Service Impacts Due to Hydraulic Spills

Summary of Recent Events

May 16, 2024

Presentation Overview

1. **Background**
   - Infrastructure State of Good Repair
   - Work Car Fleet
   - Hydraulic Spills

2. **Summary of Events**

3. **Service Disruptions – Roles and Responsibilities**

4. **Initial Assessments**
   - Vehicle Maintenance
   - Transit Control Protocols
   - Customer Communications

5. **Corrective Action and Next Steps**

Background

Infrastructure State of Good Repair (SOGR) Program

- 300 km of subway infrastructure (tracks, signals, communications, power rail and structures)
- SOGR program conducted seven days a week in three hour maintenance windows
- Specialized non-revenue rail vehicles (work cars) are required to perform SOGR work
- 20-25 work cars are used per night

TTC's Work Car Fleet

- Total work car fleet: 75 cars
- Total work cars equipped with hydraulic systems and/or equipment: 47 cars
- Average age of work car fleet: 17 years
- Life cycle of work car: 30 years +/- 5 years (depending on use)
- Custom designed and fabricated with specialized purposes

SUBWAY WORKCAR FLEET

ELECTRIC PROPULSION

RT 5
TUNNEL LEAK REPAIR

RT 25 & 73
ATC INSTALLATION
AUXILIARY DIESEL PROPULSION

RT 28 & 55
CRANE CAR
AUXILIARY DIESEL PROPULSION

RT 29
TUNNEL LINER REHAB

RT 72 & 76
OVERHEAD MAINTENANCE & ATC INSTALLATION
AUXILIARY DIESEL PROPULSION

RT 85
STRUCTURE REHAB, LEAK REPAIR & TRACK WELDING
AUXILIARY DIESEL PROPULSION

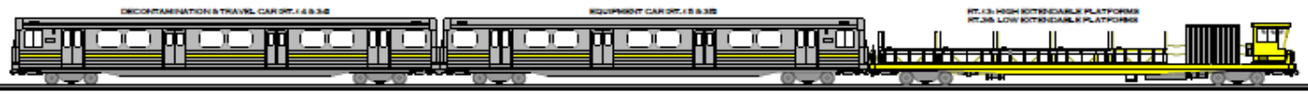
RT 81
ANCHOR BOLT DRILLING
AUXILIARY DIESEL PROPULSION

RT 86
COMMUNICATION MAINTENANCE & ATC INSTALLATION
AUXILIARY DIESEL PROPULSION

RT 9/10, 30/31, 32/33, 38/39, 60/61, 62/63, 64/65, 66/67 & 68/69
(2024)
STRUCTURE MAINTENANCE & TUNNEL LINER REHAB
AUXILIARY DIESEL PROPULSION

RT 90/91
TRACK INSPECTION VEHICLE

RT 13/14/15 & 34/35/36
ASBESTOS REMOVAL CONSIST



RT 87 & 88
CRANE CAR
AUXILIARY DIESEL PROPULSION

DIESEL PROPULSION

RT 7
LOCOMOTIVE
470 HP

RT 16 & 17
TUNNEL WASHER
400 HP

RT 18
LOCOMOTIVE
700 HP

RT 19
GENERAL UTILITY
391 HP

RT 20
CRANE CAR
391 HP

RT 48 & 49
SNOW THROWER / UTILITY
200 HP

RT 21 & 41
TIE TAMPER
400 HP

RT 6, 46, 56 & 84
DRAIN VACUUM / VACUUM EXCAVATOR
450 HP

RT 71
LOCOMOTIVE
630 HP

RT 82 & 83
CRANE CAR
400 HP

RT 89
TRACK VACUUM CAR
650 HP

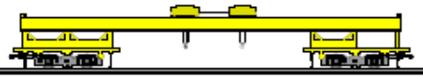
TRAILER

RT 1, 2, 42, 47, 57, 58, 59 & 70
FLATCAR

RT 8
RAIL DELIVERY SYSTEM
4 OF 13 BUGGIES SHOWN

RT 11
CRANE CAR

RT 27
BEAM REPLACEMENT CRANE (VIADUCT)



RT 40
BALLAST DELIVERY

RT 50, 51, 52 & 53
SNOW THROWER

RT 77, 78, 79 & 80
BALLAST BUGGY

SEPTEMBER 6, 2023

RAIL VEHICLE ENGINEERING - RAIL CARS & SHOPS

DRAWING 20961
ISSUE 13

RT-17 and RT-56

RT-17: Tunnel Washer Work Car

RT-56: Vacuum Work Car

Background

Hydraulic Spills

- Since January 1, 2024, there have been **six** hydraulic failures (four occurred on the main line).
- Hydraulic spills can impact acceleration, deceleration and braking distances. Spills can also impact the environment.
- Hydraulic spills are reported to the Ministry of Environment as per legislative requirements.
- Spills are contained using absorbent barriers, catch basins and vacuum trucks.
- Slippery rail conditions can also occur as a result of seasonal foliage and inclement weather.
- Standard practice is to reduce speed and operate to conditions while track conditions are assessed by infrastructure crews.

2024 Hydraulic Spills

Jan. 14, 2024

Sherbourne to Donlands
RT-56 work car spilled 10L of hydraulic fluid.

Failure: Hose failure

Jan. 17,2024

Eglinton West to Dupont SB
RT-17 work car spilled 120L of hydraulic fluid.

Failure: O-ring failure

Feb. 10, 2024

Greenwood Yard
RT-7 work car spilled 5L during pre-trip inspection (no impact to service).

Failure: O-ring failure

April 22, 2024

Greenwood Yard
RT-41 work car spilled 50L during shunting north to WYE (no impact to service).

Failure: O-ring failure

May 13, 2024

Spadina to Dupont and Greenwood
RT-56 work car spilled 200L of hydraulic fluid.

Failure: Hose failure

May 15, 2024

Davisville to Eglinton
RT-84 work car spilled 100L of hydraulic fluid.

Failure: TBD

Service disruption and response

Roles and responsibilities

- Service Disruptions Procedures: Planned and Unplanned

- Planned:
  - Shuttle Buses- Closures & Diversions
  - Event Monitoring and System Management- Transit Control
  - Stations Management- Stations

- Unplanned:
  - Initial Response- Transit Control (severity dependent)
  - On Scene Planning/Management- Chief Supervisor/Stations
  - Shuttle Planning/Monitoring- Transit Control
  - Event Monitoring and System Management- Transit Control
  - Return to Regular Service

Initial Assessment

Vehicle Maintenance Status

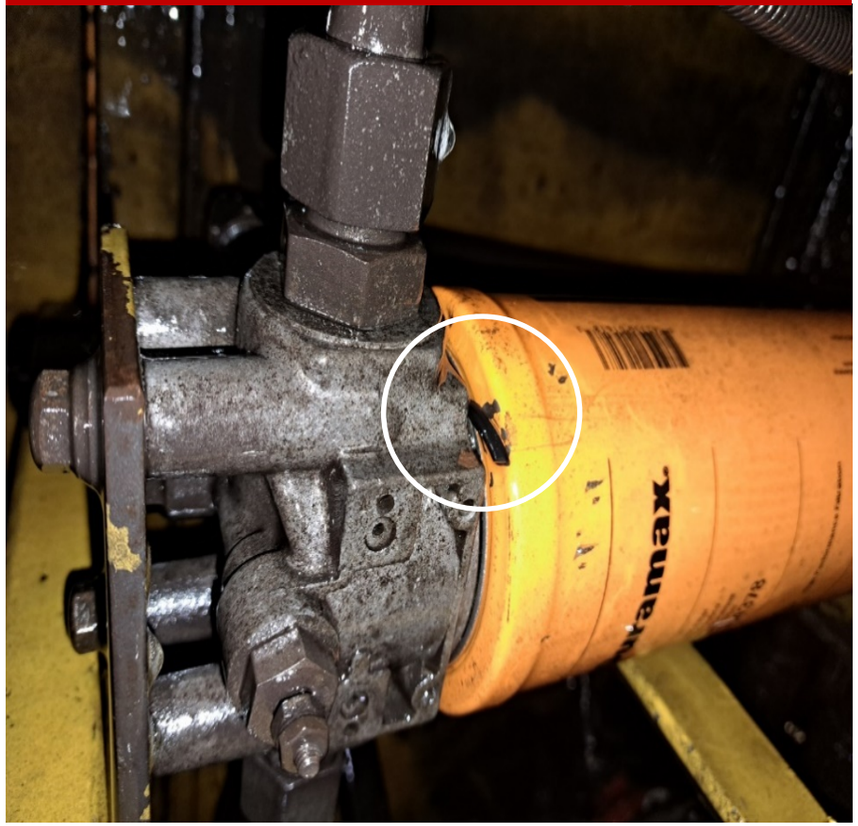
January 14, 2024 Incident – RT-56

Vehicle age:	20 Years (Dec 2004)
Source of spill:	Hydrostatic drive hose
Date of last inspection:	October 26, 2023
Compliance to inspect interval:	Yes
Results of last inspection:	No concerns identified by Vehicle Technician
Corrective actions:	1. Re-assessment of component life cycles 2. Increased technical and workmanship training (Master Sign-Up) 3. Improvements to Quality Assurance and Control functions

Initial Assessment

Vehicle Maintenance Status

January 17, 2024 Incident – RT-17



Vehicle age:	27 years (Dec 1997)
Source of spill:	O-ring high pressure filter
Date of last inspection:	November 21, 2023
Compliance to inspect interval:	Yes
Results of last inspection:	No concerns identified by Vehicle Technician
Corrective actions:	1. Re-assessment of component life cycles 2. Increased technical and workmanship training (Master Sign-Up) 3. Improvements to Quality Assurance and Control functions

Initial Assessment

Vehicle Maintenance Status

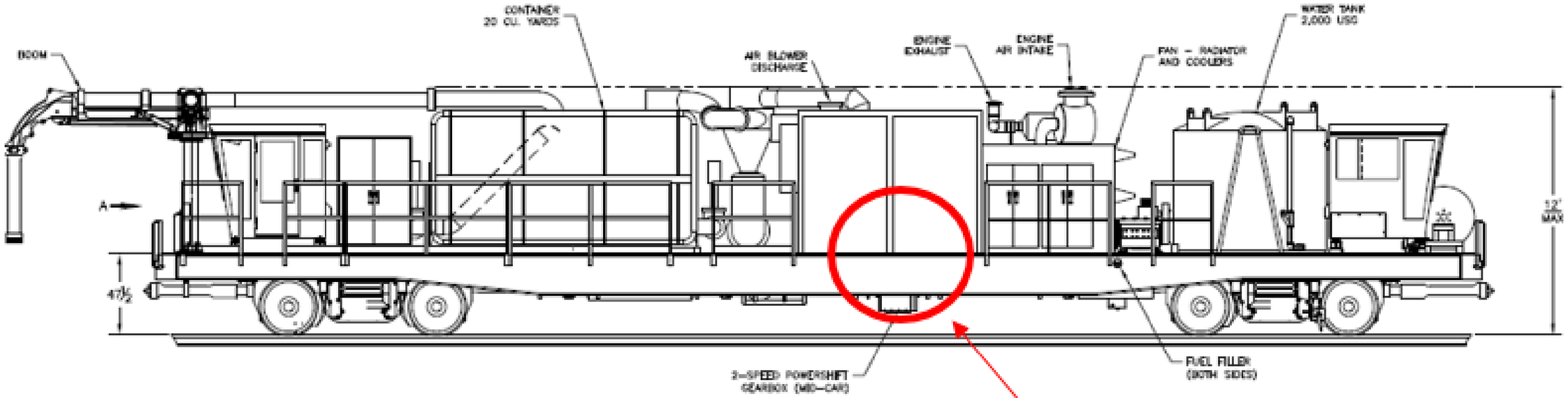
May 13, 2024 Incident – RT-56

Vehicle age:	20 years (Dec 2004)
Source of spill:	Auxiliary pump hose
Date of last inspection:	April 19, 2024
Compliance to inspect interval:	Yes
Results of last inspection:	No concerns identified by Vehicle Technician
Corrective actions:	1. Fleet check for similar routing issues 2. Re-assessment of component life cycles 3. Increased technical and workmanship training (Master Sign-Up) 4. Improvements to Quality Assurance and Control functions

Initial Assessment

Vehicle Maintenance Status

RT-56 – Vacuum Work Car



Approximate location of January 14 and May 13 failures

Initial Assessment

Vehicle Maintenance Status

May 15, 2024 Incident – RT-84

Vehicle age:	13 Years (Oct 2011)
Source of spill:	Hydrostatic hose*
Date of last inspection:	March 12, 2024
Compliance to inspect interval:	Yes
Results of last inspection:	No concerns identified by Vehicle Technician

- *Damage found to clutch plate, drive shaft and other mechanical components. Damage to hydrostatic drive hose is suspected to be a result of mechanical failures still under investigation.
- Clutch design life 7-10 years. Last replaced in 2019.

Initial assessment
Transit Control Protocols

- Revenue vehicles allowed to proceed through impacted areas at reduced speeds during the January 17 incident, after track crews had investigated.
- **Assessment of rail safety:**
  - Low to no risk for derailment – slippery rail alone is not a causal factor for derailment.
  - Low risk to Line 1 vehicle collisions – ATC calculates safe distance between vehicles based on speed and distance. ATC will reduce speed and add distance upon sensing spin/slide conditions.
  - Low risk to Line 2 vehicle collisions – BD line still operating under fixed block model. Minimum safe distance between trains is always a minimum of one signal block of separation at all times.

Initial assessment

Transit Control Protocols

- Concerns raised by Wilson Division at Jan 24, 2024 JHSC meeting regarding safety of rail and decision to allow operations to continue.
- Ministry of Labour (MOL) notified of concerns. Field visit conducted on February 1, 2024. No orders received.
- Stakeholder consultation conducted by TCC to revise Incident Management protocols and procedures. Stakeholders included TCC, Transportation, Infrastructure and Vehicle Maintenance JHSC and staff.
- Procedures revised to delay service upon indication of slick rail conditions, perform complete clean up of rail and to run test trains through impacted areas.
- Revised procedures were used in May 13 and May 15 incident.

Initial assessment

Disruption Management and Response

Challenges:

- During peak hours, one Station Supervisor is present to take on site command of service disruption, while Chief is on route
- Shuttle buses are ordered
- Additional resources are assigned to the location(s)
- Travel time impact response (buses, assistance) leading to very challenging situations for the first

Opportunities for Improvement:

- Alternate modes of transportation
- Better coordination to ensure assistance to field staff in real time
- Communications enhancements between Stations and Transit Control
- PA upgrades

Initial Assessment

Customer Communications

Updates and service alerts on ttc.ca

In-station public announcements

- Messages played every three minutes in every station – total of 16,000 announcements.

Proactive media updates

- Spokesperson on CityNews twice hourly between 11 a.m. and 5 p.m.
- Interviews conducted with nine news outlets
- Nearly 125 million impressions during closure period and shortly after (69% of coverage was neutral)

Additional TTC staff to direct customers

- 20+ additional TTC staff at Broadview station for both morning and afternoon service to guide and assist customers

Service alerts on TTC social media channels

- 18 posts on our X accounts generated 889,000+ views
- 61 customer interactions on @TTChelps
- 4 posts to @TTCNewsroom to update media

Immediate Corrective Actions

Vehicle Maintenance

1. Fleet check of all work cars equipped with hydraulic systems (16 of 47 completed as of May 15, 2024)
2. Re-assessment of life cycles for hydraulic components
3. Continuous improvement of preventative maintenance programs
4. Increase technical training for work car technicians
5. Improve quality control and quality assurance functions

Transit Control and Incident Management Protocols

1. Refine procedures to prevent vehicle recoveries and/or work car movement after the start of service run out

Next Steps

1. Complete fleet check
2. TTC Internal Audit to perform focused audit of maintenance procedures and controls in Work Car Maintenance section
3. External third-party investigator (Hatch LTK) has been on boarded to perform forensic analysis of failures and audit of maintenance policies and procedures

Summary of Events

January 14, 2024 Incident

- **8:29 a.m.** - TCC receives reports from train crews of slippery rail EB Pape to Donlands
- **8:56 a.m.** - Train reports of a platform overshoot at Pape (all doors on platform)
- **9 a.m.** - TCC contacts Track for investigation
- **9:01 a.m.** - Final report of wheel slide at Donlands
- **9:45 a.m.** - Report of hydraulic leak on RT56 at Greenwood Yard
- **10 a.m.** - Track Patrol performs Pape to Donlands inspection and advises of presence of oil on rail head and some pooling but unable to estimate how much oil may have spilled but not in any catch basins; suggests using a degreaser to clean the head or to escalate to Track Roadmaster or Foreperson
- **10:47 a.m.** - Safety advised
- **12:56 p.m.** - Track Foreperson completes inspection of Pape to Donlands and advises mainline could have trail of oil from yard; could cause some wheel slipping and if not severe at moment would need rag/wipe clean up after service
- **12:56 p.m.** - Track Patrol assigned to ride the train in the cab from Royal York to Greenwood for additional inspections and clean up organized as required

Summary of Events

January 17, 2024 Incident

Work Car:	**RT-17**
Location:	**Eglinton West to Dupont Stn**

Chronology:

- **7:13 a.m. RT-56**

  Held at Ossington for an Impassable ahead while travelling towards Greenwood yard.
- **7:18 a.m. RT-56**

  Received permission to proceed towards Greenwood Yard.
- **7:36 a.m. RT-56**

  Arrived at Greenwood Yard. No reported issues with the work car.
- **8:29 a.m. EB 212 Run, Lead car 5356**

  Reported spin/slide entering Castle Frank and Broadview stations. Intermittent spin/slide was reported at Chester station
- **8:40 a.m. EB 214 Run, Lead car 5091**
  Reported spin/slide issue and a traction fault entering Broadview station
- **8:56 a.m., EB 216 Run, Lead car 5073**

  Reported overshooting the platform at Pape station with all doors still on the platform, proper procedures followed
- **8:58 a.m. -** Transit Control advised Track Foreperson of rail conditions. Impacted area suspected to be Sherbourne to Donlands stations. Track crew dispatched to investigate & clean impacted areas

Summary of Events

January 17, 2024 Incident

- No other reports of spin slide or overshoots by any trains
- **10:33 a.m.**

  Track crew completed cleanup and cleared Chester to Pape. Crew reported slick rail, some pooling between Broadview to Chester stations. Crew proceeded to clean this impacted area
- **10:38 a.m.**

  Transit Control assigned a Chief Supervisor to investigate the reports of a leaking workcar, car at Greenwood

- **10:47 a.m.**
  Transit Control informed Safety department of the issue. MOE notified?
  Track Crew cleared Broadview to Chester area after inspecting and reporting some slick rail but no run off fluid on the running rails.

Summary of Events

May 13, 2024 Incident

- **4:13 a.m.** - Radio call from WAC advising of leak on RT56 NB north of Spadina
- **4:22 a.m.** - Initial estimate of 5L of oil have fallen out with reports of some oil on power rail
- **4:31 a.m.** - Chief Supervisor on scene and reports leak appears to be isolated at location, into the catch basin and a restricted speed may be required after clean up
- **4:54 a.m.** - Additional Chief Supervisor dispatched given extent of the leak
- **4:55 a.m.** - Site crews state RT56 will need to be coupled up as it cannot be turned on for fear of further leaks
- **5:17 a.m.** - RT56 coupled up to RT46 for towing into Bay lower
- **5:18 a.m.** - Track crew to commence clean up
- **5:49 a.m**. - Track crew completed clean up
- **5:53 a.m.** - Coupled work cars move from Bay lower on route to Greenwood Yard
- **6:08 a.m.** - RT60 and 68 lost positioning between Museum to St George NB on route back to yard
- **6:12 a.m.** - TCC makes call to operators of restricted speeds NB Museum to Spadina
- **6:45 a.m.** - Several trains EB between Yonge and Broadview advise of spin-slide alerts along with overshoots at Broadview and Yonge platforms
- **6:50 a.m.** - decision made to suspend service between St George and Broadview Stations and shuttle buses ordered
- **7:29 a.m.** - Track crews arrive to commence clean up of rail Yonge to Broadview
- **1 p.m.** - Initial cleaning completed and test train arranged between Yonge to Broadview; tests unsuccessful; further testing arranged until 6pm

Summary of Events

May 15, 2024 Incident

- **1:52 a.m.** – RT-84 went disabled NB Eglinton experiencing a hydraulic leak
- **2:55 a.m**. - Reports of approximately 200 L of oil spilled onto ballast (not catch basin); Chief Supervisor and Track Supervisor to inspect the area
- **4:39 a.m.** – RT-84 coupled to RT-21 and towed to Davisville Yard; area cleaned
- **4:55 a.m.** - test train arranged and passed through the area with no reported spin-slide or overshoot
- **5 a.m.** - Decision made to keep standby crews on site for the early morning service in the event of any issues