:8

waiting
89:24 208:18

walk
76:11

Walmart
41:3

want
7:12 34:22 44:18 122:17 139:11 158:6 177:20 185:18 187:24 201:14 203:2 219:3 222:6,16 237:10 254:22 256:12 269:12 274:11

wanted
52:8 56:17 85:21 162:13 247:15 263:13 287:12 311:24,25

washouts
180:7,12

wasn't
83:19 85:5 138:1 183:4 234:6 254:17 275:11

water
36:23 102:1 233:17 235:3,6 236:21

way
10:17,18 36:20 37:6,9 38:6 42:6 57:14 70:9 75:8 76:24 80:24 96:19 107:4 143:8 177:5,10 187:7 192:4,7 194:14 195:21 206:5 210:4 259:23 260:5 284:10 285:1 292:12 293:23 311:6

ways
15:10 29:12 35:6 51:16 61:18 177:3 244:4

We'd
246:2

we'll
27:19,20 31:4,6,7 37:19 56:12 127:11 128:1,6 139:12,13 152:18 173:14 180:24 183:1 188:6 201:9,10 269:21 312:14,17

we're
8:7 22:14 33:20 34:2 52:13 66:25 78:22,23 84:12 101:5,20 102:12 122:21 158:13 159:24 165:14 167:13,15 169:9 175:6,17 176:20 184:11,12 188:15 189:10 190:5,22 195:23 209:5 213:3 215:16 218:21 221:12 228:17 235:18 238:1 248:9 265:4 269:10 275:12 276:21

we've
56:6 92:1 102:7 148:14 166:19 188:13 189:24 202:11 203:4 226:24 232:17 237:14,16 242:9 280:21 281:24 283:2 307:8 309:4

weak
86:12

weaker
245:7

weakest
99:7

weather
87:23 254:10

web
85:24

Wednesday
206:22

week
136:15,19 137:24 184:3,7,11 211:21 285:6 289:6,12

weeks
135:23 136:1 137:1,13 183:16

weighed
195:20 228:7

weight
27:11 29:24 30:2,4 31:1 44:21,25 69:7,13 144:5, 14 189:5,11,15 195:11, 19 196:21 199:9 200:20 205:21 227:12,16

weights
191:23,25 192:11 195:25 197:24

went
83:20 137:23 174:22 184:16,18,24,25 185:1 261:25

weren't
141:6 154:25 158:25 176:25 201:18 266:1,2

west
175:14 176:5 177:2,17 262:5 268:7

westbound
235:6

Western
7:9 24:19

westward
62:10

what's
9:24 12:17 20:2 28:1 29:25 55:24 59:11 60:20 67:16 73:22 76:22 98:1 100:21 104:1,13 107:8 108:14 147:3,5 186:17 191:3 212:17 226:5,9 247:20 266:14 272:2 282:13 283:18 290:10 291:11, 12 299:8 303:22

what-if
103:24 162:1 165:5

wheel
47:15 48:11

who's
20:22 22:25 193:24 204:24

widget
78:21

widgets
78:23 79:9

willing
269:14

Wilson
309:24 310:4

Windows
94:3

Windows-based
94:6

winds
44:22

wish
38:5 61:16 64:13 65:9 68:22 69:12 202:22

wished
70:16,21 178:19

wishes
40:23

wishing
121:6

witness
41:22 42:3 85:4,15 88:23 92:13 115:14 132:14 153:15 167:10 181:22 199:21 208:16, 18 212:21 221:3 222:20 227:22 237:10,13 243:4 253:15 277:23 279:21 284:9 285:19 291:20 294:7 295:4 307:16

Wolverine
233:18 236:23

word
18:20 22:12 31:8 37:14 97:5 145:11 150:24 229:15 266:24 278:15

wordage
150:24

wording
266:7

words
230:2 247:8 304:20

work
10:6 11:25 15:19 16:2 17:4 18:4,6 19:9,14 27:23,24 43:8 51:12 60:18 61:11 65:4 66:25 69:8,11 71:5,25 77:23

78:2 94:14 116:3 122:1 125:6,19 126:4,12 127:1,9 129:14,19,20 130:3,6,17 139:12,19 149:20 151:22 153:22 154:1,3,4,7,12,14,17,18 155:1,4,6,8,11,15,19,23 161:25 162:3,6 164:4, 13,15,18 166:23 168:8 169:4,5 176:16 178:5 181:8 183:22 188:19 191:2,11 193:13,15 194:21 196:14 199:25 200:6 201:3,18,23,25 202:1,12 211:13 217:22 220:23 222:13,22 229:20,23,25 236:10 237:19 241:24 246:5 250:10 254:11,13 256:3,5 259:6 269:18 278:2,12,25 281:1,12, 14,24 282:2,14,18 286:21 304:6,16,20,24 305:10 307:25 308:5 311:15

worked
15:3 104:24 113:23 114:4 119:6 122:9,24 123:6,8 126:9,18 127:21 129:7 156:9,16, 17 194:6,7 282:13 286:24

working
11:4 12:1 14:22 41:12 67:5 93:2,5 104:20 124:12 126:21 138:11 151:22 156:5 157:11 161:19,21,23 180:24 194:8 195:5 207:3 212:2 215:6 221:20 225:5 246:21 274:19

workload
97:9 127:12

works
7:23 25:10 55:13 276:3

world
68:4 81:2,19 82:5 83:9, 21 90:4,5 95:5 260:16 294:16

wouldn't
22:12 107:12 137:24 194:13 263:22 275:15

290:12

writing
10:16

written
72:6,11 120:18 122:5 129:12 147:4 149:12

wrong
58:18 186:18 294:24 295:3 301:12 311:5

wrote
16:20 129:22

X

XLS
139:24

Y

Y-a-z-o-o
119:12

Y2k
93:7

yard
26:20 88:18,22,23,24 89:2,5,15,17 90:4,5,9 121:8 254:12 255:15,17 261:4,8,11 262:7,11,13, 25 288:6,15

yards
13:4,5 89:1,20 255:1,12

Yazoo
119:9,11,12 120:1 245:3

yeah
16:17 33:12 128:5 137:18 152:2 162:11 167:5,13 171:13 183:1 208:17 226:4 231:7 236:24 265:22

year
13:10,14 96:8,25 137:9, 21,23 138:9 165:9 182:15 183:17 246:12

year-and-a-half
13:16

years
10:3,8 153:10 179:9 180:14 246:13,18 252:8 311:6

yellow
170:13

Yep
141:10 174:19 226:20 231:21 309:9

yes-no
101:13

yes-or-no
8:11

yesterday
179:9

you'd
42:23 74:12 144:22 250:21 253:4

you'll
24:18 32:13,19 33:4 60:23,24,25 61:2,3,7, 10,11,12

you're
7:25 9:2 14:19 21:23 23:14 33:9,19 42:13 43:13,24 44:9,11 56:7 63:11 74:14 75:23 76:12 77:1,5 78:17 86:12 92:15,20 106:7 107:2,13 110:2 114:20 115:1,9,10 134:9 137:23 139:7 146:24 167:15 177:2 178:20 181:17 185:7 187:3 188:1,16 190:11 192:6 204:2 207:7 209:1 212:7,15 217:9 219:25 223:17 233:3 236:18 237:1 246:20,22 248:16 249:21 257:25 260:24 264:15 265:25 271:5 273:24 274:18 277:7 278:18 279:3 284:3,13 290:11,20,21 294:2 302:19 303:5,22 304:1 309:12

you've
42:12,13 95:18 102:1 151:20 187:13 190:11 259:20 306:10 307:12 308:20 311:6

Z

Zed
43:25

zero
50:3,12,14 73:11 295:17 296:17 298:18

zero-based
295:15 297:24,25 298:1,22 299:9

zone
27:12 30:23 31:1

EXHIBIT 1

BEFORE THE
SURFACE TRANSPORTATION BOARD

Docket No. FD 35743

APPLICATION OF THE NATIONAL RAILROAD PASSENGER CORPORATION UNDER 49 U.S.C. § 24308(a) – CANADIAN NATIONAL RAILWAY COMPANY

JOINT VERIFIED STATEMENT OF HARALD KRUEGER, BRIAN DOYLE, AND NIKOLA RANK

Table of Contents

I. Introduction & Qualifications 1

II. Overview of Study, Methodology, Work Performed, and Objectives 2

- A. Amtrak Service Goals 3
- B. Methodological Approach to Modeling 4
- C. Overview of Work Performed to Construct the Model 5

III. Identifying and Coding the Representative Plant for the Model 9

- A. Summary of Corridors 10
- B. Data Collection for and Construction of TPC Route Files 12
- C. Data Collection for and Construction of RCM Plant Configuration Table 13
  1. Plant Configuration Table 14
  2. Terminal Description Table 16
  3. Siding Exceptions Table 18
  4. Double Track Exceptions Table 19
  5. Junction Definition Table 19
- D. Simplifying Assumptions 20

IV. Selecting and Inputting the Traffic Package 22

V. Determining Representative Train Operations 33

- A. Train consists 34
- B. Train schedules 37
  1. Train departure times 38
  2. Train dwell times 39
- C. Amtrak Service Quality 40

VI. Using the Simulation Software to Quantify the Impact of Amtrak on CN 42

VII. Cost Estimates 45

VIII. Conclusion 47

Definitions and Acronyms

AEI	Automatic Equipment Identifier (an electronic railroad equipment recognition system, based on radio frequency technology, in use by the North American railroad industry; it consists of passive tags mounted on each side of rolling stock and active trackside readers that using RF technology to identify railroad equipment while en route)
CTC	Centralized Traffic Control
GTW Corridor	CN's line which runs from South Bend, IN to Port Huron, MI, and over which Amtrak's Blue Water service operates.
HPT	Horsepower-per-ton
IC Corridor	CN's line which runs from Chicago, IL to New Orleans, LA, and over which Amtrak's Illini/Saluki and City of New Orleans services operate.
MRT	Minimum Run Time
NOUPT	New Orleans Union Passenger Terminal, on IC Corridor
OTP	On-time performance
RCM	Route Capacity Model (CN's primary line-simulation program, used to analyze the interaction of different infrastructure, traffic, and operational parameters; a controlled, reproducible event-based computer simulation tool used to measure the operational impact in terms of train delay of changes in a certain parameter while holding other parameters constant)
RTBI	Right Time Business Intelligence (A web-based tool that provides a visual representation of the current state of CN's infrastructure including the location of track, sidings, crossovers, *etc.*)
RTC	Rail Traffic Controller (line-simulation modeling software made by Berkeley Simulation Software)
TPC	Train Performance Calculator (A computer program that precisely models the physics of the movement of a single train over a piece of track and produces statistics about the train's performance and operation during that movement, used by CN to develop its train schedules and service plans)
TDMS	Track Data Management System (A corporate database of mileage, elevations, curves, stations and speeds for all CN trackage)

I. Introduction & Qualifications

My name is Harald Krueger. My current position is Senior Manager, Network Planning, at Canadian National Railway Company ("CN"), a position I have held since 2010. In that role, I manage the Network Transportation Department, which is responsible for managing line and yard capacity across the CN system to improve operations and accommodate traffic growth. I am also responsible for managing the Canadian Passenger Train (VIA) scheduling and assessing any changes or new passenger service proposals on the CN system. I have over 34 years' experience with CN working in Operations, in the Transportation Planning function. My expertise is in line and terminal capacity and the application and development of simulation models for evaluation of freight and passenger operations. I hold a B.Sc. in Civil Engineering from the University of New Brunswick, and am a member of the Professional Engineers of Alberta.

My name is Brian Doyle. I am a Project Manager and Vice President of Iron Road Software & Simulation, a consulting engineering company specializing in the simulation, planning, and design of rail networks. In that role, I have overseen and managed a number of railroad capacity simulation studies for railroads in both the United States and Canada. In my 35 years in practice, I have developed diversified management experience in railroad operations, transportation planning, capacity planning, and analysis, engineering design and construction, transit development, and transportation technology including supervision of mainline, terminal, and industrial rail operations. I hold a B.Sc. in Civil Engineering from the University of New Brunswick, and am a member of the Professional Engineers of Ontario.

My name is Nikola Rank. I am the lead capacity analyst with Iron Road Software & Simulation. In that role, I have conducted a number of rail capacity studies for a variety of railroads and passenger agencies, including CN, CP, CSXT, Toronto's GO Transit, and Montreal's AMT. I am familiar with a number of rail computer simulation tools and analysis techniques, including the Route Capacity Model and Train Performance Calculation. In addition to capacity analysis, I have significant experience with wayside signal system planning concepts, including block design, braking distance calculations, and route and aspect charts. This experience has given me a deeper understanding of the fundamentals of railway capacity analysis. I hold a B.Sc. in Computer Engineering and a M.A.Sc. in Electrical Engineering, both from the University Ottawa.

II. Overview of Study, Methodology, Work Performed, and Objectives

We were asked to answer two questions: (1) what level of delay to CN's freight trains is attributable to Amtrak operating on CN's rail lines at specified service levels, and (2) what capacity improvements would be required to eliminate that incremental level of delay? In order to answer those questions, we performed a capacity study of two corridors on CN's lines: (1) the "IC Corridor," which runs from Chicago, IL to New Orleans, LA, and over which Amtrak's Illini/Saluki and City of New Orleans services operate, and (2) the "GTW Corridor," which runs from South Bend, IN to Port Huron, MI, and over which Amtrak's Blue Water service operates.[1] The study's goal was to quantify the effect of Amtrak on CN's freight operations and identify the infrastructure (track and signal plant) improvements required for those three Amtrak services to

[1] In addition to the Blue Water traffic, the simulation for the GTW corridor included six daily trains of Amtrak's Wolverine service that operates over a 1.2 mile portion of this corridor between Baron (South Bend Sub MP 176.7) and Gord (MP 175.5). We were not asked to model Amtrak trains or services on other CN lines.

achieve specified on-time performance ("OTP") targets at their endpoints on CN's lines without Amtrak's trains causing net incremental delay to CN's freight traffic.[2]

The specifics of our study are outlined below.

A. Amtrak Service Goals

In most modeling of passenger service on freight corridors, the first step is to have the passenger operator specify the service goals for the passenger trains. In this case, because Amtrak has not specified its service goals, we were asked to model two service targets based on Amtrak's endpoint OTP, as calculated on a monthly basis. The first service goal was a monthly average 80% endpoint OTP. The second service goal was a monthly average 90% endpoint OTP for Amtrak corridor trains (those in the Illini/Saluki and Blue Water services) and 85% for Amtrak long distance trains (those in the City of New Orleans service).[3]

As our capacity modeling is based on train delays, not endpoint OTP, we required that endpoint OTP goals be converted to train delays. This conversion was performed for us by Professor Jeffrey Dubin, who describes this process in his own verified statement. He calculated for us the average number of minutes of delay caused by freight trains and other passenger trains that a given Amtrak train could incur over the course of a month and still expect to achieve its target endpoint OTP. *See* Dubin VS. We used the results of his analysis in our dispatching of the model (discussed in more detail below).

---

[2] As explained in the verified statement of Professor Dubin, "endpoint" here means the portion of the Amtrak service related to operations over CN's host lines. Endpoint OTP and modeling for each service was thus coextensive with Amtrak's full service, except for the western terminus of the Blue Water service, which was modeled to the endpoint of CN's host line, where it connects to another host carrier.

[3] In a capacity constrained environment, such as the CN corridors modeled, higher service levels – meaning dispatching that reduces delays to Amtrak trains – can be expected to result in increased delays to freight trains.

B. Methodological Approach to Modeling

In order to isolate the effect of Amtrak on CN's freight trains, we constructed a model to assess the following three scenarios:

- Scenario 1: CN freight, without Amtrak, operating on existing infrastructure
- Scenario 2: CN freight, with Amtrak performing at 80% endpoint OTP (Scenario 2A) or 85/90% endpoint OTP (Scenario 2B), operating on existing infrastructure
- Scenario 3: CN freight with Amtrak performing at 80% endpoint OTP (Scenario 3A) or 85/90% endpoint OTP (Scenario 3B) and additional infrastructure to reduce net incremental freight delay caused by Amtrak to near zero

Our modeling consisted of simulating all three scenarios on both the IC Corridor and the GTW Corridor for each assumed Amtrak endpoint OTP service target.[4] Scenario 1 was used to estimate the baseline amount of delay experienced by CN's freight traffic in the target corridors in the absence of Amtrak's passenger trains. By subtracting the Scenario 1 baseline freight delay from Scenario 2, we were able to quantify the total incremental delay to CN's freight trains caused by the presence of Amtrak's passenger trains at the specified service levels, as well as identify the specific locations on the corridor where those incremental delays occurred. Once we had identified how much and where the incremental freight delay occurred due to the presence of Amtrak, we conducted a capacity analysis on the current corridor plant (*i.e.*, the plant used in Scenario 1 & 2 simulation) to identify pinch points, areas of congestion, and other areas of freight/Amtrak conflict that could be improved or mitigated through additional infrastructure (*i.e.*, additional double track, sidings, or crossovers). The additional infrastructure was added to the model incrementally in the Scenario 3 simulation until we had mitigated the incremental freight delay caused by Amtrak's passenger trains – in other words, until the level of delay to

---

[4] We did not, however, model the GTW Corridor (Blue Water service) at the 80% endpoint OTP service target. Given the allowable delay minutes calculated by Professor Dubin, we believed it was unlikely CN would have to delay its freight service significantly to meet that delay minute goal.

CN's freight trains measured in Scenario 3 was approximately equal to the level of delay to CN's freight trains measured in Scenario 1.

Through this modeling approach, we can quantify the impact of Amtrak on CN freight, identify where it was occurring, and provide a means to identify the additional infrastructure needed to reduce freight delay to a level that CN could expect to experience in the absence of Amtrak. As the final step in our analysis, we estimated costs for the specified infrastructure improvements.

Our modeling focused on the three key factors that affect main line train movements through the corridor: the representative plant, traffic, and operations. Our objective was to have identical, comparable, reproducible dispatch times and dispatch decisions between scenarios, which would allow for reliable delay comparisons between scenarios.[5]

C. Overview of Work Performed to Construct the Model

Constructing the model required three basic steps: (1) gathering data related to the representative plant, traffic, and operations, (2) verifying the data was current, correct, and correctly coded in the model, and (3) running the model and analyzing the results.

---

[5] We did not model minor or unpredictable matters such as weather disruptions, track/equipment failures, unplanned activities, or work blocks. Nor did we model detailed yard operations or other work off the main line. Doing so would have added significant complication to the model and additional subjective elements. Further, had we attempted to model these irregular sources of delay it would have effectively decreased line capacity and thus had a compounding effect on delays caused by Amtrak, which would have resulted in greater overall Amtrak incremental delays and, consequently, increased infrastructure costs required to eliminate those delays. As an example, an incremental main line delay caused by Amtrak that would have a minor impact on freight service in Scenario 2 if an alternative siding is available, could have a significantly greater impact if one assumes (in Scenario 1 and 2) that the siding may not be available due to a work block.

Data related to CN's representative plant include the specific track topography (*e.g.*, elevations, curves, and speeds) and other trackage elements (*e.g.*, sidings, double track, signals, and junctions). Sources for these data include: (i) CN's Track Data Management System ("TDMS"), a corporate database of elevations, curves, stations and speeds for all CN trackage; (ii) the Right Time Business Intelligence ("RTBI"), a web-based tool that provides a visual representation of the current state of CN's infrastructure (including the location of track, sidings, crossovers, *etc.*); and (iii) track charts, operating bulletins, and dispatcher screens.[6]

Data related to traffic on the two corridors includes CN's train service plan and historical traffic volumes. Data related to train operations includes information about the historical operating characteristics of specific trains (*e.g.*, the number of locomotives, cars, and horsepower-per-ton), where those trains operate on the two corridors (*e.g.*, origins and destinations), and where those trains stop to perform work or change crews. Data for these two elements are contained in CN's Data Warehouse, a corporate database containing detailed historical train information (*i.e.*, times, schedules, and consists) for the CN system, including historical data from many other CN's information systems.

In addition to the specific data sources described above, information was obtained through discussions with the Network Operations department (which includes the Service Design, Motive Power, and Measures groups) and regional and local operating officers (such as CN's dispatchers, superintendents, and train masters), and through field trips to areas of the network in order to familiarize ourselves with local track facilities and operations.

---

[6] These documents can be found in the folder "Manuals, TT's, etc." on the DVD containing the workpapers that support this statement.

Once the data were collected, it was formatted into files (generally, text-based tables) that could be used by our simulation software. As the data were processed and formatted, they were verified against actual operations in order to confirm they were accurate and up-to-date. For example, the freight traffic volumes we proposed to use in the model, which were based on average 2013 volumes, were reviewed with CN's Service Design department and regional operating officers, and compared to the core service plan in effect at the time. The representative plant we proposed to use was compared to the infrastructure shown on dispatcher screens, current timetables, and various other CN sources (*e.g.*, engineering track charts, RTBI, and operating bulletins). Details regarding train operations, such as dwell, operating times, frequencies and extents, were validated through an iterative process of data collection and review with the operating department and the regional and local operating officers.

Once we verified the data we had collected, we ran our simulations and analyzed the results. Our model used two primary software simulation tools: a Train Performance Calculator ("TPC") and Route Capacity Model ("RCM").[7]

The TPC is a computer program that: precisely models the physics of the movement of a single train over a piece of track; calculates time, distance, and speed values for the train as it moves over that track; and produces a table of information containing the train's speed and time at regular intervals as it moves over the track. It is used by CN to develop CN's train schedules and service plans. The TPC calculates the Minimum Run Time ("MRT") across the territory for trains used in the model and provides them for use by the RCM.

[7] The user manuals for these programs, which contain detailed information about their capabilities and functioning, are included as workpapers "TPC Manual (1987 Reference Material).pdf," "TPC Manual (notes).pdf," and "Route Capacity Model - Users Manual.pdf," all of which can be found in the folder "Manuals, TT's, etc." on the DVD containing the workpapers that support this statement.

The RCM is CN's primary line-simulation program, and is used to analyze the interaction of different infrastructure, traffic, and operational parameters. It is a controlled, reproducible, event-based computer simulation tool used to measure the operational impact (in terms of train delay) of changes in a certain parameter while holding other parameters constant. The model is easy to setup (because it uses text data tables), quick to run (*e.g.*, it takes approximately 10 seconds for it to model 9 days of operations on the IC corridor), and provides input-specific replicable results (*i.e.*, the model will reproduce identical results given identical inputs). Because RCM will make the same dispatching decisions unless there is a change to the discrete events of a train at a location, it provides an effective means to compare scenarios and measure the effect of specific changes and/or alternatives (such as different service levels, dispatch decisions or infrastructure improvements). The RCM also allows the user to interact with the simulation through a variety of dispatching commands in order to override the default dispatching decisions of the model. This flexibility allows for modeling that is more realistic, more accurate, and more consistent between the various scenarios.

The output of the RCM includes both time-distance plots for each train in the simulation, as well as aggregate data related to the delays experienced by those trains. In our analysis, we used the time-distance plots to visually identify locations of conflict where additional infrastructure could be useful in reducing delay between freight and passenger operations. The more detailed model outputs were used to measure the delay to freight both globally (*i.e.*, total delay for the entire corridor and all days of simulation), as well as in detail (*i.e.*, for each individual segment of the corridor for each day of the simulation). This approach allowed us to compare the results of each scenario in terms of total train delay, and the change in delay for each segment (for each day) which helped us to identify where delay was occurring and develop plant enhancements to reduce the conflicts causing the delay. In addition, other capacity analyses (such as return grid calculations, track occupancies, meet delays, *etc.*) were conducted to confirm both the capacity pinch-points on the corridor, and the potential means to increase/improve capacity in those areas (*i.e.*, cross-overs, service track, sidings, double track, *etc.*).

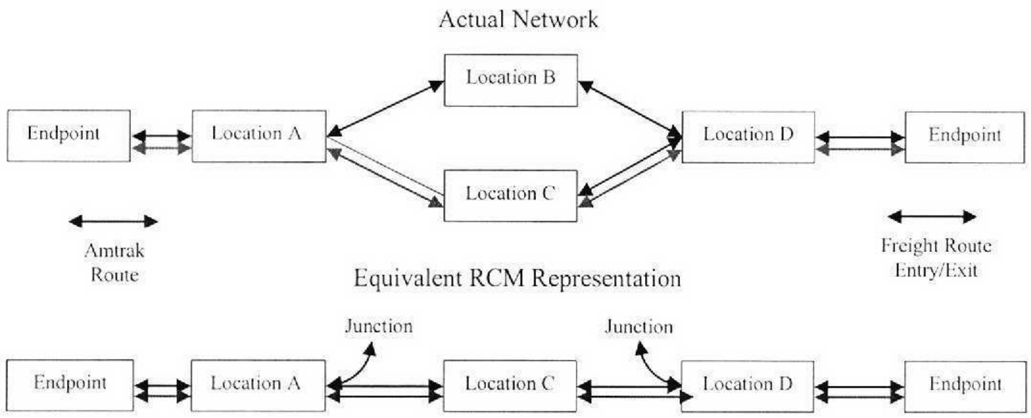
The following sections explain the process summarized above in more detail.

III. Identifying and Coding the Representative Plant for the Model

The first step in our modeling process was to build a representative description of the existing infrastructure on the two corridors which would be input into our simulation software. While delays caused by Amtrak undoubtedly have ripple effects that extend beyond the subdivisions that Amtrak operates on, in order to avoid the overwhelming complexity of attempting to model the entire CN network, we selected endpoints for the two corridors that would encompass a sufficient portion of CN's network to accurately capture the direct freight train interactions with Amtrak. For the IC Corridor, we selected the two Amtrak terminals – Chicago Union Station and New Orleans Union Passenger Terminal ("NOUPT") – as the two endpoints to define the corridor. For the GTW Corridor, we selected South Bend, IN and Port Huron, MI as the two endpoints to define that corridor.

With the corridors of interest defined, we collected data about the railroad infrastructure along the route between the endpoints. Both the RCM and TPC model a linear representation of a rail corridor and require a non-branching route description. To handle situations of branching freight traffic (*i.e.*, multiple subdivisions with common end points, such as CN's Bluford Subdivision, which runs parallel to CN's Cairo and Centralia Subdivisions but is not part of

Amtrak's route), junctions were used to allow freight trains to enter and exit the simulation at branch points, as shown on the following diagram.[8]



Once the simulation route and end points were selected, we collected the underlying physical track data for input into the models. This was a two-step process. First, we collected the topographical (*i.e.*, elevations and curves) and track speed data that would allow us to code the various files necessary to run the TPC. Next, we collected specific track data (*i.e.*, double track, sidings, cross overs, and junctions) that would allow us to build the various plant input tables used by RCM.

A. Summary of Corridors

The IC Corridor contains 934 miles of primarily north-south trackage between Chicago Union Station and the NOUPT. The corridor is predominantly CTC-controlled single track, with sidings and short sections of double track between major terminal areas.

The simulated route follows the following subdivisions from north to south:

[8] Modeling was, of course, limited to the trains that entered and exited the model. However, as described in more detail below, we used variables to control that entry and exit in order to model those patterns realistically.

Subdivision	Start Location	End Location
Foreign – Amtrak	Chicago Union	Clark Street
CN Chicago Sub	Clark Street	Champaign Yard
CN Champaign Sub	Champaign Yard	Sandoval JCT
CN Centralia Sub	Sandoval JCT	Illinois
CN Cairo Sub	Illinois	Fulton Yard
CN Fulton Sub	Fulton Yard	Hollywood Yard
CN Shelby Sub	Hollywood Yard	Lakeview
CN Yazoo Sub	Lakeview	Jackson Yard
CN McComb Sub	Jackson Yard	Southport JCT
Foreign – Amtrak	Southport JCT	NOUPT

Some freight traffic uses an alternate parallel route – CN's Bluford Sub – between Edgewood Junction (on the Champaign Sub) and Fulton Yard (on the Fulton Sub). Freight traffic using this route was coded to enter and exit the simulation at the aforementioned junction locations, therefore bypassing the Cairo, the Centralia, and a portion of the Champaign Subs.

The GTW Corridor contains 234 miles of primarily east-west track between South Bend, IN and Port Huron, MI. Almost half of the corridor (approximately 111 miles) is double track, while the balance is single track with sidings. The simulated route from real-world east to west is as follows:

Subdivision	Start Location	End Location
CN Flint Sub	Port Huron	Tappan
CN Flint Sub	Tappan	Battle Creek Yard
CN South Bend Sub	Battle Creek Yard	South Bend

Amtrak's route includes only the 158 mile portion between Port Huron and CP Gord; this portion contains 106 miles of single track and 52 miles of double track. The western portion of the simulation territory was extended beyond the endpoint of Amtrak service (CP Gord) to South Bend, the next major station west of Battle Creek, to ensure that the effect of Amtrak on freight traffic moving west of Battle Creek would be properly captured. The six daily trains on Amtrak's Wolverine service operate over a 1.2 mile portion of this corridor, with cross-plant train moves between CP Baron (South Bend Sub MP 176.7) and CP Gord (MP 175.5). These movements, including their station stop at Battle Creek, were included in the simulation of the GTW Corridor.

B. Data Collection for and Construction of TPC Route Files

The TPC program's primary function in the modeling process is to calculate Minimum Run Times ("MRTs") for specific train consists between defined points and with no other traffic present. Once the simulation route and end points have been selected, underlying topographical track data (elevations, curves, speeds) is collected and coded into TPC files that are used by the TPC in computing these MRTs. TPC files were therefore created for both the IC Corridor and the GTW Corridor.[9]

TPC files are built from two types of track data files: permanent and temporary. The permanent track data files are stored on CN's mainframe. Prior to the simulation, CN's permanent track database contained all of the track segments for each corridor with the exception of the two Amtrak segments within the passenger terminals on the IC Corridor: Chicago Union Station to Clark Street and Southport Junction to NOUPT. Station locations, speeds, elevations, and curves for these segments were collected using a combination of data measured from Google Earth and timetables effective in 2007 sourced from the Chicago Operating Rules Association (CORA) and from Amtrak (for NOUPT trackage).[10] We then added these two segments to the CN TDMS data base for use by the TPC, using the TDMS, mainframe interface for updating or supplementing the permanent track data files. The purpose of temporary track data files is to

---

[9] Each route file was assembled with the track segments (subdivisions) listed in consecutive order by direction (two route files were created for each corridor, one for each direction). The TPC route files specify how the files are used and arranged to define the path of the train form origin to destination. The various TPC files can be found in our workpapers.

[10] TDMS also assembles track data in the format required as input for TPC runs.

provide a means to run a TPC using alternative (temporary) input data while maintaining/protecting the permanent TDMS database.[11]

The track data files used by the TPC contain information about the elevations, curves, speed (including any permanent speed restrictions), station locations, and other physical characteristics of the track. Some of this track information can change over time (*e.g.*, speeds and station locations). Therefore, track information must be reviewed prior to a TPC run in order to verify it is current, and temporary track data files must be created if updates are required. In this case, in order to verify that track information was current, we reviewed CN's current timetables and operating bulletins, and temporary track data files were created and/or updated as required to reflect the current operational realities. In addition, the speed files for both passenger and freight trains were reviewed in detail using the current timetable and current operating bulletins. This included a review of turnout speeds and main track specific speeds for double track sections.

C. Data Collection for and Construction of RCM Plant Configuration Table

RCM uses a text flat file, called a spec file,[12] to input the plant, traffic and operating information needed to run the model. The RCM input file (spec file) contains a number of tables with specific plant, traffic & operating data that make up the Scenario to be simulated. The spec file contains 5 tables which define the characteristics of the plant in the model: the Plant Configuration Table, the Terminal Description Table, the Siding Exceptions Table, the Double Track Exceptions Table, and the Junction Definition Table.

---

[11] This allows for effective "What-if" analysis that requires changes to the base TDMS data to reflect changes in operation.

[12] A copy of these text files can be found in the folder "RCM Spec Files" on the DVD containing the workpapers.

In RCM, as in most network simulation tools, it is necessary to develop a continuous milepost system for distance representation. Many real-world subdivisions have discontinuities within their own milepost systems, and linking together subdivisions with increasing and decreasing mileposts and possible discontinuities between subdivision milepost systems can cause challenges when modeling. Accordingly, prior to coding the plant in RCM, a continuous milepost system was established for the simulation territory. For each corridor, we used an Excel file to create a system of RCM mileposts and record their mappings to subdivision mileposts and location names, and created a secondary lookup table for mapping location names to RCM mileposts.[13]

1. Plant Configuration Table

The Plant Configuration Table, an excerpt of which is shown below as Figure 1, is the main table used to define the overall structure of the plant in RCM. Since RCM's plant representation is always non-branching (*see* introductory discussion to Section III, above), the plant of a given corridor can be thought of as a table, with each row forming the next piece of the plant. In the plant table each row is known as a Switch Milepost, whether an actual switch is present or not. A Switch Milepost will generally correspond to a timetable location or other discrete element (such as a junction, diamond, cross-over, etc.) and is assumed to be a controlled signal location. An excerpt from the RCM Plant Configuration Table is reproduced below.

[13] These files are included in the workpapers.

Figure 1
Excerpt from Plant Configuration Table

SWITCH MILEPOST	NAME	SWITCH TYPE	TRACK TO EAST	# ESTBND INT SIG	# WSTBND INT SIG	TURNOUT SPEED	TURNOUT TRACK
066.72	DURAND__	P	S	I0	I0	25.0	
066.56	PITT_N__	P	P	I0	I0	25.0	
065.28	PITT_S__	P	S	I0	I0	25.0	
063.48	GAINES_N	P	P	I0	I0	25.0	
062.21	GAINES_S	P	S	I6	I6	25.0	
046.00	HOLLY_N_	P	P	I0	I0	25.0	
044.56	HOLLY_S_	P	S	I2	I2	25.0	
038.72	ANDERS_N	P	P	I0	I0	25.0	
037.35	ANDERS_S	P	S	I1	I1	25.0	
033.30	WATERFRD	P	S	I1	I1	25.0	
030.02	WEST_PON	P	D	I0	I0	45.0	SOUT
029.06	AUBURN__	P	D	I0	I0	25.0	BOTH
028.32	WEST_BLV	P	T	I0	I0	25.0	PONTIAC

The table contains 8 columns: the first two contain the milepost and name of the switch, and the remaining six describe the track configuration that lies to the east of the switch.[14] Switch Type means whether it is a "power" or "spring" switch. The "Track to East" column defines whether the track following the Switch is single track, double track, a siding, or a terminal. The next two columns define the number of intermediate signals that exist before the next switch; these signals are used internally for headway calculations. The "Turnout Speed" is the track speed of all switches at this location, if any are present; trains not taking a turnout are not affected by this speed. Finally, the "Turnout Track," which is used only for areas of double track, defines the orientation of switches at either end of the double track.[15]

---

[14] The RCM has a built-in compass rose, with a hardcoded requirement that mileposts increase to the west. In other words, milepost 0.0 is always the easternmost point in RCM. This compass rose is only used for internal references and layout in the model to define turnout orientation and does not affect model output; all that matters is the relative orientation. For instance, on the IC Corridor, actual CN subdivision mileposts increase to the south, so real world south corresponds to model west. The Plant Configuration Table begins at the "westernmost" point in RCM's internal logic (the greatest milepost number) and each Switch is one point further "east," toward milepost 0.0.

[15] If the keyword "Both" appears in the Turnout Track column, it means for purposes of RCM that trains on either track will be affected by the turnout speed. It should also be noted that

To collect the information needed to build this table, we drew from CN's timetables information related to operating rules and requirements, such as station locations, track speeds, rail and highway grade crossing restrictions, yards, and junctions. We also drew from track charts information on sidings, switches, signals, single and double track locations, and mileages. We determined the number of intermediate signals between switches from track charts and signal drawings. And using track data on the screens of CN's dispatchers, we identified the primary corridor trackage for through train movements and the plant available to a dispatcher to resolve conflicts (*i.e.*, sections of track that are CTC-controlled, locations of powered switches, *etc.*).[16]

Locations for Amtrak station stops were added as needed so that the scheduled departure time would be enforced at the right location. Junctions were added for freight traffic (typically switchers) that work off-line (*i.e.*, do not block the main track). These locations were identified through interviews with CN transportation personnel familiar with the operations on the corridor. Data relating these locations to actual field mileposts came from track charts and from track layouts used by CN's dispatchers.

2. Terminal Description Table

Terminals are yard areas where a large number of trains originate and terminate (corridor origin and termination points must be included as terminals), or work off-line. Trains may also pass through terminal areas if they are not scheduled to stop there (for instance Amtrak may pass through a freight yard). In RCM, terminals are defined the same way as a normal segment

---

when a Switch is placed on a piece of double track in RCM, it defines a full crossover location, and only trains using the crossover functionality (changing tracks) in the model will be impacted by the turnout speed.

[16] The source files we reviewed and from which we obtained data for the RCM plant table are in our workpapers.

between Switches (*i.e.*, they span a non-zero distance, and have an East and West end) and each terminal is included as a row in the Plant Description Table.

The Terminal Description Table, an excerpt of which is shown below as Figure 2, defines the maximum number of eastbound, westbound, and total trains allowed to occupy the terminal simultaneously before a warning is generated. However, because terminals in RCM are areas of infinite capacity (in the sense that an unlimited number of trains can be held inside any one at a given time), exceeding the maximums contained in the table will not affect the model, it will only generate a warning that can be used in post-modeling analysis.

Figure 2
Terminal Description Table for IC Corridor

TERMINAL NAME	MILEAGE	TRACKS WEST	TRACKS EAST	TOTAL TRACKS
NOUPT___	926.33	5	5	10
SWITCHNR	751.23	5	5	10
WEST_JCT	536.03	5	5	10
FULTONYD	407.75	5	5	10
CHAMPAIN	128.95	5	5	10
MRKHM_YD	022.65	5	5	10
CHI_UNIO_	0.0	5	5	10

The following terminal locations were chosen for the IC Corridor:

- Chicago Union Station (MP 0.00)
- Markham Yard (MP 22.65)
- Champaign Yard (MP 128.95)
- Fulton Yard (MP 407.75)
- Harrison Yard (Memphis) (MP 536.03)
- Jackson Yard (MP 751.23)
- New Orleans Passenger Terminal (MP 926.33)

With the exception of the first and last terminals (which are origin and destination passenger stations), all these locations are major yards along the CN route where freight trains frequently stop, work, and may change crews.

The following terminal locations were chosen for the GTW Corridor:

- South Bend (MP 099.50)

- Battle Creek Yard (MP 180.81)
- Port Huron Yard (MP 333.68)

Battle Creek Yard is a major yard along the CN route where freight trains frequently stop, work, and change crews. South Bend and Port Huron Yard are the endpoints of the segments and therefore must be defined as terminals for purposes of RCM.

3. Siding Exceptions Table

The Siding Exceptions Table, an excerpt of which is shown below as Figure 3, is a simple table that serves to set a maximum length and/or tonnage for any given siding. The lengths for each siding were taken from CN's timetables and track charts.

Figure 3
Excerpt from Siding Exception Table

SIDING EXCEPTIONS

WESTERN SW MILEAGE	LENGTH (FEET)	WEIGHT (TONS)
911.43	11211	0
899.03	10180	0
880.63	12240	0
861.83	13046	0
847.33	9290	0
778.13	13842	0

This Table can also be used in situations where road crossings limit maximum length of a train in a siding, or when weight restrictions exist on the siding track. For example, on the IC Corridor, the Siding Exception Table was used to prevent loaded bulk trains from using a siding at Curve (RCM MP 469.16) because of a weight restriction on that siding.[17] On the GTW corridor, it was used to adjust the length of the multi-siding representing Flint Yard in order to more accurately reflect the length of tracks available.

[17] This restriction was put in place after discussions with CN's transportation employees, who noted that the grade on the siding prevented loaded bulk trains from starting from a stop in the siding.

4. Double Track Exceptions Table

As noted above, putting a switch location in the middle of double track in RCM gives full crossover functionality. The Double Track Exceptions Table, an excerpt of which is shown below as Figure 4, is used to specify crossover functionality at locations on double track where an exception is required to that default. This table is used, for example, at passenger stations on double track, where a Switch entry is made in the main Plant Configuration Table, but no crossovers (or only uni-directional crossovers) are available.

Figure 4
Excerpt from Double Track Exceptions Table

WESTERN SW MILEAGE	LENGTH NORTH	LENGTH SOUTH	CROSSOVER AT SWITCH
029.06	0	0	Z
025.55	0	0	Z
025.09	0	0	EN
017.65	0	0	Z
013.45	0	0	Z
013.09	0	0	Z
011.25	0	0	X
004.26	0	0	Z
003.01	0	0	Z
0.8	0	0	Z

The table also allows one to specify length restrictions on double track segments for the purpose of restricting the train length at a stop location. This would typically be used in the case of road crossings that reduce the available siding length to hold a train. Data for this table were taken from the timetables, dispatcher screens, and track charts.

5. Junction Definition Table

The Junction Definition Table, an excerpt of which is shown below as Figure 5, contains entries for every Switch where a train may enter or exit the simulation. The only places where trains can enter or exit the simulation are the Switches that define (a) the endpoints of the corridor, (b) junction locations, or (c) terminals. Junction configurations in RCM were based on dispatcher screens, timetables, and track charts.

Figure 5
Excerpt from the Junction Definition Table

SWITCH MILEAGE	TRACK FOR ENTERING WESTBOUND TRAINS	TRACK FOR ENTERING EASTBOUND TRAINS	CAN TRAINS ALSO TAKE OTHER TRACK (CROSSOVER ?)
029.06	NORT	NONE	NO
025.55	NONE	NORT	NO
011.25	SOUT	SOUT	YES
004.26	NORT	SOUT	YES
004.25	NORT	MAIN	YES
004.13	MAIN	NORT	YES

The columns for Track for Entering Trains[18] may have four different values that affect junction configuration:

- NORT/SOUT apply to double track areas only, and they select the default track on which trains enter the simulation;
- MAIN applies to single track areas, where there can only be 1 track for entry; and
- NONE means the connection is disabled for entering traffic (this is used to allow unidirectional connections).

The final column selects whether the entering train can enter on either track (in double track territory) regardless of whether a crossover is defined at this location.

D. Simplifying Assumptions

No model of complex rail operations can hope to account for every possible detail of the real world operations. In building our representative plant, our model included a number of simplifying assumptions. Some of these simplifications were necessary due to limitations in data sources or the modeling software, while others avoided unnecessary added complexity that would not have significantly changed or improved the simulation results.

1. Where turnout speed information could not be found in timetables, track charts, or signal drawings, an assumed value reflecting surrounding territory was used.

[18] Westbound and Eastbound refer to the internal RCM compass.

2. Unpowered sidings and small yards which are not generally used by CN's dispatchers in the dispatch of the through-corridor traffic were not included in the model, as these could not be used to resolve conflicts without significant delay.

3. Industrial spurs and unpowered yards where a freight train would clear to work off-line, and later return as another train movement, were modeled as junctions.

4. Diamonds controlled by foreign railroads were not included in the simulation. Modeling delays at these diamonds would have been difficult as the cross plant movements and traffic associated with these diamonds are unpredictable and occur outside CN's control. It was instead conservatively assumed that trains could move across these diamonds unimpeded, making the network more fluid, and tending to decrease delays and the infrastructure required to address them.

5. Markham Yard on the IC Corridor is a complex multi-track operating area that was modeled as a terminal, with the plant between Markham Yard and Stuenkel modeled as double track; this allowed us to reasonably approximate operations through this area as most freight activity occurs off the double main track through this zone.

6. Since the model does not permit branching, Amtrak's use of its station in Memphis, which is on a 17-mile section of track not used by CN freight trains, was approximated by having Amtrak stop within the terminal area of CN's Memphis Harrison Yard on the IC Corridor (where, within the model, it would have no impact on other traffic), and depart Harrison Yard at the scheduled time;, this allowed us to model the continuous flow of freight leaving and entering Harrison Yard while accurately accounting for Amtrak's use of the short 17-mile section of non-freight track.

7. The south side of Harrison Yard, where there is a double track with two mains that are not parallel and have different distances, was not capable of being accurately replicated in the model; instead, one of the routes was chosen, and all trains operated on it as if it were double track, thus maintaining equivalent functionality (two main tracks) while having a minimal impact on accuracy (slightly off run times for trains taking the other route).

8. Manual switches at work locations were coded as power switches, as RCM does not recognize hand operated switches. It was assumed the extra time to align a manual vs. power switch was included in dwell time of the train at the work location.

9. South Bend was used as a simulation end point on the GTW Corridor, as the corridor crosses the Norfolk Southern (NS) controlled territory at this location. This was a natural location to terminate the simulation, well outside of Amtrak's operating corridor.

These simplifying assumptions significantly reduced the time and effort required to set up and run the simulation, and were unlikely to have an impact on the modeling results. Moreover, if they had any significant overall effect, it would be to increase the efficiency and fluidity of the modelled operations, and thus likely decrease the freight delays attributed to Amtrak in Scenario 2 and the capital investment necessary in Scenario 3.[19]

IV. Selecting and Inputting the Traffic Package

Freight rail traffic patterns fluctuate throughout the year, but modeling an entire year's worth of operations would be prohibitively burdensome. Modelers therefore must choose an adequately representative period. We have found that use of a week's worth of traffic as a base, including operational variability of train times and consists, is sufficiently representative for our modeling purposes here, and we proceeded on that basis. A week of traffic is also consistent with CN's train service plans and the RCM model's traffic input requirements, both of which are based on a seven day period.

Rather than create an artificial idealized traffic package based solely on annual averages, which would require numerous assumptions regarding the time, frequency, and characteristics of each train and likely would be unrepresentative of an actual week (i.e. would have "on average" all trains, when some trains never run on the same day, at the same time, or with the same consists), we sought to increase accuracy and realism of our traffic package by basing it on the characteristics of the specific trains that ran during an actual week in 2013. This "Sample Week", was adjusted with minor additions or subtractions to trains as necessary to match the

---

[19] In other words, each assumption ignored a complexity or issue that could cause a delay in the model, which in turn would have required more plant to resolve.

average weekly volumes of the sample week train types with the average 2013 volumes on the corridor. The following section describes this process in more detail.[20]

Our first step was to obtain train history data for 2013, which at the time we began our modeling was the latest complete year. Because trains move on and off corridors at various locations and do not always traverse the entire corridor, we broke up each corridor into discrete segments for which traffic volumes could be compared across time periods.[21] We then chose a specific "observation point" on the main line of each segment at which we could compare train volumes between the 2013 averages and the proposed sample week.[22]

Table 1
Segments and Observation Points for Chicago to New Orleans Corridor

Segment	Observation Point
Chicago to Champaign	Kankakee
Champaign to Cairo Jct	Humboldt
Cairo Jct to Memphis (Harrison Yard)	Covington
Memphis (Harrison Yard) to Jackson	Rising Sun
Jackson to Orleans Jct.	Johnston
Orleans Jct. to New Orleans	Kenner

[20] Use of 2013 data also avoided relying on traffic volumes during the highly unusual operating circumstances of the first quarter of 2014 that were caused by extreme winter conditions. The workpapers containing the underlying data discussed in this section can be found in the folder "Traffic."

[21] To be most useful, these segments were defined by major origin/destination points, such as yards and junctions, where trains would enter or exit the corridor.

[22] CN has train reporting points (*i.e.*, geographic locations where data about the trains that move past the point are recorded) spread across its system. Some reporting points record more and higher quality data about the trains than others. In choosing a reporting point for a given segment, we balanced data availability and reliability issues with geographic and operational considerations. For example, locations where trains were likely to originate or terminate, such as yards and junctions, were avoided in order to capture more accurately the number of through trains operating on each segment.

Table 2
Segments and Observation Points for Michigan Corridor

Segment	Observation Point
Port Huron to Durand	Davison
Durand to Battle Creek	Potterville
Battle Creek to South Bend[23]	Baron, Marcellus

In reviewing the data, it became clear that no one week precisely matched 2013 average train volumes. For simplicity's sake, we therefore chose as our sample week the two weeks during which we were in the field discussing operations on each corridor with the local and regional operating departments. These were the week of April 29th for the IC Corridor and the week of October 21 for the GTW Corridor.

Train data for these sample weeks were pulled from the CN corporate data base and compared to the annual averages. At each observation point, the differences between the sample week and the 2013 averages were small (less than 1 train per day), as shown on the following tables:

Table 3
Total trains per week (excluding Locals) on the IC Corridor

Observation Point	2013 Average	Sample Week (Apr. 29 – May 5)	Difference
Kankakee	137.0	140.0	3.0
Humboldt	122.8	126.0	3.2
Covington	118.7	118.0	-0.7
Rising Sun	114.3	108.0	-6.3
Johnston	75.8	72.0	-3.8
Kenner	34.1	31.0	-3.1

[23] On this segment, Baron captures cross-plant Amtrak moves, while Marcellus captures main line traffic volumes over this section.

Table 4
Total trains per week (excluding Locals) on the GTW Corridor

Observation Point	2013 Average	Sample Week (Oct. 21 – Oct. 27)	Difference
Davison	89.0	91.0	2.0
Potterville	122.4	126.0	3.6
Baron	170.9	166.0	-4.9
Marcellus	118.7	119.0	0.3

Once we had extracted the raw data from the sample week, we performed two relatively minor adjustments in order to make them more representative of a typical week.

First, we reviewed and adjusted some train counts to make the train's operation compatible with the simulation input. In pulling data for the sample week, the issue of "partial" trains already on the corridor (*i.e.*, trains that had originated prior to, or reached their destination after the close of the sample week) had to be adjusted. For these trains we generally eliminated the count of the train that started before the sample and extended the count of the train that had not completed its journey by the end of the sample week. The end result was that a daily train was assumed to appear 7 times at each observation point it was scheduled to pass in the sample week, even if in reality it appeared 6 or 8 times at a particular observation point in the raw data for the sample week.

Second, we reviewed the data for anomalies or exceptions and made minor adjustments to "clean" the raw data. Unusual moves or moves not reflective of typical main line corridor operations were removed, added, or adjusted in the count. For example, if a train took a different routing on a particular day that deviated from its normal service plan, we assumed instead that it ran according to plan on that day. Likewise, if a daily train terminated early on one of its runs during the week, we assumed the train operated according to its full service plan. It was found that Amtrak volumes, in particular on the GTW Corridor, were lower during the sample week than the regular scheduled service; this was likely due to cancellations caused by construction, missed reporting, or other unknown reasons. For simulation purposes, we assumed all Amtrak trains operated pursuant to their schedule.

These adjustments made to the train counts in the sample week, are summarized in the following tables:

Table 5
Adjustments to IC Corridor train volumes to correct data anomalies

Observation Point	Sample Week (raw)	Sample Week (cleaned)	Adjustment from raw
Kankakee	140.0	140.0	0.0
Humboldt	126.0	129.0	3.0
Covington	118.0	120.0	2.0
Rising Sun	108.0	109.0	1.0
Johnston	72.0	72.0	0.0
Kenner	31.0	29.0	-2.0

Table 6
Adjustments to GTW Corridor train volumes to correct data anomalies

Observation Point	Sample Week (raw)	Sample Week (cleaned)	Adjustment from raw
Davison	91.0	91.0	0.0
Potterville	126.0	125.0	-1.0
Baron	166.0	174.0	8.0
Marcellus	119.0	118.0	1.0

Once we had clean data for the sample week, we added or subtracted trains in order to more closely match the 2013 Average. Decisions regarding which trains should be added or removed were based on an analysis of the traffic volumes by train type. For example, if there was a segment where the volumes in the Sample Week were below the 2013 Average (and therefore required the addition of a train), determining that coal trains were underrepresented on that segment compared to the 2013 Average would suggest that a coal train should be added, instead of a manifest or intermodal train. Likewise, determining which train types on which segments were overrepresented in the Sample Week on a given segment would suggest which trains were better candidates for removal.

The volume of core trains (*i.e.*, manifest and intermodal trains that are scheduled and run regularly) on both corridors in the adjusted Sample Week was very close to their 2013 Average volumes, as shown on the following tables.

Table 7
Difference in core trains on the IC Corridor between the 2013 Average and the cleaned sample week

Observation Point	2013 Average	Sample Week (cleaned)	Difference
Kankakee	86.3	86.0	-0.3
Humboldt	69.3	70.0	0.7
Covington	68.9	70.0	1.1
Rising Sun	56.4	56.0	-0.4
Johnston	42.0	42.0	0.0
Kenner	14.1	14.0	-0.1

Table 8
Difference in core trains on the GTW Corridor between the 2013 Average and the cleaned sample week

Observation Point	2013 Average	Sample Week (cleaned)	Difference
Davison	68.6	70.0	1.4
Potterville	87.3	90.0	2.7
Baron	95.6	97.0	1.4
Marcellus	95.6	97.0	1.4

Because grain and coal volumes tend to be low in the spring, bulk traffic levels were lower in the Sample Week than the 2013 Average on the IC Corridor. On the other hand, the number of "other" train types was higher during the Sample Week than the 2013 Average.[24] In contrast, the bulk and other train volumes on the GTW Corridor during the sample week were very close to the average for the entire year. The differences between the adjusted sample week and the 2013 average for bulk and "other" train types are shown in the following two tables:

Table 9
Difference in bulk and other trains on the IC Corridor between the 2013 Average and the adjusted sample week

	Total Bulk Trains per week			Total Other Trains per week		
Observation Point	2013 Average	Sample Week (cleaned)	Difference	2013 Average	Sample Week (cleaned)	Difference
Kankakee	2.9	2.0	-0.9	5.9	10.0	4.1
Humboldt	6.0	5.0	-1.0	5.6	12.0	6.4
Covington	31.5	26.0	-5.5	4.4	10.0	5.6
Rising Sun	33.4	29.0	-4.4	10.5	10.0	-0.5
Johnston	17.8	15.0	-2.8	2.1	1.0	-1.1
Kenner	5.9	1.0	-4.9	0.3	0.0	-0.3

Table 10
Difference in bulk and other trains on the GTW Corridor between the 2013 Average and the adjusted sample week

	Total Bulk Trains per week			Total Other Trains per week		
Observation Point	2013 Average	Sample Week (cleaned)	Difference	2013 Average	Sample Week (cleaned)	Difference
Davison	1.3	3.0	1.7	5.2	4.0	-1.2
Potterville	7.4	8.0	0.6	13.8	13.0	-0.8
Baron	7.4	8.0	0.6	15.8	13.0	-2.8
Davison	7.4	8.0	0.6	15.7	13.0	-2.7

[24] For purposes of this analysis, "other" trains include all trains that are not scheduled core trains or bulk trains. Many of these trains are "extra" core trains – *i.e.*, trains that run in place of or in addition to a scheduled core train, but do not run according to a set schedule. Examples include trains that operate when the available traffic exceeds the capacity of the scheduled core trains or trains that operate in place of the core train over a segment, if the core train is late arriving to serve that segment.

Bulk and other non-core trains do not run to a schedule, and can operate on the line at any time of any day. They are therefore interchangeable for purposes of adding or subtracting trains.

Table 11
Combined bulk and other trains on the IC Corridor

Observation Point	2013 Average	Sample Week (cleaned)	Difference
Kankakee	8.8	12.0	3.2
Humboldt	11.6	17.0	5.4
Covington	35.9	36.0	0.1
Rising Sun	43.9	39.0	-4.9
Johnston	19.9	16.0	3.9

Table 12
Combined bulk and other trains on the GTW Corridor

Observation Point	2013 Average	Sample Week (cleaned)	Difference
Davison	6.5	7.0	0.5
Potterville	21.2	21.0	-0.2
Baron	23.2	21.0	-2.2
Marcellus	23.1	21.0	-2.1

Based on the foregoing analysis, we made the following adjustments to weekly train volumes for each segment of the IC Corridor:

Core trains per week

Observation Point	2013 Average	Sample Week (cleaned)	Adjustment to sample week (cleaned)	Simulation total	Difference between simulation and 2013 average
Kankakee	86.3	86.0	1.0	87.0	0.7
Humboldt	69.3	70.0	1.0	71.0	1.7
Covington	68.9	70.0	1.0	71.0	2.1
Rising Sun	56.4	56.0	0.0	56.0	-0.4
Johnston	42.0	42.0	0.0	42.0	0.0
Kenner	14.1	14.0	0.0	14.0	-0.1

Bulk trains per week

Observation Point	2013 Average	Sample Week (cleaned)	Adjustment to sample week (cleaned)	Simulation total	Difference between simulation and 2013 average
Kankakee	2.9	2.0	0.0	2.0	-0.9
Humboldt	6.0	5.0	0.0	5.0	-1.0
Covington	31.5	26.0	2.0	28.0	-3.5
Rising Sun	33.4	29.0	5.0	34.0	0.6
Johnston	17.8	15.0	4.0	19.0	1.2
Kenner	5.9	1.0	5.0	6.0	0.1

Other trains per week

Observation Point	2013 Average	Sample Week (cleaned)	Adjustment to sample week (cleaned)	Simulation total	Difference between simulation and 2013 average
Kankakee	5.9	10.0	-4.0	6.0	0.1
Humboldt	5.6	12.0	-7.0	5.0	-0.6
Covington	4.4	10.0	-5.0	5.0	0.6
Rising Sun	10.5	10.0	0.0	10.0	-0.5
Johnston	2.1	1.0	0.0	1.0	-1.1
Kenner	0.3	0.0	0.0	0.0	-0.3

Combining the adjustments to the bulk and other train volumes with the core train volumes resulted in the following final train counts for the IC Corridor simulation:

All trains per week

Observation Point	2013 Average	Sample Week (cleaned)	Adjustment to sample week (cleaned)	Simulation total	Difference between simulation and 2013 average
Kankakee	137.0	140.0	-3.0	137.0	0.0
Humboldt	122.8	129.0	-6.0	123.0	0.2
Covington	118.7	120.0	-2.0	118.0	-0.7
Rising Sun	114.3	109.0	5.0	114.0	-0.3
Johnston	75.8	72.0	4.0	76.0	0.2
Kenner	34.1	29.0	5.0	6.0	0.1

We made the following adjustments to weekly train volumes for each segment of the GTW Corridor:

Core trains per week

Observation Point	2013 Average	Sample Week (cleaned)	Adjustment to sample week (cleaned)	Simulation total	Difference between simulation and 2013 average
Davison	68.6	70.0	-1.0	69.0	0.4
Potterville	87.3	90.0	-1.0	89.0	1.7
Baron	95.6	97.0	0.0	97.0	1.4
Marcellus	95.6	97.0	0.0	97.0	1.4

Bulk trains per week

Observation Point	2013 Average	Sample Week (cleaned)	Adjustment to sample week (cleaned)	Simulation total	Difference between simulation and 2013 average
Davison	1.3	3.0	-1.0	2.0	0.7
Potterville	7.4	8.0	-1.0	7.0	-0.4
Baron	7.4	8.0	-1.0	7.0	-0.4
Marcellus	7.4	8.0	-1.0	7.0	-0.4

Other trains per week

Observation Point	2013 Average	Sample Week (cleaned)	Adjustment to sample week (cleaned)	Simulation total	Difference between simulation and 2013 average
Davison	5.2	4.0	0.0	4.0	-1.2
Potterville	13.8	13.0	0.0	13.0	-0.8
Baron	15.8	13.0	1.0	14.0	-1.8
Marcellus	15.7	13.0	1.0	14.0	-1.7

Combining the adjustments to the bulk and other train volumes with the core train volumes resulted in the following final train counts for the GTW Corridor simulation:

All trains per week

Observation Point	2013 Average	Sample Week (cleaned)	Adjustment to sample week (cleaned)	Simulation total	Difference between simulation and 2013 average
Davison	89.0	91.0	-2.0	89.0	0.0
Potterville	122.4	125.0	-2.0	123.0	0.6
Baron[25]	170.9	174.0	0.0	174.0	3.1
Marcellus	118.7	118.0	0.0	118.0	-0.7

Once these final volumes were established, we had to determine the characteristics of the trains to be added and the specific trains to be removed. On the IC Corridor, all adjustments were additions or subtractions of full trains over various segments. Specifically, we added eight G-type grain trains, two C-type coal trains, and one Q-type intermodal train and omitted seven X-type "other" trains. On the GTW Corridor, we made the following specific adjustments: we removed, at random, one of the three U-type bulk trains; we extended an X-type "other" train further back to another origin; and we truncated an M-type core train. Any new train added to the simulation traffic package was randomly assigned a start time from 00:00 to 24:00, consistent with the principle that bulk and other trains do not have consistent start times, and could operate over the corridor at any time.

Foreign trackage rights trains, which are not captured by CN's automatic train recording system, were operating on CN's lines in both the IC Corridor and the GTW Corridor during the Sample Week. Therefore, reflecting Sample Week operations, for the final simulation we included 14 NS trains per week through the Kankakee observation point on the IC corridor and 14 CSXT trains per week operating through the Davison point on the GTW Corridor.

[25] The 3.1 train per week difference at the Baron observation point includes 4 passenger trains per week missing from the raw data, likely due to the frequent cancellation of some passenger trains due to construction, missed reporting, or other unknown reasons. Without this issue, the difference is only -0.9 trains per week.

In addition, Local trains (L and R types) that switch the industries on the territory had to be taken into consideration. These trains operate at a mixed combination of regularly-scheduled service to variable day-to-day service as required. Automatic reporting can also be different for these trains, which in some cases leads to missing or unreported trains. Therefore, for these trains, we decided as a starting point to have in-depth meetings with operating personnel familiar with their typical operations. Historical volumes and train schedules, where available, were used to supplement these discussions, and those three pieces of information were integrated to achieve a reasonable week of switching service.

Amtrak trains were assumed to operate per their schedule, and were further assumed to arrive to their origination point on the CN line at their scheduled arrival time.

V. **Determining Representative Train Operations**

We reviewed a variety of sources in order to understand the representative operations of the two corridors. In particular, we reviewed historical data from 2013 in order to understand the routing, operational characteristics, and timing of the freight trains in the traffic package. We also obtained information from CN operational personnel regarding some nuances of train operations that would not necessarily be obvious from the data alone.[26] In general, we assumed operations proceeded according to the plan in place at the time,[27] subject to the parameters described below.

[26] For example, the limits of the Lansing Yard (on the GTW Corridor) include several stations on CN's main line. Through our discussions with local operating personnel, we learned that scheduled dwell time at this yard includes some travel time on the main line; to avoid double-counting this travel time, we removed it from the simulation's scheduled dwell time, as the simulation would have already accounted for the travel time in the TPC run.

[27] This is a conservative assumption, as the day-to-day realities of railroad, which include inclement weather, mechanical breakdowns, track repairs, and other unpredictable events that increase delays, would further strain the capacity of these corridors.

A. Train consists

Like train volumes, train consists (the number of loads, empties, train length, number and horsepower of locomotives, and horsepower-per-ton ("HPT")) fluctuate over time. In order to reduce the complexity and coding burden, we assumed that trains that operated on multiple days in the model operated with the same operational parameters each day. We used the following methodology in creating the train consists for each train in the model.[28]

For core, bulk and other trains we used the 66.7 percentile of trains (*i.e.*, the average plus one standard deviation) that operated in 2013 to establish train lengths. Core trains all have a target HPT, and we used these targets for the core trains. For bulk and other trains we used as a minimum (a) the target HPT in the schedule they ran on during the sample week, or (b) the actual HPT of the train in the sample week. In cases where data were missing or incomplete and for bulk trains added during the adjustment phase, we substituted historical data or data from similar trains.

To determine the appropriate consist for each Amtrak train, we used a summary of Automatic Equipment Identification ("AEI") reader records showing Amtrak train IDs and counts of locomotives and cars for the period January 1, 2013 to October 28, 2013 (inclusive). The most frequently used consist for each train was used for the RCM simulations.[29]

Other consist information concerning passenger trains was developed from information concerning Amtrak's specific locomotives and cars. Amtrak's standard locomotive in the two corridors is the P42 (4200 hp). Length, weight, resistance, and tractive effort information for this

---

[28] Statistics and operational parameters of each train in the model are included in our workpapers.

[29] This method has the benefit of effectively ignoring both outliers (such as special trains) and data gaps (such as train records indicating 0 locomotives).

locomotive type was extracted from CN's TPC locomotive library, as was separate tractive effort information for different levels of head-end power (HEP) draw.[30] Passenger car weight, length, and resistance information for both Amtrak's "Amfleet" coaches and its "Superliner" equipment was taken from publicly available information.[31]

Amtrak car resistance information was converted to the required TPC format using CN's standard "Davis equation based" formulas from the TPC Manual ("Engineering Principles" section). Braking force was calculated using CN's standard formula in the same manual using the deceleration rate for conventional passenger equipment. Consist text files for the passenger trains were then created using the same format as described above for the freight train consists.

Once we had created the list of freight and passenger trains and their operating parameters, we grouped them into "families" with like operating characteristics for purposes of TPC and dispatching priority (*e.g.*, train type, tonnage, length, and HPT) and conducted a TPC run for each family of train.[32] We also added each family of trains to the table "Train Data – Speed Classes," an excerpt of which is included below.

---

[30] Amtrak locomotives that operate on CN's lines draw electrical power for the heating and lighting of the cars from the locomotive's electrical generator. The kilowatt HEP draw reduces the power available to the traction motors and therefore impacts the tractive effort available for pulling the train.

[31] This information is contained in our workpapers.

[32] The specific families can be found in the RCM files in our workpapers.

Figure 6
Excerpt from Train Data - Speed Class Table

TRAIN DATA - SPEED CLASSES

SPEED CLASS	DIR E/W	HDWY ST	HDWY DT	PRTY 0-99	TRN TYP	W/P	CLASS LNGTH	GRS TONS	TRLNG TONS	AVG CAR WT
NB-E295A	E	0.00	0.00	55.00	E	1.833	8000	10080	9660	68.03
NB--E295	E	0.00	0.00	55.00	E	1.008	8000	10080	9660	68.03
NB-E295D	E	0.00	0.00	55.00	E	1.260	8000	10080	9660	68.03
NB--Q195	E	0.00	0.00	60.00	E	0.664	10000	14280	13860	69.65
NB--L551	E	0.00	0.00	10.00	F	1.213	5000	5460	5040	69.04
NB-L508A	E	0.00	0.00	10.00	F	1.213	4000	5460	5040	69.04
NB--L598	E	0.00	0.00	10.00	F	1.260	7000	8190	7770	69.38
NB--M301	E	0.00	0.00	50.00	F	1.500	9000	10080	9660	68.03
NB--X396	E	0.00	0.00	50.00	F	1.260	6000	8190	7770	69.38

Among other things, this table defines the primary characteristics of each train in the simulation, its dispatching priority (0 being the lowest possible priority, and 99 the highest), its weight-to-power (the inverse of its HPT) ratio, its length in feet, and its tonnage.

Of particular interest from the TPC results was the MRT the TPC calculated for certain Amtrak trains, as it appears the PRT in Amtrak's schedule is insufficient for some trains. A comparison between the PRT in the schedule for those trains and the MRT calculated by CN's TPC is shown on the following table.

Table 13
Comparison of schedule and TPC-based run times

				Difference	
Train(s)[33]	Segment endpoints	Minutes of PRT in Amtrak schedule	Minimum run time from TPC	Minutes	Percentage
58	Southport Jct – Clark St.	914.0	933.0	(19.0)	-2.1%
59	Clark St. – Southport Jct.	892.0	928.0	(36.0)	-4.0%
390 / 392	Carbondale – Clark St.	265.0	280.5	(15.5)	-5.8%
391 / 393	Clark St. – Carbondale	265.0	279.1	(14.1)	-5.3%

[33] For trains 58-59, the consist used in the TPC run was 1 P42 locomotive and 9 Superliner cars. For trains 390-393, the consist used was 1 P42 locomotive and 7 Horizon / Amfleet cars.

It should also be noted that the MRT calculated by the TPC is just that – a theoretical minimum based on optimal track and operating conditions (*e.g.*, no other traffic, optimal locomotive performance, dry weather, no wind, no wheel slip, *etc.*) and train handling characteristics (*e.g.*, optimal timing of brake applications and accelerations). CN regularly adds a 4% allowance to TPC-calculated MRTs in its passenger schedules to account for things like locomotive inefficiencies, head winds, wheel slippage, and human deficiencies in train operations (*e.g.*, braking sooner than optimal, accelerating more slowly than optimal, *etc.*). CN also adds a 5% allowance for TSO (temporary slow order) that arise from the frequent / constant track inspections which are inherent to safety & maintenance aspect of a freight railroad.

Separate from this capacity modeling exercise, TPC runs were conducted to estimate the amount of time lost when an Amtrak train operates through a crossover. These TPC runs were conducted with a variety of different Amtrak consists and representative track and crossover speeds. Based on the results of these TPC runs, with the consists Amtrak has historically operated on the CN lines and at the track and crossover speeds that currently predominate in that territory, Amtrak should lose no more than two minutes when operating through a crossover.

B. Train schedules

Train schedules include two primary components: departure times and dwell times. The departure time is the time the train is scheduled to come on-line at its origin; in essence, this is the specific time the train is created in the simulation. The dwell times are the times the train is stopped – either on-line or off-line – in order to accomplish its scheduled work (such as passenger station stops, crew changes, switching cars at a particular customer location or switching cars in a yard, *etc.*). Every schedule for core trains in CN's network has a departure time at a yard or junction, as well as dwell time for scheduled activities.

In order to simulate real-world operations involving scheduled trains (which may be operating early or late as compared to their schedule) and unscheduled trains, train departure and dwell times in the model must include a certain level of variability from the schedule. It is important that the simulation consider the variation in freight departure times from yards, and freight work times both on and off-line, as these daily variations in schedule are part of regular railroad operations. Moreover, in this type of modeling, train schedules are the primary independent variables, and have the largest effect on the output of the simulation, since these variables dictate the locations of meets and overtakes, and therefore have a significant effect on the resulting delays.[34]

1. <u>Train departure times</u>

For purposes of RCM, train departure information is contained in the table "Scheduled Trains," an excerpt of which is included below.

[34] Secondary variables (such as train performance, consist, and length), and tertiary variables (such as weather-related delays, track outages, and equipment failure), generally play a much less important role in determining delays, and were not included in the modeling (other than using averages where applicable). Had such variables been included they would have introduced additional operational inefficiencies that would have tended to increase the capital investment in capacity necessary in Scenario 3.

Figure 7
Excerpt from Scheduled Trains Table

SCHEDULED TRAINS

SPEED CLASS	DEP. TIME	TRAIN NAME	DAYS OF WEEK (LIST OR 0)	FIRST SWITCH	LAST SWITCH	PERCENT EARLY	S.D. EARLY	S.D. LATE
NB-L508A	6.50	L574C	0	58.55	22.65	0.0	0.0	0.0
NB-L508A	10.40	L508A	0	435.00	407.75	0.0	0.0	0.0
NB-L508A	8.00	L532	25	517.35	486.85	30.0	15.0	30.0
NB-L508A	9.00	L536	357	653.33	603.83	30.0	15.0	30.0
NB-L508A	16.00	L536B	357	678.50	653.33	0.0	0.0	0.0
NB-L508A	9.00	L536C	246	653.33	579.43	30.0	15.0	30.0
NB--L551	15.50	L551	0	173.95	128.95	30.0	15.0	30.0
NB-L508A	17.00	L553A	0	125.25	82.25	30.0	15.0	30.0
NB-L508A	22.00	L555	0	82.25	61.45	30.0	15.0	30.0
NB-L508A	8.00	L557	0	406.15	373.65	30.0	15.0	30.0
NB-L508A	23.99	L562A	0	804.93	751.03	0.0	0.0	0.0
NB-L508A	9.75	L564A	234567	761.93	751.03	0.0	0.0	0.0
NB-L508A	9.50	L567	23456	804.93	780.44	30.0	15.0	30.0
NB-L508A	9.25	L567C	7	828.63	804.93	0.0	0.0	0.0
NB-L508A	19.00	L574A	23457	896.90	828.63	0.0	0.0	0.0
NB-L508A	20.50	L575	12345	828.63	804.93	30.0	15.0	30.0
NB-L508A	8.00	L589A	0	309.95	254.35	0.0	0.0	0.0
NB-L508A	7.50	L589C	0	925.33	922.63	30.0	15.0	30.0
NB-L508A	0.75	L595A	0	925.33	922.63	0.0	0.0	0.0

The Train Schedule table contains all trains in the simulation. For each train, the table specifies the speed class for the train (which is linked to the TPC run for the train),[35] its scheduled departure time, the days of the week the train operates (0 in this field means the train operates every day), its origin and destination in the model (defined in terms of switch mileposts in the Plant Configuration table), and three variable parameters (Percent Early, Standard Deviation (S.D.) Early (measured in minutes), and S.D. Late (measured in minutes)), which serve to define the shape of the distribution used to generate train departure times in the model.

2. Train dwell times

For purposes of RCM, train dwell information is contained in the table "Train Stops – Scheduled Trains," an excerpt of which is included below.

[35] As the table demonstrates, there are multiple trains within each speed class.

Figure 8
Excerpt from Train Stops table

TRAIN STOPS - SCHEDULED TRAINS

TRAIN NAME	WEST SWITCH	AVG STOP TIME	ST. DEV.	EARLIEST DEPART.
L551A	155.25	30.00	0.00	0.00
L551A	159.05	30.00	0.00	0.00
L553A	82.25	71.48	20.00	0.00
L564A	761.93	90.00	20.00	0.00
L589A	288.65	45.00	0.00	0.00
L536C	624.93	75.00	15.00	0.00
L536C	653.33	33.50	0.70	0.00
L508	426.68	32.90	20.00	0.00
L508	437.65	45.00	0.00	0.00

This table lists each switch location in the Plant Configuration table at which a given train will stop. Thus, in the excerpt above, train L551A will stop twice – first at the location defined in the Plant Configuration Table at milepost 155.25 and then at the location defined at milepost 159.05. Dwell time variability of trains in RCM is controlled by 2 parameters – the average stop time and the standard deviation. Dwell time variability parameters for freight trains were based on a combination of the dwell times allowed in the schedules, discussions with Service Design and local operating officers, and historical analysis of actual dwell times; for the core, bulk, and other trains, the standard deviation was generally assumed to be 10% of the total dwell, capped at a maximum of 20 minutes. Zero variability was assumed for passenger trains. The Earliest Departure field was used only for passenger trains, which operate to a schedule that does not permit them to depart before a time certain (in other words, the train must stay in the station even after it has completed its allotted dwell if it is earlier than its scheduled departure time).

C. Amtrak Service Quality

The final aspect of train operations included in the modeling was the Amtrak service quality. CN ran two modeling simulations: the first assumed a monthly average endpoint OTP of 80%, while the second assumed a monthly average endpoint OTP of 90% for corridor trains and

85% for long-distance service trains.[36] The RCM allows a user to manually override the default dispatching decisions made by the model through the use of a command file. Using this feature we were able to generate results that closely matched those Amtrak service quality targets.

Professor Dubin determined the number of minutes of delay caused by freight trains and other passenger trains that a given Amtrak train could incur over the course of a month and still expect to arrive on time at its endpoint either 80%, 85%, or 90% of the time. *See* Dubin VS. We used the results of his analyses to set the "target" minutes of delay that a given Amtrak train could experience over the course of the model run. As we ran the model, we kept a running tab of the number of minutes of delay each train experienced, and we adjusted some meets and overtakes in order to have an end result that closely matched the target.

The "target" minutes and the average minutes of daily delay to each train in the two modeling scenarios that included Amtrak trains (Scenarios 2 and 3) are shown in the following tables:

Table 14
Target and Model delay minutes for 80% Endpoint OTP simulations

Train	Target	Scenario 2			Scenario 3		
		Model Results	Difference (mins)	Difference (%)	Model Results	Difference (mins)	Difference (%)
58	46.3	45.9	-0.4	-0.9%	45.0	-1.2	-2.7%
59	74.7	74.7	0.0	0.0%	74.1	-0.6	-0.8%
390	18.4	19.1	0.8	4.1%	18.1	-0.3	-1.4%
391	19.2	19.7	0.4	2.2%	20.3	1.1	5.8%
392	17.1	16.9	-0.2	-1.0%	17.0	-0.1	-0.7%
393	19.7	20.3	0.6	3.0%	19.4	-0.3	-1.6%

[36] As discussed above in note 4, we did not model the 80% endpoint OTP service target on the GTW Corridor.

Table 15
Target and Model delay minutes for 90%/85% Endpoint OTP simulations

Train	Target	Scenario 2			Scenario 3		
		Model Results	Difference (mins)	(%)	Model Results	Difference (mins)	(%)
58	37.95	37.7	-0.3	-0.7%	37.4	-0.5	1.3%
59	54.88	56.4	1.5	2.7%	53.7	-1.1	-2.1%
390	12.76	12.7	0.0	-0.1%	13.2	0.4	3.4%
391	13.57	13.4	-0.1	-1.1%	13.8	0.3	1.9%
392	12.36	13.0	0.6	5.2%	11.3	-1.1	-8.8%
393	9.75	9.7	-0.1	-0.7%	10.0	0.3	2.7%
364	9.8	9.9	0.2	1.9%	9.1	-0.7	-7.3%
365	11.1	11.6	0.5	4.3%	10.4	-0.7	-6.6%

VI. Using the Simulation Software to Quantify the Impact of Amtrak on CN

Once we had collected and input the data for the model, we ran a number of simulation scenarios in RCM in order to determine the incremental delay to CN freight trains caused by Amtrak. First, as Scenario 1, we simulated operations with only the representative freight traffic – and no Amtrak traffic – on the representative infrastructure on both the IC Corridor and the GTW Corridor. These two simulations established the baseline amount of delay (essentially lost transit time due to rail line capacity constraints) that would be expected to be experienced by CN trains in the absence of Amtrak. In Scenario 2, we added Amtrak trains to the mix, and held all other parameters constant. We dispatched the Amtrak trains so that they experienced a level of delay at which they would be expected to achieve a specified endpoint OTP as measured over the course of a month. As expected, the total amount of delay experienced by CN freight trains increased due to the presence of additional, high-priority trains on the corridor.

The following table shows the results for the different levels of Amtrak Endpoint OTP service.[37]

Table 16
Simulation results from Scenarios 1 and 2

Simulation	Scenario 1 (average hours of daily freight delay)	Scenario 2 (average hours of daily freight delay)	Difference (hours per day)	Difference (%)
Chicago to New Orleans: 80% OTP	39.8	64.8	25.1	63.1%
Chicago to New Orleans: 85%/90% OTP	39.8	67.2	27.5	69.1%
Battle Creek to Port Huron: 90% OTP	9.4	10.0	0.6	6.5%

After we determined the incremental freight delay in Scenario 2, we used an iterative process to add infrastructure to the existing plant in order to return freight delay levels as closely as possible to Scenario 1 levels while still meeting the specified Amtrak OTP target. We reviewed the time-distance plots generated by the RCM and performed a simple return-grid analysis,[38] and analyzed the simulation results on a day-by-day and segment-by-segment basis to determine the locations with the most significant Amtrak-caused congestion. Using our knowledge and understanding of the likely most cost-effective infrastructure improvements to alleviate freight delays, we added pieces of infrastructure in strategic locations. We then re-ran the simulation, and calculated the amount of Amtrak and freight delay. Finally, we fine-tuned the model by selectively adding and removing marginal pieces of new infrastructure until we reached our desired result: a reasonably cost-effective infrastructure additions that would allow

[37] More detailed results can be found in the workpapers "Simulation Results - Michigan Service - Scenario 3 (v3_01) Final.xlsx" and "Simulation Results - Chicago Service - Scenario 3 (v3_x8) Final.xlsx."

[38] The results of the return grid analyses are included in the workpapers in the folder "Capacity Cals."

Amtrak to operate at specified service levels without freight delays in excess of Scenario 1 levels.

Using this process iteratively we were able to offset almost all the marginal net freight delay attributable to Amtrak in Scenario 2 and, with additional fine tuning of infrastructure changes, we were able to achieve Amtrak performance closely aligned with our OTP goals.[39] Our results are shown in the following table:

Table 17
Comparison hours of daily freight delay between Scenarios 1 and 3

Simulation	Scenario 1 (average hours of daily delay)	Scenario 3 (average hours of daily delay)	Difference (hours per day)	Difference (%)
Chicago to New Orleans: 80% OTP	39.8	41.6	1.8	4.6%
Chicago to New Orleans: 85%/90% OTP	39.8	41.2	1.5	3.7%
Battle Creek to Port Huron: 90% OTP	9.4	9.4	0.0	0.2%

The infrastructure necessary to achieve these results is summarized on the following table; a schematic showing the precise locations of the required additional infrastructure is included as Exhibit 1.[40]

[39] The comparison of the minutes of delay in Scenario 3 to the "target" minutes of delay that correspond to a specified endpoint OTP % are shown above in Tables 14 and 15.

[40] The same schematics are included in the workpapers "Plant Requirements - Michigan Service - Scenario 3 (v3_01) Final.xlsx" and "Plant Requirements - Chicago Service - Scenario 3 (v3_x8) Final.xlsx."

Table 18
Summary of infrastructure necessary to mitigate Amtrak-related delays

Simulation	Miles double track	# of new sidings	# of extended sidings	# of full (bidirectional) x-overs	# of single (unidirectional) x-overs
Chicago to New Orleans: 80% OTP	64.2	12	3	9	16
Chicago to New Orleans: 85%/90% OTP	83.0	12	6	11	17
Battle Creek to Port Huron: 90% OTP	12.9	0	0	0	2

In addition to the infrastructure listed above for the Battle Creek to Port Huron corridor, a third track (with a different cost profile than the double track shown in Table 17) would be required to be installed between the control points of Baron and Gord (in Battle Creek, MI).

VII. Cost Estimates

Based on recent actual expenditures for like infrastructure improvements, we applied estimated unit costs for various pieces of infrastructure in various locations and terrains. We applied these unit costs to the specific infrastructure requirements summarized in the previous section to create an overall cost estimate for the required infrastructure for each simulation. These unit cost estimates are described on the following table.

Table 19
Unit costs of infrastructure improvements

Infrastructure type	Order of magnitude estimated unit cost
Double track (per mile)	$4,000,000
Siding	$6,000,000
Extended Siding	$4,000,000
Full x-over	$2,300,000
Additional x-over	$1,000,000

Applying those unit costs to the required infrastructure elements produces the following estimated costs:[41]

Table 20
Estimated costs of improvements on IC Corridor at 80% Amtrak Endpoint OTP

Infrastructure type	Units Necessary	Order of magnitude estimated unit cost	Total Cost
Double track (per mile)	64.2	$4,000,000	$256,800,000
Siding	12	$6,000,000	$72,000,000
Extended Siding	3	$4,000,000	$12,000,000
Full x-over	9	$2,300,000	$20,700,000
Additional x-over	16	$1,000,000	$16,000,000
Total			**$377,500,000**

Table 21
Estimated costs of improvements on IC Corridor at 85%/90% Amtrak Endpoint OTP

Infrastructure type	Units Necessary	Order of magnitude estimated unit cost	Total Cost
Double track (per mile)	83	$4,000,000	$332,000,000
Siding	12	$6,000,000	$72,000,000
Extended Siding	6	$4,000,000	$24,000,000
Full x-over	11	$2,300,000	$25,300,000
Additional x-over	17	$1,000,000	$17,000,000
Total			**$470,300,000**

[41] More detailed results can be found in the workpapers "Plant Requirements - Michigan Service - Scenario 3 (v3_01) Final.xlsx" and "Plant Requirements - Chicago Service - Scenario 3 (v3_x8) Final.xlsx."

Table 22
Estimated costs of improvements on GTW Corridor at 90% Amtrak Endpoint OTP

Infrastructure type	Units Necessary	Order of magnitude estimated unit cost	Total Cost
Double track (per mile)	12.9	$4,000,000	$51,600,000
Siding	0	$6,000,000	$0
Extended Siding	0	$4,000,000	$0
Full x-over	0	$2,300,000	$0
Additional x-over	2	$1,000,000	$2,000,000
Baron-Gord track	1	$10,000,000	$10,000,000
Total			**$63,600,000**

VIII. <u>Conclusion</u>

Using CN's standard simulation software, we were able to calculate the incremental delay to CN's freight trains caused by Amtrak's presence on CN's lines under two different Amtrak service levels. We were also able to estimate the cost of the infrastructure improvements that would be needed to eliminate or greatly reduce this incremental delay.

VERIFICATION

I, Harald Krueger, declare under penalty of perjury under the laws of the United States that I have read the foregoing Verified Statement, that I know the facts asserted therein, and that the same are true as stated. Further, I certify that I am qualified to and authorized to submit this Verified Statement on behalf of Canadian National Railway Company and its subsidiaries.

Executed on September 3, 2015

Harald Krueger

VERIFICATION

I, Brian Doyle, declare under penalty of perjury under the laws of the United States that I have read the foregoing Verified Statement, that I know the facts asserted therein, and that the same are true as stated. Further, I certify that I am qualified to and authorized to submit this Verified Statement.

Executed on August 28th, 2015

Brian Doyle

VERIFICATION

I, Nikola Rank, declare under penalty of perjury under the laws of the United States that I have read the foregoing Verified Statement, that I know the facts asserted therein, and that the same are true as stated. Further, I certify that I am qualified to and authorized to submit this Verified Statement.

Executed on September 3, 2015

Nikola Rank

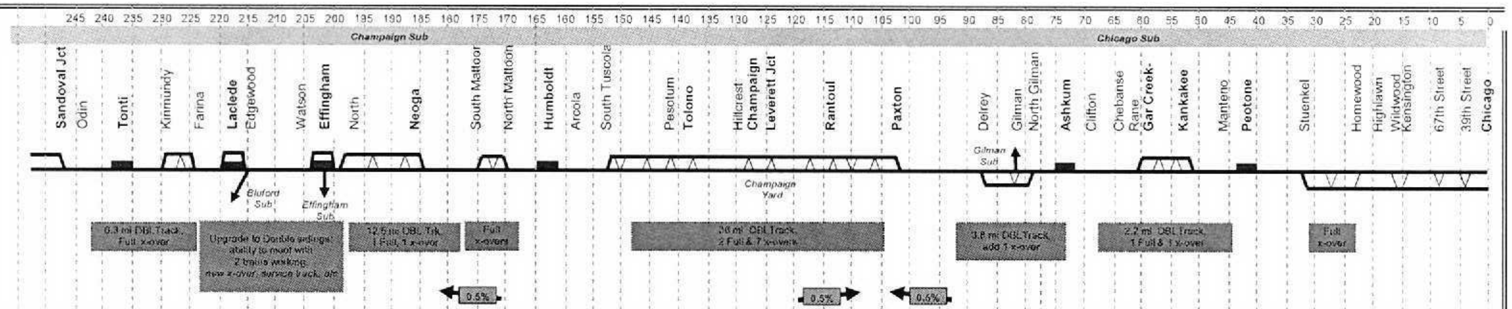
[This page is intentionally left blank.]

EXHIBIT 1

[This page is intentionally left blank.]

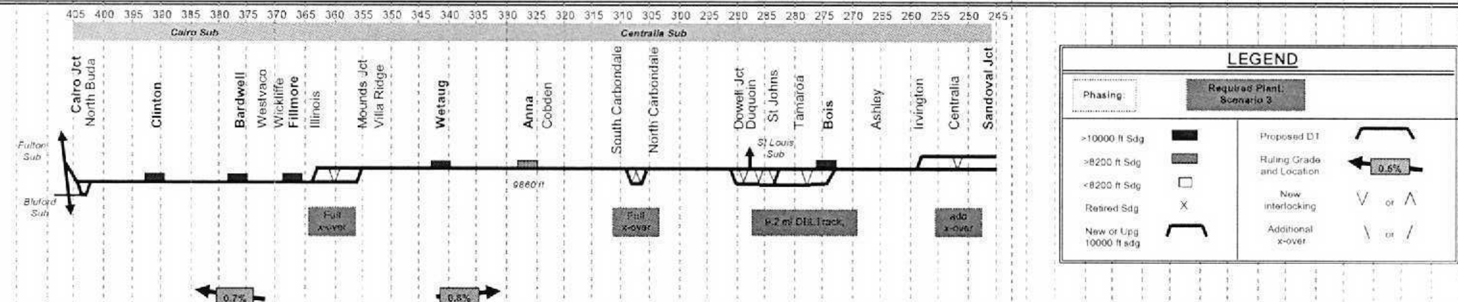
Chicago and Champaign Subs

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	60.8	$ 243 M
New Siding, R&D:	$ 6 M	2	$ 12 M
Extend Siding:	$ 4 M	0	$ 0 M
Full X-overs:	$ 2.3 M	7	$ 16 M
Add'l X-over:	$ 1 M	10	$ 10 M
SUM:			$ 281 M



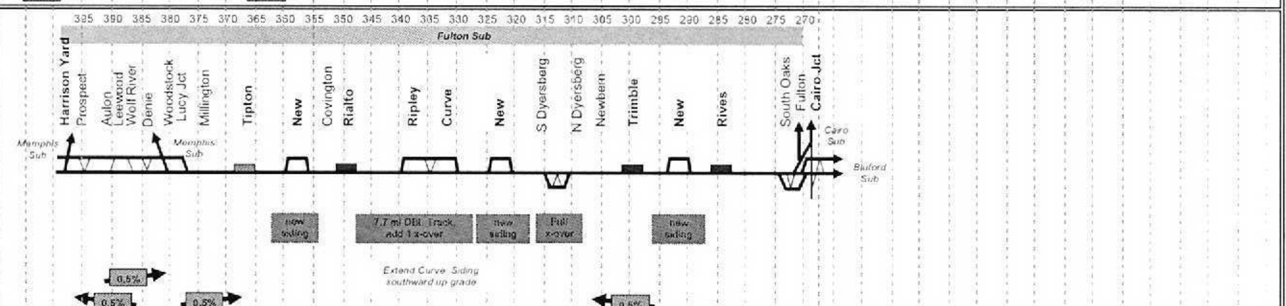
Centralia and Cairo Subs

NEW PLANT	Unit $'s	NEW	$
Double Track	$ 4 M / mi	9.2	$ 37 M
New Siding, R&D	$ 6 M	0	$ 0 M
Extend Siding	$ 4 M	0	$ 0 M
Full X-overs	$ 2.3 M	2	$ 5 M
Add'l X-over	$ 1 M	5	$ 5 M
SUM			$ 46 M



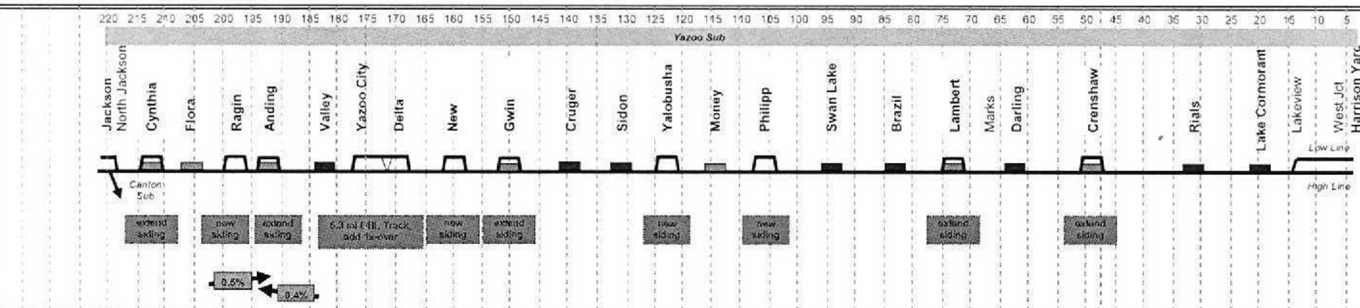
Fulton Sub

NEW PLANT	Unit $'s	NEW	$
Double Track	$ 4 M / mi	7.7	$ 31 M
New Siding, R&D	$ 6 M	3	$ 18 M
Extend Siding	$ 4 M	0	$ 0 M
New Interlocking	$ 2.3 M	1	$ 2 M
Add'l X-over	$ 1 M	1	$ 1 M
SUM			$ 52 M



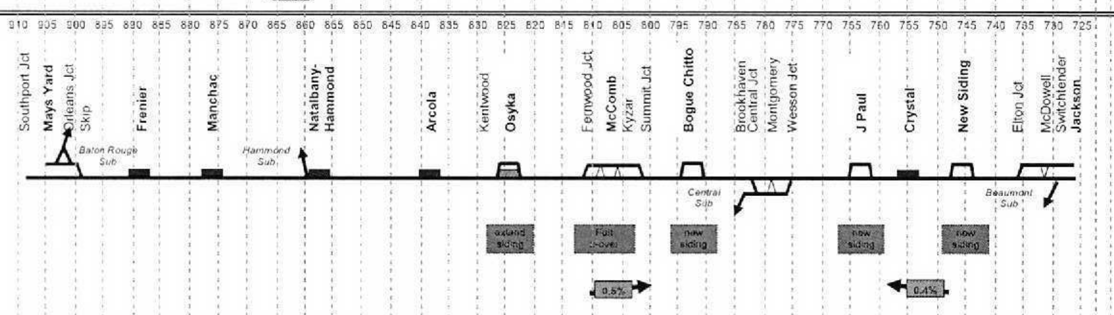
Yazoo Sub.

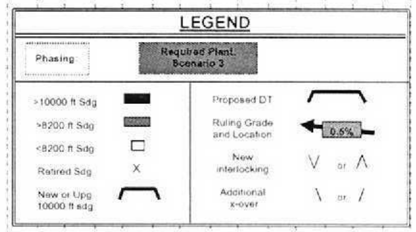
NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	5.3	$ 21 M
New Siding, R&D:	$ 6 M	4	$ 24 M
Extend Siding:	$ 4 M	5	$ 20 M
New Interlocking:	$ 2.3 M	0	$ 0 M
Add'l X-over:	$ 1 M	1	$ 1 M
SUM:			$ 66 M



McComb Sub

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	0	$ 0 M
New Siding, R&D:	$ 6 M	3	$ 18 M
Extend Siding:	$ 4 M	1	$ 4 M
New Interlocking:	$ 2.3 M	1	$ 2 M
Add'l X-over:	$ 1 M	0	$ 0 M
SUM:			$ 24 M





CHICAGO to NEW ORLEANS CORRIDOR

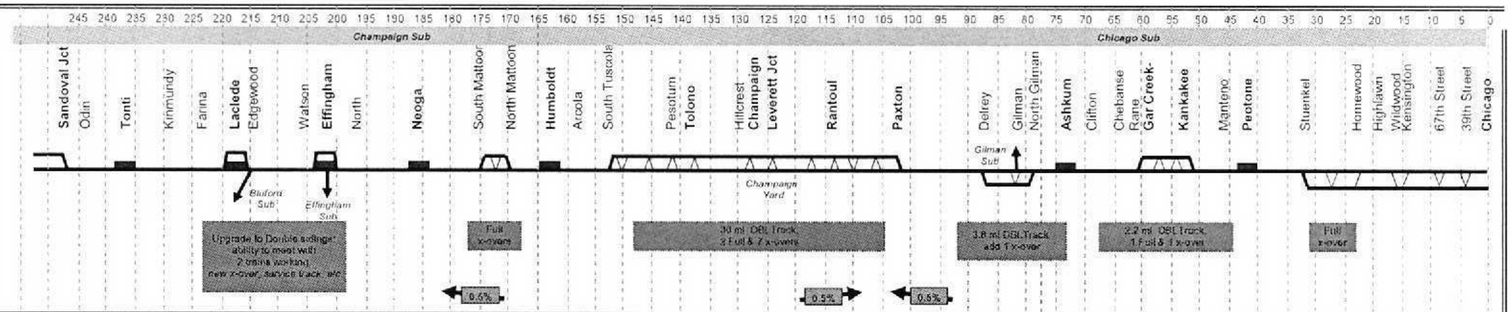
NEW PLANT	Unit $'s	NEW	$
Double Track	$ 4 M / mi	83.0	$ 332 M
New Siding, R&D	$ 6 M	12	$ 72 M
Extend Siding	$ 4 M	6	$ 24 M
New Interlocking	$ 2.3 M	11	$ 25 M
Add'l X-over	$ 1 M	17	$ 17 M
SUM			$ 470 M

Chicago to New Orleans Corridor

Required Plant: Scenario 3, 80% OTP

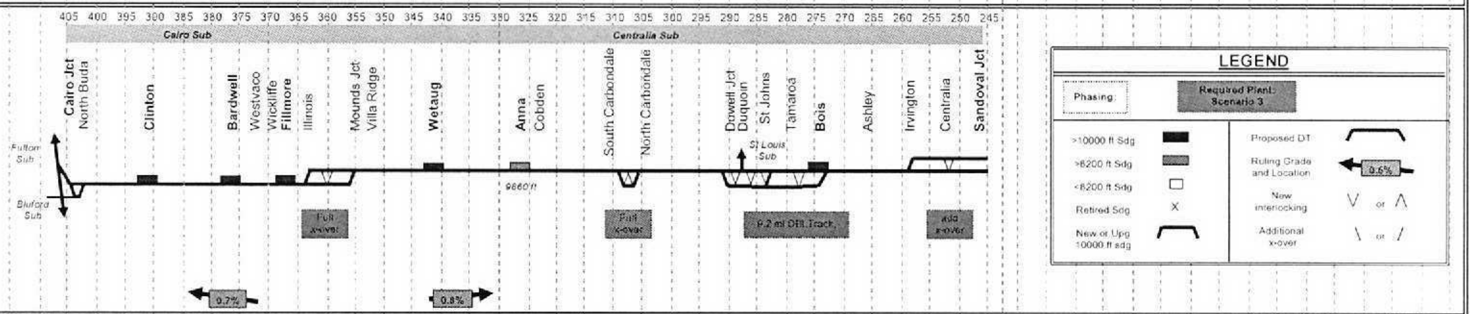
Chicago and Champaign Subs

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	42.0	$ 168 M
New Siding, R&D:	$ 6 M	2	$ 12 M
Extend Siding:	$ 4 M	0	$ 0 M
Full X-overs:	$ 2.3 M	5	$ 12 M
Addt'l X-over:	$ 1 M	9	$ 9 M
SUM:			$ 201 M



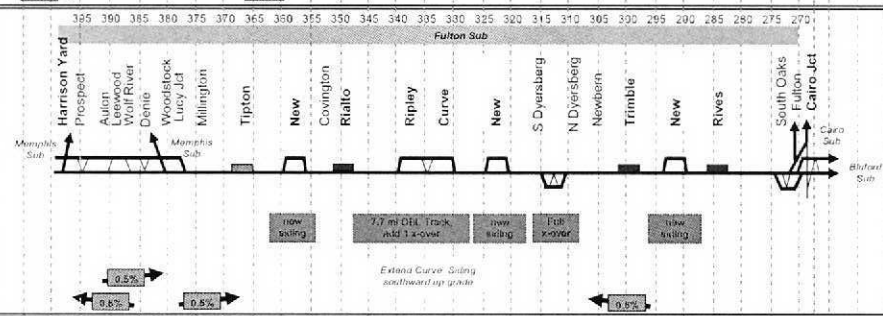
Centralia and Cairo Subs

NEW PLANT	Unit $'s	NEW	$
Double Track	$ 4 M / mi	9.2	$ 37 M
New Siding, R&D	$ 6 M	0	$ 0 M
Extend Siding	$ 4 M	0	$ 0 M
Full X-overs	$ 2.3 M	2	$ 5 M
Addt'l X-over	$ 1 M	5	$ 5 M
SUM			$ 46 M



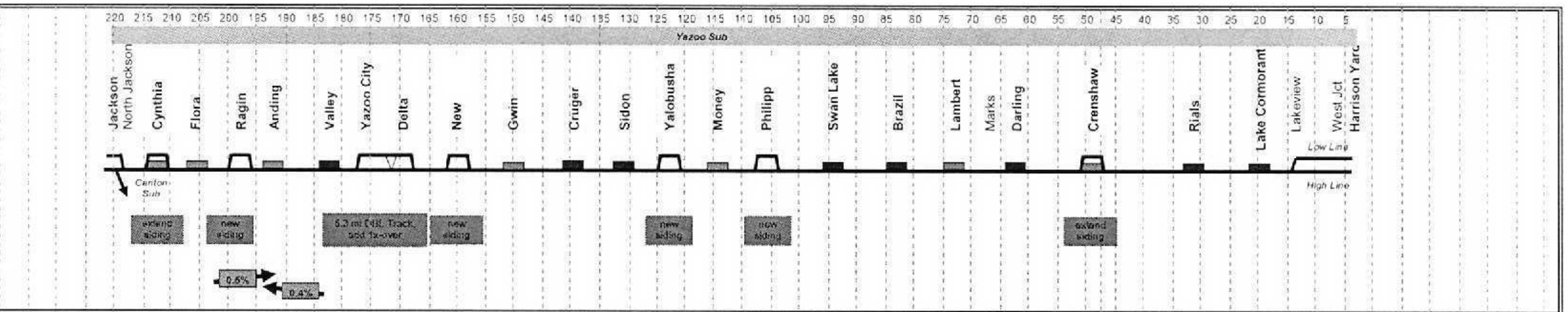
Fulton Sub.

NEW PLANT	Unit $'s	NEW	$
Double Track:	$ 4 M / mi	7.7	$ 31 M
New Siding, R&D:	$ 5 M	3	$ 18 M
Extend Siding:	$ 4 M	0	$ 0 M
New Interlocking:	$ 2.3 M	1	$ 2 M
Addt'l X-over:	$ 1 M	1	$ 1 M
SUM			$ 52 M



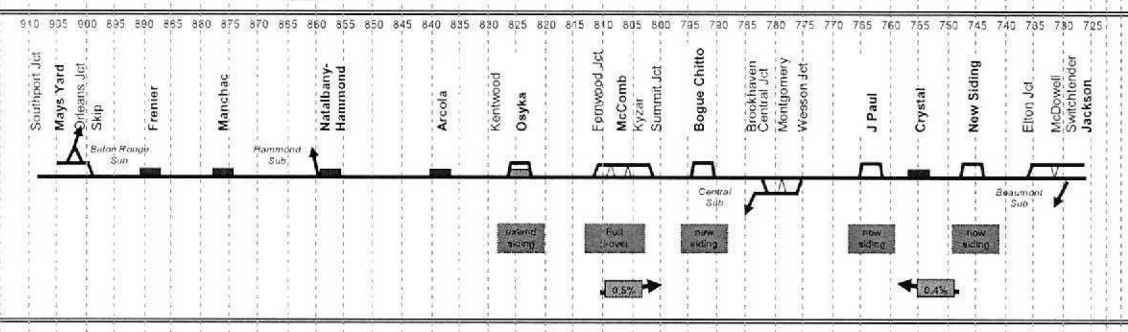
Yazoo Sub.

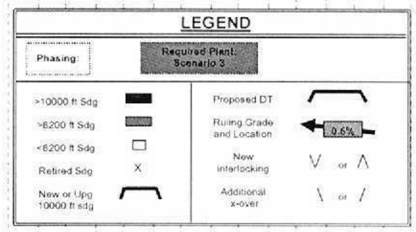
NEW PLANT	Unit $'s	NEW	$
Double Track	$ 4 M / mi	5.3	$ 21 M
New Siding, R&D	$ 6 M	4	$ 24 M
Extend Siding	$ 4 M	2	$ 8 M
New Interlocking	$ 2.3 M	0	$ 0 M
Add'l X-over	$ 1 M	1	$ 1 M
SUM			$ 54 M



McComb Sub

NEW PLANT	Unit $'s	NEW	$
Double Track	$ 4 M / mi	0	$ 0 M
New Siding, R&D	$ 6 M	3	$ 18 M
Extend Siding	$ 4 M	1	$ 4 M
New Interlocking	$ 2.3 M	1	$ 2 M
Add'l X-over	$ 1 M	0	$ 0 M
SUM			$ 24 M

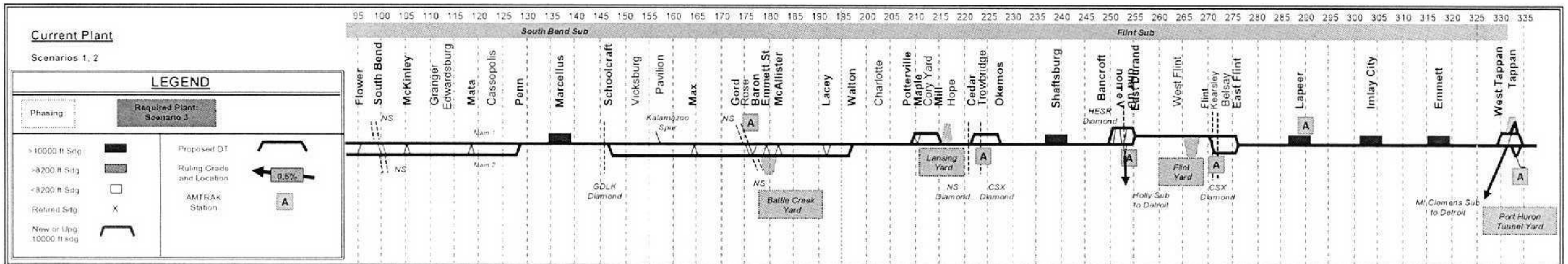




CHICAGO to NEW ORLEANS CORRIDOR

NEW PLANT	Unit $'s	NEW	$
Double Track	$ 4 M / mi	64.2	$ 257 M
New Siding, R&D	$ 6 M	12	$ 72 M
Extend Siding	$ 4 M	3	$ 12 M
New Interlocking	$ 2.3 M	9	$ 21 M
Add'l X-over	$ 1 M	16	$ 16 M
SUM			$ 378 M

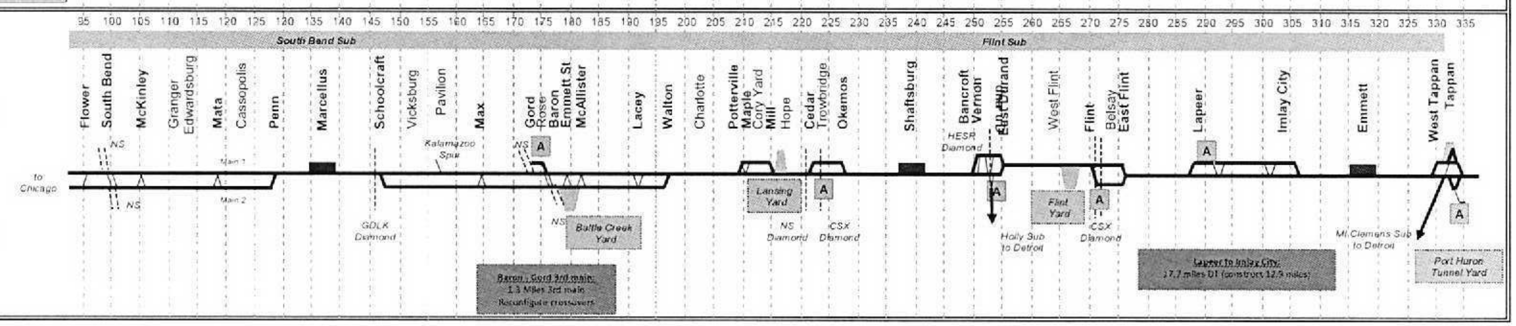
Port Huron to South Bend - Overview Schematic
(Flint and South Bend Subdivisions)



Proposed Plant

Scenario 3

NEW PLANT	Unit $'s	NEW	$
Baron-Gord Track:	fixed cost		$ 10 M
Double Track:	$ 4 M / mi	12.9	$ 52 M
New Siding, R&D:	$ 5 M	0	$ 0 M
Extend Siding:	$ 4 M	0	$ 0 M
Full X-overs:	$ 2.3 M	0	$ 0 M
Add'l X-over:	$ 1 M	2	$ 2 M
SUM:			$ 64 M



[This page is intentionally left blank.]

EXHIBIT 2

[REDACTED]

EXHIBIT 3

[REDACTED]

EXHIBIT 4

[REDACTED]

EXHIBIT 5

[REDACTED]

EXHIBIT 6

[REDACTED]

EXHIBIT 7

[REDACTED]

EXHIBIT 8

[REDACTED]

EXHIBIT 9

[REDACTED]

EXHIBIT 10

[REDACTED]

EXHIBIT 11

[REDACTED]

EXHIBIT 12

[REDACTED]

EXHIBIT 13

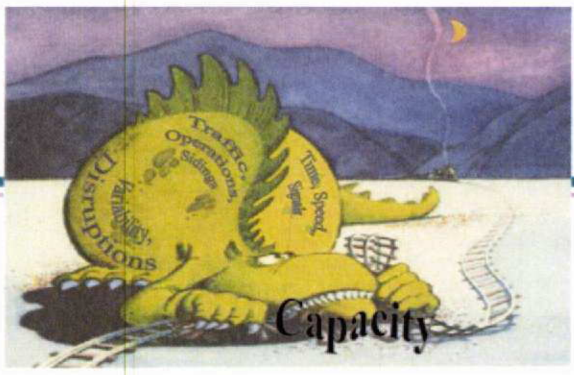
[REDACTED]

EXHIBIT 14

[REDACTED]

EXHIBIT 15

TRACK CAPACITY



Presentation to Canadian Rail Research Lab – U of A
by CN Network Planning
February 13, 2013

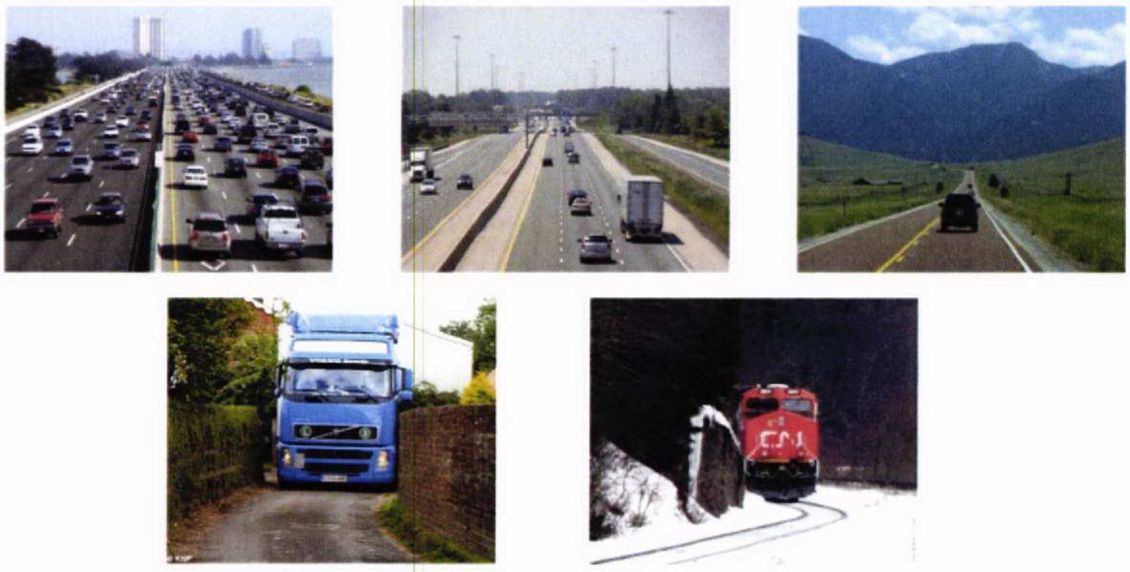
INTRODUCTION / AGENDA

- Why is Capacity Important?
- What is it?
- What are the key factors?
- How do you measure it?
- Examples of Analysis
- Examples of Train Control, Signals

A DIFFERENT WORLD

At 0.5 HpT it only takes 5 Hp to move 10 Tons

A DIFFERENT WORLD



More constrained than what you experience

IMPORTANCE OF CAPACITY

- Railroads have large capital investments
  - Locomotives, cars, trackage
- Improving asset utilization has benefits
  - Improve service & reliability
  - Increase traffic & revenue
  - Reduce costs
- Trackage is the Railroad's largest asset
  - Costly to build & maintain
  - Not flexible as loco's, car's, crew's (not easily moved)
- Capacity is the measure of track asset utilization
  - Ability to handle traffic (current & future)
  - At desired velocities (service & reliability)
  - With optimal resources (costs: locomotives, cars, crews, etc)

IMPORTANCE OF CAPACITY

- Traditional solution is to just add plant
  - Risk spending $$ in the wrong place for the wrong reasons
  - Expensive, Takes time to build, not immediately available
- Typically Track Capacity last asset to be optimized
  - If not part of a long term plan, then spending more $'s in the long run
    i.e. built 1 siding when 2 were needed, will end up building 3 in the end
  - Need to understand capacity, the relationship of different parameters
- Capacity needs to be measured & managed
  - Need to weigh competing demands for capacity and set policy
  - Optimizing one asset/objective at expense of others can lower capacity
  - Understanding network capacity strengths & weaknesses allows development of a robust & efficient Operating Plan
  - Develop cost effective long term plans to increase capacity as needed

CN

CAPACITY - WHAT IS IT?

- Depends on who you ask
  - Marketing, Engineering, Operations, Costing, Finance, etc
  - Each would have different definition
- Depends what you're trying to achieve
  - What is the objective? (definable, measurable)
    - *speed, reliability, asset utilization, crewing, GTM's, etc?*
  - Trade-off between competing interests
    - *Cannot optimize everything*
- Combined effect of Plant, Traffic and Operation
  - Number of revenue tons that can be handled over a definitive plant, by a definitive number of trains, of definitive service, size & mix within a given time at a given cost (NAH 1979)
  - Maximum footage that can be moved at a Train Speed that reliably contains cost (MJB 2012)

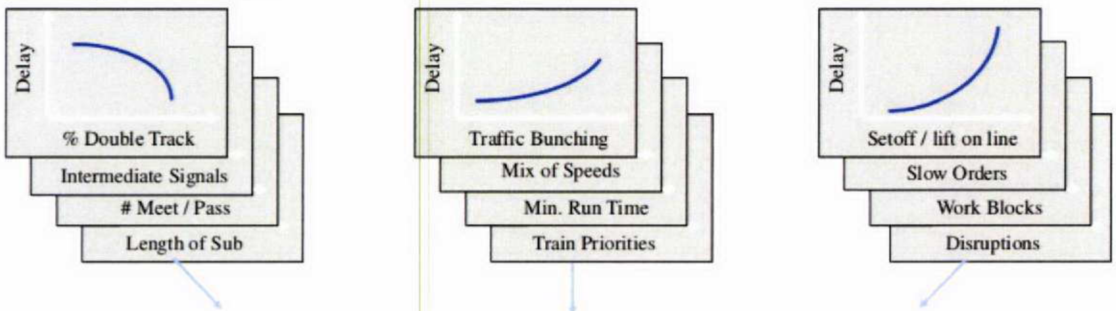
CAPACITY - WHAT IS IT?

STRESS - STRAIN RELATIONSHIP

Plant Factors:
- % Double Track
- Intermediate Signals
- # Meet/Pass Locations
- Length of Subdivision

Traffic Factors :
- Traffic Bunching
- Mix of Speeds
- Minimum Run Time
- Train Priorities

Operating Factors :
- Setoff / Lift On Line
- Slow Orders
- Work Blocks
- Disruptions



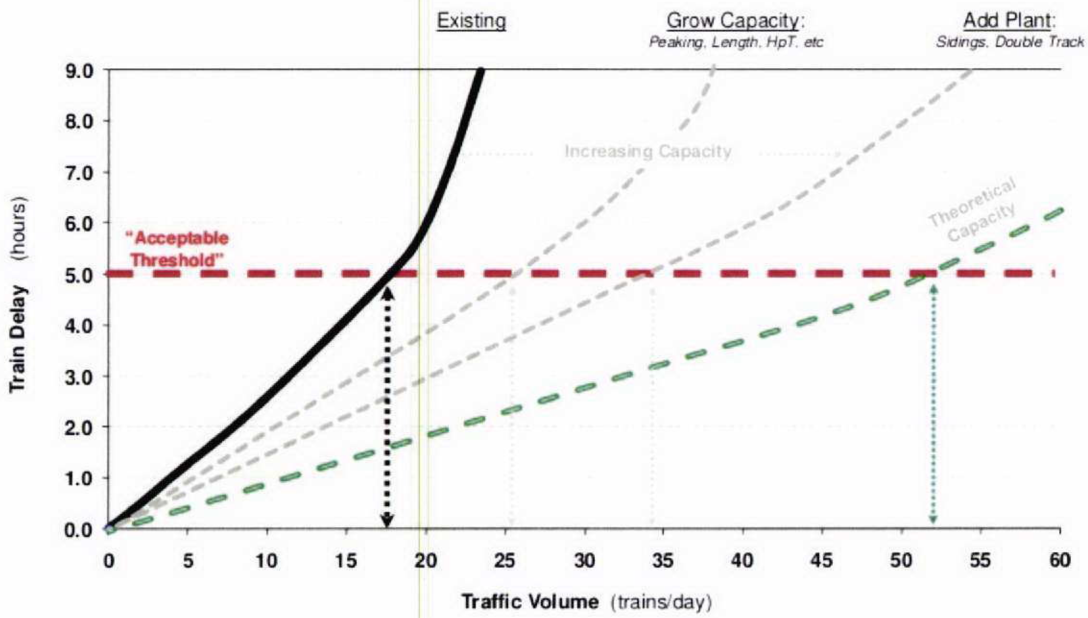
FUNCTION OF MULTIPLE FACTORS

defines the Train Volume vs. Delay relationship (stress-strain).

i.e. the Capacity Curve for a specific Plant, Traffic & Operations

CAPACITY - WHAT IS IT?

VOLUME VS. DELAY RELATIONSHIP



CAPACITY - WHAT IS IT?

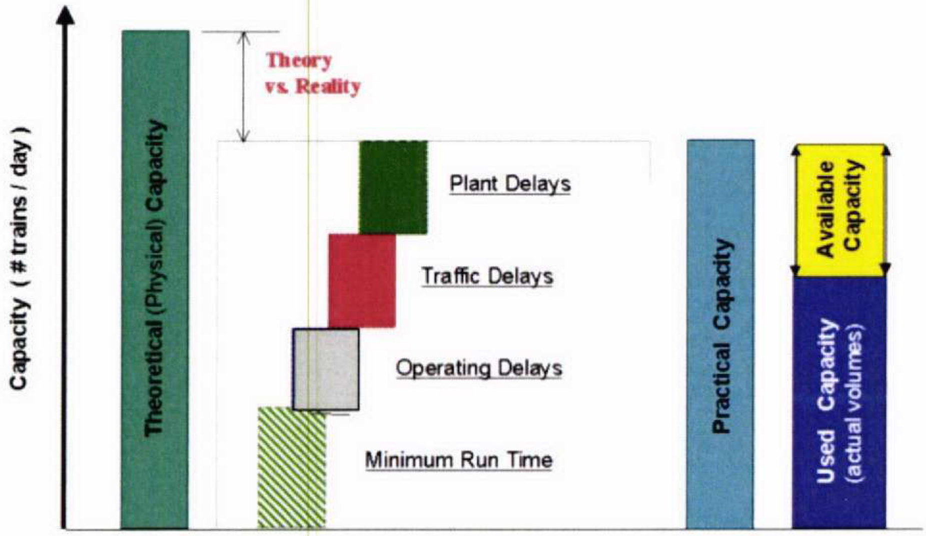
TYPES OF CAPACITY

- Theoretical Capacity
  - Maximum Traffic Volume, Physical Limit
  - Empirical Formula (no Plant, Traffic, Operations Variations)
  - Most Restrictive Segment (Siding Grid, Signal Wake)
- Practical Capacity
  - When delays become unacceptable
  - Relative to defined "Performance Threshold"
  - Changes with variation in Plant, Traffic, Operations
- Available Capacity
  - Actual volume vs. Practical Capacity

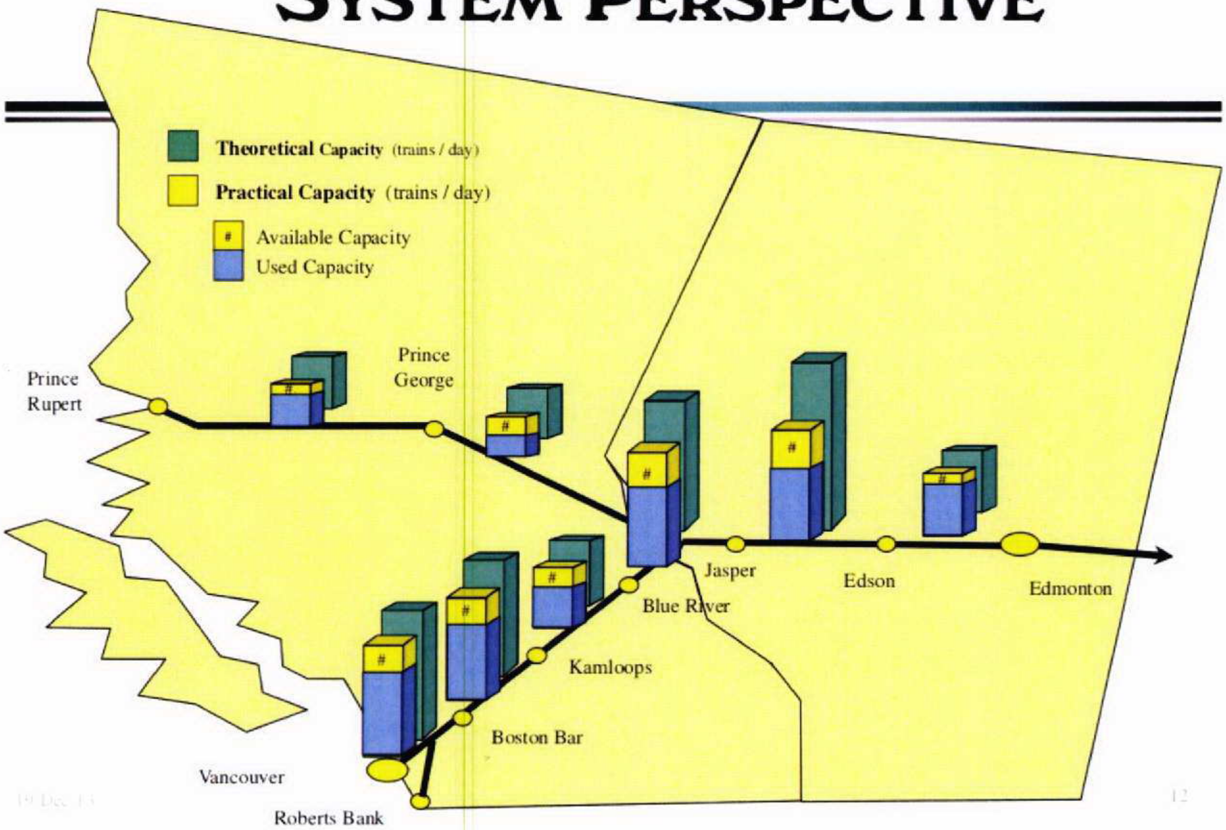
CAPACITY - WHAT IS IT?

TYPES OF CAPACITY

- Types of Capacity



System Perspective



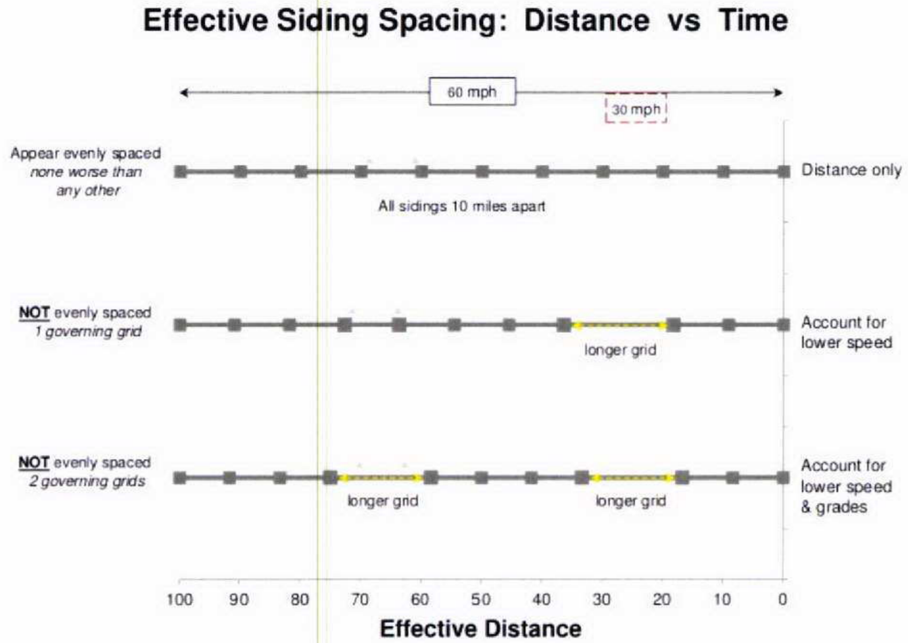
Key Factors that Drive Capacity?

CN

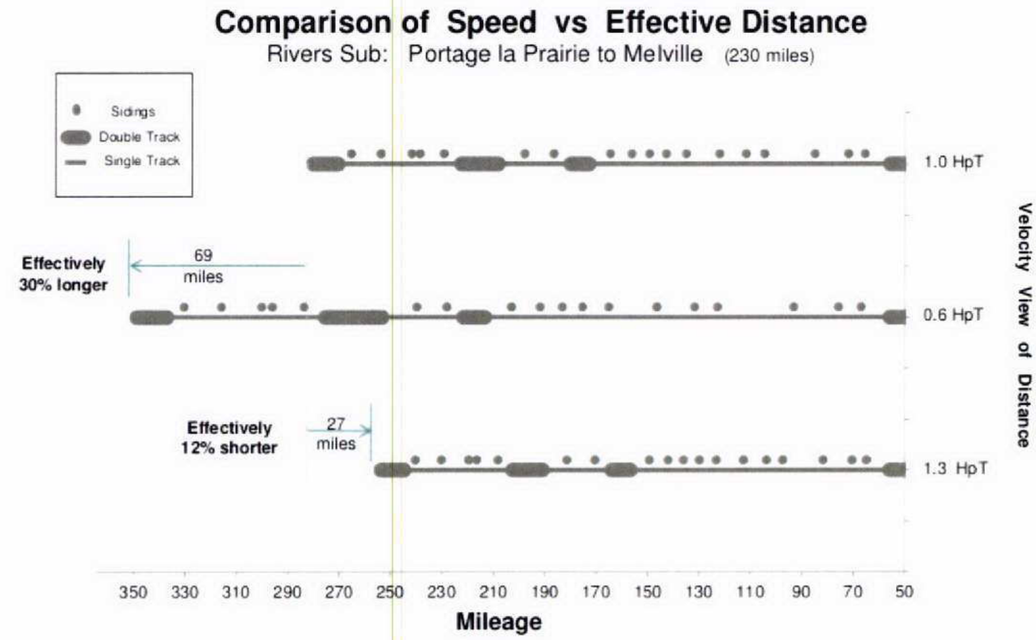
Most Significant Capacity Factors are . . .

- Speed, Uniformity & Disruptions
  - Plant: % double track, siding & signal spacing, track speeds, disruptions: plant failures (signals, rail, switch, weather, etc)
  - Traffic: train volumes, traffic mix (length, priority, bunching, Hpt) disruptions: equipment failures (pull-aparts, hot-box, etc)
  - Operations: schedules, times, priorities, on-line switching, disruptions: track maintenance, set-off/lifts, re-crews, etc

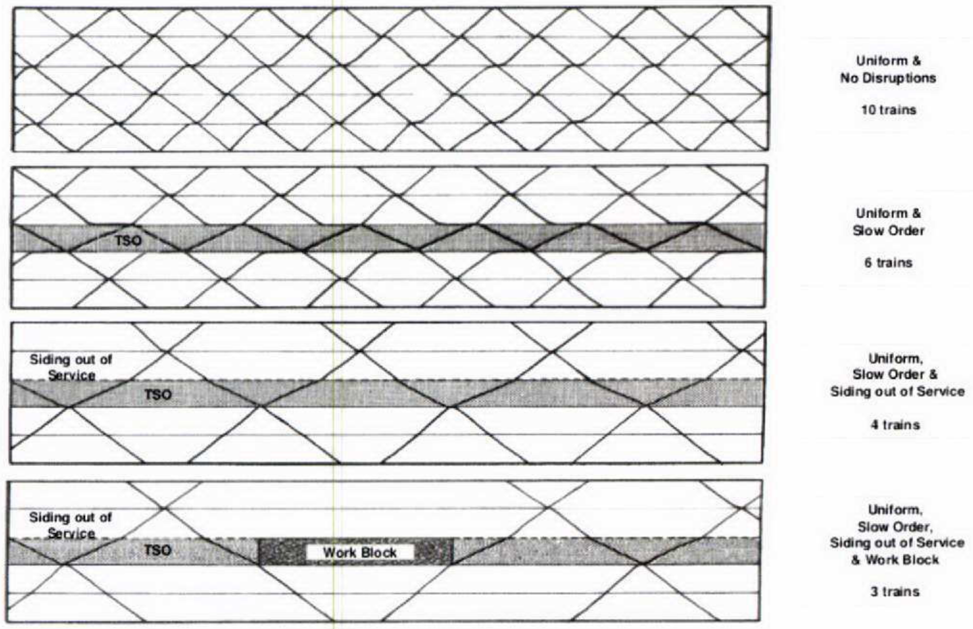
Key Factors: Significance of Time



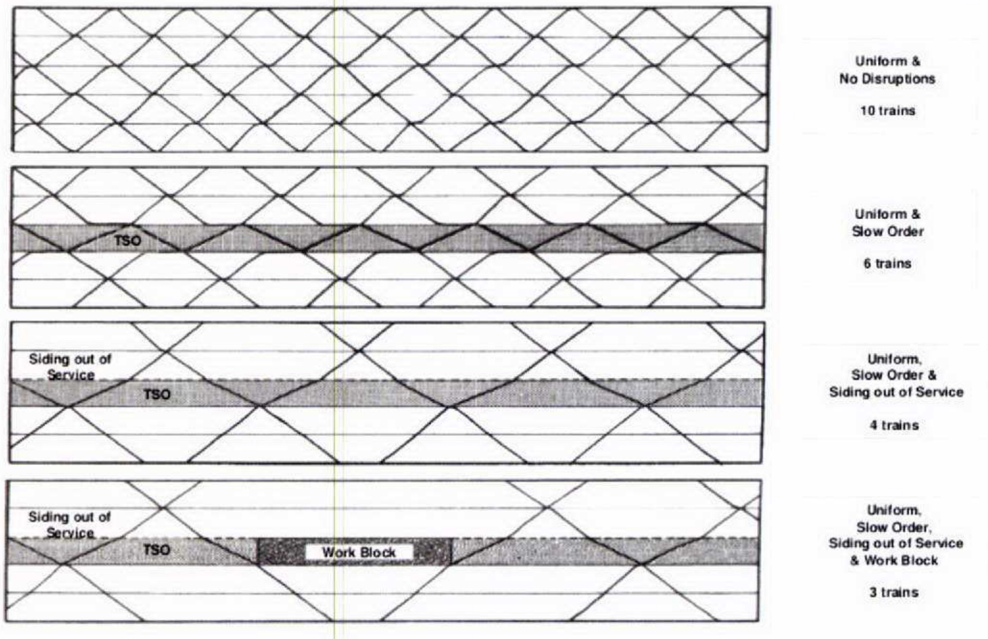
KEY FACTORS: SIGNIFICANCE OF SPEED



Key Factors: Significance of Uniformity



KEY FACTORS: UNIFORMITY, DISRUPTIONS



KEY FACTORS TO GROW CAPACITY

CN

- Train Length
  - Rules to be applied
  - Bi-modal Distribution
  - Planned, not Ad hoc
- Traffic Peaking
  - Rules for corridor (i.e. train spacing)
  - Leverage Intermediates (i.e. planned fleeting)
  - Avoid localized saturation
- Line Outages
  - Do on-line switching in off-peak
  - Minimize over-siding switchers
  - Ensure trains fit in sidings
- Speed
  - Determine Design Strategy
  - Homogeneous train speeds
  - Class of service (i.e. Bulk, Intermodal)

HOW TO MEASURE CAPACITY

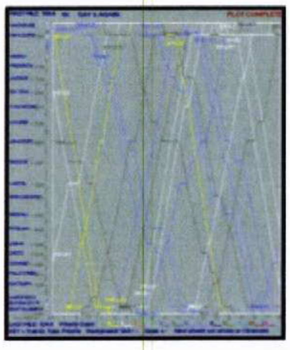
- Computer Simulation *(RTC, SYSTRA, RCM, RAILS, etc)*
  - Complex, Labour & Data Extensive
  - For complex issues, when more details required
  - Questionable Results: ***still need the fundamentals*!**
    - **no "build siding here" button**
- Parametric Model
  - Mathematical formula of Plant, Traffic, Operations relationship
  - Not commonly used *(only know of 2)*
    - 1977 by PMM, 1995 by CN
- Manual Analysis *(simple fundamental analysis)*
  - Time Distance Plots *(train channels, track consumption)*
  - Return Grid Capacity Calculation *(time based, highlight bottlenecks)*
  - Identify core problems & solutions *(order of magnitude answers)*

How to Measure Capacity

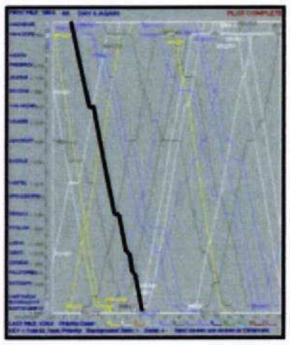
Computer Simulation

- Need clear understanding of what is the question, problem & objective
- Is the data correct, is the model validated & calibrated?
- What are the results (measures, reports) you intend to generate?

Simulation "A"



Simulation "B"



Simulation "C"

5 Traffic Levels
Base, +4, +8, +12, +16

5 Plant Scenarios
Base, Phase 1, 2, 3, 4

3 Track Maintenance's
light, medium, heavy

3 Disruptions Scenarios
Ideal, re-crews, failures

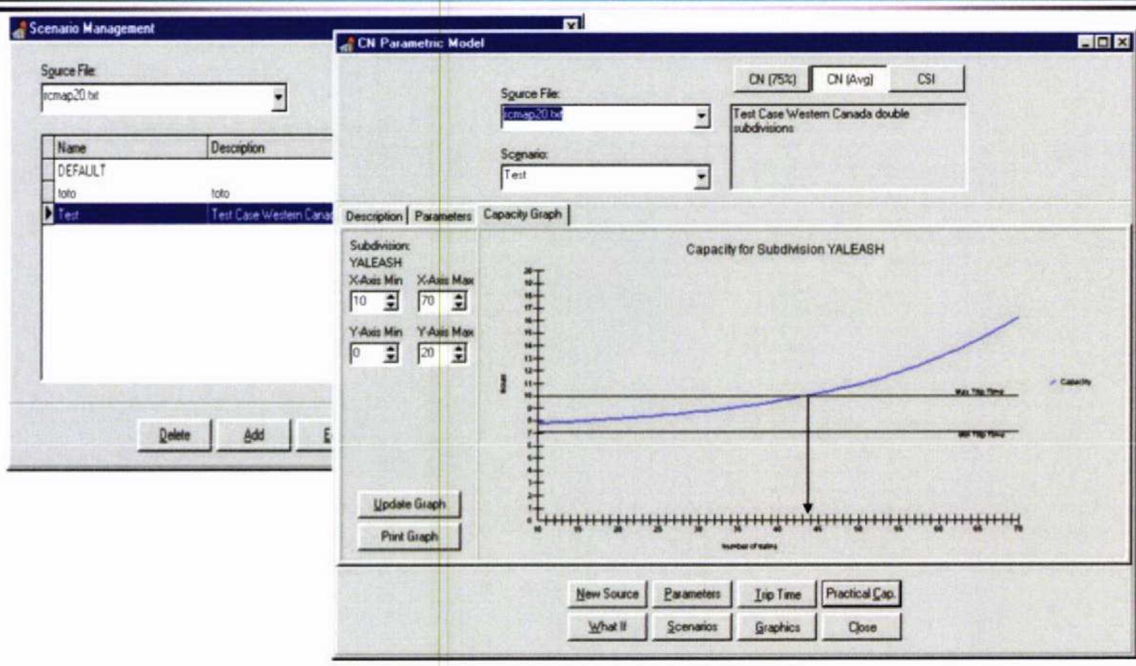
Simulate 21 days
design week x 3 for convergence

225 Total Simulations
4,725 simulation days

What will it add beyond the manual analysis?

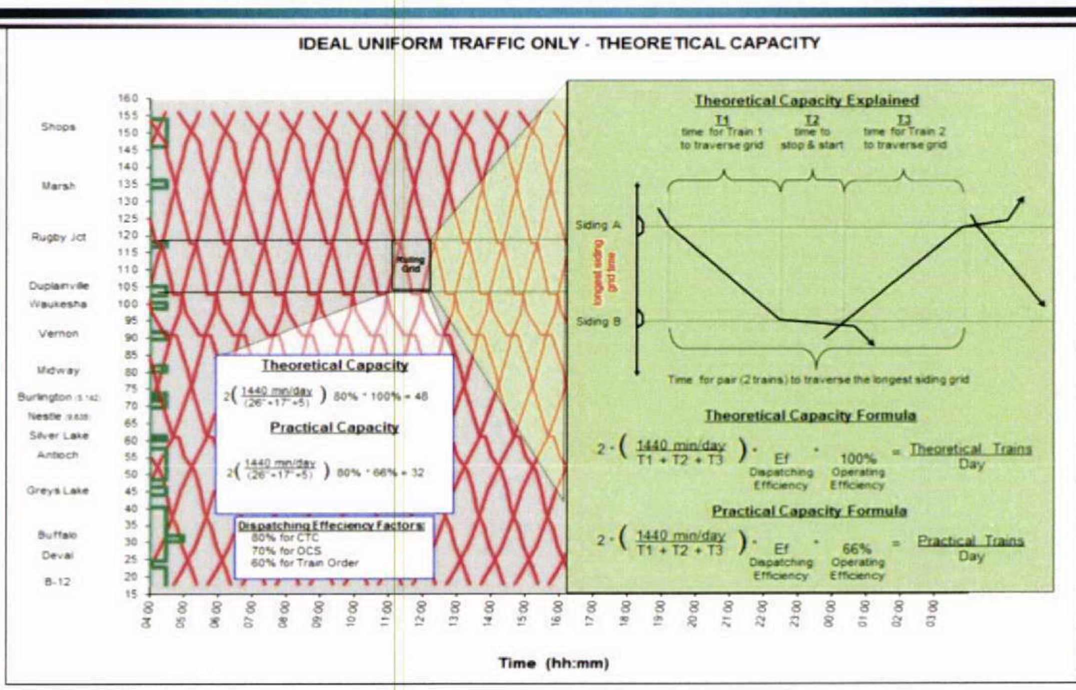
How to Measure Capacity

Parametric Model



How to Measure Capacity

Return Grid Analysis



How to Measure Capacity

Return Grid Analysis

RETURN GRID ANALYSIS: PROPOSED FUTURE SIDING PLANT - EXISTING TIMETABLE SPEEDS
LAC LA BISCH SUBDIVISION

PLANT INFO					LEGEND	CAPACITY		
MP	Name	Track	Siding			LONG Trains		
		FUTURE				0.8 HPT	1.0 HPT	1.3 HPT
		16.8 ft				9 trains/day	10 trains/day	10 trains/day
1.78	WALKER YARD	single		YD	Yard			
0.00	JCT BYPASS / ENTRY-EXIT	single		DT	Double Track	..	..	..
0.20	CT ENTRY-EXIT / VEGREVIL	single		DL	Double Track	130	125	116
0.00	ST. PAUL JCT.	single			--	..	..	..
2.60	GRACE	single			--	..	..	..
7.40	DUAGH	single			--	..	..	..
[illegible]	~~GIBBONS~~	single	[illegible]	R	-- RETIRE --	..	..	..
20.60	CORONADO	single	8000	L	LONG Siding	12	12	12
[illegible]	~~REDWATER~~	single	[illegible]	R	-- RETIRE --	..	..	..
35.00	KERENSKY	single			--	..	..	..
[illegible]	~~EGREMONT~~	single	[illegible]	R	-- RETIRE --	..	..	..
34.70		single			--	..	..	..
[illegible]	~~THORHILD~~	single	[illegible]	R	-- RETIRE --	..	..	..
42.40		single			--	..	..	..
46.00	ABEE	single	8000	L	LONG Siding	10	10	10
49.45		single			--	..	..	..
[illegible]	~~NEWBROOK~~	single	[illegible]	R	-- RETIRE --	..	..	..
56.25		single			--	..	..	..
59.60	ALPEN	single			--	..	..	..
62.00		single			--	..	..	..

Quick & Easy to Develop Alternatives

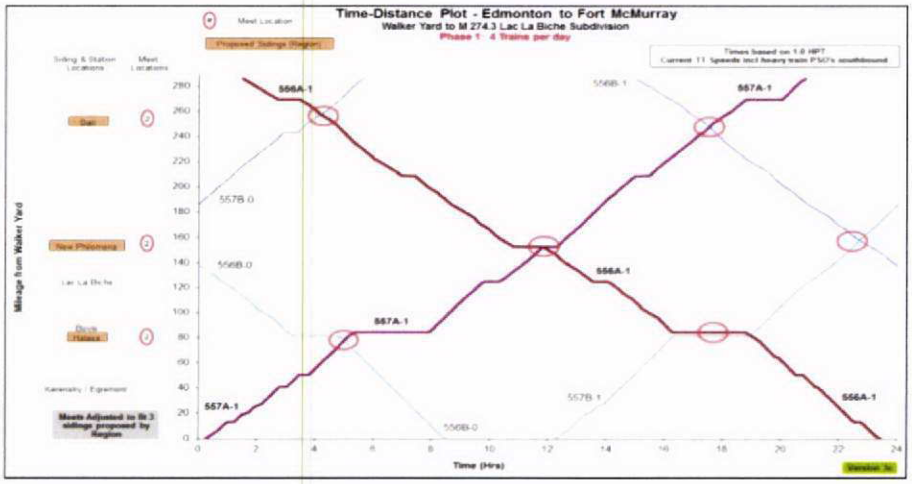
Note: High level answers only, no dynamics, flags bottlenecks

EXAMPLES
Of
ANALYSIS

TD PLOT ANALYSIS

LAC LA BICHE SUBDIVISION – PHASE 1 SERVICE (4 TRAINS)

- Time Distance Plot, work with Service Design
- adjust times to fit meets & operations to minimum plant

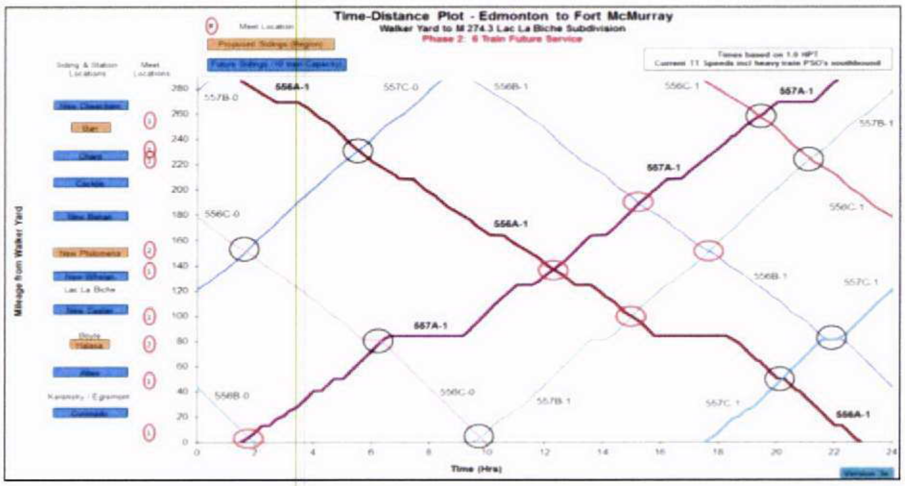


Check that locations fit Future plan

Return Grid Analysis

Lac La Biche Subdivision – Phase 2 Service (6 trains)

- Too complex for Time Distance Plot (too many meets, variability now an issue)
- Return Grid Analysis to build siding grid based on previous



Siding Grid for Future 10 trains / day

CN

RETURN GRID ANALYSIS

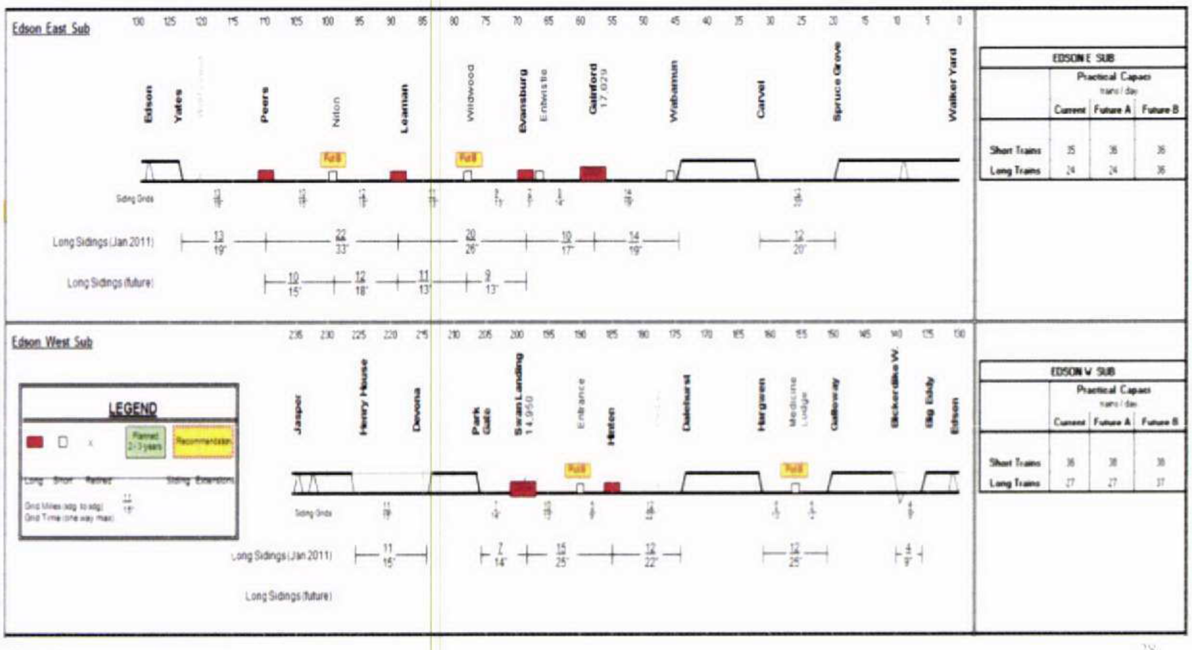
LAC LA BICHE SUBDIVISION – ULTIMATE SERVICE (10 TRAINS)

RETURN GRID ANALYSIS: PROPOSED FUTURE SIDING PLANT - EXISTING TIMETABLE SPEEDS
LAC LA BISCH SUBDIVISION

PLANT INFO					LEGEND	CAPACITY		
MP	Name	Track	Siding			LONG Trains		
						0.8 HPT	1.0 HPT	1.3 HPT
		FUTURE				9	10	10
1.78	WALKER YARD	single		YD	Yard			
0.00	JCT BYPASS / ENTRY-EXIT	single		DT	Double Track			
0.20	JCT ENTRY-EXIT / VEGREVILLE	single		DL	Double Track	130	125	116
0.00	ST PAUL JCT	single						
2.60	GRACE	single						
7.40	DUAGH	single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
20.60	CORONADO	single	8000	L	LONG Siding	12	12	12
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
35.00	KERENSKY	single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
34.70		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
42.40		single						
46.00	ABEE	single	8000	L	LONG Siding	10	10	10
49.45		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
56.25		single						
59.60	ALPEN	single						
62.00		single						
65.10	ELLSCOTT	single						
67.40		single						
69.70	MALASA	single						
70.45	NEW MALASA	single	8000	L	LONG Siding	12	13	13
71.10	JCT ALBERTA PACIFIC	single						
71.80		single						
72.50	BOYLE	single						
73.30		single						
74.10	HORNER	single						
75.70	NEW HORNER	single						
83.00	BISON	single						
84.30		single						
86.00	CASLAN	single	1520					
95.00	NEW CASLAN	single	8000	L	LONG Siding	11	11	11
100.00	HYLO	single						
105.30		single						
110.60	VENICE	single						
110.60	VENICE	single						
111.85		single						
113.10	LAC LA BICHE	single						
114.05		single						
115.00	WHELAN	single						
118.15	NEW WHELAN	single	8000	L	LONG Siding	11	11	12
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
125.15		single						
129.00	TWEEDIE	single						
133.00		single						
137.50	IMPERIAL MILLS	single						
138.30		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
140.05		single						
142.10	NEW PHILOMENA	single	8000	L	LONG Siding	10	11	11
145.30		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
156.25		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
168.15	NEW BEHAN	single	8000	L	LONG Siding	10.3	10	10
174.60	MARGIE	single						
178.95		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
189.15		single						
195.00	CONKLIN	single	8000	L	LONG Siding	9	10	10
196.00		single						
197.00	WINDELL	single						
198.00		single						
199.00	MARVIN	single						
201.10		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
208.00		single						
212.30	CHARD	single	8000	L	LONG Siding	12	14	14
214.00		single						
218.20	PINGLE	single	2610					
222.00	NEW PINGLE	single						
230.30	BARR	single	8000	L	LONG Siding	15	15	15
231.95		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
240.05		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
253.00	NEW CHEECHAM	single	8000	L	LONG Siding	10	12	12
257.40	LONG LAKE	single						
259.40		single						
[illegible]	[illegible]	single		[illegible]	-- RETIRE --			
266.70		single						
272.00	STONECREEK	single						
274.32	FT MCMURRAY	single	8000	E	-- EXTEND --	10	11	11

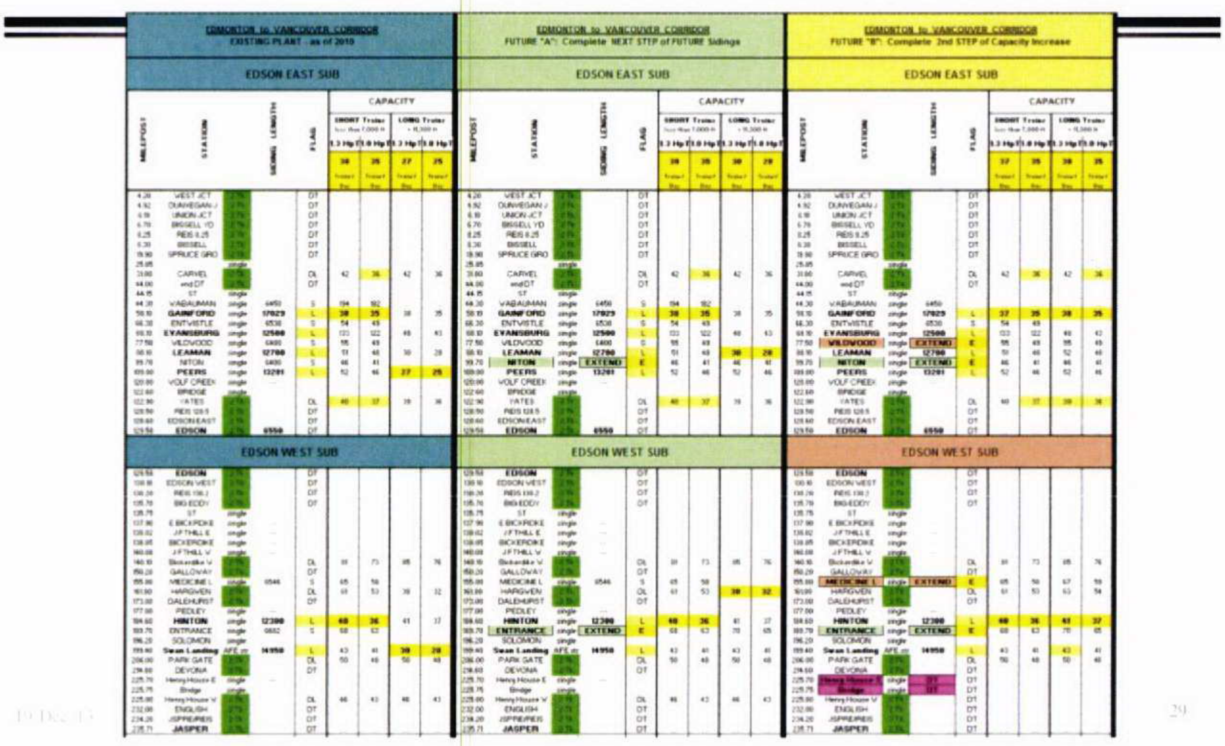
RETURN GRID ANALYSIS

EDSON SUBDIVISION – PHASED CAPACITY INCREASE



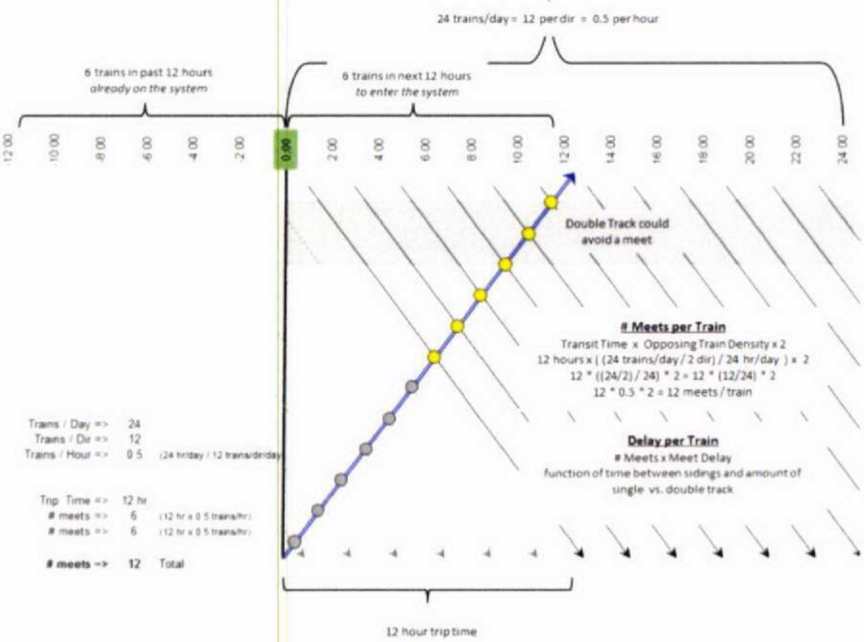
RETURN GRID ANALYSIS

EDSON SUBDIVISION – PHASED CAPACITY INCREASE



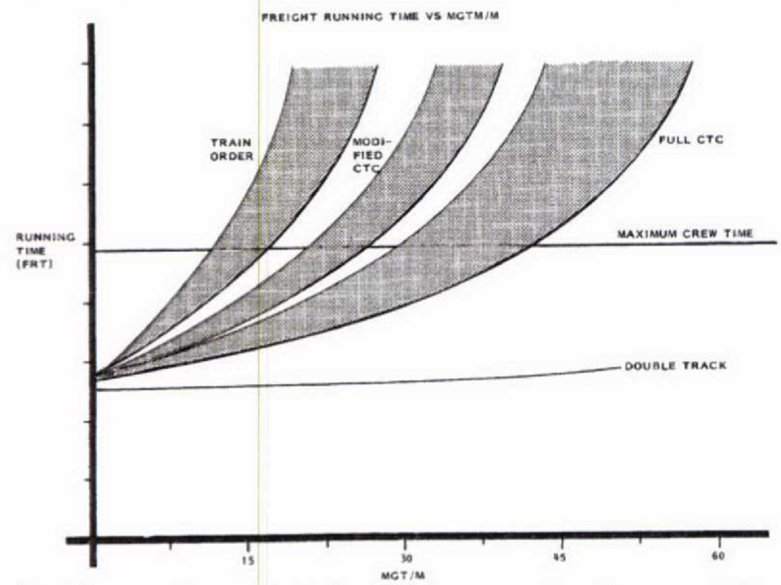
TRAIN MEETS

THEORY



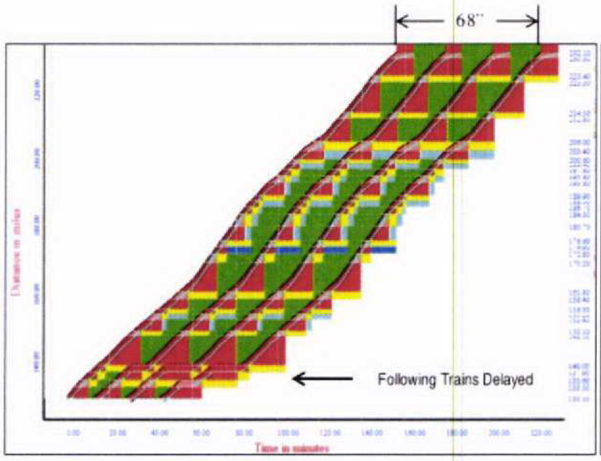
TRAIN CONTROL
&
INTERMEDIATE
SIGNALS

TRAIN CONTROL VS. CAPACITY

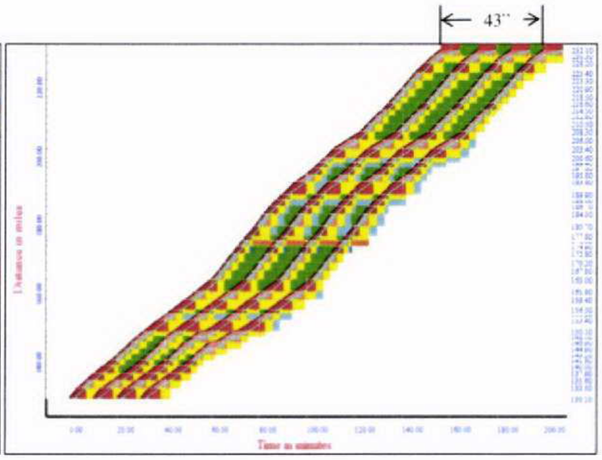


Better Train Control => Quicker Communication => More Capacity

INTERMEDIATE SIGNALS - HEADWAYS



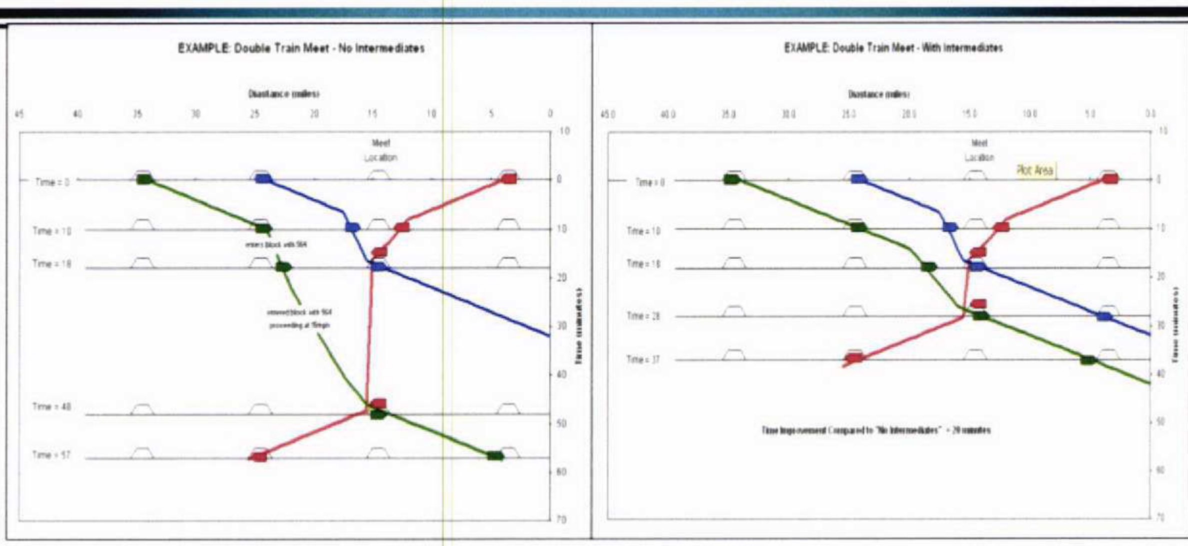
No Intermediates



With Intermediates

Intermediates Reduce Headway by 25", a 37% improvement

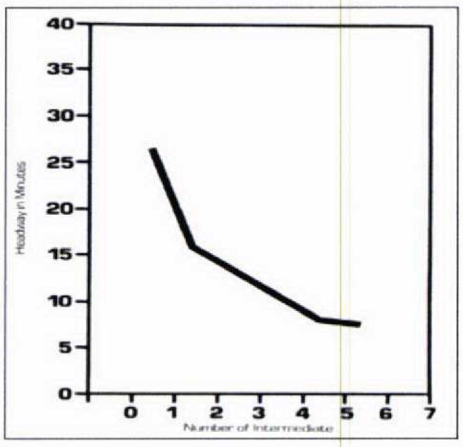
Intermediate Signals – Dbl Meets

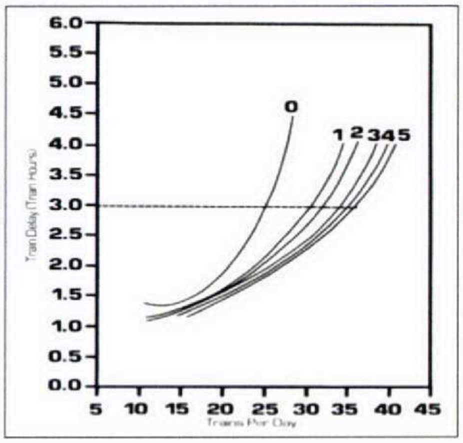


Intermediates improve Double Meet by 35% (20")

INTERMEDIATE SIGNALS - BENEFITS

- Intermediate Signals can Increase Capacity
  - Can operate trains closer (reduced Headways, fleeting)
  - Improve recoverability (flush queued trains quicker)
  - Reduce train delay (improve overtakes, double meets, etc)



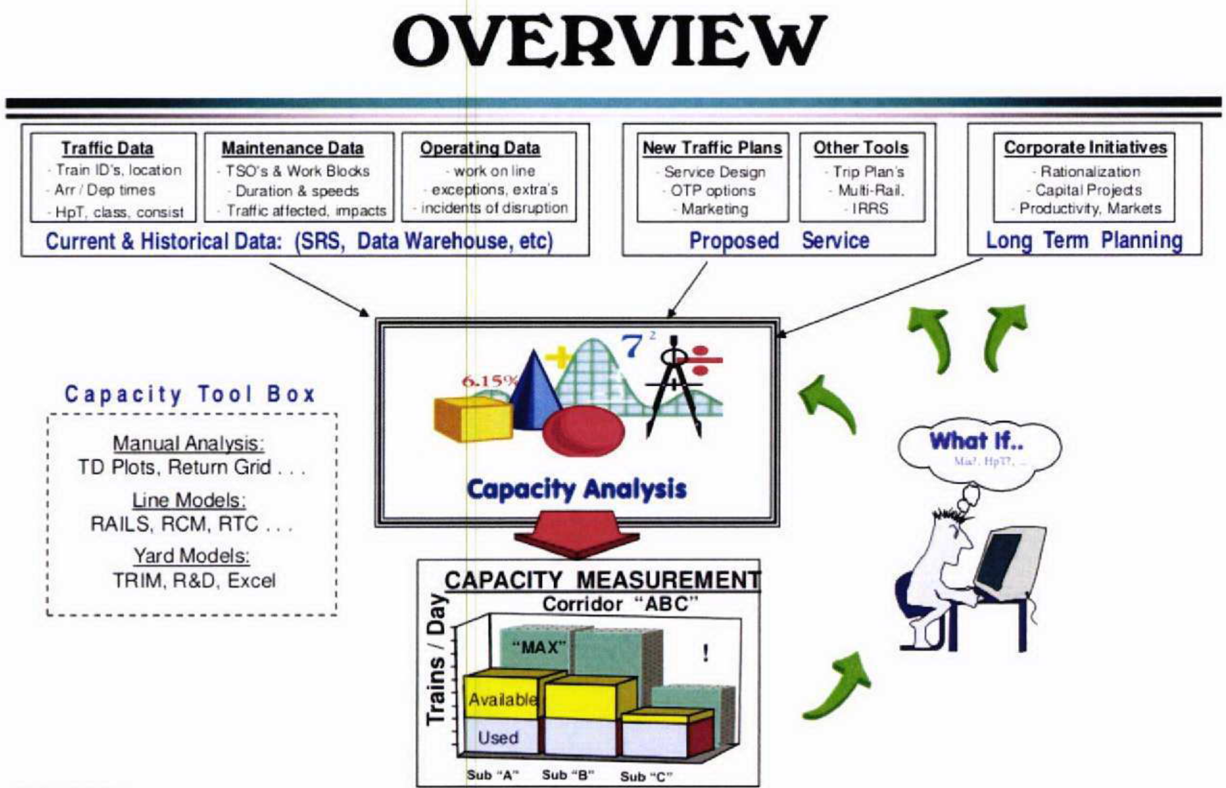


CONCLUSIONS

EFFECTIVE CAPACITY MANAGEMENT

- Improve Track Asset Utilization
  - Recognize Dynamic Nature of Capacity
  - Identify "Practical" Capacity System Wide
  - Facilitates Operating/Cost Tradeoffs
- Increase Service Reliability
  - Identify Problems
  - Support Service Design
- Balance Competing Demands for Capacity
  - Plant, Traffic & Operating Factors
  - Marketing vs. Operations vs. Engineering needs

APPENDIX


OVERVIEW
Traffic Data
- Train ID's, location
- Arr / Dep times
- HpT, class, consist
Maintenance Data
- TSO's & Work Blocks
- Duration & speeds
- Traffic affected, impacts
Operating Data
- work on line
- exceptions, extra's
- incidents of disruption
Current & Historical Data: (SRS, Data Warehouse, etc)
New Traffic Plans
- Service Design
- OTP options
- Marketing
Other Tools
- Trip Plan's
- Multi-Rail,
- IRRS
Proposed Service
Corporate Initiatives
- Rationalization
- Capital Projects
- Productivity, Markets
Long Term Planning
Capacity Tool Box
Manual Analysis:
TD Plots, Return Grid . . .
Line Models:
RAILS, RCM, RTC . . .
Yard Models:
TRIM, R&D, Excel
Capacity Analysis
What If..
CAPACITY MEASUREMENT
Corridor "ABC"
Trains / Day
"MAX"
!
Available
Used
Sub "A"
Sub "B"
Sub "C"

12/19/2013

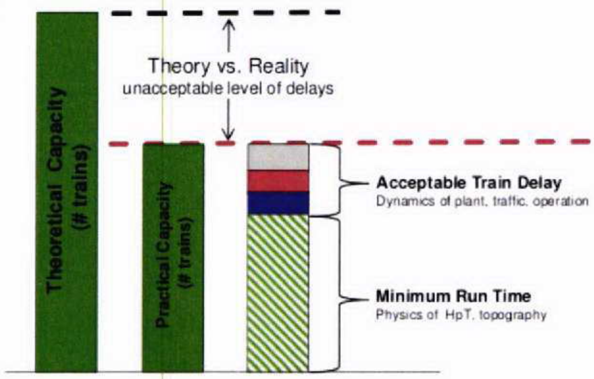
CAPACITY – WHAT IS IT

"GENERAL" RELATIONSHIP

Theoretical Capacity

Uniform Traffic & Operations

- same HpT, length, priority
- evenly spaced , no bunching
- no disruptions, exceptions



Practical Capacity

Variable Traffic & Operations

- Different HpT, length, priority
- Traffic bunching
- Disruptions, exceptions

Plant Delays

- Siding Lengths & spacing
- Track Speeds, grades
- Double Track, signals
- etc

Traffic Delays

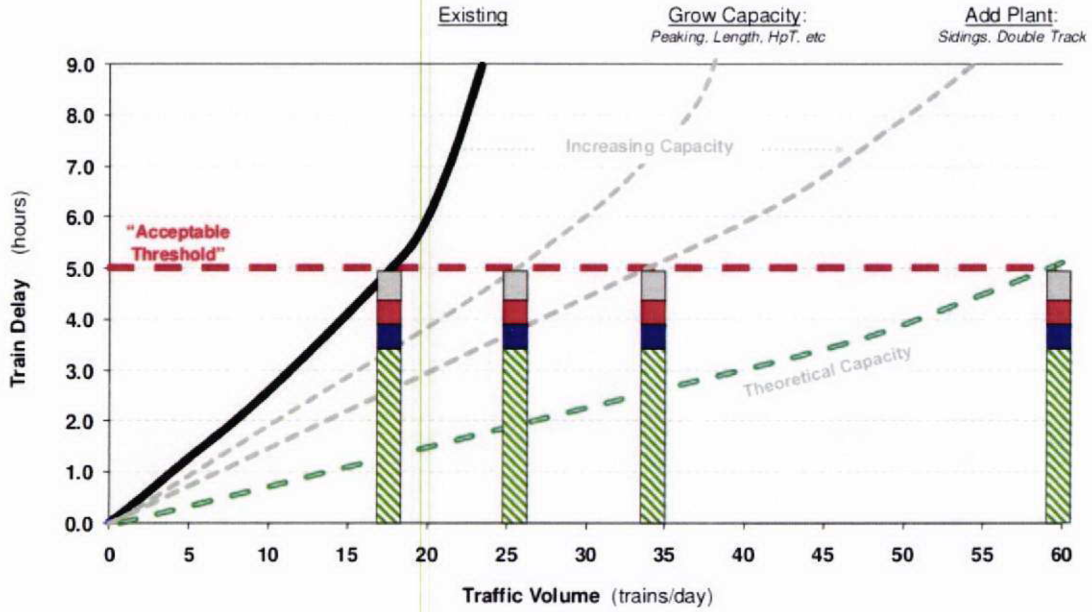
- train mix & priority
- traffic "bunching"
- equipment failures
- etc

Operating Delays

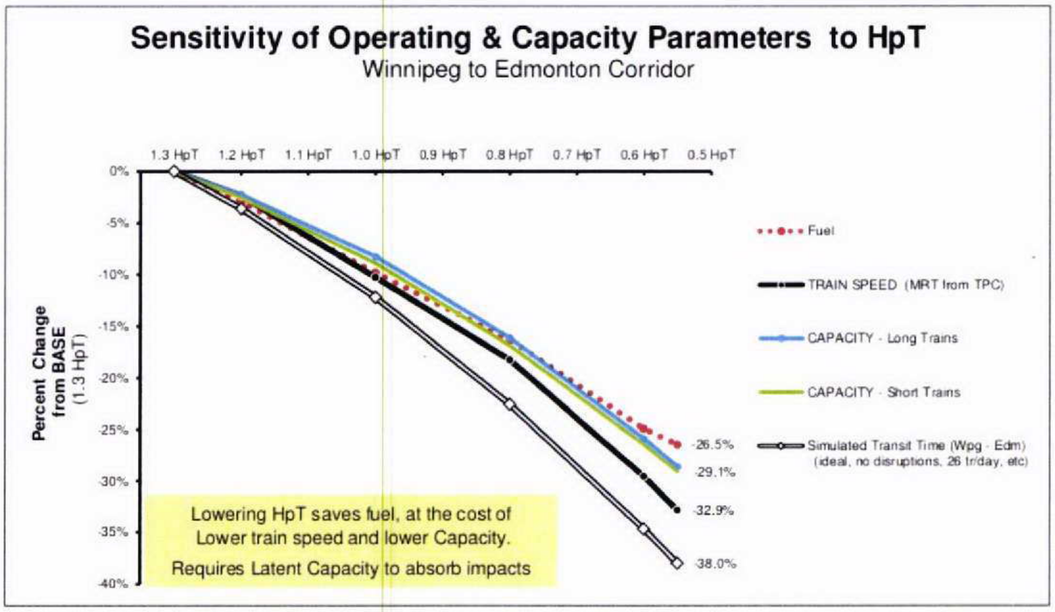
- work on line
- track maintenance
- disruptions
- etc

CAPACITY - WHAT IS IT?

VOLUME VS. DELAY RELATIONSHIP



SENSITIVITY TO HPT



ATTACHMENT 2

[REDACTED]

ATTACHMENT 3

[REDACTED]

ATTACHMENT 4

[REDACTED]

ATTACHMENT 5

[REDACTED]

CERTIFICATE OF SERVICE

I certify that on September 14, 2017, a Highly Confidential and Public version of the foregoing National Railroad Passenger Corporation's Rebuttal Submission was served by hand upon the following counsel for Canadian National Railway Company:

David A. Hirsh
James M. Guinivan
Harkins Cunningham LLP
1700 K Street, N.W., Suite 400
Washington, DC 20006-3817
dhirsh@harkinscunningham.com
jguinivan@harkinscunningham.com

Justin J. Marks