NORFOLK SOUTHERN

Amtrak Pennsylvanian RTC Analysis

Final Report

September 2021

Strategic Planning

Industrial Engineering

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01 Project Overview

Expansion of Amtrak Pennsylvanian

- PennDOT is exploring the potential to expand the current Pennsylvanian service between New York, NY and Pittsburgh, PA
  - Additional daily round trip frequency
  - Modification to current Pennsylvanian schedule
- RTC study has been performed to determine how to make the proposed change in service transparent to expected (projected to year 2040) operations

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Project scope

Evaluate the impact of modified and expanded Amtrak rail service on NS traffic fluidity between Harrisburg and Pittsburgh as measured in terms of delay.

Determine infrastructure necessary to alleviate increased delay on NS traffic ***and*** ensure Amtrak rail service delay metrics are returned to at least current levels.

Three phases to the RTC study

Base Case (year 2040)

- Future NS operations
  - Current traffic w/ expected growth
  - Current infrastructure + improvements that will be completed by year 2040
- Current Amtrak schedules

Modified Case

- Future NS operations
  - Current traffic w/ expected growth
  - Current infrastructure + improvements that will be completed by year 2040
- New Amtrak schedules
  - Modified existing
  - Expanded service

Future Case

- Potential infrastructure was layered on the Modified Case
- Various project combinations were tested until output metrics for both NS and Amtrak were back to at least Base Case levels

RTC study agreement assumptions

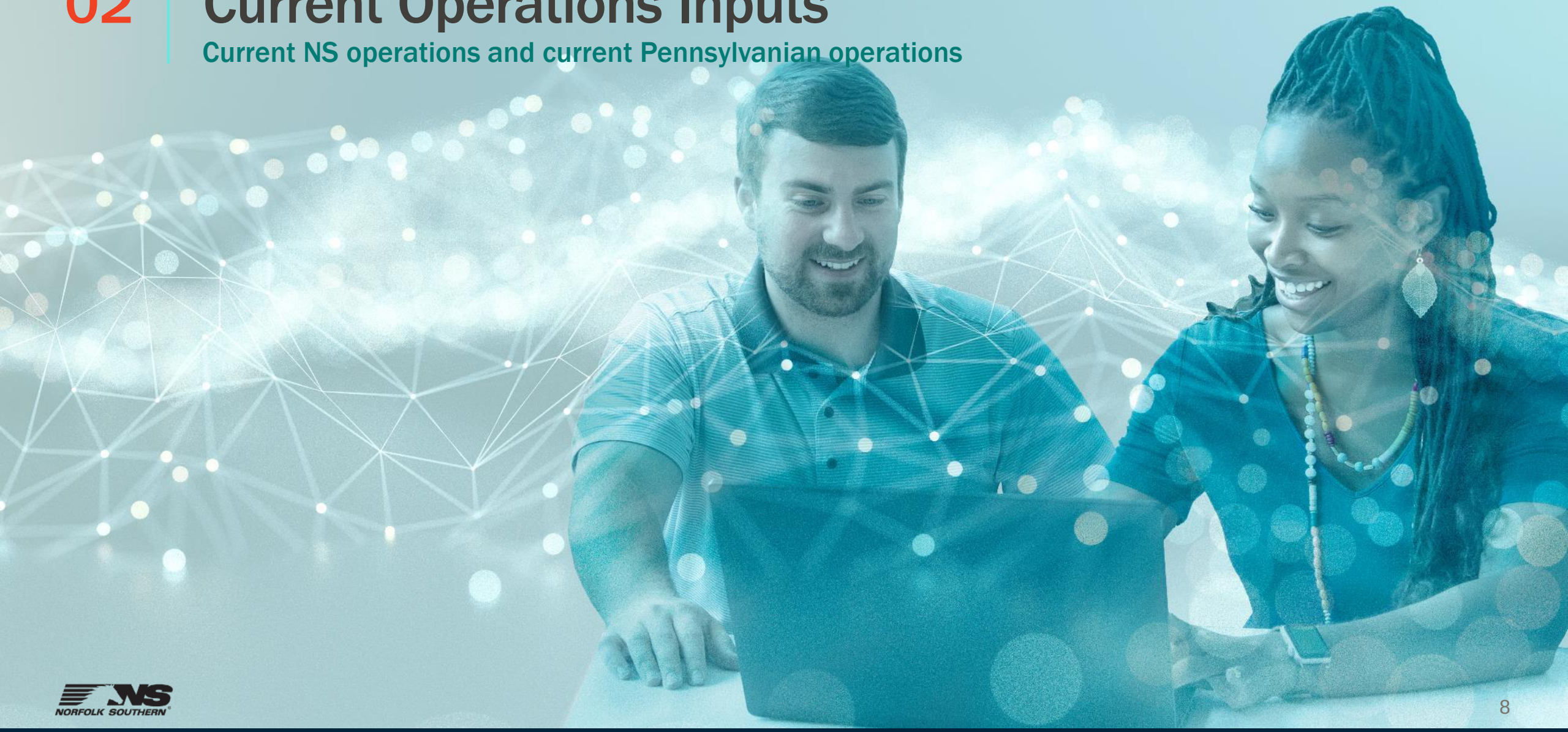
Defined assumptions outlined in PennDOT – NSRC RTC Study Agreement: Exhibit B

- The study used Berkeley Simulation Software LLC., Rail Traffic Controller Model
  - Version 75Q – Beta (64-bit) was used
- Maximum authorized speed for model: 79 mph
- Each simulation was run 5x with randomization and results averaged
- Metric output: delay minutes per 100 train miles
- Passenger trains always depart initial station on time
- For late passenger trains, model assumes full dwell time at station stops
- Infrastructure will be priced on an order of magnitude basis, on a year of construction (5 years in the future) basis
- Future defined NS traffic to be included (calendar year 2040)

02

Current Operations Inputs

Current NS operations and current Pennsylvanian operations



Current operations input

- This data was assembled and used to develop the Base Case (year 2040), ensuring that the Base Case (year 2040) reflects actual operations.
  - Current Norfolk Southern infrastructure and operations
  - Current Amtrak operations
- RTC simulation animation of current operations was used to validate inputs

Current operations input

NS Traffic

- Historical traffic volumes pulled for the week of September 15-23, 2019*
  - Scheduled freight (intermodal, multi-level, merchandise) based on schedule
  - Non-scheduled freight (unit trains, special moves, extra segments of scheduled trains) based on historical on-network times
  - Local, Yard, and Foreign trains based on field input

Amtrak Traffic

- Used NS historical schedules (verified against ASMAD – Amtrak Status Maps Archive Database)
  - All trains depart initial on-network station / location on time (no randomization)
    - Pennsylvanian: Pittsburgh station for Eastbound trains / Harrisburg station for Westbound trains
    - Capitol Limited: MP PC15 (Leetsdale) for Eastbound trains / CP Bloom for Westbound trains
  - Train and engine consists based on NS data

*Selected week for historical traffic needed to meet the following criteria: 1) Post NS TOP21 implementation, 2) Pre-Covid impact, 3) Avoid major holiday shut-downs, 4) Avoid any major maintenance, re-routes or abnormal events

Current operations input: Amtrak

Pennsylvanian Schedules:

Amtrak 42 (Eastbound) (Arr/Dep)		Amtrak 43 (Westbound) (Arr/Dep)	
Pittsburgh:	------ / 7:30	Harrisburg:	------ / 14:36
Greensburg:	8:08 / 8:10	Lewistown:	15:44 / 15:46
Latrobe:	8:19 / 8:20	Huntingdon:	16:21 / 16:23
Johnstown:	9:00 / 9:03	Tyrone:	16:48 / 16:49
Altoona:	9:57 / 10:01	Altoona:	17:09 / 17:13
Tyrone:	10:16 / 10:18	Johnstown:	18:07 / 18:10
Huntingdon:	10:43 / 10:45	Latrobe:	18:50 / 18:51
Lewistown:	11:22 / 11:24	Greensburg:	19:00 / 19:02
Harrisburg:	12:53 / ------	Pittsburgh:	20:01 / ------

Capitol Limited Schedules:

Amtrak 30 (Eastbound) (Arr/Dep)		Amtrak 29 (Westbound) (Arr/Dep)	
Leetsdale:	------ / 4:43	CP Bloom:	------ / 23:43
Pittsburgh:	5:05 / 5:20	Pittsburgh:	23:48 / 0:00*

*One minute discrepancy between NS schedule data and ASMAD data, ASMAD shows 2359 departure, NS schedule shows 0000 departure.

Model assumptions – helper operations

Between Altoona and Pitcairn there are several sections of heavy grade. Helpers – one or more locomotives that temporarily assist a train requiring additional power to climb a grade – are needed regularly in this area. The following are the assumptions used for helper operations in this area:

- Any train over 9,000 feet (between Altoona and Conpit) received helper power
- Engines added based on tonnage ratings for the segment
- Eastbound helpers were added at either Pitcairn, Conpit or CP C
  - Off at Altoona
- Westbound on at Antis
  - Off at CP C or Pitcairn
- 10-minute dwell to attach / detach
  - Operations indicate that about half of the trains can detach helper power 'on the fly'. This means the train does not need to stop to detach.
    - Approximately 50% of trains needing helpers were coded to detach without stopping

- 177 trains needed helpers between Altoona and Conpit in the 9-day simulation (just under 20 trains per day)
- 8 trains needed helpers to/from Pitcairn in the 9-day simulation (about 1 train per day)

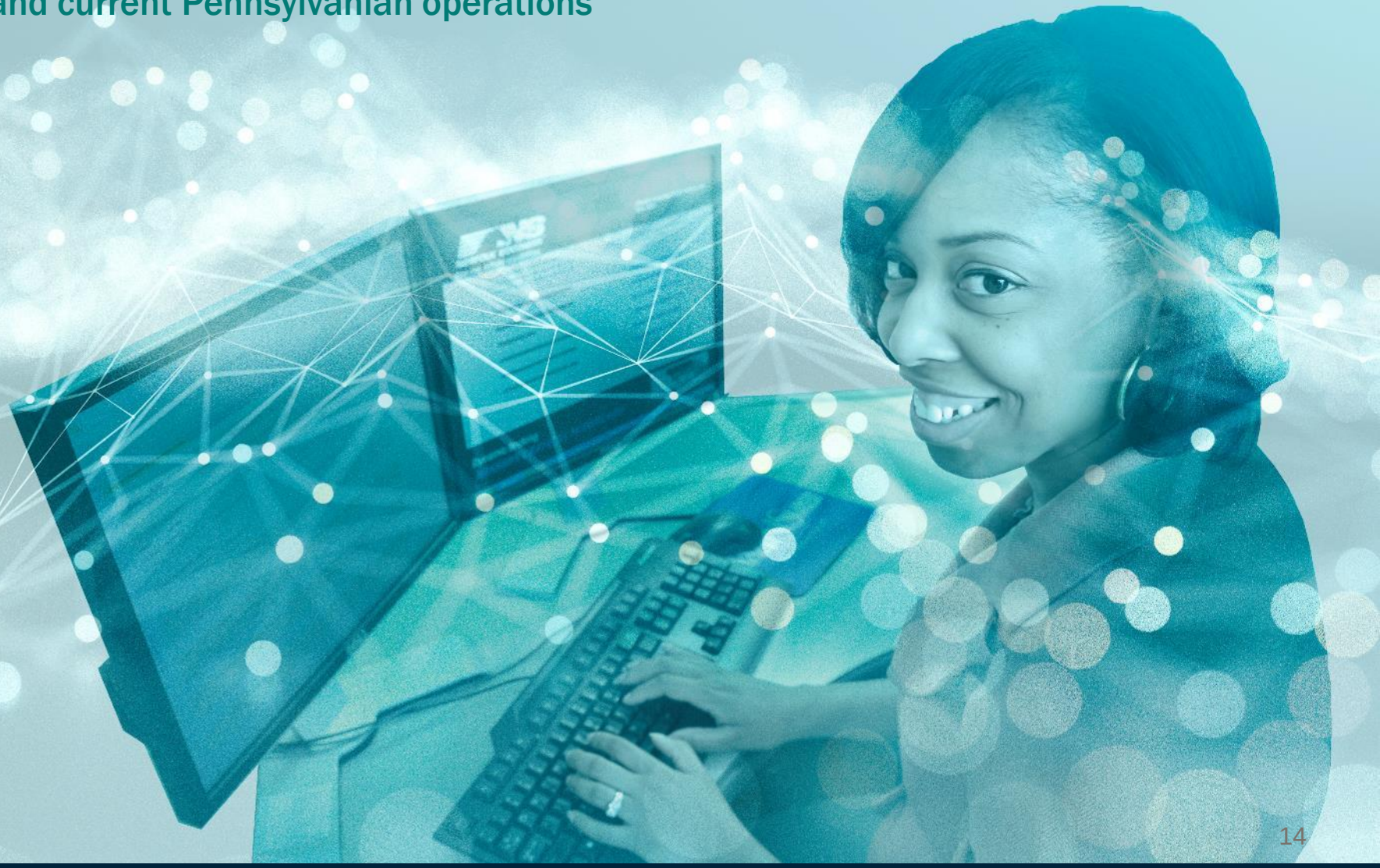
Current operations input validation

- Several validation meetings were held with the NOC (Network Operations Center – Norfolk Southern's train dispatching operations), Keystone Division management, as well as local and field personnel.
  - Freight train movement and routing, helper operations, local train operations, and Amtrak schedules and routing were confirmed
  - Freight train usage of other than main tracks was discussed
  - Simulation animation was reviewed

- Adjustments were made and confirmed based on input from validation meetings.

03 Base Case Model

Future NS operations and current Pennsylvanian operations



Base Case

- Represents the future operational fluidity for the study area with expected freight growth
  - Includes the expected (projected to calendar year 2040) Norfolk Southern operations
  - Amtrak 2040 operations remain unchanged from Amtrak current (pre-Covid) operations
- Defines the baseline metrics to which all additional cases will be compared against

Base Case model inputs

NS Operations:

- Current NS traffic:
  - Same as defined in ‘Current operations input’
  - Updated schedules / consists as needed to reflect train plan*
- Added future anticipated NS traffic:
  - Three daily, round-trip (six total) merchandise trains
  - One daily, one-way intermodal train
- Adjusted current train routing to account for expected NS operations:
  - Pittsburgh Vertical Clearance Project (PVCP) assumed to be in service
  - NS traffic adjusted to meet intended function of the project
    - Route faster, higher priority traffic via the Pittsburgh Line / slower, lower priority via the Mon Line

Amtrak Operations:

- Current Amtrak service:
  - Same as defined in ‘Current operations input’

*NS Enola Yard’s revised operating plan resulted in several train schedule changes and routing adjustments in Harrisburg Terminal

Base Case NS operations

Defining future freight on the line

- Expected freight volumes (in terms of carloads) for year 2040 were determined using Norfolk Southern's five-year forecast in conjunction with Moody's forecast for annual GDP growth in the years beyond 2025.
- Network Planning and Optimization converted expected carload growth into train growth
  - Manifest/Unit growth (daily):
    - 3 Eastbound and 3 Westbound – Average train size: 167 cars
  - Intermodal growth (daily):
    - 1 Westbound – Average train size: ~10,000 feet

Base Case NS operations

Adding growth trains to the model

- The following trains were added to the Base Case model to represent the expected growth on the line

  - **Westbound**

Symbol	Cars	Tonnage	Length (ft)	Engine consist – DP (distributed power)	Operations
Merch1	167	11,956	10,246	2 engines headend / 2 engines middle	Su/M/Tu/W/Th/F/Sa
Merch3	167	11,956	10,246	2 engines headend / 2 engines middle	Su/M/Tu/W/Th/F/Sa
Merch5	167	11,956	10,246	2 engines headend / 2 engines middle	Su/M/Tu/W/Th/F/Sa
IM1*	61	5,667	10,333	2 engines headend (not DP)	Su/M/Tu/W/Th/F/Sa

  - **Eastbound**

Symbol	Cars	Tonnage	Length (ft)	Engine consist – DP	Operations
Merch2	167	9,272	12,250	2 engines headend / 2 engines middle	Su/M/Tu/W/Th/F/Sa
Merch4	167	9,272	12,250	2 engines headend / 2 engines middle	Su/M/Tu/W/Th/F/Sa
Merch6	167	9,272	12,250	2 engines headend / 2 engines middle	Su/M/Tu/W/Th/F/Sa

*IM train was defined and prioritized as non-premium.

Simulation parameters*

- Assumptions outlined for the Current Case are applied (i.e., helper operations, priorities, etc.), unless otherwise defined
- Randomization:
  - Randomization for NS traffic was set to current NS operating standards:
    - 15 minutes early to 1 hour late for Premium Intermodal trains
    - 15 minutes early to 2 hours late for Intermodal, Merchandise, and Multilevel trains
    - 10 minutes early to 10 minutes late for Unit, Local and Extra trains
    - Amtrak not randomized
- Simulation set-up:
  - Simulation runs for nine modeled days
    - One warm-up day and one cool-down day are excluded from the data output
    - Seven full simulation days are included in the data output
  - Randomized simulations were run until five completed runs were achieved

04 Modified Case Model

Future NS operations with modified existing and expanded Amtrak operations

Modified Case

- Defines the impact the proposed Amtrak schedules have on freight operations.
  - Layers modifications to the existing Amtrak service as well as the expanded service on top of the Base Case model.
- Output metrics were compared against baseline metrics to determine impact.

Modified Case Amtrak operations

Pennsylvanian Schedules*:

Eastbound				Westbound		
Amtrak 40 (Arr/Dep) Daily		Amtrak 42 M-F	Amtrak 44 Sa/Su	Amtrak 43 (Arr/Dep) Daily		Amtrak 45 Daily
Pittsburgh:	------ / 7:00	------ / 12:00	------ / 12:30	Harrisburg:	------ / 9:46	------ / 16:40
Greensburg:	7:39 / 7:41	12:38 / 12:40	13:08 / 13:10	Lewistown:	10:54 / 10:56	17:46 / 17:48
Latrobe:	7:50 / 7:51	12:49 / 12:50	13:19 / 13:20	Huntingdon:	11:31 / 11:33	18:23 / 18:25
Johnstown:	8:30 / 8:33	13:30 / 13:33	14:00 / 14:03	Tyrone:	11:58 / 11:59	18:50 / 18:51
Altoona:	9:26 / 9:30	14:26 / 14:30	14:56 / 15:00	Altoona:	12:19 / 12:23	19:06 / 19:10
Tyrone:	9:45 / 9:47	14:45 / 14:47	15:15 / 15:17	Johnstown:	13:17 / 13:20	20:02 / 20:05
Huntingdon:	10:12 / 10:14	15:12 / 15:14	15:42 / 15:44	Latrobe:	14:00 / 14:01	20:43 / 20:44
Lewistown:	10:49 / 10:51	15:49 / 15:51	15:19 / 16:21	Greensburg:	14:10 / 14:12	20:52 / 20:54
Harrisburg:	12:23 / ------	17:23 / ------	17:53 / ------	Pittsburgh:	15:11 / ------	22:01 / ------

Capitol Limited Schedules: Remain the same as the Base Case

*Original schedule provided in Exhibit C contained errors, the schedules used in the simulation were provided via email from PennDOT 9/16/2020

05 Modified Case Model (alternative schedules)

Modified Case
(alternative schedules)

- Analysis of the Modified Case output indicated a conflict between schedules for the Eastbound Amtrak 42 & 44 and the Westbound Amtrak 43.
  - PennDOT, working with Amtrak, produced alternative schedules to reduce the infrastructure necessary to mitigate impact on freight operations.
- The inputs and assumptions for the Modified Case (alternative schedules), other than the schedules, remain the same as those defined in the Modified Case.

Modified Case Amtrak operations – alternative schedules

Pennsylvanian Schedules*:

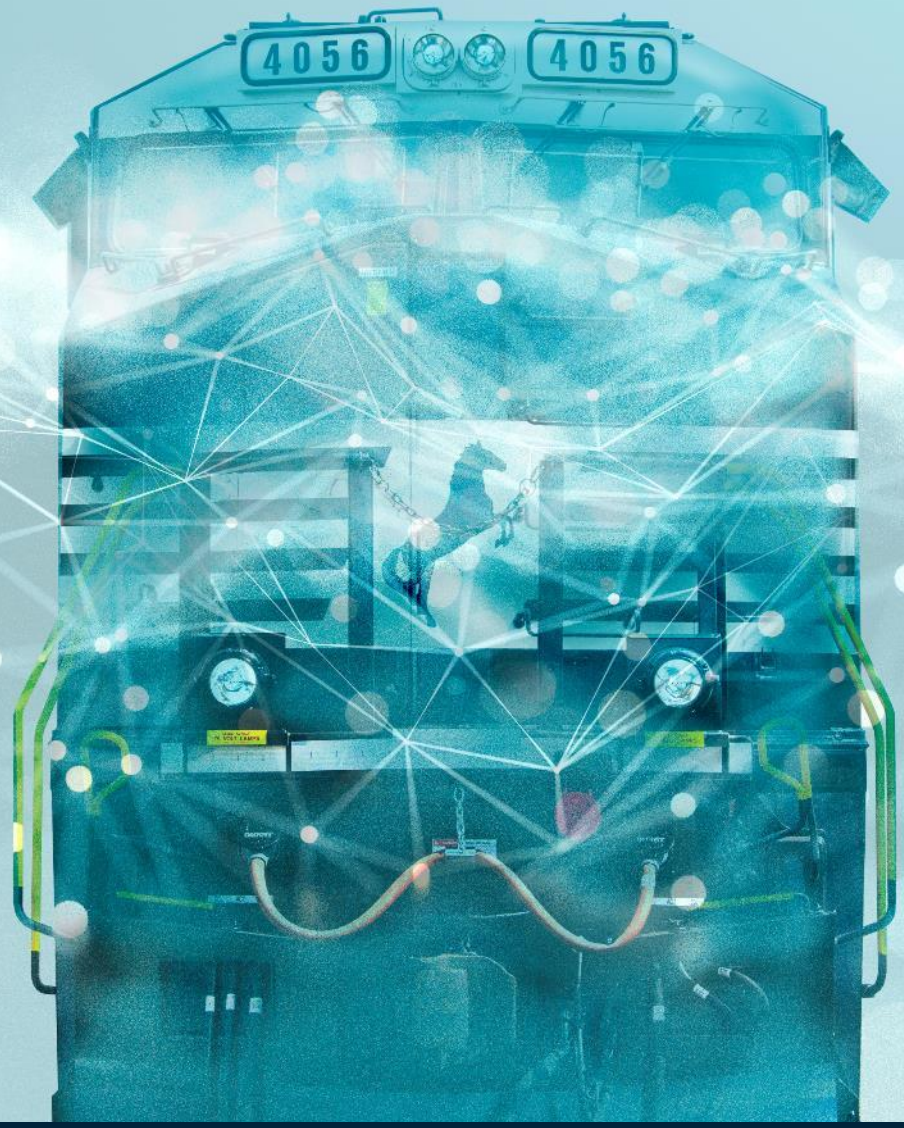
Eastbound			Westbound		
Amtrak 40 (Arr/Dep) Daily		**Amtrak 42 Daily**	**Amtrak 43 (Arr/Dep) Daily**		**Amtrak 45 Daily**
Pittsburgh:	------ / 7:00	------ / 12:30	Harrisburg:	------ / 9:41	------ / 16:40
Greensburg:	7:39 / 7:41	12:38 / 13:10	Lewistown:	10:49 / 10:51	17:46 / 17:48
Latrobe:	7:50 / 7:51	12:49 / 13:20	Huntingdon:	11:26 / 11:28	18:23 / 18:25
Johnstown:	8:30 / 8:33	13:30 / 14:03	Tyrone:	11:53 / 11:54	18:50 / 18:51
Altoona:	9:26 / 9:30	14:26 / 15:00	Altoona:	12:14 / 12:18	19:06 / 19:10
Tyrone:	9:45 / 9:47	14:45 / 15:17	Johnstown:	13:12 / 13:15	20:02 / 20:05
Huntingdon:	10:12 / 10:14	15:12 / 15:44	Latrobe:	13:55 / 13:56	20:43 / 20:44
Lewistown:	10:49 / 10:51	15:49 / 16:21	Greensburg:	14:05 / 14:07	20:52 / 20:54
Harrisburg:	12:23 / ------	17:53 / ------	Pittsburgh:	15:06 / ------	22:01 / ------

Capitol Limited Schedules: Remain the same

*Alternative schedules received via email 5/18/2021

06 Simulation Results

Base Case vs. Modified Case



Defining performance metrics

- The output metric this study used to determine the impact the proposed Amtrak service had on freight operation fluidity and Amtrak rail service, and to ensure the mitigation of that impact, was delay minutes per 100 train miles.

- Delay in RTC is the additional time it takes a train to operate across a route to due to conflicts with other traffic (difference between uninhibited run time and the actual simulated run time).
  - Delay is then normalized, based on distance traveled (RTC uses 100 train miles), resulting in the RTC output of delay minutes per 100 train miles.

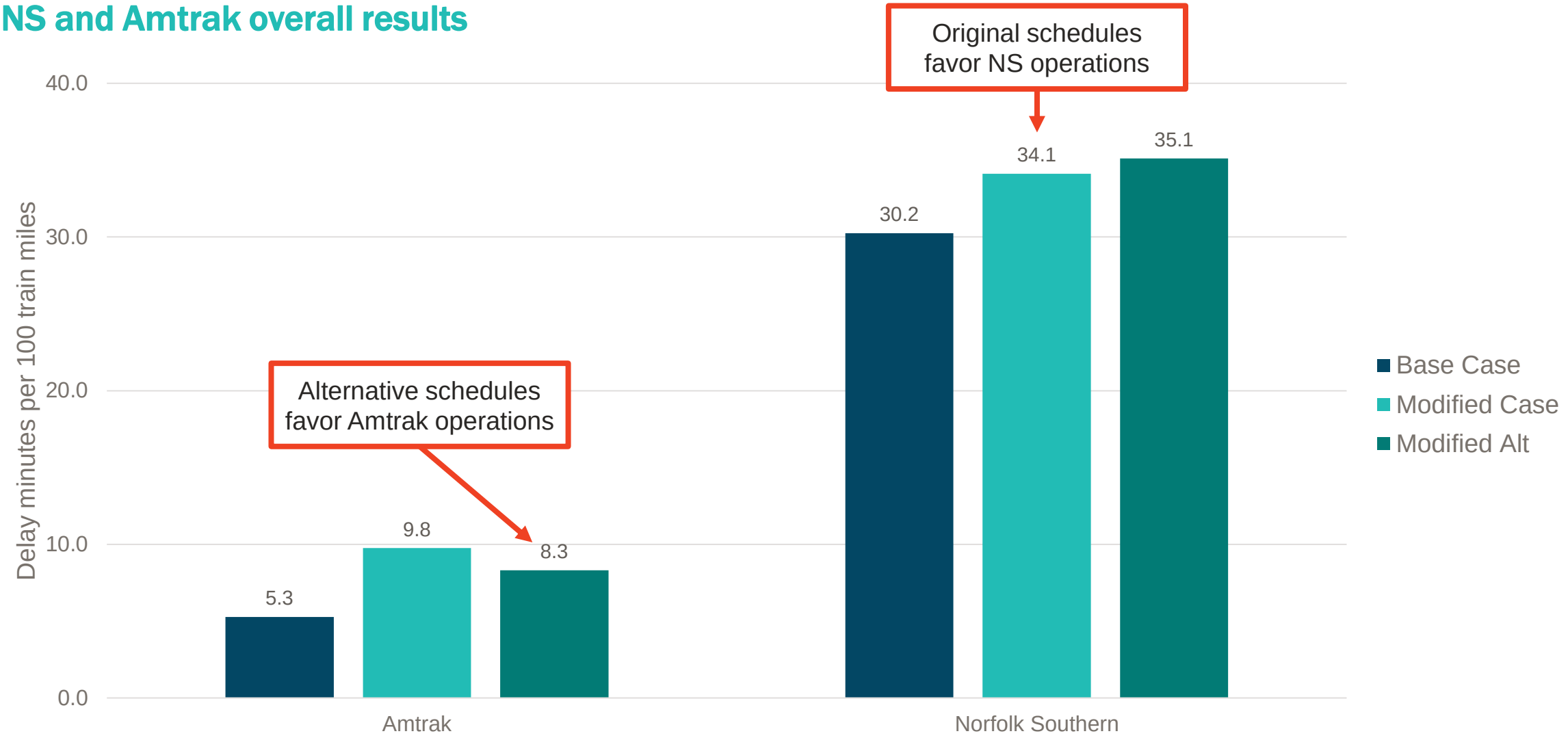
- Using only one **overall** output metric may not give a true indication of transparency.
  - Due to differing priorities by train type, it is possible to see increases in delay for one train type yet have a transparent overall result.
  - One schedule, or set of infrastructure, could favor one train while negatively impacting another.

- NS output was compared for all train types and was also reviewed for Expedited (Intermodal) and Freight (all others) to ensure priority traffic was not negatively affected.

- Amtrak output was compared for overall service and was also reviewed for Eastbound service delay and Westbound service delay to ensure delay metrics are returned to Base Case levels.

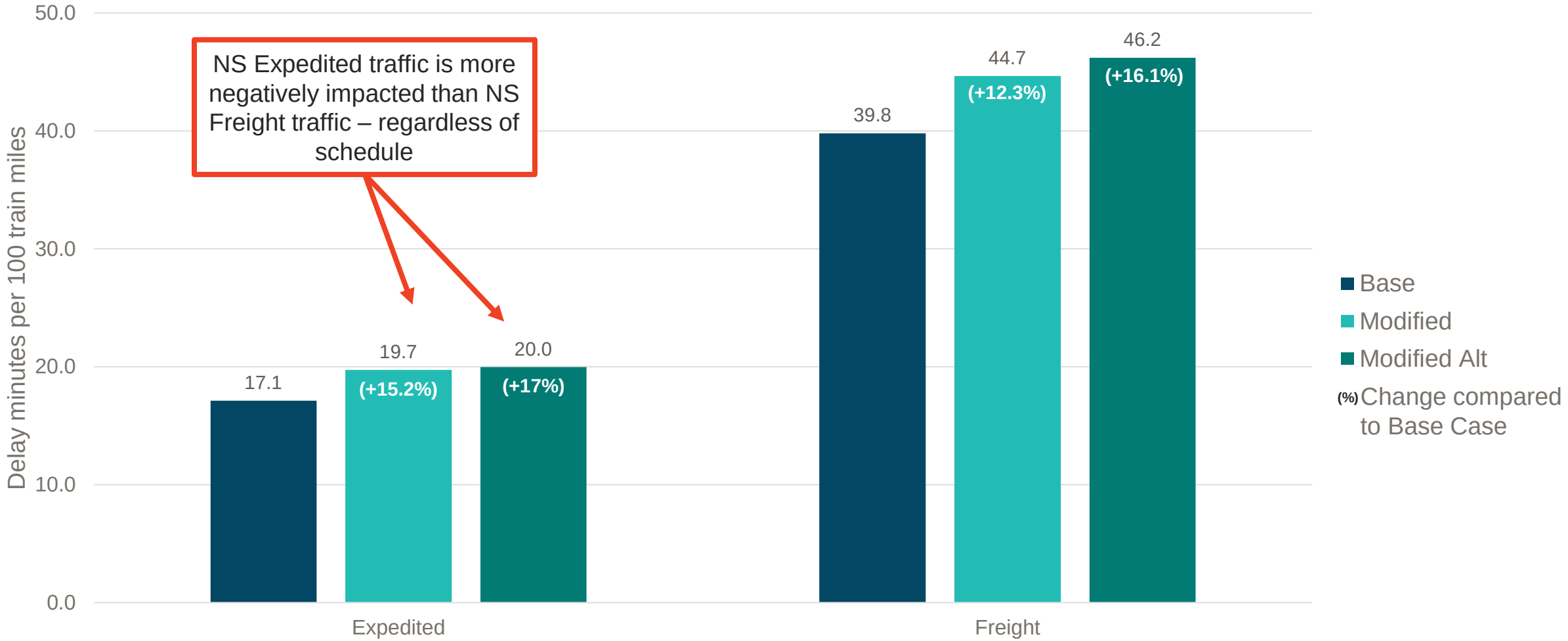
Comparing the Base Case to the Modified Cases

NS and Amtrak overall results



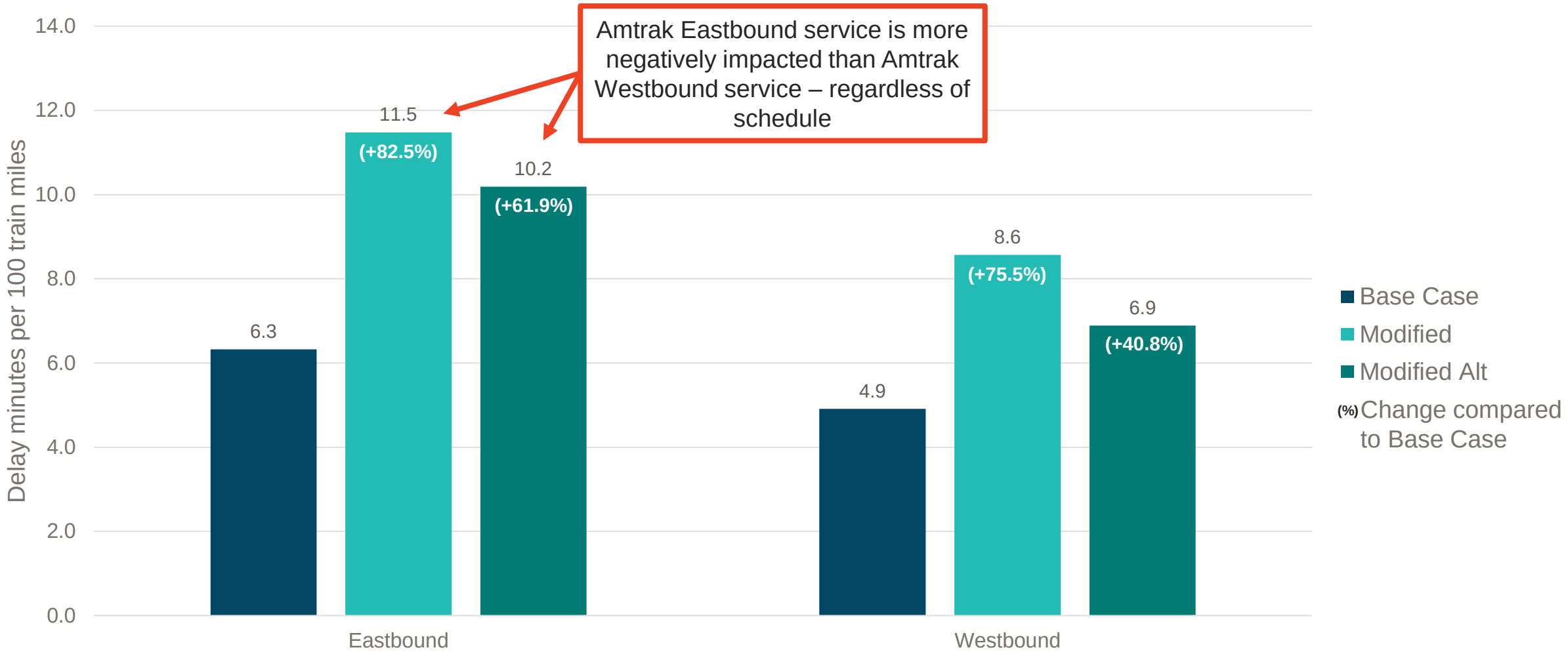
Comparing the Base Case to the Modified Cases

NS by train type results



Comparing the Base Case to the Modified Cases

Amtrak by direction results



Comparing the Base Case to the Modified Cases

Discussion

- NS results:
  - Overall, Expedited and Freight delays increased when the proposed Amtrak service was added to the line.
  - All three metrics resulted in a lower increase in delays (less negative impact) when tested with the originally defined Amtrak schedules (the original schedule favors NS operations).
  - Expedited traffic experienced a larger increase in delay (was more impacted) than Freight traffic.
- Amtrak results:
  - Overall, Eastbound and Westbound delays increased from Base Case levels when the proposed Amtrak service was tested.
  - All three metrics resulted in a lower increase in delays (less negative impact) when tested with the alternative schedules (the alternative schedule favors Amtrak operations).
  - Amtrak Eastbound service experienced a larger increase in delay (was more impacted) than Amtrak Westbound service.
- Indications/Implications:
  - The increase to NS and Amtrak delay metrics indicate a lack of capacity on the line to maintain Base Case levels of fluidity.
  - Infrastructure is necessary to mitigate the additional delay the proposed Amtrak service causes to NS operations and is also needed to ensure Amtrak delay levels are brought back to at least the Base Case levels.
  - Due to the inconsistent output for the two Amtrak schedules (original schedule favors NS performance, alternate schedule favors Amtrak performance) both schedules were tested against any potential infrastructure.

07 Infrastructure Improvements

Infrastructure improvements – project selection

- RTC output and RTC animation were analyzed to determine areas of constraint causing NS and Amtrak operations to experience the greatest delay increase / adverse impact from the proposed Amtrak service.

- Two generalized concerns were identified from the analysis as underlying causes of capacity constraint on the line:
  - Terminal congestion
  - Line fluidity

- RTC analysis, field input, review of prior studies, and knowledge of operations were taken into consideration when determining projects to be tested. Projects were selected to reduce or eliminate one, or both, of the above listed constraints.

Terminal Congestion

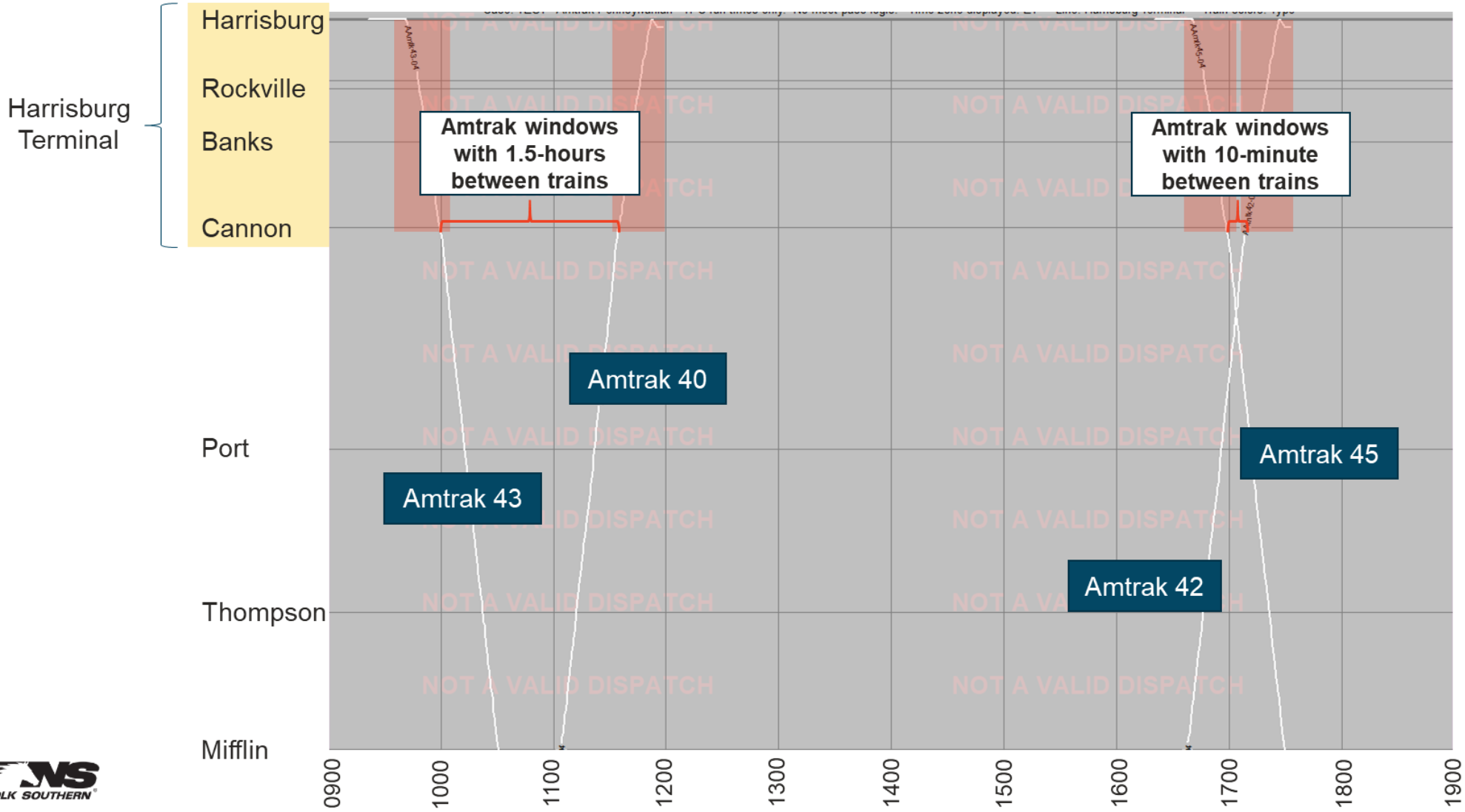
- A terminal is a point on a rail line with one or more yards. Terminals cause congestion for a variety of reasons:
  - Crew changes – train stops (generally on the main) for the inbound crew to hand over control of the train to an outbound crew
  - Fueling / Service events
  - Yarding – trains slow on the mainline as they pull into the yard
  - Headroom – trains pull out of the yard and occupy the mainline while building, or breaking down, a train
  - Staging – trains stop at outlying locations on the mainline until a yard can handle or until there is an opportunity to advance for a crew change or fueling event

- There are several terminals on the line. Two of these terminals have been identified as contributors to delay increase:
  - Harrisburg Terminal – consists of 3 yards within 12 miles
  - Rose Yard in Altoona

- For Amtrak to move through terminals without delay, NS operations must clear a route in advance of Amtrak arrival (Amtrak window). During Amtrak windows freight ability to fully utilize track capacity is diminished. The proposed Amtrak service increases the number of Amtrak windows on the line, resulting in additional freight delay.

Afternoon Amtrak windows create one extended window

Closely scheduled trains create additional constraints in Harrisburg Terminal

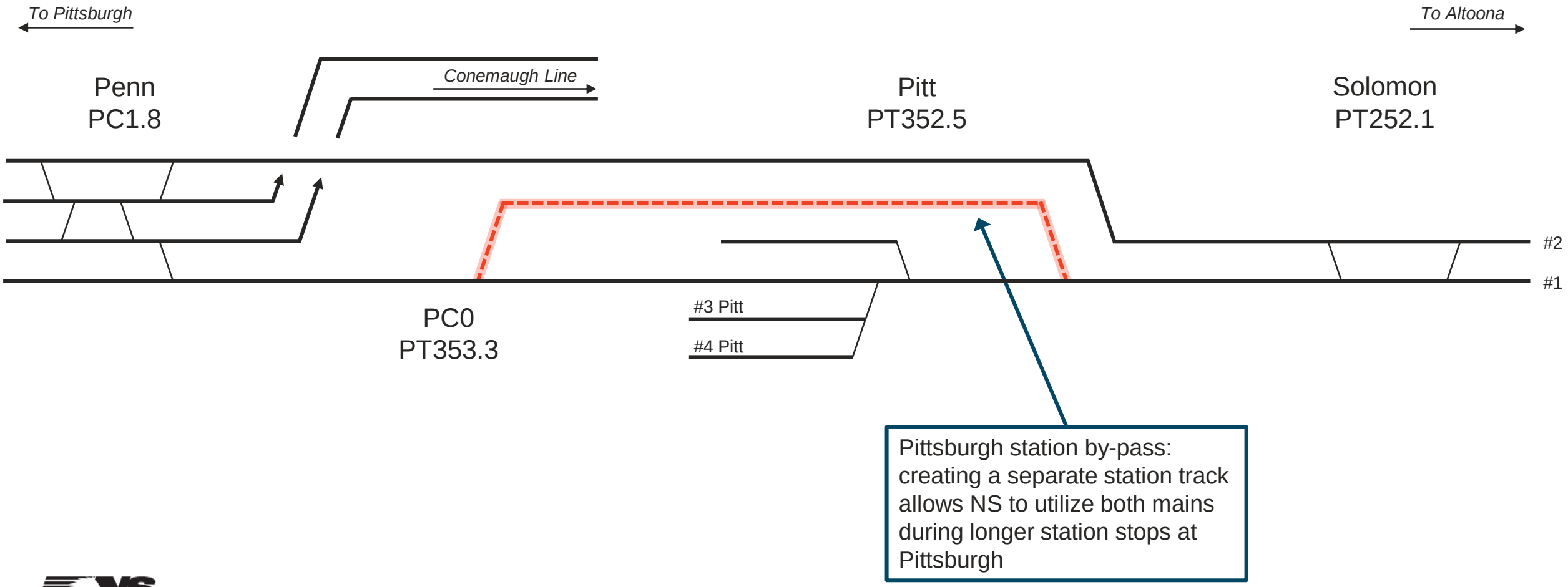


Line fluidity

- To maintain a fluid rail line (keep all traffic moving) there must be sufficient capacity (enough tracks) to allow faster moving traffic routes around slower traffic, and trains need the ability to capitalize on all available mainline capacity (access to all tracks)
  - Faster moving trains need access to available tracks to bypass slower moving trains
    - This is crucial to keep Amtrak moving, and prevent NS delay, between Altoona and Conpit where the discrepancy in train speed is exacerbated by the heavy grades
  - Adequately spaced universal crossovers (a set of switches that allow for movement between all tracks at a specific location) and bypass tracks are needed for flexibility in routing to prevent unnecessary delays
    - In congested terminals – like Altoona and Harrisburg – multiple routing options allow through train movement while performing other terminal operations (such as crew changes and headroom)

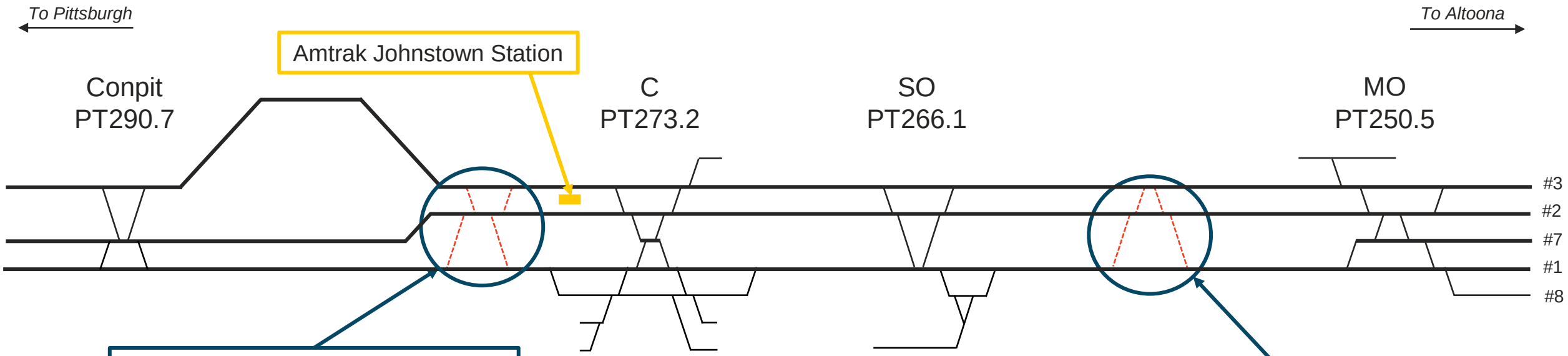
Altoona West infrastructure

Adds fluidity to the line



Altoona West infrastructure

Adds fluidity to the line and increases Amtrak utilization of the station track on Main 3

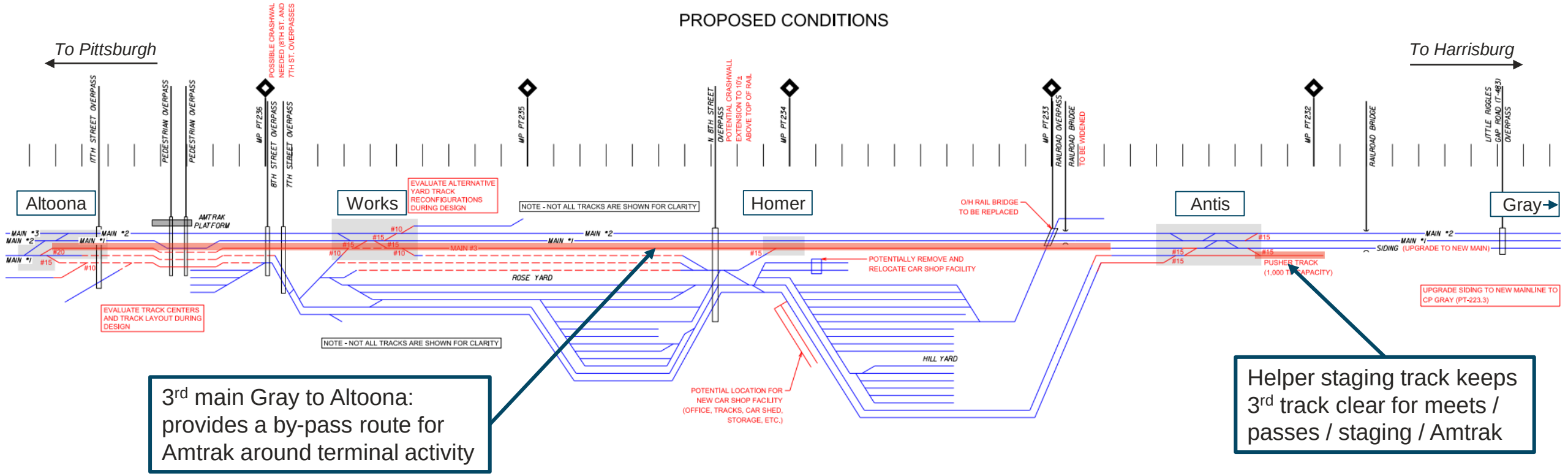


Universal crossovers at PT 276: creates ~3 miles of additional parallel triple track, provides additional route flexibility and line fluidity by reducing the distance between crossover points, and increases Amtrak's usage of the station track on Main 3

Universal crossovers at PT 257: creates additional route flexibility and line fluidity by reducing the distance between crossover points

Altoona infrastructure

Provides additional route around terminal congestion and adds fluidity in the terminal

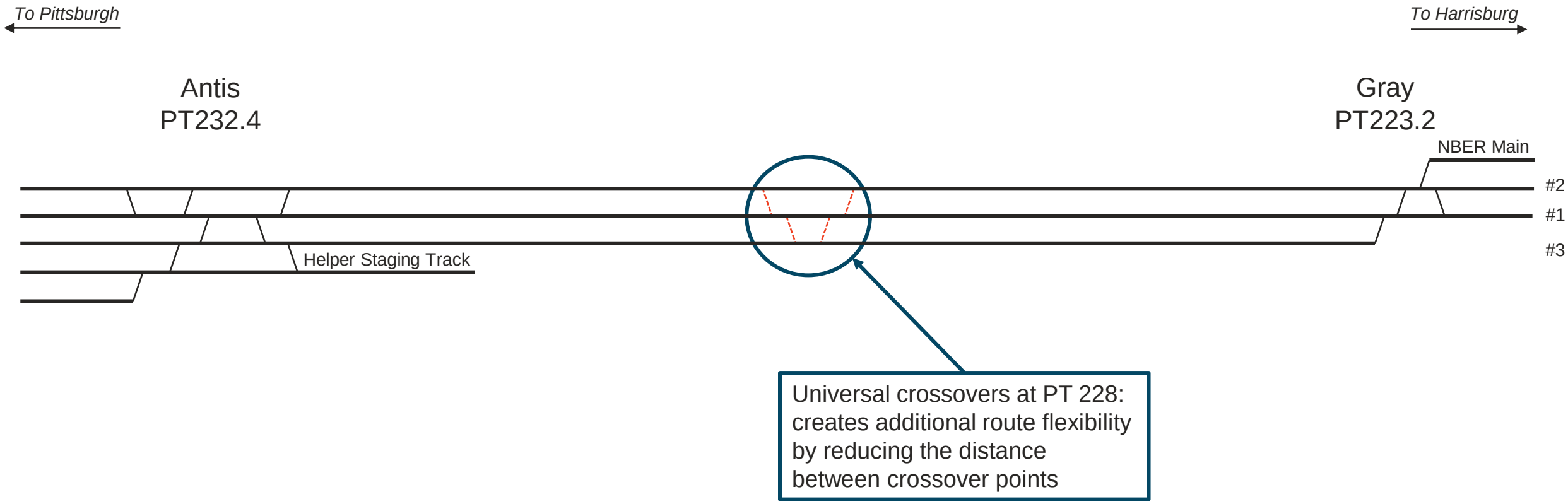


3rd main Gray to Altoona: provides a by-pass route for Amtrak around terminal activity

Helper staging track keeps 3rd track clear for meets / passes / staging / Amtrak

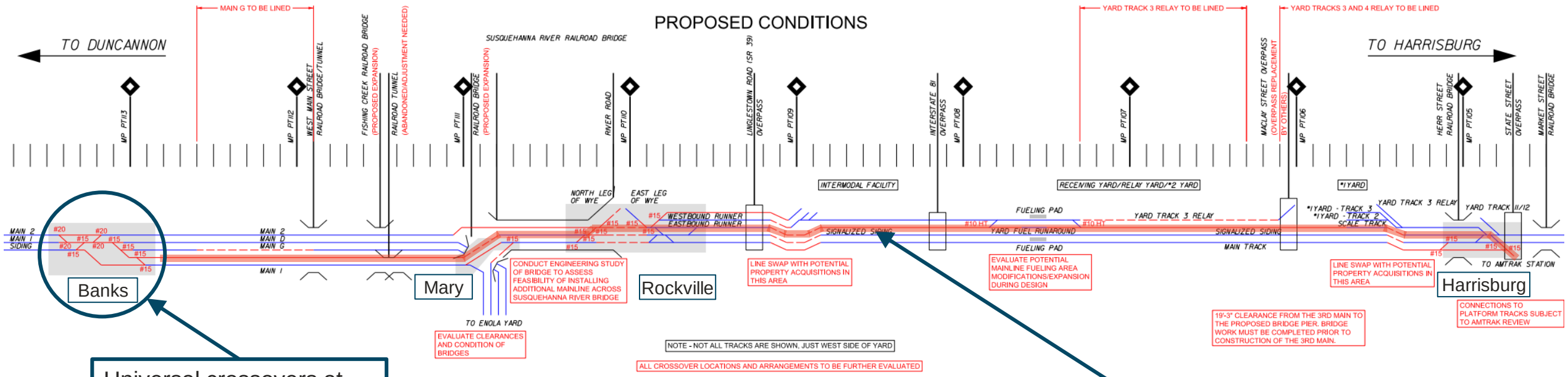
Altoona East infrastructure

Adds fluidity to the line



Harrisburg Terminal Infrastructure

Provides additional route around terminal congestion and adds fluidity in the terminal



Universal crossovers at Banks: creates additional route flexibility and fluidity through the terminal

3rd track Harrisburg to Banks: provides a by-pass route for Amtrak around terminal activity

07 Simulation Results

Future Case (infrastructure added) vs Base Case

Future Case

- Layers potential improvements on the Modified Case to determine a set of projects (infrastructure solution set) necessary to mitigate the impact of the proposed Amtrak service
  - Multiple infrastructure combinations were tested in the model and results were compared to the Base Case
  - The infrastructure solution set was determined when all defined model output metrics were returned to at least Base Case levels

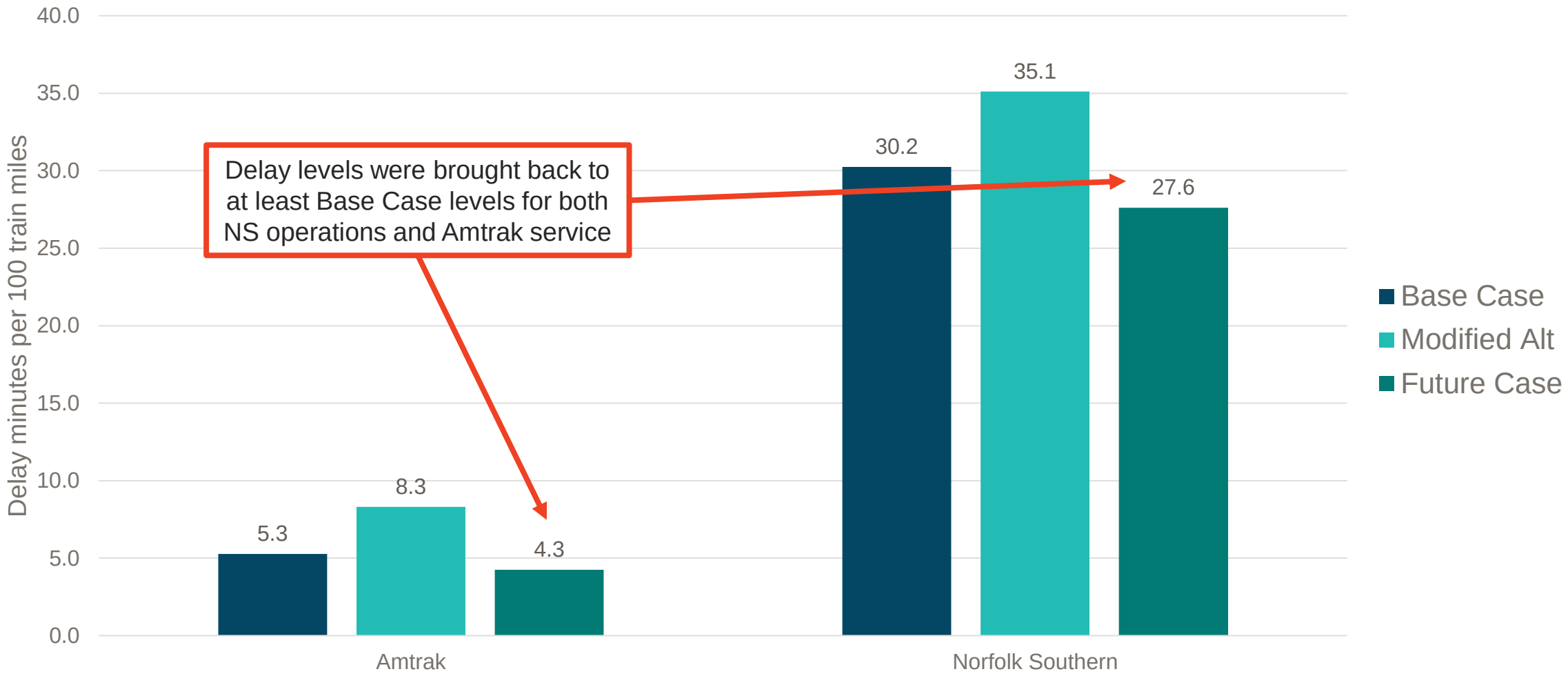
Infrastructure solution set*

Infrastructure solution set and identified areas of capacity constraint

*The defined infrastructure solution set is successful when combined with the alternative Amtrak schedules

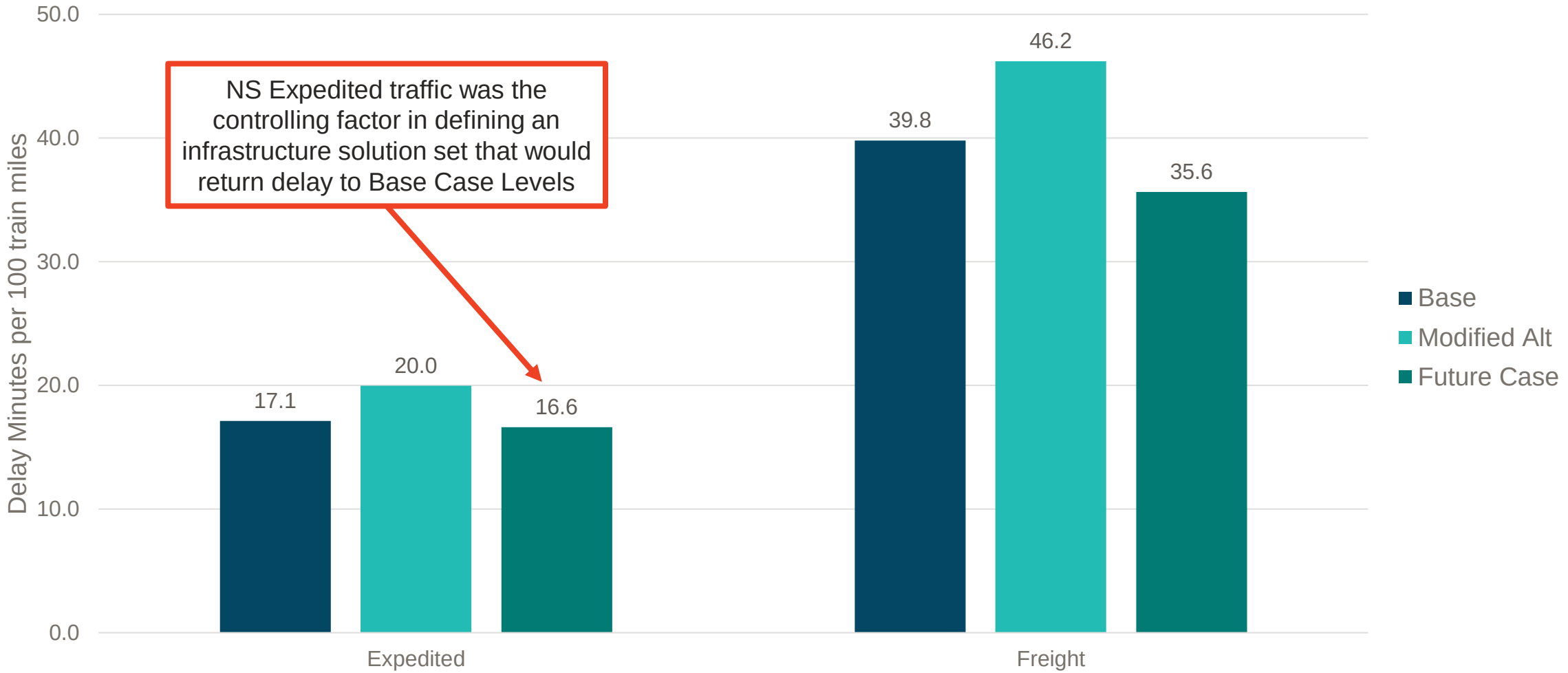
Comparing Base Case to Future Case

Overall results – alternative Amtrak schedules and infrastructure solution set



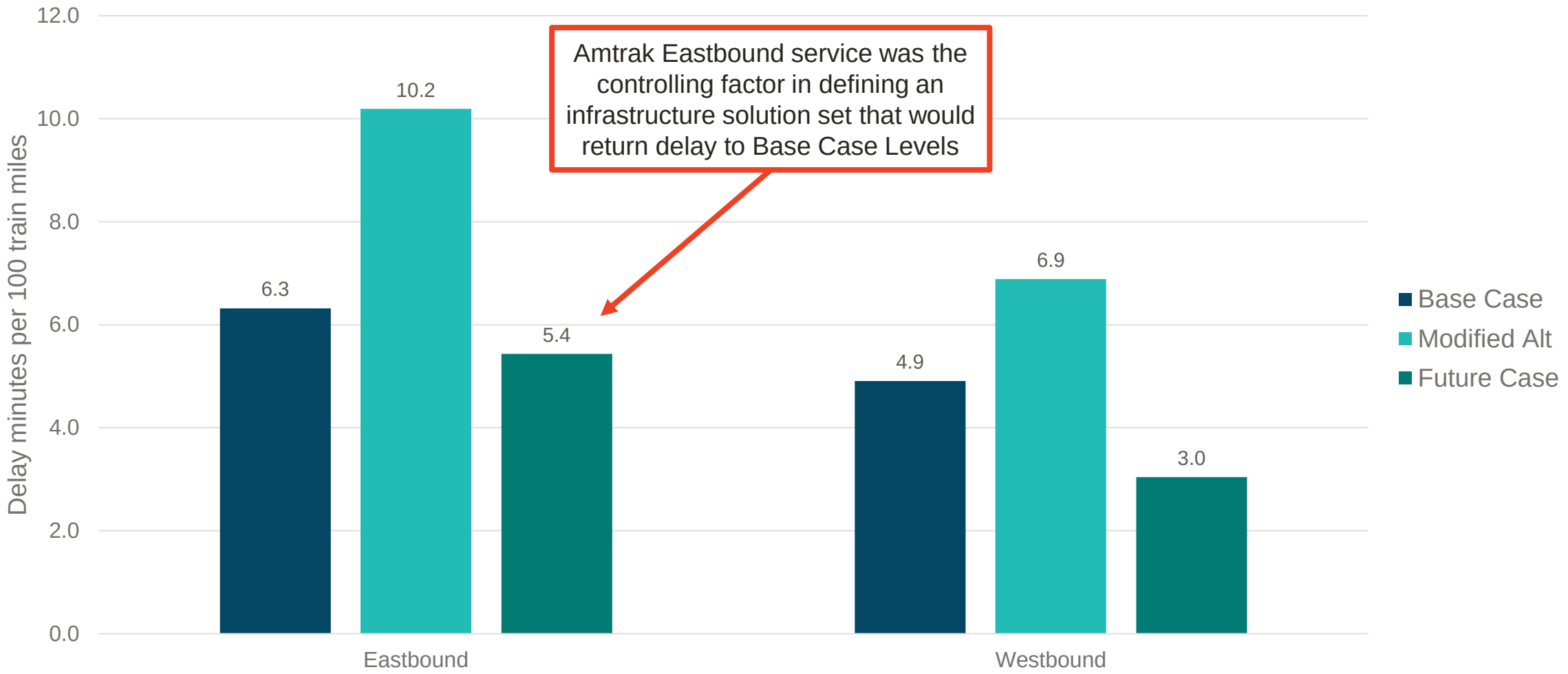
Comparing Base Case to Future Case

NS by train type results – alternative Amtrak schedules and infrastructure solution set



Comparing Base Case to Future Case

Amtrak by direction results - alternative Amtrak schedules and infrastructure solution set



Comparing Base Case to Future Case

Discussion

- The alternative schedule provided to test in the Modified Case did eliminate the need for additional infrastructure.
  - None of the infrastructure project combinations, when tested with the originally proposed schedules, resulted in all defined metrics restored to Base Case levels.

- NS Expedited traffic and Eastbound Amtrak service were the controlling factors in the final project selection.
  - Only the infrastructure solution set brought both NS Expedited traffic and Amtrak Eastbound service metrics back to Base Case levels

- The infrastructure solution set was successful in mitigating the negative impact the proposed Amtrak service had on NS traffic and brought Amtrak delay back to least Base Case levels.

08 Conclusion & Recommendation

Conclusion and recommendation

- Norfolk Southern does not have adequate capacity to operate the proposed new and modified Amtrak schedules without degradation to both Amtrak and NS operations.
- To mitigate the added delay to both Amtrak and NS trains, and to protect NS priority (expedited) traffic – additional infrastructure is needed on the line.
- With the inclusion of the projects identified as the infrastructure solution set, at an estimated cost of $142M-171M, Future Case outputs indicate that there is sufficient capacity to restore line fluidity and relieve the added congestion the future Amtrak service causes.
    - *The proposed infrastructure solution set is based on the set of assumptions outlined in this report. If these assumptions change, more or less infrastructure may be required.*
- It is recommended that all projects identified in the infrastructure solution set be constructed prior to the addition and/or modification of the current Amtrak service to ensure transparency to current operations.

Thank you.

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Appendix:
Order of Magnitude Estimates and Schematics

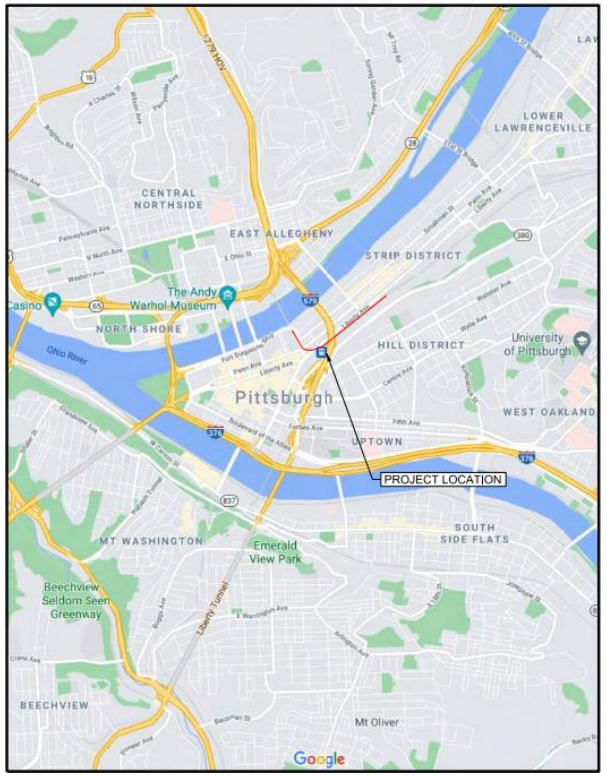
Pittsburgh, PA

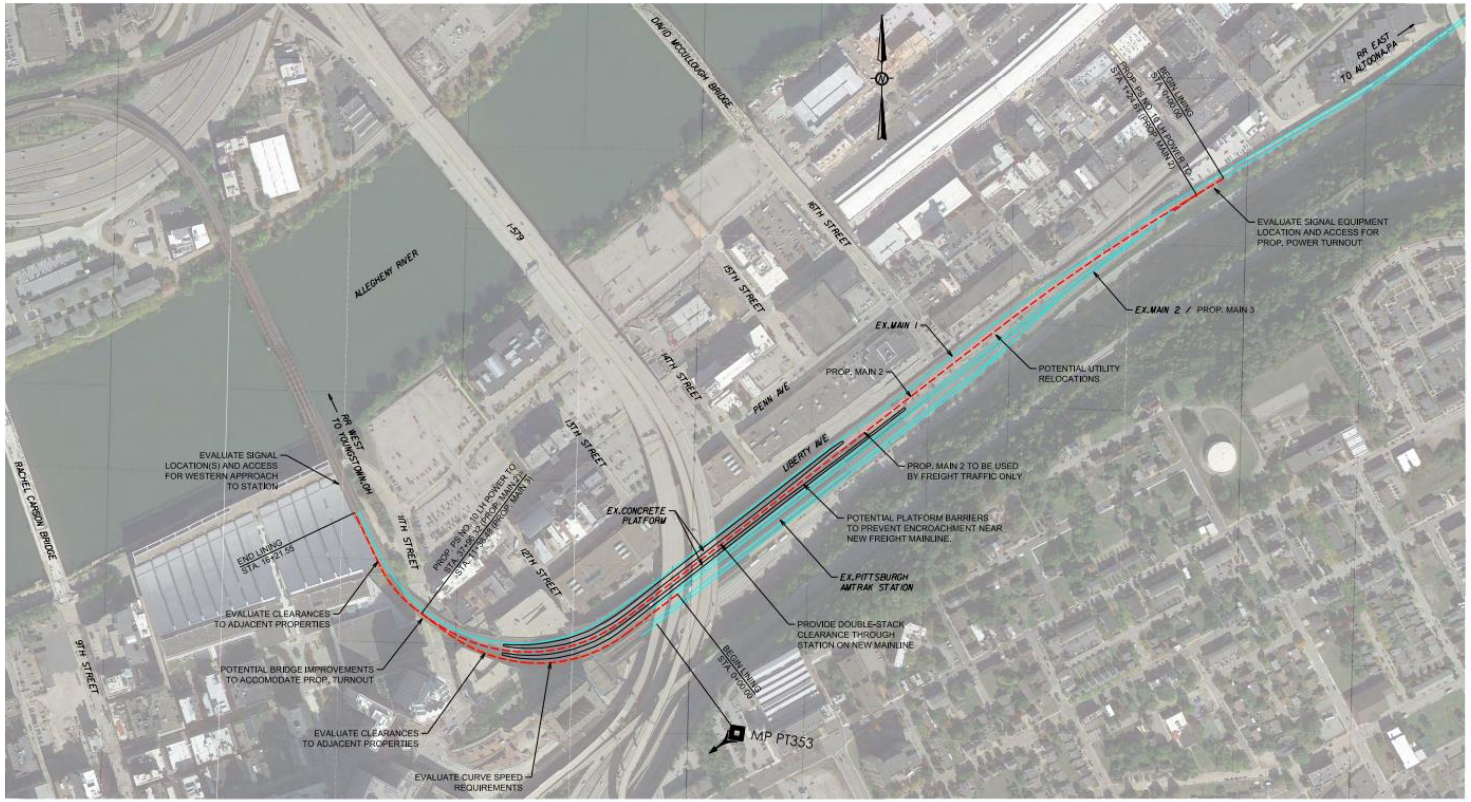
Pittsburgh, PA – 2nd Mainline through Amtrak Station:

Order-of-Magnitude Estimate: **$12.5 – 18.5 Million**

- Construct additional freight mainline through Amtrak station, with power turnouts on each end. Modify station to provide double-stack clearances.
- Assumes prior/simultaneous completion of clearance improvements on existing tracks.
- Further evaluation needed on clearances at west end, potential bridge improvements, and utility relocations.

CONSTRUCTION SITE LOCATION MAP





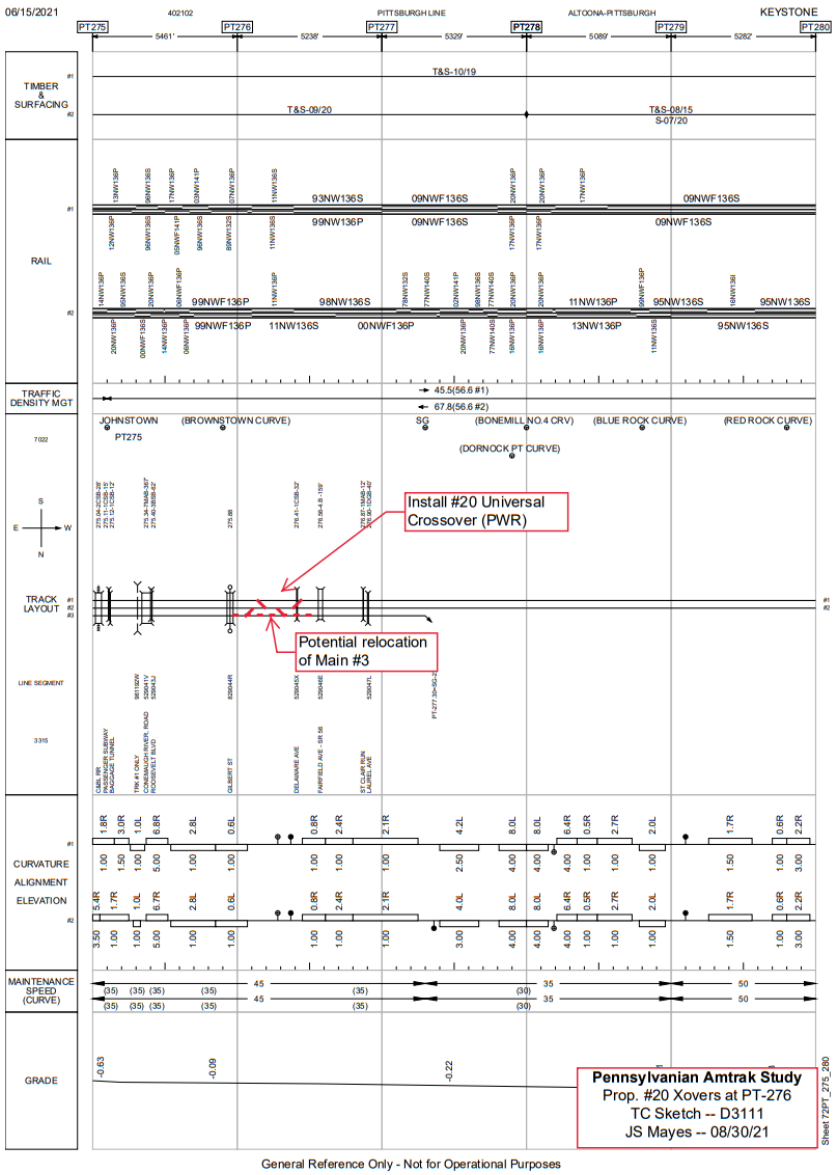
HIGH LEVEL CONCEPT - FOR DISCUSSION PURPOSES ONLY

Johnstown, PA

Johnstown, PA – Universal Crossover at PT-276:

Order-of-Magnitude Estimate: **$9.5 – 11.5 Million**

- Construct universal crossover (3 mains) with power #20 turnouts.
- Construct access road for signal construction and maintenance.
- Rebuild Main #3 (1/2 mile) to reduce track centers and equalize T/R elevations.



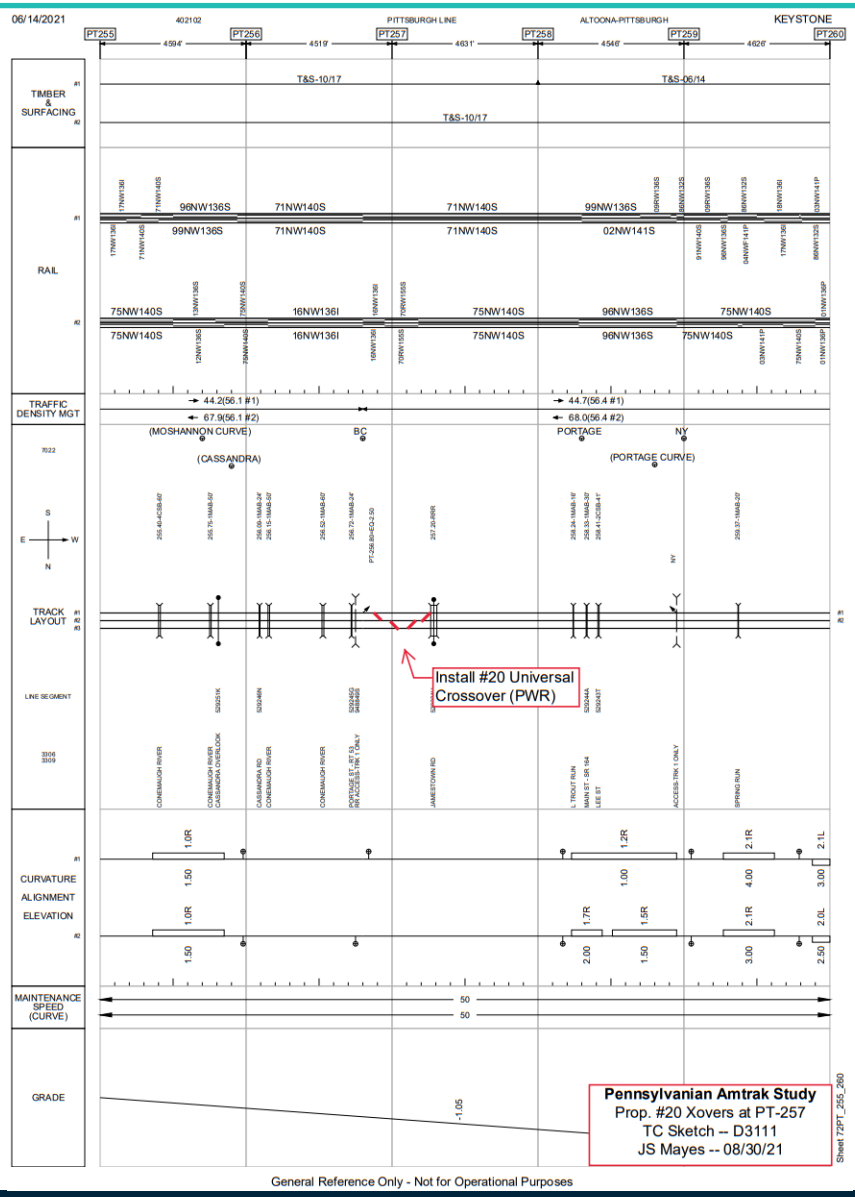
General Reference Only - Not for Operational Purposes

Portage, PA

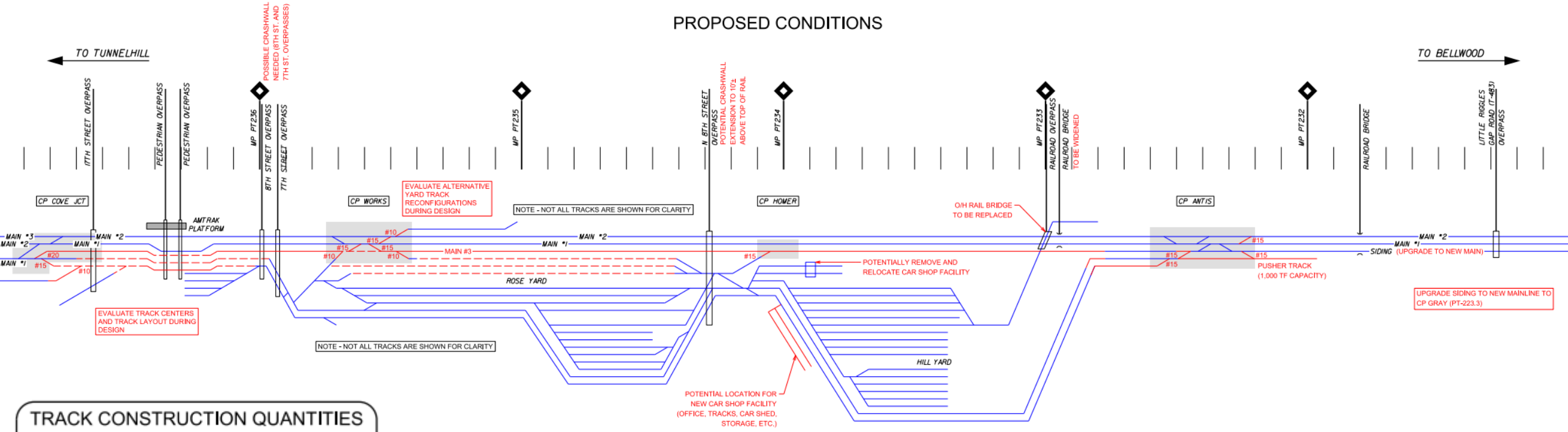
Portage, PA – Universal Crossover at PT-257:

Order-of-Magnitude Estimate: **$7.8 – 9.8 Million**

- Construct universal crossover (3 mains) with power #20 turnouts.
- Construct access road for signal construction and maintenance.



Altoona, PA



TRACK CONSTRUCTION QUANTITIES	
NEW TRACK	±26,000 TF
TURNOUTS	3 - #10, 9 - #15, 1 - #20
TRACK TO BE LINED/UPGRADED	±27,000 TF

LEGEND

- C/L EXISTING TRACK
- #15 C/L PROPOSED TRACK AND TURNOUT
- C/L TRACK TO BE LINED
- LIMITS OF CONTROL POINT

Altoona, PA – 3rd Mainline around Yard:

Order-of-Magnitude Estimate: **$51.5 – 61.5 Million**

- Construct a new Main #3 between Cove Jct and CP Antis.
- Construct a new Pusher Track (1,000 TF capacity) at CP Antis.
- Just east of CP Homer, the new 3rd Main will impact several buildings and storage areas associated with the existing car repair shop. These will need to be relocated as part of construction.
- Further evaluation needed on 1) track/signal phasing to maintain operations, 2) track centers near the Amtrak platform, 3) operations at CP Works, 4) track layout at Rose Yard (may upgrade yard track to Main #3 and provide replacement capacity elsewhere in the yard), 5) options for modifying/relocating the car shop, and 6) need for O/H bridge replacement at PT-233.

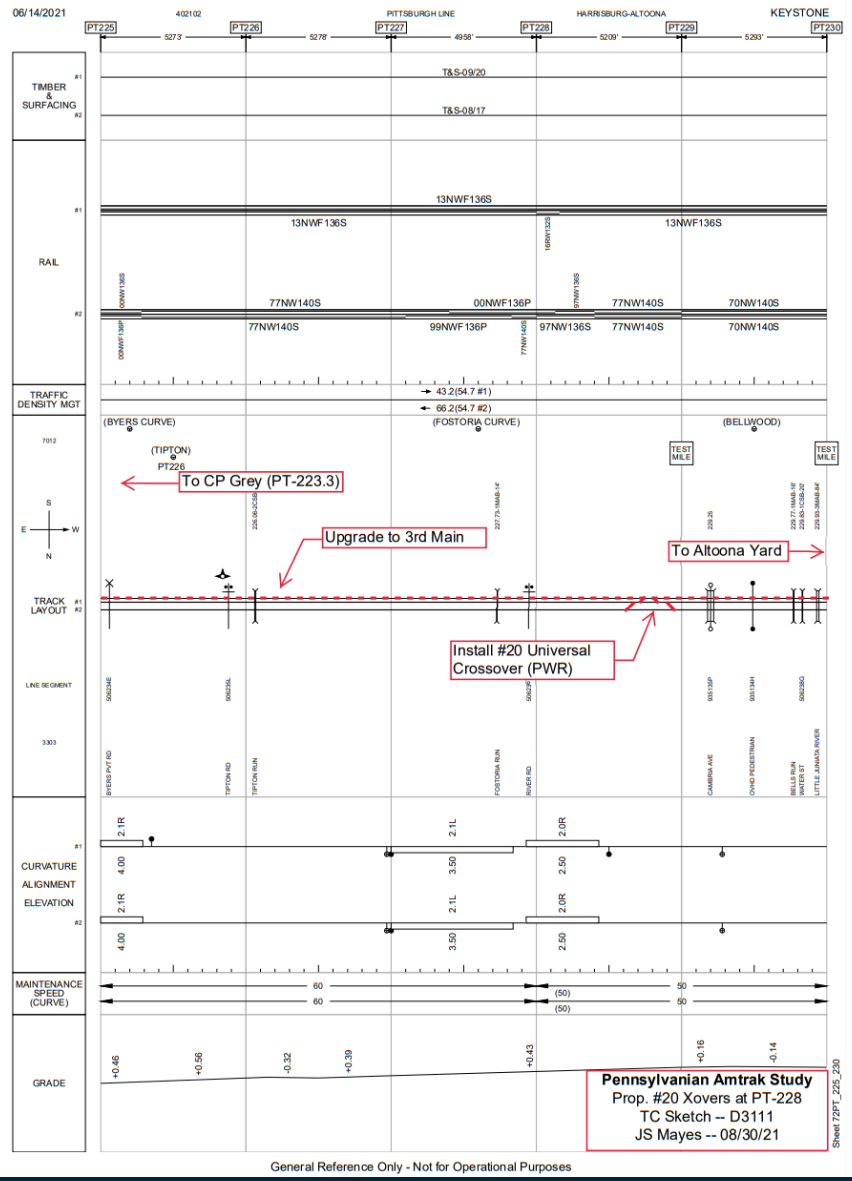
NORFOLK SOUTHERN

Altoona, PA

Altoona, PA – Universal Crossover at PT-228 & Upgrade Siding to Mainline:

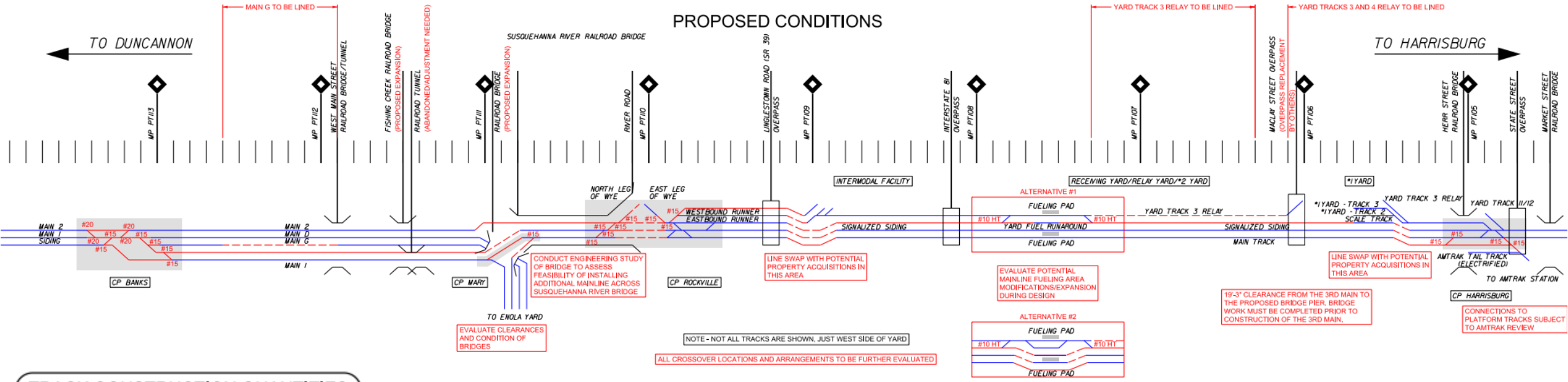
Order-of-Magnitude Estimate: **$11.5 – 14.5 Million**

- Upgrade siding to mainline between CP Antis & CP Grey.
- Construct universal crossover (3 mains) at PT-228.
- Construct access road for signal construction and maintenance.



General Reference Only - Not for Operational Purposes

Harrisburg, PA



TRACK CONSTRUCTION QUANTITIES	
NEW TRACK	±40,000 TF
TURNOUTS	2 - #10, 19 - #15, 4 - #20
TRACK TO BE LINED/UPGRADED	±43,000 TF

LEGEND

- C/L EXISTING TRACK
- #15 C/L PROPOSED TRACK AND TURNOUT
- C/L TRACK TO BE LINED
- LIMITS OF CONTROL POINT

Harrisburg, PA – Proposed 3rd Mainline:

Order-of-Magnitude Estimate: **$50 – 55 Million**

- Construct 3rd mainline between Amtrak Station (CP Harrisburg) and PT-113 (CP Banks).
- Project requires replacement of the Maclay Street overpass (design underway by PennDOT).
- Further evaluation needed on 1) crossover locations/arrangements, 2) potential bridge work at Rockville, 3) evaluate clearances and bridge conditions at north end of Enola Yard, 4) track alignments at mainline fuel pad, 5) evaluate line swaps and property needs north of Amtrak station, and 6) connections to Amtrak station tracks.
- ***Does not include potential improvements to the Rockville Bridge (Susquehanna River Bridge).*** NSR will need to conduct an engineering study of the bridge to evaluate improvements to accommodate the 3rd Main.

NORFOLK SOUTHERN