Maintenance-of-Way-Related Accidents and Incidents Analysis, Findings, and Recommendations

Prepared By
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Revision/ Date:	Revision 0 August 13, 2019

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REVISION HISTORY

Revision	Description	Date	Prepared by
Revision 0	Initial release	August 13, 2019	Dr. Alan Bing Eloy Martinez Mable Bakali Teresa Franz

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Table of Contents

Executive Summary

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Review of Maintenance-of-Way-Related Accidents and Incidents on the Northeast Corridor

Background and Introduction

Accidents and incidents related to maintenance of way activities are of considerable concern to Amtrak. This is because of both the risk of a train accident caused by maintenance-of-way activity and risk of injury to track maintenance employees working close to moving rail vehicles. The need to analyze these accidents and incidents arose from:

- A recommendation from the 2013-2015 analysis of the safety of Tier III train operation, that Amtrak should achieve a significant reduction in train accidents (mostly obstruction collisions) due to maintenance-of-way activities. This recommendation was included in the Waiver Petition to FRA for Tier III operations. This analysis predated the Chester accident described below.
- The Chester, PA accident occurred on 4/3/2016. This accident involved the collision between a passenger train and a backhoe at high speed. The passenger train derailed and the collision with the backhoe resulted in two track worker fatalities and several injuries on board the train.
- In June 2018, stricter "slow by" restrictions for trains passing maintenance-of-way activities on an adjacent track were introduced, in part a response to the Chester, PA accident. Such restrictions are having a significant impact on train schedules, and Amtrak wishes to identify risk mitigations that would allow the restrictions to be relaxed.

Objective and Scope

The objective of this analysis was to identify risk mitigations that would yield a measurable reduction in maintenance-of-way accidents and incidents, thus meeting the safety goals for Tier III operations. The results of the analysis were intended to allow Amtrak to relax current slow-by restrictions and, more generally, yield significant improvement in Amtrak's operational safety for passengers and employees.

The scope of the analysis included all Amtrak-operated trackage on the spine of the NEC, excluding most incidents in yard and major passenger stations. The period analyzed was 2000-2018, after the Boston-New Haven electrification was completed and the start of ACELA operations.

Approach

The approach envisioned for this project was to conduct a semi-quantitative risk analysis of MOW accidents and incidents to determine the frequency and severity of incidents as a function of MOW safety practices. To this end, the project team requested both data on the numbers and nature of accidents and incidents between 2000 and the most recent available. Additionally, the project team requested data that would be indicative of the amount, types, and locations of MOW work performed between 2000 and 2018, such as maintenance records and indirect measures of maintenance activity such as Form Ds, TSRBs and foul time mandatory directives. Unfortunately, historic MOW activity data

was only available for the past three years and other supporting data was usually only readily available for a few recent months. As a result, it was not possible to conduct a formal risk analysis. Instead, the analysis concentrated on Amtrak incident listings, supported by the content of FRA Accident/Incident reports in RAIRS, and an Amtrak compilation of incident investigations, known as "Grade Crossing Data", but that actually contained investigations of many incident types. This effort yielded information on approximately 70 incidents of interest in Amtrak files, of which about 40% were the subject of more detailed investigations and 25 the subject of FRA RAIRS reports. Because almost all the incidents had a human-factors cause, an analysis process called Human Factors Analysis and Classification System (HFACS) was used. These analyses provided some insight into accident causes but were limited because Amtrak data gathering, and investigations were not designed to be used with HFACS analysis.

As well as analyzing data as summarized above, visits were made to all three Amtrak CETC centers, in Boston, New York and Wilmington, and to observe undercutter and TLM operations in the field. These site visits provided a good understanding of Amtrak safety procedures in the field and those providing track worker protection by dispatchers in the control centers.

Benefits of slow-by restrictions

Slow-by restrictions are applied by Amtrak and other railroads when trains are passing selected MOW operations on an adjacent track. In Amtrak's case, the NORAC rule book required an 80 mph slow-by when passing an undercutter and TLM. Due to concern about risks to track workers and passing trains, this restriction was modified with effect from June 25, 2018, reducing slow-by speed from 80 mph to 60 mph and increasing the distance over which the speed restriction is applied for not only the undercutter and TLM, but the entire length of the work zone. In addition, the restrictions are to be applied to larger scale projects where a track is out of service for a continuous period and requires a larger number of employees to be on site. Under these criteria, a slow-by would have likely been in effect at the time of the Chester, PA accident and would have reduced damage to the passing passenger train. However, it is likely that the employees operating the backhoe would have still suffered serious or fatal injury.

More generally, the rationale for slow-by restrictions are:

- Reduce the risk of a track worker being hit by a passing train
- Reduce the severity of a collision between a passing train and an track maintenance equipment fouling the adjacent track
- In locations having very tight clearances, reduce the risk of a side-swipe collision between a passing train and track maintenance equipment.

Accidents and incidents involving collisions between a passing train and MOW equipment were reviewed to estimate the benefit from slow-by restrictions. There were 11 such accidents on the NEC in Amtrak's incident file between 2000 and the most recent available (2017), one of which was the Chester, PA accident. Of the remaining 10 accidents, 5 were minor collisions between MOW equipment unintentionally fouling the adjacent track without foul time being requested, two appeared to be due to an operating error involving unauthorized movement of a MOW consist causing a collision with a passenger train and one where there was inadequate clearance between tracks after completing maintenance. It is unlikely that slow-by restrictions would have been applied in any of these incidents.

Slow-by restrictions could have been a factor in the remaining two incidents and in the Chester, PA accident.

Although track worker casualties were not a primary objective of this project, a cursory review of injuries to engineering department employees due to being struck by a passenger train was undertaken, which identified 7 fatalities. The casualty reports lacked sufficient detail to determine the exact activities of the employee, or whether slow-by requirements would have been a factor.

This analysis indicated that the benefits of slow-by restrictions are uncertain. However, it is unlikely that either Amtrak management or regulatory authorities would be able to relax slow-by restrictions without implementing relevant risk reduction measures and clear evidence of a reduction in risk to track workers and passing trains. Recommended risk reduction measures are:

- Improve foul time procedures, including implementing EEEPS of an equivalent system and more consistent use of supplemental shunting devices
- Regular inspections of MOW equipment in service and on the completion of a shift to ensure all equipment is properly secured, to reduce the chance of an unintended foul
- Ensure that clearances are not eroded by re-checking track centerline distances and cant
- Reduce risk to track workers by enhancing approaching train warning systems and improving access to safe refuges on track maintenance equipment and at trackside

Findings and Recommendations – Short to medium term

Findings and recommendations for short to medium term actions to reduce accident train and employee casualty risks related to maintenance of way are summarized below.

Accident/Incident data capture and analysis

Amtrak needs a robust program to ensure that accident/incident and casualty data are recorded for each incident, follow-up investigations are carried out as necessary and relevant MOW activity data are available for analysis. This project found that much of the needed data was lacking, limiting the kinds of analysis that could be carried out. In the future the data should support the following kinds of analysis:

- Analysis of accident/incident causes and consequences to provide feedback to the engineering department so that safety procedures and systems can be modified to reduce risk
- Support the analysis of long-term trends in accident/incident types, causes and consequences, particularly to support preparation and ongoing support of a detailed hazard analysis for MOW activities
- Support the conduct of risk analyses into key aspects of MOW procedures and equipment. In particular, this needs the routine recording of MOW activity and traffic level by track in order to estimate a measure of exposure to risk.

In gathering this data, it will be important to ensure consistency over time, so that trend analysis is meaningful.

With regard to incident investigation, the main recommendation is that Amtrak adopt the HFACS methodology for analyzing human factors accidents, and design data gathering to support this analysis.

The project team notes that Amtrak has been making considerable progress in these areas, particularly to achieve complete and timely reporting and investigation of incidents, and strongly supports continuing efforts in this area.

Voice Radio Problems

Voice radio is the primary, and in most cases, the only means of communicating mandatory orders, such as Form Ds and foul time orders, between MOW crews in the field and the dispatcher. Radio performance was widely criticized during field visits to MOW operations and dispatch centers. Audio quality can be poor; coverage from the base stations located along the track is highly variable, with dead spots and areas where messages from distant base stations can be heard; and radio channels can be congested at busy times. In addition, the Roadway Worker in Charge (RWIC) is responsible for both communications with the dispatcher and relaying orders to all supervisors at the work site. Work-sites can extend over 2-3 miles for the TLM and undercutter. While there is no evidence that radio problems have been a significant incident cause, it is clear that communications can be delayed and there is a risk of adding to the chance of errors.

Recommendations to reduce the impact of radio problems:

- Amtrak is already reviewing base station location and performance, and is taking action to improve coverage.
- A careful review of the radios currently in use by MOW crews is recommended, to ensure they are being properly set up and maintained, and to evaluate whether replacing some or all of these radios with better performing models.
- Consider replacing voice radio with direct digital communications to work crews and MOW equipment, as discussed under long term recommendations below.

Address the "Blame Culture"

The traditional railroad industry response to a human error incident has been to identify and discipline the front-line worker most directly responsible for the error. Until recently, this was also the practice at Amtrak. However, a blame culture has the effect of making workers reluctant to cooperate with incident investigations, suppressing information valuable in understanding the root cause of an error, and developing risk reduction measures.

Amtrak stated that they understand this problem and have initiated a "Just Culture" program that emphasizes understanding and correcting the root causes of an error and avoids the use of penalties except in the case of reckless behavior. The project team strongly supports this effort.

Staffing and Training

Based on comments during field visits, Amtrak faces a number of difficulties in staffing MOW activities with adequately trained workers and supervisors, including safety-critical watchmen and lookouts. There have been many retirements in recent years as a generation of track workers recruited when Amtrak took over the NEC in 1976 and started work on a massive improvement program. Also, it is hard to recruit workers to a job that requires night and weekend work, especially at a time of low unemployment. As a result, interviewees reported track crews were understaffed, and in some cases

appeared to have had insufficient training, particularly a lack of on-the-job training to supplement classroom and on-line training.

Recommendations in this area are:

- Review training programs to ensure both job skills and safety practices are covered
- Make sure that both front-line workers and newly qualified supervisors have a period of supervised on-the-job training and experience before being able to assume full responsibility. Good supervisor training is especially important with the loss of experienced employees through retirement.
- In the longer term, look for opportunities to automate some job functions, especially as older track maintenance equipment is replaced by newer models.

Review and improve the watchman and lookout function

Watchmen provide visual and audible warning of approaching trains so that workers on active tracks can seek safe refuge in the minimum 15 second notice that must be provided. As such, watchmen are absolutely critical to track worker safety, and must perform flawlessly without any backup. Interviewees during field visits said that finding reliable recruits to be watchmen was especially challenging. Furthermore, many watchmen are required to provide timely warning in high speed territory and at locations with poor visibility, increasing staffing and training difficulties.

The primary recommendation in this area is to augment and eventually replace watchmen with a technological warning system, both to reduce risk to track workers and ease the pressure on staff resources. Amtrak is actively evaluating systems that provide approaching train warning to individual workers to supplement manual warning. The project team strongly encourages this effort and recommends that Amtrak not only seek supplementary warning systems but also look for systems that could eventually replace manual warning.

Job and safety briefings

Based on observations on site, Amtrak is careful to provide a safety briefing to individuals when they first arrive on site. However, some briefings are hurried and formulaic and do not ensure they are fully understood. Also, introducing more incremental job and safety briefings when new tasks are started during a shift is recommended. For example, when a piece of maintenance machinery is about to start up, conduct a short briefing to ensure that all employees in the vicinity are fully aware of what they need to do.

Maintenance scheduling for longer roadway work windows

Current practice is that any disruption to the regular train service is to be kept to an absolute minimum. Performing maintenance work under traffic leads to frequent interruptions, low productivity and more exposure of work crews to passing trains. Accepting more disruption to scheduled service at low traffic times or seasons could improve efficiency and less risk exposure. An example of a recent use of this approach was at Penn Station in New York, where several trains were diverted or cancelled to facilitate a maintenance “blitz” within the station over a few weeks in July and August. Experience with this approach in 2018 was judged successful and is being repeated in 2019.

Control of Norfolk Southern trains on the NEC.

While making visits to CETC control centers, the project team found out that NS freight trains operating on the NEC could not communicate with the ACSES system and thus were not in compliance with PTC requirements, including those for the protection of designated work zones. Amtrak recently confirmed that this was correct, but said that an effort had begun to equip the Wilmington CETC with the freight railroad vital communication system I-ETMS for communications between NS trains and Wilmington CETC. This effort, funded by NS, would ensure full compliance with PTC regulations.

Presentation: Maintenance-of-Way-Related Accidents and Incidents Analysis, Findings, and Recommendations

Maintenance-of-Way-Related Accidents and Incidents Analysis, Findings, and Recommendations

- Presentation to Amtrak
- August 5, 2019

Presentation Content

The presentation is divided into two sections:

- Section 1: Introduction, Approach, Principal Findings and Recommendations
- Section 2: Incident Analysis Methodology

Section 1

Introduction, Approach, Principal Findings, and Recommendations

Background

The number and severity of work zone accidents and incidents are an ongoing concern for the safety of train operations on the Northeast Corridor

- A 2014-2016 risk analysis of future Tier III high-speed operations recommended that Amtrak set up a System Safety Program to reduce the number and severity of collisions with MOW materials and equipment.
- A high-speed collision at Chester PA on 4/3/2016 between a backhoe and a passenger train resulted in two fatalities and multiple injuries on the derailed train. The NTSB Report 17/02 published in November 2017 identified many safety deficiencies in Amtrak's safety procedures.
- In response to the Chester PA accident, Amtrak initiated a more restrictive slow-by requirement for service trains passing certain MOW operations.

The initial objective for this project was to carry out an analysis to identify risk mitigation actions which would enable relaxing the slow-by requirement and reduce the impact on Amtrak schedules.

Background

In addition, a leading recommendation from the original risk analysis of Tier III operation on the NEC was to address obstruction collisions due to MOW activities

1. Two groups of these accidents should be the first targets for risk mitigation:

   1a. Implement a program of construction of fences and barriers to prevent trespass and highway vehicle access in the 20 most vulnerable route segments as indicated by the risk model and on-the-ground assessments.

   1b. Continue with and expand where possible an active system safety program addressing the diverse causes of obstruction collisions with Amtrak MOW equipment and materials, contractor equipment and materials, and miscellaneous objects.

This study expands on recommendation 1b to include other MOW-related incidents to better identify causes and candidate mitigations

Background

Quantitative results from the Tier III risk analysis further reinforced the need to identify ways of reducing MOW-related incidents

Analysis Case	Normalized Risk Metrics – Values per Million Train Miles		
	Accidents	Injuries	$ Damage
Increased Service with all Tier II Trainsets (Regulatory Null Case)	0.294	0.119	43,991
Tier III Trainsets with improved ROW segregation	0.271	0.123	45,661
Tier III trainsets with improved ROW segregation + MOW-related incident reduction	0.246	0.116	43,062

The combination of improvements to ROW segregation and MOW hazard reduction takes key safety measures to below the Regulatory Null case

- Normalized Injuries 3% lower (most critical)
- Normalized Damage 2% lower
- Normalized Accidents 16% lower

Completed Tasks

This study analyzed train accidents and incidents involving maintenance-of-way equipment and staff in the Northeast Corridor, including travel to and from work zones

- Assembled data on train-movement accidents and incidents related to roadway inspection, maintenance, and renewals on Amtrak-operated segments of the Northeast corridor
- Obtained detailed information on each event using FRA accident/incident reports, NTSB reports, and internal Amtrak incident reports
- Analyzed accident/incident data and reports to determine key event categories, quantities, locations, and causal factors using a human factors analysis and classification system (HFACS)
- Identified risk reduction measures and describe benefits and impacts
- Considered speed reductions on adjacent tracks
- Recommended a risk reduction program that should achieve measurable safety benefits while minimizing operational impacts

The rationale for work zone slow-by restrictions were a particular focus

Scope

The analysis focused on accidents and incidents involving maintenance of way equipment and workers within and outside work zones in the Northeast Corridor

- Accident and incident data on the Northeast Corridor from 2000 to the present, after introduction of the high-speed Acela service
- Limited to main track operated by Amtrak, and with a few exceptions excluding incidents in yards and major passenger stations
- Included FRA-reportable accidents and non-reportable incidents from Amtrak's internal incident reporting system
- This analysis did not consider:
  - Accidents and incidents related to roadway work not on or near main tracks
  - Accidents and incidents related to movements of highway vehicles not near main tracks

Technical Approach

Recommendations were developed from both analyses of reports on accidents and incidents occurring during maintenance-of-way activities and field visits and interviews

Data Analysis

- FRA accident/incident data from RAIRS
- Amtrak incident reports
  - Human factors analysis
  - Assessment of slow-by rationale
- Selected NTSB Reports
- Limited analysis of various other Amtrak data sets, e.g.
  - Amtrak injury log
  - Recent slow-by orders
  - NEC track maintenance records

Field Visits

- TLM Operations near Newark, DE
- Undercutter operations near New Haven, CT
- Northeast Corridor CETC Control Centers in
  - Boston, MA
  - New York, NY
  - Wilmington, DE

Technical Approach

A lack of suitable data meant that it was not possible to include a risk analysis of slow-by restrictions, as originally intended.

- A risk analysis would have required the use of a suitable measure of exposure to risk in MOW work zones. Then risk is measured by harm (incident occurrence and severity) per unit of exposure.
- In the case of MOW operations, exposure is a function of the speed and volume of rail traffic on adjacent tracks and the time that maintenance equipment and employees are at the work site.
- Although a snapshot of traffic data (from about 2013) is available from a previous risk analysis project, there was no long-term record of MOW and renewal activity on the NEC.

Analysis Results – FRA RAIRS Data

Analysis of FRA accident/incident data shows a marked increase in accident rate in more recent years, especially in the mid-Atlantic division (line code AP)

Division	Accidents 2000-2009	Accidents 2010-2017	Total Accidents
New England	6	3	9
New York/New Jersey	1	1	2
Mid Atlantic	5	9	14
Total	12	13	25
Annual Average	1.20	1.63	1.39

With the lack of long-term data on the amount of maintenance performed in each year, it is not clear whether the increase in accident rate is a function maintenance activity or a decline in safety performance.

Analysis Results – Amtrak Incident Data

Analysis of Amtrak internal incident data and reports shows an increase in accident rate between 2007-2013 for both the New York/New Jersey (line code AN) region and the Mid Atlantic (line code AP) region.

Division	Accidents 2000-2006	Accidents 2007-2013	Accidents 2014-2018	Total Accidents
New England	7	6	5	18
New York/New Jersey	1	11	8	20
Mid Atlantic	5	17	10	32
Total	13	34	23	70
Annual Average	1.86	4.86	4.6	3.68

Note: It is not possible to separate the influence of the change in the volume of maintenance work done, an actual change in safety performance, and more thorough reporting.

Analysis Results – Field Visits and Interviews

Several common themes emerged from the field observations and discussions with Amtrak staff, which provided key inputs to recommendations in this report.

- The poor performance of voice radios was mentioned frequently. Complaints included congestion at busy times, uneven coverage from base transmitters along the route, and poor voice quality.
- Several comments were made on staffing, including the difficulty of finding workers, inadequate training, and a workforce with inadequate experience.
- There are limitations of the ACSES system, particularly in initiating temporary speed restrictions for slow-by requirements. Currently planned daily in the early morning to avoid delaying revenue-service train traffic. Speed restrictions imposed when actual work begins.
- Observations suggested that more effort is needed to improve safety briefings when workers first come on site and task briefings before starting individual activities.

Introduction – Slow-By Restrictions

Slow-by restrictions reduce the maximum speed of service trains passing selected MOW equipment to reduce the likelihood and severity of incidents.

- *Reduce the chance of injury to roadway workers*
  - Reduce the severity of injury if hit by a passing train
  - Reduce the chance that a worker standing by the track or taking refuge on MOW equipment will be unbalanced by the passing train
- *Reduce the severity of collisions between a passing train and roadway maintenance equipment:*
  - When errors in managing foul time result in the passing train hitting MOW equipment
  - Collisions due to improperly secured attachments to MOW equipment
  - Collisions due to the lack of adequate clearance between the passing train and MOW equipment

Analysis – Slow-By Restrictions

In spite of recent enhancements to slow-by restrictions, analysis of incidents involving passing trains show that the benefits are uncertain.

- Slow-by restrictions were tightened with effect from July 1, 2018
  - Before: Speeds restricted to 80 mph when passing a TLM, and also an undercutter if requested by the RWIC
  - After: Restricted to 60 mph for the whole work zone, where a TLM or an undercutter were active, and elsewhere by request of the RWIC
- There were 11 incidents where a passing train collided with MOW equipment between 2000 and 2018, including the Chester, PA accident.
- Consequences were serious – as well as 2 fatalities and several injuries at Chester, there were 1 fatality and 9 injuries among the remaining 10 collision incidents.

Analysis – Slow-By Restrictions (continued)

In spite of recent enhancements to slow-by restrictions, analysis of incidents involving passing trains show that the benefits are uncertain

- Based on the available limited information, a mandatory 60 mph slow-by would have been applied to one minor-damage incident under current (2019) policy.
- A discretionary slow-by restriction could have been applied at Chester, PA accident work site, reducing consequences, and at one other minor-damage incident.
- In addition, there were approximately 7 fatalities between 2000 and 2018 due to a MOW employee being hit by a passenger train not associated with an equipment collision, including one at Bowie, MD. The available descriptions are insufficient to determine whether slow-by restrictions were relevant to these incidents.

Conclusions – Slow-By Restrictions

Although slow-by restrictions appear to yield limited benefits, Amtrak must show a substantial reduction in risk before they can be relaxed.

- Achieve a substantial reduction in risks to trains passing work zones on an adjacent track and to roadway workers working on active track
- Reduce collisions with MOW equipment fouling an adjacent track
  - Improve foul time procedures, including implementation of EEPS or a similar system
  - Regular inspections of MOW equipment in service and on completion of shifts to minimize unintended foul events
  - Ensure that clearances are not eroded by re-checking track center distances and cant after completion of track work
- Reduce risks to roadway workers through improvements to approaching train warning systems and safe refuges on track maintenance equipment and at trackside

Slow-by restrictions could be relaxed after demonstrating improvement

Recommendations – Incident Data and Analysis

Amtrak needs to make substantial improvements to their reporting and analysis of damage and injury incidents occurring during MOW activities.

- Make sure that the basic information about each incident is captured, including time-of-day, speeds, nature of the MOW activity, etc.
- Adopt the HFACS procedure for analyzing human factors incidents, including ensuring, as far as possible, gathering the required data
- Initiate or strengthen efforts to perform hazard analyses on NEC MOW operations to identify risks, whether-or-not incidents have occurred in the recent past
- Ensure there is a robust feed-back loop to ensure incidents are thoroughly investigated and appropriate corrective actions are taken
- In data gathering, it is important that exposure data is being recorded in a convenient format that would support future risk analyses

Amtrak has been making significant progress in these areas, with preparation of the monthly CSO report and improved data gathering.

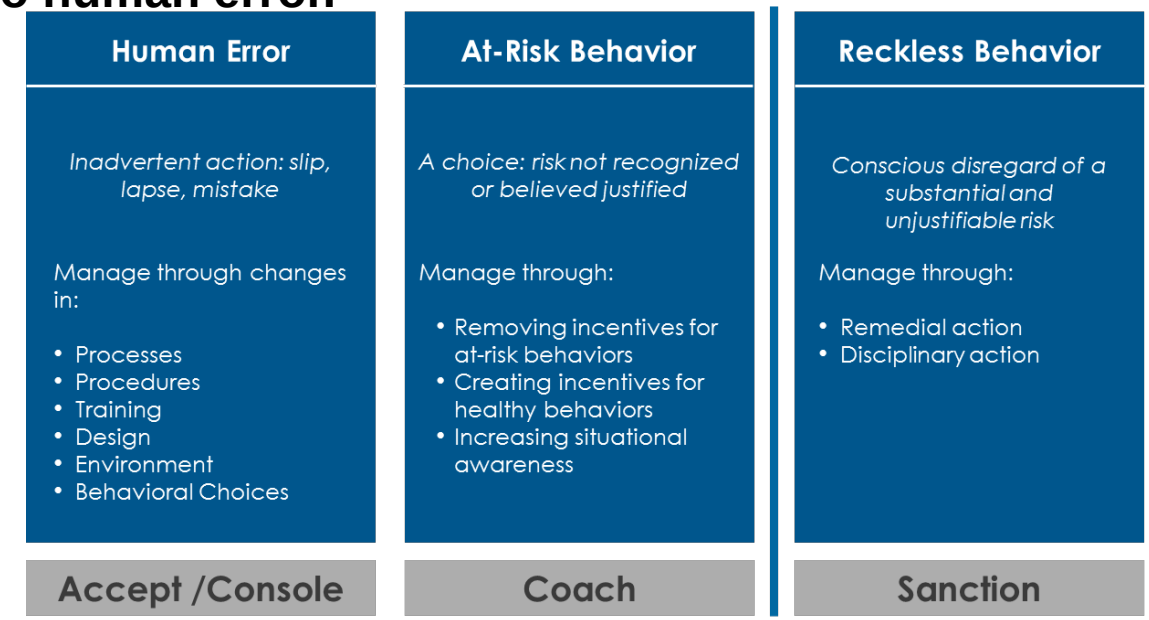
Recommendations – Voice Radio

Amtrak's voice radio systems have serious deficiencies that slow down safety-critical MOW operations and pose a risk of contributing to an accident or incident.

- Coverage from the base stations distributed along the track is uneven, with some dead spots and stations that can be heard over greater distances than required. ***Amtrak is addressing this problem by reviewing base station performance and adding and/or adjusting locations as necessary.***
- To obtain the best performance from existing radios, review current radio maintenance and set up procedures and make changes to improve reliability and voice quality
- In the medium term, review radios available from qualified vendors to see if replacing the current stock of radios with compatible improved models would be feasible and justifiable.
- In the longer term, investigate the feasibility of introducing direct digital transmission of Form Ds and Foul Time orders to work crews, to reduce radio congestion and improve reliability.

Recommendations – Blame Culture

Amtrak is moving away from the traditional railroad response to incidents of blaming and disciplining, to a more constructive response to human error.



Source Amtrak

We strongly support this effort, which will help facilitate any action to identify the root cause of errors.

Recommendations - Staffing and Training

Retirements and turnover among the MOW workforce emphasized the importance of effective training of new employees.

- Turnover has increased in recent years, particularly due to retirements of workers hired when Amtrak took ownership of the NEC in 1976.
- With lower unemployment, Amtrak is finding it more difficult to hire workers, and experiencing more turnover as individuals chose work that does not involve nights and weekends.
- The less experienced workforce may result in an increased chance of human factor related incidents without good training, thus:
  - Amtrak should review training for roadway workers to emphasize safety as well as job skills and ensure that new workers have a period of on-the-job mentoring to ensure that training is durable.
  - Supervisors also need thorough training and on-the-job mentoring to offset the loss of experienced staff through retirements and turnover.

Recommendations – The Watchman Function

The watchman is absolutely critical to the safety of all on-track maintenance personnel at a work site and must function flawlessly.

- The traditional railroad watchman relies only on visual detection of approaching trains to deliver an audible and visual warning.
- The watchman function can require many individuals to perform adequately, especially in high-speed territory or where visibility is restricted, further increasing the pressure on recruiting and training roadway workers.
- Technological means of augmenting or replacing the watchman function is highly desirable, both to reduce the risk of roadway workers being hit by trains and to reduce the pressure on staff resources.
- ***Amtrak is evaluating systems that augment existing roadway warning procedures. We strongly encourage this effort and recommend that Amtrak continues to seek reliable warning systems that not only supplement existing procedures but in time could replace them.***

Recommendations – Other Initiatives

Amtrak should also consider or continue with other initiatives to improve safety performance or reduce the exposure of MOW staff and equipment to risk:

Job and Safety Briefings

Based on observations on site, Amtrak is careful to provide a safety briefing to individuals when they first arrive on site. However, some briefings are hurried and formulaic and do not ensure they are fully understood. Introducing more incremental job and safety briefings when new tasks are started during a shift is recommended.

Maintenance Scheduling

Current practice is that any disruption to the regular train service is to be kept to an absolute minimum. Performing maintenance work under traffic leads to frequent interruptions, low productivity, and more exposure of work crews to passing trains. Accepting more disruption to scheduled service at low traffic times or seasons could improve efficiency and less risk exposure. A fresh look is recommended.

Section 2

Incident Analysis Methodology

Data Filtering & Organization

- The provided log of incidents was first sorted to exclusively capture accidents that:
  - Occurred on the North East Corridor (NEC)
  - Occurred on the Mainline (with major incidents occurring in yards included)
  - Involved Maintenance of Way (MOW) equipment

MOW-Related Events on the NEC in Amtrak's Incident Log

Incident Number	Incident Date	Train #	City	Milepost	Track	State	Accident Type	FRA Rpt	M of E Damage	M of W Damage	FRA Narrative Text	On NEC spine?	On Main Line?	MOW?	Notes	Track Marking	Accompanying Document

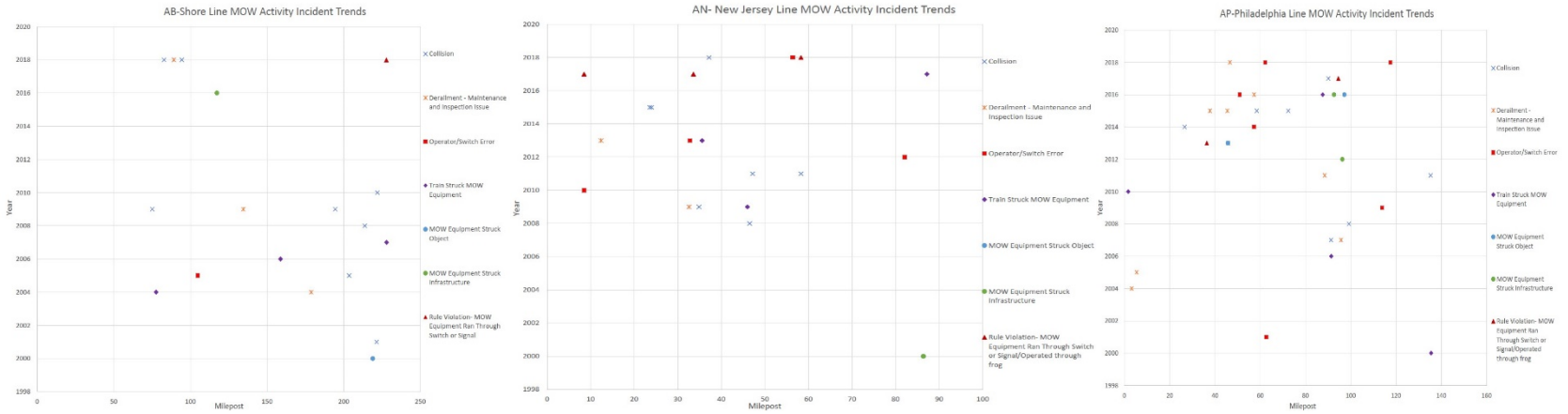
- Next, the incident data was organized into varying tabs as shown in the image below. The tab titled "By Year Data Analysis" contained the most relevant data points.

- Within this tab, incidents were further categorized by type: MOW Equipment Collisions, Train Struck MOW Equipment, Derailment Types, MOW Equipment Struck Surroundings, Rule Violation.

Initial Evaluation

- For initial evaluation, scatter plot graphs were produced to analyze potential patterns relating to position (Mile Post - MP) on the NEC, or time (Year of Occurrence).

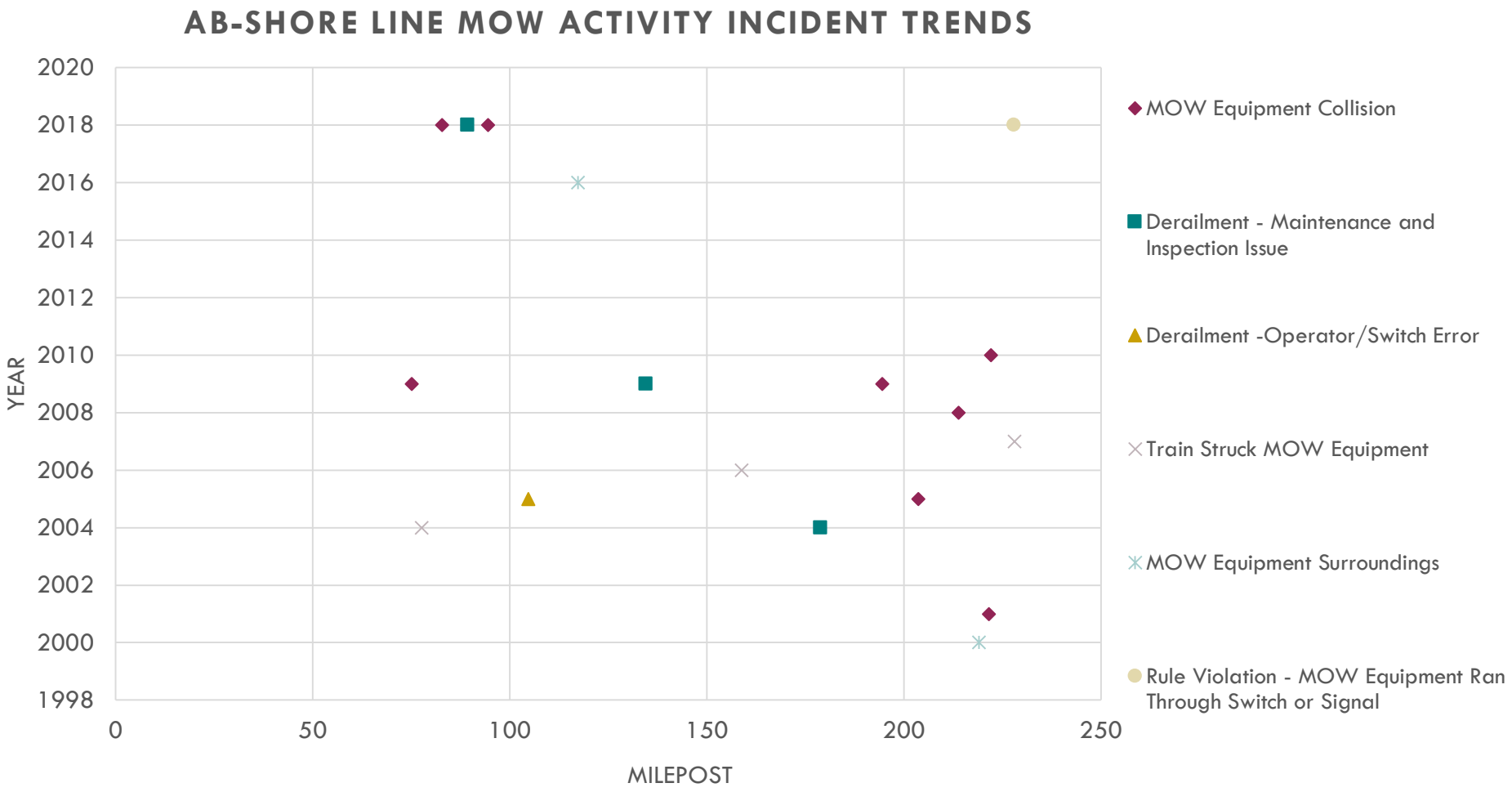
- These graphs appear in the following slides.



Scatter Plot Example

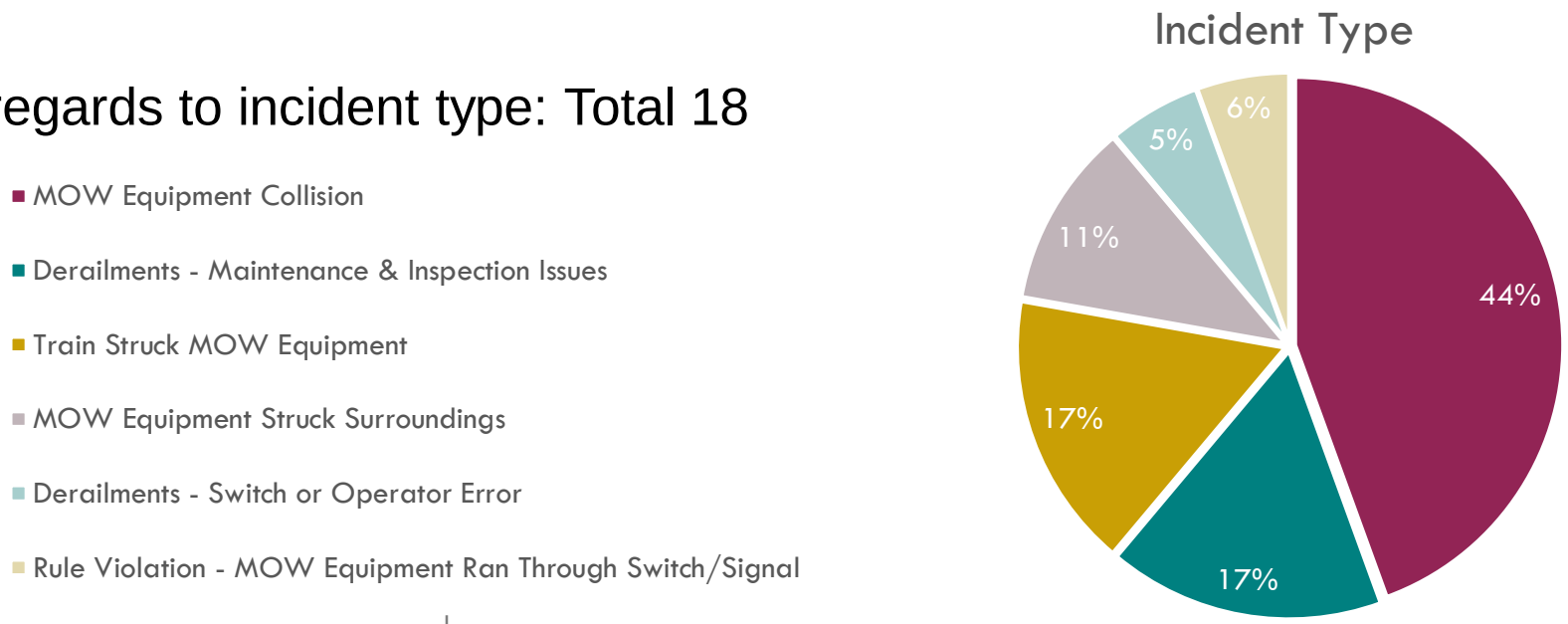
- Image Source: https://www.google.com/search?q=scatter+plots&source=lnms&tbm=isch&sa=X&ved=0ahUKEwilubGHjeXjAhWMmuAKHUDhCxoQ_AUIESgB&biw=1236&bih=530#imgrc=ejvykGeAwMQu7M:&spf=1564780356376

AB Line Incident Activity Scatter Plot

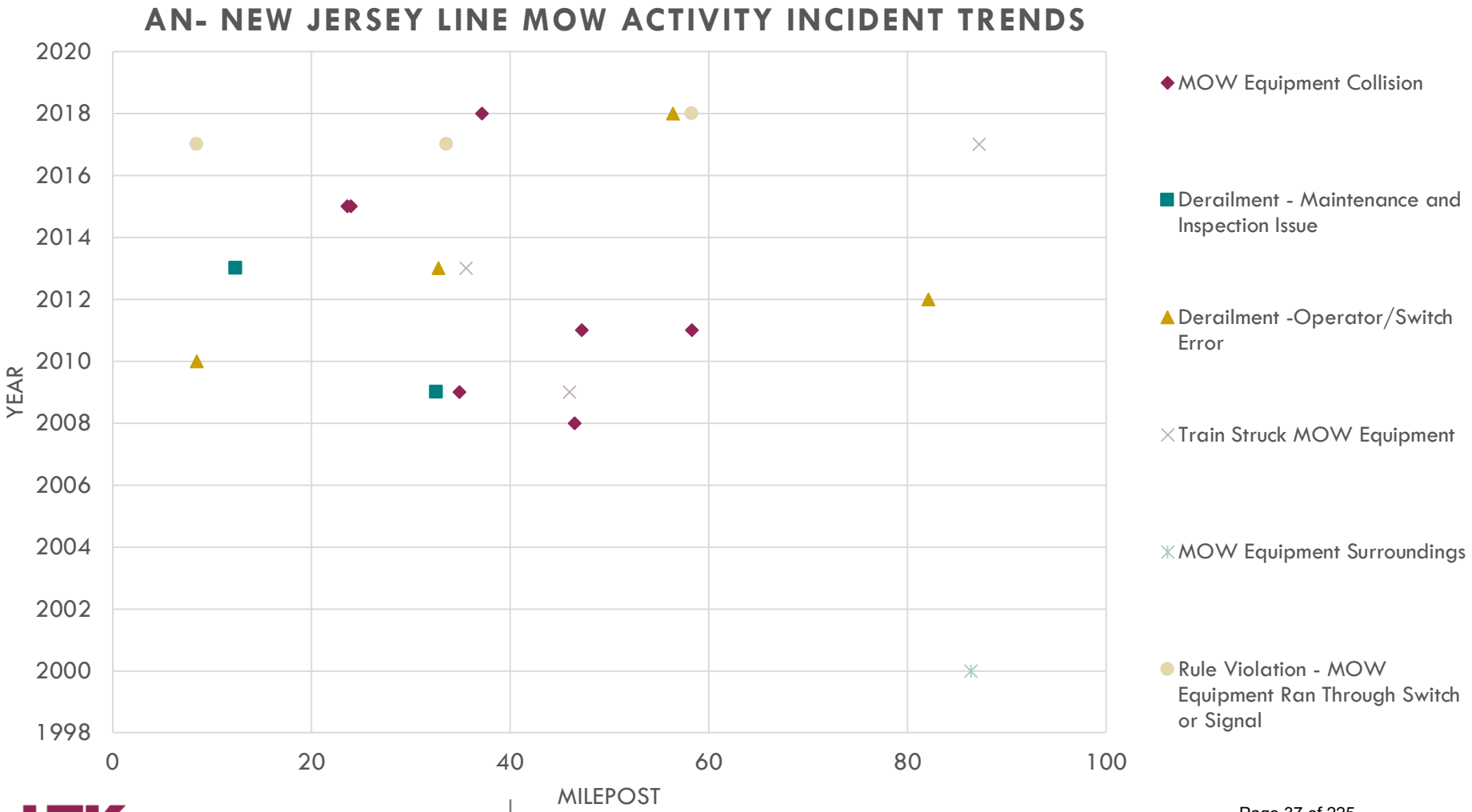


First Glance AB Line Data Trends

- The majority of incidents occurred between the years 2004 and 2010.
- Additionally, incident activity is heightened towards the extremities of the AB line portion of the NEC (MP 72 & MP 229).
- In regards to incident type: Total 18

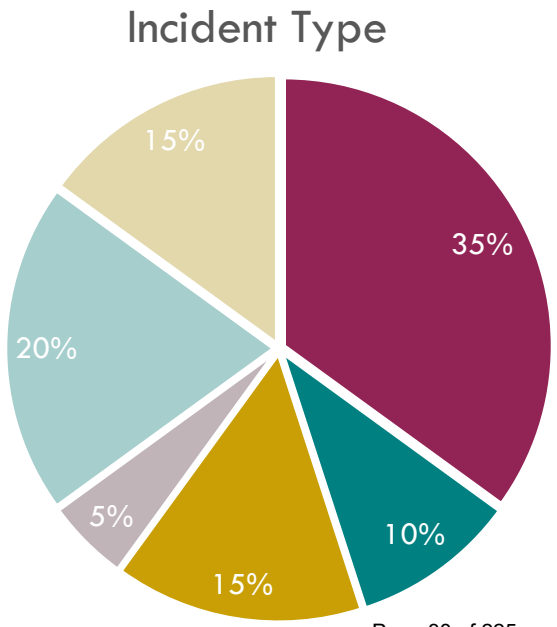


AN Line Incident Activity Scatter Plot

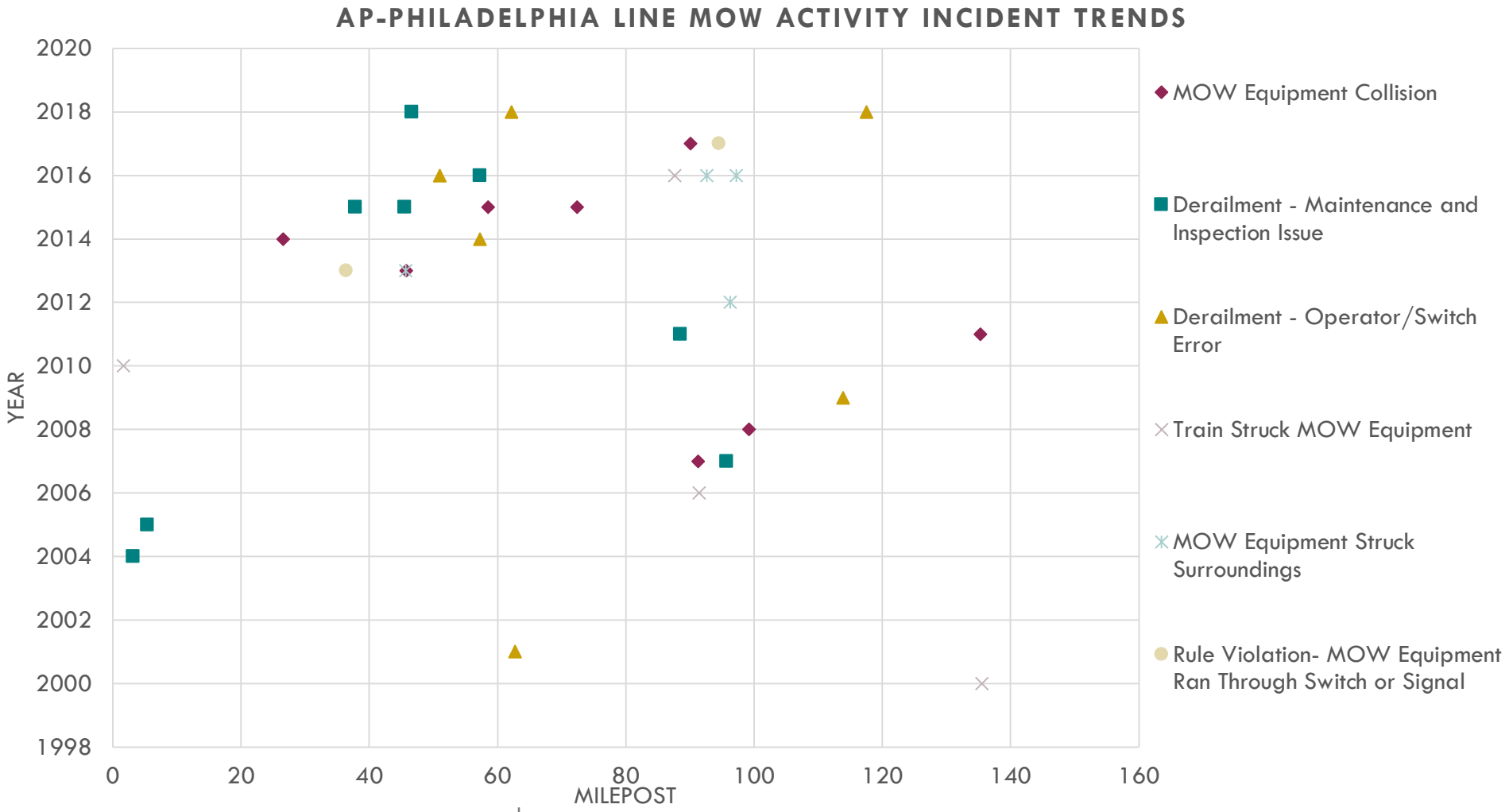


First Glance AN Line Data Trends

- There was an increase in incidents starting in the year 2008.
- Additionally, incident activity is widely distributed throughout this segment of the NEC, having a small gap (between MP 60 & MP 80)
- In regards to incident type: Total 20
  - MOW Equipment Collision
  - Derailments - Maintenance & Inspection Issues
  - Train Struck MOW Equipment
  - MOW Equipment Struck Surroundings
  - Derailments - Switch or Operator Error
  - Rule Violation - MOW Equipment Ran Through Switch/Signal

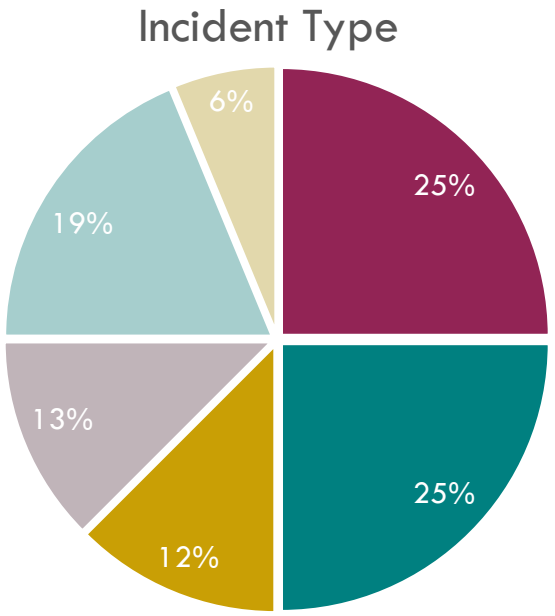


AP Line Incident Activity Scatter Plot



First Glance AP Line Data Trends

- There was an increase in incidents starting in the year 2006, with another dramatic increase starting in the year 2012.
- Additionally, incident activity is widely distributed throughout this segment of the NEC.
- In regards to incident type: Total 32



In-Depth Incident Evaluation

Next, a Human Factors Analysis and Classification System (HFACS) analysis was conducted to determine key event categories, quantities, locations, and causal factors related to Maintenance of Way activity along the NEC.

MOW Equipment Collisions								
Incident # - Year	MP	Overview	Comment	HFACS Code 4	Unsafe acts	HFACS Code 3	Preconditions to Unsafe Acts	PDF
113703 - 2009	AB - 75.1	AMTRAK PETTIBONE WAS STOPPED AT SHORELINE JCT HOME BOARD, CONTRACTED HY-RAIL HOLLAND WELDING TRUCK FOLLOWING PETTIBONE, MAKING REVERSE MOVE, FAILED TO STOP, RUNNING INTO THE REAR OF THE PETTIBONE.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00	1A, 1C	**Over-Controlled/Under Controlled System:** Contracted hi-rail welding truck following Pettibone failed to stop while making a reverse move and ran into the Pettibone vehicle. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	N
156569 - 2018	AB - 82.8	THREE PIECES OF EQUIPMENT WERE MOVING EAST AND STOPPING AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING. THE LEAD PIECE WAS STABILIZER A16106, FOLLOWED BY REGULATOR A14314 AND THE FINAL TRAILING PIECE WAS TAMPER L11507. LEAD PIECE A16106 HAD STOPPED AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING ALONG WITH REGULATOR A14314. THE TRAILING PIECE L11507 WAS UNABLE TO STOP SHORT OF THE REGULATOR TO THE EAST CAUSING IMPACT AT APPROXIMATELY 2-3 MPH. THERE WERE NO INJURIES TO REPORT.	**Injuries:** None **Associated Damage Cost:** None	1A, 1C	**Over-Controlled/Under Controlled System:** Tamper, as a part of a 3 piece equipment consist was unable to stop short of regulator, and caused impact between the two vehicles. **Widespread/Routine Violation:** Per report, tamper operator allegedly violated NORAC Rule 80. **Breakdown in Visual Scan:** Primary cause of incident is listed in report as failure to stop within half the range of vision.	2B	**Workspace Incompatible with Operation:** Secondary cause of incident is listed in report as, stop needed to be made on top of a greaser just west of the eastbound home board for Orchard interlocking, causing the tamper to slide.	Y

The Human Factors Analysis and Classification System (HFACS)[1]

- Aims to identify causal factors to produce **a systematic, multifaceted, and retrospective comprehension of incident error** by evaluating workers' ability to interact with colleagues and tools to execute tasks in their work environment.

- Further, the model:
  - Was originally developed by two behavioral scientists in the US Department of Defense to classify aviation incidents, before being applied to the rail industry
  - Is one of the most commonly used and widely available frameworks for the analysis and classification of human factors contributing to an incident
  - Helps develop data-driven trends that can promote potential courses of corrective action for future prevention
  - *Was designed for use by all members of an investigation team for a more complete and accurate record of human actions or inactions believed to cause an incident* (1)

Hfacs.com. (2019). *Human Factors Analysis and Classification System* [online] Available at: https://www.hfacs.com/ [Accessed 29 Jul. 2019].

Reasons to Apply HFACS[2]

- *The analysis of rail systems in the United Kingdom, and other regions in Europe has revealed human error as a causal factor in major and minor safety-sensitive rail incidents.*
  - *Incidents considered to be minor due to low financial or physical impact can be indicators of risks for more serious future incidents, while incidents considered to be major events can incur fines, infrastructure repair costs, service disruption, and negative public opinion which are costly to organization (2)*

144658 - 2016	97.2	BALLAST REGULATOR TRACK CAR 14256 OPERATING SOUTH ON NO.1 TRACK STRUCK TWO STRINGS OF CONTINUOUSLY WELDED RAIL THAT WAS LAYING IN THE GAUGE ON NO.1 TRACK.	**Injuries:** None **Associated Cost:** None (Note: Incident caused equipment to foul track 2. Thus, hold was put into effect, causing single track operation on track 3 from Biddle- MP 94.3 to Point- MP 90.1.)	1A	**Procedure/Checklist Not Followed Correctly:** Previous work crew or employee failed to remove rail materials. **Breakdown in Visual Scan:** Operator did not observe rails prior to collision.	2A	**Blind Spot:** Strings of rail were positioned up on high ballast, and laid above the top of the running rails of the track. Thus, the obstructing rail may have been difficult to readily observe.	Y
145127 - 2016	92.6	WHILE WORKING ON "A" TRACK AT MP 92.6 THE TLM DERAILED WHILE BEING MOVED BY KW-902. IT WAS REPORTED THAT THE TLM STRUCK A BRIDGE AT MP 92.61 MONUMENT ST.	**Injuries:** None **Associated Damage Cost:** Equipment: $400,000.00 Maintenance of Way: $525,000.00 (Note: TLM Struck Bridge)	1A	**Over-Controlled/Under Controlled System:** MOW equipment struck surrounding infrastructure, a bridge. **Break Down In Visual Scan:** MOW employees did not observe clearance between equipment and bridge.	2A	**Weather Conditions Affecting Vision:** Event occurred at 3:34AM, and conditions were reported to be dark.	Y

Madigan, R., Golightly, D. and Madders, R. (2016). *Application of Human Factors Analysis and Classification System (HFACS) to UK rail safety-of-the-line incidents - White Rose Research Online*. [online] Eprints.whiterose.ac.uk. Available at: http://eprints.whiterose.ac.uk/104357/ [Accessed 29 Jul. 2019].

James Reason's Swiss Cheese Model: Identifying Latent & Active Failures [2]

- Reason's model provides the basis for the HFACS model of human error, enabling investigators to evaluate the active and latent failures that encompass the causal sequence of events that lead to an accident.
  - **Active Failures:**
    - Are errors or violations associated with the front-line operators of a system
    - Have effects that are evident immediately
  - **Latent Failures:**
    - Are hidden errors associated with the designers and managers of a system
    - Have effects that can lie dormant within a system for a long period of time
    - Become more evident when analyzed in the context of other factors
    - Can pose the greatest risks to system safety, and give rise to further issues, despite the rectification of more immediate performance issues
- *Reason argues that human error is a consequence, not cause, of latent failures and through the comprehension of such failures organizations can limit reoccurrence of error.*(2)

HFACS & James Reason's Swiss Cheese Model[1]

Active Failures:

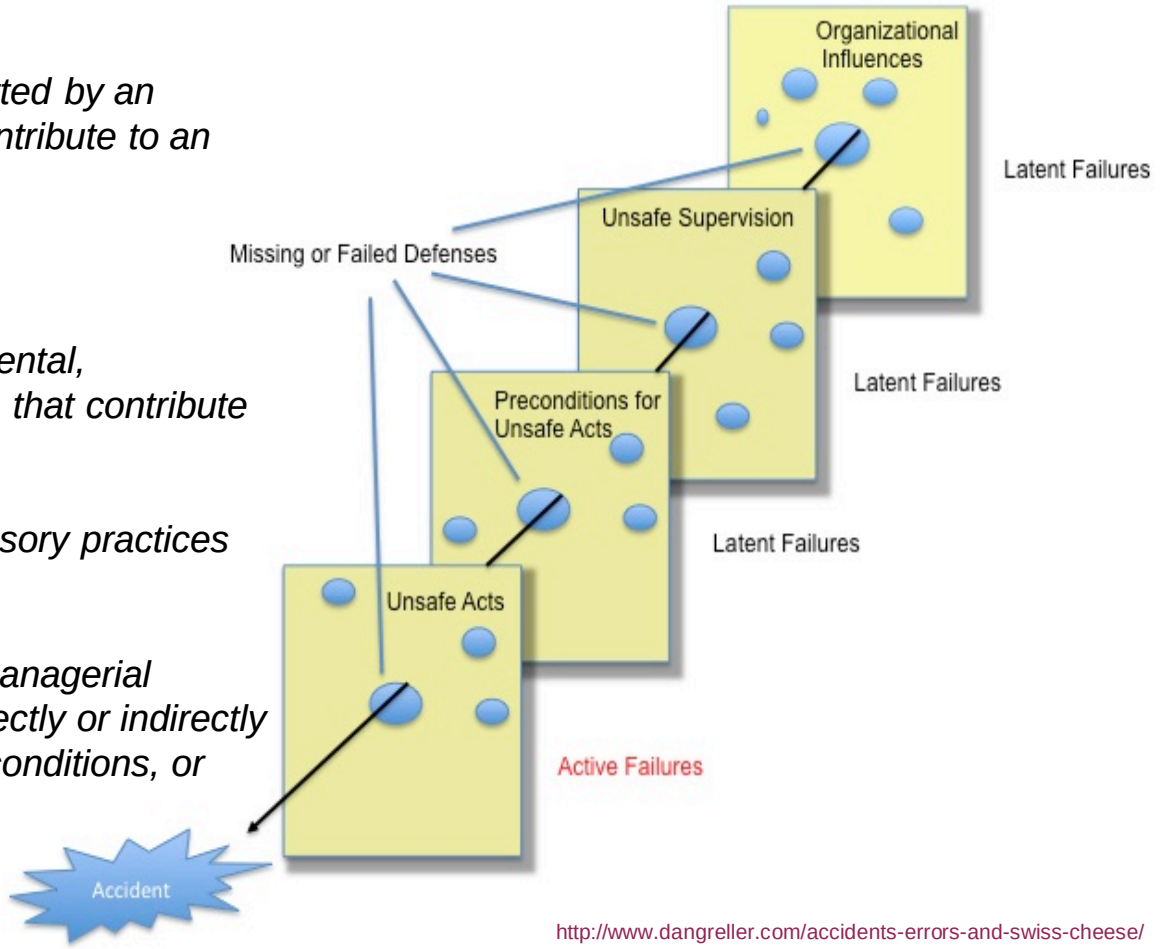
Unsafe Acts – Actions or inactions committed by an individual that are believed to cause or contribute to an incident.

Latent Failures:

Preconditions for Unsafe Acts – Environmental, technological, and physical circumstances that contribute to human error.

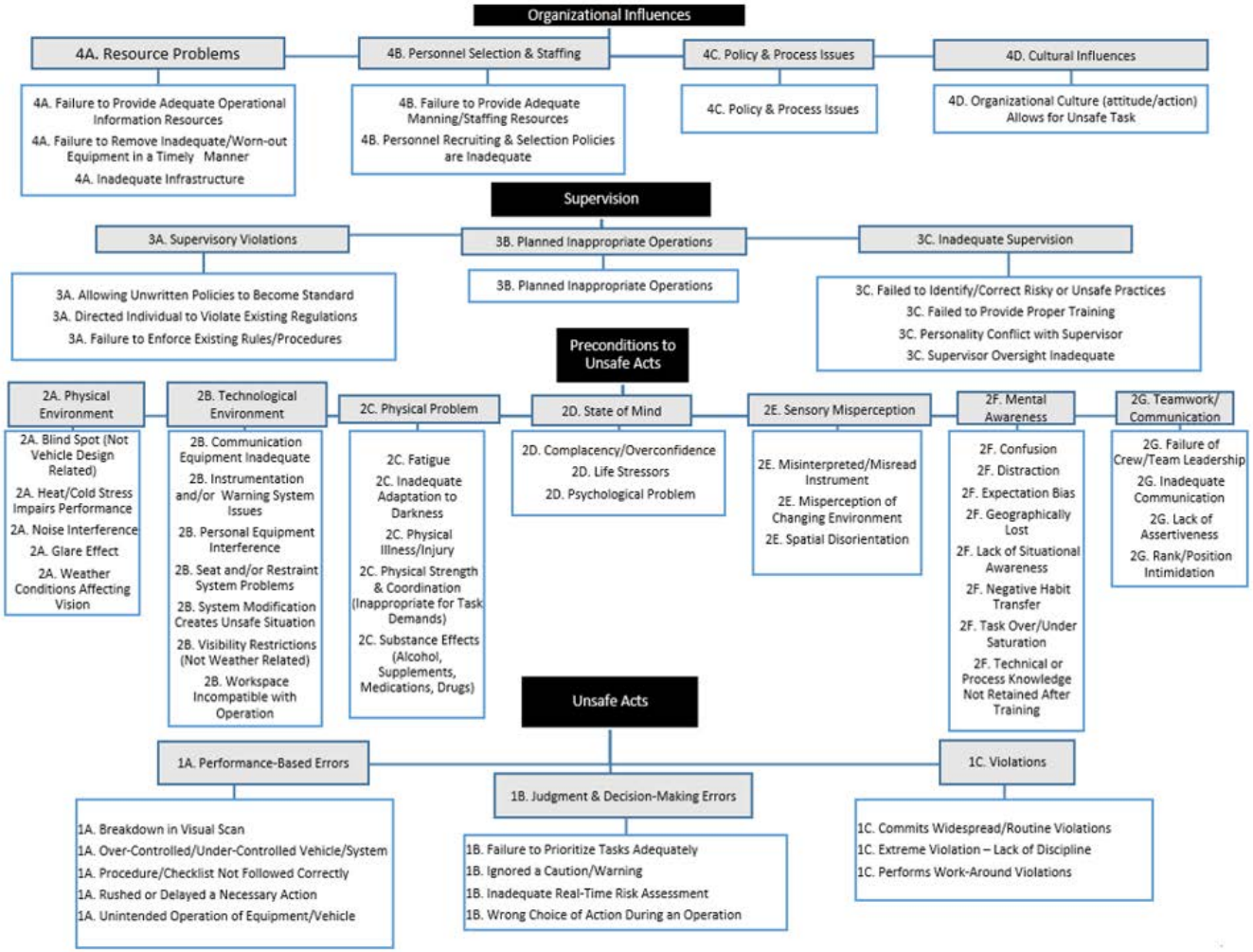
Unsafe Supervision – Inadequate supervisory practices that facilitate an unsafe work environment.

Organizational Influences – Upper level managerial procedures within an organization that directly or indirectly promote improper supervisory practices, conditions, or actions of workers.



http://www.dangreller.com/accidents-errors-and-swiss-cheese/

Codification System[1]



Application of HFACS to Amtrak Data

- The filtering process employed for this study resulted in a subset of 70 maintenance-of-way related incidents occurring between the years 2000 and 2018.

- The following six incident categories were analyzed using HFACS criteria:

  - MOW Equipment Collision
  - Train Struck MOW Equipment
  - MOW Equipment Struck Surroundings
  - Switch Related MOW Equipment Derailment
  - Maintenance and Inspection Issue Related Derailment
  - Rule Violations

Methodology

- Incidents were codified based on extracted data from accident narratives, and supplemental investigative reports to determine the contributing safety factors, which were correlated to designated HFACS codes.

- Note: More than one code could be attributed to a single accident for both active and latent failures. However, factors having the same identification code, were represented once.

- Patterns were identified using frequency counts.

Analysis By Accident Type: Active & Latent Causal Factor Frequencies

Collisions

Incident Total: 23

Active Failures – Unsafe Acts

Performance Based Errors
(23) Over-Controlled/Under-Controlled System
(2) Procedure/Checklist Not Followed Correctly
(7) Break Down in Visual Scan
(6) Rushed or Delayed Necessary Action
(1) Unintended Operation of Vehicle

Judgment & Decision-Making Errors
(1) Failure to Prioritize Tasks Adequately
(6) Ignored a Caution/Warning
(3) Inadequate Real-Time Risk Assessment
(3) Wrong Choice of Action During Operation

Violations
(19) Commits Widespread/Routine Violations

Latent Failures – Preconditions

Insufficient Information Provided (10)

Technological Environment
(3) Instrumentation Issues
(3) Communication Equipment Inadequate
(2) Workspace Incompatible with Operation

Teamwork/Communication
(1) Failure of Crew/Team Leadership

Physical Environment
(2)Weather Conditions Affecting Vision

Mental Awareness:
(2) Lack of Situational Awareness
(2) Distraction
(2) Technical or Process Knowledge Not Retained After Training

Sensory Misperception
(2) Misperception of Changing Environment
(1) Spatial Disorientation

Physical Problem
(2) Physical Illness/Injury - Medically Disqualified (Pending Drug & Alcohol Testing)
(1) Substance Effects
(1) Fatigue

Train Struck MOW

Incident Total: 9

Active Failures – Unsafe Acts

Performance Based Errors
(6) Over-Controlled/Under-Controlled System
(3) Procedure/Checklist Not Followed Correctly
(1) Break Down in Visual Scan

Judgment & Decision-Making Errors
(2) Failure to Prioritize Tasks Adequately
(3) Inadequate Real-Time Risk Assessment
(2) Wrong Choice of Action During Operation

Violations
(1) Extreme Violations - Lack of Discipline

Latent Failures – Preconditions

Insufficient Information Provided (7)

Technological Environment
(1) Instrumentation Issues

Teamwork/Communication
(1) Failure of Crew/Team Leadership

Technological Environment
(1) Workspace Incompatible with Operation

Train Struck Object

Incident Total: 8

Active Failures – Unsafe Acts

Performance Based Errors
(7) Over-Controlled/Under-Controlled System
(2) Procedure/Checklist Not Followed Correctly
(6) Break Down in Visual Scan

Judgment & Decision-Making Errors
(1) Failure to Prioritize Tasks Adequately
(2) Inadequate Real-Time Risk Assessment
(1) Wrong Choice of Action During Operation

Latent Failures – Preconditions

Insufficient Information Provided (4)

Physical Environment
(3)Weather Conditions Affecting Vision
(2) Blindspot

Analysis By Accident Type: Active & Latent Causal Factor Frequencies

Rule Violation

Incident Total: 8

Active Failures – Unsafe Acts

Performance Based Errors
(7) Over-Controlled/Under-Controlled System
(3) Breakdown in Visual Scan
(3) Procedure/Checklist Not Followed Correctly

Judgment & Decision-Making Errors
(3) Failure to Prioritize Tasks Adequately
(4) Ignored Caution/Warning
(5) Wrong Choice of Action During Operation
(5) Inadequate Real-Time Risk Assessment

Violations
(5) Extreme Violation – Lack of Discipline
(2) Commits Widespread/Routine Violation

Latent Failures – Preconditions

Sensory Misperception
(1) Spatial Disorientation
(2) Misperception of Changing Environment

Physical Environment
(1) Blind Spot

Mental Awareness
(3) Lack of Situational Awareness
(1) Distraction
(1) Technical or Process Knowledge Not Retained After Training

State of Mind
(1) Overconfidence

Teamwork/Communication
(2) Failure of Crew/Team Leadership

Insufficient Information Provided (4)

Derailment – Operator or Switch Error

Incident Total: 12

Active Failures – Unsafe Acts

Performance Based Errors
(12) Over -Controlled/Under-Controlled System
(1) Procedure/Checklist Not Followed Correctly
(2) Breakdown in Visual Scan

Judgement & Decision-Making Errors
(3) Inadequate Real-Time Risk Assessment
(2) Failure to Prioritize Tasks Adequately
(2) Wrong Choice of Action During Operation

Violations
(1) Extreme Violation – Lack of Discipline

Latent Failures – Preconditions

Sensory Misperception
(1) Spatial Disorientation
(4) Misperception of Changing Environment

Mental Awareness
(1) Distraction
(1) Confusion
(2) Lack of Situational Awareness
(3) Technical or Process Knowledge Not Retained After Training

Physical Environment
(1) Weather Conditions Affecting Vision

Physical Problem
(1) Fatigue

Teamwork/Communication
(3) Failure of Crew/Team Leadership

Technological Environment
(1) Workspace Incompatible With Operation

Insufficient Information Provided (7)

Derailment – Maintenance & Inspection Issue

Incident Total: 10

Active Failures – Unsafe Acts

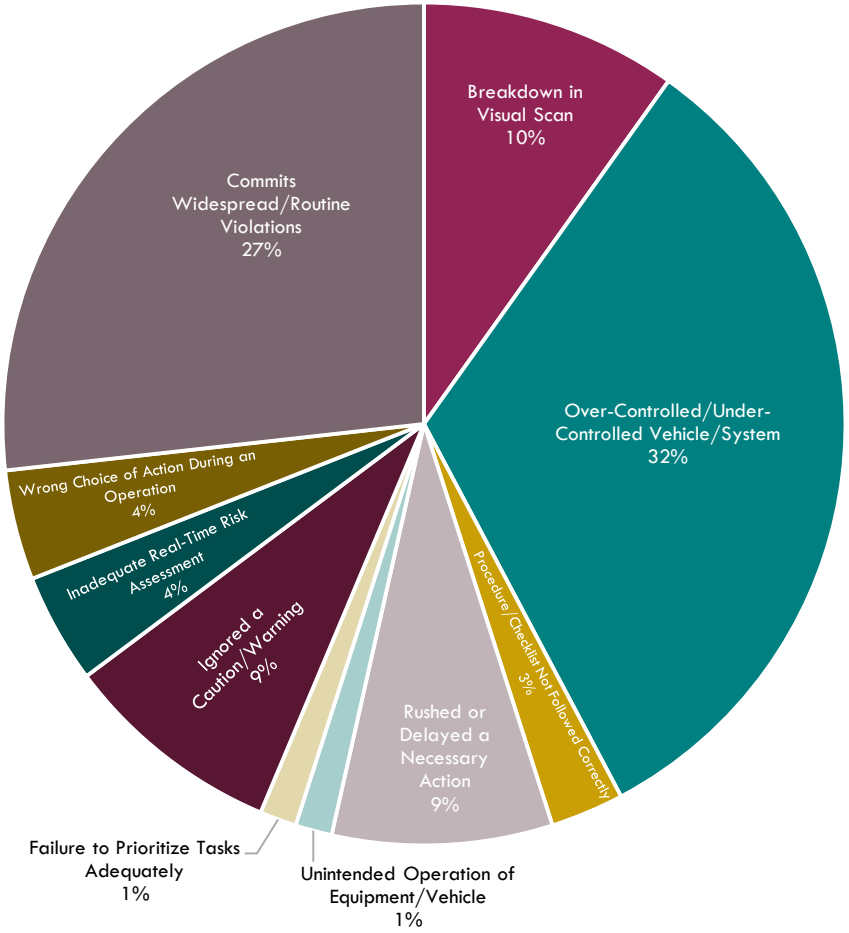
Performance Based Errors
(10) Over-Controlled/Under-Controlled System

Latent Failures – Preconditions

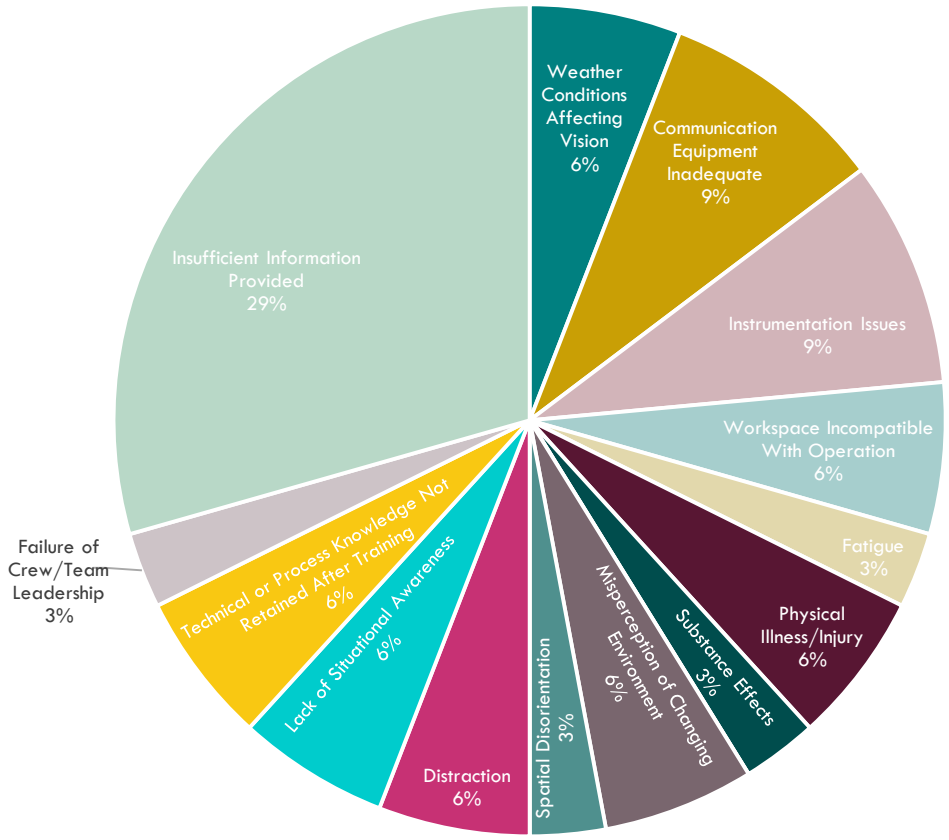
Technological Environment
(8) Instrumentation Issues
(2) Workspace Incompatible with Operation

Collision Incidents: 23

Active Failures

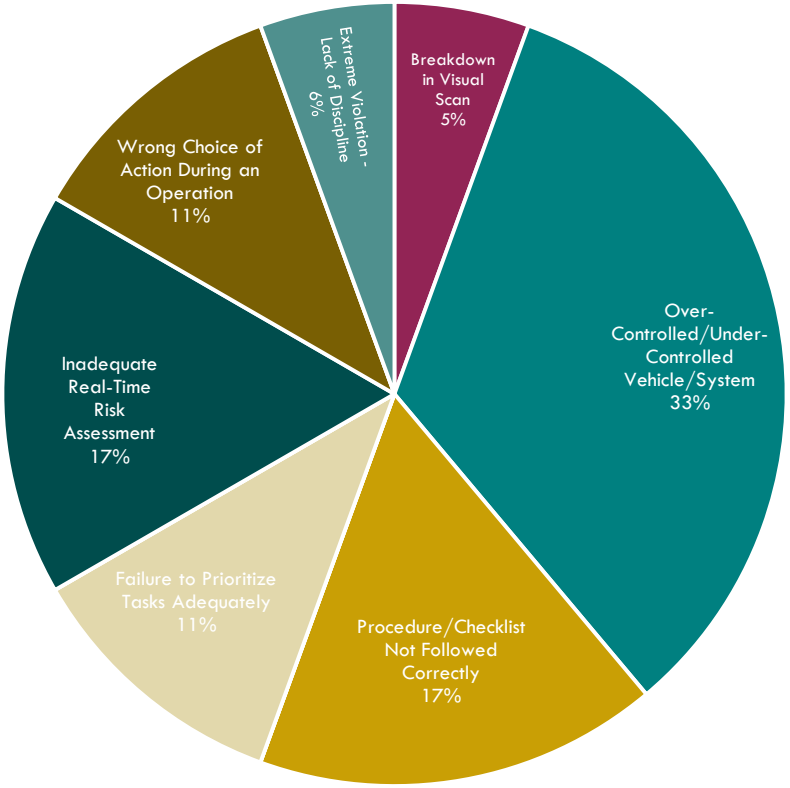


Latent Failures

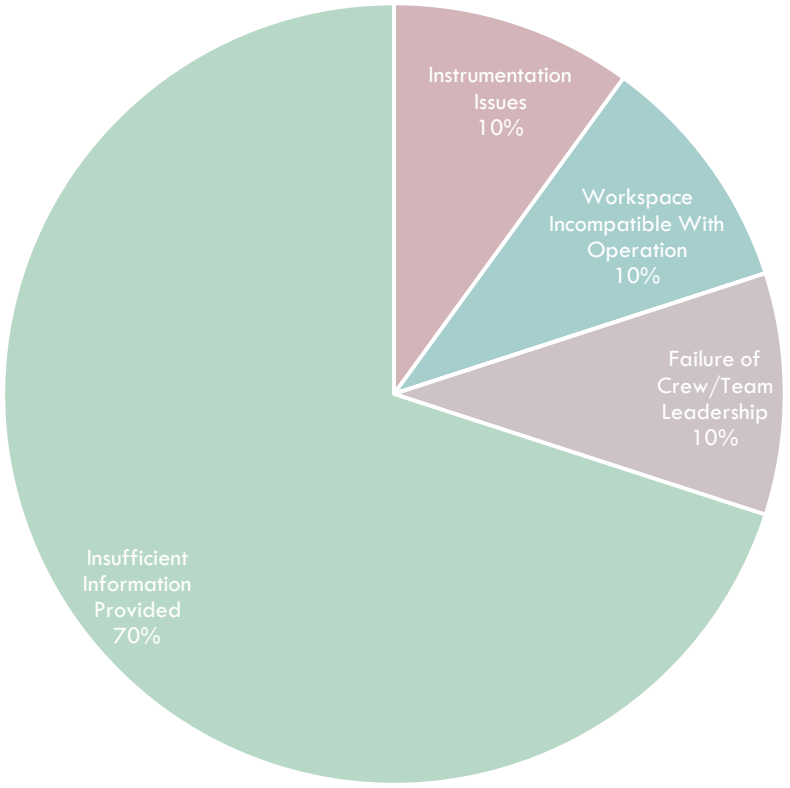


Train Struck MOW Equipment: 9

Active Failures

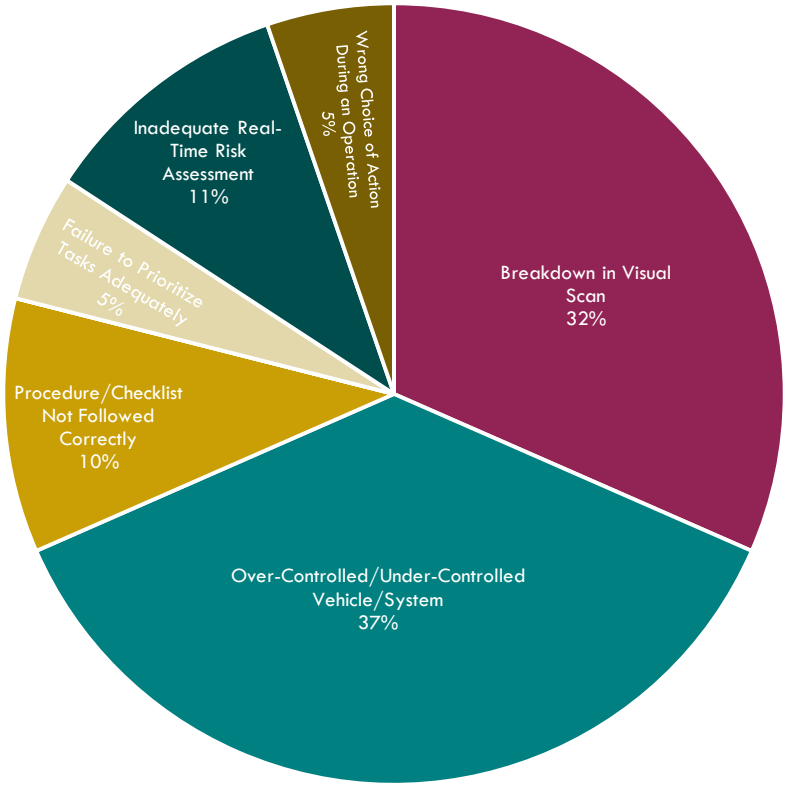


Latent Failures

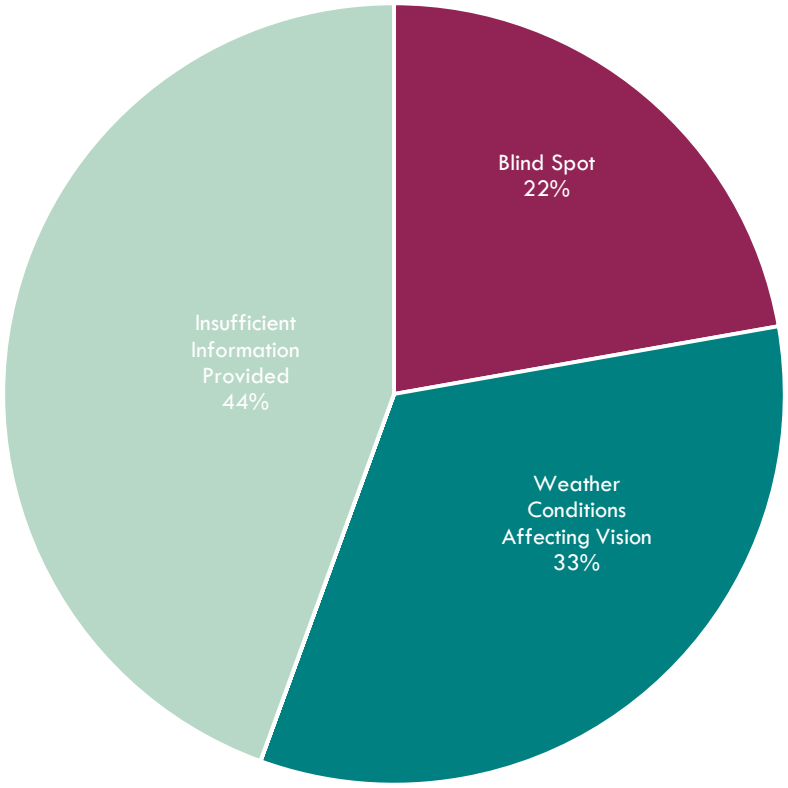


Train Struck Object: 8

Active Failures

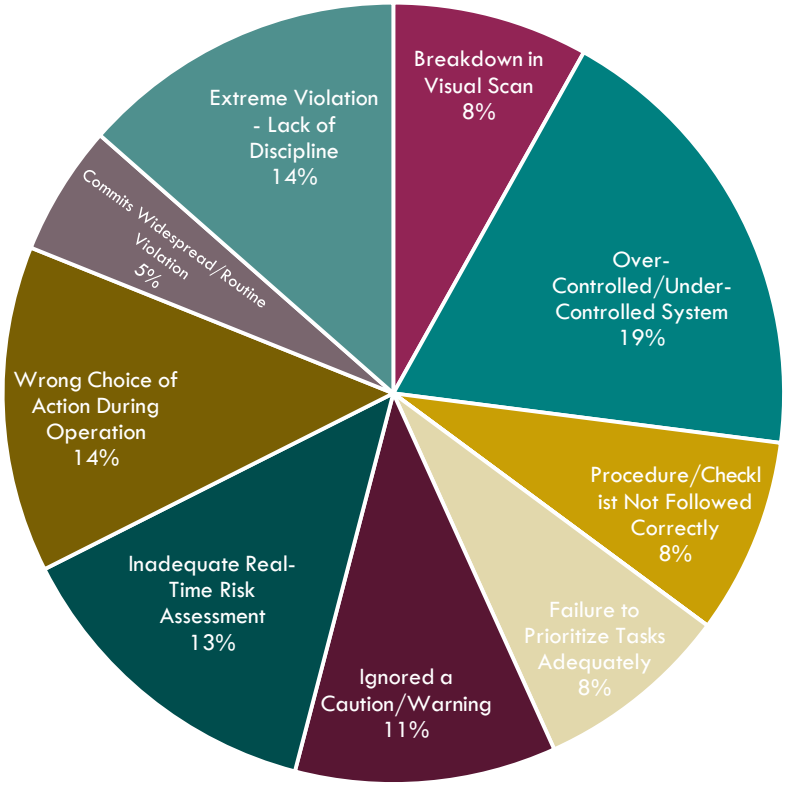


Latent Failures

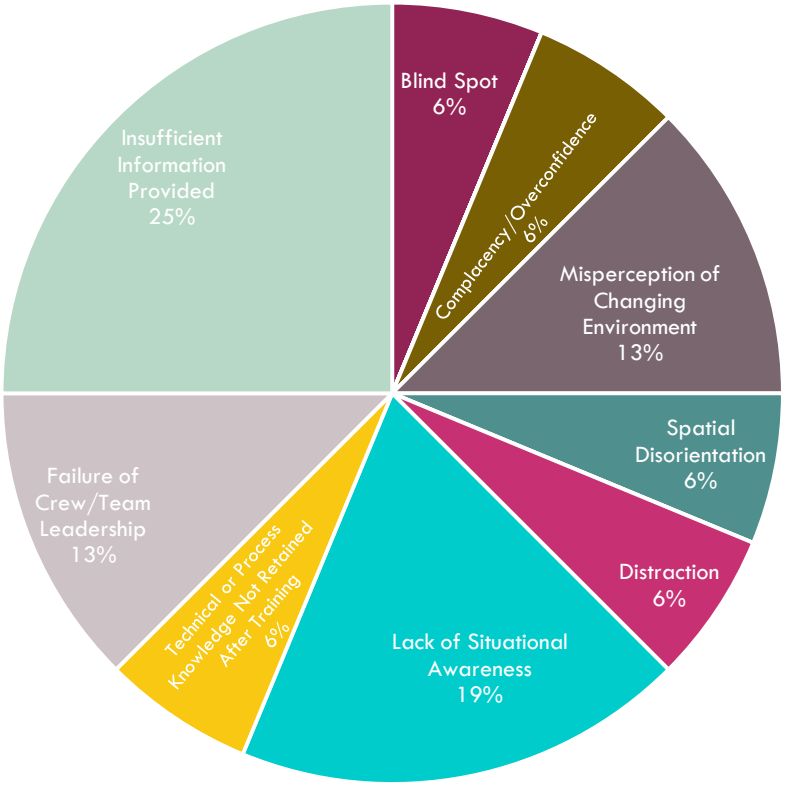


Rule Violation: 8

Active Failures

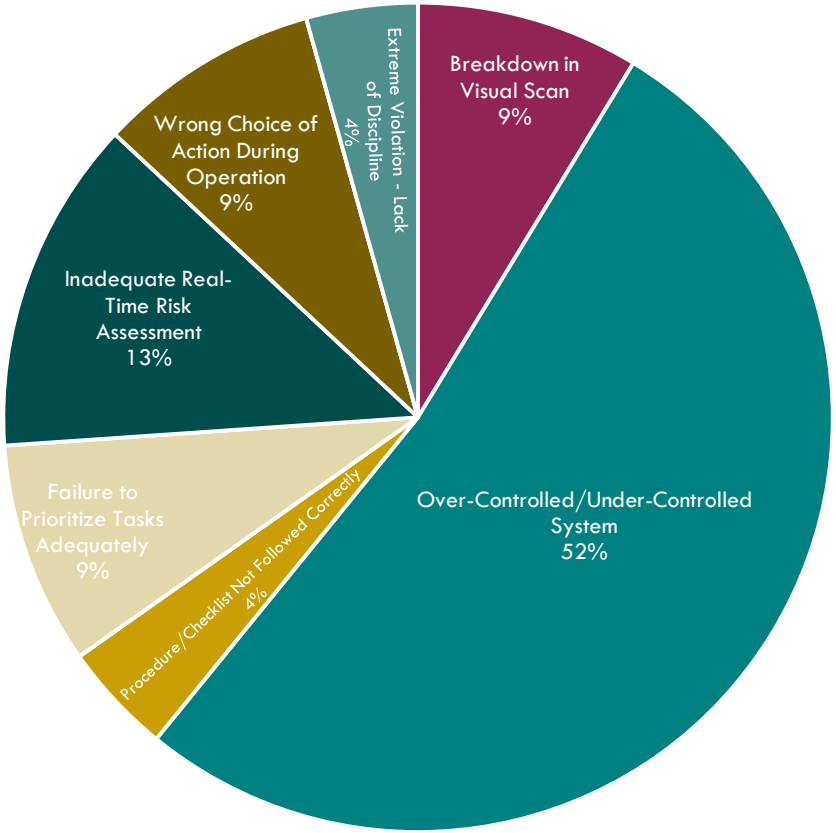


Latent Failures

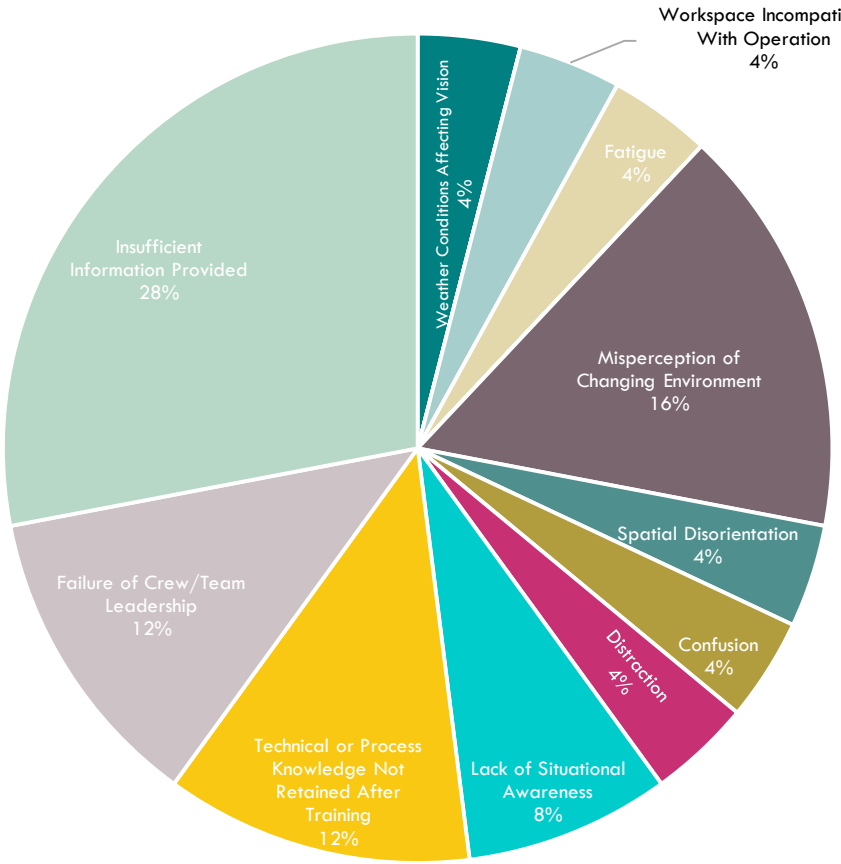


Derailment – Operator/Switch Error: 12

Active Failures

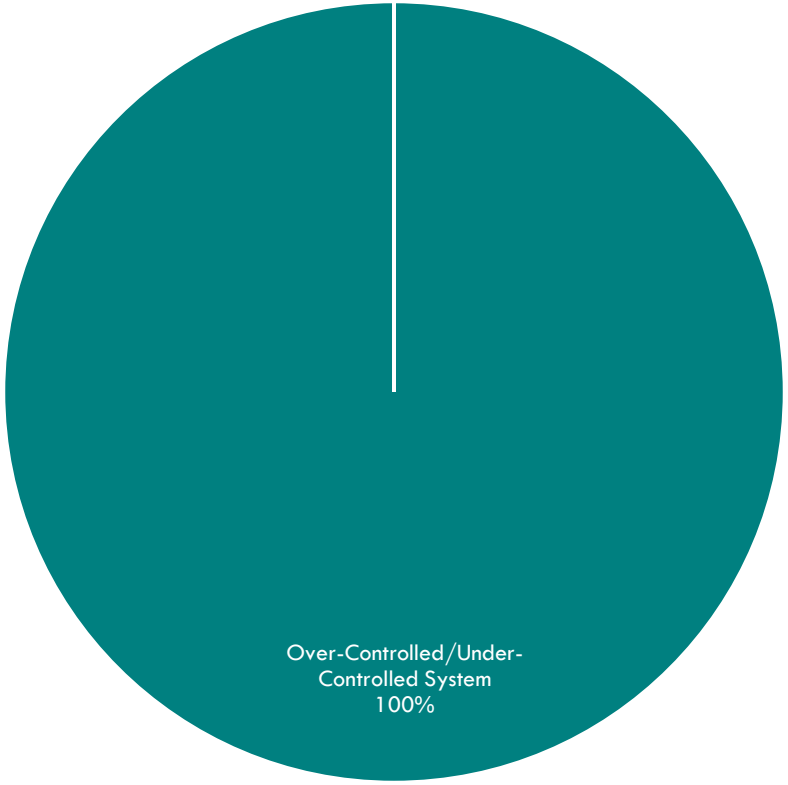


Latent Failures

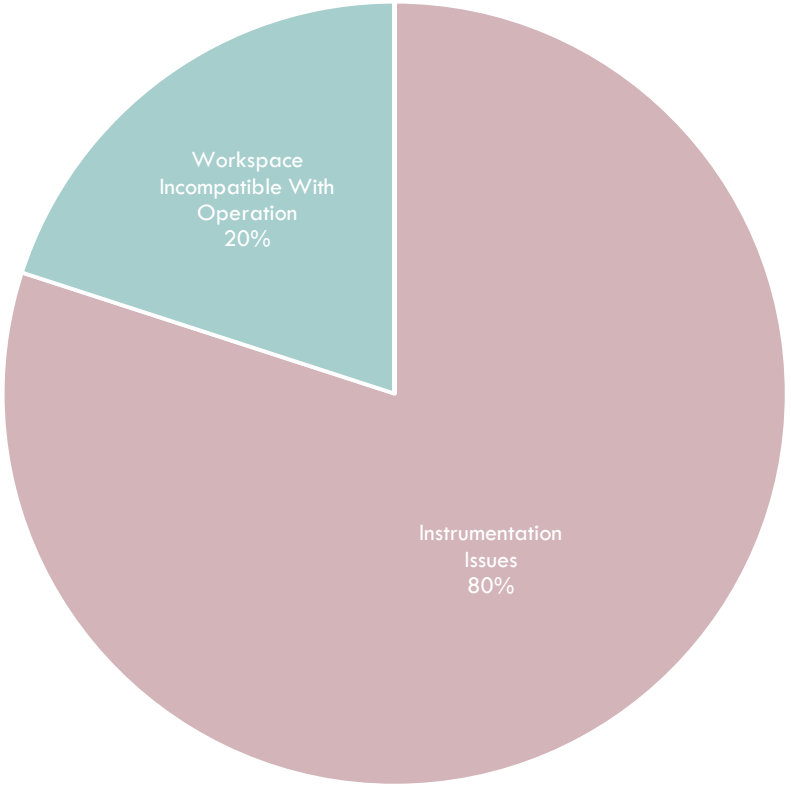


Derailment – Maintenance & Inspection Issue: 10

Active Failures



Latent Failures



HFACS Limitations: Data Quality

- The validity of the HFACS model's findings relies on the size and quality of information provided for the data set.

- In this study, as previously explained, HFACS codes were derived using incident narratives, and supplemental reporting documents.

  - Among the 70 incidents evaluated, only 29 of these incidents were accompanied by a supplemental report.

  - Further, many incidents, even those having supplemental documentation provided minimal information (preconditions were not found for 33 of 70 incidents).

HFACS Limitations: Supervision & Organizational Influences

- Investigations are primarily performed by front-line supervisors, as opposed to impartial accident investigators.

- Considering a reluctance among supervisors to implicate themselves, their work staff, or employers in a safety sensitive event:
  - Latent failures related to supervision and organizational influences have a tendency to be underreported.
  - At Amtrak, of 29 incidents accompanied by a supplemental report, just 3 incidents referenced supervisory, or organizational factors.

- Thus, the depth of the analysis is inevitably limited by the small subset of incidents (70), as well as the deficiency of the information provided.

References

1. Hfacs.com. (2019). *Human Factors Analysis and Classification System* [online] Available at: https://www.hfacs.com/ [Accessed 29 Jul. 2019].

2. Madigan, R., Golightly, D. and Madders, R. (2016). *Application of Human Factors Analysis and Classification System (HFACS) to UK rail safety-of-the-line incidents - White Rose Research Online*. [online] Eprints.whiterose.ac.uk. Available at: http://eprints.whiterose.ac.uk/104357/ [Accessed 29 Jul. 2019].

Data Tables and Detailed Analysis Results

Track Charts

AB Line

AMTRAK

Line Code: AB-Shore Line
72.5 - 77.5

PAGE: 1A
27-NOV-12

MILE

73 5282 74 5254 75 5293 76 5279 77 5288 Mile MP

INFRASTRUCTURE

"Mill River" "Shore Line Junction"

OH 72.94 OH 73 OH 73.22 OH 73.27 OH 73.35 OH 73.53 OH 73.59 UG 73.72 UG 73.85(AS 1.61) UG 73.97 OH 74.18 OH 74.29 OH 74.34 OH 74.38 UG 74.79 UG 75.05 UG 0.7 OH 75.18 UG 75.24 UG 75.65 UG 75.77 UG 75.92 OH 76.24

LEGEND

Grand Ave. Signal Bridge
Utility Bridge Utility Bridge IR 91 N & S
Wallace St. Signal Bridge
Mill River
Humphrey St.
James St.
Blachley Ave.
I-91 NB I-91 SB Ferry St.
Quinnipiac River
Middletown Ave. Middletown Ave. I-91 N & S
Little River
Stream
Quinnipiac Avenue
Hemmingway St.
Clifton Street

CURVES

	152	151	150.1	150	149	148	147
TRACK1	4.07° 2.76		2.35° 1.18			3.09° 4.33	1.81° 2.76	1.82° 2.76
	4.14° 2.76	4.04° 2.76	0.72° 0.39	2.03° 1.57	1.3° 0.39	1.1° 0.39	3.25° 5.51	1.82° 3.15	1.84° 3.15	2.33° 3.94	2.12° 3.54	1.27° 4.33
TRACK2		4.12° 2.76	0.87° 0.79		1.43° 1.18	1.2° 1.18						1.28° 2.76	1.26° 2.76
TRACK3	2.36° 1.57	0.25° 0.0											
TRACK4													

GRADIENT

0.10 0.70 0.12 -0.38 0.28 -0.08 0.52 -0.58

MILE

Mile 78 79 80 81 82 MP

5290 5269 5296 5273 5286

INFRASTRUCTURE

Branford Station
"Branford"

OH 78.02 OH 78.26 UG 78.57 OH 78.69 UG 78.83 OH 79.29 UG 79.32 UG 80.59 UG 80.67 UG 80.86 OH 80.95 OH 81.25 UG 81.44 UG 81.87 UG 82

UG 79

1 2

LEGEND

I-95 High St. Foxon River Lake Road Lake Saltonstall Hosley Rd. Stream Boston Post Rd. Stream Stream Harbor St. Kirkham St. Indian Head Rd. Montowese St. Branford River

CURVES

	146	145	144.1	144	143	142	141	140
TRACK1	3.14° 5.91	2.31° 4.33	2.07° 3.94	2.12° 3.94	1.16° 2.36	0.98° 1.97	0.86° 1.57	1.07° 1.97	1.7° 3.15	3.02° 5.91	1.86° 4.33	3.18° 3.94	3.86° 4.72	3.9° 4.72	1.37° 1.57	0.5° 0.79
TRACK2	3.21° 5.51	2.32° 3.94								3.01° 5.91	1.94° 3.54	3.21° 3.94			1.37° 1.57	0.51° 0.79
TRACK3																
TRACK4																

GRADIENT

-0.58 0.14 0.02 0.60 0.11 -0.63 -0.82 -0.67 0.16 0.57 0.08 0.46

MILE

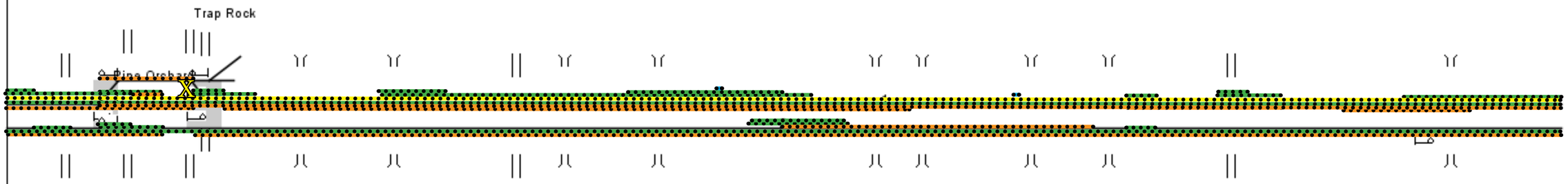
83 5275 84 5284 85 5281 86 5281 87 5282 Mile MP

INFRASTRUCTURE

"Pine" "Orchard"

OH 82.84 OH 82.86 OH 83.08 OH 83.25 UG 83.58 UG 83.91 OH 84.29 UG 84.41 UG 84.76 UG 85.41 UG 85.58 UG 85.95 UG 86.17 OH 86.54 UG 87.27

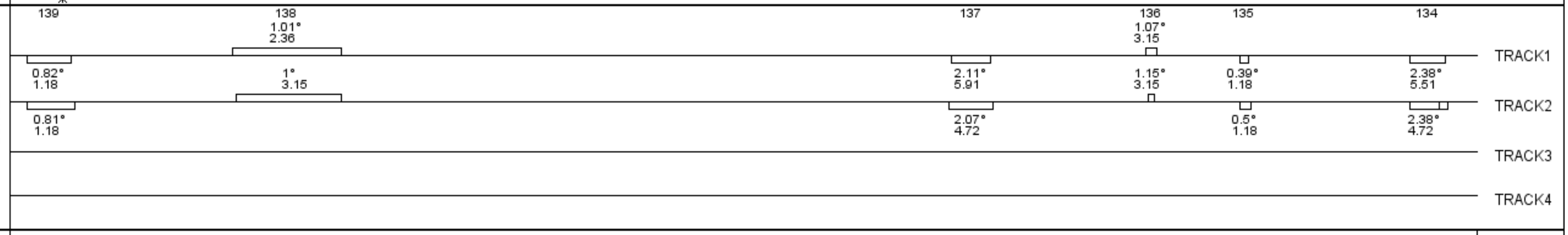
Trap Rock



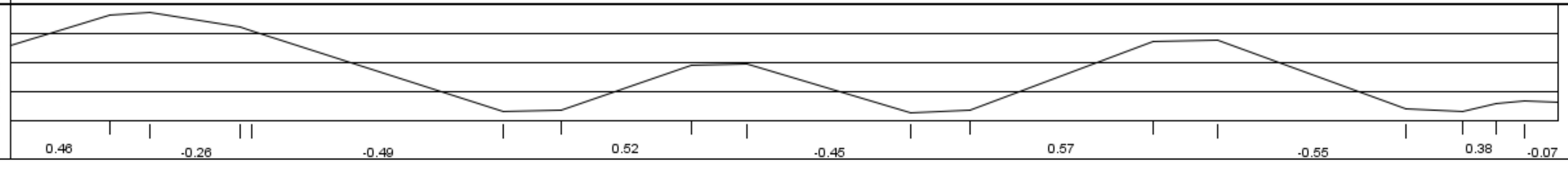
LEGEND

Pipe Bridge * | Signal Bridge | Signal Bridge Birch Rd. | Totoket Rd. | New Haven Trap Rock | Pleasant Point Rd. | Pine River | Thimble Island Rd. | Stony Creek River | Roger's Farm | Leetes Island Rd. | New Quarry Rd. | Moose Hill Rd. | Leetes Island Creek

CURVES



GRADIENT



MILE

88 — 5283 — 89 — 5277 — 90 — 5254 — 91 — 5259 — 92 — 5294 — Mile MP

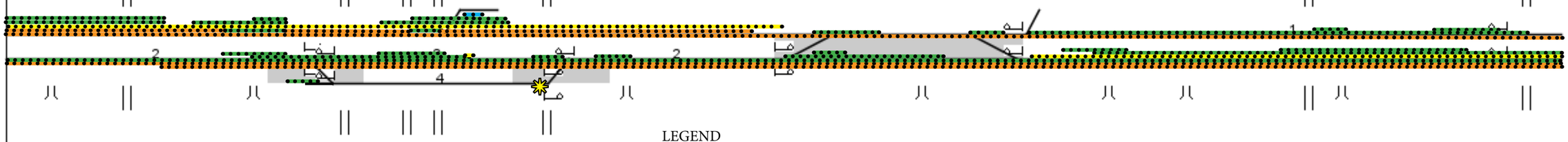
INFRASTRUCTURE

Guilford Station
"Meadow" "Triebel" "Guilford"

UG 87.79 | OH 88.03 | UG 88.43 | OH 88.73 | OH 88.95 | OH 89.03 | OH 89.38 | UG 89.64 | UG 90.6 | UG 91.18 | UG 91.45 | OH 91.82 | UG 91.91 | OH 92.53

Whitfield Siding

Landon Lumber



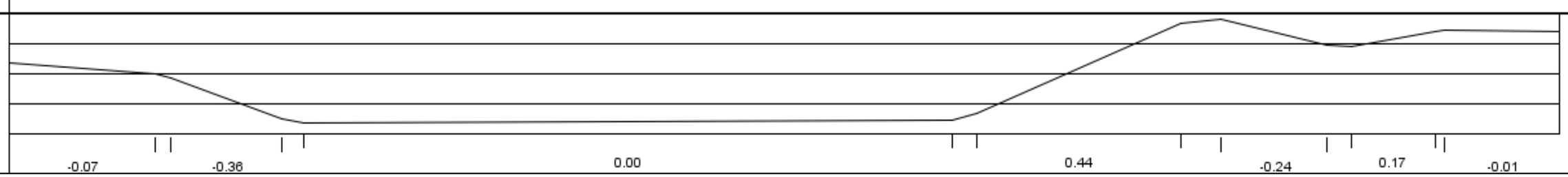
LEGEND

Sachem's Head Rd. | Mulberry Point Rd. | West River | Signal Bridge | New Whitfield St. | Pedestrian overpass | Signal Bridge | East Creek | East River | Boston Post Rd. | Mungertown Rd. | Foot Path Rd. | Neck River | Copse Rd.

CURVES

	133	132	131	130	129	128
TRACK1	1.12° 3.94		0.17° 0.57° 0.79 3.15	0.21° 1.18		0.93° 3.94
TRACK2	1.12° 3.94	0.24° 0.79	0.74° 4.33	0.22° 0.39	0.16° 0.79	0.96° 3.94
TRACK3		0.3° 0.39			0.2° 0.39	
TRACK4						

GRADIENT



MILE

93 5270 94 5263 95 5300 96 5277 97 5284 Mile MP

Madison Clinton

INFRASTRUCTURE

OH 92.89 OH 93.08 OH 93.88 UG 93.95 OH 94.57 UG 94.83 UG 96.16 UG 96.6 UG 96.89 UG 96.93 UG 97.04 UG 97.1 OH 97.49

M&W Siding

LEGEND

Bostich Stub Track

Route 79 Durham Turnpike Horse Pond Rd. Bishop's Crossing Hammonasset Connct. River RoadRiver Cattle Pass North High St. Hull St. Ped. Underpass Indian River Cemetary Access Liberty St.

CURVES

	127	126	125	124
TRACK1	1.61° 5.12	2.22° 2.42° 5.12 5.91	1.51° 5.12	0.99° 3.54
TRACK2	1.61° 5.12	2.23° 2.47° 5.12 5.91	1.5° 5.12	0.98° 3.54
TRACK3				
TRACK4				

GRADIENT

-0.01 0.05 0.50 -0.37 0.05 0.53 -0.06 -0.54 -0.27

MILE

98 99 100 101 102 Mile MP

5302 5281 5264 5266 5311

Westbrook

INFRASTRUCTURE

OH 97.87 OH 99.16 UG 99.8 OH 100.54 UG 101.11 UG 101.22 OH 101.36

Cheeseborough

LEGEND

Old Post Rd. Grove Beach Rd. Wrights River Old Clinton Rd. Pond Meadow Rd. Westbrook River Essex Rd.

CURVES

123 122 121 120

123: 1.05° 4.33 | 0.93° 3.54 | 1.26° 5.12 | 0.52° 1.97
123: 1.04° 4.72 | 0.93° 3.94 | 1.25° 5.51 | 0.53° 2.36
122: 2.14° 5.51
122: 2.16° 5.51
121: 1.89° 4.72 | 0.91° 2.36
121: 1.9° 4.72 | 0.91° 2.36
120: 2.81° 5.12
120: 2.55° 5.12

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

-0.27 0.04 0.15 -0.11 0.65 0.49 -0.39 0.14 0.47 -0.66

MILE

Mile 103 (5330) 104 (5120) 105 (5397) 106 (5266) 107 (527) MP

INFRASTRUCTURE

Saybrook "Saybrook" Old Saybrook

"Brook" "View" "Conn"

OH 102.85 | OH 103.62 | OH 103.8 | OH 104.15 | UG 104.48 | UG 104.56 | OH 104.71 | OH 105.05 | OH 105.15 | OH 105.28 | OH 105.45 | OH 105.84 | UG 106.89 | UG 107.35

West Leg of Wye | East Leg of Wye | Tilcon Tomasso

Donnellys

LEGEND

Spencer Plain Rd. | School House Rd. | Signal Bridge | Ingram Hill Rd. | Oyster River | Elm St. | Signal Bridge | Signal Bridge | Pedestrian overpass | Boston Post Rd. | Cantilever Signal Br | Signal Bridge | Connecticut River | Lieutenant River

CURVES

119	118	117	116	115
			3.51° 5.12	2.2° 5.91
0.3° 0.39	2.25° 5.51	0.88° 2.76	3.51° 5.12	2.22° 5.91
0.24° 0.39	2.07° 5.51	0.9° 2.76		
	0.88° 2.36			

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

-0.66 | -0.21 | 0.52 | -0.28 | 0.36 | -0.17 | -0.26 | 0.50 | 0.02 | -0.51

Yellow - (07/24/18 - 0346am - 07/25/18 - 0252am)
Pink - (07/30/18 - 0250am - 07/31/18 - 0358pm)
(07/30/18 - 0250am - 07/31/18 - 0358pm)
Green - (08/02/18 - 0340am - 08/02/18 - 0313pm)
Blue - (08/03/18 - 0308am - 8/06/18 - 0249am)
(08/07/18 - 0251am - 08/08/18 - 0254am)
(08/09/18 - 0319am - 08/10/18 - 0258am)
(08/13/18 - 1259am - 08/14/18 - 0259am)
(08/15/18 - 0252am - 08/16/18 - 0501am)
Red - (11/01/18 - 0324am - 11/11/18 - 0150am)
(11/11/18 - 150am - 11/12/18 - 0213am)

MILE

108 5280 109 5294 110 5228 111 5324 112 5281 Mile MP

INFRASTRUCTURE

UG 107.94 OH 108.01 | UG 108.11 | OH 108.51 | UG 108.76 | UG 108.87 | UG 109.21 | OH 109.43 | UG 110.74 | UG 110.95 | OH 111.48 | UG 112.06 | UG 112.2 | UG 112.58

OD 107.9

Duck River Route 156 | McCurdy Rd. | Johnnycake Hill | Mile Creek Rd. | Cattle Pass | Blackhall River | Buttonball Rd. | Cross Lane | Swan's Cattle Pass | Route 156 | Champions Rd. | Pedestrian underpass | Four Mile River

LEGEND

CURVES

	114				113	112	111	110
TRACK1	0.51° 1.97	0.94° 3.94	0.46° 1.97	1.11° 4.33	2.03° 5.12	2.02° 5.12	2.1° 5.91	3.25° 5.51
TRACK2	0.49° 1.57	0.98° 3.15	0.39° 1.18	1.28° 4.33	2.04° 5.12	2° 4.72	2.07° 5.12	3.27° 5.12
TRACK3								
TRACK4								

GRADIENT

-0.51 | 0.74 | -0.54 | 0.60 | 0.06 | 0.63 | -0.52 | -0.38 | 0.06

MILE

Mile
MP 113 (5281) 114 (5272) 115 (5283) 116 (5294) 117 (529)

INFRASTRUCTURE

"Crescent" "Nan"

OH 112.74 | UG 112.82 | UG 113.18 | UG 113.2 | UG 113.77 | UG 114.3 | UG 115.13 | OH 115.62 | UG 115.86 | UG 116.74 | UG 116.79 | OH 117.31 | OH 117.52

East Lyme Yard

LEGEND

Rocky Neck Footbrdg | Rocky Neck Pass | Brides Brook | Giant's Neck Rd. | Lyle Creek | Miamacook River | Black Point Rd. | Columbus Ave. | Beach Passway | Niantic River | Roadway | Millstone Rd. West | Millstone Plant Rd.

CURVES

	109	108	107	106	105				104	103
TRACK1	3.12° 5.12	2.61° 4.33 / 2.62° 3.94	2.02° 5.51 / 2.06° 5.51	1.91° 4.33 / 1.92° 5.12	1.35° 2.36 / 1.03° 1.97	0.58° 1.18 / 0.7° 1.18	1.8° 3.54 / 1.87° 3.15	1.51° 2.76 / 1.5° 2.76	2.23° 4.33 / 2.25° 3.94	3.08° 5.91 / 3.01° 5.51
TRACK2	3° 4.72		2.01° 5.12 / 2.04° 5.12							3.03° 5.12 / 2.98° 5.12
TRACK3										
TRACK4										

GRADIENT

-0.40 | 0.34 | -0.49 | -0.16 | 0.45 | 0.34 | -0.50 | -0.27 | 0.16 | 0.68

MILE

Mile 118 (5268) 119 (5243) 120 (5570) 121 (4980) 122 (561) MP

INFRASTRUCTURE

"Shaws Cove"

UG 118.19 | UG 118.92 | OH 119.85 | Miners Lane | OH 121.51 | OH 121.66 | UG 121.89 | UG 122.11 | UG 122.2 | UG 122.65

Minor Alexander

LEGEND

Millstone Power Plant

Hendel Siding

Gardiners Wood Rd. | Jordan's Cove | Great Neck Rd. | Ocean Ave. | Montauk Ave. | Culvert | Pequot Ave. | Walbach St. | Shaws Cove

CURVES

	102	101	100	99	98	97	96
TRACK1	3.05° 5.91	3.06° 5.51	2.03° 3.54 / 3.17° 5.51	2.03° 3.54 / 3.16° 5.51 / 2.56° 4.33 / 2.58° 4.33	1.16° 1.18 / 1.05° 1.18 / 1.5° 1.57 / 0.86° 0.79 / 3.57° 3.94	0.54° 0.79	1.22° 1.18
TRACK2	3.02° 5.12 / 0.99° 1.57	3.12° 5.51			1.25° 1.57 / 1.01° 1.18 / 1.51° 1.57 / 0.84° 0.79 / 3.7° 4.33	0.72° 0.79	1.08° 1.18
TRACK3							
TRACK4							

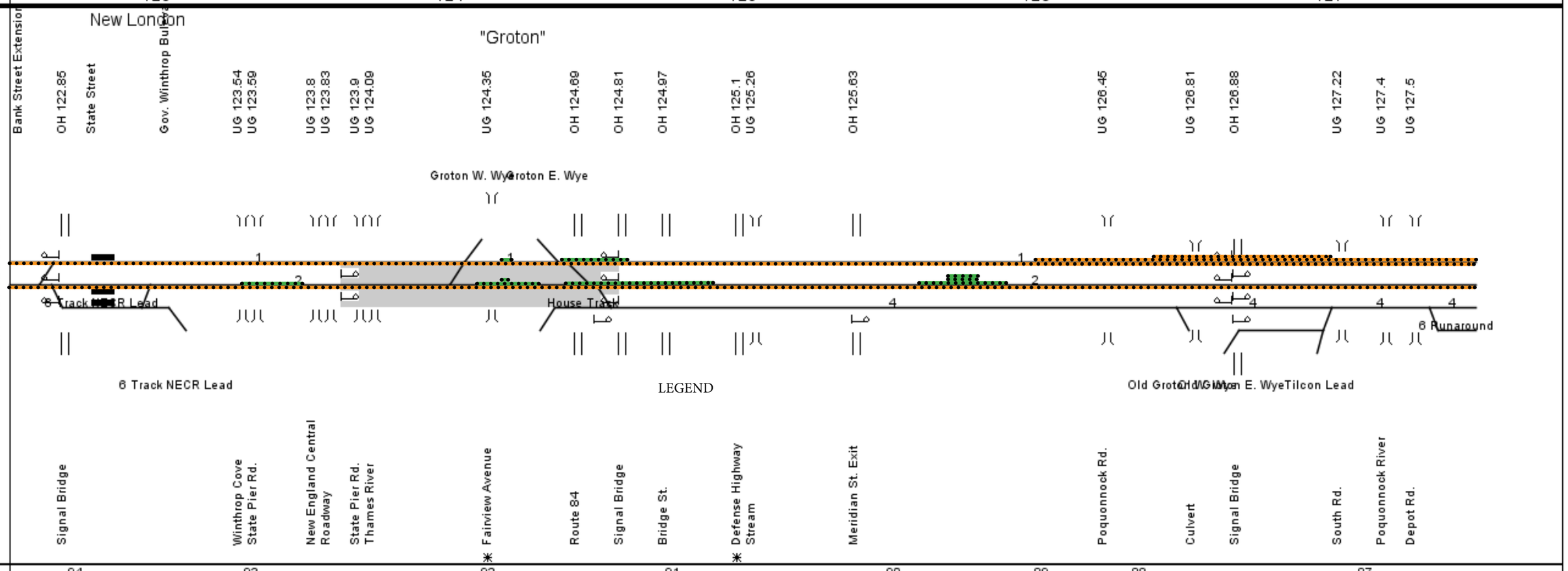
GRADIENT

-0.61 | 0.08 | -0.55 | 0.06 | 0.55 | -0.57 | 0.58 | -0.71 | -0.64 | -0.04

MILE

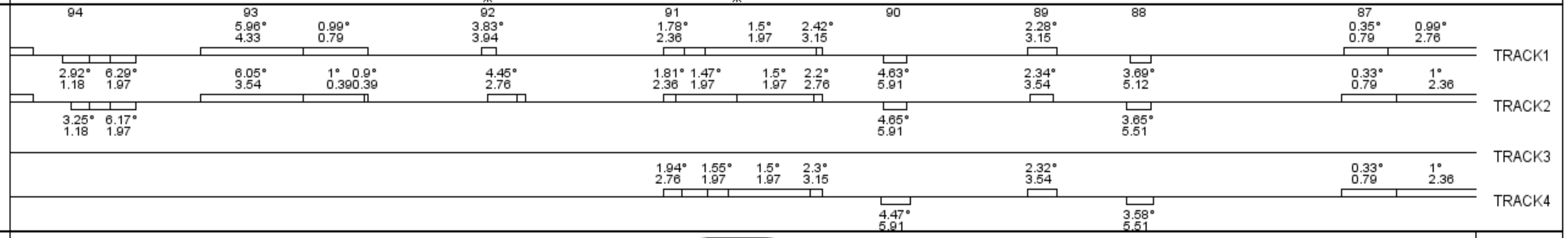
123 5140 124 5164 125 5068 126 5274 127 5278 Mile MP

INFRASTRUCTURE

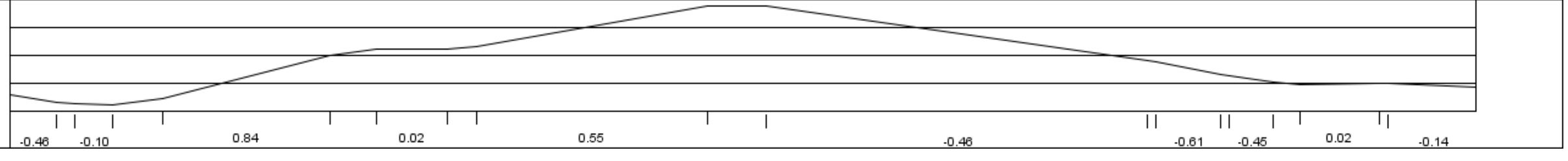


LEGEND

CURVES



GRADIENT



MILE

Mile
MP

128 5491 129 5073 130 5284 131 5268 132 5217

INFRASTRUCTURE

"Palmers Cove"

"Mystic River"

Mystic

OH 128.29
UG 128.34
OH 128.7
UG 128.96
UG 129.54
OH 129.71
OH 130.31
UG 130.63
UG 131.2
UG 131.42
School Street
UG 131.9
UG 132.16
UG 132.46
Broadway Extension

DD 127.8

Mystic Yard

2
4
6 Runaround
1
3

LEGEND

Signal Bridge
Mumford Cove
Pedestrian Walkway
Cattle Pass
Palmer's Cove
Groton Long Point Rd.
Mosher Ave.
Noank Cove
Six Penny Cove
Parker Cove
Bennet's Cove
Mystic River
Marsh Trestle

CURVES

	87	86	85	84	83	82	81
TRACK1		1.48° 2.76	3.23° 5.91	2.08° 3.94	2.7° 5.12	1.61° 4.33	1.02° 1.97 / 2.5° 5.12	3.99° 5.51
TRACK2		1.47° 2.36	3.11° 5.12	2° 3.15	2.67° 4.33	1.63° 5.12	1.02° 2.36 / 2.54° 5.91	4.03° 5.51
TRACK3								
TRACK4	1° 2.36							

GRADIENT

-0.14 0.56 -0.60 0.12 -0.31 0.32 -0.45 -0.04 0.47 -0.43 0.20

MILE

Mile
MP

133 — 5274 — 134 — 5289 — 135 — 5246 — 136 — 5426 — 137 — 5181

INFRASTRUCTURE

UG 132.75
OH 133.06
UG 133.34
Latimer Point Rd.
UG 133.77
UG 134.25
OH 134.54
Wamphassuc Public
UG 135.51
UG 135.67
OH 136.04
OH 136.22
Walker's Dock
Freeman's Island
UG 137.52

LEGEND

Williams Cove
Mason Island Rd.
Cattle Pass
Wilcox Cove
Quiambaug Cove
Noyes Avenue
West Harbor
East Harbor
Viaduct
Footbridge
Wequetequock

CURVES

	80	79	78	77	76	75	
TRACK1	0.68° 1.18	2.92° 4.72	2.43° 5.12	2.94° 5.12 / 2.93° 3.94	2.98° 5.12 / 2.86° 3.94	3.86° 5.12	3.4° 4.33 / 1.32° 1.57
TRACK2	0.67° 1.18	2.89° 4.72	2.43° 4.33			3.81° 5.12	3.35° 4.72 / 1.32° 1.97
TRACK3							
TRACK4							

GRADIENT

0.20 — 0.69 — -0.42 — 0.08 — -0.31 — 0.05 — -0.35 — 0.37 — -0.51 — 0.02 — 0.44 — -0.62

MILE

138 5369 139 5185 140 5286 141 5307 142 5298 Mile MP

INFRASTRUCTURE

Westerly

OH 137.81 OH 138.63 Palmer St. (CUT 140. UG 140.84 UG 141.16 UG 141.35 UG 141.44 UG 141.49 OH 141.77 OH 142.46

Westerly Yard Lead

LEGEND

Palmers Neck Rd. Green Haven Rd. Ditch West Broad St. Pawtucket River Canal St. Station subway High St. Old Hopkington Rd.

CURVES

	74	73	72	71	70	69.1
		2.04° 5.51		2.01° 5.51	2.33° 5.51	0.2° 0.79
TRACK1	1.03° 2.76	2.06° 5.51	1.99° 4.72	1.05° 2.36 0.83° 1.97	2.03° 5.51 2.02° 5.51	2.34° 5.91 0.24° 0.79
TRACK2	1.07° 2.76		1.99° 5.12	1.02° 2.76 0.8° 1.97		
TRACK3						
TRACK4						

GRADIENT

0.30 0.47 -0.28 -0.05 0.26 -0.07 0.71 0.40 -0.43

MILE

143 5280 144 5272 145 5297 146 5602 147 4958 Mile MP

"High Street"

INFRASTRUCTURE

OH 142.68 | UG 143.59 | UG 144.35 | OH 146.25 | UG 146.39 | UG 147.45

LEGEND

Route 78 | Aguntaug Brook | Dixon's Swamp | Main St. | Pawcatuck River | Pawcutuck River

CURVES

	69	68	67	66
TRACK1		1.84° 4.33 / 1.98° 4.72	2.46° 5.51 / 2.29° 5.91	1.01° 3.15
TRACK2	1.4° 3.54	1.84° 4.33 / 1.99° 4.72		1.01° 2.76
TRACK3				
TRACK4				

GRADIENT

-0.43 | -0.31 | 0.09 | 0.55 | -0.11 | 0.04

AMTRAK

Line Code: AB-Shore Line
147.5 - 152.5

PAGE: 16A
27-NOV-12

MILE

148 — 5190 — 149 — 5281 — 150 — 5288 — 151 — 5278 — 152 — 528 Mile MP

INFRASTRUCTURE

OH 148.41 | UG 149.47 | OH 149.95 | UG 150.25 | UG 150.59 | OH 152.3

1 2 2

LEGEND

Woodriver Hot Box

Burdickville Rd. | Pawcatuck River | Kings Factory Rd. | Meadow Brook | Pawcatuck River | Carolina Back Rd.

CURVES

	66	65	64	63
TRACK1	1.01° 3.15 / 1.94° 5.91 / 1.02° 3.15	1.58° 5.91 / 1.1° 4.33 / 1.29° 4.72	1.9° 5.91	2.19° 5.12 / 2.09° 5.12 / 2.22° 5.12
TRACK2	1.01° 2.76 / 1.97° 5.91 / 1.05° 3.15	1.58° 5.91 / 1.1° 4.33 / 1.24° 4.72	1.81° 5.12	2.24° 5.51 / 2.1° 5.12 / 2.24° 5.51
TRACK3				
TRACK4				

GRADIENT

0 | 0.04 | 0.11 | -0.08 | 0.18 | -0.13 | 0.05 | 0.41 | 0.24 | -0.29

MILE

Mile
MP
153
5264
154
5293
155
5289
156
5278
157
5281

INFRASTRUCTURE

UG 152.71
UG 153.01
UG 153.34
OH 153.54
UG 153.93
OH 154.04
OH 154.33
154.3
UG 154.61
UG 155.85
UG 156.03

1
2

LEGEND

Pawcatuck River
Shannock Village Rd.
Pawcatuck River
Hoxies Rd.
Pawcatuck River
Kenyon School Rd.
Route 2
Queen's Brook
Usquepaug River
Sherman's Swamp

CURVES

62
1.5°
4.33
1.5°
5.51
1.49°
5.51
61
1.95°
5.51
1.91°
4.33

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

-0.29
0.27
-0.02
0.09

MILE

158 5285 159 5318 160 5251 161 5291 162 5286 Mile MP

INFRASTRUCTURE

Kingston

"Kingston"

OH 158.22

OH 158.32

UG 159.37

OH 161.8

Arnold Lumber Siding

Pedestrian overpass

Kingstown Rd.

Hundred Acre Pond

Yawgoo Mill Pond Br

LEGEND

CURVES

60 0.3° 0.39 | 59 0.24° 0.39 | 0.15° 0.39 | 58 1.01° 5.12 | 1.03° 5.12 | 1° 4.72 | 57 0.3° 1.57 | 0.19° 1.18 | 56 0.15° 0.79 | 0.15° 0.79

TRACK1

TRACK2

TRACK3

TRACK4

GRADIENT

0.09 0.12 0.49 -0.26 0.32 -0.27 0.51

MILE

Mile MP: 163 (5276) 164 (5284) 165 (5283) 166 (5282) 167 (5388)

INFRASTRUCTURE

"Stony"

OH 163.21 | OH 163.5 | OH 165.05 | OH 165.46 | UG 165.9 | OH 166.87 | UG 167.66

3 3 3 2

LEGEND

Exeter Rd. | Dry Bridge Rd. | Hatchery Rd. | Col. Rodman Hwy. | Ten Rod Rd. | Stony Lane | Farmway

CURVES

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

0.51 | 0.08 | -0.58 | -0.55 | -0.62 | -0.38 | 0.11

MILE

Mile
168 5181 169 5282 170 5315 171 5236 172 5302 MP

"Davisville" "Malcolm"

INFRASTRUCTURE

OH 168.53
OH 168.57
OH 168.93
OH 169.79
OH 169.99
UG 170.1
UG 171
UG 171.06
UG 171.42
OH 171.52
UG 171.84
UG 172.13

5 East Greenwich

4

LEGEND

Devils Foot Rd.
Cantilever Signal Br
RT 403
Post Road
Signal Bridge
Hunts River
Old Forge Rd.
Pains Pond
Culvert
Rocky Hollow Rd.
Ped. Underpass
King St.

CURVES

55 0.09° 0.39
54 0.03° 0.39
53 0.99° 5.12 0.99° 5.91
52 1.05° 3.54 1.27° 4.33 1.48° 5.12 1.24° 4.33 1° 3.54 1.26° 4.33 1.49° 5.12

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

0.11 -0.24 0.34 -0.38 -0.17 -0.36 -0.09 0.31 -0.08 -0.05

MILE

Mile 173 5281 174 5285 175 5283 176 5288 177 528 MP

INFRASTRUCTURE

"Packard"

UG 172.74 | UG 172.77 | OH 172.91 | UG 173.71 | UG 174.06 | UG 174.54 | UG 174.76 | OH 175 | OH 175.31 | OH 175.61 | OH 176.22 | OH 176.61 | OH 176.65 | OH 176.67

Gannon Chemical

LEGEND

Ocean Point Rd. | Chepiwanoxet Way | Garnet St. Footbridge | Masthead Drive | Clyde Ave. | Apponaug Cove | Rocky Point Rd. | Gorton Parr Rd. * | Cantilever Signal Br | Main Ave. * | Signal Bridge * | Station Sky-walk Coronado Rd. Signal Bridge

CURVES

51: 1.25° 5.12; 1.26° 4.72

50: 1.55° 5.91; 1.54° 5.51; 1.56° 5.91

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

-0.05 | 0.08 | 0.48 | 0.21 | -0.32 | -0.23

MILE

178 5287 179 5274 180 5257 181 5289 182 5270 Mile MP

"Post" "Cranston"

INFRASTRUCTURE

UG 177.81
OH 178.09
OH 178.13
OH 178.39
OH 178.89
UG 179.16
UG 179.16
OH 179.95
OH 180.29
UG 180.34
OH 180.68
OH 180.69
OH 180.71
OH 180.9
OH 180.99
OH 181.16
OH 181.66
OH 182.45
OH 182.59
OH 182.64

Spalding Brick
Cranston Passing Siding
3
6
6 Lead East

LEGEND

Harbor Port

Lincoln Ave.
Route 37 East
Route 37 West
Signal Bridge
Signal Bridge
Pawtuxet River Track 3
Pawtuxet River Tracks 1 & 2
Signal Bridge
Park Ave.
Mashapaug Brook
I-95 Off Ramp
Route 10
I-95 On Ramp
Cantilever Signal Br
I-95 N & S
Roger Williams Ave.
Reservoir Ave.
Magnam Rd.
Utility Pipe
Cranston St. Viaduct

CURVES

49.2 49.1 49 48 47 46 45

0.04° 0.79
0.03° 0.39
0.95° 3.15
1.07° 3.54
1.1° 3.54
1.08° 3.54
1.75° 5.91
1.74° 5.51
4.95° 5.51
4.96° 5.12
4.19° 5.51
4° 5.91

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

-0.23 -0.01 0.25 0.06 -0.19 0.07 0.35 -0.07 -0.44 0.01

MILE

183 5319 184 4657 185 5009 186 5452 187 5108 Mile MP

INFRASTRUCTURE

Providence
"Atwells" "Brayton" "Orms" "Pawtucket"

OH 182.99 OH 183.33 OH 183.39 OH 183.51 OH 183.65 OH 183.87 OH 183.95 OH 184.29 OH 184.61 OH 184.67 OH 185 OH 185.15 OH 185.17 UG 185.26 OH 185.34 OH 185.63 UG 185.76 OH 186.07 OH 186.12 OH 186.3 OH 186.44 UG 186.75 OH 186.85 OH 186.95 UG 187.26 OH 187.37 OH 187.47 OH 187.6

DD 183.5 Capco Steel Siding Yard 17

LEGEND

Union Ave. | Olneyville Expwy. Olneyville Expwy. | Westminster St. Utility Pipes | Harris Ave. | Broadway Ext. Ramp | Atwell's Ave. | Signal Bridge Dean St. | I-95 Off Ramp AD | I-95 South I-95 On Ramp CD | Woonsquatucket River Francis Street | Signal Bridge Flood Diversion Culvt | Orms St. | I-95 North | Signal Bridge | Charles St. | West River Track 7 | Signal Bridge | Branch Ave. | City Sewer | Cantilever Signal Bridge | Cantilever Signal Bridge | Smithfield Ave. East | Sears | West Lead

CURVES

	45	44	43		42	41	40	39	38	37	36	35	34	33
TRACK1	4° 5.91	3.27° 3.94	1.94° 3.15	3.07° 4.72	3.15° 1.97		1.91° 1.18			4.32° 4.72	2.6° 2.76	1.52° 1.57		0.99° 1.18	
TRACK2	3.99° 5.12	3.04° 3.94	1.95° 3.15	3.09° 5.12	2.89° 1.97	2.34° 1.57	1.89° 1.18	5.56° 1.97	2.13° 0.79	4.56° 5.12	2.52° 2.76	1.53° 1.57	1.98° 2.36	1.01° 1.18	1.01° 1.97
TRACK3						2.22° 1.57		5.12° 0.79	1.6° 0.39				2° 2.36		1.03° 3.54
TRACK4								1.52° 0.39							
								9.94° 1.57							

GRADIENT

0.01 -0.64 -0.89 0.21 -0.25 0.58 -0.33 -0.00 0.36 -0.01 0.35 0.63

MILE

188 5283 189 5318 190 5322 191 5236 192 5285 Mile MP

INFRASTRUCTURE

"Lawn"

South Attleboro

UG 188.27 OH 188.33 OH 188.91 OH 189 OH 189.24 OH 189.61 OH 189.81 OH 189.84 OH 189.88 OH 189.99 OH 190.23 UG 190.49 UG 190.55 OH 190.85 OH 190.86 OH 190.93 OH 190.99 OH 191.13 OH 191.89 OH 192.47 UG 192.76

MOE Spray Wash Track and Wo... Blackstone Valley Railroad Lead

189.9

MBTA Layover East

Pawtucket Yard Lead

LEGEND

Moshassuck River
Signal Bridge
Lonsdale Ave.
Mineral Spring Ave.
Conant St.
Dexter St.
Broad St.
Barton St.
Pawtucket Station
Jenks St.
Sacred Heart Ave.
High St.
Blackstone River
Route I-95 SB
Route I-95 NB
Cole St.
P & W RR
Washington St.
Ped. Overpass
County Rd.
Seven Mile River

CURVES

	32	31	30	29	28	27	26
	1.38° 2.76	0.76° 1.57		0.84° 0.79	4.19° 4.33		4.41° 5.91 3.06° 3.94 2.87° 3.94
TRACK1	1.4° 5.12	0.73° 2.76	0.49° 0.39	0.55° 0.39	4.27° 4.33	3.28° 4.33	4.48° 5.91 3.1° 4.33 0.86° 1.18
TRACK2			0.3° 0.39			3.68° 4.33	
TRACK3							
TRACK4							

GRADIENT

0.34 -0.48 0.46 -0.15 0.10 0.36 -0.35

MILE

Mile 193 (5277) 194 (5458) 195 (5142) 196 (5260) 197 (5315) MP

INFRASTRUCTURE

UNKNOWN STATION "Hebronville" | Attleboro "Thatcher" "Boro"

OH 193.3 | OH 193.58 | UG 193.69 | UG 193.75 | OH 193.89 | OH 194.83 | OH 195.23 | OH 195.41 | UG 195.55 | OH 196.36 | OH 196.53 | UG 196.59 | OH 196.72 | UG 197.13 | UG 197.19 | UG 197.38 | UG 197.51 | UG 197.64

Furman Lumber Siding

Layover Yd West | Layover Yd East

LEGEND

Middleboro & Cape Cod

Pond St | Signal Bridge | Ten Mile River | Ten Mile River | South Main St. | Thurber Ave. | South Main St. | Signal Bridge | Canal | Thatcher St. | Cantilever Signal Br Ten Mile River | Olive St. | South Main St. | Station Ped. Subway | Park St. | Route 123 | Peck Street

CURVES

24

1.51° 5.91

1.5° 5.91

1.5° 5.91 | 1.48° 5.91

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

-0.03 | 0.21 | 0.38 | -0.11 | 0.17 | 0.55 | -0.32

MILE

198 5279 199 5301 200 5321 201 5230 202 5278 Mile MP

INFRASTRUCTURE

"Holden"

OH 198.01 OH 198.14 OH 198.41 OH 198.68 OH 200.49 UG 200.66 UG 201.5 OH 201.67 UG 201.97 OH 202.51 OH 202.95

Forte-Fiber

LEGEND

Holden St. Cantilever Signal Br Signal Bridge Lindsey St. Gilbert St. Wading River Elm St. Ped. Under. Elm St. Hodges Brook School St. Rt. 405 East

CURVES

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

-0.32 -0.06 0.24 0.12 -0.04 0.12 0.37

AMTRAK

Line Code: AB-Shore Line
202.5 - 207.5

PAGE: 27A
27-NOV-12

MILE

Mile
203 5285 204 5286 205 5300 206 5379 207 5190 MP

INFRASTRUCTURE

Mansfield Station
"Mansfield"

OH 203
UG 203.85
UG 204
UG 204.17
UG 204.44
UG 206.42

Zayers Industrial
American Paper
Framingham Secondary
Blaine Chemical Industrial Lead

Merckens Chocolate

LEGEND

Tighe Indrustrial

Route 140 E & W
Route 140 Copeland Dr
Rumford River
Route 106 Chauncy St
North Main Street
Cocasset St.

CURVES

23 0.82° 4.33 0.81° 4.33
22 1.02° 4.72 1.02° 4.72

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

0.37 0.00 0.30 0.55 0.34 0.42

MILE

208 5289 209 5264 210 5275 211 5277 212 5308 Mile MP

Sharon

INFRASTRUCTURE

OH 207.92
DD 208.7
UG 209.66
OH 209.95
OH 211.04
OH 211.62
UG 212.02

LEGEND

Wolomolopoag St.
Garden St. Ped. Sub.
South Main St.
Depot St.
Maskwonicut Rd.
Canton St.

CURVES

21 1° 5.91
0.98° 5.91
1.01° 5.91
20 1.04° 4.33
1.08° 4.72
19 0.87° 4.33
0.91° 4.72

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

0.42 -0.07 0.10 -0.56 -0.83 -0.70

MILE

Mile
MP

213 214 215 216 217

5223 5346 5281 5303 5276

Canton Junction
"Junction"

Route 128

INFRASTRUCTURE

OH 212.95
UG 213.74
OH 213.76
OH 214.22
OH 214.33
UG 214.75
OH 215.74
OH 215.79
OH 216.18
UG 216.32
OH 217.42
OH 217.48
OH 217.49

West Lead
East Lead

Stoughton Branch

LEGEND

High St.
Canton Viaduct
Signal Bridge
Spaulding St.
Chapman St.
Canton Stream
I-95 North
I-95 South
Dedham Rd.
Neponset River
Rte 128 Footbridge
Route 128 SB
Route 128 NB

CURVES

18
1°
5.12
0.98°
5.12

17
1°
4.72
0.99°
4.72
1.03°
5.12
1.02°
4.72

16
0.99°
5.91
0.99°
5.91

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

-0.70 -0.42 -0.88 -0.37 -0.77 -0.51 -0.28 -0.03 0.01

MILE

218 5289 219 5282 220 5290 221 5285 222 5284 Mile MP

INFRASTRUCTURE

Readville
"Transfer" "Read"
Hyde Park

OH 218.2 UG 218.57 OH 219.41 OH 219.46 OH 219.56 OH 219.76 OH 219.96 OH 220.18 UG 220.42 OH 220.74 OH 221.2 UG 221.31 UG 221.65 OH 221.85 OH 222 OH 222.36 OH 222.46

Stop and Shop
Dorchester Branch Lead

LEGEND

Signal Bridge
Sprague Brook
Franklin Branch Station Footbridge
Milton St.
Signal Bridge
Signal Bridge
Reservation Road
Mother Brook
River St.
West St.
Ped. Underpass
Stony Brook
Footbridge
Signal Bridge
Canterbury St.
Cummins Hwy.

CURVES

15.1
0.12°
0.39
0.16°
0.0

15
1.07°
3.94
1.08°
3.94
1.14°
3.94

14
1.02°
3.94
1.03°
4.33
0.27°
0.79

TRACK1
TRACK2
TRACK3
TRACK4

GRADIENT

0.01 0.13 -0.19 0.05 0.26 -0.28

MILE

Mile 5310 MP

223 (5288) 224 (5282) 225 (5305) 226 (5271) 227

INFRASTRUCTURE

Needham Branch "Forest" | Forest Hills "Plains" | Ruggles Street

OH 222.82 | UG 223.15 | OH 223.41 | OH 223.46 | OH 223.6 | OH 223.7 | OH 224.05 | OH 224.4 | OH 224.42 | OH 224.7 | OH 224.9 | OH 225.05 | OH 225.4 | OH 225.76 | OH 226 | OH 226.3 | OH 226.45 | OH 226.54 | OH 226.65 | OH 226.81

5 Needham Branch

LEGEND

Blakemore St. | Ped. Underpass | Signal Bridge Ukraine Way Stat. Parking Lot | Wash. St. & Sta. | * Signal Bridge | Green / Gordon Sts. Signal Bridge | Emergency Access | Boylston St. & Sta. | Atherton St. | Centre St. | Cedar St. | Tremont St.& Sta. | Ruggles / Prentiss Sts. | Ruggles Station | Access Ramp | Footbridge | Camden St. Footbrig

CURVES

	13	12.1	12	11	10	9	8.1	8
TRACK1	0.29° 1.18 / 0.95° 3.94	0.47° 0.79	0.85° 3.94	1.21° 5.91	1.27° 5.91	1.01° 4.72	0.2° 0.0	9.35° 0.39
TRACK2	0.29° 1.18 / 0.93° 3.94 / 0.96° 3.94		0.85° 3.54	1.21° 5.12	1.27° 5.51	1.01° 4.33		
TRACK3	0.28° 1.18 / 0.84° 3.94 / 0.96° 4.33 / 0.4° 1.97		0.85° 3.54	0.82° 3.54	1.27° 5.51	1.02° 4.33 / 0.88° 3.94		
TRACK4								

GRADIENT

-0.28 | 0.26 | -1.32 | -0.40 | 0.01 | -0.43 | 0.30 | -0.20 | -0.48 | 0.16 | -1.18 | 0.03

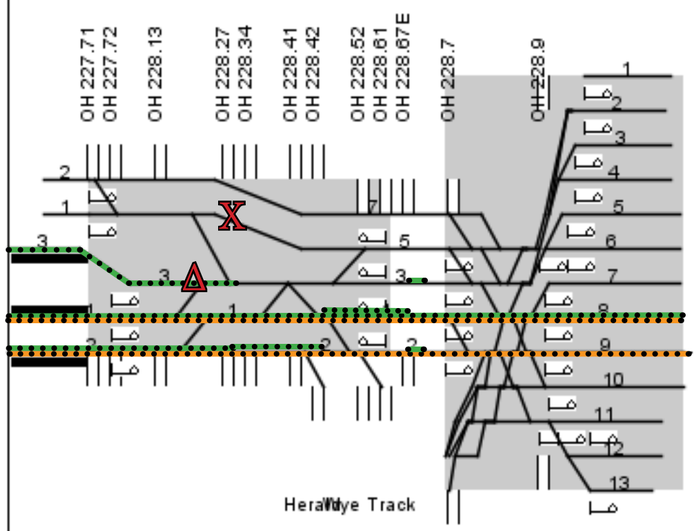
MILE

228 4237 229

Mile
MP

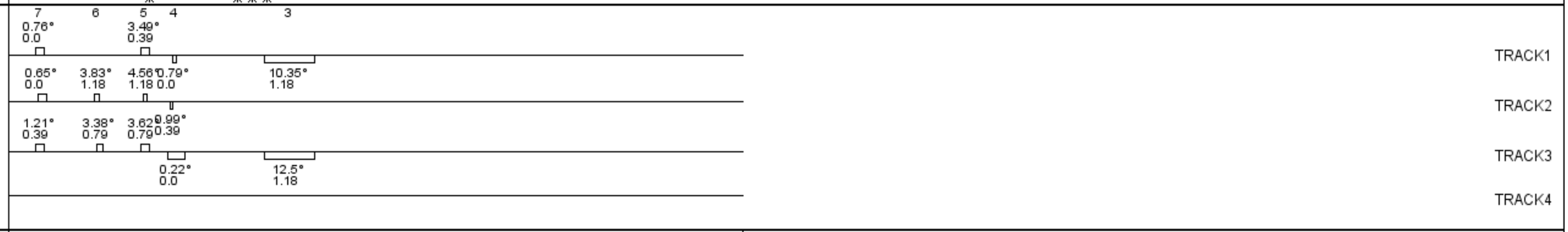
INFRASTRUCTURE

Back Bay "Cove" — Boston South Station "Tower 1"

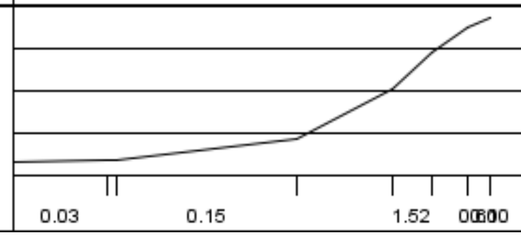


LEGEND

CURVES



GRADIENT



AN Line

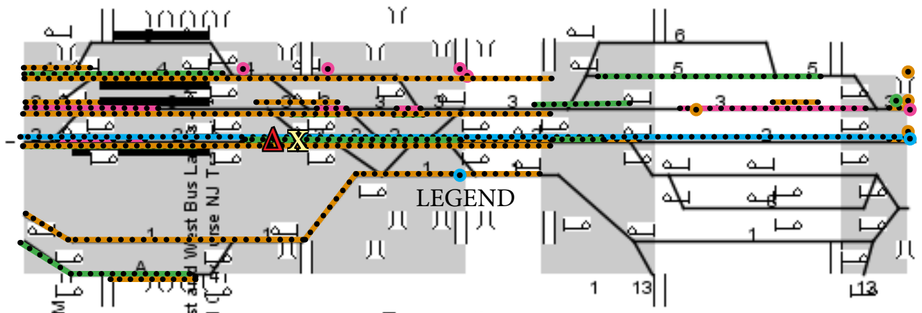
MILE

Mile 9 — 5281 — 8 — 5183 — 7 — 5219 — MP

INFRASTRUCTURE

"Dock" "Rea" "Hudson"

UG 8.98 | OH 8.8 | UG 8.71 | UG 8.71 | UG 8.66 | UG 8.57 | UG B8.50 | OH 8.34 | UG 8.41 | UG 8.36 | UG 8.1 | OH 8 | UG 7.98 | OH 7.98 | OH 7.85JC | OH 8.20JC | UG 7.06



* PATH Flyover - West - HM
* Signal Bridge
* Market St. - HM
Market St.
* Newark Psgr. Station East and West Bus Lanes
* Newark Station East End (Penn Jersey NJ Transit)
* Passaic River
Signal Bridge
* Eastbound Jumper - HM
* Westbound Jumper - HM
* Fourth Street
Signal Bridge
Fifth St. Ped. Underpass
Signal Bridge
Signal Bridge
Signal Bridge
* Frank Creek

247 | 246 | 245 | 244 | 243

CURVES

TRACK4
TRACK3
TRACK2
TRACK1

0.79° 0.39 | 3.44° 1.18
0.6° 0.39 | 1.55° 0.39 | 0.69° 0.79 | 0.66° 0.0 | 3.33° 3.15
0.18° 0.0 | 0.69° 0.79

GRADIENT

0.44 | -0.33 | 0.31 | 0.00 | -0.23

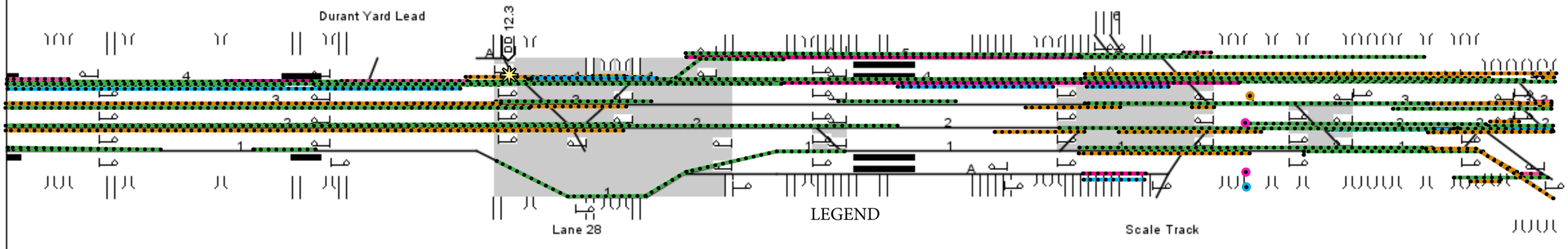
MILE

14 5312 13 5236 12 5165 11 5376 10 5433 Mile MP

North Elizabeth "Lane" "Haynes" Newark International Airport "Hunter" "Cliff"

UG 13.9 UG 13.83 OH 13.7 UG 13.64 UG 13.36 OH 13.1 UG 12.98 OH 12.97 OH 12.42 UG 12.37 OH 12.1 UG 12.12 UG 12.02 OH 11.95 OH 11.6 OH 11.45 UG 11.4 OH 11.4 OH 11.39 OH 11.29 OH 11.17 OH 10.9 OH 10.88 OH 10.95 UG 10.7 UG 10.71 OH 10.58 OH 10.56 OH 10.55 OH 10.54 OH 10.52 UG 10.05 UG 10 UG 9.89 UG 9.84 UG 9.68 UG 9.65 UG 9.54 UG 9.54 UG 9.39 UG 9.29 UG 9.29 UG 9.2 UG 9.15 UG 9.1 UG 9.1 UG 9.02

INFRASTRUCTURE



Chestnut St. Magnolia St. | Signal Bridge Mary St. | Fairmount Ave. | Hand Place | North Ave. Signal Bridge | Signal Bridge | McClellan St. | Signal Bridge Waverly Jumpover Sewer Signal Bridge | Signal Bridge | Signal Bridge Pipe Tunnel Signal Bridge Haynes Ave Signal Bridge | Pedestrian overpass | State Highway 22 - WB Route I-78 WB Signal Bridge | Peddie Tub Sewer Chamber Signal Bridge Conrail Lehigh Line Signal Bridge Signal Bridge | State Highway 21 - SB | Miller St. Wright St. | Astor St. | Murray St. | South St. Ped U P South St. Station | Pennington St. - HM Pennington St. | Chestnut St. | E. Kinney St. - HM E. Kinney St. Cottage Street - HM Walnut St. | Elm St. - HM Elm St. | Green St.

CURVES

	251	250	249.1	249	248
TRACK4	0.13° 0.79	0.34° 1.97		1.01° 0.39	0.84° 1.18
	0.11° 0.79	0.33° 1.97		1.01° 3.15	
TRACK3	0.06° 0.79	0.33° 1.57	1° 0.39	0.97° 2.76 1.02° 3.15	1.07° 0.39
TRACK2		0.37° 1.97 0.34° 1.97		1.26° 3.15	1.56° 2.76
TRACK1		0.33° 1.57			

GRADIENT

0.13 | 0.38 | 0.49 | 0.12 | 0.19 | -0.16 | -0.73 | -0.37 | 0.02

AMTRAK

Line Code: AN-New Jersey Line
19.0 - 14.0

PAGE: 15A
27-NOV-12

MILE

19 — 5228 — 18 — 5318 — 17 — 5253 — 16 — 5291 — 15 — 5278 — Mile MP

Linden

"Merck"

"Elmora"

Elizabeth

INFRASTRUCTURE

UG 18.98 | UG 18.76 | DD 18.7 | OH 17.7 | UG 17.65 | UG 17.53 | UG 17.26A | OH 16.95 | OH 16.28 | UG 16.14 | OH 15.72 | OH 15.6 | UG 15.31 | UG 15.1 | OH 15.05 | UG 14.71 | UG 14.59 | UG 14.49 | UG 14.45 | UG 14.22 | UG 14.06 | UG 14.03

0 Running Track — Stiles Yard Lead West

0 Running Track — Stiles Siding Lead

LEGEND

Grand Ave. | Scott Ave. | Signal Bridge | Stiles St. | West Creek | Pennsylvania Ave. Wall | Signal Bridge | B & O RR | Tannery Creek | Signal Bridge | Park Ave | Sewer | Elmora Ave. Signal Bridge | South St. | Pearl St. | Rahway Ave. Elizabeth River | W. Jersey St. | Roadway Broad St.

CURVES

	255	254	253	252
TRACK4	0.29° 0.39		1.58° 2.76 / 2.39° 3.94	2.04° 3.54 / 1.95° 3.94
TRACK3	0.21° 1.18 / 0.22° 0.39	0.2° 0.39 / 0.16° 0.79	1.54° 3.15 / 1° 1.97	1.48° 2.36 / 1.29° 1.97
TRACK2		0.16° 0.39	1.53° 2.36 / 1.5° 2.36	1.9° 3.54
TRACK1		0.19° 0.79	0.52° 1.18 / 2.47° 4.72	

GRADIENT

0.19 | 0.01 | -0.23 | -0.06 | 0.38 | -0.49 | 0.14 | -0.29 | 0.34 | -0.46 | 0.13

MILE

24 5378 23 5336 22 5315 21 5176 20 5294 Mile MP

Metro Park
"Menlo" "Iselin" "Roads" "Union" Rahway

INFRASTRUCTURE

OH 23.75 OH 23.63 OH 23.58 UG 23.44 UG 23.42 UG 23.39 UG 23.07 UG 22.97 OH 22.8 UG 22.65 UG 22.5 UG 21.9 OH 21.59 OH 21.43 OH 20.85 UG 20.5 UG 20.42 OH 20.21 UG 20.22 UG 20.16 UG 20.01 OH 19.85 UG 19.72 UG 19.55 OH 19.4 UG 19.39 UG 19.31 UG 19.21 UG 19.13

Union Sta Westward Tunnel
Eastward Tunnel
LEGEND
Colonia Siding
91

Signal Bridge
Signal Bridge
Signal Bridge
Stream
S. Wood Ave.
Metro Park Station
Garden State Pkwy.
Stream
Signal Bridge
Green St.
Stream
Sucker Brook
Signal Bridge
Colonia Blvd.
Signal Bridge
St. George Ave.
Stream
Signal Bridge Culvert
Inman Ave.
Walters Ave. Ped. Under.
Signal Bridge
Hazelwood Ave
Emerson Ave.
Signal Bridge Ped. Underpass
Irving & Cherry Sts.
Poplar St. Rahway River

CURVES

TRACK4
TRACK3
TRACK2
TRACK1

	265	264	263	262	261	260	259	258	256
TRACK4	1.63° 5.91	0.44° 1.57	0.78° 2.76	0.87° 3.15	0.83° 3.15	0.79° 3.15	0.85° 3.54	0.83° 3.15	0.76° 2.76	0.72° 2.76	0.79° 3.94	0.71° 3.15	0.43° 0.79	0.4° 1.18	0.52° 1.18	0.45° 0.79	0.16° 0.79	0.36° 3.15
TRACK3	1.31° 5.12	0.86° 4.33	0.82° 4.33	0.28° 1.57	0.76° 3.15	0.73° 2.76	0.76° 3.15	0.82° 4.33	0.41° 1.57	0.53° 1.57	0.08° 0.39	0.31° 1.18	0.2° 0.79
TRACK2	1.5° 5.12	0.85° 3.15	0.81° 3.15	0.87° 3.15	0.76° 3.94	0.78° 3.94	0.79° 3.15	0.46° 1.18	0.51° 1.97	0.34° 0.79	0.53° 3.15
TRACK1	0.44° 1.57	0.71° 2.76	0.82° 3.15	0.85° 4.33	0.63° 1.57	0.41° 0.79	0.49° 1.18

GRADIENT

0.48 0.13 0.48 0.06 0.36 0.07 -0.28 0.48 0.06

MILE

5296 5292 5258 5262 5165

29 28 27 26 25 Mile MP

"Edison" Metuchen "Lincoln"

INFRASTRUCTURE

UG 28.84 OH 28.73 UG 28.29 OH 27.91 OH 27.78 UG 27.66 OH 27.4 OH 26.88 OH 26.66 UG 26.24 UG 26.23 UG 26.18 UG 26.05 UG 25.84 OH 25.63 UG 25.32 UG 24.58 OH 24.57 UG 24.56 UG 24.38 UG 24.08

Metuchen Yard Metuchen West Leg Of Wye

LEGEND

Plainfield Ave. Signal Bridge Stream Signal Bridge Camp Kilmer Talmadge Rd. Signal Bridge Signal Bridge Bridge St. Stream Memorial Park Lehigh Valley RR Lake St. Main St. Signal Bridge Grove Ave. Stream Signal Bridge Port Reading RR Parsonage Rd. Evergreen Ave.

CURVES

271 270 269 268 267 266

TRACK4: 0.2° 1.57 | 0.79° 0.41° 3.54 1.97 | 1.51° 1.44° 0.84° 4.33 4.33 2.36 | 0.89° 1.02° 2.76 2.76 | 1.21° 1.21° 0.65° 4.33 4.33 2.36 | 0.61° 1.53° 2.36 5.51 | 1.54° 5.51

TRACK3: 0.26° 1.57 | 0.82° 2.36 | 1.48° 1.43° 4.33 4.33 | 2.05° 5.91 | 1.2° 1.21° 1.2° 4.33 4.33 4.33 | 1.7° 5.91

TRACK2: 0.33° 1.57 | 0.89° 3.94 | 1.49° 1.41° 5.91 5.51 | 1.21° 4.72 | 1.57° 5.51

TRACK1: 0.49° 1.57 | 0.85° 2.76 | 1.46° 0.49° 4.33 1.57 | 1.96° 5.91 | 1.97° 5.91 | 1.21° 4.33 | 1.26° 0.95° 4.33 3.15

GRADIENT

-0.32 0.07 -0.35 0.01 -0.48 0.42 -0.52 0.48

AMTRAK

Line Code: AN-New Jersey Line
34.0 - 29.0

PAGE: 12A
27-NOV-12

MILE

Mile MP: 34 (5400) 33 (5237) 32 (5290) 31 (5266) 30 (5228)

Jersey Ave "County" | New Brunswick | Edison

INFRASTRUCTURE

OH 33.94 | OH 33.75 | UG 33.25 | OH 32.95 | UG 32.61 | OH 32.5 | UG 31.9 | UG 31.8 | UG 31.75 | UG 31.63 | UG 31.55 | UG 31.49 | OH 31.44 | UG 31.43 | UG 31.35 | UG 31.22 | UG 31.12 | UG 31.02 | UG 31.01 | UG 30.92 | UG 30.8 | UG 30.51 | OH 30.13 | OH 29.78 | UG 29.42 | OH 29.05

Yard / Industry Lead

General Tire & Rebar

LEGEND

Howe Lane | Signal Bridge | Two Mile Run | Signal Bridge | One Mile Run | Signal Bridge | Handy St. | Suydam St. | Townsend St. | Bayard St. | Paterson St. | Joyce Kilmer Ave. | Signal Bridge | French St. | Ped. Underpass | George St. | Neilson St. | River Rd. | SR 18 | Raritan River | Bound Brook Rd. | Mill Creek | Signal Bridge | Signal Bridge | Sutton Lane | Signal Bridge

CURVES

	TRACK4	TRACK3	TRACK2	TRACK1
274	0.5° 3.54	0.5° 3.15	0.5° 3.54	0.52° 3.15
273	0.51° 3.15	0.54° 3.15	0.53° 3.15	0.54° 3.15
272	0.51° 3.15	0.51° 3.15	0.51° 3.15	0.5° 2.76 / 0.52° 3.15

GRADIENT

0.27 | 0.54 | -0.06 | 0.40 | 0.11 | -0.32

MILE

39 (5271) 38 (5281) 37 (5257) 36 (5302) 35 (5200) Mile MP

INFRASTRUCTURE

UG 38.97 | UG 38.6 | UG 38.16 | UG 37.54 | OH 37.1 | OH 36.7 | DD 36.2 | OH 35.48 | OH 35.03 | OH 34.99 | OH 34.72 | UG 34.49

Deans Siding

Adams Lead

LEGEND

Stream | Deans Lane | Oakey's Brook | Oakey's Brook | Signal Bridge | Signal Bridge | * | Adams Lane | Signal Bridge | Route #1 | Signal Bridge | Stream

CURVES

274
0.51°
3.54
TRACK4

0.5°
3.15
TRACK3

0.5°
3.54
TRACK2

0.5°
3.15
TRACK1

GRADIENT

-0.26 | 0.30 | 0.01 | -0.22 | 0.10 | -0.43 | -0.14 | 0.05 | 0.27

AMTRAK

Line Code: AN-New Jersey Line
44.0 - 39.0

PAGE: 10A
27-NOV-12

MILE

Mile MP

44 5284 43 5283 42 5280 41 5310 40 5251

INFRASTRUCTURE

"Midway"

OH 43.1 | OH 42.18 | OH 41.57 | OH 41.2 | OH 41.06 | UG 40.95 | OH 40.7 | OH 40.46 | UG 40.14 | OH 39.97 | OH 39.45 | UG 39.35 | UG 39.27

Jamesburg Branch

LEGEND

Signal Bridge | Signal Bridge | Signal Bridge | E. New Rd. | Signal Bridge | Lawrence Brook | Ridge Rd. | Signal Bridge | Lawrence Brook | Major Rd. | Signal Bridge | Lawrence Brook Deans Pond Rd.

CURVES

276 275

TRACK4: 0.53° 3.54 | 0.56° 3.54 | 0.55° 3.54 | 0.06° 0.39 | 0.36° 2.36 | 0.55° 3.54

TRACK3: 0.55° 3.54 | 0.56° 3.94 | 0.33° 2.36

TRACK2: 0.55° 3.54 | 0.56° 3.54 | 0.33° 1.97

TRACK1: 0.56° 3.54 | 0.54° 3.54 | 0.57° 3.94 | 0.55° 3.54 | 0.31° 1.97 | 0.34° 2.36

GRADIENT

-0.14 | 0.20 | -0.12 | 0.30 | -0.34 | -0.26

MILE

49 48 47 46 45 Mile MP

5254 5266 5274 5288 5264

Princeton Jct

INFRASTRUCTURE

OH 49.01 UG 48.88 OH 48.7 OH 47.8 UG 47.72 OH 47.45 UG 47.06 OH 47 OH 46.83 OH 46.55 UG 46.47 UG 46.3 OH 45.9 OH 45.41 OH 44.9 OH 44.85 UG 44.48 OH 44.47

Clarksville Rd. Stream Signal Bridge Signal Bridge Stream Alexander Rd. Ped. Underpass Signal Bridge Hightstown Rd. Signal Bridge Swingers Race Millstone River Signal Bridge Plainsboro Rd. Signal Bridge Signal Bridge Devils Run Schalks Rd.

LEGEND

CURVES

TRACK4
TRACK3
TRACK2
TRACK1

GRADIENT

0 30 -0.36 0.21 0.35 0.03 -0.26 0.12 -0.14

MILE

54 5241 53 5370 52 5218 51 5293 50 5307 Mile MP

Hamilton

INFRASTRUCTURE

UG 53.64 OH 53.47 OH 53.01 OH 52.8 OH 52.25 OH 52.24 UG 51.91 OH 51.79 OH 51.55 UG 51.49 OH 50.62 UG 50.47 OH 49.8

DU 51.9

4 3 2 1

Colemans Creek Colemans Rd. Hamilton Station Ped Br Signal Bridge IR 295 IR 295 Stream Youngs Rd. Signal Bridge Assunpink Creek Quakerbridge Rd. Stream Signal Bridge

LEGEND

CURVES

277

TRACK4 0.31° 1.57

TRACK3 0.34° 1.57

TRACK2 0.4° 1.57

TRACK1 0.38° 1.57

GRADIENT

0.02 -0.40 0.21 -0.14 -0.40 0.30

MILE

59 (4558) 58 (6031) 57 (4468) 56 (5243) 55 (5277) Mile MP

INFRASTRUCTURE

Trenton
"Morris" "West Fair" "East Fair" "Ham"

OH 58.97E MY I/L Highway Grad
OH 58.92
OH 58.72
OH 58.3
OH 58.2
UG 58.16
UG 58.11
UG 58.03
OH 58
UG 57.75
UG 57.61
UG 57.54
UG 57.43
OH 57.21
OH 57.16
OH 56.95
OH 56.94
OH 56.93
OH 56.8
UG 56.76
OH 56.70S
OH 56.5
OH 56.49
OH 56.38
OH 56.3
OH 56.24
OH 56.1
OH 56.01
OH 55.75
UG 55.51
OH 55.51B
OH 55.5
UG 55.23
OH 55.15
OH 54.83
OH 54.7
OH 54.2

5 Running Track
4 Running Track
3 Running Track
2 Running Track
1 Running Track
0 Track
0 Running Track
Wall Track
Fre Eight Whee Seat Tr Lead
M.U. Yard Ladder M.U. Yard Ladder Union Standard Bolt Durabond

LEGEND

Signal Bridge
Fairless Spur
Conrail-Thorndale Sec
Signal Bridge
Signal Bridge
Pennsylvania Ave.
Ped. Underpass
Washington St.
Signal Bridge
Delaware River
Bloomsbury St.
Warren St.
Union St.
Center St.
Broad St.
Rt. 129 Ramp
Rt. 129 Ramp
Conrail-S.Trenton Br.
Trenton Freeway
Sewer
Signal Bridge
Signal Bridge
Chestnut St.
Monmouth St.
Signal Bridge
Chambers St.
Signal Bridge
Signal Bridge
Olden Ave.
Assunpink Creek
Signal Bridge
Signal Bridge
Nottingham Way
Signal Bridge
Whitehead Rd.
Signal Bridge
Signal Bridge

CURVES

280
0.78° 3.15
0.98° 3.94
0.76° 2.76
0.88° 3.54
0.83° 3.54
0.85° 3.94
0.58° 1.57
0.59° 3.94

279
0.11° 0.39
0.75° 2.36
0.77° 2.36
1.06° 2.36

278
0.35° 1.18
0.26° 0.79
0.35° 1.18
0.34° 1.18
0.34° 0.79

TRACK4
TRACK3
TRACK2
TRACK1

GRADIENT

-0.40 0.20 0.70 -0.32 -0.12 -0.34 -0.04 -0.43 0.02

MILE

64 5283 63 5288 62 5301 61 5267 60 5284 Mile MP

Levittown/Tullytown

INFRASTRUCTURE

UG 63.97
UG 63.17 OH 63.1
UG 62.59
OH 62.2
OH 61.8
OH 61.2
OH 60.15
OH 59.87
61.7
60.1
4
3
0 Track
Art Craft

LEGEND

Cross Drain
Ped. Tunnel * Fallsington Road
Bridge
Brelsford Run
Signal Bridge
Signal Bridge *
Signal Bridge
Signal Bridge
Tyburn Rd.

CURVES

283 282 281 280

TRACK4
0.75° 4.72
0.78° 5.12
0.41° 2.36

TRACK3
0.76° 5.12
0.41° 1.97
0.19° 0.79

TRACK2
0.76° 5.12
0.41° 1.18
0.42° 2.76

TRACK1
0.76° 5.12
0.4° 2.36

GRADIENT

0.33 -0.09 -0.02 0.05 -0.10 0.18 -0.06 -0.40

MILE

69 — 5374 — 68 — 5269 — 67 — 4012 — 66 — 5273 — 65 — 5273 — Mile MP

INFRASTRUCTURE

Bristol

"Croy" "Grundy"

OH 68.46 OH 68.4 UG 67.46 UG 67.17 OH 67.2 UG 66.86 UG 66.71 UG 66.64 UG 66.57 UG 66.41 UG 66.38 UG 66.22 OH 66.11 UG 66.06 UG 66.02 UG 65.47 OH 65.04 OH 64.9 OH 64.34 OH 64.2

5 Track

4

3

2

1

0 Track

Croy Yard Ladder track

LEGEND

UNKNOWN

Central Ave. Footbridge
Signal Bridge
Bristol Pike
Otter Creek
Signal Bridge
Bath Rd.
Spruce St. Pine St.
Corson St.
Beaver St. Ped. Underpass
Jefferson St.
Signal Bridge Pennsylvania Canal Adams Hollow Creek
✳ Green Lane
PA Turnpike
Signal Bridge
Randall Ave.
Signal Bridge

CURVES

	287		286		285		284	
TRACK4	0.17° 0.39		0.5° 2.36		0.77° 3.94	0.75° 3.54	0.67° 3.94	
TRACK3	0.12° 0.39		0.5° 2.36			0.75° 5.12	0.7° 3.94	
TRACK2	0.15° 0.39		0.5° 2.36			0.75° 3.94	0.71° 4.33	
TRACK1	0.16° 0.39		0.5° 2.36	0.51° 2.36	0.47° 1.97	0.06° 0.39	0.75° 5.12	0.71° 3.94

GRADIENT

0.04 -0.28 0.01 -0.12 0.48 -0.18 0.33

MILE

74	5276	73	5278	72	5291	71	5279	70	5176	Mile MP

Andalusia | Cornwells Heights | Eddington | Croydon

INFRASTRUCTURE

OH 73.67 | OH 73.45 | OH 72.65 | UG 72.11 | OH 72.2 | OH 71.7 | OH 71.45 | UG 70.69 | OH 70.5 | UG 70.08 | UG 69.65 | UG 69.29 | UG 69.16 | UG 69.13

Eddington

LEGEND

Tennis Ave. | Signal Bridge * | Signal Bridge | Station Ave. | Signal Bridge | Signal Bridge | Street Rd. | Neshaminy Creek | Signal Bridge | Pipe Tunnel | Neshaminy Creek | Cedar Avenue | Stream * | Stream *

CURVES

	289	288
TRACK4	0.38° 2.76 / 0.39° 2.76	1.2° 5.91
TRACK3	0.39° 1.57 / 0.31° 1.18	1.2° 5.91
TRACK2	0.39° 1.97	1.2° 5.91
TRACK1	0.45° 1.57 / 0.37° 1.57	1.19° 5.51 / 1.25° 5.91

GRADIENT

-0.09 | 0.06 | -0.23 | 0.07 | -0.26 | 0.14 | 0.22 | 0.04

MILE

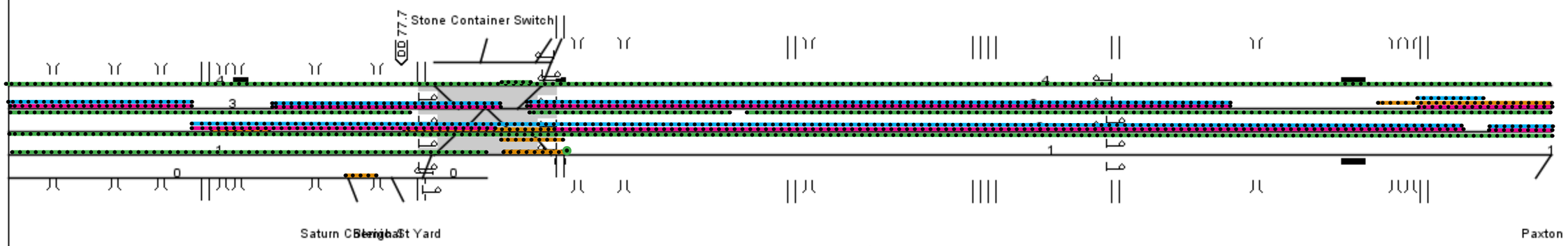
79	5388	78	5174	77	5289	76	5220	75	5324	Mile MP

Tacony

Holmesburg Jct.
"Holmes"

Torresdale

INFRASTRUCTURE



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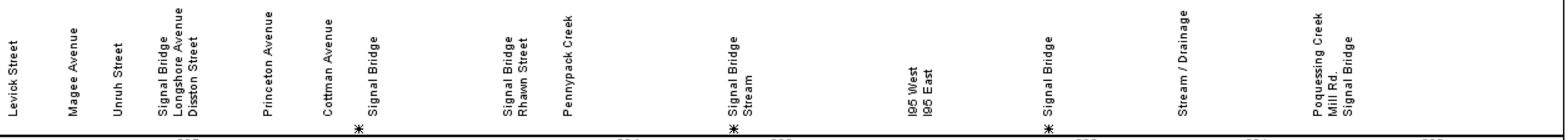
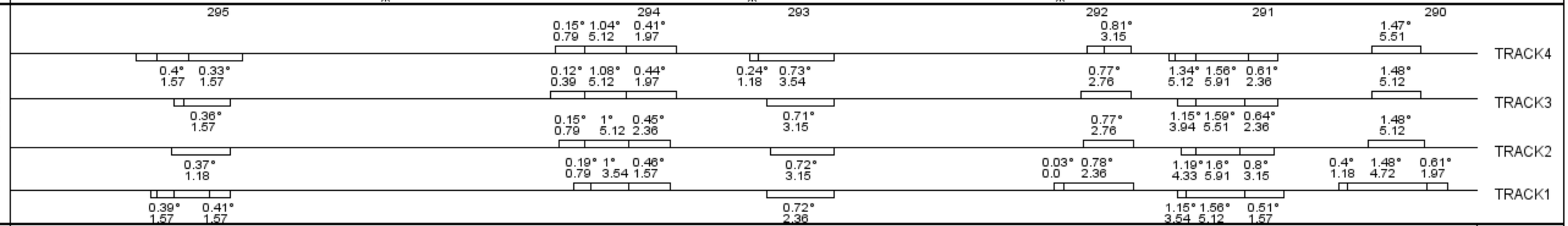


CURVES



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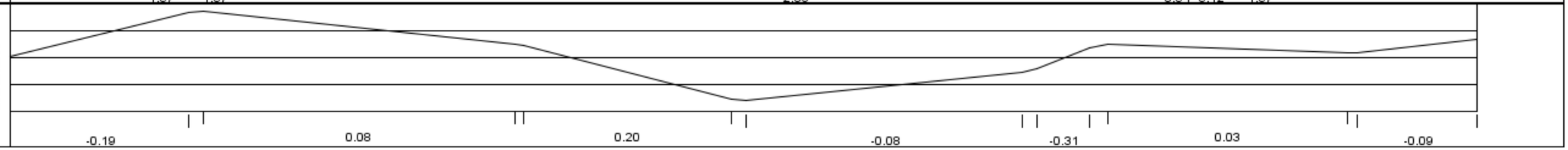


MILE

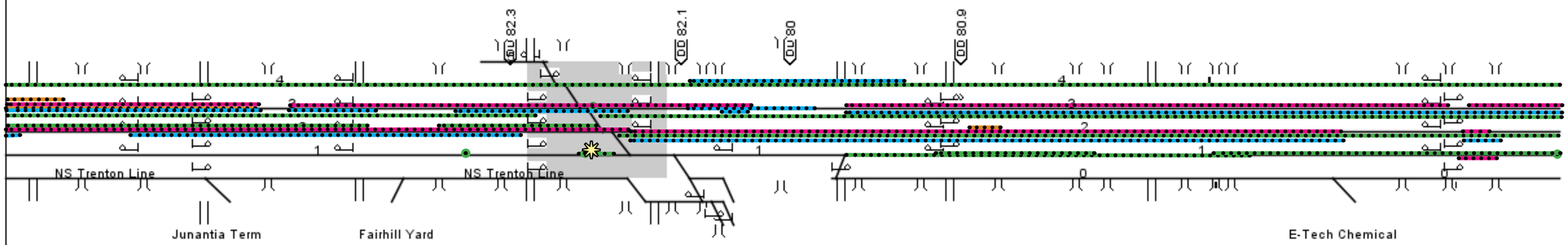
84 (5180) 83 (5266) 82 (5304) 81 (5277) 80 (5272) Mile MP

Frankford Jct. "Shore" Bridesburg Wissinoming

INFRASTRUCTURE

OH 83.56 UG 83.45 UG 83.25 OH 83.02 UG 82.82 OH 82.69 UG 82.27 UG 82.06 OH 82.03 UG 81.85 UG 81.69 OH 81.55 UG 81.53 UG 81.42 UG 81.39 UG 81.15 OH 81.1 UG 80.92 UG 80.71 OH 80.69 UG 80.48 UG 80.22 UG 80.12 OH 80.1 UG 79.89 UG 79.8 UG 79.73 UG 79.15 UG 78.99 UG 78.82

DD 82.3 DD 82.1 DD 80 DD 80.9



LEGEND

5th St. | Conrail | 2nd Street | Front Street | B St. | Signal Bridge | Gas Main | I St. | Signal Bridge | K St. | Kensington Avenue | Signal Bridge Castor Avenue | Ped. Underpass Frankford Avenue | City Sewer | Signal Bridge Frankford Creek | Adams Avenue | Signal Bridge | Church Street | Orthodox Street | Margaret Street | Signal Bridge | Wakeling Street | Aramingo Avenue Bridge Street | Vankirk Street | Comly Street | City Sewer

CURVES

299 298 297 296.2 296.1 296

TRACK4
2.7° 5.12 | 0.42° 0.79 | 0.5° 0.79 | 4.04° 5.12 | 1.53° 1.97 | 1.74° 1.97 | 1° 1.18 | 0.08° 0.39 | 0.07° 0.39 | 0.17° 0.39 | 0.09° 0.0 | 0.59° 1.97 | 0.54° 1.57 | 0.68° 1.97

TRACK3
2.5° 5.12 | 0.39° 0.79 | 2.59° 3.15 | 3.99° 5.12 | 1.33° 1.57 | 1.67° 1.97 | 1.76° 2.36 | 0.32° 0.39 | 0.16° 0.39 | 0.06° 0.0 | 0.11° 0.0 | 0.6° 1.97 | 0.58° 1.57 | 0.82° 2.36

TRACK2
2.61° 5.12 | 0.38° 0.79 | 4.04° 5.12 | 4° 5.12 | 0.25° 0.39 | 1.63° 1.97 | 1.76° 2.36 | 0.14° 0.39 | 0.11° 0.39 | 0.07° 0.39 | 0.59° 1.97 | 0.72° 2.36

TRACK1
2.79° 5.12 | 0.38° 0.79 | 0.36° 0.79 | 4.06° 5.12 | 3.96° 5.12 | 1.61° 1.97 | 1.74° 2.36 | 0.15° 0.39 | 0.56° 1.97 | 0.6° 1.97 | 0.71° 2.36

GRADIENT

0.03 | -0.87 | 0.54 | 0.60 | -0.14 | -0.38 | 0.11 | -0.19

AMTRAK

Line Code: AN-New Jersey Line
89.0 - 84.0

PAGE: 1A
27-NOV-12

MILE

Mile MP: 88, 87, 5112, 86, 4774, 85, 5886

INFRASTRUCTURE

North Philadelphia

"Girard" "Mantua" "Lehigh" "Clearfield"

UG 87.4 OH 87.13 | UG 87.24 | UG 87.14 | UG 86.98 | UG 86.86 OH 86.78 OH 86.75 | OH 86.64 | OH 86.5 OH 86.49 | OH 86.36 | OH 86.2 | OH 86.11 | OH 85.93 | UG 85.76 | OH 85.62 UG 85.61 | UG 85.46 UG 85.41 | OH 85.25 OH 85.1 | OH 85.03 UG 84.97 | UG 84.83 | OH 84.7 UG 84.68 UG 84.6 UG 84.57 | UG 84.51 | UG 84.3 | UG 84.16 | OH 84.14 | UG 83.93 UG 83.85 | UG 83.7

OD 87.1 | OD 84.3

NS Trenton Line

LEGEND

Viaduct Signal Bridge | Girard Ave. | Schuylkill River | CSX | Water Main Signal Bridge | Signal Bridge | Oxford Street | Signal Bridge Cecil B Moore Ave. | Montgomery Ave. | Signal Bridge | Ridge Avenue | Diamond Street | 25th St. | Signal Bridge Dauphin St. | York St. 22nd St. | Signal Bridge | Signal Bridge | Signal Bridge Lehigh Ave. | 17th St. | Signal Bridge Ped. Underpass Out of Service Ped. Underpass Baggage Tunnel | Broad St. | 12th St. | Germantown Ave. | Signal Bridge | Allegheny Avenue Conrail | 6th St.

CURVES

	304	303.2	303.1	303	302	301	300.1	300
TRACK4	0.23° 0.39 0.86° 0.79	1.54° 0.79	2.11° 0.79 1.65° 0.79	0.15° 0.39 0.26° 0.39	0.12° 0.0	2.44° 3.54	0.83° 1.18	0.79° 1.18 1.33° 2.36
TRACK3	3.8° 1.97 3.36° 1.57	1.11° 0.79 1.1° 0.39	0.84° 1.57	1.78° 3.94	0.48° 0.79 1.9° 2.36	1.41° 2.36	0.85° 0.39	1.13° 1.97
TRACK2	6° 2.76 4.32° 6.97 2.71° 1.18	1.14° 0.39 0.7° 0.39	0.14° 0.39 0.31° 0.39	1.07° 0.79	1.55° 1.18	1.02° 0.79		
TRACK1		1.05° 0.39						

GRADIENT

0.00 | 0.22 | -0.50 | -0.18 | -0.57 | 0.57 | 0.03

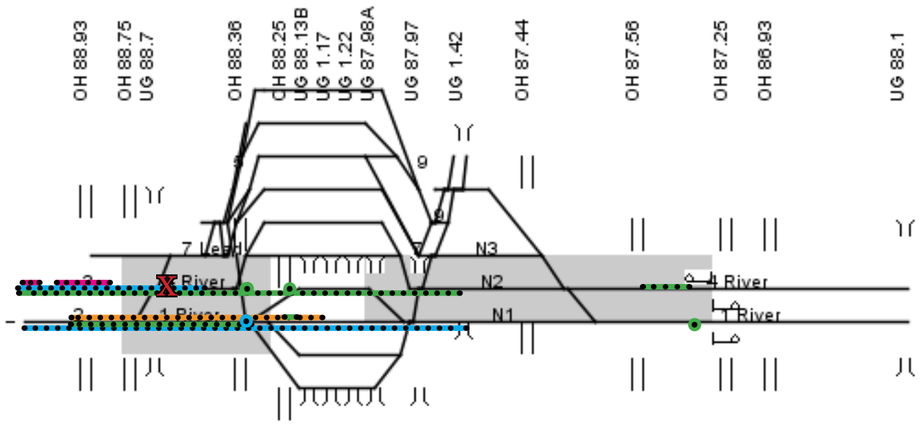
AP Line

MILE

Mile
MP
2
5011
1
7766

INFRASTRUCTURE

30th Street Station
"South Penn" "North Penn"



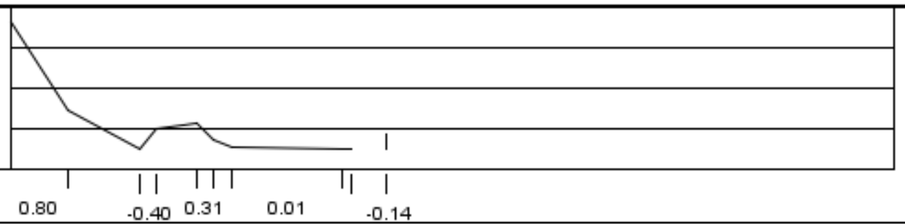
LEGEND

W. Phl. Elevated RR
South Street Sewer
Walnut St.
Chestnut St.
Steam Tunnel
Subway
Subway
North Baggage Tunnel
Steam Tunnel
Grays Ferry
Spring Garden
CSX Highline
Signal Bridge
34th St.
Steam Tunnel

CURVES

TRACK4
TRACK3
TRACK2
TRACK1

GRADIENT



MILE

7 — 5284 — 6 — 5275 — 5 — 5294 — 4 — 5031 — 3 — 5536 — Mile MP

Curtis Park Darby "Phil"

INFRASTRUCTURE

OH 6.85 / UG 6.76 — UG 6.53 — UG 6.44 — UG 6.19 — OH 6.09 — OH 5.8 / UG 5.73 — UG 5.58 — OH 5.51 — OH 5.31 — OH 5.16 — OH 4.84 — OH 4.75 — OH 4.69 — OH 3.72 — OH 3.64 — OH 3.3 — OH 3.2 / OH 3.11A / OH 3.11 — OH 3 — OH 2.81 — OH 2.5 — OH 2.35 — OH 89.87 / UG 89.71 — OH 89.5 — UG 89.32 — OH 89.3

Arsenal

LEGEND

Escape

Calcon Hook Rd. Ped. Underpass — Lafferty's Draw — * Darby Creek — 5th St. — 4th Street — Signal Bridge Cobbs Creek — Island Avenue — * 72nd St. — 71st St. — 70th St. — 67th St. — 66th St. Ped. Xing — 65th St. — 63rd St. — 62nd St. — * Signal Bridge — * Pipe Signal Bridge B & O RR — Signal Bridge — * 54th St. — Signal Bridge — 49th St. — Grays Ferry Rd. Sewer — Signal Bridge — University Ave. — Signal Bridge

CURVES

311 — 309 — 308 — 307.2 — 307.1 — 307 — 306 — 305

TRACK4: 1° 2.76 | 1.1° 2.76 | 1.1° 2.76 | 0.28° 0.39 | 0.25° 0.39 | 0.31° 0.39 | 1.17° 1.57 | 2.55° 5.91 | 1.09° 2.76

TRACK3: 1° 2.76 | 1.1° 2.76 | 1.1° 2.76 | 0.19° 0.39 | 1.44° 3.54 | 2.5° 5.51 | 1.99° 4.33 | 2.19° 5.12

TRACK2: 1° 2.76 | 1.1° 2.76 | 1.1° 2.76 | 0.25° 0.39 | 1.52° 3.54 | 2.11° 4.72

TRACK1: 1° 2.76 | 1.1° 2.76 | 1.1° 2.76

GRADIENT

0.48 — -0.04 — -0.37 — -0.23 — 0.24 — -0.02 — 0.44 — -0.34 — 0.68 — 0.80

MILE

12 — 5195 — 11 — 5292 — 10 — 5276 — 9 — 5292 — 8 — 5285 — Mile MP

Crum Lynne | Ridley Park | Moore | Norwood | Glenolden | Folcroft | Sharon Hill

"Baldwin"

INFRASTRUCTURE

UG 11.75 | OH 11.69 | UG 11.69 | UG 11.52 | OH 11.5 | OH 11.48 | OH 11.5 | UG 11.18 | UG 11.08 | OH 10.76 | OH 10.52 | OH 10.42 | UG 10.05 | UG 9.56 | OH 9.4 | OH 9.11 | OH 9.04 | UG 8.73 | UG 8.64 | OH 8.4 | UG 8.32 | UG 8.18 | OH 8.03 | OH 7.75 | OH 7.58 | UG 7.4 | OH 7.4 | OH 7.16

LEGEND

Patterson Dr. Signal Bridge B & O Railroad ✳ | Leiper Crossing I-95 NB I-95 SB Signal Bridge | Chester Pike | Little Crum Creek | Rosemont Ave. | Swarthmore Ave. ✳ | Sellers Ave. ✳ | Stone Creek | Lincoln Ave. | Signal Bridge | Amosland Ave. Winona Ave. | Muckinipates Creek | Chester Pike | Signal Bridge | Glenolden Ave. | Dyers Run | Ashland Ave. | Primos Ave. | Folcroft Ave. | Hermispotar Creek Signal Bridge ✳✳ | Sharon Ave.

CURVES

314 — 313 — 312 — 311

	314	313	312	311
TRACK4	0.93° 2.36	0.91° 4.72 · 0.99° 5.12 · 1.05° 5.51 · 0.96° 3.94 · 1° 4.33	1.02° 4.72 · 1.09° 5.12	1° 2.76
TRACK3	0.84° 2.36	0.32° 1.57 · 1.01° 5.51 · 0.68° 3.94	1.13° 5.12	1° 2.76
TRACK2	0.71° 1.97	0.85° 4.72 · 1.01° 5.51 · 0.19° 1.18	1.13° 5.12	1° 2.76
TRACK1	0.82° 1.97			1° 2.76

GRADIENT

-0.44 | -0.58 | 0.33 | 0.21 | 0.48 | -0.05 | 0.48

MILE

Mile MP

17 (5303) 16 (5281) 15 (5328) 14 (5217) 13 (5291)

"Hook" Highland Avenue Lamokin Street Chester Eddystone

INFRASTRUCTURE

OH 16.95 OH 16.73 UG 16.49 UG 16.35 UG 16.04 UG 15.7 OH 15.7 UG 15.5 UG 15.36 UG 15.18 UG 15.09 UG 15.02 UG 14.94 UG 14.85 UG 14.8 UG 14.67 UG 14.6 OH 14.4 OH 14.34 OH 14.28 OH 14.1 UG 14.02 UG 13.96 UG 13.83 UG 13.79 UG 13.68 UG 13.58 UG 13.51 UG 13.49 UG 13.42 OH 13.4 UG 13.25 UG 13.17 UG 13.07 UG 12.92 UG 12.85 UG 12.65 OH 12.7 UG 12.41 UG 12.28

DD 16.8 DD 16.3 DD 15.7

Lower 5

LEGEND

Witco Chem

Signal Bridge | Signal Bridge | Marcus Hook Creek | Main St. | Stony Creek | Booth St. Signal Bridge | Highland Ave. | Wilson St. | Stream | Engle St. Jeffrey St. | Yarnall St. Reaney St. Flower St. | Central Ave. | Tilghman Rd. | Signal Bridge | Pennell St. Lloyd Street | Signal Bridge | Kerlin St. | Parker Street | Concord Ave. Barclay St. | Viaduct | Chester Creek Viaduct Market Edgemont St | Welsh St. | Signal Bridge | Madison Ave. Upland St. | Morton & Potter Sts. | Caldwell St. Hinkson St. | Ridley Creek | Signal Bridge | Eddystone Ave. | Saville Ave.

CURVES

	318	317	316	315	314
TRACK4	0.12° 1.18	0.12° 1.18 / 0.14° 1.18	0.51° 1.97	0.5° 0.79° 1.57 2.36 / 0.77° 1.97	0.8° 1.97 / 0.86° 1.97 / 0.8° 1.97 / 0.85° 1.97
TRACK3	0.12° 1.18	0.09° 1.18	0.52° 0.79	0.41° 0.8° 1.18 2.36	0.82° 2.36 / 0.85° 2.36 / 0.82° 2.36 / 0.87° 2.36
TRACK2	0.11° 1.18	0.13° 1.18	0.51° 1.97	0.76° 2.36	0.82° 2.36 / 0.84° 2.36 / 0.81° 1.97 0.86° 2.36
TRACK1	0.11° 1.18		0.5° 1.97		0.83° 1.97 / 0.7° 1.57 0.75° 1.97 / 0.84° 1.97

GRADIENT

0.09 -0.14 -0.47 0.00 0.40 -0.55 0.41 0.20 0.14

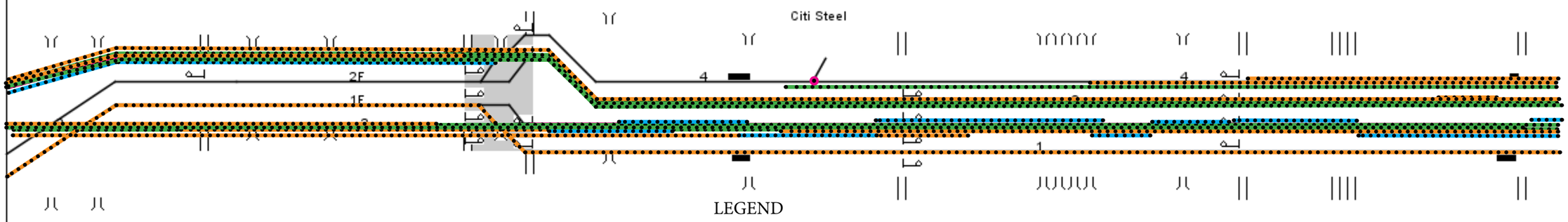
MILE

22 — 5276 — 21 — 5285 — 20 — 5271 — 19 — 4805 — 18 — 5271 — Mile MP

Claymont — "Holly" — Marcus Hook

INFRASTRUCTURE

UG 21.98, UG 21.73, OH 21.3, UG 21.24, UG 20.98, OH 20.58, UG 20.41, OH 20.38E, UG 20.05, UG 19.59, OH 19.2, UG 18.7, UG 18.62, UG 18.58, UG 18.51, UG 18.2, OH 18.1, OH 17.71, OH 17.41, OH 17.11

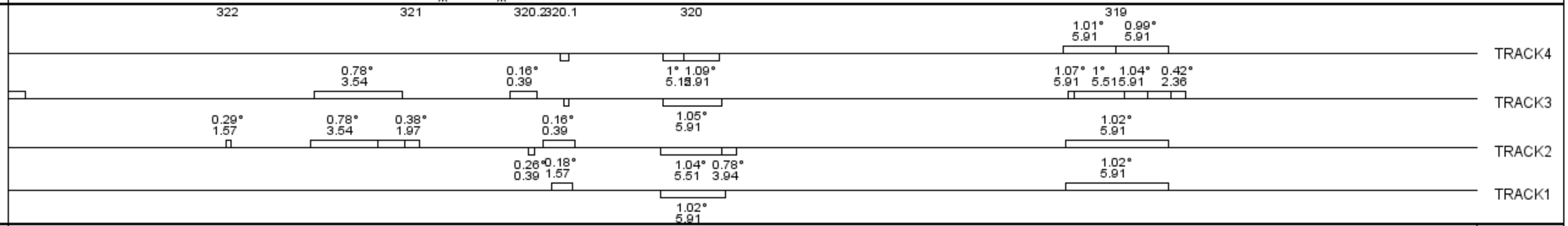


LEGEND

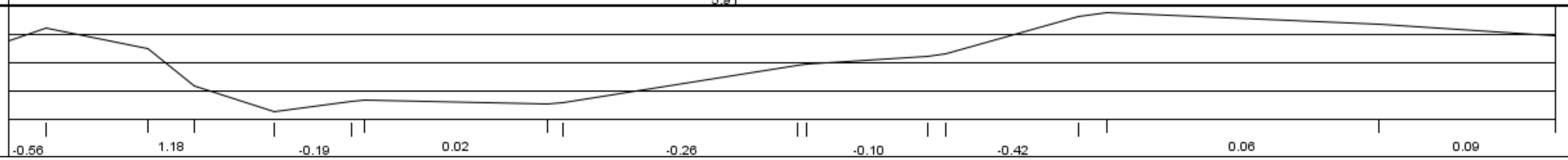
Quarryville Creek, Flyover, Signal Bridge, Perkins Creek, Perkins Creek, Signal Bridge, Stream, Signal Bridge, Stockdale Run, Ped. Underpass, Signal Bridge, Private Lane, Naaman Creek, Brickyard Rd., Philadelphia Pike, Sewer, Signal Bridge, Blueball Ave., Signal Bridge, Market St.

CURVES

322, 321, 320.2, 320.1, 320, 319



GRADIENT



MILE

27 (5256) 26 (5325) 25 (5354) 24 (5102) 23 (5411) Mile MP

Wilmington
"Brandy" "Wine" "Landlith" "Bell"

INFRASTRUCTURE

UG 27 UG 26.92 UG 26.85 UG 26.82 UG 26.75 UG 26.73 UG 26.69 UG 26.6 OH 26.51 OH 26.41 OH 26.4 UG 26.33 UG 26.11 UG 26.07 UG 25.97 UG 25.82 UG 25.73 UG 25.58 UG 25.64 UG 25.45 OH 25.45 UG 24.69 OH 24.4 OH 24 OH 23.81 OH 23.78 UG 23.61 OH 22.8 UG 22.71 UG 22.47 OH 22.1 UG 22.06

Ft House Track
Bullmans Track
Shellpot Branch
1 2F 1F

LEGEND

Orange St. * Market St. King St. French St. Walnut St. Walnut St. Poplar St. Lombard St. * Signal Bridge Signal Bridge 3rd St. 4th & Church Sts. 7th St. 8th St. Brandywine Creek Private Entrance * 12th St. 14th St. Marsh Ditch Vandever Avenue Signal Bridge Shellpot Creek Signal Bridge Marsh Rd. I-495 I-495 Stream * Signal Bridge Squirrel Run Dog Run Signal Bridge Sewer

327 326 324 323

CURVES

TRACK4
TRACK3
TRACK2
TRACK1

0.55° 1.18
3.41° 1.57 | 3.15° 1.57 | 1.55° 0.79 | 1.63° 0.79
0.55° 1.57
0.85° 4.33
2.89° 1.18 | 2.13° 0.79 | 1.8° 0.79 | 1.62° 0.79
0.53° 1.18
1.04° 3.94 | 1.57° 5.91 | 1.52° 5.51 | 1.55° 5.51
1.02° 3.94 | 1.51° 5.91 | 1.53° 5.91 | 1.53° 5.91
1.02° 3.94 | 1.51° 5.91 | 1.53° 5.91 | 1.51° 5.91

GRADIENT

0.37 0.05 -0.16 0.18 0.38 0.04 0.33 -0.42 -0.23 0.12 -0.01 -0.56

MILE

5253 5285 5303 5258 5218

32 31 30 29 28 Mile MP

"Ragan" "Yard"

INFRASTRUCTURE

UG 31.92 OH 30.92 UG 30.67 OH 30.62 OH 30.01 OH 29.76 UG 29.68 OH 29.6 UG 29.34 UG 28.72 OH 28.2 OH 28.19 OH 28.1 UG 27.85 UG 27.64 UG 27.42 UG 27.36 UG 27.32 UG 27.21 OH 27.2 UG 27.06 UG 27.02

Crowell Corporation

Newport Industrial Park

West Yard Track

LEGEND

Red Clay Creek Culvert
Signal Bridge
James St. Route 141
Signal Bridge
Signal Bridge
Folly Run Culvert Signal Bridge
Stream Culvert
Mill Creek
Signal Bridge Signal Bridge
Signal Bridge
B & O RR
Beech St.
Lower Linden St. Shipley Run Madison St.
Justison St. Signal Bridge Tatnall St. Avenue of the States

CURVES

331 330 329.2 329.1 329 328.2 328.1 328

TRACK4
TRACK3
TRACK2
TRACK1

0.57° 3.94
0.37° 1.97
0.55° 3.54
1.1° 5.91
1.09° 5.91
1.08° 5.91
0.26° 1.57
0.28° 1.18
0.25° 1.18
0.25° 1.18
0.52° 2.76
0.75° 3.94
0.77° 3.54
0.93° 5.12
0.93° 4.33
0.89° 4.72
0.9° 4.33
0.75° 3.54
0.25° 0.39
0.2° 0.39
3.65° 2.76
3.69° 2.76
0.57° 0.39
3.91° 3.15
3.72° 2.76
1.69° 0.79
3.76° 3.15
0.3° 2.76

GRADIENT

0.09 -0.26 0.06 0.14 0.02 0.31 0.03 -1.17 0.13 -0.25 0.37

MILE

5338 | 5232 | 5342 | 5283 | 5311

37 | 36 | 35 | 34 | 33 — Mile MP

INFRASTRUCTURE

"Ruthby"

Churchman's Crossing

OH 36.62 | UG 36.42 UG 36.4 | OH 36.25 | OH 36.06 OH 35.96 | UG 35.77 OH 35.6 | OH 35.1 | UG 34.78 | UG 34.65 | OH 34.2 | OH 33.9 | UG 33.11 OH 33.1 UG 33 | UG 32.72 | OH 32.5 | OH 32.07

Harmony Industrial Park

DD 34.9

LEGEND

Signal Bridge | Ogletown Rd. Ogletown Run | Signal Bridge | Rt 273 EB Red Mill Rd. | Stream Signal Bridge | Harmony Rd. | Waterway | Cow Run | Delaware Park Rd. | Signal Bridge | Mill Race Route 7 Stanton Rd. | White Clay Creek | Signal Bridge | Signal Bridge

CURVES

335 | 334 | 333 | 332

TRACK4

TRACK3

TRACK2

TRACK1

0.2° 0.39

0.18° 0.39

0.2° 0.39

0.44° 2.36

0.55° 2.36

0.61° 2.36

0.53° 3.15

0.53° 2.76

0.55° 2.36

1.06° 5.51

1.1° 5.91

1° 4.72

1.27° 5.91

GRADIENT

0.42 | 0.00 | -0.34 | 0.52 | 0.54 | 0.36 | 0.02 | 0.09

MILE

5289 5275 5290 5269 5228

42 41 40 39 38 Mile MP

INFRASTRUCTURE

Newark

"Iron" "Davis"

UG 41.76 OH 41.61 OH 41.5 OH 41.35 OH 40.8 UG 40.71 OH 40.58 UG 40.12 OH 40.02 UG 39.94 OH 39.9 OH 39.6 UG 39.25 OH 38.97 OH 38.88 OH 38.7 UG 38.66 OH 38.3 OH 37.92 OH 37.52 OH 37.1

DD 41.7

Track 5 General Foods

LEGEND

Chrysler Lead South Chrysler Lead North Delmarva Branch

Grade Run * Signal Bridge * Signal Bridge Signal Bridge Otts Chapel Rd. Persimmon Run Signal Bridge Christiana Creek Delaware Route 4 * McCullough Run Signal Bridge Signal Bridge Stream Signal Bridge Footbridge * Signal Bridge Stream Signal Bridge S. Chapel St. Marrows Rd. Signal Bridge

CURVES

337 336

TRACK4

0.54° 2.76

TRACK3

0.54° 3.15 0.53° 2.76

TRACK2

0.57° 2.76 0.53° 2.36

TRACK1

0.55° 2.76

GRADIENT

-0.68 -0.49 0.01 0.34 0.01 0.26 0.42

MILE

47 (5393) 46 (5229) 45 (5342) 44 (5269) 43 (4278) Mile MP

Elkton

INFRASTRUCTURE

UG 46.67
OH 46.67
OH 46.6
OH 46.63
UG 46.11
OH 45.9
OH 45.88
UG 45.29
OH 45.17
OH 44.9
UG 44.8
OH 44.79
UG 44.26
UG 44.06
UG 43.33
OH 43.2
UG 42.51
OH 42.09

LEGEND

Red Mill

Tillison Run Culvert
Signal Bridge
Old Elk Neck Rd.
Signal Bridge
Little Elk Creek
Route 40 W.
Route 40 E.
Stream
Bridge St.
Signal Bridge
Passenger underpass
North St.
Big Elk Creek
Cow Run Number 2
Cow Run No. 1
Signal Bridge
Muddy Lane
St. Hwy. I-95

CURVES

	340	339.1	339	338
TRACK4				
TRACK3	0.94° 5.91	0.17° 1.18	0.59° 3.54	0.24° 1.57 / 0.28° 1.57
TRACK2	0.95° 5.91		0.57° 3.54	0.24° 0.79 / 0.28° 1.18
TRACK1	0.94° 5.91		0.58° 3.54	0.23° 0.79 / 0.28° 1.18

GRADIENT

0.44 | 0.02 | -0.26 | -0.02 | -0.26 | -0.68

MILE

5180 5294 5276 4823 5135

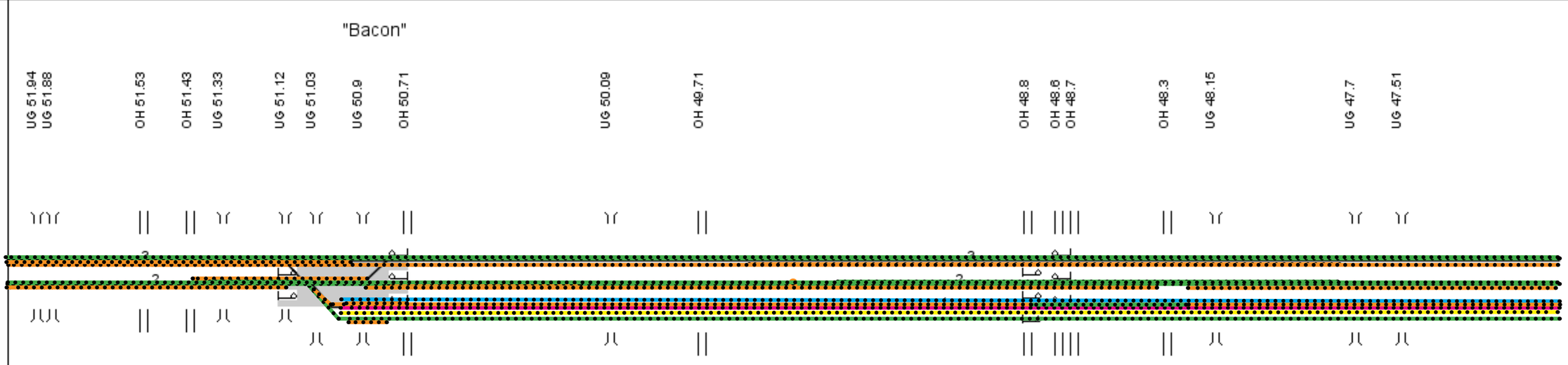
52 51 50 49 48

Mile MP

"Bacon"

INFRASTRUCTURE

UG 51.94
UG 51.88
OH 51.53
OH 51.43
UG 51.33
UG 51.12
UG 51.03
UG 50.9
OH 50.71
UG 50.09
OH 49.71
OH 48.8
OH 48.6
OH 48.7
OH 48.3
UG 48.15
UG 47.7
UG 47.51



LEGEND

Stony Run
MD Route 7
Signal Bridge
Route 272
Pass. Tunnel
McCullough Culvert
Northeast Creek
Waterway
Signal Bridge
Waterway
Signal Bridge
Signal Bridge
Route 7
Signal Bridge
Signal Bridge
Pole Cat Run
Mill Creek
Waterway

CURVES

343 342 341 340

TRACK4
TRACK3
TRACK2
TRACK1

0.82° 5.51
0.81° 5.51
1.41° 4.33
1.43° 5.51
1.42° 5.51
1.06° 5.91
1.06° 5.91
1.03° 5.91
0.94° 5.91
0.95° 5.91
0.94° 5.91

GRADIENT

-0.41 -0.64 -0.52 -0.60 0.62 0.44

MILE

57 5277 56 5194 55 4908 54 5214 53 5280 Mile MP

INFRASTRUCTURE

UG 56.92 UG 56.51 UG 56.26 OH 55.23 OH 55.17 OH 54.76 UG 54.29 OH 53.51 OH 53.3 UG 52.98 UG 52.64

53.2 52.4

3 2

LEGEND

Principio Creek | Mountain Hill Rd. | Long Hollow | Signal Bridge | Signal Bridge | Route 267 | Stream | Heislers Rd. | Signal Bridge | Broad Creek | Peddlers Run

CURVES

347 346 345 344

TRACK4

TRACK3

1.41° 5.91

1.4° 5.91

0.18° 0.79

0.39° 1.97 0.57° 2.76

1.08° 5.51

TRACK2

0.17° 0.79

0.57° 2.76

1.15° 5.91

TRACK1

GRADIENT

-0.10 -0.61 0.06 0.60 0.33 0.18 -0.24 -0.41

MILE

62 — 5024 — 61 — 5275 — 60 — 5476 — 59 — 5053 — 58 — 5302 — Mile MP

"Grace" — Perryville "Perry" — "Prince"

INFRASTRUCTURE

UG 61.72 | OH 61.35 | UG 60.85 | UG 60.77 | UG 60.69 | UG 60.66 | UG 60.61 | UG 60.56 | UG 60.51 | UG 60.07 | UG 59.52 | OH 59.46 | UG 0.51 | UG 0.5 | OH 59.01 | UG 59 | OH 58.86 | OH 58.34 | OH 57.85 | OH 57.6 | OH 57.36 | OH 57.1

PVL S Leg of Wye | PVL N leg of Wye

LEGEND

South End PVL MW Base Lead

North End PVL MW Base

Lewis Run | Lewis Lane | Stream | Juniata St. | Station Tunnel | Adams St. | Centennial Lane | Stokes St. | Freedom Lane | Susquehanna River | Conrail | Signal Bridge | S leg of wye | N leg of wye | Signal Bridge | Mill Creek | Hooker Chemical | Coudons Rd. | Coudons Rd. | Bromwell's Rd. | Signal Bridge | Signal Bridge

CURVES

349 — 0.91° 1.57

348 — 0.52° 1.57 — 0.51° 1.57 — 0.5° 1.57

TRACK4
TRACK3
TRACK2
TRACK1

GRADIENT

-0.22 | 0.04 | -0.41 | 0.04 | 0.42 | 0.06 | 0.04 | -0.40 | 0.52

MILE

67 (5291) 66 (5294) 65 (5262) 64 (5281) 63 (5267) Mile MP

INFRASTRUCTURE

Aberdeen

"Oak"

OH 66.88N | UG 66.15 | OH 65.54 | UG 65.46 OH 65.45 | OH 65.2 | OH 64.96 | UG 64.47 | OD 64.2 | UG 63.97 | OH 63.72 | UG 63.12 | OH 62.76 UG 62.7 | OH 62.09

LEGEND

APG S Leg of Wye | APG N Leg of Wye | Hartford Gateway | Havre De Grace Old line

Boothby Hill Rd. North | Stream | Route 132 | Passenger underpass Footbridge | Signal Bridge | Northern Thruway | Jays Run | Swan Creek | Swan Creek Rd. | Blenhams Run | Signal Bridge Mill Run | State Route 7

CURVES

352 | 351 | 350.1 | 350

TRACK4
TRACK3
TRACK2
TRACK1

1.01° 5.91
0.53° 3.54
1.01° 5.91
0.73° 5.91
0.54° 3.15
0.16° 1.18
0.67° 4.33

GRADIENT

0.26 | -0.35 | 0.02 | 0.34 | 0.28 | -0.24 | 0.19 | -0.22

MILE

72 5286 71 5274 70 5288 69 5279 68 5286 Mile MP

INFRASTRUCTURE

"Bush"

UG 72.14 | OH 71.59 | OH 71.45 | OH 69.53 | OH 69.25 | OH 67.5 | OH 67.33

Clorox

LEGEND

Bush River * | Signal Bridge | Signal Bridge | Signal Bridge | Chelsea Road | Signal Bridge * | Signal Bridge

CURVES

353

TRACK4

TRACK3

0.52° 2.36 | 0.24° 1.18

TRACK2

0.54° 2.76 | 0.23° 1.18

TRACK1

GRADIENT

-0.23 -0.15 -0.47 -0.16 -0.09 -0.05 -0.20 -0.39

MILE

77 — 5276 — 76 — 5281 — 75 — 5276 — 74 — 5263 — 73 — 5320 — Mile MP

Edgewood

"Magnolia" "Wood"

INFRASTRUCTURE

OH 76.98 | OH 76.78 | UG 75.8 OH 75.75 | OH 75.46 | OH 75.17 | UG 75.12 | OH 74.39 | OH 73.69 | OH 73.31 | OH 72.2

DD 75.1

Edgewood Siding

Magnolia Siding

3 3 3 3

X

LEGEND

Signal Bridge | Signal Bridge * | Stream State Route 24 | Signal Bridge | Signal Bridge * | Edgewood Rd. | Signal Bridge | Signal Bridge | Signal Bridge | Signal Bridge

CURVES

355

TRACK4

TRACK3

0.09°
0.39

TRACK2

0.07°
0.39

TRACK1

GRADIENT

-0.37 | -0.00 | 0.43 | 0.05 | 0.32 | 0.02

MILE

82 — 5270 — 81 — 5302 — 80 — 5281 — 79 — 5291 — 78 — 5340 — Mile MP

"Gunpow"

INFRASTRUCTURE

OH 81.68 | OH 80.8 | OH 80.61 | OH 79.72 | OH 79.4 | OH 79.29 | UG 78.86 | UG 78.21

DD 79.3

Baltimore Gas & Electric

Chase Pub Del Track MOW

LEGEND

Signal Bridge | Signal Bridge | Ebenezer Rd. | Signal Bridge | Signal Bridge | Signal Bridge | Gunpowder River | Stream

358 | 357.1 | 357 | 356

CURVES

TRACK4

TRACK3

0.28° 0.79 | 0.31° 0.79 | 0.29° 0.79 | 0.32° 0.79 | 0.27° 0.79 | 0.2° 0.79 | 1.23° 5.91 | 0.29° 1.57

TRACK2

0.29° 1.57 | 0.28° 1.57 | 0.31° 1.97 | 0.29° 1.57 | 0.33° 1.97 | 0.29° 1.57 | 0.27° 1.18 | 1.25° 5.91 | 0.37° 1.57

TRACK1

0.28° 1.57 | 0.33° 1.97 | 0.28° 1.57 | 0.32° 1.97 | 0.29° 1.57

GRADIENT

-0.31 | 0.17 | -0.08 | 0.05 | -0.06 | -0.34 | -0.07 | -0.37

MILE

87 — 5220 — 86 — 5307 — 85 — 5375 — 84 — 5195 — 83 — 5288 — Mile MP

Stemmer's Run — Martin

INFRASTRUCTURE

OH 86.88 | UG 86.71 | OH 85.7 | UG 85.63 | UG 85.17 | UG 85.15 | OH 83.9 | OH 83.7 | DD 83.4 | OH 83.31 | OH 82.57 | UG 82.19 | OH 82.05

Chesapeake Industrial — Marc Facility — Baltimore Gas & Electric

LEGEND

Rossville Blvd. | Stream | Signal Bridge | Stream | State Highway | State Highway | Rt 43 Whitemarsh Blvd | Signal Bridge | Signal Bridge | Earles Rd. | Stream | Signal Bridge

361 — 359 — 358

CURVES

TRACK4

0.69° 4.33 | 0.66° 3.94 | 0.36° 2.36

TRACK3

0.67° 3.94 | 0.69° 4.33 | 0.04° 0.39 | 1.02° 5.91 | 0.89° 5.12 | 0.42° 1.18 | 0.04° 0.0 | 0.33° 0.79 | 0.32° 0.79

TRACK2

0.67° 4.33 | 1.01° 5.91 | 0.86° 5.12 | 0.32° 1.97 | 0.28° 1.57 | 0.33° 1.97

TRACK1

1.01° 5.91 | 0.86° 5.12 | 0.32° 1.97 | 0.28° 1.57 | 0.33° 1.97

GRADIENT

0.01 — -0.39 — 0.39 — -0.16 — -0.00 — 0.34 — 0.02 — 0.26 — -0.31

MILE

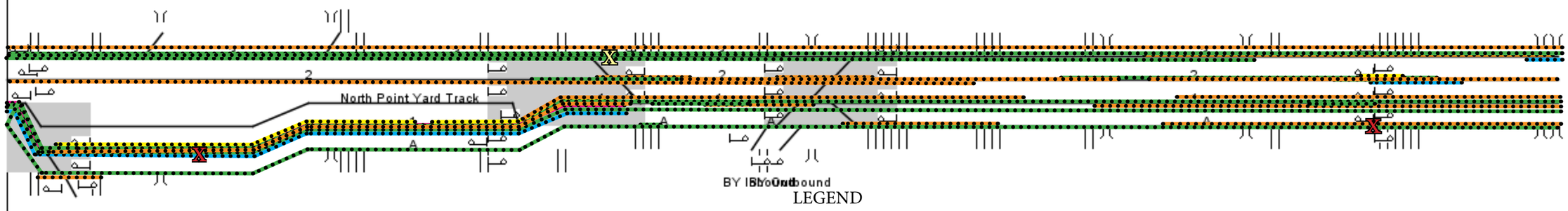
92 5215 91 5364 90 5224 89 5285 88 5336 Mile MP

"Bay" "Point" "River"

OH 91.93 OH 91.7 UG 91.52 UG 90.98 OH 90.89 OH 90.86 OH 90.4 OH 90.2 OH 89.95 OH 89.9 OH 89.5 UG 89.45 OH 89.26 OH 89.18 OH 89.2 OH 88.9 OH 88.84 OH 88.56 UG 88.51 UG 88.01 OH 87.9 OH 87.67 OH 87.51 OH 87.47 UG 87.07 UG 87.03

Kieckheffer Industrial Baltimore Steel and Industrial

INFRASTRUCTURE



LEGEND

Tunnel Rd. Signal Bridge Stream North Point Rd. Signal Bridge IR-95 Signal Bridge Signal Bridge Signal Bridge Signal Bridge Signal Bridge Black River Signal Bridge Patapsco Freeway Signal Bridge Signal Bridge Severn Avenue Windless Freeway Stream Chesaco Stream Signal Bridge Signal Bridge S.E. Freeway S.E. Freeway Stemmers Run Stemmers Run Rd.

371 369 365 363 361

CURVES

TRACK4: 0.91° 1.18 | 0.75° 5.12 | 0.98° 5.91 | 0.96° 5.91 | 0.94° 5.91 | 0.97° 5.91 | 0.9° 5.51

TRACK3: 0.9° 1.18 | 0.45° 1.18 | 0.33° 0.79 | 0.33° 0.79 | 0.23° 0.79 | 0.27° 0.79 | 0.69° 4.72 | 0.39° 2.76 | 0.44° 3.15 | 0.6° 4.33 | 0.88° 5.91 | 0.98° 5.91 | 0.96° 5.91 | 0.94° 5.91 | 0.97° 5.91 | 0.94° 5.91 | 0.92° 5.51

TRACK2: 0.52° 0.79 | 0.65° 3.15 | 0.36° 1.57 | 0.32° 1.57 | 0.33° 1.57 | 0.26° 1.18 | 0.55° 3.54 | 0.4° 2.76 | 0.44° 3.15 | 0.67° 4.72 | 0.88° 5.91 | 0.57° 3.94 | 0.96° 5.91 | 0.95° 5.91 | 0.92° 5.91

TRACK1: 0.12° 0.0 | 0.34° 3.15 | 0.33° 2.76 | 0.34° 2.76 | 0.38° 2.36 | 0.43° 2.76 | 0.4° 2.76 | 0.62° 4.33 | 0.71° 4.72 | 0.9° 5.91 | 0.85° 5.51 | 0.91° 5.91

GRADIENT

0.38 -0.00 0.34 -0.02 -0.13 -0.41 0.38 0.01

MILE

97 4862 96 5249 95 5171 94 5267 93 5379 Mile MP

Baltimore
"Charles" "Paul" "Biddle"

OH 95.9 UG 95.95 OH 95.8 OH 95.6 OH 95.5 OH 95.66 OH 95.61 OH 95.54 OH 95.41 UG 95.26 OH 95.28 OH 94.6 UG 94.5 UG 94.34 UG 94.3 UG 94.2 UG 94.1 UG 94.07 UG 93.97 UG 93.9 OH 93.8 UG 93.75 UG 93.68 UG 93.6 UG 93.52 UG 93.45 OH 93.3 OH 93.23 OH 93.01 UG 92.68 OH 92.64 UG 92.61 UG 92.5 UG 92.42 OH 92.15 OH 92.09

INFRASTRUCTURE

Mount Vernon Track

LEGEND

Pres St Branch

Signal Bridge
Jones Falls
Maryland Ave.
Signal Bridge
Station Concourse
St. Paul St.
Calvert St.
Guilford Ave.
Sewer
Signal Bridge
Signal Bridge
Broadway
Gay St.
Preston St.
Washington St.
Chase St.
Chester St.
Collington Ave.
Patterson Park Ave.
Signal Bridge
Milton Ave.
Luzerne Ave.
Lakewood Ave.
Kenwood Ave.
Linwood Ave.
Signal Bridge
Edison Highway
Signal Bridge
North Haven St.
Signal Bridge
Monument St.
Kresson St.
Pulaski Hwy.
Signal Bridge
CSX RR

377 376 375 374 373 372

CURVES

TRACK4
TRACK3
TRACK2
TRACK1

5.69° 1.18 2.23° 0.39 7.94° 1.57
6.24° 1.97 2.28° 0.79 9.45° 2.76
1.57° 0.39 0.4° 0.0 3.14° 0.79
3.98° 3.94 1.24° 1.18
4.43° 3.94 1.3° 1.18
4.23° 3.54 4.39° 3.54
4.04° 3.94 0.41° 0.39
1.2° 1.18 4.08° 3.54
4.48° 4.33 1.43° 1.18
2.03° 4.33
2° 2.76 2.06° 2.76
2.01° 3.94 1.86° 3.94
1.96° 2.36 2.09° 2.36
2° 3.15 1.76° 2.76
2.02° 3.15 1.78° 2.76

GRADIENT

1.30 -0.01 0.00 0.71 -1.14 0.22 0.06 0.32 1.05 0.38

MILE

102 (5250) 101 (5207) 100 (5316) 99 (5273) 98 (5277) Mile MP

West Baltimore
"Bridge" "Fulton"

OH 101.82 | OH 101.3 | OH 100.7 | OH 100.59 | UG 100.33 | UG 100.25 | OH 99.81 | UG 99.53 OH 99.3 | UG 99.2 OH 99.1 | UG 98.95 | UG 98.69 | UG 98.5 UG 98.45 | OH 98.36 OH 98.25 | UG 98.18 | OH 98.08 | OH 97.85 | OH 97.6 UG 97.72 | OH 97.55 | OH 97.5 | OH 97.1

INFRASTRUCTURE

Mrs Filberts

Washington Al Grain Cup | Loudon Park

LEGEND

Baltimore Beltway | Signal Bridge | Signal Bridge | Wilkens Ave. | Maiden Choice Run | Louden Park Drive | Frederick Rd. | Sewer Signal Bridge | Gwynns Falls Signal Bridge | Franklintown Rd. | Warwick Ave. | Mulberry St. West Franklin St. | Edmondson Ave. Signal Bridge | Sewer | Signal Bridge | Signal Bridge | Signal Bridge Sewer | Signal Bridge | Signal Bridge | Signal Bridge

385 | 384 | 383 | 382 | 381 | 380 | 379 | 379.1 | 378

CURVES

TRACK4: 1.01° 3.94 | 1.91° 5.12 | 1.5° 3.94 | 0.34° 0.79 | 4.41° 1.97 | 3.89° 1.57 | 4.05° 1.97

TRACK3: 0.16° 0.39 | 1.2° 3.15 | 2.07° 5.91 | 1.52° 4.33 | 2.12° 1.97 | 0.72° 0.79 | 0.23° 0.39 | 4.36° 3.94 | 4.03° 3.54 | 3.8° 3.15 | 0.05° 0.0 | 0.52° 0.0

TRACK2: 1° 5.12 | 0.16° 0.39 | 1.33° 3.94 | 1.88° 5.51 | 1.6° 4.72 | 3.71° 3.15 | 3.2° 2.76 | 0.74° 0.79 | 0.34° 0.39 | 9.66° 1.97

TRACK1: 1.01° 5.12 | 0.23° 0.79 | 0.13° 0.39 | 0.68° 1.97

GRADIENT

-1.08 | -0.98 | 0.51 | 0.48 | -0.06 | -0.56 | 0.58 | 0.04 | -0.54 | -0.93 | 1.16 | 0.85

MILE

107 5290 106 5263 105 5220 104 5249 103 5298 Mile MP

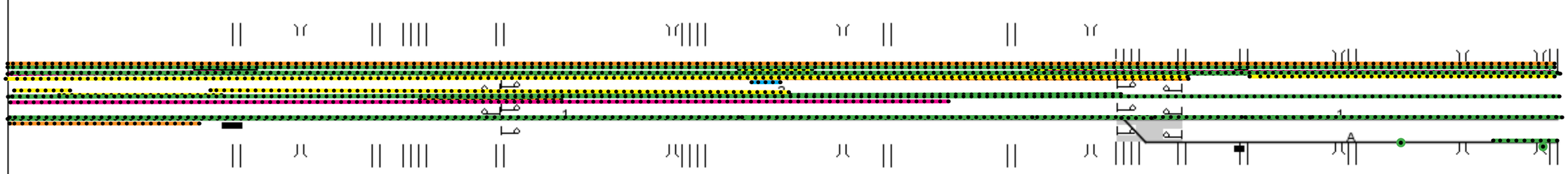
BWI

Halethorpe

"Winans"

INFRASTRUCTURE

OH 106.25 UG 106.06 OH 105.78 OH 105.73 OH 105.7 OH 105.45 UG 104.88 OH 104.87 OH 104.84 UG 104.36 OH 104.18 OH 103.79 UG 103.52 OH 103.4 OH 103.3 OH 103.1 OH 103.02 UG 102.72 OH 102.69 UG 102.35 UG 102.08 OH 102.08



LEGEND

BWI Station | Red Run | I-295 Ramp | I-295 | I-295 Ramp ✳ | Signal Bridge | Patapsco Rd. I-195 I-195 | Patapsco River | Expressway ✳ | B & O RR | Herbert's Run ✳ | Signal Bridge Signal Bridge | Signal Bridge ✳ | Francis Avenue | Stream I-95 ✳ | Sulphur Spring Rd. | Stream Signal Bridge

391 390 389 388 387 386 385

CURVES

TRACK4

TRACK3

TRACK2

TRACK1

1.55° 5.91 | 1° 5.91 | 0.52° 3.15 | 0.29° 1.57 | 0.8° 3.94 | 1.17° 5.91 | 0.07° 0.39 | 0.26° 1.97

1° 5.91 | 1.04° 5.12

1.54° 5.91 | 1.01° 3.94 | 0.98° 3.94 | 0.51° 2.36 | 0.09° 0.39 | 0.98° 5.12 | 0.47° 2.36 | 0.92° 4.72 | 0.28° 1.97 | 0.98° 4.72

1.51° 5.91 | 1.54° 5.91 | 0.52° 2.76 | 1.16° 5.91 | 0.32° 1.97

GRADIENT

0.40 0.06 0.34 0.17 -0.04 -0.96 -0.92 -1.08

AMTRAK

Line Code: AP-Philadelphia Line
112.0 - 107.0

PAGE: 6A
27-NOV-12

MILE

112 5260 111 5306 110 5259 109 5268 108 5278 Mile MP

INFRASTRUCTURE

OH 111.49
UG 111.44
OH 111.22
OH 110.3
OH 110.3
UG 110.12
OH 109.6
OH 109.42
OH 109.4
OH 108.58
OH 107.7
OH 107.19
Balt Commons
OO 107.5
MacMillan Bloedel

LEGEND

Signal Bridge
Stream
Signal Bridge
Severn Road
Signal Bridge
Pass. Tunnel
Signal Bridge
SR-100
SR-100
State Highway
Signal Bridge
Stony Run Road

CURVES

396 395 392

TRACK4
TRACK3
TRACK2
TRACK1

0.9° 5.91
0.92° 5.91
0.9° 5.91
0.56° 3.54
0.97° 5.91
0.35° 1.97
0.5° 2.76
0.19° 1.18
0.5° 3.15
0.42° 2.76
0.9° 5.91
0.21° 1.18
1.04° 5.91
0.5° 3.15
0.9° 5.91

GRADIENT

0.52 -1.03 -0.78 1.01 -0.05 1.00 -0.34 1.08

MILE

5206 5249 5271 5258 5309

117 116 115 114 113

Mile
MP

INFRASTRUCTURE

Odenton

"Grove"

UG 116.75 | UG 116.42 | UG 116.04 | UG 115.61 | OH 115.37 | OH 114.5 | UG 113.7 | OH 113.45 | OH 112.8 OH 112.76 | OH 112.4 UG 112.17

DD 116.4

Odenton S. End | Odenton N. End | Natl Plastics

LEGEND

Stream | 5th Avenue | Little Patuxent River | Rogues Harbor | Signal Bridge | Signal Bridge | Pass. Tunnel | SR-175 | Signal Bridge SR-32 WB | Signal Bridge Severn Run

CURVES

401 400 399 398 397

TRACK4

TRACK3

TRACK2

TRACK1

0.87° 5.91 | 0.38° 2.36 | 0.9° 5.91 | 0.89° 5.91 | 0.34° 2.36

0.89° 5.91 | 0.9° 5.91 | 0.51° 1.97 | 1.08° 4.33 | 0.77° 3.15 | 1.01° 5.91 | 0.72° 4.33 | 0.97° 5.91 | 1° 5.91

GRADIENT

1.03 0.73 -0.83 -0.99 -0.13 0.72 0.51 -0.17 0.95 -0.51

MILE

122 5294 121 5250 120 5315 119 5269 118 5327 Mile MP

Bowie State

"Bowie"

INFRASTRUCTURE

UG 121.3 | UG 120.8 OH 120.75 | OH 120.48 | OH 120.2 | OH 119.5 UG 119.46 | OH 119.1 | OH 118.45 | UG 118.09 | OH 117.34

S. Leg of Wye N. Leg of Wye

LEGEND

Stream | Stream Signal Bridge | Chestnut Ave. | Signal Bridge | Route 197 Pass. Tunnel | Signal Bridge | Signal Bridge | Big Patuxent River | Signal Bridge

CURVES

406 405 404 403 402 401

TRACK4
TRACK3
TRACK2
TRACK1

0.01° 0.0
0.83° 5.51 | 0.33° 1.97
0.5° 1.57
0.86° 5.91 | 0.04° 0.39
0.75° 4.72
0.9° 5.91 | 0.89° 5.91
0.92° 5.91 | 0.1° 0.79
0.5° 2.36
0.86° 5.91
0.59° 2.36
0.59° 2.36
0.91° 5.91 | 0.89° 5.91
0.85° 5.12
0.48° 1.97 | 0.51° 1.97 | 0.56° 2.36
1.52° 5.91

GRADIENT

0.62 -0.06 0.49 -0.20 -0.82 1.01 -0.65 -1.09 1.03

MILE

5438 5111 5243 5325 5279

127 126 125 124 123 Mile MP

Seabrook

"Carroll"

INFRASTRUCTURE

OH 126.8 UG 126.52 OH 126.34 OH 126.32 OH 125.73 UG 125.32 OH 125.14 UG 124.72 OH 124.5 UG 124.4 UG 123.86 UG 123.42 DD 123.3 OH 122.9 OH 122.88 OH 122.75 OH 122.7

LEGEND

Home Depot

Signal Bridge Pass. Subway Capital Beltway Capital Beltway Route 450 Muddy Hole Carter Ave. Pass. Tunnel Signal Bridge Stream Stream Folly Branch Glendale Rd. Glendale Rd. Signal Bridge Signal Bridge

409 408 407

CURVES

TRACK4 TRACK3 TRACK2 TRACK1

0.43° 2.36 1.06° 5.91

1.19° 5.91 1.02° 5.91 1.04° 5.91

1.19° 5.91 1.03° 5.91 1.03° 5.91

1.08° 5.91

GRADIENT

MILE

5281 5279 5285 5285 5290

132 131 130 129 128

Mile MP

New Carrollt

"Landover"

INFRASTRUCTURE

UG 131.75 OH 131.17 OH 130.7 UG 130.53 OH 130.25 OH 129.1 OH 128.87 UG 128.76 OH 128.5 UG 127.88 UG 127.65 UG 127.7 OH 127.44 UG 127.35 OH 127.65 UG 127.2 UG 127.04

130.7

5 Freight

4 Freight

LEGEND

Ardwick Industrial

Anacostia River | Kenilworth Ave. | Signal Bridge | Stream | Columbia Pk. | Signal Bridge | Landover Rd. Beaver Dam | Signal Bridge | Beaver Dam | Beaver Dam Metro Light Rail Elevated | MD Rt. 50 | Stream | Signal Bridge Stream | Pass. Subway

413 411 410 409.1

CURVES

TRACK4

TRACK3

TRACK2

TRACK1

	TRACK4	TRACK3	TRACK2	TRACK1
413		0.68° 4.72	0.68° 4.72	
		0.67° 4.72	0.67° 4.72	
		0.65° 4.33	0.87° 5.91	
411	1.04° 4.72	0.5° 1.97	1.01° 4.72	
410		0.42° 2.36	0.42° 1.97	0.49° 2.76
409.1			0.18° 0.79	0.16° 0.79

GRADIENT

0 78 0.04 -0.22 -0.58 -0.52 -0.07 -0.34 -0.82 0.56 -0.84 -1.16 -1.00

MILE

137 136 135 134 133 Mile MP

8214 4400 5286 5279

Union Station Coach Yard Ivy City Service Facility

"A" "K" "C"

INFRASTRUCTURE

OH 136.6 UG 136.55 UG 136.41 UG 136 OH 136 UG 135.56 UG 135.41 OH 135.4 UG 135.33 OH 135.28 UG 135.19 OH 135.05 UG 135.02 OH 134.83 OH 134.6 OH 134.52 OH 134.47 OH 134.4 OH 134.1 OH 133.89 UG 133.72 UG 133.62 UG 133.39 UG 133.28 UG 133.17 UG 132.84 UG 132.7 OH 132.45 OH 132.4 UG 132.26

UG 132.4

38 39 40 41 42 42 3 2

Southward Main

Northward Main

LEGEND

Signal Bridge 1st & Delaware Ave.
Canal & S. Capitol
Ventilation Shaft Subway
H Street
K Street Signal Bridge L Street
Signal Bridge M Street
Signal Bridge Florida Ave.
New York Ave.
Signal Bridge
CSX RR
Ninth St.
Signal Bridge
Signal Bridge
Signal Bridge New York Ave.
Montana Ave.
Stream
Bladensburg Rd.
Stream
Dinky Track
Stream
New York Ave.
Signal Bridge Stream

CURVES

414

1.01°
4.72

TRACK4
TRACK3
TRACK2
TRACK1

GRADIENT

0.00 0.82 0.21 0.72 0.60 0.78

Site Visits

April 15, 2019

Field Visit: TLM and Associated Operations Between Ragan and Davis Interlockings

Introduction

These notes cover observations of Amtrak's Plasser P811 Track Laying Machine (TLM) together with associated activities operating between Ragan (MP 29.8) and Davis (MP 38.5) Interlockings near Newark, DE. The overall operation consists of a preparation crew working ahead of the TLM, the TLM itself and a follow-up crew working behind the TLM. At the time of the visit, the TLM and the preparation crew were at work, but the follow-up crew were scheduled to work the following night. The overall operation involves around the clock work, but different crews work at different speeds, depending on the production rate of each crew and local circumstances. Typically, Amtrak tries to maintain a couple of work gap days between the crews so that they do not delay each other.

The work was performed under a Form D issued to the foreman in charge of the overall operation. The practice is to issue a new Form D each evening when the overnight crews start work and transfer the form to the daytime foreman in charge using Amtrak's Form D transfer form. When needed, the form D is relinquished to the dispatcher for a "dispatcher hold" if a work train needs access to the work site. For example, to deliver or pick up materials. Also, as at the undercutter work site and as required by Amtrak's overall safety procedures, a Site-Specific Safety Work Plan was provided.

Work Site and TLM Operations

The work site is a three-track high speed mainline with posted speeds of 135 mph for Acela and 125 mph for Northeast Regional services. The line carries full Amtrak NEC service of Acela's, Regionals and a few long-distance trains. There are also SEPTA/Delaware DoT commuter trains at peak hours and an occasional NS freight. A limited number of commuter trains have been replaced by buses during non-peak hours. There is also one commuter station within the work zone (Churchman's Crossing, DE) where modifications to both commuter service and TLM operations are required, as detailed in the project work and safety plan. The work was being performed on track 1, the easternmost track. Track 2 (center) remained in operations with a 60 mph "slow-by" and track 3 (westernmost) was in operation at full speed.

The TLM itself exchanges old concrete ties and rail for new ties and rail. Initial preparation work includes de-energizing and grounding electric power to the catenary to ensure safety and removing train control devices and connections. The pace of work was approximately 1.5 seconds per tie, or about 1 ft/sec. A crew working ahead of the TLM removes the rail clips and other rail attachments, any damaged ties and concrete chunks likely to impede TLM operations and moves the new rail strings from between the rails to outside the rail where they can be picked up by the TLM. Follow-up operations involve destressing the rail prior to replacing the rail clips, welding the rail strings together and surfacing and lining the track back to its correct position. Finally, train control systems are replaced, and electric power restored. Except for removing and replacing rail clips, the overall operation is similar to that seen at the undercutter work site. Generally, the work does not require foul-time, except for a ballast regulator working

with the follow-up crew. Otherwise all the machines can operate without needing foul-time, and the busy train schedule means that there is very little opportunity. The crew said that the only possible times during the day were short periods mid-morning or mid-afternoon. Safety was provided by a group of watchmen separately at the TLM, advance work site and the follow up work site as these were spread over 2-3 miles.

Visit Observations

Specific observations at these work sites were as follows:

- The Site-Specific Safety Work Plan provided, appeared to be a draft version which was incomplete is some respects (for example, no contents page) and there were a couple of errors regarding milepost locations. Unless this had been corrected and completed later, there is a possibility of a misunderstanding. The errors probably resulted from using a previous plan as a template.
- The work site seems to be moderately hazardous. The TLM was working on the inside track on a shallow curve. The TLM crew were either seated in the machine itself or were observing its operation from the center in-service track. It was clearly impractical to operate the TLM from the field side away from traffic because of the location of the controls, and the very high ballast bank meant that a field side operator or observer would have a poor view of machine operation and climbing on board would be difficult. When a warning of an approaching train was sounded, the TLM stopped operation and the crews working on the adjacent track took refuge on or under the machine. There were no locations on the machine that were specifically designed as crew refuges. Because the TLM and its attendant rail vehicles add up to quite a long consist, crew members working alongside the TLM could not easily see approaching trains. However, watchmen stationed on the outside of the curve did have a good view of the outermost watchman. Five watchmen were on duty and were able to give sufficient warning of approaching trains.
- The procedure required distributing the Form D to all concerned crew members. The Roadway Worker in Charge (RWIC), located where the TLM was working, received the Form D from the dispatcher by voice transmission over the regular radio channel. Then the resulting written Form D was photographed by the RWIC using his Amtrak issued cell phone and sent to other foreman and machine operators on-site as an attachment to a text message. Thus, in effect, an electronic Form D was being created and used for on-site distribution, although this method could not be used for transmission between the dispatcher and work crew. The crew felt that this method was far quicker and more reliable than transmitting the Form D among the on-site crews over voice radio.
- Verbal safety briefings occurred at both the undercutter and TLM work sites as required by Amtrak's safety rules and the Site-Specific Safety Work Plan. At the undercutter work site, the briefing seemed hurried and a rote exercise, with not much effort to ensure that those present understood the content or provide for questions. The briefing at the TLM work site was better.

Summary

The first point is the use of cell phones to distribute a photo of the Form D within the work crew. Although the foreman emphasized that they only used Amtrak issued cell phones, not personal phones, it is not clear whether this practice is in full compliance with FRA and NORAC operating rules. Nor are there any written rules that were in practice during the visit for preparing and transmitting the Form, to acknowledge receipt, and for retaining access to a copy of the transmission for later access, all of which apply to the traditional voice radio/written forms procedure. In all, the cell phone procedure seems to exist in a grey area.

A second point is associated with the general watchman procedure. Although this is a very traditional railroad safety procedure, there are a number of questions. The safety of the crew depends absolutely on the vigilance of the watchmen to warn of an approaching train. There is no backup. Moreover, safety depends on the one watchman that is furthest out from the work site in the direction from which the train is approaching. This is especially true of high-speed territory, as at the TLM work site. Maintaining the vigilance for a full work shift is also very demanding. The watchman's job is difficult and stressful. Further, it is becoming difficult to find workers to perform this function, especially given that watchmen make up 20-25% of work crews, and experienced watchman are retiring.

The next point is the age and reliability of the track maintenance equipment. The equipment at both locations required the attention of mechanics to fix faults, holding up operations and exposing more crew members to risk over a longer time. The TLM was old and a replacement machine was not under consideration.

April 18, 2019

Dispatching Center Visit: Boston CETC

CETC Boston controls the NEC main line from Boston South Station to just east of New Haven Station, at approximately MP 73. This territory is controlled from nine dispatcher desks in the control center. In addition, four desks in the same facility occupied by MBTA staff control movements on commuter rail routes originating in South Station. The action was observed from a separate room equipped with a display duplicating the main active displays being used by the dispatchers. The scale of the display was adjustable, so that it could look at a wide territory or a single block. It was also possible to listen to voice communications between individual dispatchers and vehicles and work crews in the field.

Operations Observed

Given the specific interest in the safety management of track maintenance and inspection activities, the specific activities observed comprised the operation of an undercutter working at approximately MP 75-76 east of Mill River Junction and the movements of a hi-rail track car in the same vicinity being used by a track inspector. The undercutter was working on Track 1, which had been taken out of service for an extended period (several weeks). Train schedules had been adjusted for single track/two-way operation on Track 2, so that train service by Amtrak and a commuter operator, Shore Line East, could be maintained. However, it was noted that there was little room for further schedule adjustment to accommodate a delayed train approaching the single-track operation, and additional delay could result. This was more of a problem with trains approaching from New Haven, where departures are controlled by Metro North Commuter Railroad, and Amtrak had only limited notice of approaching trains. Trains approaching from the Boston direction were visible to the dispatchers, who then had more time to respond to delayed trains.

Approximately three miles of track where the undercutter was working was subject to a slow-by restriction on the active track 2 of 60 mph. This was enforced by ACSES messages transmitted directly to the trains and no manual action was needed. The undercutter foreman requested foul time on the adjacent track 2 on most occasions when there was a gap in train operations. As is normal practice, no reason was given by the undercutter foreman. It will be necessary to observe undercutter operation from the track to see foul time reasons. Foul time was normally ended by the foreman after an agreed time, often only a few minutes. An important point is that it takes about 3 minutes to complete the communications required to establish foul time, including reading the foul time message by the dispatcher, the repeat by the track foreman to confirm understanding and recording the message in the manual train sheets and foreman's log.

The Boston CETC uses traditional railroad voice communication practices with no electronic aids. See below for alternative procedures used by the New York and Wilmington CETCs. Another factor is that good dispatching practice requires that a dispatcher should complete the whole procedure without interruption. Thus, any other claims on dispatcher time have to wait. In this case the dispatcher was also managing the movements of a hi-rail car that simply had to wait. Typically, a dispatcher's workload my involve supervising the movements of 3 or 4 track cars performing inspections or maintenance activities. All these communications are by voice radio, which can lead to overload at busy times and slow down operations. More details of this

operation will be provided in the report on the visit to observe undercutter operations on April 23, 2019.

Amtrak CETC Capabilities

Dispatching practices vary between the three CETCs, Boston, New York and Wilmington. As observed, Boston used traditional voice and manual practice to issue and record Form Ds and foul time. The New England region lacks digital communications to support high security electronic messaging between the CETC and track foremen in the field and the do not use any electronic devices for communications with the CETC or the maintenance crews on the ground. Also, the dispatchers maintain traditional written records at the dispatch center of Foul Time permissions issued and Form Ds.

According to Boston staff, practices are different in New York and Wilmington. The Boston and Wilmington centers were designed and built by Rockwell-Collins with some equipment and/or software provided by ARINC. New York CETC has a new dispatching system called AMTEC, developed by Amtrak and presumably using displays and software from multiple vendors. It is intended to be the future standard and will be rolled out to the other centers as funds permit. Given that the systems in Boston and Wilmington are to be replaced, Amtrak is reluctant to upgrade capabilities at these locations. The New York center will be able to issue electronic foul time messages in the near future. A particular feature of this system (called Enhanced Electronic Employee Safety System or EEEPS) will be that only the track foreman to whom the foul time was issued can cancel it electronically before train operations can resume.

Wilmington CTEC issues electronic movement authorities, Form Ds and Foul Time electronically to Norfolk Southern freight trains. NS did not want to install ACSES on their locomotives, so instead Amtrak issues messages to NS trains using the freight railroad PTC (I-ETMS) system that relies on digital radio messages, as used elsewhere on the NS network.

Another suggestion from Amtrak staff is that digital radio communications to track forces be used to provide them with a view of the dispatcher's screen showing train movements around where they are working. They felt this would enhance safety by improving situational awareness and catch errors and enable the crews in the field to better plan their activities. Apparently, moveable bridge tenders already have this capability (hard wired rather than by radio) which enables them to better advise boaters of when bridges can be lifted.

April 23, 2019

Visit Notes: Undercutter Project, Mill River to Branford

Introduction

A contract undercutter together with associated work equipment and work crews had started work on Track 1 of the Shore Line between MP 73.9 (Mill River Jc.) and Branford (MP 81.2) on April 14, 2019. The project plan shows the planned completion date is June 6, 2019, after which the crews will move further east to undercut more track. Details of the planned work and safety procedures are provided in a Site-Specific Safety Work Plan. A hard copy of this plan is available. All service trains were operating only on Track 2 for the duration of the project.

The work was being performed under the authority of a Form D taken out each morning before work started and was relinquished at the end of the working day. Overnight, the out of service track was on a dispatcher hold, until work resumed. The dispatcher hold enabled the dispatcher to authorize restricted speed train movement on the out-of-service track, for example for a delivery of new ballast or removal of spoil.

Summary of Work to be Performed

An undercutter project involves far more than just undercutting. The main tasks are as follows:

- Preparation, including de-energizing the catenary, removing all rail connections and devices (including ACSES transponders) that could be damaged by the undercutter, and a tamper pass to slew the track laterally so that track centers between tracks 1 and 2 are at least 12'-6". This is to ensure that the undercutter can work without fouling the adjacent track. A vacuum truck is used to remove ballast where the undercutter will be inserted and around all the rail connections to enable prep work to be carried out. Damaged concrete ties are removed and replaced by a tie gang.
- The undercutter is inserted – a wing each side if the track is inserted laterally, meeting on the centerline. Ballast is cleared away under the track at the point of insertion by a vacuum truck. Insertion requires foul time, but the undercutter is able to operate after insertion without foul time. The undercutter moves forward at 1-2 ft/sec, extracting ballast to a depth of 12-18 in using a screw mechanism. The extracted ballast is fed to a shaking screen table which separates good ballast from fine material. The good ballast is dumped back on the track behind the undercutter and the extracted fines are conveyed to a ballast car following the undercutter or are dumped at trackside.
- New ballast is dumped behind the undercutter, followed by a ballast regulator and two tamping machines working in tandem to restore the track to the correct alignment and height. At the point where this tamping was observed, the track level appeared very low, and further deliveries of ballast and passes of the tampers were clearly required to restore the correct track level. Use of the ballast regulator requires foul time, but the tampers can work alongside an active adjacent track. The undercutter was working from West to East.
- The final steps required to restore the track to operating condition are one or more passes of a ballast stabilizer to consolidate the ballast (this minimized the period of lower speed operation after completion of the project), restore all electrical and train control

related connections to the track, including ACSES transponders, and rail de-stressing to restore the correct neutral rail temperature.

Visit Observations

Two sites were visited during this trip. The first was where the follow-up tamping was taking place. This work was being performed on a long curve with moderate visibility on a low bank. All activities were observed from the inactive track or at lineside outside the active track. The second site, further east was where the undercutter was working. This was a more challenging site from a safety point of view. There was no access for highway vehicles, and it was necessary to walk along the inactive track to get to where the undercutter was working. This was on a curve and in a rock cut with steep sides and only minimum clearance outside either track, just sufficient for the catenary support structures and a ditch. Visibility was very limited. Operation of the undercutter had to be observed from the active track, relying on the watchmen for safety. These were stationed at close intervals on the outside of the active track (inside the curve) and provided an audible and visual warning of an approaching train. The two sites were at least a mile apart and each was out of sight of the other. Overall, the watchmen seemed to provide very good safety oversite at the work site, but it was clearly labor intensive. About 20-25% of on-site personnel were watchmen, although there would have been fewer at a site with better visibility.

Foul time could be requested by the foreman at either site. It was not clear how they communicated with each other, but they clearly must have. All the supervisors kept their radios on and usually monitored communications on the primary dispatching channel. They recognized the voices of the different foremen working in the area, including a crew working nearby on the Hartford-Springfield line and a track inspector. Message content, of course, also explained the purpose of the exchange. Another concern was how everyone on site was kept up to date with the current status of foul time. Foul time was granted and cancelled several times during the visit, generally when there was sufficient time between service train movements. It was not clear how everyone on site was kept aware of current status and when it was safe to be on or near the active track. A possible explanation was that only workers active on the task that required foul time were kept aware, and other staff assumed that there was no foul time in effect and relied on the watchmen for their safety.

Summary

Two major points were raised when the foremen were asked what could be improved. One was radio capacity. Use of the single radio channel was very limiting regarding the number of messages that could be handled at busy times. Foremen reported that when the radio channel was congested, sometimes someone had to step in (the dispatcher) and insist that non-urgent messages wait and set a priority for important traffic. The up side of the single channel is that the whole crew was better informed and there was little danger of missing critical messages while tuned to another channel. The crew was generally aware of the plans for electronic foul time communications and expected that to reduce radio traffic.

The second point concerned understaffing. Because of recruiting cycles a generation ago, there had been many retirements among roadway workers, and the crew was below its planned strength. With current wage scales and very low unemployment in the area, it was difficult to

recruit more workers. Some of this was due to rivalry between area railroads, such as Metro North.

Although not strictly related to safety, there is a worry that some of the work being performed may not be fully effective. The narrow rock cut where the undercutter was working clearly had poor drainage. The tops of ties ahead of the undercutter were covered in mud, and the ditch to the outside (west) of track 1 was full of water from recent rain. A pair of backhoes was working to clear out this ditch but were having difficulty dumping the spoils on top of a steep bank, and some tended to fall back into the ditch. There were also larger rocks in the ballast, which perhaps had fallen from the steep bank, and would jam the undercutter. Hand work to clear the undercutter was required, with the workers standing in the water in the ditch. It looked as if a more comprehensive drainage project was needed to ensure a durable improvement. The safety angle was that the work environment was being made more challenging and lower quality work would shorten the interval before more track work was needed.

June 3, 2019

Dispatching Center Visit: Wilmington CETC

ACSES

To address problems related to human error on the Amtrak owned portions of the Northeast Corridor (NEC), Amtrak has instituted a system called the Advanced Civil Speed Enforcement System otherwise referred to as (ACSES). In conjunction with cab signaling, ACSES functions as Amtrak's positive train control (PTC) system. While meeting with dispatching employees at the Amtrak Wilmington CETC location, the following notes and comments were shared, regarding the current ACSES program:

In Wilmington, it was explained that the dispatching system in New York is 20 years old, while the dispatching systems in Boston and Wilmington are newer commercial systems. Soon, the dispatching centers in Wilmington and Boston are migrating to the New York system to minimize cost, and limit reliance on an outside party for updates and service. This transition will result in the temporary loss of the electronic Form D feature.

In further discussion about the ACSES system, Amtrak representatives explained that the program only functions to impose speed restrictions, enforcing the slow-by as a manual entry by the dispatcher at the start time of field work. While the ACSES system electronically captures and transmits data transcribed from the Form D, a physical Form D document is also distributed to train crews. This physical document is validated after communication of receipt by a minimum of 5 train crews.

There is also a document called a Temporary Speed Restriction Bulletin (TSRB) that functions as a consolidated Form D. The TSRB document is distributed daily at about 5AM, with each division issuing their own version of this document containing the relevant speed restrictions for the day.

Regarding the ACSES program, the following issues were discussed:

1. Slow-by information cannot be logged ahead of time. Instead, slow-by data must be registered into the system at the start time of work. As a result, prior to issuing a speed restriction, all train movements are stopped as a protective measure, resulting in up to 30-minute delays or more. One Amtrak employee expressed his preference for SEPTA's method of issuing verbal warnings according to special instruction from a rule book.

2. Norfolk Southern, who operates equipment across the NEC uses a positive train control system called I-ETMS. This system does not interface with Amtrak's system, and there is no enforcement for compliance with Amtrak's system along the corridor. Though Norfolk Southern releases a transcript of incoming trains along the mainline, this practice limits the protection of work zones from Norfolk Southern trains.

3. Also, Form D information concerning Hi-Rail equipment is not transmitted to oncoming trains.

4. Lastly, the ACSES system's inability to provide blocking protection was highlighted. Protection in the form of "foul time" is provided only after a work zone supervisor relays the protection needs of the work zone to a dispatcher. The dispatcher records the directive, and a blocking measure appears on the dispatcher's screen but is not transmitted to the field. Subsequently, work zone groups are required to implement supplemental shunting devices as a back-up safety measure. The dispatcher's block is removed only after a supervisor reports all track equipment clear.

Radio Issues

Beyond the ACSES program, radio congestion was highlighted as a barrier to employee safety. In times of high traffic, dispatching supervisors mentioned the propensity for messages to be intercepted between work crews, requiring supervisors or team members to repeat back information to the dispatcher in an effort to ensure accurate communication. Amtrak employees expressed this need for repetition diminished situational awareness in the field and was a source of potential error.

Dispatching Work Distribution

In accordance with Amtrak procedures, only a dispatcher qualified on a segment of track can log into the dispatch desk that services that track. Additionally, there is a day and night shift. Generally, during the day shift approximately 50-miles of track is monitored by two dispatchers, with the workload split evenly. Conversely during the night shift, when there is reduced traffic, one dispatcher is responsible for the entire 50-mile segment. Further, a job briefing occurs between dispatch shifts, where the outgoing dispatcher communicates relevant information regarding the status of trains and work crews to the incoming dispatcher.

C^3RS

Following discussion about Amtrak's dispatching practices, employees described current on-track safety measures related to maintenance of way work. Meeting attendants discussed Amtrak's C^3RS program, which enables field and dispatching employees to close-call report incidents without fear of retribution. The program serves to function as a feedback mechanism for incidents that do not result in injury or damage that meets the FRA threshold. While the program has been implemented, Amtrak employees expressed the opinion that the program does not operate effectively, commenting that while at least one close-call incident is reported a day, employees have limited awareness concerning the execution of follow-up activities like investigations, or recommendations for corrective action. Furthermore, the employee recalled an occasion with serious safety implications, where a dispatcher mistakenly directed freight into a work zone, and close-called the incident, because there was no injury. To add, there is a large time elapse between the occurrence of a close-call incident, and the official receipt of C^3RS documentation. As a result, management does not have the resources to evaluate the incident and issue a violation charge if necessary, on a timely basis.

Insights Moving Forward

At the end of the meeting, Amtrak employees were given the opportunity to share their desired improvements to Amtrak dispatching procedures. While employees acknowledged that phase 1 of Amtrak's system had not functioned as originally proposed there was optimism about the finished development of the system, as phase 2 includes implementation of work zone protection by Form D.

In conclusion, to enhance the efficiency of speed restrictions, and minimize train delays, one dispatching supervisor expressed the desire for a route protection feature. With route protection, the system would have advanced awareness of the route the train will travel.

June 11, 2019

Dispatching Center Visit: New York CTEC

The New York Centralized Electrification and Traffic Control (CETC) center consisted of office space, and a large conference room overlooking the main control room. The control room hosted large, active screens displaying the New York CETC controlled segments of the Northeast Corridor (NEC). The configuration of the screens was similar to Wilmington's CETC center; however, the colors seemed less vivid. In total, there appeared to be about 12 dispatching desks, with 3 desks solely devoted to Penn Station. Specifically, one desk served the station itself, while the other desks oversaw the approaches to the station through the Hudson and East River tunnels.

As the visit took place in the late morning, dispatchers appeared to be less busy than peak period activity. Nevertheless, the dispatching center hosted a calm atmosphere giving the impression that the center was well managed.

After observing the main control room, the following topics were discussed:

ACSES

Comparing the earlier Advanced Civil Speed Enforcement System (ACSES), and the current ACSES system being used, an Amtrak representative expressed their preference for the former version of ACSES, which they believed functioned better than the newer commercial version of ASCES. The employee mentioned that the current software has a tendency to yield signals that "bleed" over tracks, causing trains that are operating concurrently to proceed at the lowest programmed speed. Additionally, engineers can experience issues when reversing trainsets if the ACSES on-board system is not reset properly. In such cases, the system employs default braking settings, preventing the engineer from initiating train movement, which may cause a delay. Further, the Amtrak employee mentioned that SEPTA trains may be issued penalties, as the system thinks the trains are rolling backwards. The braking rate enforced by ACSES can be more restrictive than that of an experienced engineer, further increasing the likelihood for delays. Note this is a common issue with positive train control (PTC) and similar systems that enforce braking to a defined target, as the system anticipates the stop signal. Moreover, although adaptive braking systems can reflect the actual braking performance of individual trains to some extent, these systems cannot reflect the variables considered by an experienced engineer like terrain, grade, curvature, and weather.

Infrastructure

Next, the conversation focused on the condition of Amtrak's infrastructure in New York. An Amtrak employee expressed concern with the state of good repair of the railroad and its congestion. It was stated that about six hundred trains travel through the New York tunnels on any given day with two tunnels out of service each night.

In addition, Portal Bridge was highlighted as a vulnerable point along the mainline, with the bridge getting stuck open on occasion after opening to permit maritime traffic. On other

occasions, the rails on the bridge do not adequately re-align, prompting signals that prevent trains from passage. In either case, time is required to transport a repairman to resolve the issue, resulting in delays. Similar to Wilmington's CTEC facility, switch failures were cited as a common daily occurrence.

Track Usage

The Amtrak controlled West end of Penn Station encompasses track territory that spans from Harold interlocking to the regions of Trenton, and Newark; while, the East end is a joint venture between Amtrak and the Long Island Railroad (LIRR). On the West end, the division is usually only operating three tracks in support of MOW activities like the Constant Tension Acela project. Notably, track two has been continuously out of service from Ham Interlocking to Adams Interlocking. Otherwise, track usage is discussed and reported on a daily and weekly basis. For day-time needs, a daily usage form must be submitted by 10:00AM.

Temporary Speed Restriction Bulletin (TSRB) & Supplemental Shunting Devices (SDD)

An Amtrak representative shared their preference for the issuance of the document by the track foreman or supervisor overnight. This would allow the TSRB's contents to be logged into the system in the morning by the Assistant Chief. It was also noted that employees are required to use supplemental shunting devices when fouling with equipment for 5 minutes or more during the completion of on-track work.

Amtrak Staffing

In discussion about personnel, an Amtrak representative suggested that the organization was in need of individuals who take their jobs and safety measures seriously. The employee even recalled instances where they "banned" Foreman from the railroad who they deemed as unfit or unprepared to execute their roles properly. As a solution, the representative proposed that the organization hire individuals with previous rail experience or train personnel in the field longer. Additionally, the representative encouraged mentorship. For example, after a candidate completes their physical characteristics examination and can serve as a dispatcher, that individual spends one to two months at the desk with another dispatcher as part of on the job training before taking on solo operations.

Radio Issues

New York Amtrak personnel expressed substantial dissatisfaction with the voice radio system used to communicate with the roadway workers, track cars, and trains in the field. Radio issues were criticized as a safety hazard, impeding employees' ability to communicate and receive messages effectively and serving as an added stressor. The employee emphasized issues such as variable coverage from base stations along the right-of-way (ROW), stating that correspondence from some stations is inadequately transmitted, while messages from other stations are heard beyond their intended locations. Further, the Amtrak employee recommended implementation of a trunk radio system comparable to technology used by the police force.

The information included in this document comprises discoveries gathered from MOW work site visits, CETC dispatching center visits, and meetings with Amtrak personnel.

SPARTAN System

When questioned about the organization's auditing practices, a representative detailed Amtrak's SPARTAN system. For physical operational testing, a testing officer observes track work procedures, assessing various skillsets like employees' stop signal, braking, and shoving capabilities. After completing the prescribed test, the employee is deemed compliant, in need of coaching, or issued a warning. In discussion, quotas associated with the SPARTAN system were cited as a problem, with the operations testing officer being required to issue a minimum of about fifty tests a month. Similarly, engineering must complete forty core tests. While Amtrak issues fifty to one hundred tests a week, reporting two to four failures, this failure rate does not correlate to Amtrak's current performance statistics. The employee commented that corrective measures are continuously employed; however, these actions are not usually safety offensive.

AMTRAK – SMS (Safety Management System)

Amtrak is instituting a comprehensive new safety management system (SMS) to improve their safety culture, which they're referring to as "JUST" Culture. "JUST" Culture aims to eliminate the culture of fear, labeling incidents with the following behavioral categories: complete mistake, at risk, or deliberate. SMS is intended to change from reactive responses to individual safety events towards a continual assessment and predictive understanding of risks facing the entire organization before an unwanted event occurs. Amtrak noted that SMS has been a cornerstone of improving safety in the aviation, healthcare, and energy industries.

Insights Moving Forward

When asked about recommendations to improve Amtrak's operating environment, an Amtrak employee commented that on-time performance improved with reduced service due to ongoing renovations at Penn Station. Accordingly, the employee endorsed the practice of operating less service trains during track work, or scheduling more frequent and longer work windows at night.

July 26, 2019

Teleconference: Short-Term and Long-Term Solutions for Safety of MOW Operations

Introduction

The information included in this document comprises discoveries gathered from MOW work site visits, CETC dispatching center visits, and meetings with Amtrak personnel in order to address the issue of MOW Safety on the Northeast Corridor (NEC).

Additional information regarding slow-by rules was requested. An Amtrak employee informed LTK consultants of the previous and current slow-by rules. Amtrak's previous slow-by rule required a slow-by when the train went by the actual maintenance machines. Amtrak has since implemented a new rule, which gives the option to implement a slow-by whenever needed. A slow-by is minimally required for TLM and undercutter machines.

The increase in incident reporting in the recent few years was also discussed. An Amtrak employee described the "Safe to Safer" program that was implemented about 5 years ago; which led to an increase in incident reports. Since implementing this program, there has been a noticeable increase in reports to the extent that minor incidents like tripping have been logged; employees have begun to err on the side of caution. Amtrak's safety team has placed emphasis on reporting any incident that could potentially be serious in the future. It was noted that while this is a great improvement, the incident reports need more structure and need to be much more thorough.

Short Term Solutions

Due to employee criticism of the voice radio system, it has been recommended that the voice radio system be improved, and potentially be converted to a digital system. An Amtrak employee stated that there is a capital project focused on improving the radio systems of the NEC.

It was recommended to Amtrak to initiate a more thorough incident reporting process. An HFACS procedure would be better as it forces all incident reports to be investigated from every angle, and it gives a breakdown of structural issues within the organization that could be contributing to accidents. An Amtrak employee stated that a contributing factor as to why incident reports lack information in certain cases is due to a 24-hour completion rule; if an employee involved in the incident is unconscious or in the hospital, it makes completion of incident reports in 24 hours rather difficult as they cannot answer all necessary questions within that time frame. It was then discussed that there needs to be a review process in which an Amtrak employee will go back and review incident reports and request the missing information. An Amtrak employee replied that the safety department reviews all incident reports received once a week to determine whether incidents of the previous week are of concern or not. The Amtrak employee also stated that the engineering department does investigations for certain incidents. Additionally, it was recommended that the training for filing an incident report be changed, urging employees to be more thorough in the reporting process.

The information included in this document comprises discoveries gathered from MOW work site visits, CETC dispatching center visits, and meetings with Amtrak personnel.

Next, it was recommended that the “Blame Culture” present within Amtrak’s organization be addressed and changed. Correspondence and other visits have given the impression that blame culture is a significant source of mistrust and discontent from Amtrak employees, which infringes on the possibility of an accurate accident investigation. An Amtrak employee addressed this point by informing all of the new program at Amtrak called “Just Culture,” which emphasizes preventing accidents from reoccurring in the future rather than emphasizing that there must be an employee at fault, and they must be penalized accordingly. It is also noted that this culture change is new, and education is still being implemented throughout Amtrak’s corporation.

It was next recommended that there be more on-the-job training for new employees. There are reports of a surge of new and young employees within Amtrak since the generation previously working has largely retired. Younger/new employees are not as confident, safe, or efficient on the job. It was also recommended that the watchman function be improved, due to the fact that this can be a single point of failure, as currently the process is entirely manual. An additional concern here is that workers can not hear an audible warning because the machines in operation can be loud. Another recommendation made was to perform a comprehensive safety check and job briefing before maintenance work begins.

Lastly, it was recommended that scheduling for roadway maintenance work should begin to allot more time for each job. Doing so will reduce the exposure to hazardous conditions for maintenance workers. Increasing the scheduled maintenance time reduces the amount of work that is high-risk and done under heavy traffic conditions, which makes conditions safer for maintenance workers and tends to keep projects on time and within budget.

Long Term Solutions

It was noted that ACSES has significant inflexibility when used to implement TSRBs and out of service blocks. Amtrak explained that dispatchers implement work zones by placing a manual block to prevent trains entering the work zone. The question of whether Norfolk Southern trains on the NEC are equipped with ACSES readers was addressed. An Amtrak employee commented that the NS trains had a separate system to use for train-to-control center communications and would request further information regarding this issue.

Additionally, it was recommended that there be an automated tacking process of trains, because there is currently only a manual process in place where the dispatcher relies on radio communication from approaching trains. Implementing an automatic tracking system will minimize the need for voice radio communication and the chance of error.

July 30, 2019

Teleconference: Amtrak Incident Reporting

Introduction

The topic of this meeting is Amtrak's incident reporting process. This includes how the process has changed in recent years, what it encompasses currently, and future changes Amtrak's safety department plans to make.

Changes in Reporting Requirements

There has been an increase in incident reporting in the last few years, both in Amtrak internal reports and FRA reportables. An Amtrak employee stated that there used to be two forms to fill out and they have since been combined into one form; this encourages employees to be more thorough because they do not have to go to the effort of filling out information twice. It is important for employees to know what types of events they should be reporting and to practice better reporting procedures. It was noted that FRA reportables must reach a certain threshold of damage.

An Amtrak employee stated that once a report is received, it is stored in "Grade crossing incidents," a folder which encompasses any incident, collision, derailment, or other event. The safety department analyzes these reports weekly. It was asked if after these incidents were reviewed, whether Amtrak sent out notices to employees to prevent reoccurrence. The process for reviewing incidents needs improvement.

Changes in Safety Culture

Amtrak's new "Just Culture" has changed the environment from Amtrak being a disciplinary organization to a learning organization where the goal is to prevent similar mistakes in the future. An Amtrak employee stated that there is now a Risk Review Board as a part of the official process, which has been in effect since about October 2018. That is in addition to the implementation of the new "Just Culture" program also in effect since October 2018.

The topic of Amtrak's "Cardinal Rules" was raised. The "Cardinal Rules" are a set of rules that will lead to immediate dismissal if broken. Amtrak has formed a committee to review the cardinal rules and transform them into the top "safety sensitive rules," which are the critical set of rules that must be followed in order to maintain personal and others' safety. This is an effort to remove the negative connotation from the cardinal rules. It was noted that systemic issues deter rule compliance.

Training and Safety Measures

The topics of on the job training and job hazard analysis were discussed. Due to the young or inexperienced workforce, the training program should emphasize extended on the job training to ensure that employees responsible for safety critical tasks are adequately trained to complete these tasks. Additionally, employees should be trained to conduct job hazard analyses when they are introduced to a new role or environment.

An Amtrak employee stated that there is now a quality assurance audit team to ensure that the front-line supervisors are doing their part to keep the work zones safe. It was asked if Amtrak rules are implemented differently across the NEC. Different divisions may interpret the roadway protection procedures differently, causing discrepancies in safety procedures. Additionally, it was asked if there is something being done to train employees to fill out forms with as much information as possible. The process needs to be taught to all employees and standardized.

Summary

At the end of the meeting, there was discussion of data provided to LTK. It was discussed that the organization and exchange of information was not always adequate and consistent, therefore improving the central reporting system could streamline the process. Therefore, it is recommended that Amtrak simplify the HFACS process and implement it.

Support Findings from the Chester, PA NTSB Report & HFACS Analyses

Support Findings from the Chester, PA NTSB Report & HFACS Analyses

The Human Factors Analysis and Classification System (HFACS) model was applied to a group of seventy incidents to identify areas of concern within Amtrak's maintenance of way (MOW) work practices. Application of the HFACS model allows individuals to identify causal factors and to produce a systematic multifaceted error analysis by evaluating roadway workers' ability to interact with colleagues and tools to execute tasks in their work environment. After careful review of incident files made available by Amtrak, about sixty percent of the incidents analyzed were not accompanied by supplemental reports; mainly, incidents predating the year 2011. Although there is an apparent deficit of information existing for incidents predating 2011, increased reporting for incidents in recent years indicates a positive data capture trend. Nonetheless, the scarcity of information prevented many incidents from being evaluated beyond the surface level, and in most cases latent failures related to organizational influences and supervision could not be derived from the provided information.

In an attempt to provide some insight into causal factors relating to potential organizational influences and supervision, the National Transportation Safety Board's (NTSB) report of the 2016 Chester, PA accident was referenced. The NTSB's report identified several human errors that indicated larger safety concerns within Amtrak's organizational culture. In this document, some contributing elements of the Chester, PA accident are highlighted to discuss organizational shortfalls and to recognize the status of Amtrak's efforts to achieve an improved safety culture.

Supplemental Shunting Devices

Amtrak's Rule SI 140-S2 commands the use of an SSD when equipment fouls a track in signaled territory or within interlocking limits for a duration of time that exceeds 5 minutes (Amtrak 2016). Accordingly, the employee-in-charge (EIC) of covering fouling activities is required to apply the device to the track after communicating the need for foul time to the dispatcher. The application of the SSD then activates track occupancy logic on the dispatcher screen. Throughout the report, the NTSB emphasizes that the presence of SSDs on the track would have prevented the Chester accident (NSTB 2017).

During an interview with investigators, the night foreman explained that he did not have access to SSDs. Although Amtrak was promoting the use of SSDs, this safety device was not readily available to employees. Furthermore, *"the foreman was not questioned about applying SSDs by the dispatcher or the track supervisor, indicating an organization wide disregard for SSDs at the time of the incident"(NTSB 2017)*.

Fortunately, Amtrak addressed this oversight soon after the incident, issuing alerts that addressed protocols for fouling track and emphasized the use of redundant protection for roadway workers, as recommended in the NTSB's report. Additionally, the organization outfitted all of their roadway equipment with dedicated storage for SSDs. While attending meetings at Amtrak's CETC dispatching centers in New York and Delaware, SSDs were referred to as on-track safety protection requirements at both locations.

Site-Specific Work Plan

Beyond the implementation of supplemental shunting devices, the NTSB's report recommended the execution of site-specific work plans (SSWP) for all on track maintenance projects to assess the risks associated with designated worksites. "SSWPs also promote the adequate coverage of topics like the statement of work, staffing and equipment requirements, relevant hazards, and safety prior to the start of track work"(NTSB 2017). In the case of the Chester, PA incident, "*the engineering department of Amtrak's Mid Atlantic Division within the NEC worked with the transportation department to implement the Chester project's 55 hour track outage, but it did not prepare a site-specific work plan*" (NTSB 2017). Though Amtrak does require foremen to complete job assignment tasks, conduct job briefings, and oversee on-track safety protection while the track supervisor oversees the work progress and overall job-site safety, these roles do not necessitate control over all the elements of work planning. For example, the report notes that *"the single watchman's view of incoming trains was insufficient and prevented him from providing a timely warning of approaching trains"* (NTSB 2017), suggesting that an SSWP could have mitigated risks by considering the number of watchmen needed to support on track safety for the project.

On-Site Job Briefings

Although a site-specific work plan is not executed for smaller work projects, Amtrak requires the completion of on-site job safety briefings for all MOW activities prior to the start of work. However, during the Chester project, the day foreman overseeing work activities told railway workers that the tracks were protected without conducting a job briefing. In fact, the foreman attained eight signatures from employees on a job briefing form. Only the RailVac superintendent refused to begin work without the completion of a job briefing, prompting the foreman to vocalize statements about foul protection. In the absence of a formal job briefing, the RailVac superintendent proceeded, signing the job briefing. At that point in time, the day foreman had not called the dispatcher to pick up the previous foreman's fouls as instructed, and when interviewed later, the day foreman expressed his intention to complete the foul time log during the course of work.

Shift Change – Transferring Foul Time

In the Chester, PA accident, the night foreman was eager to leave the worksite after his twelve-hour shift. The day foreman arrived late to the job-site. The transfer of foul time was not executed according to Amtrak procedure. Amtrak requires the removal of all on-track equipment and work staff by the exiting foreman prior to the release of foul time. The incoming foreman must contact the dispatcher to request the same required fouls prior to permitting workers, and equipment to resume track work. The NTSB report notes that this procedure is not efficient, and slows the progression of work. The short-cut utilized to release and request foul time by the day and night foremen, without the removal of equipment or track laborers, was considered common practice at the time of the accident. Note, "the director of operating practices indicated that a process that allowed foreman to communicate with a train dispatcher to jointly transfer their fouls with a train dispatcher's knowledge and approval could be designed and implemented…[to decrease] the opportunity for a single point failure by one or both of the foreman"(NSTB 2017).

Safety Management System

After identifying a variety of unsafe conditions and risky behaviors related to the Chester, PA accident, the NTSB concluded that safety appears to be low priority in Amtrak employees' performance practices and decision-making processes. NTSB also suggested that these findings are indicative of a systemic problem within Amtrak's safety culture. The report highlights twenty-nine active failures and latent conditions connected to the fatal accident. Similarly, the application of the HFACS model in this study of seventy Amtrak MOW incidents, spanning the years 2000 to 2018, revealed an assortment of active failures and latent conditions related to human causal factors.

At the time of the Chester, PA incident, Amtrak had three safety programs in place: Safe-2-Safer, C^3RS, and the Safety Liaison program. Amtrak in negotiation with workforce unions, permitted union employees to opt out of the Safe-2-Safer and C^3RS programs. To elaborate, employees viewed the policies as excessively punitive and believed such programs in conjunction with Amtrak's Cardinal Rules policy enabled managers to place blame directly on workers. Interviews with Amtrak confirmed senior leadership's perspective that workers were primarily accountable for their safety needs, and incidents could be prevented by the proper execution of rules. It should be noted that the Safety Liaison Program suffered from being understaffed.

Currently, Amtrak is migrating to a Safety Management System named "Just Culture" in an effort to diminish blame culture in the work force and address system wide safety concerns. In recent talks with Amtrak personnel, representatives shared the idea that safety is not the burden of one individual, as Amtrak seeks to hold workers, managers, and supervisors collectively accountable without exercising undue severe punishments. Labeling incidents with the following behavioral categories: complete mistake, at risk, or deliberate, Amtrak aims to eliminate the culture of fear with "Just Culture."

References

Ntsb.gov. (2017). *Amtrak Train Collision with Maintenance-of-Way Equipment*. [online] Available at: https://www.ntsb.gov/investigations/AccidentReports/Reports/RAR1702.pdf [Accessed 29 Jul. 2019].

AMTRAK MOW INCIDENTS

HUMAN FACTORS ANALYSIS & CLASSIFICATION SYSTEM (HFACS)

MOW Equipment Collisions

MOW Equipment Collisions

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
113703 - 2009	**AB - MP 75.1**	AMTRAK PETTIBONE WAS STOPPED AT SHORELINE JCT HOME BOARD, CONTRACTED HY-RAIL HOLLAND WELDING TRUCK FOLLOWING PETTIBONE, MAKING REVERSE MOVE, FAILED TO STOP, RUNNING INTO THE REAR OF THE PETTIBONE.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00	1A, 1C	**Over-Controlled/Under Controlled System:** The contracted hi-rail Holland welding truck following the Pettibone failed to stop while making a reverse move and ran into the Pettibone vehicle. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	**N**
156569 - 2018	**AB - MP 83.06 TR 1**	THREE PIECES OF EQUIPMENT WERE MOVING EAST AND STOPPING AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING. THE LEAD PIECE WAS STABILIZER A16106, FOLLOWED BY REGULATOR A14314 AND THE FINAL TRAILING PIECE WAS TAMPER L11507. LEAD PIECE A16106 HAD STOPPED AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING ALONG WITH REGULATOR A14314. THE TRAILING PIECE L11507 WAS UNABLE TO STOP SHORT OF THE REGULATOR TO THE EAST CAUSING IMPACT AT APPROXIMATELY 2-3 MPH. THERE WERE NO INJURIES TO REPORT.	**Injuries:** None **Associated Damage Cost:** Equipment: $400.00	1A, 1C	**Over-Controlled/Under Controlled System:** As apart of a three piece equipment consist, the tamper was unable to stop short of the regulator, and caused impact between the two vehicles. **Widespread/Routine Violation:** Per report, the tamper operator allegedly violated NORAC Rule 80. **Breakdown in Visual Scan:** The primary cause of the incident was listed in the report as a failure to stop within half the range of vision.	2B	**Workspace Incompatible with Operation:** The statement, "stop needed to be made on top of a greaser just west of the eastbound home board for Orchard interlocking, causing the tamper to slide," was listed as the secondary cause of the incident.	**Y**
156047 - 2018	**AB - MP 94.4 TR 2**	A TRACK SUPERVISOR REPORTED TWO PIECES OF TRACK EQUIPMENT, A BALLAST REGULATOR (A14404) AND TAMPER (A10508) COLLIDED IN THE OUT OF SERVICE TRACK AT MP 94.42 ON #2 TRACK. THERE WAS MINOR DAMAGE TO THE BATTERY DOOR REPORTED ON THE BALLAST REGULATOR.	**Injuries:** Two employees requested medical attention for back pain, and were transported to nearby medical centers, diagnosed, and released. **Associated Damage Cost:** Equipment:$300.00	1A, 1C	**Over-Controlled/Under Controlled System:** The ballast regulator and the tamper collided in the out-of-service track. Specifically, within a five piece equipment consist, the tamper operator failed to stop, and collided with the regulator vehicle. **Rushed or Delayed Necessary Action:** The operator slowed the idle of the machine, and began braking, but was not able to stop in time to prevent collision. **Breakdown in Visual Scan:** The primary cause of the incident was listed in the report as a failure to stop within half the range of vision. **Widespread/Routine Violation:** Per report, the tamper operator allegedly violated NORAC Rule 80.	2B	**Workspace Incompatible with Operation:** Realizing that he could not stop, the tamper operator instructed the stopped regulator to move east via radio. The regulator operator tried to move, but the vehicle did not have good traction due to grease on the rail in a curve. **Instrumentation Issues:** The incident was initiated when the third piece operator radioed that he was coming to a stop and needed a mechanic to repair a leak on the machine. Additionally, the tamper operator stated that he did not feel a brake application.	**Y**

MOW Equipment Collisions Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
112484 - 2009	AB - MP 194.5	A JUNIOR TAMPER MACHINE A 11267 RAN INTO THE BACK OF A SWIVEL DUMP TRUCK AG 95399 AT MP 194.47 IN ATTLEBORO, MA.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $21,600.00	1A, 1C	**Over-Controlled/Under Controlled System:** The junior tamper machine ran into the back of the Swivel dump. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	N
97800 - 2005	AB - MP 203.6 TR 2	BALLAST REGULATOR A14117 MADE CONTACT WITH TAMPER A10707 WHICH WAS STOPPED ON NO.2 TRACK AT MP203.6 IN MANSFIELD.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $35,000.00	1A, 1C	**Over-Controlled/Under Controlled System:** The ballast regulator made contact with the tamper. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	N
109728 - 2008	AB - MP 213.8	GEISMAR CRANE A50410 STRUCK REAR OF WELDING TRUCK STOPPED AT HOME SIGNAL FOR JUNCTION INTERLOCKING. SPERRY CAR TESTING IN INTERLOCKING, CRANE FAILED TO STOP.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1C	**Over-Controlled/Under Controlled System:** The Geismar crane failed to stop, and collided with the welding truck. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	N
71652 - 2001	AB - MP 221.5 TR 2	QUADDRILL UNIT T15301 WAS TRAVELLING ON #2 TRACK UP TO THE READVILLE MCE. FACILITY. THE OPERATOR OF THE QUADDRILL DETERMINED THAT THE SPIKER UNIT T23402 WAS STOPPED AHEAD OF HIM ON TRACK 2. THE OPERATOR APPLIED BRAKES APPROXIMATELY 150 FEET FROM THE STOPPED UNIT BUT HE REPORTS THAT HIS PRIMARY BRAKES DID NOT FUNCTION.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00	1A	**Over-Controlled/Under Controlled System:** Per operator, upon determining that the spiker unit was stopped ahead of him, he applied the brakes, but they did not function properly.	2B	**Instrumentation Issues:** The operator stated that his brakes did not function properly.	N
114883 - 2010	AB - MP 222	VACUUM TRUCK AU-18673 STRUCK THE REAR OF A RENTED VACUUM TRUCK NEAR BOSTON, MA.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $57,050.00	1A	**Over-Controlled/Under Controlled System:** The vacuum truck struck the rear of a rented vacuum truck.	N/A	**Insufficient Information Provided**	N

MOW Equipment Collisions Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
140362 - 2015	AN - MP 23.6	TWO PIECES OF TRACK EQUIPMENT, REGULATOR TC14328 AND 6700/TC11029 COLLIDED AT THE EASTBOUND HOME SIGNAL AT MENLO. THE BRAKING DISTANCE OF THE REGULATOR WAS INCORRECTLY JUDGED AFTER HEARING THAT THE LEAD EQUIPMENT WAS STOPPED AT THE HOME SIGNAL. NO EMPLOYEES WERE CHARGED WITH A RULE VIOLATION, DUE TO NOT MEETING THE 30 DAY TIME FRAME TO FILE. AMTRAK'S EQUIPMENT DAMAGE ON TC11029 WAS $15,000.00.	**Injuries**: Information not provided **Associated Damage Cost:** Equipment: $15,000.00	1A, 1B, 1C	**Rushed or Delayed Necessary Action, Over-Controlled/Under Controlled System:** After hearing that the lead equipment was stopped at the home signal, the regulator incorrectly judged the braking distance and collided with another **Ignored a Caution/Warning, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The lead equipment transmitted a message that it was stopped at the home signal, and the regulator proceeded, braking too late to prevent collision. **Widespread/Routine Violation**: *Appears to be an operating rule violation; however, due to not meeting the 30 day time frame to file, the employees were not charged with a rule violation.*	N/A	**Insufficient Information Provided**	N
135912 - 2015	AN - MP 24.2 TR 4	TIE GANG TRAVELING EAST INSIDE OF OUT OF SERVICE TRACK ON NO.4 TRACK WHEN COLLISION OCCURRED AT MP24.2. BALLAST REGULATOR STOPPED, FLASHED LIGHTS TO SIGNAL STOPPING. JR. TAMPER NEXT IN LINEUP FLASHED ITS LIGHTS TO SIGNAL IT STOPPING. THE TIE HANDLER 2 FOLLOWED BY SIGNALING IT WAS STOPPING. THE NIPPER CLIPPER FOLLOWED, FLASHED ITS LIGHT IN THE SAME MANNER. THE TRIPP 2 MACHING WAS APPROACHING AND COLLIDED WITH THE NIPPER CLIPPER. THE NIPPER CLIPPER WAS PUSHED INTO THE TIE HANDLER 2.	**Injuries:** Employee in the nipper clipper was injured, receiving 17 stiches on the left side of his forehead. **Associated Damage Cost:** Equipment: $500.00	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The Tripp 2 machine collided with the nipper clipper, pushing the nipper clipper into the tie handler **Break Down in Visual Scan:** The Tripp 2 machine operator failed to observe the nipper clipper's light indication signaling it's stop. **Ignored a Caution/Warning:** Though other equipment pieces were able to communicate coming to a stop using their vehicle lights, the Tripp machine failed to successfully respond to the warning. Furthermore, the foreman operating the ballast regulator at the front of the equipment consist transmitted his/her intention to stop over the radio. **Widespread/Routine Violation:** Per report, the incident was classified as an alleged operating rule violation.	N/A	**Insufficient Information Provided**	Y
114041 - 2009	AN - MP 34.9	TRACK CARS WERE CLEARING UP AFTER COMPLETING THE WORK ASSIGNED AND THE SOUTHERN MOST PIECES OF EQUIPMENT STOPPED AT MP 34.9 TO PICK UP WHISTLE BOARDS AND TRACK BARRICADE WHEN PETTY BONE SPEED SWING L47956 COLLIDED WITH THE JR. TAMPER G11262, CAUSING DAMAGE TO THE TAMPER AND PERSONAL INJURY TO THE EQUIPMENT OPERATOR OF THE TAMPER.	**Injuries:** The collision caused personal injury to the equipment operator of the tamper. **Associated Damage Cost:** Equipment: $8000.00	1A, 1C	**Over-Controlled/Under Controlled System:** The Pettibone Speed Swing failed to stop short of the equipment and collided with the junior tamper. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	N

MOW Equipment Collisions Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
156677 - 2018	AN - MP 37.2 TR 2	TLS CLIPPING GANG WS TRACK TRAVELING FROM GRUNDY NO.5 TRACK TO HUNTER YARD. WHILE OPERATING EAST ON NO.2 TRACK AT ADAMS INTERLOCKING NIPPER CLIPPER CALLED OUT VIA RADIO "COMING TO A STOP". THE TRAILING PIECE OF EQUIPT, RAIL HEATER DID NOT ACKNOWLEDGE THE MESSAGE OR HEAR IT. OPERATOR OF THE RAIL HEATER STATED WHEN HE REDUCED THE SPEED OF THE MACHINE IT SLAMMED THE BRAKES CREATING A "JERK". WHEN THE MACHINE JERKED HE ACCIDENTLY TURNED THE KNOB AND INCREASED THE SPEED STRIKING THE NIPPER CLIPPER AHEAD. THIS CAUSED THE CART ATTACHED TO RAIL HEATER TO DERAIL.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B	**Ignored Caution/Warning:** The nipper clipper operator called out via radio, "coming to a stop," but the trailing rail heater did not acknowledge the message or hear it. **Over-Controlled/Under Controlled System, Rushed or Delayed Necessary Action, Unintended Operation of Equipment/Vehicle:** The rail heater operator stated that when he reduced the speed of the machine, it slammed the brakes creating a jerk. Further, the operator said that he accidentally increased the speed of the rail heater, and collided with the nipper clipper when the machine jerked.	2B	**Communication Equipment Inadequate:** The nipper clipper called out via radio, "coming to a stop," but it does not appear that the rail heater received the message.	N
107980 - 2008	AN - MP 46.5	TIE HANDLER OPERATOR WHILE MOVING WEST TO WORK SITE ON OOS TRACK, RAN INTO A PARKED BALLAST CRIBBER A26706. OPERATOR FAILED TO STOP IN TIME, SLIDING INTO THE BALLAST CRIBBER DUE TO WET RAIL CONDITIONS.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $2,000.00	1A	**Over-Controlled/Under Controlled System, Rushed or Delayed Necessary Action:** The tie handler operator failed to stop in time, sliding into the ballast cribber.	2F	**Technical or Process Knowledge Not Retained After Training:** The operator was unable to maneuver the tie handler amidst wet rail conditions.	N
121243 - 2011	AN - MP 47.2 TR 4	THREE PIECES OF EQUIPMENT BEHIND A TAMPER MACHINE FAILED TO STOP AND STRUCK THE TAMPER MACHINE WITH NO APPARENT DAMAGE TO THE EQUIPMENT	**Injuries:** The foreman complained of neck, shoulder, and back pain. Consequently, the foreman was taken to University Medical Center in Princeton. **Associated Damage Cost:** None	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The three pieces of equipment behind a tamper machine failed to stop, and struck the tamper machine. **Break Down in Visual Scan:** The machine operators did not observe the tamper machine slowing. **Ignored a Caution/Warning:** The foreman was piloting a tamper, and notified the three pieces behind him that he was going to stop in Princeton Junction to conduct an on track job briefing and that they too should come to a stop. The trailing BMS equipment failed to stop and struck the tamper with no apparent damage to the equipment. **Widespread/Routine Violation:** Per report, the incident was classified as an alleged operating rule violation.	2A, 2F	**Technical or Process Knowledge Not Retained After Training:** The primary cause of the incident was listed as sliding wheels, with the contributing cause listed as wet rail. The operator was unable to maneuver the BMS equipment amidst wet rail conditions. **Weather Conditions Affecting Vision:** Visibility was listed as dark, while rain was listed as the weather condition.	Y

MOW Equipment Collisions Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
120473 - 2011	AN - MP 58.3 TR 1	MOFW REGULATOR TCA 14308 COLLIDED WITH REAR OF MOFW STABILIZER TCA 16106 ON NO.1 TRACK IN MORRIS INTERLOCKING DERAILING 1 WHEEL OF REGULATOR (OPERATOR OF REGULATOR FLED THE SCENE).	**Injuries:** Per latest report, there were two injuries. To add, the stabilizer employee was taken to the hospital with an unspecified injury, while another employee reported stiffness in his back, and neck discomfort to legs. **Associated Damage Cost:** None	1A, 1C	**Over-Controlled/Under Controlled System:** When the stabilizer moved west to clear the work-site and stopped, the regulator failed to stop and collided with the vehicle. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	2F	**Distraction, Lack of Situational Awareness:** Operator inattention was listed as the primary cause of the incident.	Y
133864 - 2014	AP - MP 26.6 TR 2	Z-052 OPERATED 5 TRACK CARS (TAMPER A11269; HI-RAIL SWIVEL DUMP AG94693; BALLAST REGULATOR; TRACK STABILIZER, AND LRV4) #1 TRACK FROM YARD TO BRANDY AND #2 TRACK FROM BRANDY TO WINE INTERLOCKING WHEN THE TAMPER PULLED UP AND STOPPED AT THE 2N SIGNAL TO RECEIVE RULE 241. THE HI-RAIL SWIVEL DUMP FOLLOWING DID NOT STOP IN TIME AND COLLIDED WITH THE TAMPER. AMTRAK'S EQUIPMENT DAMAGE IS $12,000.00.	**Injuries:** None **Associated Damage Cost:** Equipment: $12,000.00	1A, 1C	**Over-Controlled/Under Controlled System, Rushed or Delayed a Necessary Action:** The hi-rail Swivel dump did not stop in time, and collided with a tamper ahead. **Widespread/Routine Violation:** The employee executed an operating rule violation; specifically, employee failed to follow NORAC Rule 813, and NORAC Rule 80.	2C	**Medically Disqualified (Pending Drug & Alcohol Testing) - Physical Illness/Injury:** Conclusion was not further specified in report.	Y
126928 - 2013	AP - MP 45.8 TR 3	OPERATOR OF THE LITTLE GIANT CRANE A58852, PLUS 1 BALLAST CAR A14312, WAS MOVING INTO POSITION TO DISTRIBUTE MORE BALLAST TO THE TRACK WHEN THE BALLAST REGULATOR WAS WORKING IN BOTH DIRECTIONS CAUSING THE WEIGHT TO PULL THE CRANE FURTHER THAN ANTICIPATED STRIKING THE BALLAST REGULATOR AT WALKING SPEED. AMTRAK'S TOTAL DAMAGE IS $1,100.00.	**Injuries:** None **Associated Damage Cost:** Equipment: $1,100.00	1A, 1B, 1C	**Break down in Visual Scan:** The Little Giant crane operator failed to observe his/her increasing closeness to the ballast regulator. **Over-Controlled/Under Controlled System:** Upon noticing the closing distance to the ballast regulator, the Little Giant crane operator made a maneuver to stop; however, the maneuver still caused the vehicle to collide with the ballast regulator. **Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The operator realized he/she was approaching the regulator, and dumped air to stop the crane, but the weight of the ballast car pulled the crane forward anyway. **Rushed or Delayed Necessary Action:** The operator made an attempt to stop his/her vehicle but the action was executed too late to prevent collision. **Widespread /Routine Violation:** Per report, the event was listed as a M/W operating rule violation.	2B, 2E, 2F, 2G	**Lack of Situational Awareness:** The crane operator was unaware that the ballast regulator was still working in both directions on track. **Misperception of Changing Environment:** Despite "communication being good at times," the crane operator misjudged the stopping distance, and was forced to make an abrupt stop. **Spatial Disorientation:** The operator failed to sense the position of his/her vehicle in relation to the ballast regulator. **Failure of Crew/Team Leadership:** The operator lacked awareness of other MOW activities occurring simultaneously. **Communication Equipment Inadequate:** In report, communication is described as "good at times," implying an inconsistency in the adequacy of communication needed to support task.	Y

MOW Equipment Collisions Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
137030 - 2015	AP - MP 58.5 TR 1	SPERRY 149 WAS IN A 3 PIECE EQUIPMENT CONSIST HEADING BACK TO PERRYVILLE MW BASE. SPERRY 149 HAD STOPPED AT THE SWITCH TO OPEN IT SO ALL PIECES COULD CLEAR INTO THE BASE FOR THE NIGHT. SPEED SWING A47956 CONTINUED TO PROCEED NORTH TOWARD SPERRY 149 AND STARTED TO BRAKE WHEN THE BRAKES WOULD NOT STOP THE MACHINE AND AS THE EMERGENCY BRAKE WAS APPLIED TO NO AVAIL, SPEED SWING A47956 EVENTUALLY COLLIDED WITH SPERRY 149. AMTRAK'S EQUIPMENT DAMAGE IS $7,500.00.	**Injuries:** None **Associated Damage Cost:** Equipment:$7,500.00	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** Operating at 8MPH, the speed swing was backing while pulling a 20-ton track cart with four pieces of rail. Though the other equipment in this three piece consist stopped at a switch, the speed swing proceeded north and collided with the Sperry vehicle ahead. **Widespread /Routine Violation:** Per report, the speed swing operator allegedly executed an operating rule violation. Specifically the employee's actions were categorized as an alleged violation of NORAC Rule 813, movement of multiple track cars. As well as, an alleged violation of NORAC Rule 80, movement at restricted speed. **Ignored Caution/Warning:** The foreman in charge stopped at the switch with Sperry 149 to open the switch for entry of the equipment into the MW Base. Then, the foreman noticed the speed swing was still moving forward, and radioed the operator to stop; however, the equipment did not stop its progression towards the Sperry vehicle.	2B, 2E	**Misperception of Changing Environment:** Per report, the speed swing operator misjudged the distance, preventing him/her from stopping short of the Sperry vehicle. **Instrumentation Issues:** Per operator, the brakes were applied, as well as the emergency brake to no avail.	Y
137920 - 2015	AP - MP 72.4 TR 2	TRACK EQUIPMENT WITH BALLAST REGULATOR A14322 SOUTH END LEAD AND TAMPER A11038 TRAILING RECEIVED A RULE 241 AT BUSH INTERLOCK TO PROCEED PAST THE STOP SIGNAL INTO OUT OF SERVICE #2 TRACK. BALLAST REGULATOR PROCEEDED TO OUT OF SERVICE TRACK WHEN EQUIPMENT BEGAN TO SLOW DOWN TO A STOP. THE TAMPER A11038 WAS FOLLOWING THE BALLAST REGULATOR A14322 AND FAILED TO STOP SHORT OF THE EQUIPMENT COLLIDING WITH THE BALLAST REGULATOR. AMTRAK'S BALLAST REGULATOR DAMAGE IS $100,000.00 AND AMTRAK'S TAMPER DAMAGE IS $40,000.00.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $140,000.00	1A, 1C	**Over-Controlled/Under Controlled System:** While the ballast regulator slowed to a stop, the tamper following failed to stop and collided with the ballast regulator. **Widespread/Routine Violation:** The ballast regulator and the tamper received rule 241 to proceed past the stop signal into the out of service track. The ballast regulator proceeded into the out of service track, then the equipment slowed to a stop. The tamper following failed to stop short of the ballast regulator.	N/A	**Insufficient Information Provided**	N

MOW Equipment Collisions Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
150235 - 2017	AP - MP 90.1 TR 3	TC A14311 WAS OPERATING SOUTH ON OUT OF SERVICE TRACK 3 BETWEEN POINT MP 90.1 AND BAY MP 91.9. THE OPERATOR FAILED TO STOP BEFORE COLLIDING WITH TC A16104 THAT WAS AHEAD AT MP 91.7. THERE WAS NO TRACK DAMAGE. THE TOTAL COST FOR LABOR FOR BOTH UNITS IS $886.29. THERE WAS NO MATERIAL COST, REPAIR INCLUDED REMOVING AND STRAIGHTENING THE DAMAGED LOCK MECHANISM ON THE BALLAST REGULATOR AND REINSTALLATION ON THE MACHINE. $886.29 DAMAGE FOR A14311 AND $0.00 FOR A16104.	**Injuries:** None **Associated Damage Cost:** Equipment: $886.29	1A, 1C	**Over-Controlled/Under Controlled System:** The MOW vehicle failed to stop, and collided with another MOW vehicle ahead. **Widespread/Routine Violation:** Per report, the operator of TCA14311 executed an alleged rule violation.	N/A	**Insufficient Information Provided**	Y
104120 - 2007	AP - MP 91.3	WHILE TRAVELING TAMPER IN THE REVERSE DIRECTION TO THE TIE-UP POINT, THE OPERATOR LOST FOCUS OR WAS DISTRACTED WHILE CONCENTRATING ON RADIO CONVERSATION, DID NOT SEE SPIKER STOPPED IN THE BLOCK AHEAD AND STRUCK THE SPIKER BENDING THE TOW BAR ON THE TAMPER PARTS CART.	**Injuries:** Information not provided **Associated Damage Cost:** N/A	1A, 1B, 1C	**Procedure/Checklist Not Followed Correctly, Breakdown in Visual Scan:** Prior to reversing, the operator did not observe the spiker stopped in the block. **Over-Controlled/Under Controlled System:** The tamper made a reverse move, and struck the spiker vehicle. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The operator proceeds with movement, prior to interpreting instruction, and does not account for the risks associated with his/her course of action. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	2B, 2F	**Distraction:** The operator was focused on the radio conversation during the movement. **Communication Equipment Inadequate:** The operator's focus was directed towards deciphering the radio conversation, rather than the task at hand.	N
106719 - 2008	AP - MP 99.2 TR 1	BURRO CRANE TC58830 WITH TWO 20 TON CARTS SHOVING ON NO.#1 TRACK RAN INTO THE BACK OF A STOPPED WELDING TRUCK AJ25408 AT MP99.2. THE FOREMAN HAD INSTRUCTED THE OPERATOR OF THE BURRO CRANE TO STOP AT AUTOMATIC SIGNAL 993, BUT THE OPERATOR FAILED TO STOP AND STRUCK THE REAR OF THE TRUCK DUE TO OPERATOR FALLING ASLEEP. THE TRACK WAS OUT OF SERVICE UNDER FORM D AUTHORITY. THE RELATIONSHIP BETWEEN THE POSITIVE DRUG RESULT AND THE CAUSE OF THE ACCIDENT COULD NOT BE DETERMINED.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $10,000.00	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The burro crane did not stop, and collided with a stopped welding truck. **Ignored a Caution/Warning:** The operator was given instruction by the foreman to stop at the automatic signal, but he/she failed to stop. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	2C	**Fatigue:** The operator fell asleep. **Substance Effects:** Drug and alcohol testing yielded a positive drug result.	N

MOW Equipment Collisions Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
120046 - 2011	**AP - MP 135.3 TR 22**	COLLISION - A MATWELL TRUCK BACKED INTO A TIE HANDLER WITH A CART	**Injuries:** None **Associated Damage:** Equipment: $3,725.00	1A, 1C	**Procedure/Checklist Not Followed Correctly, Break down in Visual Scan:** The employee failed to ensure that the roadway was clear. **Over-Controlled/Under Controlled System:** The Matwell truck backed into a tie handler. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	2C	**Medically Disqualified (Pending Drug & Alcohol Testing) - Physical Illness/Injury:** Conclusion was not further specified in report. **Weather Conditions Affecting Vision:** The condition during the event which occurred at 4:15AM, was listed as dusk.	**Y**

Train Struck MOW Equipment

Train Struck MOW Equipment

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
92857 - 2004	**AB - MP 77.6**	AMTRAK SHORE LINE EAST TEST EXTRA WITH ENGINE 6695 AND 3 CARS STRUCK 3 PIECES OF CONTRACTOR EQUIPMENT AT MP 77.6, EAST OF NEW HAVEN, CT.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $60,500.00 Maintenance of Way: $8,000.00	1A, 1B	**Breakdown in Visual Scan:** The contractor did not observe the position of the equipment in relation to the adjacent tracks. **Inadequate Real-Time Risk Assessment, Failure to Prioritize Tasks Adequately:** The contractor failed to adequately assess the risks associated with operating the equipment on the track. **Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The contractor did not adequately protect the equipment.	N/A	**Insufficient Information Provided**	**N**
102555 - 2006	**AB - MP 158.8 TR 1**	THE TRACK FOREMAN OPERATED TRACK CAR TC AA23776 OUTSIDE OF HIS AUTHORITY LIMITS AND ENTERED THE INTERLOCKING LIMITS ON TRACK 1 AT KINGSTON, RI. TRAIN 163 THEN STRUCK THE TRACK CAR.	**Injuries**: Information not provided **Associated Damage Cost:** Equipment: $30,000.00 Maintenance of Way: $1,000.00	1B, 1C	**Extreme Violation - Lack of Discipline:** The track foreman operated the track car outside of his authority limits, and entered the interlocking limit on track 1. **Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The foreman proceeded outside of his authority limits, failing to recognize the risks associated with this course of action. Ultimately, the track car was struck by a train.	N/A	**Insufficient Information Provided**	**N**
104269 - 2007	**AB - MP 228 TR 5**	TRAIN 448 ENGINE 101 AND 4 CARS STRUCK A PIECE OF MOFW EQUIPMENT A LULL LIFT ON #5 TRACK IN COVE INTERLOCKING.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $150.00	1A	**Over-Controlled/Under Controlled System:** Train 448 struck a Lull lift.	N/A	**Insufficient Information Provided**	**N**
127728 - 2013	**AN - MP 35.6 TR 4**	WHILE NJTR TRAIN 3827 WAS PASSING STANDING TRACK EQUIPMENT, AMTRAK TC-47953, NJTR TRAIN 3827 SUSTAINED DAMAGE AS A RESULT OF TC-47953 HAD THE CAB DOOR AJAR AND IT SWUNG OPEN AND STRUCK THE SIDE OF THE NJTR TRAIN 3827. NJTR'S EQUIPMENT DAMAGE IS $3,039.00.	**Injuries:** None **Associated Damage Cost:** Equipment: None	1A	**Over-Controlled/Under Controlled Vehicle/System:** The track equipment components were not adequately secured. As a result, the track car cab door swung open and was struck by a train.	N/A	**Insufficient Information Provided**	**Y**
113910 - 2009	**AN - MP 46 TR 3**	TRAIN 56 ENGINE 902 AND 5 CARS, OPERATING ON NYP LINE NO. 2 TRACK, CLIPPED PIECE OF MOFW EQUIPMENT TIED DOWN ON NO. 3 TRACK.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $1,000.00 Maintenance of Way: $2,000.00	1A	**Procedure/Checklist Not Followed Correctly:** The work crew did not properly secure the equipment.	N/A	**Insufficient Information Provided**	**N**

Train Struck MOW Equipment Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
148209 - 2017	AN - MP 87.2 TR 3	TRAIN 642 OPERATING WITH CAB CAR C/9638 IN THE LEAD, 4 CARS AND LOCOMOTIVE E/657 STRUCK A DOOR ON TRACK EQUIPMENT A47931 THAT WAS STANDING ON NO.3 TRACK (OUT OF SERVICE) BETWEEN MANTUA MP 87.2 AND LEHIGH MP85.1.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled Vehicle/System:** The track equipment components were not adequately secured, and the locomotive struck a door on the track equipment.	2B	**Instrument Issues:** A defective door latch was found on the equipment.	Y
144471 - 2016	AP - MP 87.6 TR A	NORFORK SOUTHERN TRAIN NS33A'S AUTO CARRIER TTGX CARS WAS TRAVELING NORTHBOUND BETWEEN RIVER AND GUNPOW ON #1 TRACK WHEN THE AUTO CARRIER STRUCK CAT CAR # A16507 LOCATED ON LETTER A TRACK AT MP 87.6 UNDER RT.702 OVERHEAD BRIDGE. AMTRAK'S EQUIPMENT DAMAGE IS $13,000.00.	**Injuries:** None **Associated Damage Cost:** Equipment: $13,000.00	1A, 1B	**Procedure/Checklist Not Followed Correctly:** After working on track 1, the crew failed to take measurements to see if the elevation needed to be adjusted. Thus, the track centers were too short in distance, given the elevation of track 1, and the lack of elevation in track A. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The team proceeded with the work task, without ensuring the proper execution of a vital step and accounting for the associated risks.	2B, 2G	**Failure of Crew/Team Leadership:** The work crew failed to execute a necessary work task, exposing team members to a potentially dangerous outcome. **Workspace Incompatible with Operation:** The elevation variance in the track caused the auto-carrier to tilt towards the catenary car.	Y
101029 - 2006	AP - MP 91.4 TR 1	TRAIN 1662 WITH ENGINE 664 AND 2 CARS STRUCK THE UNDERCUTTER (A14909) THAT WAS FOULING NO.1 TRACK WHICH CAUSED TRAIN 1662 AND THE UNDERCUTTER CONSIST TO DERAIL.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $900,000.00 Maintenance of Way: $150,000.00	1A	**Over-Controlled/Under Controlled System:** Train 1662 struck the undercutter.	N/A	**Insufficient Information Provided**	N
60992 - 2000	AP - MP 135.5	TRAIN 199 STRUCK AN EXTENSION ARM ON A TIE TAMPER WORKING ON ADJACENT TRACK.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00	1A	**Over-Controlled/Under Controlled System:** Train 199 struck an extension arm on a tie tamper.	N/A	**Insufficient Information Provided**	N

MOW Equipment Struck Surroundings

MOW Equipment Struck Surroundings

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
144171 - 2016	AB - MP 117.3 TR 2	WHILE MOW EQUIPMENT AWX-536 WAS TOWING A LEASED UNDER CUTTER (LORAM MUD MANTIS) ON NO.2 TRACK, THE EQUIPMENT STRUCK A BRIDGE ABUTMENT AT MP 117.31 MILLSTONE PT. ROAD.	**Injuries**: Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** MOW equipment struck the surrounding infrastructure, a bridge abutment. **Break Down In Visual Scan:** MOW employees did not observe the clearance between the equipment and the bridge abutment.	N/A	**Insufficient Information Provided**	N
60085 - 2000	AB - MP 219	CAT CAR 16512 RAN OUT FROM UNDER WIRE HITTING DROP PIPE AT BOSTON, MA.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00 Maintenance of Way: $7,000.00	1A	**Over-Controlled/Under Controlled System:** The catenary car struck an object, a drop pipe.	N/A	**Insufficient Information Provided**	N
62994 - 2000	AN - MP 86.4	BOOM TOO HIGH HITTING BRIDGE AT PHILADELPHIA. PA.	**Injuries**: Information not provided **Associated Damage Cost:** Infrastructure: $162.00	1A	**Over-Controlled/Under Controlled System:** The boom was too high and hit a bridge. **Break Down in Visual Scan:** The work crew failed to observe, and assess the clearance between the boom and the bridge.	N/A	**Insufficient Information Provided**	N
117576 - 2010	AP - MP 1.7 TR 4	SEPTA TRAIN 541 STRUCK A PIECE OF RAIL BEING DRAGGED BY AN AMTRAK CONTRACTOR AT MILEPOST 1.7 ON TRACK 4 NEAR PHILADELPHIA, PA.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B	**Breakdown in Visual Scan:** The contractor did not observe the position of the rail in relation to the track and train. **Inadequate Real-Time Risk Assessment, Failure to Prioritize Tasks Adequately:** The contractor failed to adequately assess the risks associated with transporting materials on the track. **Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The contractor did not adequately secure the rail while transporting materials.	N/A	**Insufficient Information Provided**	N
130557 - 2013	AP - MP 45.7 TR 1	THE WING OF A BALLAST REGULATOR, TCA 14322, STRUCK AN AXLE THAT WAS BURIED IN THE BALLAST AND DERAILED. AMTRAK'S EQUIPMENT DAMAGE IS $7,500.00.	**Injuries:** The ballast regulator operator struck his/her head. **Associated Damage Cost:** Equipment: $7,500.00	1A	**Over-Controlled/Under Controlled System:** The ballast regulator derailed unintentionally. **Breakdown in Visual Scan:** The operator did not observe the buried axle.	2A	**Blind Spot:** The wing of the ballast regulator caught the axle, which was buried in ballast. **Weather Conditions Affecting Vision:** The event occurred at 12:09 AM, and conditions were reported to be dark and cloudy.	Y
145127 - 2016	AP - MP 92.6 TR A	WHILE WORKING ON "A" TRACK AT MP 92.6 THE TLM DERAILED WHILE BEING MOVED BY KW-902. IT WAS REPORTED THAT THE TLM STRUCK A BRIDGE AT MP 92.61 MONUMENT ST.	**Injuries:** None **Associated Damage Cost:** Equipment: $400,000.00 Maintenance of Way: $525,000.00	1A	**Over-Controlled/Under Controlled System:** MOW equipment struck the surrounding infrastructure, a bridge. **Break Down In Visual Scan:** MOW employees did not observe the clearance between the equipment and the bridge.	2A	**Weather Conditions Affecting Vision:** The event occurred at 3:34AM, and conditions were reported to be dark.	Y

MOW Equipment Struck Surroundings Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
144658 - 2016	AP - MP 92.7 TR 1	BALLAST REGULATOR TRACK CAR 14256 OPERATING SOUTH ON NO.1 TRACK STRUCK TWO STRINGS OF CONTINUOUSLY WELDED RAIL THAT WAS LAYING IN THE GAUGE ON NO.1 TRACK.	**Injuries:** None **Associated Cost:** None (Note: The incident caused the equipment to foul track 2. Thus, a hold was put into effect, causing single track operation on track 3 from Biddle-MP 94.3 to Point-MP 90.1.)	1A	**Procedure/Checklist Not Followed Correctly:** The previous work crew or employee failed to remove the rail materials. **Breakdown in Visual Scan:** The operator did not observe the rails prior to the collision.	2A	**Blind Spot:** The strings of rail were positioned up on high ballast, and laid above the top of the running rails of the track. Thus, the obstructing rail may have been difficult to readily observe.	Y
123041 - 2012	AP - MP 96.3 TR 2	BURRO CRANE BOOM STRUCK CATENARY	**Injuries:** None **Associated Damage Cost:** Infrastructure: $7,500.00 (Note: The catenary wires were down as a result, causing single track operation between Charles-MP 95.9 to Fulton-MP 97.7)	1A, 1B	**Over-Controlled/Under Controlled System:** The Burro crane operator struck the surrounding infrastructure. **Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** A track production group was utilizing the Burro crane to thread rail in the north end of the BP tunnel. When the thread roller got stuck on a pandrol clip, the subsequent strain on the load line caused the wheels of the crane to lift. In response, the operator released the load line, which caused the boom of the crane to slingshot up, striking the catenary suspension bracket, dislodging the bracket from the tunnel ceiling.	2A	**Weather Conditions Affecting Vision:** Conditions during the event which occurred at 4:29AM, were reported to be dark, with a presence of fog.	Y

MOW Equipment Derailment - Switch Related

MOW Equipment Derailment - Switch Related

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
155491 - 2018	AB - MP 89.2 TR 4	RULE VIOLATION/DERAILMENT: AT TRIEBEL INTERLOCKING, SPERRY RAIL CAR 125 ON TRACK 1 WAS SWITCHING OVER TO TRACK 2 WHEN THE FOREMAN RECEIVED A FORM D TO OPERATE BETWEEN MEADOW INTERLOCKING AND TRIEBEL INTERLOCKING ON TRACK #4. WHILE OPERATING ON TRACK #4 BETWEEN MEADOW AND TRIEBEL, THE FOREMAN OPERATED PAST THE LIMITS AND WENT PAST THE HOMEBOARD AT TRIEBEL. THIS MOVE PUT THE SPERRY CAR PAST ITS OUT OF SERVICE LIMITS AND OVER THE 42 SWITCH WHICH WAS LINED AGAINST THE MOVE. AT THIS POINT THE SPERRY CAR OPERATOR REALIZED THE CARRIAGE FOR THE TESTING EQUIPMENT DERAILED OVER THE 42 SWITCH AND MADE A REVERSE MOVE OVER THE MOVABLE POINT FROG AT THE 42 SWITCH, WHICH DERAILED THE LEADING 2 WHEELS OF THE SPERRY CAR.	**Injuries:** None **Associated Damage Cost:** Infrastructure: $8,000.00	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** A Sperry rail car derailed unintentionally when the foreman piloted the equipment outside of it's out-of-service limits. **Extreme Violation - Lack of Discipline:** The track foreman instructed the operator to proceed past his out of service limits and he went past the home board at Triebel interlocking. **Wrong Choice of Action During Operation, Inadequate Real-Time Risk Assessment:** Passing his out-of-service limits, the Sperry car operator proceeded over the 42 switch which was lined against the move. The operator then made a reverse move over the movable point frog at the 42 switch. As a result, the movement derailed the leading two wheels of the Sperry car. Per report, the Sperry car operator made the reverse move without being told to do so by the foreman.	2E, 2C, 2F, 2G	**Spatial Disorientation, Misperception of Changing Environment:** Per report, the foreman stated that he did not realize they had gone past his limits until the dispatcher called him on the radio to inform him to stand hard. **Fatigue, Distraction, Confusion, Lack of Situational Awareness:** Per report, the foreman being distracted/zoned out, and tired while piloting past his limits was listed as the primary cause of the incident. **Failure of Crew/Team Leadership:** The foreman operator failed to maintain awareness during work activities. **Technical or Process Knowledge Not Retained After Training:** Employee testimony referenced that the foreman piloting equipment was not a "seasoned" employee. In fact, the regular pilot for the Sperry car had called out, and Foreman Riera had not piloted the Sperry car before.	Y
99483 - 2005	AB - MP 104.7 TR 2	MAKING A REVERSE MOVE TRACK CAR TCAA23676 DERAILED OVER THE SWITCH POINTS OF THE #21 CROSSOVER ON THE TRACK#2 SIDE.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The MOW vehicle derailed unintentionally over switch points.	N/A	**Insufficient Information Provided**	N
114284 - 2010	AN - MP 8.5 TR 2	TRACK CAR DERAILMENT TCAJ15401 DERAILED OVER THE 63 SWITCH ON #2 TRACK AT THE EAST OF DOCK.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally over a switch.	N/A	**Insufficient Information Provided**	N
128189 - 2013	AN - MP 12.4 TR 4	YARD CREW OPERATING TRACK CAR 14316 ON NO.4 TRACK STRUCK SOMETHING CAUSING TWO WHEELS TO GO ON THE GROUND AT LANE INTERLOCKING. THERE WAS NO EQUIPMENT DAMAGE.	**Injuries:** None **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The ballast regulator's two front wheels derailed unintentionally when the regulator's plow clipped a concrete tie as it was working.	2A	**Weather Conditions Affecting Vision:** Conditions during the event which occurred at 1:30AM, were reported to be dark.	Y
128716 - 2013	AN - MP 32.8	TRACK CAR (CRIBBER) TC-26708 DERAILED WHILE OPERATING OVER THE NO.54 SWITCH TO THE MILLSTONE BRANCH AT COUNTY.	**Injuries:** None **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally over a switch.	N/A	**Insufficient Information Provided**	Y

MOW Equipment Derailment - Switch Related Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
152599 - 2018	AN - MP 56.4 TR 1	TRACK CAR A154521 WAS OPERTING WESTBOUND AT FAIR INTERLOCKING, MP 56.4 FROM THE HIGH TRACK TO NO. 1 TRACK WHEN THE TRACK CAR DERAILED ON THE NO. 16 SWITCH FROG. THE EQUIPMENT WAS NOT FOULING ANY OTHER TRACKS, AND THERE WERE NO INJURIES. THE TRACK CAR WAS RERAILED WITH NO REPORTED DAMAGE TO THE EQUIPMENT OR INFRASTRUCTURE.	**Injuries:** None **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally over a switch frog.	N/A	**Insufficient Information Provided**	Y
125924 - 2012	AN - MP 82.1 TR 1	A CART LOADED WITH RAIL THAT WAS COUPLED TO A BURRO CRANE DERAILED WHILE OPERATING WEST FROM #1 TRACK THROUGH THE 19 SWITCH LINED IN REVERSE.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $1,500.00 Maintenance of Way: $2,000.00 (Additionally, the NJT train operated back to Cherry Hill station, and a bussing operation was established.)	1A, 1B	**Over-Controlled/Under Controlled System:** A cart loaded with rail that was coupled to a Burro crane derailed through a switch lined in reverse. **Procedure/Checklist Not Followed Correctly:** The foreman did not ascertain the status of the track after granting permission for a train to operate through his out-of-service territory. As a result, his equipment operated with switches lined against the movement. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** When CTEC needed to operate an NJT train through out-of-service limits, the foreman in charge of the track granted permission, and the train received a Form D. While the NJT train was getting rule 241 by the signal, the foreman's Burro crane was operating through switches now lined against him, in the reverse direction, which derailed the cart attached to the Burro crane.	2E, 2F, 2G	**Failure of Crew/Team Leadership:** The foreman lacked awareness concerning the status of his out-of-service track. **Lack of Situational Awareness:** Although the foreman granted permission for the train to pass through his out-of-service limits, he appears to lose awareness of the track's changed condition. **Misperception of Changing Environment:** In anticipation of the passing train, the switches are lined in the direction opposing the Burro crane's movement. Still, the Burro crane operates through the reverse-lined switches.	Y
141612 - 2016	AP - MP 51.0	TRACK CAR TCA1011 DERAILED ON THE NO.21 SWITCH AS A RESULT OF THE ROUTE WAS IMPROPERLY LINED. AMTRAK'S EQUIPMENT DAMAGE IS $4,220.00.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $4220.00	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally, as a result of an improperly lined switch.	N/A	**Insufficient Information Provided**	N
134208 - 2014	AP - MP 57.3	TRACK CAR A10604 TAMPER DERAILED WHILE OPERATING IN THE NORTH DIRECTION OVER THE 43 SWITCH AT PRINCE INTERLOCKING THAT WAS NOT LINED FOR THE MOVE. AMTRAK'S EQUIPMENT DAMAGE IS $125,000.00.	**Injuries:** Information not provided **Associated Damage:** Equipment: $125,000.00	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally, as a result of operating in the north direction over a switch that was not lined for the move.	N/A	**Insufficient Information Provided**	N

MOW Equipment Derailment - Switch Related Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
155884 - 2018	AP - MP 62.2 TR 4	AMTRAK BALLAST REGULATOR A14329 OPERATING NORTH ON PW LINE NO.4 TRACK IN FOREMAN MARTIN'S OUT OF SERVICE, DERAILED AT MP 62.2. THE REGULATOR WAS PART OF GANG Z073 PERFORMING SURFACING OPERATIONS BETWEEN OAK AND GRACE INTERLOCKINGS. UPON DERAILMENT, THE REGULATOR F-END SHIFTED TOWARDS THE FIELD SIDE OF NO.4 TRACK, AND THE OPPOSING END FOULED NO.3 TRACK. THE CAUSE OF THE INCIDENT WAS EXCESSIVE BALLAST UNDER REGULATOR PLOW. THERE WERE NO INJURIES TO REPORT.	**Injuries:** None **Associated Damage Cost:** None (Note: The incident caused the equipment to foul track 3. Thus, a hold was put into effect, causing single track operation from Wood-MP 75.3 to Perry-MP 59.5.)	1A	**Over-Controlled/Under Controlled System:** The ballast regulator derailed unintentionally, while winging in ballast from the field side of track 4 between Grace and Oak (specifically MP 62.25).	2E, 2F	**Misperception of Changing Environment:** The incident occurred when too much ballast was brought into the gage of track, getting caught under the wheels and derailing the regulator. **Technical or Process Knowledge Not Retained After Training:** The ballast regulator operator was an August 2017 new hire, qualified on the equipment on July 9, 2018. Per report, the cause of the derailment was an operator error due mainly to the operator's inexperience with transferring ballast.	Y
112994 - 2009	AP - MP 113.9	CRANE DID NOT STOP FOR THE DE-RAIL, CAUSING REAR WHEELS OF THE CRANE TO COME OFF OF THE TRACK. CRANE WAS RE-RAILED AND PULLED BACK INTO THE YARD.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The crane did not stop for the derail. **Breakdown in Visual Scan:** The operator did not observe the derail.	N/A	**Insufficient Information Provided**	N
152551 - 2018	AP - MP 117.5 TR 2	A PIECE OF TRACK EQUIPMENT, TCA 14332, DERAILED AT MP 117.0 ON #2 TRACK IN A 3 TRACK AREA, FOULING # 1 TRACK. THERE WERE NO REPORTED INJURIES. THE CAUSE OF THE DERAILMENT IS REMOVAL OF EXCESSIVE BALLAST ON THE EAST SIDE OF NO. 2 TRACK BY THE UNDERCUTTER, CAUSING A 10 INCH DROP IN CROSS-LEVEL.	**Injuries:** None **Associated Damage Cost:** None (Note: The derailment caused single track operation on track 3 from Bowie-MP 120.5 to Grove-MP 112.4.)	1A, 1B	**Over-Controlled/Under Controlled System:** The ballast regulator derailed unintentionally while pushing too much stone. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment:** There appears to be little coordination between the simultaneous MOW activities. Additionally, the risks associated with the concurrent activities was not accounted for. **Break Down In Visual Scan:** The ballast regulator failed to observe the decrease in elevation on the track.	2B, 2E, 2F, 2G	**Misperception of Changing Environment:** The removal of excess ballast on the east side of track 2 by the undercutter working ahead caused a 10 inch drop in cross-level; however, per the report, the ballast regulator was pushing too much stone which may have been visually deceiving from an elevated point. **Failure of Crew/Team Leadership:** There appears to be a failure to effectively coordinate simultaneous MOW activities. **Workspace Incompatible with Operation:** The loss in 10 inches in cross level caused a high slant between the rails, and the regulator slipped off the track. **Technical or Process Knowledge Not Retained After Training:** As a result of pushing too much stone, the operator did not realize the decrease in elevation.	Y

MOW Equipment Derailment - Maintenance & Inspection Issue Related

MOW Equipment Derailment - Maintenance & Inspection Issue Related

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
111436 - 2009	AB - MP 134.5 TR 2	AA23767 PATROLING EAST ON TRK #2, PROCEEDED THRU CUT SECTION. BOLT AFFIXING REAR STABLIZER BAR TO VEHICLE SNAPPED CAUSING VEHICLE TO SHIFT SIDE TO SIDE AND DERAIL.	**Injuries:** Information not provided **Associated Damage Cost:** Maintenance of Way: $900.00	1A	**Over-Controlled/Under Controlled System:** The MOW vehicle derailed unintentionally.	2B	**Instrumentation Issues:** The bolt affixing the rear stabilizer bar to the vehicle snapped, causing the vehicle to shift side to side and ultimately derail.	N
94099 - 2004	AB - MP 178.8 TR 2	MDZ SURFACING UNIT WITH 3 PIECES OF TRACK EQUIPMENT WAS TRAVELING WEST ON #2 TRACK, UNDER FORM D PERMISSION, WHEN THE REAR CAR DERAILED DUE TO TRANSFER CASE DROPPING INTO GAUGE OF TRACK.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $110,445.00 Maintenance of Way: $109,794.00	1A	**Over-Controlled/Under Controlled System:** The MDZ surfacing unit with three pieces of track equipment derailed unintentionally.	2B	**Instrumentation Issues:** The transfer case dropped into the gauge of the track.	N
113690 - 2009	AN - MP 32.6	SHORT DRAW BAR CONNECTED BETWEEN THE CHIPPER 6041 AND TC10067 ON WESTWARD MOVEMENT. THERE WAS A YAWING EFFECT CAUSING THE EQUIPMENT TO DERAIL WHEN BEING SHOVED.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The chipper and the track car vehicles derailed unintentionally.	2B	**Instrumentation Issues:** The short draw bar connected between the chipper and the track car created a yawing effect when the equipment was being shoved.	N
91699 - 2004	AP - MP 3.2	A SINGLE PIECE OF TRACK EQUIPMENT, SPIKER TCN23128 DERAILED 1 WHEEL ON THE #34 SWITCH. A SAFETY PIN KEEPER LATCH OPENED DUE TO VIBRATION CAUSED BY WEAR OF SAFETY PIN BORE HOLE, ALLOWING PIN TO BACK OUT FROM LOCKED POSITION.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The spiker equipment derailed unintentionally on a switch.	2B	**Instrumentation Issues:** The safety pin bore hole on the track equipment was worn, which allowed the keeper latch to open.	N
97101 - 2005	AP - MP 5.4 TR 2	TC/AX 54706 MOVING EAST ON #2 TRACK, DERAILED THE 2 REAR WHEELS DUE TO WHEELS OUT OF ADJUSTMENT.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally.	2B	**Instrumentation Issues:** The rear wheels on the equipment were out of adjustment.	N
136402 - 2015	AP - MP 37.8 TR 3-5	TRACK CAR AB34701 DERAILED OVER #37 SWITCH AT MP 37.8 BLOCKING TRACKS #1 THROUGH #5 TRACK. RAIL SWEEP, ON HIGH RAIL, CAUGHT RAIL WHEEL CAUSING WHEEL TO RIDE UP OVER OPEN SWITCH POINT CAUSING WHEEL TO DERAIL. THERE WAS NO EQUIPMENT DAMAGE.	**Injuries:** None **Associated Damage Cost:** None (Note: Derailment blocked tracks 1 through 5.)	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally over a switch.	2B	**Workspace Incompatible with Operation:** The anatomy of the vehicle and the rail became inadvertently intertwined during work.	Y
151752 - 2018	AP - MP 46.6 TR 2	A PIECE OF TRACK EQUIPMENT (TCA14333) OPERATING SOUTH ON NO.2 TRACK DERAILED 1 PAIR OF WHEELS AT MP 46.6. DURING THE COURSE OF REGULAR BALLAST WORK, THE FLANGE NOTCHES ON THE FORWARD PLOW (SEE FIG 2) HAD INADVERTENTLY BECAME SNAGGED ON SEVERAL BOLTS ATTACHED TO THE RAIL, CAUSING THE FORWARD TWO WHEELS OF THE BALLAST REGULATOR TO DERAIL. NO DAMAGE TO INFRASTRUCTURE OR EQUIPMENT WAS DIRECTLY OBSERVED. NO OPERATING RULES VIOLATIONS WERE DIRECTLY OBSERVED.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally.	2B	**Workspace Incompatible with Operation:** The anatomy of the vehicle and the rail became inadvertently intertwined during work.	N

MOW Equipment Derailment - Maintenance & Inspection Issue Related Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
142980 - 2016	**AP - MP 57.3 TR 2-3**	CATENARY CAR C/16517 DERAILED THROUGH THE PRINCE INTERLOCKING WHILE OPERATING ON #2 TRACK TO #3 TRACK. THE CAUSE OF THE DERAILMENT IS THE IDLER TRUCK WAS STIFF AND DID NOT PROPERLY SLEW CAUSING THE EQUIPMENT TO DERAIL WHILE TRAVERSING THE CROSSOVER. AMTRAK'S EQUIPMENT DAMAGE IS $65,000.00.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $65,000.00	1A	**Over-Controlled/Under Controlled System:** The catenary car derailed unintentionally.	2B	**Instrumentation Issues:** The idler truck on the equipment was stiff.	**N**
120378 - 2011	**AP - MP 88.5 TR 3**	TRACK EQUIPMENT TCA39843 DERAILED AT MP 88.5 ON NO.3 TRACK DURING TREE TRIMMING OPERATIONS.	**Injuries:** None **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track equipment derailed unintentionally.	2B	**Instrumentation Issues:** The locking pin in the rail gear vibrated loose. Further, the Asplundh truck had the rail gear down, and it did not come with a safety clasp to hold the pin into position, causing a mechanical failure.	**Y**
103519 - 2007	**AP - MP 95.7**	GRINGING MOTOR FELL OUT OF RAIL GRINDER LPCI, DERAILED IN BIDDLE INTERLOCKING WHILE OPERATING NORTH OVER THE FROG OF THE 23 SWITCH.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $260.00	1A	**Over-Controlled/Under Controlled System:** The Rail Grinder LPCI derailed unintentionally.	2B	**Instrumentation Issues:** The **g**rinding motor fell out of Rail Grinder LPCI.	**N**

Rule Violation

Rule Violation

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
156007 - 2018	**AB - MP 227.9 TR 3**	RULE VIOLATION: ATK BOSTON TRACK INSPECTORS, SR. ENGINEER OF TRACK, AND REGIONAL FRA TRACK INSPECTOR WERE COMPLETING A HI-RAIL INSPECTION BETWEEN MP 227.9 AND MP 218.0. WHILE PROCEEDING ON TRACK 3 THROUGH COVE I/L LIMITS WITH A 241 IN THE TRACK CAR, THEY ENCOUNTERED A C&S EMPLOYEE THAT WAS STANDING FOUL OF THE TRACK. AS THE HI-RAIL VEHICLE APPROACHED ON TRACK 3, THEY SOUNDED THEIR HORN TO ALERT EMPLOYEES THE HI-RAIL WAS PROCEEDING IN THEIR DIRECTION AND TO BE AWARE OF THE MOVEMENT. AS THE TRACK CAR APPROACHED, ONE EMPLOYEE WAS STANDING IN VERY CLOSE PROXIMITY OF THE 53B SWITCH FROG. THE OTHER TWO C&S EMPLOYEES WERE STANDING CLEAR OF ALL TRACKS IN THE GAP BETWEEN TRACK THREE AND FIVE.	**Injuries:** None **Associated Damage Cost:** None	1A, 1B, 1C	**Extreme Violation - Lack of Discipline:** As the hi-rail vehicle approached track 3, the employee was standing foul of the track. As the report states the C&S employee committed an alleged operating rule violation by fouling the track prior to establishing roadway worker protection. **Failure to Prioritize Tasks Adequately, Ignored Caution/Warning, Wrong Choice of Action During Operation, Inadequate Real-Time Risk Assessment:** Although the inspector and engineer sounded a horn to alert employees of their progress on the track, one employee was standing in close proximity to the 5B switch. Per report, the employee was waiting for the track car to clear area, so they could acquire "local control" and begin work replacing bond wires. Additionally, the employee wanted to point out a possible track defect to the passing inspectors to ensure they did not overlook it as they traversed past. **Breakdown in Visual Scan:** The employee failed to observe the approaching vehicle.	2E, 2F	**Spatial Disorientation, Misperception of Changing Environment:** Per report, the employee believed that they were clear of all live track. **Lack of Situational Awareness, Overconfidence:** The employee has been working in Boston territory for close to twenty-five years, and believed he was not fouling the track at the time of observation.	**Y**
149291 - 2017	**AN - MP 8.5 TR 2**	ON NEW YORK TO PHILADELPHIA MAIN LINE AT MP 8.5 DOCK INTERLOCKING ON #2 TRACK, A FOREMAN PILOTING TRACK EQUIPMENT ALLEGEDLY PASSED SIGNAL 148R IN STOP POSITION WITHOUT PERMISSION. THIS SIGNAL LEADS INTO ABS TERRITORY AND REQUIRES RULE 241 TO BE PASSED. FORM D A203 WAS IN EFFECT FOR AUTHORITY ON NO.2 TRACK BETWEEN DOCK AND HUNTER WITH A LINE 3 TO PASS STOP SIGNAL AT CLIFF.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The foreman piloting the track equipment allegedly passed signal 148R in the stop position without permission. **Ignored a Caution/Warning, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The foreman piloting the track equipment allegedly passed signal 148R in the stop position without permission, leading into ABS territory and requiring rule 241 to be passed. **Extreme Violation - Lack of Discipline:** The foreman piloting the track equipment allegedly passed signal 148R in the stop position without permission.	N/A	**Insufficient Information Provided**	**N**

Rule Violation Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
150481 - 2017	AN - MP 33.6 TR 3	REGIONAL TRAIN 151 ENTERED AN OUT OF SERVICE TRACK, 3 TRK WITHOUT A FORM D BETWEEN COUNTY INT AND HAM INT THAT WAS OUT BY BULLETIN ORDER NYW6-85SUM NORAC RULE 133E. TRAIN CREW OPERATED INTO AN OOS TRACK WITHOUT THE PROPER AUTHORITY.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B, 1C	**Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The regional train entered an out-of-service track without a Form D. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The train crew operated into an out-of-service track without proper authority. If the track was out of service for maintenance of way work, this event could have had serious ramifications. **Extreme Violation - Lack of Discipline:** The region between County and Ham interlocking was out by bulletin order NYW6-85SUM NORAC Rule 133E, when train 151 operated into an out of service track without proper authority.	N/A	**Insufficient Information Provided**	N
150484 - 2017	AN - MP 33.6 TR 3	HIGH SPEED TRAIN 2103 ENTERED AN OUT OF SERVICE TRACK, 3 TRK AT DELCO INTERLOCKING WITHOUT A FORM D BETWEEN COUNTY INT AND HAM INT THAT WAS OUT BY BULLETIN ORDER NYW6-85SUM NORAC RULE 133E. CTEC 8 ALLOWED TRAIN 2103 TO OPERATE IN AN OOS TRACK WITHOUT PROPER AUTHORITY. THERE WAS NO EQUIPMENT DAMAGE.	**Injuries: Information not provided** **Associated Damage Cost:** None	1A, 1B, 1C	**Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** A high speed train was permitted by CTEC to enter an out-of-service track without a Form D. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The train crew operated into an out-of-service track without proper authority. If the track was out of service for maintenance of way work, this event could have had serious ramifications. **Extreme Violation - Lack of Discipline:** Region between County and Ham interlocking was out by bulletin order NYW6-85SUM NORAC Rule 133E, when CTEC allowed train 2103 to operate into the out of service track without proper authority.	N/A	**Insufficient Information Provided**	N

Rule Violation Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
153804 - 2018	**AN - MP 58.3 TR 2-1**	TRACK FOREMAN WAS MAKING A SHOVING MOVE WITH TRACK CARS FROM NO.2 TO NO.1 TRACK AT MORRIS MP-58.3. IT IS ALLEGED THAT THE NO.62 SWITCH WAS IMPROPERLY LINED WHEN THE DISPATCHER ISSUED RULE-241. THE TRACK CAR DRIVER OPERATED PAST THE SIGNAL AND INTO THE IMPROPERLY LINED SWITCH. THERE WAS NO DERAILMENT AND NO INJURIES.	**Injuries:** None **Associated Damage Cost:** None	1A, 1B, 1C	**Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The track car operator proceeded past the signal and into the improperly lined switch. **Ignored a Caution/Warning, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** When the dispatcher issued Rule-241, it is alleged that the No. 62 switch was improperly lined, and the track car driver operated past the signal and into the improperly lined switch. **Extreme Violation - Lack of Discipline:** When the dispatcher issued Rule-241, it is alleged that the No. 62 switch was improperly lined and the track car driver operated past the signal and into the improperly lined switch.	N/A	**Insufficient Information Provided**	**Y**
128388 - 2013	**AP - MP 36.4 TR 1**	TSAVE EQUIPMENT TRAVELLED THROUGH A MOVABLE POINT FROG THAT WAS NOT ALIGNED CORRECTLY	**Injuries:** None **Associated Damage Cost:** Maintenance of Way: $2530.00	1A, 1C	**Breakdown in Visual Scan:** The operator was looking down at the controls, and did not ensure that the switch and MPF were properly aligned for northward movement. Similarly, the foreman's attention was on something he/she dropped. **Over-Controlled/Under Controlled System:** The foreman and the management operator ran through a movable point frog not lined for the intended northward movement. **Widespread/Routine Violation:** In the report, the event was listed as an operating rule violation, being that the foreman and management operator ran through a movable point frog.	2F, 2G	**Lack of Situational Awareness, Distraction:** The foreman pilot's attention was directed towards a dropped object, while the management operator's attention was directed towards his/her controls instead of the track. Thus, the employees failed to realize that the switch was not lined for intended movement. **Failure of Crew/Team Leadership:** The foreman and management operator failed to maintain the awareness required to operate the equipment without error. **Technical or Process Knowledge Not Retained After Training:** The operator was looking down at his/her controls instead of the track ahead.	**Y**
68802 - 2001	**AP - MP 62.7**	A BMS (BALLAST MANAGEMENT SYSTEM) MACHINE WAS OPERATING AT MILEPOST 62.8 NEAR HAVRE DE GRACE, MD, WHEN IT STRUCK THE #43 SWITCH, CAUSING DAMAGE TO BOTH THE SWITCH AND THE BMS MACHINE. THE CAUSE WAS DETERMINED TO BE THE ABSENCE OF A GROUND MAN DIRECTING THE MOVEMENT.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $2435.00 Maintenance of Way:$9,000.00	1A	**Over-Controlled/Under Controlled System:** The ballast machine struck a switch.	2G	**Failure of Crew/Team Leadership:** The groundman directing movement was absent.	**N**

Rule Violation Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
147383 - 2017	AP - MP 94.5	THE BALLAST REGULATOR TRACK CAR/14401 WAS BEING OPERATED SOUTHBOUND ON THE PW LINE FROM MP 92 TO BIDDLE INTERLOCKING/MP 94. AS THE TRACK CAR OPERATOR APPROACHED BIDDLE THE LRV-11 VAC TRAIN WAS WORKING AROUND THE CURVE AT MP 94.5. THE TRACK CAR OPERATOR DID NOT NOTICE THE # 19 SWITCH AT BIDDLE LINED AGAINST MOVEMENT WHEN HE OPERATED THROUGH THE SWITCH. THE TRACK CAR OPERATOR SAFELY STOPPED THE REGULATOR AND INFORMED HIS SUPERVISOR.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The ballast regulator proceeded through a switch lined against the move, resulting in a close-call collision. **Breakdown in Visual Scan:** The ballast regulator operator did not observe the switch lined against the move, and the LRV-11 Vac train working around the curve. **Ignored Caution/Warning:** The track car proceeded with the move, despite the switch being lined against the movement. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	2A, 2E, 2F	**Lack of Situational Awareness, Misperception of Changing Environment:** The LRV-11 Vac train vehicle was working around a curve, and the operator proceeded towards the vehicle without any awareness that the switch was not lined for the movement of his/her equipment. **Blind Spot:** The opposing vehicle was working around a curve.	N

Data Discrepancies

Data Discrepancies

Information Source	Incident# - Year	MP / TR# Location	Overview	Injuries	Damage Cost	Comment
Incident Log	**156569 - 2008**	**AB - MP 82.8 TR 1**	THREE PIECES OF EQUIPMENT WERE MOVING EAST AND STOPPING AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING. THE LEAD PIECE WAS STABILIZER A16106, FOLLOWED BY REGULATOR A14314 AND THE FINAL TRAILING PIECE WAS TAMPER L11507. LEAD PIECE A16106 HAD STOPPED AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING ALONG WITH REGULATOR A14314. THE TRAILING PIECE L11507 WAS UNABLE TO STOP SHORT OF THE REGULATOR TO THE EAST CAUSING IMPACT AT APPROXIMATELY 2-3 MPH. THERE WERE NO INJURIES TO REPORT.	Information Not Provided	Associated Damage Cost: None	**The damage cost, and the mile post location was not updated in the incident log from the report.**
Amtrak Report	**156569 - 2018**	**AB - MP 83.06 TR 1**	THREE PIECES OF EQUIPMENT WERE MOVING EAST AND STOPPING AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING. THE LEAD PIECE WAS STABILIZER A16106, FOLLOWED BY REGULATOR A14314 AND THE FINAL TRAILING PIECE WAS TAMPER L11507. LEAD PIECE A16106 HAD STOPPED AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING ALONG WITH REGULATOR A14314. THE TRAILING PIECE L11507 WAS UNABLE TO STOP SHORT OF THE REGULATOR TO THE EAST CAUSING IMPACT AT APPROXIMATELY 2-3 MPH. THERE WERE NO INJURIES TO REPORT.	Injuries: None	Associated Damage Cost: Equipment: $400.00	**The damage cost, and the mile post location was not updated in the incident log from the report.**

Data Discrepancies Continued

Information Source	Incident# - Year	MP / TR# Location	Overview	Injuries	Damage Cost	Comment
Incident Log	**155491 - 2018**	**AB - MP 89.2 TR 4**	RULE VIOLATION/DERAILMENT: AT TRIEBEL INTERLOCKING, SPERRY RAIL CAR 125 ON TRACK 1 WAS SWITCHING OVER TO TRACK 2 WHEN THE FOREMAN RECEIVED A FORM D TO OPERATE BETWEEN MEADOW INTERLOCKING AND TRIEBEL INTERLOCKING ON TRACK #4. WHILE OPERATING ON TRACK #4 BETWEEN MEADOW AND TRIEBEL, THE FOREMAN OPERATED PAST THE LIMITS AND WENT PAST THE HOMEBOARD AT TRIEBEL. THIS MOVE PUT THE SPERRY CAR PAST ITS OUT OF SERVICE LIMITS AND OVER THE 42 SWITCH WHICH WAS LINED AGAINST THE MOVE. AT THIS POINT THE SPERRY CAR OPERATOR REALIZED THE CARRIAGE FOR THE TESTING EQUIPMENT DERAILED OVER THE 42 SWITCH AND MADE A REVERSE MOVE OVER THE MOVABLE POINT FROG AT THE 42 SWITCH, WHICH DERAILED THE LEADING 2 WHEELS OF THE SPERRY CAR.	Information Not Provided	Associated Damage Cost: None	**The damage cost was not updated in the incident log from the report.**
Amtrak Report	**155491 - 2018**	**AB - MP 89.2 TR 4**	RULE VIOLATION/DERAILMENT: AT TRIEBEL INTERLOCKING, SPERRY RAIL CAR 125 ON TRACK 1 WAS SWITCHING OVER TO TRACK 2 WHEN THE FOREMAN RECEIVED A FORM D TO OPERATE BETWEEN MEADOW INTERLOCKING AND TRIEBEL INTERLOCKING ON TRACK #4. WHILE OPERATING ON TRACK #4 BETWEEN MEADOW AND TRIEBEL, THE FOREMAN OPERATED PAST THE LIMITS AND WENT PAST THE HOMEBOARD AT TRIEBEL. THIS MOVE PUT THE SPERRY CAR PAST ITS OUT OF SERVICE LIMITS AND OVER THE 42 SWITCH WHICH WAS LINED AGAINST THE MOVE. AT THIS POINT THE SPERRY CAR OPERATOR REALIZED THE CARRIAGE FOR THE TESTING EQUIPMENT DERAILED OVER THE 42 SWITCH AND MADE A REVERSE MOVE OVER THE MOVABLE POINT FROG AT THE 42 SWITCH, WHICH DERAILED THE LEADING 2 WHEELS OF THE SPERRY CAR.	Injuries: None	Associated Damage Cost: Infrastructure: $8,000.00	**The damage cost was not updated in the incident log from the report.**

Data Discrepancies Continued

Information Source	Incident# - Year	MP / TR# Location	Overview	Injuries	Damage Cost	Comment
Incident Log MP Parameter	**97800 - 2005**	**AB - MP 208.6 TR 2**	BALLAST REGULATOR A14117 MADE CONTACT WITH TAMPER A10707 WHICH WAS STOPPED ON NO.2 TRACK AT MP203.6 IN MANSFIELD.	Injuries: Information not provided	Associated Damage Cost: Equipment: $35,000.00	**The mile post parameter was inconsistently recorded in the incident narrative and the incident log mile post parameter box.**
Incident Log Narrative	**97800 - 2005**	**AB - MP 203.6 TR 2**	BALLAST REGULATOR A14117 MADE CONTACT WITH TAMPER A10707 WHICH WAS STOPPED ON NO.2 TRACK AT MP203.6 IN MANSFIELD.	Injuries: Information not provided	Associated Damage Cost: Equipment: $35,000.00	**The mile post parameter was inconsistently recorded in the incident narrative and the incident log mile post parameter box.**
Incident Log Damage Cost Parameter	**133864 - 2014**	**AP - MP 26.6 TR 2**	Z-052 OPERATED 5 TRACK CARS (TAMPER A11269; HI-RAIL SWIVEL DUMP AG94693; BALLAST REGULATOR; TRACK STABILIZER, AND LRV4) #1 TRACK FROM YARD TO BRANDY AND #2 TRACK FROM BRANDY TO WINE INTERLOCKING WHEN THE TAMPER PULLED UP AND STOPPED AT THE 2N SIGNAL TO RECEIVE RULE 241. THE HI-RAIL SWIVEL DUMP FOLLOWING DID NOT STOP IN TIME AND COLLIDED WITH THE TAMPER. AMTRAK'S EQUIPMENT DAMAGE IS $12,000.00.	Information Not Provided	Associated Damage Cost: Equipment: $6,000.00	**The damage cost was not updated in the incident log from the report.**
Incident Log Narrative, Amtrak Report	**133864 - 2014**	**AP - MP 26.6 TR 2**	Z-052 OPERATED 5 TRACK CARS (TAMPER A11269; HI-RAIL SWIVEL DUMP AG94693; BALLAST REGULATOR; TRACK STABILIZER, AND LRV4) #1 TRACK FROM YARD TO BRANDY AND #2 TRACK FROM BRANDY TO WINE INTERLOCKING WHEN THE TAMPER PULLED UP AND STOPPED AT THE 2N SIGNAL TO RECEIVE RULE 241. THE HI-RAIL SWIVEL DUMP FOLLOWING DID NOT STOP IN TIME AND COLLIDED WITH THE TAMPER. AMTRAK'S EQUIPMENT DAMAGE IS $12,000.00.	Injuries: None	Associated Damage Cost: Equipment: $12,000.00	**The damage cost was not updated in the incident log from the report.**

Data Discrepancies Continued

Information Source	Incident# - Year	MP / TR# Location	Overview	Injuries	Damage Cost	Comment
Incident Log	136402 - 2015	AP - MP 38.4 TR 3-5	TRACK CAR AB34701 DERAILED OVER #37 SWITCH AT MP 37.8 BLOCKING TRACKS #1 THROUGH #5 TRACK. RAIL SWEEP, ON HIGH RAIL, CAUGHT RAIL WHEEL CAUSING WHEEL TO RIDE UP OVER OPEN SWITCH POINT CAUSING WHEEL TO DERAIL. THERE WAS NO EQUIPMENT DAMAGE.	Information Not Provided	Associated Damage Cost: None	**The mile post parameter was inconsistently recorded in the incident log and several documents.**
Incident Narrative, Amtrak Report	136402 - 2015	AP - MP 37.8 TR 3-5	TRACK CAR AB34701 DERAILED OVER #37 SWITCH AT MP 37.8 BLOCKING TRACKS #1 THROUGH #5 TRACK. RAIL SWEEP, ON HIGH RAIL, CAUGHT RAIL WHEEL CAUSING WHEEL TO RIDE UP OVER OPEN SWITCH POINT CAUSING WHEEL TO DERAIL. THERE WAS NO EQUIPMENT DAMAGE.	Injuries: None	Associated Damage Cost: None	**The mile post parameter was inconsistently recorded in the incident log and several documents.**
Incident Log Narrative	120378 - 2011	AP - MP 88.5 TR 3	TRACK EQUIPMENT TCA39843 DERAILED AT MP 88.5 ON NO.3 TRACK DURING TREE TRIMMING OPERATIONS.	Information Not Provided	Associated Damage Cost: None	**The mile post parameter was inconsistently recorded in the incident log and several documents.**
Amtrak Report	120378 - 2011	AP - MP 85.2 TR 3	TRACK EQUIPMENT TCA39843 DERAILED AT MP 88.5 ON NO.3 TRACK DURING TREE TRIMMING OPERATIONS.	Injuries: None	Associated Damage Cost: None	**The mile post parameter was inconsistently recorded in the incident log and several documents.**

Data Discrepancies Continued

Information Source	Incident# - Year	MP / TR# Location	Overview	Injuries	Damage Cost	Comment
Incident Log Damage Cost Parameter	**137920 - 2015**	**AP - MP 72.4 TR 2**	TRACK EQUIPMENT WITH BALLAST REGULATOR A14322 SOUTH END LEAD AND TAMPER A11038 TRAILING RECEIVED A RULE 241 AT BUSH INTERLOCK TO PROCEED PAST THE STOP SIGNAL INTO OUT OF SERVICE #2 TRACK. BALLAST REGULATOR PROCEEDED TO OUT OF SERVICE TRACK WHEN EQUIPMENT BEGAN TO SLOW DOWN TO A STOP. THE TAMPER A11038 WAS FOLLOWING THE BALLAST REGULATOR A14322 AND FAILED TO STOP SHORT OF THE EQUIPMENT COLLIDING WITH THE BALLAST REGULATOR. AMTRAK'S BALLAST REGULATOR DAMAGE IS $100,000.00 AND AMTRAK'S TAMPER DAMAGE IS $40,000.00.	Information Not Provided	Associated Damage Cost: Equipment: $100,000.00	**The damage cost parameter was inconsistently recorded in the incident narrative and the incident log damage cost parameter box.**
Incident Log Narrative	**137920 - 2015**	**AP - MP 72.4 TR 2**	TRACK EQUIPMENT WITH BALLAST REGULATOR A14322 SOUTH END LEAD AND TAMPER A11038 TRAILING RECEIVED A RULE 241 AT BUSH INTERLOCK TO PROCEED PAST THE STOP SIGNAL INTO OUT OF SERVICE #2 TRACK. BALLAST REGULATOR PROCEEDED TO OUT OF SERVICE TRACK WHEN EQUIPMENT BEGAN TO SLOW DOWN TO A STOP. THE TAMPER A11038 WAS FOLLOWING THE BALLAST REGULATOR A14322 AND FAILED TO STOP SHORT OF THE EQUIPMENT COLLIDING WITH THE BALLAST REGULATOR. AMTRAK'S BALLAST REGULATOR DAMAGE IS $100,000.00 AND AMTRAK'S TAMPER DAMAGE IS $40,000.00.	Information Not Provided	Associated Damage Cost: Equipment: $140,000.00	**The damage cost parameter was inconsistently recorded in the incident narrative and the incident log damage cost parameter box.**
Incident Log	**150235 - 2017**	**AP - MP 90.1 TR 3**	C A14311 WAS OPERATING SOUTH ON OUT OF SERVICE TRACK 3 BETWEEN POINT MP 90.1 AND BAY MP 91.9. THE OPERATOR FAILED TO STOP BEFORE COLLIDING WITH TC A16104 THAT WAS AHEAD AT MP 91.7. THERE WAS NO TRACK DAMAGE. THE TOTAL COST FOR LABOR FOR BOTH UNITS IS $886.29. THERE WAS NO MATERIAL COST, REPAIR INCLUDED REMOVING AND STRAIGHTENING THE DAMAGED LOCK MECHANISM ON THE BALLAST REGULATOR AND REINSTALLATION ON THE MACHINE. $886.29 DAMAGE FOR A14311 AND $0.00 FOR A16104.	Information Not Provided	Associated Damage Cost: Equipment: $886.29	**The damage cost was inconsistently recorded in the incident log damage cost parameter box and Amtrak's correspondence.**
Amtrak Correspondence	**150235 - 2017**	**AP - MP 90.1 TR 3**	C A14311 WAS OPERATING SOUTH ON OUT OF SERVICE TRACK 3 BETWEEN POINT MP 90.1 AND BAY MP 91.9. THE OPERATOR FAILED TO STOP BEFORE COLLIDING WITH TC A16104 THAT WAS AHEAD AT MP 91.7. THERE WAS NO TRACK DAMAGE. THE TOTAL COST FOR LABOR FOR BOTH UNITS IS $886.29. THERE WAS NO MATERIAL COST, REPAIR INCLUDED REMOVING AND STRAIGHTENING THE DAMAGED LOCK MECHANISM ON THE BALLAST REGULATOR AND REINSTALLATION ON THE MACHINE. $886.29 DAMAGE FOR A14311 AND $0.00 FOR A16104.	Injuries: None	Associated Damage Cost: Equipment: $726.00	**The damage cost was inconsistently recorded in the incident log damage cost parameter box and Amtrak's correspondence.**

Data Discrepancies Continued

Information Source	Incident# - Year	MP / TR# Location	Overview	Injuries	Damage Cost	Comment
Incident Log	**120046 - 2011**	**AP - MP 135.3 TR 22**	COLLISION - A MATWELL TRUCK BACKED INTO A TIE HANDLER WITH A CART	Information Not Provided	Associated Damage Cost: Equipment: $2000.00	**The damage cost was inconsistently recorded in the incident log, and the Amtrak report.**
Amtrak Report	**120046 - 2011**	**AP - MP 135.3 TR 22**	COLLISION - A MATWELL TRUCK BACKED INTO A TIE HANDLER WITH A CART	Injuries: None	Associated Damage Cost: Equipment:$3725.00	**The damage cost was inconsistently recorded in the incident log, and the Amtrak report.**
Incident Log MP Parameter	**135912 - 2015**	**AN - MP 24 TR 4**	TIE GANG TRAVELING EAST INSIDE OF OUT OF SERVICE TRACK ON NO.4 TRACK WHEN COLLISION OCCURRED AT MP24.2. BALLAST REGULATOR STOPPED, FLASHED LIGHTS TO SIGNAL STOPPING. JR. TAMPER NEXT IN LINEUP FLASHED ITS LIGHTS TO SIGNAL IT STOPPING. THE TIE HANDLER 2 FOLLOWED BY SIGNALING IT WAS STOPPING. THE NIPPER CLIPPER FOLLOWED, FLASHED ITS LIGHT IN THE SAME MANNER. THE TRIPP 2 MACHING WAS APPROACHING AND COLLIDED WITH THE NIPPER CLIPPER. THE NIPPER CLIPPER WAS PUSHED INTO THE TIE HANDLER 2.	Information Not Provided	Associated Damage Cost: None	**The damage cost was not updated in the incident log from the report. Also, although there is only a minor difference, the mile post parameter was inconsistently recorded in the incident log and several documents.**
Incident Log Narrative, Amtrak Report	**135912 - 2015**	**AN - MP 24.2 TR 4**	TIE GANG TRAVELING EAST INSIDE OF OUT OF SERVICE TRACK ON NO.4 TRACK WHEN COLLISION OCCURRED AT MP24.2. BALLAST REGULATOR STOPPED, FLASHED LIGHTS TO SIGNAL STOPPING. JR. TAMPER NEXT IN LINEUP FLASHED ITS LIGHTS TO SIGNAL IT STOPPING. THE TIE HANDLER 2 FOLLOWED BY SIGNALING IT WAS STOPPING. THE NIPPER CLIPPER FOLLOWED, FLASHED ITS LIGHT IN THE SAME MANNER. THE TRIPP 2 MACHING WAS APPROACHING AND COLLIDED WITH THE NIPPER CLIPPER. THE NIPPER CLIPPER WAS PUSHED INTO THE TIE HANDLER 2.	Injuries: Employee in the nipper clipper was injured, receiving 17 stiches on the left side of his forehead.	Associated Damage Cost: Equipment: $500.00	**The damage cost was not updated in the incident log from the report. Also, although there is only a minor difference, the mile post parameter was inconsistently recorded in the incident log and several documents.**

Data Discrepancies Continued

Information Source	Incident# - Year	MP / TR# Location	Overview	Injuries	Damage Cost	Comment
Incident Log , Amtrak Report	**120473 - 2011**	**AN - MP 58.3 TR 1 Morrisville, PA**	MOFW REGULATOR TCA 14308 COLLIDED WITH REAR OF MOFW STABILIZER TCA 16106 ON NO.1 TRACK IN MORRIS INTERLOCKING DERAILING 1 WHEEL OF REGULATOR (OPERATOR OF REGULATOR FLED THE SCENE).	Information Not Provided	Associated Damage Cost: None	**There are two differing city, and state locations associated with the same mile post in these two separate events.**
Incident Log , Amtrak Report	**153804 - 2018**	**AN - MP 58.3 TR 2-1 Hamilton Township, NJ**	TRACK FOREMAN WAS MAKING A SHOVING MOVE WITH TRACK CARS FROM NO.2 TO NO.1 TRACK AT MORRIS MP-58.3. IT IS ALLEGED THAT THE NO.62 SWITCH WAS IMPROPERLY LINED WHEN THE DISPATCHER ISSUED RULE-241. THE TRACK CAR DRIVER OPERATED PAST THE SIGNAL AND INTO THE IMPROPERLY LINED SWITCH. THERE WAS NO DERAILMENT AND NO INJURIES.	Injuries: None	Associated Damage Cost: None	**There are two differing city, and state locations associated with the same mile post in these two separate events.**
Incident Log, Amtrak Report	**148261 - 2017**	**AN - MP 8.6 TR 3**	#642 WAS OPERATING EAST ON #2 TRACK. WHEN PASSING TRACK EQUIPMENT ON #3 TRACK THE VACUUM CAUSED BY TRAIN PULLED DOOR OPEN ON A47931. A DEFECTIVE DOOR LATCH WAS FOUND ON EQUIPMENT. THE ENGINE ON REAR OF TRAIN STRUCK DOOR AND TORE THE BRAKE INDICATOR LIGHT OF SIDE OF ENGINE.	Information Not Provided	Associated Damage Cost: None	**The event was listed in the incident log twice, with varying incident numbers, and at different mile post locations.**
Incident Log	**148209 - 2017**	**AN - MP 87.2 TR 3**	TRAIN 642 OPERATING WITH CAB CAR C/9638 IN THE LEAD, 4 CARS AND LOCOMOTIVE E/657 STRUCK A DOOR ON TRACK EQUIPMENT A47931 THAT WAS STANDING ON NO.3 TRACK (OUT OF SERVICE) BETWEEN MANTUA MP 87.2 AND LEHIGH MP85.1.	Information Not Provided	Associated Damage Cost: None	**The event was listed in the incident log twice, with varying incident numbers, and at different mile post locations.**

Data Deficiencies

Data Deficiencies

Supplemental Report Not Provided

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
60992 - 2000	AP - MP 135.5	TRAIN 199 STRUCK AN EXTENSION ARM ON A TIE TAMPER WORKING ON ADJACENT TRACK.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00	1A	**Over-Controlled/Under Controlled System:** Train 199 struck an extension arm on a tie tamper.	N/A	**Insufficient Information Provided**	N
60085 - 2000	AB - MP 219	CAT CAR 16512 RAN OUT FROM UNDER WIRE HITTING DROP PIPE AT BOSTON, MA.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00 Maintenance of Way: $7,000.00	1A	**Over-Controlled/Under Controlled System:** The catenary car struck an object, a drop pipe.	N/A	**Insufficient Information Provided**	N
62994 - 2000	AN - MP 86.4	BOOM TOO HIGH HITTING BRIDGE AT PHILADELPHIA. PA.	**Injuries**: Information not provided **Associated Damage Cost:** Infrastructure: $162.00	1A	**Over-Controlled/Under Controlled System:** The boom was too high and hit a bridge. **Break Down in Visual Scan:** The work crew failed to observe, and assess the clearance between the boom and the bridge.	N/A	**Insufficient Information Provided**	N
92857 - 2004	AB - MP 77.6	AMTRAK SHORE LINE EAST TEST EXTRA WITH ENGINE 6695 AND 3 CARS STRUCK 3 PIECES OF CONTRACTOR EQUIPMENT AT MP 77.6, EAST OF NEW HAVEN, CT.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $60,500.00 Maintenance of Way: $8,000.00	1A, 1B	**Breakdown in Visual Scan:** The contractor did not observe the position of the equipment in relation to the adjacent tracks. **Inadequate Real-Time Risk Assessment, Failure to Prioritize Tasks Adequately:** The contractor failed to adequately assess the risks associated with operating the equipment on the track. **Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The contractor did not adequately protect the equipment.	N/A	**Insufficient Information Provided**	N
97800 - 2005	AB - MP 203.6 TR 2	BALLAST REGULATOR A14117 MADE CONTACT WITH TAMPER A10707 WHICH WAS STOPPED ON NO.2 TRACK AT MP203.6 IN MANSFIELD.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $35,000.00	1A, 1C	**Over-Controlled/Under Controlled System:** The ballast regulator made contact with the tamper. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	N
99483 - 2005	AB - MP 104.7 TR 2	MAKING A REVERSE MOVE TRACK CAR TCAA23676 DERAILED OVER THE SWITCH POINTS OF THE #21 CROSSOVER ON THE TRACK#2 SIDE.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The MOW vehicle derailed unintentionally over switch points.	N/A	**Insufficient Information Provided**	N

Data Deficiencies Continued

Supplemental Report Not Provided

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
101029 - 2006	AP - MP 91.4 TR 1	TRAIN 1662 WITH ENGINE 664 AND 2 CARS STRUCK THE UNDERCUTTER (A14909) THAT WAS FOULING NO.1 TRACK WHICH CAUSED TRAIN 1662 AND THE UNDERCUTTER CONSIST TO DERAIL.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $900,000.00 Maintenance of Way: $150,000.00	1A	**Over-Controlled/Under Controlled System:** Train 1662 struck the undercutter.	N/A	**Insufficient Information Provided**	N
102555 - 2006	AB - MP 158.8 TR 1	THE TRACK FOREMAN OPERATED TRACK CAR TC AA23776 OUTSIDE OF HIS AUTHORITY LIMITS AND ENTERED THE INTERLOCKING LIMITS ON TRACK 1 AT KINGSTON, RI. TRAIN 163 THEN STRUCK THE TRACK CAR.	**Injuries**: Information not provided **Associated Damage Cost:** Equipment: $30,000.00 Maintenance of Way: $1,000.00	1B, 1C	**Extreme Violation - Lack of Discipline:** The track foreman operated the track car outside of his authority limits, and entered the interlocking limit on track 1. **Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The foreman proceeded outside of his authority limits, failing to recognize the risks associated with this course of action. Ultimately, the track car was struck by a train.	N/A	**Insufficient Information Provided**	N
104269 - 2007	AB - MP 228 TR 5	TRAIN 448 ENGINE 101 AND 4 CARS STRUCK A PIECE OF MOFW EQUIPMENT A LULL LIFT ON #5 TRACK IN COVE INTERLOCKING.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $150.00	1A	**Over-Controlled/Under Controlled System:** Train 448 struck a Lull lift.	N/A	**Insufficient Information Provided**	N
109728 - 2008	AB - MP 213.8	GEISMAR CRANE A50410 STRUCK REAR OF WELDING TRUCK STOPPED AT HOME SIGNAL FOR JUNCTION INTERLOCKING. SPERRY CAR TESTING IN INTERLOCKING, CRANE FAILED TO STOP.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1C	**Over-Controlled/Under Controlled System:** The Geismar crane failed to stop, and collided with the welding truck. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	N
112994 - 2009	AP - MP 113.9	CRANE DID NOT STOP FOR THE DE-RAIL, CAUSING REAR WHEELS OF THE CRANE TO COME OFF OF THE TRACK. CRANE WAS RE-RAILED AND PULLED BACK INTO THE YARD.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The crane did not stop for the derail. **Breakdown in Visual Scan:** The operator did not observe the derail.	N/A	**Insufficient Information Provided**	N
112484 - 2009	AB - MP 194.5	A JUNIOR TAMPER MACHINE A 11267 RAN INTO THE BACK OF A SWIVEL DUMP TRUCK AG 95399 AT MP 194.47 IN ATTLEBORO, MA.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $21,600.00	1A, 1C	**Over-Controlled/Under Controlled System:** The junior tamper machine ran into the back of the Swivel dump. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	N

Data Deficiencies Continued

Supplemental Report Not Provided

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
113703 - 2009	**AB - MP 75.1**	AMTRAK PETTIBONE WAS STOPPED AT SHORELINE JCT HOME BOARD, CONTRACTED HY-RAIL HOLLAND WELDING TRUCK FOLLOWING PETTIBONE, MAKING REVERSE MOVE, FAILED TO STOP, RUNNING INTO THE REAR OF THE PETTIBONE.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00	1A, 1C	**Over-Controlled/Under Controlled System:** The contracted hi-rail Holland welding truck following the Pettibone failed to stop while making a reverse move and ran into the Pettibone vehicle. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	**N**
113910 - 2009	**AN - MP 46 TR 3**	TRAIN 56 ENGINE 902 AND 5 CARS, OPERATING ON NYP LINE NO. 2 TRACK, CLIPPED PIECE OF MOFW EQUIPMENT TIED DOWN ON NO. 3 TRACK.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $1,000.00 Maintenance of Way: $2,000.00	1A	**Procedure/Checklist Not Followed Correctly:** The work crew did not properly secure the equipment.	N/A	**Insufficient Information Provided**	**N**
114041 - 2009	**AN - MP 34.9**	TRACK CARS WERE CLEARING UP AFTER COMPLETING THE WORK ASSIGNED AND THE SOUTHERN MOST PIECES OF EQUIPMENT STOPPED AT MP 34.9 TO PICK UP WHISTLE BOARDS AND TRACK BARRICADE WHEN PETTY BONE SPEED SWING L47956 COLLIDED WITH THE JR. TAMPER G11262, CAUSING DAMAGE TO THE TAMPER AND PERSONAL INJURY TO THE EQUIPMENT OPERATOR OF THE TAMPER.	**Injuries:** The collision caused personal injury to the equipment operator of the tamper. **Associated Damage Cost:** Equipment: $8000.00	1A, 1C	**Over-Controlled/Under Controlled System:** The Pettibone Speed Swing failed to stop short of the equipment and collided with the junior tamper. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	N/A	**Insufficient Information Provided**	**N**
114284 - 2010	**AN - MP 8.5 TR 2**	TRACK CAR DERAILMENT TCAJ15401 DERAILED OVER THE 63 SWITCH ON #2 TRACK AT THE EAST OF DOCK.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally over a switch.	N/A	**Insufficient Information Provided**	**N**
114883 - 2010	**AB - MP 222**	VACUUM TRUCK AU-18673 STRUCK THE REAR OF A RENTED VACUUM TRUCK NEAR BOSTON, MA.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $57,050.00	1A	**Over-Controlled/Under Controlled System:** The vacuum truck struck the rear of a rented vacuum truck.	N/A	**Insufficient Information Provided**	**N**

Data Deficiencies Continued

Supplemental Report Not Provided

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
117576 - 2010	**AP - MP 1.7 TR 4**	SEPTA TRAIN 541 STRUCK A PIECE OF RAIL BEING DRAGGED BY AN AMTRAK CONTRACTOR AT MILEPOST 1.7 ON TRACK 4 NEAR PHILADELPHIA, PA.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B	**Breakdown in Visual Scan:** The contractor did not observe the position of the rail in relation to the track and train. **Inadequate Real-Time Risk Assessment, Failure to Prioritize Tasks Adequately:** The contractor failed to adequately assess the risks associated with transporting materials on the track. **Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The contractor did not adequately secure the rail while transporting materials.	N/A	**Insufficient Information Provided**	**N**
134208 - 2014	**AP - MP 57.3**	TRACK CAR A10604 TAMPER DERAILED WHILE OPERATING IN THE NORTH DIRECTION OVER THE 43 SWITCH AT PRINCE INTERLOCKING THAT WAS NOT LINED FOR THE MOVE. AMTRAK'S EQUIPMENT DAMAGE IS $125,000.00.	**Injuries:** Information not provided **Associated Damage:** Equipment: $125,000.00	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally, as a result of operating in the north direction over a switch that was not lined for the move.	N/A	**Insufficient Information Provided**	**N**
140362 - 2015	**AN - MP 23.6**	TWO PIECES OF TRACK EQUIPMENT, REGULATOR TC14328 AND 6700/TC11029 COLLIDED AT THE EASTBOUND HOME SIGNAL AT MENLO. THE BRAKING DISTANCE OF THE REGULATOR WAS INCORRECTLY JUDGED AFTER HEARING THAT THE LEAD EQUIPMENT WAS STOPPED AT THE HOME SIGNAL. NO EMPLOYEES WERE CHARGED WITH A RULE VIOLATION, DUE TO NOT MEETING THE 30 DAY TIME FRAME TO FILE. AMTRAK'S EQUIPMENT DAMAGE ON TC11029 WAS $15,000.00.	**Injuries**: Information not provided **Associated Damage Cost:** Equipment: $15,000.00	1A, 1B, 1C	**Rushed or Delayed Necessary Action, Over-Controlled/Under Controlled System:** After hearing that the lead equipment was stopped at the home signal, the regulator incorrectly judged the braking distance and collided with another track vehicle. **Ignored a Caution/Warning, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The lead equipment transmitted a message that it was stopped at the home signal, and the regulator proceeded, braking too late to prevent collision. **Widespread/Routine Violation**: *Appears to be an operating rule violation; however, due to not meeting the 30 day time frame to file, the employees were not charged with a rule violation.*	N/A	**Insufficient Information Provided**	**N**

Data Deficiencies Continued

Supplemental Report Not Provided

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
137920 - 2015	AP - MP 72.4 TR 2	TRACK EQUIPMENT WITH BALLAST REGULATOR A14322 SOUTH END LEAD AND TAMPER A11038 TRAILING RECEIVED A RULE 241 AT BUSH INTERLOCK TO PROCEED PAST THE STOP SIGNAL INTO OUT OF SERVICE #2 TRACK. BALLAST REGULATOR PROCEEDED TO OUT OF SERVICE TRACK WHEN EQUIPMENT BEGAN TO SLOW DOWN TO A STOP. THE TAMPER A11038 WAS FOLLOWING THE BALLAST REGULATOR A14322 AND FAILED TO STOP SHORT OF THE EQUIPMENT COLLIDING WITH THE BALLAST REGULATOR. AMTRAK'S BALLAST REGULATOR DAMAGE IS $100,000.00 AND AMTRAK'S TAMPER DAMAGE IS $40,000.00.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $140,000.00	1A, 1C	**Over-Controlled/Under Controlled System:** While the ballast regulator slowed to a stop, the tamper following failed to stop and collided with the ballast regulator. **Widespread/Routine Violation:** The ballast regulator and the tamper received rule 241 to proceed past the stop signal into the out of service track. The ballast regulator proceeded into the out of service track, then the equipment slowed to a stop. The tamper following failed to stop short of the ballast regulator.	N/A	**Insufficient Information Provided**	N
144171 - 2016	AB - MP 117.3 TR 2	WHILE MOW EQUIPMENT AWX-536 WAS TOWING A LEASED UNDER CUTTER (LORAM MUD MANTIS) ON NO.2 TRACK, THE EQUIPMENT STRUCK A BRIDGE ABUTMENT AT MP 117.31 MILLSTONE PT. ROAD.	**Injuries**: Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** MOW equipment struck the surrounding infrastructure, a bridge abutment. **Break Down In Visual Scan:** MOW employees did not observe the clearance between the equipment and the bridge abutment.	N/A	**Insufficient Information Provided**	N
141612 - 2016	AP - MP 51.0	TRACK CAR TCA1011 DERAILED ON THE NO.21 SWITCH AS A RESULT OF THE ROUTE WAS IMPROPERLY LINED. AMTRAK'S EQUIPMENT DAMAGE IS $4,220.00.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $4220.00	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally, as a result of an improperly lined switch.	N/A	**Insufficient Information Provided**	N
149291 - 2017	AN - MP 8.5 TR 2	ON NEW YORK TO PHILADELPHIA MAIN LINE AT MP 8.5 DOCK INTERLOCKING ON #2 TRACK, A FOREMAN PILOTING TRACK EQUIPMENT ALLEGEDLY PASSED SIGNAL 148R IN STOP POSITION WITHOUT PERMISSION. THIS SIGNAL LEADS INTO ABS TERRITORY AND REQUIRES RULE 241 TO BE PASSED. FORM D A203 WAS IN EFFECT FOR AUTHORITY ON NO.2 TRACK BETWEEN DOCK AND HUNTER WITH A LINE 3 TO PASS STOP SIGNAL AT CLIFF.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The foreman piloting the track equipment allegedly passed signal 148R in the stop position without permission. **Ignored a Caution/Warning, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The foreman piloting the track equipment allegedly passed signal 148R in the stop position without permission, leading into ABS territory and requiring rule 241 to be passed. **Extreme Violation - Lack of Discipline:** The foreman piloting the track equipment allegedly passed signal 148R in the stop position without permission.	N/A	**Insufficient Information Provided**	N

Data Deficiencies Continued

Supplemental Report Not Provided

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
150481 - 2017	AN - MP 33.6 TR 3	REGIONAL TRAIN 151 ENTERED AN OUT OF SERVICE TRACK, 3 TRK WITHOUT A FORM D BETWEEN COUNTY INT AND HAM INT THAT WAS OUT BY BULLETIN ORDER NYW6-85SUM NORAC RULE 133E. TRAIN CREW OPERATED INTO AN OOS TRACK WITHOUT THE PROPER AUTHORITY.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B, 1C	**Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The regional train entered an out-of-service track without a Form D. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The train crew operated into an out-of-service track without proper authority. If the track was out of service for maintenance of way work, this event could have had serious ramifications. **Extreme Violation - Lack of Discipline:** The region between County and Ham interlocking was out by bulletin order NYW6-85SUM NORAC Rule 133E, when train 151 operated into an out of service track without proper authority.	N/A	**Insufficient Information Provided**	N
150484 - 2017	AN - MP 33.6 TR 3	HIGH SPEED TRAIN 2103 ENTERED AN OUT OF SERVICE TRACK, 3 TRK AT DELCO INTERLOCKING WITHOUT A FORM D BETWEEN COUNTY INT AND HAM INT THAT WAS OUT BY BULLETIN ORDER NYW6-85SUM NORAC RULE 133E. CTEC 8 ALLOWED TRAIN 2103 TO OPERATE IN AN OOS TRACK WITHOUT PROPER AUTHORITY. THERE WAS NO EQUIPMENT DAMAGE.	**Injuries: Information not provided** **Associated Damage Cost:** None	1A, 1B, 1C	**Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** A high speed train was permitted by CTEC to enter an out-of-service track without a Form D. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The train crew operated into an out-of-service track without proper authority. If the track was out of service for maintenance of way work, this event could have had serious ramifications. **Extreme Violation - Lack of Discipline:** Region between County and Ham interlocking was out by bulletin order NYW6-85SUM NORAC Rule 133E, when CTEC allowed train 2103 to operate into the out of service track without proper authority.	N/A	**Insufficient Information Provided**	N

Data Deficiencies Continued

Supplemental Report Provided

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
127728 - 2013	AN - MP 35.6 TR 4	WHILE NJTR TRAIN 3827 WAS PASSING STANDING TRACK EQUIPMENT, AMTRAK TC-47953, NJTR TRAIN 3827 SUSTAINED DAMAGE AS A RESULT OF TC-47953 HAD THE CAB DOOR AJAR AND IT SWUNG OPEN AND STRUCK THE SIDE OF THE NJTR TRAIN 3827. NJTR'S EQUIPMENT DAMAGE IS $3,039.00.	**Injuries:** None **Associated Damage Cost:** Equipment: None	1A	**Over-Controlled/Under Controlled Vehicle/System:** The track equipment components were not adequately secured. As a result, the track car cab door swung open and was struck by a train.	N/A	**Insufficient Information Provided**	Y
128716 - 2013	AN - MP 32.8	TRACK CAR (CRIBBER) TC-26708 DERAILED WHILE OPERATING OVER THE NO.54 SWITCH TO THE MILLSTONE BRANCH AT COUNTY.	**Injuries:** None **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally over a switch.	N/A	**Insufficient Information Provided**	Y
135912 - 2015	AN - MP 24.2 TR 4	TIE GANG TRAVELING EAST INSIDE OF OUT OF SERVICE TRACK ON NO.4 TRACK WHEN COLLISION OCCURRED AT MP24.2. BALLAST REGULATOR STOPPED, FLASHED LIGHTS TO SIGNAL STOPPING. JR. TAMPER NEXT IN LINEUP FLASHED ITS LIGHTS TO SIGNAL IT STOPPING. THE TIE HANDLER 2 FOLLOWED BY SIGNALING IT WAS STOPPING. THE NIPPER CLIPPER FOLLOWED, FLASHED ITS LIGHT IN THE SAME MANNER. THE TRIPP 2 MACHING WAS APPROACHING AND COLLIDED WITH THE NIPPER CLIPPER. THE NIPPER CLIPPER WAS PUSHED INTO THE TIE HANDLER 2.	**Injuries:** Employee in the nipper clipper was injured, receiving 17 stiches on the left side of his forehead. **Associated Damage Cost:** Equipment: $500.00	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The Tripp 2 machine collided with the nipper clipper, pushing the nipper clipper into the tie handler. **Break Down in Visual Scan:** The Tripp 2 machine operator failed to observe the nipper clipper's light indication signaling it's stop. **Ignored a Caution/Warning:** Though other equipment pieces were able to communicate coming to a stop using their vehicle lights, the Tripp machine failed to successfully respond to the warning. Furthermore, the foreman operating the ballast regulator at the front of the equipment consist transmitted his/her intention to stop over the radio. **Widespread/Routine Violation:** Per report, the incident was classified as an alleged operating rule violation.	N/A	**Insufficient Information Provided**	Y
150235 - 2017	AP - MP 90.1 TR 3	TC A14311 WAS OPERATING SOUTH ON OUT OF SERVICE TRACK 3 BETWEEN POINT MP 90.1 AND BAY MP 91.9. THE OPERATOR FAILED TO STOP BEFORE COLLIDING WITH TC A16104 THAT WAS AHEAD AT MP 91.7. THERE WAS NO TRACK DAMAGE. THE TOTAL COST FOR LABOR FOR BOTH UNITS IS $886.29. THERE WAS NO MATERIAL COST, REPAIR INCLUDED REMOVING AND STRAIGHTENING THE DAMAGED LOCK MECHANISM ON THE BALLAST REGULATOR AND REINSTALLATION ON THE MACHINE. $886.29 DAMAGE FOR A14311 AND $0.00 FOR A16104.	**Injuries:** None **Associated Damage Cost:** Equipment: $886.29	1A, 1C	**Over-Controlled/Under Controlled System:** The MOW vehicle failed to stop, and collided with another MOW vehicle ahead. **Widespread/Routine Violation:** Per report, the operator of TCA14311 executed an alleged rule violation.	N/A	**Insufficient Information Provided**	Y

Data Deficiencies Continued

Supplemental Report Provided

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
152599 - 2018	AN - MP 56.4 TR 1	TRACK CAR A154521 WAS OPERTING WESTBOUND AT FAIR INTERLOCKING, MP 56.4 FROM THE HIGH TRACK TO NO. 1 TRACK WHEN THE TRACK CAR DERAILED ON THE NO. 16 SWITCH FROG. THE EQUIPMENT WAS NOT FOULING ANY OTHER TRACKS, AND THERE WERE NO INJURIES. THE TRACK CAR WAS RERAILED WITH NO REPORTED DAMAGE TO THE EQUIPMENT OR INFRASTRUCTURE.	**Injuries:** None **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** The track car derailed unintentionally over a switch frog.	N/A	**Insufficient Information Provided**	Y
153804 - 2018	AN - MP 58.3 TR 2-1	TRACK FOREMAN WAS MAKING A SHOVING MOVE WITH TRACK CARS FROM NO.2 TO NO.1 TRACK AT MORRIS MP-58.3. IT IS ALLEGED THAT THE NO.62 SWITCH WAS IMPROPERLY LINED WHEN THE DISPATCHER ISSUED RULE-241. THE TRACK CAR DRIVER OPERATED PAST THE SIGNAL AND INTO THE IMPROPERLY LINED SWITCH. THERE WAS NO DERAILMENT AND NO INJURIES.	**Injuries:** None **Associated Damage Cost:** None	1A, 1B, 1C	**Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The track car operator proceeded past the signal and into the improperly lined switch. **Ignored a Caution/Warning, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** When the dispatcher issued Rule-241, it is alleged that the No. 62 switch was improperly lined, and the track car driver operated past the signal and into the improperly lined switch. **Extreme Violation - Lack of Discipline:** When the dispatcher issued Rule-241, it is alleged that the No. 62 switch was improperly lined and the track car driver operated past the signal and into the improperly lined switch.	N/A	**Insufficient Information Provided**	Y

Recommendation References

Blame Culture

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
133864 - 2014	AP - MP 26.6 TR 2	Z-052 OPERATED 5 TRACK CARS (TAMPER A11269; HI-RAIL SWIVEL DUMP AG94693; BALLAST REGULATOR; TRACK STABILIZER, AND LRV4) #1 TRACK FROM YARD TO BRANDY AND #2 TRACK FROM BRANDY TO WINE INTERLOCKING WHEN THE TAMPER PULLED UP AND STOPPED AT THE 2N SIGNAL TO RECEIVE RULE 241. THE HI-RAIL SWIVEL DUMP FOLLOWING DID NOT STOP IN TIME AND COLLIDED WITH THE TAMPER. AMTRAK'S EQUIPMENT DAMAGE IS $12,000.00.	**Injuries:** None **Associated Damage Cost:** Equipment: $12,000.00	1A, 1C	**Over-Controlled/Under Controlled System, Rushed or Delayed a Necessary Action:** The hi-rail Swivel dump did not stop in time, and collided with a tamper ahead. **Widespread/Routine Violation:** The employee executed an operating rule violation; specifically, employee failed to follow NORAC Rule 813, and NORAC Rule 80.	2C	**Medically Disqualified (Pending Drug & Alcohol Testing) - Physical Illness/Injury:** Conclusion was not further specified in report.	Y
156047 - 2018	AB - MP 94.4 TR 2	A TRACK SUPERVISOR REPORTED TWO PIECES OF TRACK EQUIPMENT, A BALLAST REGULATOR (A14404) AND TAMPER (A10508) COLLIDED IN THE OUT OF SERVICE TRACK AT MP 94.42 ON #2 TRACK. THERE WAS MINOR DAMAGE TO THE BATTERY DOOR REPORTED ON THE BALLAST REGULATOR.	**Injuries:** Two employees requested medical attention for back pain, and were transported to nearby medical centers, diagnosed, and released. **Associated Damage Cost:** Equipment:$300.00	1A, 1C	**Over-Controlled/Under Controlled System:** The ballast regulator and the tamper collided in the out-of-service track. Specifically, within a five piece equipment consist, the tamper operator failed to stop, and collided with the regulator vehicle. **Rushed or Delayed Necessary Action:** The operator slowed the idle of the machine, and began braking, but was not able to stop in time to prevent collision. **Breakdown in Visual Scan:** The primary cause of the incident was listed in the report as a failure to stop within half the range of vision. **Widespread/Routine Violation:** Per report, the tamper operator allegedly violated NORAC Rule 80.	2B	**Workspace Incompatible with Operation:** Realizing that he could not stop, the tamper operator instructed the stopped regulator to move east via radio. The regulator operator tried to move, but the vehicle did not have good traction due to grease on the rail in a curve. **Instrumentation Issues:** The incident was initiated when the third piece operator radioed that he was coming to a stop and needed a mechanic to repair a leak on the machine. Additionally, the tamper operator stated that he did not feel a brake application.	Y
156569 - 2018	AB - MP 83.06 TR 1	THREE PIECES OF EQUIPMENT WERE MOVING EAST AND STOPPING AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING. THE LEAD PIECE WAS STABILIZER A16106, FOLLOWED BY REGULATOR A14314 AND THE FINAL TRAILING PIECE WAS TAMPER L11507. LEAD PIECE A16106 HAD STOPPED AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING ALONG WITH REGULATOR A14314. THE TRAILING PIECE L11507 WAS UNABLE TO STOP SHORT OF THE REGULATOR TO THE EAST CAUSING IMPACT AT APPROXIMATELY 2-3 MPH. THERE WERE NO INJURIES TO REPORT.	**Injuries:** None **Associated Damage Cost:** Equipment: $400.00	1A, 1C	**Over-Controlled/Under Controlled System:** As apart of a three piece equipment consist, the tamper was unable to stop short of the regulator, and caused impact between the two vehicles. **Widespread/Routine Violation:** Per report, the tamper operator allegedly violated NORAC Rule 80. **Breakdown in Visual Scan:** The primary cause of the incident was listed in the report as a failure to stop within half the range of vision.	2B	**Workspace Incompatible with Operation:** The statement, "stop needed to be made on top of a greaser just west of the eastbound home board for Orchard interlocking, causing the tamper to slide," was listed as the secondary cause of the incident.	Y

Radio Performance Issues

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
104120 - 2007	AP - MP 91.3	WHILE TRAVELING TAMPER IN THE REVERSE DIRECTION TO THE TIE-UP POINT, THE OPERATOR LOST FOCUS OR WAS DISTRACTED WHILE CONCENTRATING ON RADIO CONVERSATION, DID NOT SEE SPIKER STOPPED IN THE BLOCK AHEAD AND STRUCK THE SPIKER BENDING THE TOW BAR ON THE TAMPER PARTS CART.	**Injuries:** Information not provided **Associated Damage Cost:** N/A	1A, 1B, 1C	**Procedure/Checklist Not Followed Correctly, Breakdown in Visual Scan:** Prior to reversing, the operator did not observe the spiker stopped in the block. **Over-Controlled/Under Controlled System:** The tamper made a reverse move, and struck the spiker vehicle. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The operator proceeds with movement, prior to interpreting instruction, and does not account for the risks associated with his/her course of action. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	2B, 2F	**Distraction:** The operator was focused on the radio conversation during the movement. **Communication Equipment Inadequate:** The operator's focus was directed towards deciphering the radio conversation, rather than the task at hand.	N
126928 - 2013	AP - MP 45.8 TR 3	OPERATOR OF THE LITTLE GIANT CRANE A58852, PLUS 1 BALLAST CAR A14312, WAS MOVING INTO POSITION TO DISTRIBUTE MORE BALLAST TO THE TRACK WHEN THE BALLAST REGULATOR WAS WORKING IN BOTH DIRECTIONS CAUSING THE WEIGHT TO PULL THE CRANE FURTHER THAN ANTICIPATED STRIKING THE BALLAST REGULATOR AT WALKING SPEED. AMTRAK'S TOTAL DAMAGE IS $1,100.00.	**Injuries:** None **Associated Damage Cost:** Equipment: $1,100.00	1A, 1B, 1C	**Break down in Visual Scan:** The Little Giant crane operator failed to observe his/her increasing closeness to the ballast regulator. **Over-Controlled/Under Controlled System:** Upon noticing the closing distance to the ballast regulator, the Little Giant crane operator made a maneuver to stop; however, the maneuver still caused the vehicle to collide with the ballast regulator. **Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The operator realized he/she was approaching the regulator, and dumped air to stop the crane, but the weight of the ballast car pulled the crane forward anyway. **Rushed or Delayed Necessary Action:** The operator made an attempt to stop his/her vehicle but the action was executed too late to prevent collision. **Widespread /Routine Violation:** Per report, the event was listed as a M/W operating rule violation.	2B, 2E, 2F, 2G	**Lack of Situational Awareness:** The crane operator was unaware that the ballast regulator was still working in both directions on track. **Misperception of Changing Environment:** Despite "communication being good at times," the crane operator misjudged the stopping distance, and was forced to make an abrupt stop. **Spatial Disorientation:** The operator failed to sense the position of his/her vehicle in relation to the ballast regulator. **Failure of Crew/Team Leadership:** The operator lacked awareness of other MOW activities occurring simultaneously. **Communication Equipment Inadequate:** In report, communication is described as "good at times," implying an inconsistency in the adequacy of communication needed to support task.	Y

Radio Performance Issues Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
156677 - 2018	AN - MP 37.2 TR 2	TLS CLIPPING GANG WS TRACK TRAVELING FROM GRUNDY NO.5 TRACK TO HUNTER YARD. WHILE OPERATING EAST ON NO.2 TRACK AT ADAMS INTERLOCKING NIPPER CLIPPER CALLED OUT VIA RADIO "COMING TO A STOP". THE TRAILING PIECE OF EQUIPT, RAIL HEATER DID NOT ACKNOWLEDGE THE MESSAGE OR HEAR IT. OPERATOR OF THE RAIL HEATER STATED WHEN HE REDUCED THE SPEED OF THE MACHINE IT SLAMMED THE BRAKES CREATING A "JERK". WHEN THE MACHINE JERKED HE ACCIDENTLY TURNED THE KNOB AND INCREASED THE SPEED STRIKING THE NIPPER CLIPPER AHEAD. THIS CAUSED THE CART ATTACHED TO RAIL HEATER TO DERAIL.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B	**Ignored Caution/Warning:** The nipper clipper operator called out via radio, "coming to a stop," but the trailing rail heater did not acknowledge the message or hear it. **Over-Controlled/Under Controlled System, Rushed or Delayed Necessary Action, Unintended Operation of Equipment/Vehicle:** The rail heater operator stated that when he reduced the speed of the machine, it slammed the brakes creating a jerk. Further, the operator said that he accidentally increased the speed of the rail heater, and collided with the nipper clipper when the machine jerked.	2B	**Communication Equipment Inadequate:** The nipper clipper called out via radio, "coming to a stop," but it does not appear that the rail heater received the message.	N

Staffing Issues

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
68802 - 2001	AP - MP 62.7	A BMS (BALLAST MANAGEMENT SYSTEM) MACHINE WAS OPERATING AT MILEPOST 62.8 NEAR HAVRE DE GRACE, MD, WHEN IT STRUCK THE #43 SWITCH, CAUSING DAMAGE TO BOTH THE SWITCH AND THE BMS MACHINE. THE CAUSE WAS DETERMINED TO BE THE ABSENCE OF A GROUND MAN DIRECTING THE MOVEMENT.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $2435.00 Maintenance of Way:$9,000.00	1A	**Over-Controlled/Under Controlled System:** The ballast machine struck a switch.	2G	**Failure of Crew/Team Leadership:** The groundman directing movement was absent.	N
107980 - 2008	AN - MP 46.5	TIE HANDLER OPERATOR WHILE MOVING WEST TO WORK SITE ON OOS TRACK, RAN INTO A PARKED BALLAST CRIBBER A26706. OPERATOR FAILED TO STOP IN TIME, SLIDING INTO THE BALLAST CRIBBER DUE TO WET RAIL CONDITIONS.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $2,000.00	1A	**Over-Controlled/Under Controlled System, Rushed or Delayed Necessary Action:** The tie handler operator failed to stop in time, sliding into the ballast cribber.	2F	**Technical or Process Knowledge Not Retained After Training:** The operator was unable to maneuver the tie handler amidst wet rail conditions.	N
121243 - 2011	AN - MP 47.2 TR 4	THREE PIECES OF EQUIPMENT BEHIND A TAMPER MACHINE FAILED TO STOP AND STRUCK THE TAMPER MACHINE WITH NO APPARENT DAMAGE TO THE EQUIPMENT	**Injuries:** The foreman complained of neck, shoulder, and back pain. Consequently, the foreman was taken to University Medical Center in Princeton. **Associated Damage Cost:** None	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The three pieces of equipment behind a tamper machine failed to stop, and struck the tamper machine. **Break Down in Visual Scan:** The machine operators did not observe the tamper machine slowing. **Ignored a Caution/Warning:** The foreman was piloting a tamper, and notified the three pieces behind him that he was going to stop in Princeton Junction to conduct an on track job briefing and that they too should come to a stop. The trailing BMS equipment failed to stop and struck the tamper with no apparent damage to the equipment. **Widespread/Routine Violation:** Per report, the incident was classified as an alleged operating rule violation.	2A, 2F	**Technical or Process Knowledge Not Retained After Training:** The primary cause of the incident was listed as sliding wheels, with the contributing cause listed as wet rail. The operator was unable to maneuver the BMS equipment amidst wet rail conditions. **Weather Conditions Affecting Vision:** Visibility was listed as dark, while rain was listed as the weather condition.	Y

Staffing Issues

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
125924 - 2012	AN - MP 82.1 TR 1	A CART LOADED WITH RAIL THAT WAS COUPLED TO A BURRO CRANE DERAILED WHILE OPERATING WEST FROM #1 TRACK THROUGH THE 19 SWITCH LINED IN REVERSE.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $1,500.00 Maintenance of Way: $2,000.00 (Additionally, the NJT train operated back to Cherry Hill station, and a bussing operation was established.)	1A, 1B	**Over-Controlled/Under Controlled System:** A cart loaded with rail that was coupled to a Burro crane derailed through a switch lined in reverse. **Procedure/Checklist Not Followed Correctly:** The foreman did not ascertain the status of the track after granting permission for a train to operate through his out-of-service territory. As a result, his equipment operated with switches lined against the movement. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** When CTEC needed to operate an NJT train through out-of-service limits, the foreman in charge of the track granted permission, and the train received a Form D. While the NJT train was getting rule 241 by the signal, the foreman's Burro crane was operating through switches now lined against him, in the reverse direction, which derailed the cart attached to the Burro crane.	2E, 2F, 2G	**Failure of Crew/Team Leadership:** The foreman lacked awareness concerning the status of his out-of-service track. **Lack of Situational Awareness:** Although the foreman granted permission for the train to pass through his out-of-service limits, he appears to lose awareness of the track's changed condition. **Misperception of Changing Environment:** In anticipation of the passing train, the switches are lined in the direction opposing the Burro crane's movement. Still, the Burro crane operates through the reverse-lined switches.	Y
128388 - 2013	AP - MP 36.4 TR 1	TSAVE EQUIPMENT TRAVELLED THROUGH A MOVABLE POINT FROG THAT WAS NOT ALIGNED CORRECTLY	**Injuries:** None **Associated Damage Cost:** Maintenance of Way: $2530.00	1A, 1C	**Breakdown in Visual Scan:** The operator was looking down at the controls, and did not ensure that the switch and MPF were properly aligned for northward movement. Similarly, the foreman's attention was on something he/she dropped. **Over-Controlled/Under Controlled System:** The foreman and the management operator ran through a movable point frog not lined for the intended northward movement. **Widespread/Routine Violation:** In the report, the event was listed as an operating rule violation, being that the foreman and management operator ran through a movable point frog.	2F, 2G	**Lack of Situational Awareness, Distraction:** The foreman pilot's attention was directed towards a dropped object, while the management operator's attention was directed towards his/her controls instead of the track. Thus, the employees failed to realize that the switch was not lined for intended movement. **Failure of Crew/Team Leadership:** The foreman and management operator failed to maintain the awareness required to operate the equipment without error. **Technical or Process Knowledge Not Retained After Training:** The operator was looking down at his/her controls instead of the track ahead.	Y

Staffing Issues Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
144471 - 2016	**AP - MP 87.6 TR A**	NORFORK SOUTHERN TRAIN NS33A'S AUTO CARRIER TTGX CARS WAS TRAVELING NORTHBOUND BETWEEN RIVER AND GUNPOW ON #1 TRACK WHEN THE AUTO CARRIER STRUCK CAT CAR # A16507 LOCATED ON LETTER A TRACK AT MP 87.6 UNDER RT.702 OVERHEAD BRIDGE. AMTRAK'S EQUIPMENT DAMAGE IS $13,000.00.	**Injuries:** None **Associated Damage Cost:** Equipment: $13,000.00	1A, 1B	**Procedure/Checklist Not Followed Correctly:** After working on track 1, the crew failed to take measurements to see if the elevation needed to be adjusted. Thus, the track centers were too short in distance, given the elevation of track 1, and the lack of elevation in track A. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The team proceeded with the work task, without ensuring the proper execution of a vital step and accounting for the associated risks.	2B, 2G	**Failure of Crew/Team Leadership:** The work crew failed to execute a necessary work task, exposing team members to a potentially dangerous outcome. **Workspace Incompatible with Operation:** The elevation variance in the track caused the auto-carrier to tilt towards the catenary car.	**Y**
147383 - 2017	**AP - MP 94.5**	THE BALLAST REGULATOR TRACK CAR/14401 WAS BEING OPERATED SOUTHBOUND ON THE PW LINE FROM MP 92 TO BIDDLE INTERLOCKING/MP 94. AS THE TRACK CAR OPERATOR APPROACHED BIDDLE THE LRV-11 VAC TRAIN WAS WORKING AROUND THE CURVE AT MP 94.5. THE TRACK CAR OPERATOR DID NOT NOTICE THE # 19 SWITCH AT BIDDLE LINED AGAINST MOVEMENT WHEN HE OPERATED THROUGH THE SWITCH. THE TRACK CAR OPERATOR SAFELY STOPPED THE REGULATOR AND INFORMED HIS SUPERVISOR.	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** The ballast regulator proceeded through a switch lined against the move, resulting in a close-call collision. **Breakdown in Visual Scan:** The ballast regulator operator did not observe the switch lined against the move, and the LRV-11 Vac train working around the curve. **Ignored Caution/Warning:** The track car proceeded with the move, despite the switch being lined against the movement. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation.*	2A, 2E, 2F	**Lack of Situational Awareness, Misperception of Changing Environment:** The LRV-11 Vac train vehicle was working around a curve, and the operator proceeded towards the vehicle without any awareness that the switch was not lined for the movement of his/her equipment. **Blind Spot:** The opposing vehicle was working around a curve.	**N**

Staffing Issues Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
152551 - 2018	AP - MP 117.5 TR 2	A PIECE OF TRACK EQUIPMENT, TCA 14332, DERAILED AT MP 117.0 ON #2 TRACK IN A 3 TRACK AREA, FOULING # 1 TRACK. THERE WERE NO REPORTED INJURIES. THE CAUSE OF THE DERAILMENT IS REMOVAL OF EXCESSIVE BALLAST ON THE EAST SIDE OF NO. 2 TRACK BY THE UNDERCUTTER, CAUSING A 10 INCH DROP IN CROSS-LEVEL.	**Injuries:** None **Associated Damage Cost:** None (Note: The derailment caused single track operation on track 3 from Bowie-MP 120.5 to Grove-MP 112.4.)	1A, 1B	**Over-Controlled/Under Controlled System:** The ballast regulator derailed unintentionally while pushing too much stone. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment:** There appears to be little coordination between the simultaneous MOW activities. Additionally, the risks associated with the concurrent activities was not accounted for. **Break Down In Visual Scan:** The ballast regulator failed to observe the decrease in elevation on the track.	2B, 2E, 2F, 2G	**Misperception of Changing Environment:** The removal of excess ballast on the east side of track 2 by the undercutter working ahead caused a 10 inch drop in cross-level; however, per the report, the ballast regulator was pushing too much stone which may have been visually deceiving from an elevated point. **Failure of Crew/Team Leadership:** There appears to be a failure to effectively coordinate simultaneous MOW activities. **Workspace Incompatible with Operation:** The loss in 10 inches in cross level caused a high slant between the rails, and the regulator slipped off the track. **Technical or Process Knowledge Not Retained After Training:** As a result of pushing too much stone, the operator did not realize the decrease in elevation.	Y
155491 - 2018	AB - MP 89.2 TR 4	RULE VIOLATION/DERAILMENT: AT TRIEBEL INTERLOCKING, SPERRY RAIL CAR 125 ON TRACK 1 WAS SWITCHING OVER TO TRACK 2 WHEN THE FOREMAN RECEIVED A FORM D TO OPERATE BETWEEN MEADOW INTERLOCKING AND TRIEBEL INTERLOCKING ON TRACK #4. WHILE OPERATING ON TRACK #4 BETWEEN MEADOW AND TRIEBEL, THE FOREMAN OPERATED PAST THE LIMITS AND WENT PAST THE HOMEBOARD AT TRIEBEL. THIS MOVE PUT THE SPERRY CAR PAST ITS OUT OF SERVICE LIMITS AND OVER THE 42 SWITCH WHICH WAS LINED AGAINST THE MOVE. AT THIS POINT THE SPERRY CAR OPERATOR REALIZED THE CARRIAGE FOR THE TESTING EQUIPMENT DERAILED OVER THE 42 SWITCH AND MADE A REVERSE MOVE OVER THE MOVABLE POINT FROG AT THE 42 SWITCH, WHICH DERAILED THE LEADING 2 WHEELS OF THE SPERRY CAR.	**Injuries:** None **Associated Damage Cost:** Infrastructure: $8,000.00	1A, 1B, 1C	**Over-Controlled/Under Controlled System:** A Sperry rail car derailed unintentionally when the foreman piloted the equipment outside of it's out-of-service limits. **Extreme Violation - Lack of Discipline:** The track foreman instructed the operator to proceed past his out of service limits and he went past the home board at Triebel interlocking. **Wrong Choice of Action During Operation, Inadequate Real-Time Risk Assessment:** Passing his out-of-service limits, the Sperry car operator proceeded over the 42 switch which was lined against the move. The operator then made a reverse move over the movable point frog at the 42 switch. As a result, the movement derailed the leading two wheels of the Sperry car. Per report, the Sperry car operator made the reverse move without being told to do so by the foreman.	2E, 2C, 2F, 2G	**Spatial Disorientation, Misperception of Changing Environment:** Per report, the foreman stated that he did not realize they had gone past his limits until the dispatcher called him on the radio to inform him to stand hard. **Fatigue, Distraction, Confusion, Lack of Situational Awareness:** Per report, the foreman being distracted/zoned out, and tired while piloting past his limits was listed as the primary cause of the incident. **Failure of Crew/Team Leadership:** The foreman operator failed to maintain awareness during work activities. **Technical or Process Knowledge Not Retained After Training:** Employee testimony referenced that the foreman piloting equipment was not a "seasoned" employee. In fact, the regular pilot for the Sperry car had called out, and Foreman Riera had not piloted the Sperry car before.	Y

Staffing Issues Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
155884 - 2018	AP - MP 62.2 TR 4	AMTRAK BALLAST REGULATOR A14329 OPERATING NORTH ON PW LINE NO.4 TRACK IN FOREMAN MARTIN'S OUT OF SERVICE, DERAILED AT MP 62.2. THE REGULATOR WAS PART OF GANG Z073 PERFORMING SURFACING OPERATIONS BETWEEN OAK AND GRACE INTERLOCKINGS. UPON DERAILMENT, THE REGULATOR F-END SHIFTED TOWARDS THE FIELD SIDE OF NO.4 TRACK, AND THE OPPOSING END FOULED NO.3 TRACK. THE CAUSE OF THE INCIDENT WAS EXCESSIVE BALLAST UNDER REGULATOR PLOW. THERE WERE NO INJURIES TO REPORT.	**Injuries:** None **Associated Damage Cost:** None (Note: The incident caused the equipment to foul track 3. Thus, a hold was put into effect, causing single track operation from Wood-MP 75.3 to Perry-MP 59.5.)	1A	**Over-Controlled/Under Controlled System:** The ballast regulator derailed unintentionally, while winging in ballast from the field side of track 4 between Grace and Oak (specifically MP 62.25).	2E, 2F	**Misperception of Changing Environment:** The incident occurred when too much ballast was brought into the gage of track, getting caught under the wheels and derailing the regulator. **Technical or Process Knowledge Not Retained After Training:** The ballast regulator operator was an August 2017 new hire, qualified on the equipment on July 9, 2018. Per report, the cause of the derailment was an operator error due mainly to the operator's inexperience with transferring ballast.	Y

Job Briefing

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
126928 - 2013	**AP - MP 45.8 TR 3**	OPERATOR OF THE LITTLE GIANT CRANE A58852, PLUS 1 BALLAST CAR A14312, WAS MOVING INTO POSITION TO DISTRIBUTE MORE BALLAST TO THE TRACK WHEN THE BALLAST REGULATOR WAS WORKING IN BOTH DIRECTIONS CAUSING THE WEIGHT TO PULL THE CRANE FURTHER THAN ANTICIPATED STRIKING THE BALLAST REGULATOR AT WALKING SPEED. AMTRAK'S TOTAL DAMAGE IS $1,100.00.	**Injuries:** None **Associated Damage Cost:** Equipment: $1,100.00	1A, 1B, 1C	**Break down in Visual Scan:** The Little Giant crane operator failed to observe his/her increasing closeness to the ballast regulator. **Over-Controlled/Under Controlled System:** Upon noticing the closing distance to the ballast regulator, the Little Giant crane operator made a maneuver to stop; however, the maneuver still caused the vehicle to collide with the ballast regulator. **Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The operator realized he/she was approaching the regulator, and dumped air to stop the crane, but the weight of the ballast car pulled the crane forward anyway. **Rushed or Delayed Necessary Action:** The operator made an attempt to stop his/her vehicle but the action was executed too late to prevent collision. **Widespread /Routine Violation:** Per report, the event was listed as a M/W operating rule violation.	2B, 2E, 2F, 2G	**Lack of Situational Awareness:** The crane operator was unaware that the ballast regulator was still working in both directions on track. **Misperception of Changing Environment:** Despite "communication being good at times," the crane operator misjudged the stopping distance, and was forced to make an abrupt stop. **Spatial Disorientation:** The operator failed to sense the position of his/her vehicle in relation to the ballast regulator. **Failure of Crew/Team Leadership:** The operator lacked awareness of other MOW activities occurring simultaneously. **Communication Equipment Inadequate:** In report, communication is described as "good at times," implying an inconsistency in the adequacy of communication needed to support task.	**Y**

Clearance Issues

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
62994 - 2000	AN - MP 86.4	BOOM TOO HIGH HITTING BRIDGE AT PHILADELPHIA. PA.	**Injuries**: Information not provided **Associated Damage Cost:** Infrastructure: $162.00	1A	**Over-Controlled/Under Controlled System:** The boom was too high and hit a bridge. **Break Down in Visual Scan:** The work crew failed to observe, and assess the clearance between the boom and the bridge.	N/A	**Insufficient Information Provided**	N
144171 - 2016	AB - MP 117.3 TR 2	WHILE MOW EQUIPMENT AWX-536 WAS TOWING A LEASED UNDER CUTTER (LORAM MUD MANTIS) ON NO.2 TRACK, THE EQUIPMENT STRUCK A BRIDGE ABUTMENT AT MP 117.31 MILLSTONE PT. ROAD.	**Injuries**: Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled System:** MOW equipment struck the surrounding infrastructure, a bridge abutment. **Break Down In Visual Scan:** MOW employees did not observe the clearance between the equipment and the bridge abutment.	N/A	**Insufficient Information Provided**	N
144471 - 2016	AP - MP 87.6 TR A	NORFORK SOUTHERN TRAIN NS33A'S AUTO CARRIER TTGX CARS WAS TRAVELING NORTHBOUND BETWEEN RIVER AND GUNPOW ON #1 TRACK WHEN THE AUTO CARRIER STRUCK CAT CAR # A16507 LOCATED ON LETTER A TRACK AT MP 87.6 UNDER RT.702 OVERHEAD BRIDGE. AMTRAK'S EQUIPMENT DAMAGE IS $13,000.00.	**Injuries:** None **Associated Damage Cost:** Equipment: $13,000.00	1A, 1B	**Procedure/Checklist Not Followed Correctly:** After working on track 1, the crew failed to take measurements to see if the elevation needed to be adjusted. Thus, the track centers were too short in distance, given the elevation of track 1, and the lack of elevation in track A. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The team proceeded with the work task, without ensuring the proper execution of a vital step and accounting for the associated risks.	2B, 2G	**Failure of Crew/Team Leadership:** The work crew failed to execute a necessary work task, exposing team members to a potentially dangerous outcome. **Workspace Incompatible with Operation:** The elevation variance in the track caused the auto-carrier to tilt towards the catenary car.	Y
113703 - 2009	AB - MP 75.1	AMTRAK PETTIBONE WAS STOPPED AT SHORELINE JCT HOME BOARD, CONTRACTED HY-RAIL HOLLAND WELDING TRUCK FOLLOWING PETTIBONE, MAKING REVERSE MOVE, FAILED TO STOP, RUNNING INTO THE REAR OF THE PETTIBONE.	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00	1A, 1C	**Over-Controlled/Under Controlled System:** The contracted hi-rail Holland welding truck following the Pettibone failed to stop while making a reverse move and ran into the Pettibone vehicle. **Widespread/Routine Violation:** *Though not stated explicitly, it appears this collision may be the result of an operating rule violation*	N/A	**Insufficient Information Provided**	N

Clearance Issues Continued

Incident # - Year	MP / TR#	Overview	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
156569 - 2018	**AB - MP 83.06 TR 1**	THREE PIECES OF EQUIPMENT WERE MOVING EAST AND STOPPING AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING. THE LEAD PIECE WAS STABILIZER A16106, FOLLOWED BY REGULATOR A14314 AND THE FINAL TRAILING PIECE WAS TAMPER L11507. LEAD PIECE A16106 HAD STOPPED AT THE EASTBOUND HOMEBOARD AT ORCHARD INTERLOCKING ALONG WITH REGULATOR A14314. THE TRAILING PIECE L11507 WAS UNABLE TO STOP SHORT OF THE REGULATOR TO THE EAST CAUSING IMPACT AT APPROXIMATELY 2-3 MPH. THERE WERE NO INJURIES TO REPORT.	**Injuries:** None **Associated Damage Cost:** Equipment: $400.00	1A, 1C	**Over-Controlled/Under Controlled System:** As apart of a three piece equipment consist, the tamper was unable to stop short of the regulator, and caused impact between the two vehicles. **Widespread/Routine Violation:** Per report, the tamper operator allegedly violated NORAC Rule 80. **Breakdown in Visual Scan:** The primary cause of the incident was listed in the report as a failure to stop within half the range of vision.	2B	**Workspace Incompatible with Operation:** The statement, "stop needed to be made on top of a greaser just west of the eastbound home board for Orchard interlocking, causing the tamper to slide," was listed as the secondary cause of the incident.	**Y**
156047 - 2018	**AB - MP 94.4 TR 2**	A TRACK SUPERVISOR REPORTED TWO PIECES OF TRACK EQUIPMENT, A BALLAST REGULATOR (A14404) AND TAMPER (A10508) COLLIDED IN THE OUT OF SERVICE TRACK AT MP 94.42 ON #2 TRACK. THERE WAS MINOR DAMAGE TO THE BATTERY DOOR REPORTED ON THE BALLAST REGULATOR.	**Injuries:** Two employees requested medical attention for back pain, and were transported to nearby medical centers, diagnosed, and released. **Associated Damage Cost:** Equipment:$300.00	1A, 1C	**Over-Controlled/Under Controlled System:** The ballast regulator and the tamper collided in the out-of-service track. Specifically, within a five piece equipment consist, the tamper operator failed to stop, and collided with the regulator vehicle. **Rushed or Delayed Necessary Action:** The operator slowed the idle of the machine, and began braking, but was not able to stop in time to prevent collision. **Breakdown in Visual Scan:** The primary cause of the incident was listed in the report as a failure to stop within half the range of vision. **Widespread/Routine Violation:** Per report, the tamper operator allegedly violated NORAC Rule 80.	2B	**Workspace Incompatible with Operation:** Realizing that he could not stop, the tamper operator instructed the stopped regulator to move east via radio. The regulator operator tried to move, but the vehicle did not have good traction due to grease on the rail in a curve. **Instrumentation Issues:** The incident was initiated when the third piece operator radioed that he was coming to a stop and needed a mechanic to repair a leak on the machine. Additionally, the tamper operator stated that he did not feel a brake application.	**Y**
145127 - 2016	**AP - MP 92.6 TR A**	WHILE WORKING ON "A" TRACK AT MP 92.6 THE TLM DERAILED WHILE BEING MOVED BY KW-902. IT WAS REPORTED THAT THE TLM STRUCK A BRIDGE AT MP 92.61 MONUMENT ST.	**Injuries:** None **Associated Damage Cost:** Equipment: $400,000.00 Maintenance of Way: $525,000.00	1A	**Over-Controlled/Under Controlled System:** MOW equipment struck the surrounding infrastructure, a bridge. **Break Down In Visual Scan:** MOW employees did not observe the clearance between the equipment and the bridge.	2A	**Weather Conditions Affecting Vision:** The event occurred at 3:34AM, and conditions were reported to be dark.	**Y**

Train Struck MOW Equipment
(with Speed Data)

Incident # - Year	MP / TR#	Overview	Time of Day	Speed Data	Environmental Conditions	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
60992 - 2000	AP - MP 135.5	TRAIN 199 STRUCK AN EXTENSION ARM ON A TIE TAMPER WORKING ON ADJACENT TRACK.	Information not provided	Information not provided	Information not provided	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $500.00	1A	**Over-Controlled/Under Controlled System:** Train 199 struck an extension arm on a tie tamper.	N/A	**Insufficient Information Provided**	N
92857 - 2004	AB - MP 77.6	AMTRAK SHORE LINE EAST TEST EXTRA WITH ENGINE 6695 AND 3 CARS STRUCK 3 PIECES OF CONTRACTOR EQUIPMENT AT MP 77.6, EAST OF NEW HAVEN, CT.	3:45 AM	60 MPH	**Visibility: Dark** **Weather: Clear**	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $60,500.00 Maintenance of Way: $8,000.00	1A, 1B	**Breakdown in Visual Scan:** The contractor did not observe the position of the equipment in relation to the adjacent tracks. **Inadequate Real-Time Risk Assessment, Failure to Prioritize Tasks Adequately:** The contractor failed to adequately assess the risks associated with operating the equipment on the track. **Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The contractor did not adequately protect the equipment.	N/A	**Insufficient Information Provided**	N
101029 - 2006	AP - MP 91.4 TR 1	TRAIN 1662 WITH ENGINE 664 AND 2 CARS STRUCK THE UNDERCUTTER (A14909) THAT WAS FOULING NO.1 TRACK WHICH CAUSED TRAIN 1662 AND THE UNDERCUTTER CONSIST TO DERAIL.	9:30 AM	35 MPH	**Visibility: Dark** **Weather: Cloudy**	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $900,000.00 Maintenance of Way: $150,000.00	1A	**Over-Controlled/Under Controlled System:** Train 1662 struck the undercutter.	N/A	**Insufficient Information Provided**	N
102555 - 2006	AB - MP 158.8 TR 1	THE TRACK FOREMAN OPERATED TRACK CAR TC AA23776 OUTSIDE OF HIS AUTHORITY LIMITS AND ENTERED THE INTERLOCKING LIMITS ON TRACK 1 AT KINGSTON, RI. TRAIN 163 THEN STRUCK THE TRACK CAR.	12:53 PM	37 MPH	**Visibility: Day** **Weather: Clear**	**Injuries**: Information not provided **Associated Damage Cost:** Equipment: $30,000.00 Maintenance of Way: $1,000.00	1B, 1C	**Extreme Violation - Lack of Discipline:** The track foreman operated the track car outside of his authority limits, and entered the interlocking limit on track 1. **Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The foreman proceeded outside of his authority limits, failing to recognize the risks associated with this course of action. Ultimately, the track car was struck by a train.	N/A	**Insufficient Information Provided**	N
104269 - 2007	AB - MP 228 TR 5	TRAIN 448 ENGINE 101 AND 4 CARS STRUCK A PIECE OF MOFW EQUIPMENT A LULL LIFT ON #5 TRACK IN COVE INTERLOCKING.	Information not provided	Information not provided	Information not provided	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $150.00	1A	**Over-Controlled/Under Controlled System:** Train 448 struck a Lull lift.	N/A	**Insufficient Information Provided**	N
113910 - 2009	AN - MP 46 TR 3	TRAIN 56 ENGINE 902 AND 5 CARS, OPERATING ON NYP LINE NO. 2 TRACK, CLIPPED PIECE OF MOFW EQUIPMENT TIED DOWN ON NO. 3 TRACK.	Information not provided	Information not provided	Information not provided	**Injuries:** Information not provided **Associated Damage Cost:** Equipment: $1,000.00 Maintenance of Way: $2,000.00	1A	**Procedure/Checklist Not Followed Correctly:** The work crew did not properly secure the equipment.	N/A	**Insufficient Information Provided**	N
117576 - 2010	AP - MP 1.7 TR 4	SEPTA TRAIN 541 STRUCK A PIECE OF RAIL BEING DRAGGED BY AN AMTRAK CONTRACTOR AT MILEPOST 1.7 ON TRACK 4 NEAR PHILADELPHIA, PA.	Information not provided	Information not provided	Information not provided	**Injuries:** Information not provided **Associated Damage Cost:** None	1A, 1B	**Breakdown in Visual Scan:** The contractor did not observe the position of the rail in relation to the track and train. **Inadequate Real-Time Risk Assessment, Failure to Prioritize Tasks Adequately:** The contractor failed to adequately assess the risks associated with transporting materials on the track. **Procedure/Checklist Not Followed Correctly, Over-Controlled/Under Controlled System:** The contractor did not adequately secure the rail while transporting materials.	N/A	**Insufficient Information Provided**	N

Incident # - Year	MP / TR#	Overview	Time of Day	Speed Data	Environmental Conditions	Comment	HFACS Code 1	Unsafe acts	HFACS Code 2	Preconditions to Unsafe Acts	PDF
127728 - 2013	AN - MP 35.6 TR 4	WHILE NJTR TRAIN 3827 WAS PASSING STANDING TRACK EQUIPMENT, AMTRAK TC-47953, NJTR TRAIN 3827 SUSTAINED DAMAGE AS A RESULT OF TC-47953 HAD THE CAB DOOR AJAR AND IT SWUNG OPEN AND STRUCK THE SIDE OF THE NJTR TRAIN 3827. NJTR'S EQUIPMENT DAMAGE IS $3,039.00.	9:31 AM	Information not provided (Note: The customary 80 MPH slow order for the adjacent track was in effect at the TLM location from MP-33.4 to MP-34.1)	Information not provided	**Injuries:** None **Associated Damage Cost:** Equipment: None	1A	**Over-Controlled/Under Controlled Vehicle/System:** The track equipment components were not adequately secured. As a result, the track car cab door swung open and was struck by a train.	N/A	**Insufficient Information Provided**	Y
144471 - 2016	AP - MP 87.6 TR A	NORFORK SOUTHERN TRAIN NS33A'S AUTO CARRIER TTGX CARS WAS TRAVELING NORTHBOUND BETWEEN RIVER AND GUNPOW ON #1 TRACK WHEN THE AUTO CARRIER STRUCK CAT CAR # A16507 LOCATED ON LETTER A TRACK AT MP 87.6 UNDER RT.702 OVERHEAD BRIDGE. AMTRAK'S EQUIPMENT DAMAGE IS $13,000.00.	12:50 AM	19 MPH	Visibility: Dark Weather: Clear	**Injuries:** None **Associated Damage Cost:** Equipment: $13,000.00	1A, 1B	**Procedure/Checklist Not Followed Correctly:** After working on track 1, the crew failed to take measurements to see if the elevation needed to be adjusted. Thus, the track centers were too short in distance, given the elevation of track 1, and the lack of elevation in track A. **Failure to Prioritize Tasks Adequately, Inadequate Real-Time Risk Assessment, Wrong Choice of Action During Operation:** The team proceeded with the work task, without ensuring the proper execution of a vital step and accounting for the associated risks.	2B, 2G	**Failure of Crew/Team Leadership:** The work crew failed to execute a necessary work task, exposing team members to a potentially dangerous outcome. **Workspace Incompatible with Operation:** The elevation variance in the track caused the auto-carrier to tilt towards the catenary car.	Y
148209 - 2017	AN - MP 87.2 TR 3	TRAIN 642 OPERATING WITH CAB CAR C/9638 IN THE LEAD, 4 CARS AND LOCOMOTIVE E/657 STRUCK A DOOR ON TRACK EQUIPMENT A47931 THAT WAS STANDING ON NO.3 TRACK (OUT OF SERVICE) BETWEEN MANTUA MP 87.2 AND LEHIGH MP85.1.	8:10 AM	Estimated: 80 MPH	Visibility: Day Weather: Clear	**Injuries:** Information not provided **Associated Damage Cost:** None	1A	**Over-Controlled/Under Controlled Vehicle/System:** The track equipment components were not adequately secured, and the locomotive struck a door on the track equipment.	2B	**Instrument Issues:** A defective door latch was found on the equipment.	Y