Memorandum

New York City Transit

Date December 12, 2014

To Joe Leader, Senior Vice President, Department of Subways

From Cheryl E. Kennedy, Vice President, Office of System Safety

Re **Final Report, Derailment, S/O 65th Street, Queens Line**

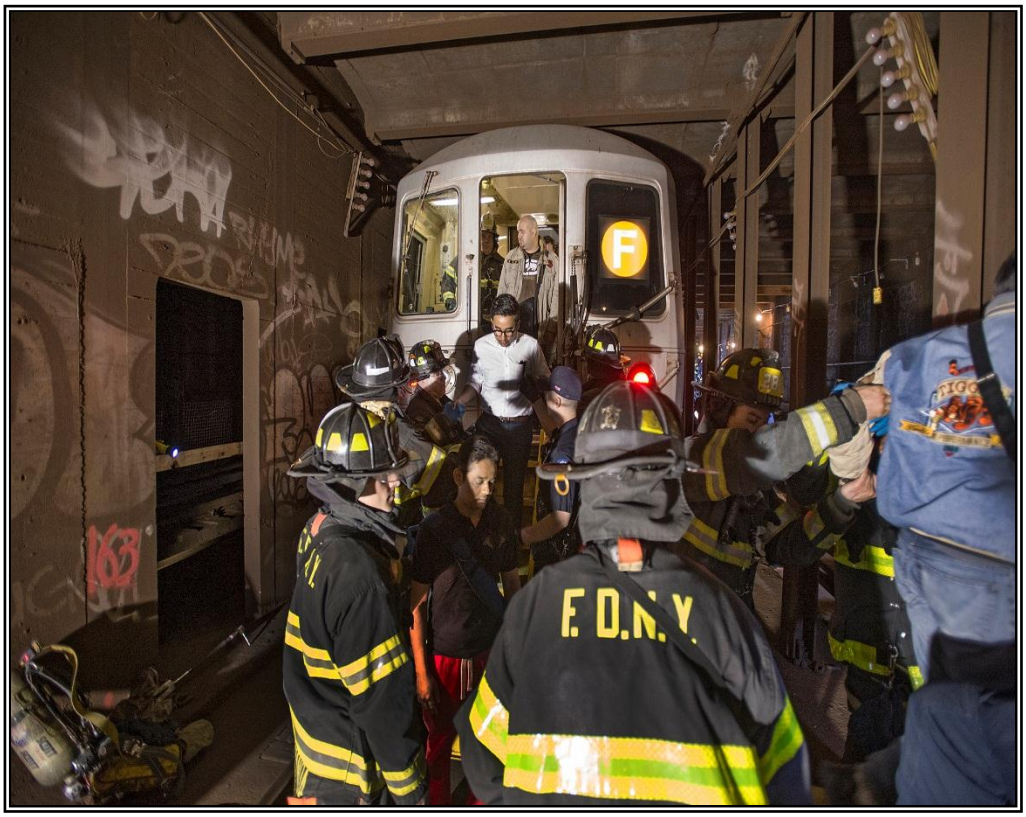
On May 2, 2014, the Office of System Safety investigated a Main-line derailment that occurred south of the 65th Street Station on Track D3 on the Queens Line.

Based on a review of the attached report, please provide a response to the recommendations within 30 days.

cc: C. Bianco
J. Bromfield
L. Finkelman
J. Gaul
W. Habersham
S. Librera
D. Knights
H. Lambert
K. Mooney
P. Lavin
G. Rivera
File

New York City Transit

Office of System Safety Derailment Report



65th Street

Queens Line

Occurrence Date:
May 2, 2014

Derailment

S/O 65th Street, Track D3

May 2, 2014

FINAL REPORT

December 12, 2014

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SYNOPSIS

At approximately 10:16 hours, on May 2, 2014, an eight car train designated as the 09:57 "F" 179/STL (consist: S/M 5742-5743-5745-5744-5634-5635-5637-5636) was traveling southbound on express Track D3, south of 65th Street Station on the Queens Line. As the train was traversing the area, a 7 foot, 11 inch section of the west rail at column number D3 1374+60 fractured beneath the train, resulting in several cars of the consist derailing. During the event, the Train Operator (T/O) felt the train begin to bounce in an odd manner and heard an unusual noise. He placed the train into an emergency braking mode in response to this stimuli. The train travelled approximately 500 feet while derailed before coming to rest, at which time, the T/O was notified by the Conductor (C/R) that it appeared that the train had derailed. The T/O notified the Rail Control Center (RCC) of the incident. Upon New York City Transit (NYCT) personnel's' arrival at the incident site, it was observed that the #1 truck of the second south car (5743), as well as all of the trucks of the third, fourth, fifth and sixth cars (5745-5744-5634-5635) and the #1 truck of the seventh car (5637), of the consist had derailed.

The RCC informed New York City Fire Department (FDNY) and New York City Police Department (NYPD) personnel of the incident and requested assistance. NYCT and inter-agency Emergency Services personnel responded to the scene and established a command post at Broadway and 60th Street. Approximately one thousand customers were safely evacuated from the derailment site through Emergency Exit #395. In addition, there were 32 minor non-life threatening injuries reported by customers (30) and employees (2) as a result of this incident. The total costs associated with this incident were estimated to be $2,035,001.08

The rail involved in the incident was a 19 foot, 6 inch length of plug rail that was installed on February 8, 2014 to replace a previous broken rail identified at the same location. Sections of the fractured rail involved in the derailment were submitted to Lucius Pitkin Inc. (LPI) for an independent evaluation to validate the integrity of the rail. The results of the testing indicate that the rail met all NYCT and American Railway Engineering and MOW Association (AREMA) specifications. LPI also identified the location where the web meets the head at the cut end of the west rail at the rail joint located at D3 1374+60 to be the initiation point of the rail break that resulted in the derailment. A Priority 2 (P2) track defect, consisting of a deteriorated tie and broken "Pandrol" plate, was present beneath the rail joint at the Point of Derailment (POD), which resulted in the rail joint not being provided with adequate lateral or vertical restraint while under load (see pictures in Appendix "A").

The Office of System Safety (OSS) has determined that the causal factor in this derailment was the failure of Division of Track (DT) personnel responsible for track inspection activities to identify, document and correct a P2 track defect that was present at the POD for at least one year prior to this incident. In addition, three separate rail breaks occurred in the same segment of plug rail within an approximate

eleven month time frame. DT personnel did not adequately investigate the underlying causes for the recurrent rail breaks and they did not adequately carry out existing practices to address track defects at the POD when rail verification and rail replacement activities occurred. Furthermore, having a robust Computerized Maintenance Management System (CMMS) in place with the capability of flagging and alerting senior management of potential hotspots would be beneficial in averting derailments of this nature in the future.

INVESTIGATION

Occurrence

OSS believes the following sequence of events is the most probable scenario that occurred during the derailment. At approximately 10:16 hours, on May 2, 2014, an eight car train designated as the 09:57 "F" 179/STL (consist: S/M 5742-5743-5745-5744-5634-5635-5637-5636) was traveling southbound on express Track D3, south of 65th Street on the Queens Line. As the train traversed the area, a 7 foot, 11 inch section of the west running rail located at survey marker D3 1374+60 fractured beneath the leading truck (#2 truck) of the second car (5743). At that time, the head and web of the rail separated from its base, which resulted in the wheels of the trailing #1 truck of Car 5743 derailing, followed by both of the trucks of the third, fourth, fifth and sixth cars (5745-5744-5634-5635) and the #1 truck of the seventh car (5637) of the consist also derailing. The derailed trucks began to run along the exposed web of the west running rail further fracturing it into multiple pieces, as well as inflicting extensive damage to the running rails, tie blocks, and tie plates that were downstream of the POD.

A section of the broken west rail bowed outward and collided with the energized contact rails of both Track D1 and D3 causing an explosion and the fusing of these components, which resulted in the subsequent smoke condition in the area. The circuit breakers feeding the contact rails opened due to an overload condition, which removed power from the contact rails on Tracks D1 and D3.

The derailed trucks' impact with wayside system elements resulted in extensive damage to Car Equipment undercar components as well. While not a complete inventory of damage, most of the cars involved in the incident sustained shoe beam assembly, wheel, traction motor, and shear pin damage. The car bodies of the derailed cars came into contact with four structural columns positioned between tracks D1 and D3 resulting in bent column flanges; however, the structural columns were not dislodged. The car bodies of some of the derailed cars also scraped against tunnel walls in the incident area resulting in additional damage to Car Equipment components.

At some point during the event, the T/O felt the train begin to bounce in an odd manner and heard an unusual noise; therefore, he placed the train into an emergency braking mode in response to this stimuli. The train came to final rest at survey marker D3 1369+60 after having travelled for an approximate distance of 500 feet while derailed, at which time, the T/O was notified by the C/R that the train was derailed. The T/O notified the RCC of the situation. RCC management ensured that power was removed from all four tracks in the area of the derailment and alerted the FDNY and NYPD of the incident.

In addition, RCC personnel coordinated with field personnel to choreograph the removal of additional revenue trains that had been trapped within the incident area. An emergency command post was established at Broadway and 60th Street to facilitate the safe evacuation of approximately 1000 customers from the train to the street via emergency exit #395.

The following is a detailed report of the incident investigation.

Rapid Transit Operations

Train Operator Statement:

The T/O aboard the 0957 "F" 179th/STL stated that as he was travelling south on Track D3, south of 65 Street, the train began bouncing, accompanied by a loud noise. He immediately placed the master controller into the emergency brake position to bring the train to a stop. As the T/O was in the process of reporting the unusual occurrence, the C/R informed him that the train had derailed; subsequently, the T/O reported the incident to the RCC. The T/O and C/R then took actions to secure the train, check for customer injuries and inform the customers that assistance was in route to the scene.

The cars involved in this incident are of the R46 car class and are not equipped with data logging devices; therefore, the actual speed that the train was travelling during the event was not recorded. However, there appears to be no indication that the train was travelling in excess of the normal operating speed for this area and it is estimated that the train would have been travelling at approximately 40 MPH during the incident.

Rapid Transit Operations (RTO) was not a contributing factor in this incident.

Human Factors

T/O #1 was originally hired by the NYCT on July 11, 1983 in the title of C/R. He was promoted to the title of T/O on April 7, 1985. T/O #1 was critiqued on March 22, 2014, on all aspects of train operation by his assigned Train Service Supervisor (TSS). He received a rating of "satisfactory" in all areas including proper train control, judgment of speed, proper station stop and signal comprehension. A review of the

T/O's disciplinary action history revealed one operational infraction; a wrong route for which he received a reprimand.

T/O #1 worked the following hours on the day of the incident and the seven days prior to the incident:

Incd. Day	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
0:38	12:45	OTO	12:45	RDO	8:00	9:28	10:33

Total: 54:09 hours.

The hours worked by the T/O on the day of the incident and the seven days prior to it, were within the NYCT's current Hours of Service practices.

Fitness for Duty

Occupational Health Services (OHS) personnel performed post incident testing on the T/O approximately 4 hours and 21 minutes after the incident occurred. The reason cited for the testing not being performed within two hours of the incident was attributed to the on scene incident investigation and the time consumed transporting the T/O to the Medical Assessment Center (MAC). OHS personnel administered alcohol testing at 14:37 hours. Drug testing occurred at 14:42 hours. The results of the post incident testing were negative.

Division of Track

The track in the area of the derailment is a Type II design, which is a concreted type of track specially designed for use in subway locations. It was originally installed in 1933 with oak tie blocks embedded in concrete. In 1982, CWR and container plates with rubber rail seats were installed as part of the installation of welded rail for noise and vibration attenuation purposes. Subsequently, DT replaced the obsolete container plates with rolled steel Pandrol plates.

The rail involved in the May 2, 2014, derailment was installed on February 8, 2014 at D3 1374+60 to replace a broken rail detected by the Track Geometry Car 3 (TGC3) during Ultra Sonic (UT) rail testing that occurred on February 4, 2014. The rail was manufactured by Arcelor Mittal in November of 2013, and delivered to NYCT shortly thereafter as part of a batch (heat number 27T582HH) of 135 rails. As part of post incident activities, sections of the fractured rail were submitted to LPI for an independent evaluation to validate the integrity of the rail. Extensive testing of the rail, including metallurgical, chemical, strength and hardness analysis, and detailed electron microscope scanning of the fractured surfaces at the point of the break was performed. The results of the testing indicate that the new rail met all NYCT and

AREMA specifications. In addition, NYCT contracted another independent vendor (Baker) to test a portion of the other rails delivered to NYCT from the same batch; 87 of the 135 rails were tested and no anomalies were found.

Chronological History of Rail Breaks:

OSS reviewed broken rail defect data supplied by Track Engineering (TE) and was able to identify three instances, where broken rails have occurred within the same 19 foot, 6 inch section of rail in the vicinity of D3 1374+60. The rail breaks occurred within an approximate eleven month time period prior to and encompassing the May 2, 2014, derailment. The chronological history below provides a brief synopsis of the three rail breaks:

1. On June 11, 2013, Sperry Rail Services (SRS) UT testing identified a "Split Web-Outside" (SWO) rail defect at D3-1374+55. The rail contained a "visible" break and it was replaced on June 12, 2013. The rail break occurred approximately 2 feet, 5 inches from the cut edge at the north end of the west rail, where the future May 2, 2014 rail break initiated.

2. On February 4, 2014, the TGC3 performed UT testing of Track D3. A "Base of Web-Outside" (BWO) rail defect designated "Breakout Complete" was detected and verified at D3 1374+55. The rail break in this instance was approximately three feet from the cut edge at the north end of the rail joint (future POD) and 6 inches south of the June 11, 2013 rail break. Temporary repairs were made on February 5, 2014, and a new rail was installed on February 8, 2014.

3. On May 2, 2014, the rail installed on February 8, 2014 failed. The leading edge of the cut north end of the west rail at D3 1374+60, where the head of the rail meets the web on the gauge side was identified to be the initiation point of the rail break that eventually resulted in the derailment.

DT Track Maintenance:

DT personnel are required to regularly inspect track to identify conditions that deviate from the standards established in the MW-1 Track Standards Manual. DT Track Inspectors (T/I) are tasked with the inspection of main line tracks within a defined geographic area twice during a seven day period. T/Is are also responsible for documenting defects affecting the condition of track components based upon the "Codes for Track Inspector Reporting Form," i.e. broken plates, defective ties and fasteners, pumping track, etc. A DT supervisor must inspect main line track twice a month on average, which is referred to as the 14 day Supervisory inspection. In addition, DT Superintendents make a general inspection of their assigned Zone every

three months, including a detailed inspection of all guarded curves, with a radius of less than 500 feet, on all mainline tracks and yard leads in approach to mainline track.

OSS reviewed the hourly and supervisory Track Inspection Forms for a period of one year leading up to the derailment. The most recent T/I inspection prior to the derailment occurred on April 29, 2014, and the last Supervisory inspection occurred on April 22, 2014. The inspection records indicate that DT personnel did not identify, document or correct any Priority defects on the west rail in the immediate incident area during the period reviewed.

The first plate under the rail joint of the new 19 foot, 6 inch rail installed on February 8, 2014 was sheared on the gauge side of the track, offering no support for vertical and lateral movement of the rail joint under load. A review of video data captured during earlier TGC4 runs reflect that the plate at this location had been broken for at least one year prior to the derailment and the condition of the tie beneath the sheared plate was poor. Additionally, the distance between the center of the joint and the first non-defective fastener under the rail joint was approximately equal to 25 inches, as seen on the video pictures. When the distance between the centerline of a non-defective tie or fastener and the center of the rail joint is equal to or more than 24 inches, the condition (joint support failure) should be classified as a P2 defect as per MW-1 Standards Table 108.3-Crosstie and Fastening Requirements.

A reported P2 defect requires a supervisor to inspect the condition within 24 hours of the time of detection of the condition and the standard governing this activity states in part, "The investigating person shall immediately determine whether a slow speed may be necessary and what work is required, and shall base these decisions on findings and other factors, such as type of condition, its location and the permanent speed of the track where the condition was found. Every effort shall be made to correct these conditions as soon as practicable." The uncorrected P2 defect at D3 1374+60 was determined to be the primary causal factor leading to the broken rail that resulted in the derailment.

After the installation of the new rail on February 8, 2014, there was a 1/8 inch top mismatch where the cut edge of the CWR rail installed in 1982 met the leading edge of the new 19 foot, 6 inch rail. NYCT MW-1 Track Standards (2010), Section 203.5 Rails (K), states, "Rails of unequal wear at a joint must be brought to an even surface in accordance with established welding procedures. When welding is not possible or practical, step joints may be used." The difference in height between the tops of the two adjoining rails was not remedied. In this instance, the DT should have installed vertical offset (raise) bars to address the top mismatch. In addition, they should have corrected the broken plate, as well as addressed the deteriorated tie under the rail joint.

Post incident investigative activities also identified that the joint bars at this location appear to have been unintentionally transposed (the gauge and field side joint bars were swapped) prior to the February 8, 2014 rail replacement. The joint bar from the gauge side of the rail joint was not identified and therefore not recovered after the derailment; however, the field side of rail joint bar was closely examined by LPI and TE, which revealed that the top of it was worn unequally, creating a "ridge" or 'step" with a very sharp edge where it was positioned beneath the end of the new 19 foot, 6 inch rail involved in the May 2, 2014 derailment. Therefore, the LPI report concludes that the downward movement of the rail under load, coupled with the rotation of the rail toward the gauge of the track, and the bottom side of the head of the rail encountering the sharp edge of the "ridge," where the end of the rail was supported by the joint bar, created a stress point concentration in the area where the crack in the rail initiated. Although there is no prohibition against reusing joint bars, employees are expected to install either new joint bars or to "ground" the existing ones to ensure that they are free of burrs and sharp edges to ensure a good fit.

Additionally, the LPI report further hypothesizes that a missing (or rather an undrilled and uninstalled) bolt at the joint bar connection to the adjoining CWR may have exacerbated the prying action of the joint bars during deflection. It's DT's practice to only drill the two outermost holes furthest from the cut end of the rail in CWR and install two bolts to allow for thermite welding to occur at a later date. Although leaving the end hole blank is a standard railroad practice when the rails are going to be thermite welded, the DT does not currently have a procedure in place to adequately address returning to the location to perform welding activities. This is evidenced by the DT replacing the same section of plug rail three times during an approximate eleven month span (June 11, 2013 to May 2, 2014); however, they never returned to thermite weld the existing CWR and new plug rails together on any of these occasions.

Following the issuance of the initial LPI report, DOS management requested LPI perform additional modeling of the conditions that were present at the POD, as well as perform modeling of a variety of other scenarios related to the support of a rail joint on type II track to determine which factors had the greatest influence in the development of the rail end crack that ultimately resulted in the catastrophic breakage of the rail. LPI's modeling and finite element analysis of the joint determined that the "integrity of the tie support and joint bar wear were found to be the most and second most influential variables, respectively, affecting rail stress local to the observed crack-initiation site. Conversely, small changes in spacing among other neighboring ties, presence or absence of a sixth bolt (adjacent to rail joint gap), and rail-top condition (worn or not worn) were substantially less influential." TE is using the results of the LPI modeling to finalize the proposed revisions to the MW-1 Track Standards Manual.

Another indication that DT personnel are not adequately identifying and addressing defects was demonstrated by their failure to capture track defects during the rail flaw verification process. Upon receiving notification of a potential UT rail defect, a DT supervisor and a representative from the UT contractor will go to the location to manually verify the existence of the rail defect. Upon confirming the defect, the DT supervisor is required to complete an "Ultrasonic Verification of Mainline Tracks" form. The form is intended to capture pertinent information that will be imparted to maintenance workers, who will be tasked with correcting a verified defect. Information required to be entered on the verification form includes length and type of rail, track hardware, tools and material needed to perform the repair. OSS reviewed the verification and repair forms for the two UT defects (June 11, 2013 and February 4, 2014) that occurred within the eleven month period prior to the May 2, 2014, derailment. In both instances, the forms do not reflect that there were outstanding track defects, despite the presence of the broken plate, fasteners, and deteriorated tie at the future POD, which constituted a P2 defect.

Following the derailment, DT management took several actions to elevate employee awareness of the deficiencies that were identified during post incident activities to aid in preventing a reoccurrence of this type of derailment, which are outlined in the "Actions Taken" section of this report.

The DT was the causal factor in this derailment.

MOW Track Engineering

The key goal of the NYCT Track Program is to continue to maintain mainline tracks in a state of good repair. The overall objective is to eliminate safety hazards (such as derailments, broken rails, etc.), maximize throughput by the elimination of slow speed orders due to track conditions, increase passenger comfort and the ride quality of the tracks and enhance the reliability of system. Keeping mainline tracks in a state of good repair is achieved through DT maintenance forces and staff from the TE group working both independently and cooperatively to evaluate, inspect and maintain mainline track.

TE personnel perform a variety of functions and automated inspections intended to support the track maintenance program. One specific activity performed by TE personnel is the Quadrennial Track and Switch Condition Survey. Key objectives of these periodic surveys are to establish a definitive system of track devices, updating the Track Device System with actual measured data and categorizing each track device by its remaining useful track life. This data is coupled with information collected through automated inspections such as the TGC and UT inspection runs, thus providing the means of planning future Capital Track rehabilitation and maintenance investments. The last Mainline Track Condition Survey conducted by TE personnel in the vicinity

of the derailment area occurred in calendar year 2010. At that time, the track was rated as Condition 3 (6-10 years of remaining useful life) based upon the condition of the tie blocks and numerous broken plates under the running rails.

In addition, TGCs are utilized to measure track geometry, i.e. tunnel clearances, rail wear, flange ways and rail flaws under dynamic loads. The TGC runs are typically performed on all mainline tracks three times annually. The most recent TGC run prior to the derailment was performed in the incident area on March 18, 2014 and although a P2 defect existed from an MW-1 Track Standards stand point due to the inadequately supported rail joint, this condition did not result in a TGC priority track defect being identified at that time. OSS attributes this circumstance to the fact that limited vertical deflection in a segment of rail may not be critical, unless other factors are at play, i.e. as in this case, it is at a location where an inadequately supported rail joint is present.

TE personnel also perform UT testing for the purpose of identifying internal rail flaws, which is supported by NORDCO and SRS systems. UT inspections are conducted on mainline track on average four (4) times per year on outdoor locations and nine (9) times per year in the underground (subway) portion of the system. A UT inspection of the running rails in the incident area was last performed, prior to the derailment, by SRS car 403 on April 9, 2014. There was no indication of any rail flaws on either running rail at that time.

NYCT has robust multi-layered track maintenance program; however, a significant concern at the agency is the previously identified five subway corridors, where the ratio of rails breaks per mile is noticeably higher than the average based upon historical rail break data. These five corridors are:

- Queens Blvd. Line between 5 Avenue and Continental Avenue;
- 8 Avenue Line between 168 Street and Jay Street;
- 6 Avenue Line between 59 Street and Broadway-Lafayette Street;
- Broadway-7 Avenue Line between Dyckman Street and Chambers Street;
- 60 Street under river tunnel on the Astoria Line.

In addition, TE personnel previously performed an analysis of the broken rail data collected, and formulated the "CWR and Resilient Fastener Initiative" intended to significantly reduce the number of broken rails and improve track conditions in the aforementioned five critical corridors. DT has since implemented the plan as part of the "2014 Capital Track Reconstruction Program." Track Construction (TC) has begun installing resilient fasteners (RF) plates on the critical corridors and expects to install 26,495 RF plates system-wide in calendar year 2014. RF plate installation is currently in progress on the Queens Blvd, 8th Avenue and Astoria/60th Street Tube corridors.

In addition, on October 3, 2013, NYCT retained the services of John Zuspan from "Track Guy" Consultants to ensure that there is no condition or technical approach to this issue that has not been examined in depth and to assess that the proposed actions and steps taken by NYCT are the correct ones with regard to the "CWR and Resilient Fastener Initiative." The primary actions being performed under this initiative are as follows:

- Installing new CWR, either 115RE or 100-8 rail (at locations where clearances may be an issue);
- Eliminate as many bolted joints as possible and replace deteriorated tie blocks in those corridors;
- Install new resilient fasteners in the 5 corridors.

The "Track Guy" Consultant summarized their findings by stating in part, "Controlling water and removing mud should greatly reduce the number of rail breaks along with a major program for replacing rail with new CWR and installing resilient type fasteners."

Additionally, TE is performing more frequent UT inspections in the five corridors stated above, as well as submitting a budget proposal for improved cameras and software to ensure they have complete detailed coverage of the track and rail elements. These activities will be outlined in greater detail in the "Actions Taken" section of this report.

This incident illuminates the necessity for NYCT to have a fully integrated CMMS. When viewing each rail defect individually, their occurrences may not have set off an alarm bell; however, when considering the fact that recurrent broken rails were taking place in a small geographic area, it would be beneficial to have an automated system in place that would allow this data to be flagged and alert senior management of a potential "hot spot" that requires a greater level of attention.

Division of Signals (DS):

DS personnel performed an inspection of the derailment area. There was no damage to signal equipment; however it was identified that the "45 MPH" sign that appeared in the General Signal Arrangement (GSA) drawings at stationing D3-1390+00 was absent in the field. A new sign was installed by DS personnel. In addition, DS personnel replaced the "30 MPH" sign located at D3-1398+00 and the "35 MPH" sign located at D3-1362+61 due to the poor condition of the signage making them not readily visible to T/Os. The DS has since implemented corrective actions, which will be outlined in the "Actions Taken" section of this report.

Although signal signage in the immediate area was missing or in poor condition, the DS was not a contributing factor to the derailment.

MOW Signals Operations Engineering (SOE):

SOE conducted a post incident operational testing of the signal system in the vicinity of the derailment. The control lines for signals D3-1375 and D3-1366 were tested and found to be working as designed. Track Circuits D3-1375 and D3-1373 were shunt-tested with approved shunt files and the equipment was found to be working as designed.

Personnel from SOE performed an independent post incident assessment of the signage in the vicinity of the derailment. The location of the signs are as follows:

Stationing	Posted Sign
D3-1398+00	30 MPH
D3-1390+00	45 MPH
D3-1362+61	35 MPH
D3-1310+65	35MPH

The SOE report states in part, "A closer review of the posted speed signs in the area shows that some of the signs may be unnecessary, but at this time, no signs will be removed since all posted speeds are lower than the safe speeds for the area."

Division of Infrastructure

The Division of Infrastructure (DI) personnel conducted a post incident inspection of the incident site and made the required repairs to the bent flanges on the structural support columns that been damaged by the derailed train. In addition, the area was inspected for signs of water intrusion, which can compromise the integrity of the track and no water related defects were found.

The DI was not a contributing factor in this derailment.

Division of Car Equipment

The cars involved in this incident are of the R-46 car class. They were built in 1975 by Pullman Standard. The cars are 75 feet long overall and each weigh approximately 91,000 lbs. As stated earlier, the R-46 car class is not equipped with data logging devices; therefore, the speed of the train, as well as other pertinent information was not available to aid in reconstructing the event.

Car Case Histories

The R-46 class cars are maintained according to the Scheduled Maintenance (SM) calendar. A review of the car case histories for all cars involved in this incident for the

time period of May 2, 2013 through May 2, 2014, indicated that they completed periodic SM 1, 2, 3, 4 Type Inspections at the Jamaica Yard Maintenance Facility. The review reflected that there were no braking, propulsion or truck system defects that contributed to this derailment.

Cars Involved in the Derailment (5742, 5743, 5745, 5744, 5634, 5635, 5637, 5636): On March 5, 2014, cars 5634, 5635, 5637 and 5636 were inspected at the Jamaica Maintenance Shop. The remaining cars, 5742, 5743, 5745 and 5744 were inspected on May 28, 2014, at the Coney Island Overhaul Shop. All of the cars sustained extensive damage including, but not limited to, damaged wheels, traction motors and shear pins. An itemized list of the damages sustained by each car is on file. The pre-millennium cars (such as the R-46 cars involved in this incident) were built to defined strength parameters, and not to the current energy absorption parameters of the newer cars in the fleet; however, none of the cars involved in the May 2, 2014 incident exhibited any deformation of the car's structure as a result of colliding with structural columns.

Car Equipment Engineering and Technical Support (CEE&TS) gauged all of the wheels with the NYCT no. 230 Wheel Flange Limit Gage. They were found to be within NYCT specifications. Additionally, the wheels were measured with the no. 391 Back to Back Gage and all measurements were within NYCT specifications (documentation on file).

DCE was not a contributing factor in the derailment.

Interagency Emergency Response

NYPD, FDNY and EMS personnel were notified of the incident and responded to the scene. The coordination of the emergency response between personnel from NYCT and external agencies was reviewed. OSS determined that the required interagency protocols were followed and the response was efficient and effective.

Rules and Regulations

NYCT MW-1 Track Standards (2010): Section 104.3 Conditions and Course of Action

(A) Priority 1: Conditions requiring immediate action. The qualified person detecting the condition shall make every effort to correct it immediately and must also evaluate whether to allow operation to continue under supervision or to place the track out of service immediately.
(B) Priority 2: Conditions that require inspection by a supervisor-or Deputy Superintendent of Track of the Staten Island Railway – within 24 hours of the time of detection of the condition. The investigating person shall immediately determine whether a slow speed may be necessary and what work is required, and shall base these decisions on findings and other factors, such as type of

condition, its location and the permanent speed of the track where the condition was found. Every effort shall be made to correct these conditions as soon as practicable.

(C) Priority 3: Such designation alerts to a track condition that may affect the ride comfort qualities of the track and that could potentially degrade to a worse condition if left uncorrected. Work programs should be established for the correction of these conditions on mainline revenue tracks.

NYCT MW-1 Track Standards (2010): Section 108.3 Crosstie and Fastening Requirements which states in part;

(A) Crossties must be capable of holding rails to their proper gauge and alignment securing fasteners, from excessive horizontal and vertical movement and transmitting vertical and horizontal wheel loads to the supporting structure or ballast.

(B) A crosstie is considered defective when it is split or otherwise impaired to the extent that it will not hold spikes or other fasteners.

(C) A fastener is considered defective if it is broken, worn out or not spiked in such a way that allows the base of the running rail to move laterally or vertically more than ½ inch relative to the crosstie.

(D) Each 39-feet segment of track must be supported by non-defective crossties and/or fasteners as prescribed by Table 108.3. Where direct fixation is used, each rail fastening device is considered to be a "crosstie " location. Table 108.3 states in part; "if the distance between the centerline of at least one non-defective tie or fastener and the center of the rail joint is greater than or equal to 24 inches the condition is a Priority 2."

NYCT MW-1 Track Standards (2010): Section 203.5 Rails

(K) Rails of unequal wear at a joint must be brought to an even surface in accordance with established welding procedures. When welding is not possible or practical step joints may be used.

NYCT MW-1 Track Standards (2010): Section 203.10 Rail Joints

(B) Bolted rail joints must be properly installed and maintained to perform the following functions:

1. Provide structural continuity by transferring vertical and lateral wheel loads between adjacent rails with no relative vertical movement of abutting rails ends.

(G) Rail end batter and mismatch shall be corrected by an approved welding method. When welding worn rail to match new rail, a weld strip of four inches is required for every 1/8 inch of mismatch.

MOW Maintenance Gram MMG#001-12: Importance of properly and accurately completing the required broken rail forms.

Properly broken rail package consists of:
1. Completed Preliminary Broken Rail Form
2. Completed Broken Rail Failure Report properly and accurately filled
3. Letter from the Zone Track Superintendent to the Sub-Div General
4. 14 Day Supervisory Inspection, last inspection prior to the break
5. Track Inspector "Track Inspection Reporting Form" prior to break
6. List of all outstanding track complaints of the broken rail area.
7. Copy of the printout of the last TGC run over the broken rail area
8. Pictures of the broken rail and its environment

The Broken Rail package must be compiled and submitted in timely manner to the Assistant Chief Track Officer's (A.C.T.O.) office.

Damages Costs:

DT Damage

Various track appurtenances were replaced in order to restore Track D3 to a SGR:

DT Labor Costs:	$1,019,429.00
DT Material Costs:	$180,149.00
Total DT Costs:	**$1,199,578.00**

DI Damage

Various infrastructure appurtenances were replaced in order to restore Track D3 to a SGR:

DI Labor Costs:	$95,940.00
DI Material Costs:	$3,500.00
Total DI Costs:	**$99,440.00**

DCE Damage:

Various components were replaced in order to bring the cars to a SGR:

DCE Labor Costs:	$244,483.08
DCE Material Costs:	$491,500.00
Total DCE Costs:	**$735,983.08**

Total Incident Costs:	**$2,035,001.08**

Injuries
There were 32 minor non-life threatening injuries reported by customers (30) and employees (2) as a result of this incident.

Weather
The incident occurred in the subway; therefore, weather was not a contributing factor in this incident.

ANALYSIS

From the physical evidence gathered at the scene of the accident, a review of independent consultant reports, DT, SRS and TGC inspection reports, as well as the results of employee interviews, the following sequence of events is considered to have been most probable:

- At approximately 10:16 hours, on May 2, 2014, an eight car train designated as the 09:57 "F" 179/STL (consist: S/M 5742-5743-5745-5744-5634-5635-5637-5636) was traveling southbound on express Track D3, south of 65th Street on the Queens Line.

- As the train traversed the area, a 7 foot, 11 inch section of the west running rail located at survey marker D3 1374+60 fractured beneath the leading first truck (#2 truck) of the second car (5743). The head and web of the rail separated from its base resulting in the wheels of the trailing #1 truck of Car 5743 derailing, followed by both of the trucks of the third, fourth, fifth and sixth cars (5745-5744-5634-5635) and the #1 truck of the seventh car (5637) of the consist also derailing.

- The train came to final rest at survey marker D3 1369+60 after having travelled south for an approximate distance of 500 feet while derailed. The derailed trucks of the incident train inflicted extensive damage to Right of Way (ROW) and DCE components.

- In addition, the derailed cars came into contact with structural support columns and tunnel walls resulting in additional car body damage. The contact rails of Tracks D1 and D3 were struck by a portion of the adjoining negative west rail that was dislodged from Track D3 during the event, which resulted in an explosion and the subsequent smoke condition in the area. The circuit breakers feeding the contact rails opened due to an overload condition, which removed power from the contact rails on Tracks D1 and D3.

- The cars involved in this incident are of the R46 car class and are not equipped with data logging devices; therefore, the actual speed that the train was travelling during the event was not recorded. However, there appears to be no indication that the train was travelling in excess of the normal operating speed for this area and it is estimated that the train would have been travelling at approximately 40 MPH at the time of the event.

- The rail involved in the May 2, 2014 derailment was manufactured by Arcelor Mittal in November of 2013. Extensive independent testing was performed on both the incident rail, as well as other rails delivered in the same batch to NYCT. No anomalies were found; therefore, Arcelor Mittal's Quality Assurance practices are not considered to be a causal factor in the derailment.

- A review of video data captured during earlier TGC4 runs reflect that the plate at the POD had been broken for at least one year prior to the derailment. In addition, the condition of the tie under the sheared plate was poor.

- The distance between the center of the joint and the first non-defective fastener under the rail joint was approximately equal to 25 inches; therefore, this condition (joint support failure) should have been classified as a P2 defect condition as per MW-1 Standards Table 108.3-Crosstie and Fastening Requirements.

- A reported P2 defect requires a supervisor to inspect the condition within 24 hours of the time of detection of the condition and states in part, "The investigating person shall immediately determine whether a slow speed may be necessary and what work is required, and shall base these decisions on findings and other factors, such as type of condition, its location and the permanent speed of the track where the condition was found. Every effort shall be made to correct these conditions as soon as practicable."

- The uncorrected P2 defect at D3 1374+60 was determined to be the primary causal factor leading to the broken rail that resulted in the derailment. The first plate under the rail joint intended to support the new 19 foot, 6 inch rail installed on February 8, 2014 was sheared on the gauge side of the track, offering no support for vertical and lateral movement of the rail joint under load.

- DT personnel are required to regularly inspect track to identify conditions that deviate from the standards established in the MW-1 Track Standards Manual. OSS reviewed the hourly and supervisory Track Inspection Forms for a period of one year leading up to the derailment, DT inspection records indicate that their personnel did not identify, document or correct any Priority defects on the west rail

in the immediate incident area during the period reviewed; therefore it appears that although the MW-1 Track Standards are clearly defined on the requirements for classifying the aforementioned condition as a P2 defect, DT maintenance personnel did not appear to be aware of the gravity of the condition. DT management has since taken action to address this concern by issuing MMG #009-14 Rail Joints to elevate employee awareness. The MMG will be discussed in greater detail in the Actions Taken section of this report.

- The most recent TGC run prior to the derailment was performed in the incident area on March 18, 2014 and although a P2 defect existed from an MW-1 Track Standards stand point due to the inadequately supported rail joint, this condition did not result in a TGC priority track defect being identified at that time. OSS attributes this circumstance to the fact that limited vertical deflection in a segment of rail may not be critical, unless other factors are at play, i.e. as in this case, it is at a location where an inadequately supported rail joint is present.

- A UT inspection of the running rails in the incident area was last performed, prior to the derailment, by SRS car 403 on April 9, 2014. There was no indication of any rail flaws on either running rail at that time.

- OSS reviewed the rail verification and repair forms for the two identified UT defects (June 11, 2013 and February 4, 2014) that occurred within the eleven months prior to the May 2, 2014 derailment. In both instances, the verification forms do not reflect that there outstanding track defects in the immediate area, despite the presence of the broken plate, fasteners, and deteriorated tie, which constituted a P2 defect. Therefore, based on this circumstance, it is OSS's position that DT personnel did not adequately investigate the underlying causes for the rail breaks, nor did they adequately document track defects during the rail flaw verification process.

- After the new rail was installed on February 8, 2014, there was a 1/8 inch top mismatch, where the CWR rail installed in 1982 met with the leading edge of the new 19 foot, 6 inch rail. NYCT MW-1 Track Standards (2010), Section 203.5 Rails (K), states, "Rails of unequal wear at a joint must be brought to an even surface in accordance with established welding procedures. When welding is not possible or practical, step joints may be used."

- The fact that the difference in height between the tops of the two adjoining rails was not remedied is an indication that DT maintenance forces are not adequately addressing track deficiencies while performing rail renewal activities. In this instance, the DT should have used vertical offset (raise) bars to address the top

mismatch. In addition, they should have corrected the broken plate, as well as addressed the deteriorated tie under the rail joint.

- Post incident investigative activities also identified that the joint bars at this location may have been unintentionally transposed (the gauge and field side joint bars were swapped) prior to the February 8, 2014 rail replacement. An examination of the joint bar by LPI and TE revealed that the top of the field side joint bar was worn unequally, creating a "ridge" or 'step" with a very sharp edge where it was positioned beneath the end on the new 19 foot, 6 inch rail involved in the May 2, 2014 derailment. The LPI report concludes that the downward movement of the rail under load, coupled with the rotation of the rail toward the gauge of the track, and it encountering the sharp edge of the "ridge," where the end of the rail was supported by the joint bar, created a stress point concentration in the area where the crack in the rail initiated.

- In addition, LPI's modeling and finite element analysis of the joint determined that the "integrity of the tie support and joint bar wear were found to be the most and second most influential variables, respectively, affecting rail stress local to the observed crack-initiation site. Conversely, small changes in spacing among other neighboring ties, presence or absence of a sixth bolt (adjacent to rail joint gap), and rail-top condition (worn or not worn) were substantially less influential."

- It's DT's practice to only drill the two outermost holes in CWR and install two bolts to allow for thermite welding to occur at a later date. Although leaving the end hole blank is a standard railroad practice when the rails are going to be thermite welded, the DT does not currently have a procedure in place to adequately address returning to the location to perform welding activities. This is evidenced by the DT replacing the same section of plug rail three times during an approximate eleven month time span; however, they never returned to thermite weld the existing CWR and new plug rails together on any of these occasions.

- It should be noted that rail breaks frequently occur in the vicinity of rail joints; therefore, having an effective welding program that eliminates as many rail joints as possible, reduces the probability of rail breaks occurring.

- TE personnel had previously identified five subway corridors where the ratio of rails breaks per mile is noticeably higher than the average based upon historical rail break data. As a result of the analysis, DT has implemented the "CWR and Resilient Fastener Initiative" as part of the Capital Track Reconstruction Program.

- In addition, on October 3, 2013, NYCT retained the services of John Zuspan from

"Track Guy" Consultants to ensure that there is no condition or technical approach to this issue that has not been examined in depth and to assess that the proposed actions and steps taken by NYCT are the correct ones with regard to the "CWR and Resilient Fastener Initiative." The "Track Guy" Consultant summarized their findings by stating in part, "Controlling water and removing mud should greatly reduce the number of rail breaks along with a major program for replacing rail with new CWR and installing resilient type fasteners."

- DS personnel performed an inspection of the derailment area. There was no damage to signal equipment; however it was identified that the "45 MPH" sign that appeared in the GSA drawings at stationing D3-1390+00 was absent in the field. The sign was reinstalled by DS personnel. In addition, DS personnel replaced the "30 MPH" sign located at D3-1398+00 and the "35 MPH" sign located at D3-1362+61 due to the poor condition of the signage making them not readily visible to T/Os. Although signal signage in the immediate area was missing or in poor condition, the DS was not a contributing factor to the derailment.

- SOE conducted a post incident operational testing of the signal system in the vicinity of the derailment. The equipment was found to be working as designed. In addition, SOE performed an independent post incident assessment of the signage in the vicinity of the derailment. At this time, no signs will be removed.

- Upon being notified of the situation, the RCC ensured that power was removed from all four tracks in the area of the derailment and alerted the FDNY and NYPD of the incident. In addition, RCC personnel coordinated with field personnel to choreograph the removal of additional revenue trains that had been trapped within the incident area. An emergency command post was established at Broadway and 60 Street to facilitate the safe evacuation of approximately 1000 customers from the train to the street via emergency exit #395. The inter-agency coordination appeared to be efficient and effective.

CONCLUSION

OSS has determined that the causal factor in this derailment was the failure of DT personnel responsible for track inspection activities to identify, document and correct a P2 track defect that was present at the POD for at least one year prior to this incident. In addition, three separate rail breaks occurred in the same segment of plug rail within an approximate eleven month time frame. DT personnel did not adequately investigate the underlying causes for the recurrent rail breaks and they did not adequately carry out existing practices to address track defects at the POD when rail verification and rail

replacement activities occurred. Furthermore, having a robust CMMS in place with the capability of flagging and alerting senior management of potential hotspots would be beneficial in averting derailments of this nature in the future.

ACTIONS TAKEN

1. DT reviewed the actions of their personnel involved in the incident and took the following actions:
   - DT management is working in conjunction with Labor Relations to charge three M/S1s and a T/I with discipline for their role in this derailment.
   - DT management reviewed the actions of the General Superintendent (GS) responsible for the geographic area where the derailment occurred and found his actions to be contributory to the event; however, discipline will not pursued as this individual has already been demoted to the title of M/S 1 for a separate infraction and is no longer a member of the managerial ranks. In addition, DOS management has requested that this individual not be permitted to be restored to a managerial title in the future.
   - The DT Superintendent assigned to the zone encompassing the incident area was not charged in this incident. The rationale for this decision is that this individual had only recently been assigned to this zone as of February 4, 2014.
   - The M/S II that completed the repair and documentation of the broken rail on February 8, 2014 has since retired; therefore, DT management will not be pursuing disciplinary charges.
   - DT management performed a post incident quality assurance audit of the T/I and Supervisory inspections performed on the Queens Line to determine the caliber of inspections being performed. The audit resulted in a M/S 1 and a T/I responsible for inspections in the area, where the derailment occurred, being cited for improper performance. Each employee received a 10 day suspension.
   - DT management issued and discussed MMG #007-14, "Broken Rail Procedures" and MMG #009-14, "Rail Joints" with all Subway Maintenance and Capital Construction (CN) employees during Quarterly Safety Briefings and Monthly Safety meetings. The MMG's are described in greater detail below.

2. On June 11, 2014, the Chief Track Officer (CTO) issued MMG #007-14, "Broken Rail Procedure." The new MMG supersedes the previous broken rail procedure (MMG #001-12 issued on February 13, 2012). The revised MMG now includes the following instructions, "New joint bars shall be used, and inspected for any sharp edges, burrs, or other defects that could compromise the rail section; joint bars shall not be transposed. Raise bars will be used when there is mismatched rail wear. Replacement of broken plates and fasteners under new rail ends joints is

mandatory." Additionally, MMG #007-14 requires, "The Zone Superintendent must submit a repair action plan on how he/she will prevent another broken rail in this immediate area to their General Superintendent as soon as possible." See Appendix "B" for all MMGs issued as a result of this incident.

3. On July 29, 2014, the CTO issued MMG #009-14 Rail Joints, which states in part, "Broken fasteners under the receiving end (in the direction of traffic) of the running rail at a joint shall be replaced as soon as possible; In addition, if there are signs of movement, either vertically, laterally or both at the joint, this condition shall be classified as a Priority 2, requiring that a slow speed shall be posted at the location until the broken fastener is replaced."

4. TE management is in the process of revising the MW-1 Track Standards Manual (2014) based upon the results of the modeling performed by LPI.

5. DT management instituted a campaign to identify and repair broken plates at rail joints. The DT has since corrected the limited number of broken plates identified on outdoor sections of the system and created a tracking system for broken plates occurring in the subway, where this condition is more prevalent. As of November 7, 2014, seventy six (76%) of the identified locations have been corrected. The remaining locations are in areas, which do not require slow speed orders. This activity is ongoing.

6. The DT intends to add eight (8) Maintenance Supervisors, Level IIs (M/S IIs) to the Track Maintenance group in 2015 to improve the span of supervisory control, as well as increasing the number and frequency of supervisory inspections on the five (5) corridors experiencing the highest ratio of rail breaks per mile.

7. Following the May 2, 2014 derailment, DOS executive management implemented more frequent UT inspection of the above 5 corridors, which were inspected every 15 days during an initial evaluation period. The UT inspections in these corridors are now occurring on a monthly basis.

8. As of October 2014, TE completed nine (9) UT inspection cycles of the five corridors and has taken corrective action to address the defects identified during the inspections. The tenth (10) inspection cycle commenced on November 12, 2014.

9. In addition, DT established rapid verification teams to expedite the response, verification and correction of reported rail defects identified during UT testing.

10. DT is evaluating alternative welding methods and the purchase of newer more efficient equipment to improve the current thermite welding procedure.

11. DT implemented the "CWR and Resilient Fastener Initiative" intended to significantly reduce the number of broken rails and improve track conditions in five critical corridors experiencing a high ratio of broken rails per mile. The primary actions being performed under this initiative are as follows: install new CWR and resilient fasteners, eliminate as many bolted joints as possible and replace deteriorated tie blocks.

12. TC intends to install 26,495 RF plates system-wide in calendar year 2014. The DT has installed approximately 23,083 RF plates (87% of the goal) as of November 12, 2014. RF plate installation is currently in progress on the Queens Blvd, 8th Avenue and Astoria/60th Street Tube corridors.

13. TE management has submitted a budget proposal to upgrade the TGC4 with additional Field Side View and Power Rail View Video Systems (cameras, lights and computers) to have complete detailed coverage of the track and rail elements.

14. TE personnel are also pursuing software that will automatically detect potential rail and fastener defects using the Rail View and Side View Video Systems, which will aid in accurately and objectively flagging MW-1 Priority Defects and require a dedicated team to review and verify the data. The TGC3 will have a video car equipped with the latest technology added to it in the early years of the next Capital Program.

15. The DS installed a new sign at D3-1390+00. In addition, DS personnel replaced the "30 MPH" sign located at D3-1398+00 and the "35 MPH" sign located at D3-1362+61.

16. On June 5, 2014, DS management issued MMG #14-05, "Fixed Signals" to re-enforce with DS maintenance personnel the necessity to ensure the signal signage is present and effective. MMG #14-05 states in part, "Wayside fixed signals provide important and crucial information to train operators. They are necessary to ensure the delivery of safe and reliable on time service to our customers. Attention must be given to these components during routine maintenance activities of nearby signals and switches or when performing First of the Month activities. These signals are to be in place, kept visible, clean and illuminated. Refer to the latest drawings for correct positioning and notify a maintenance supervisor prior to repositioning or replacing a fixed signal."

17. The DS is developing a supervisory inspection standard procedure document, which will include a check list requiring the verification and condition of fixed signals.

RECOMMENDATIONS

OSS recommends:

1. DT provide OSS with an update regarding the disciplinary action taken toward the three M/S1s and the T/I for their role in this derailment.

2. TE provide OSS with the revised MW-1 Track Maintenance Standards reflecting the modifications made in response to the LPI modeling.

3. DOS ensure that the "CWR and Resilient Fastener Initiative" receives adequate funding and its full implementation is expedited.

4. DT notify OSS when the eight (8) M/S IIs are added to the Track Maintenance group and provide the revised number and frequency of supervisory inspections along the 5 corridors experiencing the highest ratio of breaks per mile.

5. DT provide OSS with periodic updates on the progress of the "CWR and Resilient Fastener Initiative."

6. DT provide OSS with periodic updates on the campaign to identify and repair broken plates at rail joints within the subway.

7. DT provide OSS with periodic updates on the status of adopting alternative welding methods and the purchase of newer more efficient equipment to improve the current thermite welding procedure.

8. TE provide OSS with the final proposal to upgrade the TGC4 with additional Field Side View and Power Rail View Video Systems and accompanying software.

9. DS provide OSS with the supervisory inspection standard procedure, which will include a check list requiring the verification and condition of fixed signals, when available.

Note: OSS previously recommended that the DOS adopt a CMMS. The progress of its implementation is currently being tracked with recommendations stemming from a prior incident report. In May of 2014, a maintenance planning group was formed with

representatives from Infrastructure, Signals, Station Maintenance, and Track sub-divisions. This new unit is providing insight into the requirements of the CMMS.

SUBMITTAL

Prepared by:
This report was prepared by Anthony Chiappi, Superintendent, Rapid Transit Investigations, OSS.

Signature: _____ Date: 12/12/2014

Reviewed by:
This report was reviewed by John Morro, Manager, Rapid Transit Investigations, OSS.

Signature: _____ Date: 12/12/2014

Submitted by:
This report is submitted by Patrick Lavin, Senior Director, OSS.

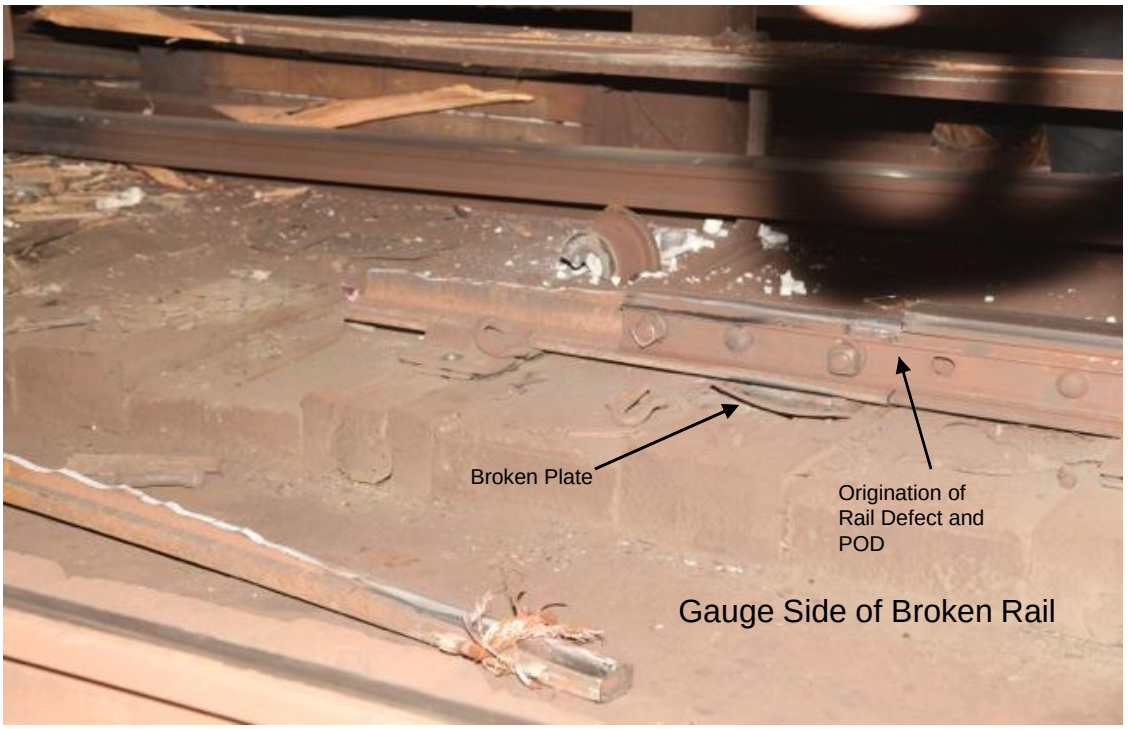
Signature: Patrick Lavin Date: 12/12/2014

APPENDIX “A”

Photographs

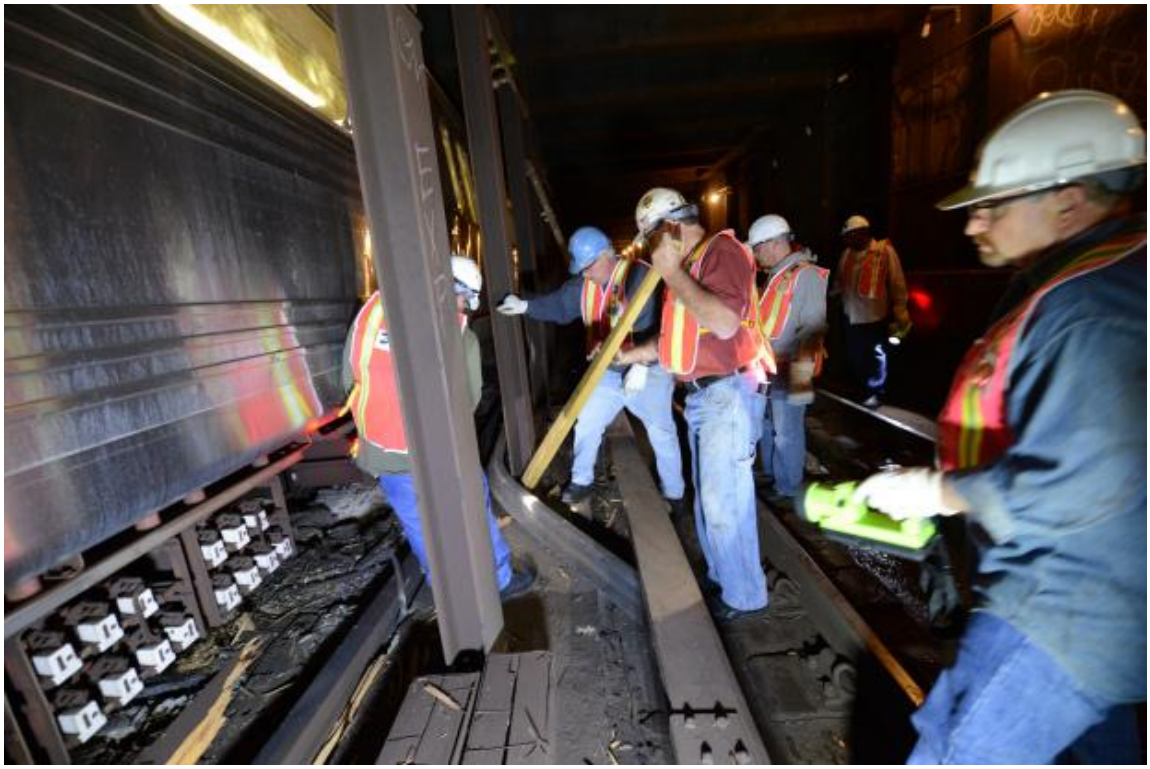

Gauge Side View of Rails at future P.O.D. S/O 65th St., track D3 – QBL – TGC4 Video of 11/08/2013

Gauge Side View of Rail Joint and broken plate at POD – TGC4 Video 11/8/2013



Post Incident View of Fractured Rail and Unsupported Rail Joint

Extensive Damage to Track D3



Removal of Running Rail from Track D3 bent towards and contacting 3rd Rail on Track D1

APPENDIX “B”

Maintenance Grams

MOW MAINTENANCE GRAM

OFFICE OF THE CHIEF OFFICER TRACK, MTA-NEW YORK CITY TRANSIT

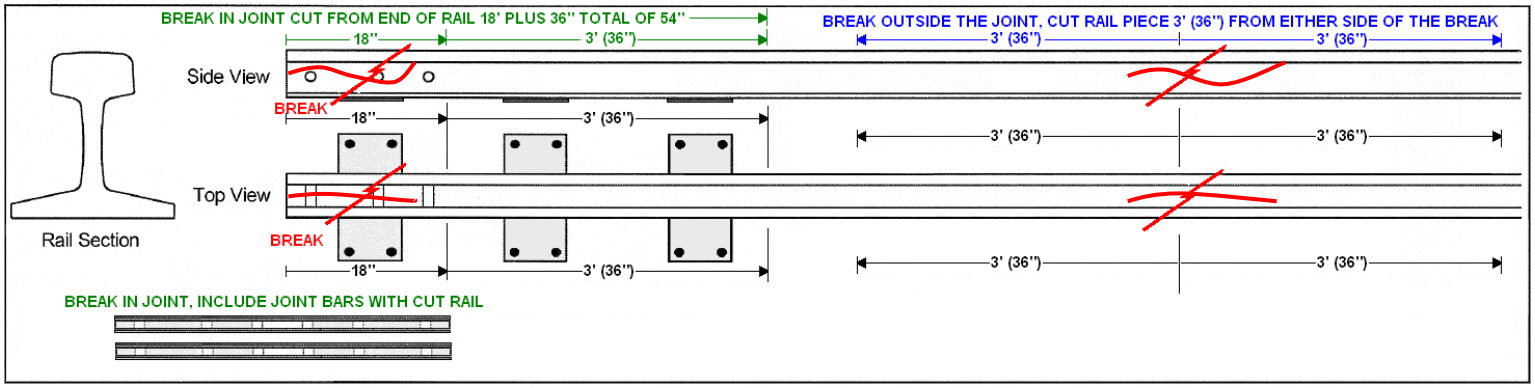
MMG# 007-14 June 11, 2014

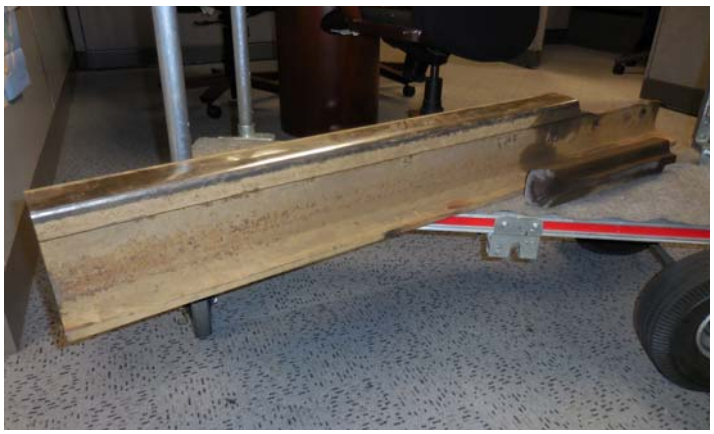
Broken Rail Procedure

Properly completed broken rail package consists of:

1. Completed **Preliminary Broken Rail form**
2. Completed **Broken Rail Failure Report properly and accurately filled**
3. **Letter** from the Zone Track Superintendent to the Sub-Div General
4. **14 day Supervisory Inspection**, last "Track Inspection Reporting Form" prior to the break
5. Track Inspector last "**Track Inspection Reporting Form**" prior to the break
6. List of all outstanding track complaints of the broken rail area
7. Copy of the printout of the last **TGC run** over the broken rail area
8. **Pictures** of the broken rail and its environment

All in-service broken rails that are caused by a head-web separation, or a horizontally split web (similar to the ones that occurred S/O 65th St. on track D3 and S/O DeKalb Ave. on track Q2 recently), **are cut at the site in such a way that the joint bars and a minimum of 3 ft. of the adjoining rail** (in case of the break occurring at a joint) on each side of the break are preserved. **In addition, pictures must be taken showing the configuration of the break in the track location, as found before any repairs were made or the rail disturbed.**



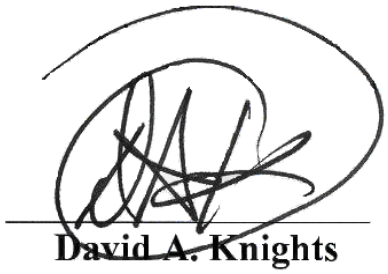


The Broken Rail package must be compiled and submitted in timely manner to the A.C.T.O. office at 130 Livingston Street, 9th floor, office, and a copy of the package must be also sent to the A.C.O., Track Engineering at 130 Livingston St., room 8028.

When a broken rail is found:

- Preliminary Broken Rail Information form is completed on the initial call by Sub-division Track Office, and the A.C.T.O. Office is notified.
- A typical repair standard practice is to replace the entire rail, usually using a standard 39 foot long rail. New joint bars shall be used, and inspected for any sharp edges, burrs or other defects that could compromise the rail section; joint bars shall not be transposed. Raise bar will be used when there is mismatched rail wear. Replacement of broken plates and fasteners under new rail ends joints is mandatory.
- At the conclusion of the broken rail job, the damaged section of the rail must be cut out and clearly labeled indicating the location, track number and date of break, then brought to 130 Livingston, 9th floor, ACTO office. The remaining rail piece is removed from the right of way or secured, painted red to indicate a scrap rail and scheduled to be removed. The Sub-division Track Office, Control, A. C. T.O. office and Command are notified of the status of the track at the completion of repairs.
- After completion of the broken rail it is IMPORTANT that the **Broken Rail Failure Report** be filled in **completely and accurately**, and included in the **broken rail package** which is then sent to the A.C.T.O. office at 130 Livingston Street, 9th floor, in a timely manner.
- Detailed pictures must be taken of the broken rail and its environment which is also sent along with the broken rail package.
- A letter from the Zone Superintendent to the Sub-Division General Superintendent must be included in the package, detailing how the broken rail was found, the location and time of the broken rail, the type of track and hardware, a description of the break, train traffic diversion, what was done to correct the broken rail, list the last Sperry run date and result over the broken rail location, the probable cause to the broken rail and lastly the disposal of the broken rail.
- **The Zone Superintendent must submit a repair action plan on how he/she will prevent another broken rail in this immediate area to their General Superintendent as soon as possible.**
- A copy of the Broken Rail package and the cut piece(s) of broken rail (for close examination and further analysis) must be sent as soon as possible to the Office of the A.C.O., Track Engineering at 130 Livingston St., room 8073.

THINK SAFETY, OWNERSHIP and RESPONSIBILITY.



David A. Knights
Chief Officer, Track

MOW MAINTENANCE GRAM

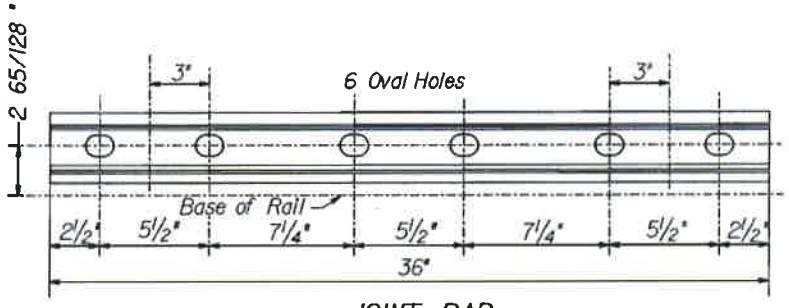
OFFICE OF THE CHIEF OFFICER TRACK, MTA-NEW YORK CITY TRANSIT

MMG# 009-14 July 29, 2014

Rail Joints

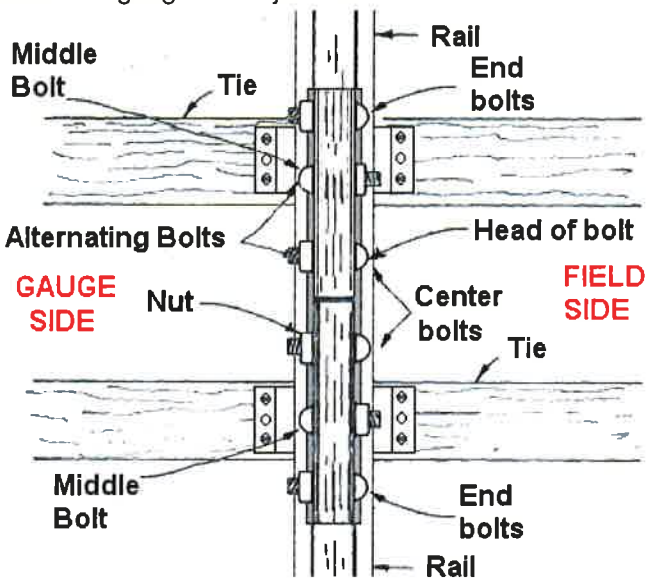
The MW-1 (E) states that the six holes 36 inch toeless "G" bar is the standard joint bar for splicing rails (connecting and supporting the separate ends of rails).

- Each six hole joint shall be comprised of no less than six bolts with their nuts and spring washers.
- **New bolts, new nuts, and new spring washers must be applied after any time that the rail joint is open.** Lubrication should be applied to the joint bar and the bolt threads during installation.

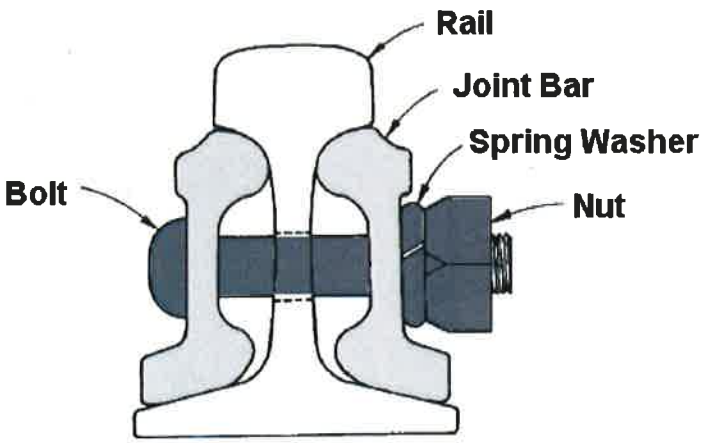


JOINT BAR

- Each six hole G-bar joint shall have the bolts with alternating head positions starting with the two center bolts, which must have their bolt heads to the field side of the joint bar, as well as the bolts at each end of the six holes G-Bar facing to the field side of the joint bar. The middle bolts (between the center bolt and end bolt) must have their bolt heads towards the gauge of the joint bar.



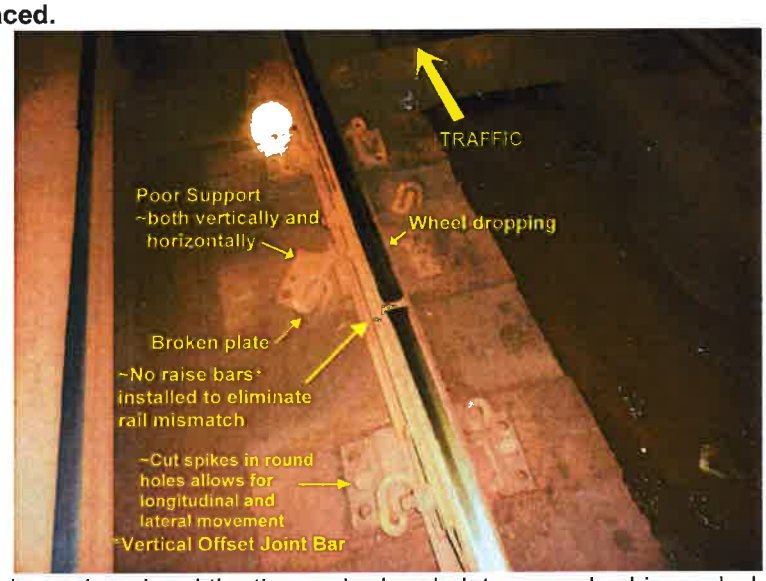
Alternating Bolt Pattern



Proper Bolt Installation

- It is absolutely essential that G-bars be properly seated and all six track bolts must be tightened to compress the spring washer between the nut and the joint bar. This will reduce rail end batter, joint bar stress, broken bolts and bars.
- **When installing new rails, the surfaces of the joint bars that would be in contact with the surface of the running rail shall be examined for any burrs, sharp edges or other imperfections that could cause a concentration of stress points on the running rail; if this is the case the joint bar shall be replaced with a new one, or ground accordingly to assure a proper good fit.**
- Avoid striking the G-bar when installing rail hold down spikes or Pandrol clips.

- Broken plates under a rail joints are a major concern for the integrity and longevity of the rail joint. Timely corrective action as described in the MW-1 is absolutely essential to prevent joint failure and battered running rails. **Broken fasteners under the receiving end (in the direction of traffic) of the running rail at a joint shall be replaced as soon as possible; in addition, if there are signs of movement, either vertically, laterally or both at the joint, this condition shall be classified as a Priority 2, requiring that a slow speed shall be posted at the location until the broken fastener is replaced.**



- Any broken tie plate must be replaced and the tie repaired and plate properly shimmed when you overhaul any rail joint as per the MW-1.
- When a rail joint is opened for maintenance, the joint bars must be inspected and cleaned; the rail in the joint area and the contact surfaces of the joint bar shall be cleaned (wire brushed) to remove any debris.
- Vertical Offset Bars (a/k/a: raise bars) must be used to adjust the in-service joints to worn rail when installing a new running rail. This will preserve the new rail and inhibit rail end batter, and prevent wheel dropping on the trailing end of the joint which prevents rail head flattening and broken joint bars. Vertical Offset Bars comes in various rise sizes; 1/16", 1/8", 1/4", and 3/8".

THINK SAFETY, OWNERSHIP and RESPONSIBILITY.

David A. Knights
Chief Officer, Track

NEW YORK CITY TRANSIT
MAINTENANCE OF WAY/ SIGNALS
MAINTENANCE GRAM

June 5, 2014 MG 14 - 05

Maintenance of Wayside Fixed Signals

Wayside fixed signals provide important and critical information to train operators. They are necessary to ensure the delivery of safe and reliable on time service to our customers. Attention must be given to these components during routine maintenance activities of nearby signals and switches or when performing First of the Month activities. These signals are to be in place, kept visible, clean and illuminated. Refer to the latest drawings for correct positioning and notify a maintenance supervisor prior to repositioning or replacing a fixed signal. A few examples of fixed signals are listed and pictured below.

Blue lights indicate the location of Emergency Alarms Boxes, Emergency Telephones and Fire Extinguishers.

Holding and Starting lights alerts the train crew to hold in a station due to service requirements or emergencies and when to leave the terminals.

Speed signs alerts the train operator to the maximum allowable train speed within a controlled area.

Car Markers indicate where train operators must safely stop their train.

The Most Important Thing We *Maintain* Is Safety

Paul Camera
Assistant Chief Signals Officer