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Alstom QMS: OCS Maintenance

Closing meeting: Discussion of Draft Audit Findings
12 June 2020

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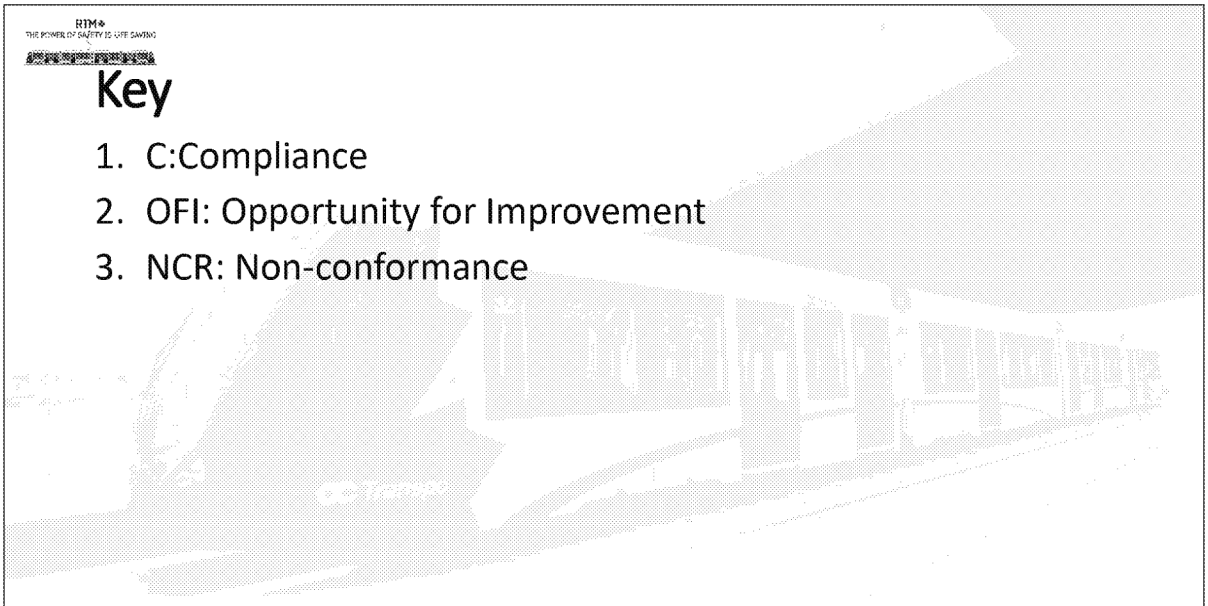
Key

1. C:Compliance
2. OFI: Opportunity for Improvement
3. NCR: Non-conformance



Training

- The Power Technician team is tasked with performing OCS Maintenance activities. The team consists of Electricians and Linemen; 7 technicians and a team lead.
- The current trainings identified as required for OCS Maintenance include:
  - Power Tech WMS Priority 1
  - Power Tech WMS Priority 2
  - Power Tech WMS Priority 3
  - OCS Awareness Training

Training NCR0067

- Training records provided do not confirm all current 8 Power Technicians attended the OCS Awareness Training which is identified as Mandatory for Power Technicians in the Training Matrix [NCR]
  - Note: There are safety and liability implications as a result of providing improper training to employees, especially in a high risk environment like the OCS.
- Attendance records for some of the WMS trainings did not provide information on the Trainer even though it was one of the fields on the form. Some of the records also don't specify the mode of training. (OFI)

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Training – Alstom Response

- All power technicians received training covering OCS Awareness.
- X3 employees received as part of prior employment with OLRTC during construction.
- OCS Awareness is a RTM mandatory course. The contents of the course is duplicated within:
  - ELROR v1.2
  - Alstom EHS Site Orientation
- Alstom recommends eliminating OCS Awareness in favor of the other courses

Technician	OCS Awareness	ELROR v1.2	Alstom EHS site Orientation
Jun (Roger) Fan	OCS Authorization Card (Yellow)	2019-05-19	2018-08-13
Luc Poirier	2018-05-02	2019-05-14	2018-09-17
Marlon Stewart	OCS Authorization Badge Green (OLRT)	2019-05-14	2018-08-13
Simon Kendall	OCS Authorization Badge Yellow (OLRT)	2019-05-14	2018-10-29
Alex Trafford	2019-10-24	2019-11-18	2019-10-23
Doug Legere	2019-08-28	2019-08-27	2019-08-26
Simon Seguin-Beauchamp	2020-01-22	2020-01-20	2020-01-13
Jason Bradley	2020-05-22	2020-05-19	2020-05-19

Alltrade

- Upon the commencement of Commercial Service, Alstom recognized that it did not have sufficient resources with the correct training to maintain the network and manage various OCS rectification activities that still remained for completion after the T&C phase.
- Alstom sub-contracted multiple maintenance elements to Alltrade
  - Alltrade was the subcontractor of Cymi and the company which erected the OCS all along the Confederation Line.

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AllTrade – Alstom Response

- Alstom contracted AllTrade prior to RSAD to provide support.
- OCS maintenance was not subcontracted to AllTrade, instead they were only present to help build the experience of the power technicians.
- AllTrade were always accompanied by an Alstom technician.
- Main purpose to have AllTrade was due to limited access to system prior to RSAD and due to a lack of presence of support via the Construction Contractor.
- Agreement with AllTrade include extra vehicle to support in event of RTM vehicle not being available.

Training – Audit Team Observations

- The audit team observed
  - gaps in the OCS training program for the Power Technician team who inspect and maintain the OCS.
  - during the audit, Alstom made reference to a number of issues which impeded their ability to properly maintain the system, however an organization such as Alstom with a reputation for being competent and capable of maintaining an OCS system ought to be able to fill these gaps.
  - Although Alltrade was retained by Alstom to support maintenance activities of the OCS, it is unclear if Alstom used this opportunity to further train their Power Technicians on the OCS and the Maintenance procedures required to maintain the system.*
  - Despite the engagement, skill and dedication of Alstom's workforce, they presently have minimal experience of maintaining deliberately tensioned conductors, which is very different to skills used in maintaining overhead Hydro lines, for example

*Alltrade ceased to be a sub-contractor of Alstom's on May 28th, 2020.

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Training – Alstom Response

- Power Technician WMS - Priority 1, 2 and 3 training status

Technician	Power Technician WMS - Priority 1	Power Technician WMS - Priority 2	Power Technician WMS - Priority 3
Jun (Roger) Fan	2019-12-10	2020-05-12	Planned as part of yearly maintenance - scheduled for June/ July, 2020
Luc Poirier	2019-12-10	2020-05-11	
Marlon Stewart	2020-12-15	2020-05-07	
Simon Kendall	2019-12-10	2020-05-11	
Alex Trafford	2020-05-12	2020-05-12	
Doug Legere	2020-05-12	2020-05-12	
Simon Seguin-Beauchamp	2020-05-12	2020-05-11	
Jason Bradley	Delayed due to COVID19 Scheduled 30-Jul-2020	On Hold due to COVID	

- Ottawa Confederation Line is the first catenary system in Eastern Ontario & Quebec.
- There are no other than Hydro Lines with in the regional area.
- The team is supported with personnel with previous experience with LRT catenary systems

Name	Title	Localisation	Experience
Stive Compper	Ottawa OCS Specialist	Local	Catenary System Expert (Engineering) - SNCF in France (15+ years experience)
Damien Lamy	Systems Operation Manager	Local	Alstom Technician in Reims - OCS & TPSS Maintenance (9+ years experience)
Richard France	Project Manager	Local	Dublin Engineering Manager & Project Manger for Dublin Luas, which included OCS maintenance (8+ years)
Laurent Gouteron	Engineering Manager for Power Systems	Global	Traction Power & OCS Expert with Alstom (20+ years experience)

Monitoring & Measurement

- An annual APPM Achievement Report has been developed for OCS assets and it includes the Minimum acceptable criteria and work method statement used for verification. (C)
- Documentation for monitoring activities to ensure optimal OCS alignment are performed monthly as visual inspections and biannually as measurements on the Balance weight assembly was provided. (C)
- A WMS to document quarterly contact wire wear checks in locations such as junctions, overlaps, section insulation and crossover transition to rigid wire was also provided. (C)

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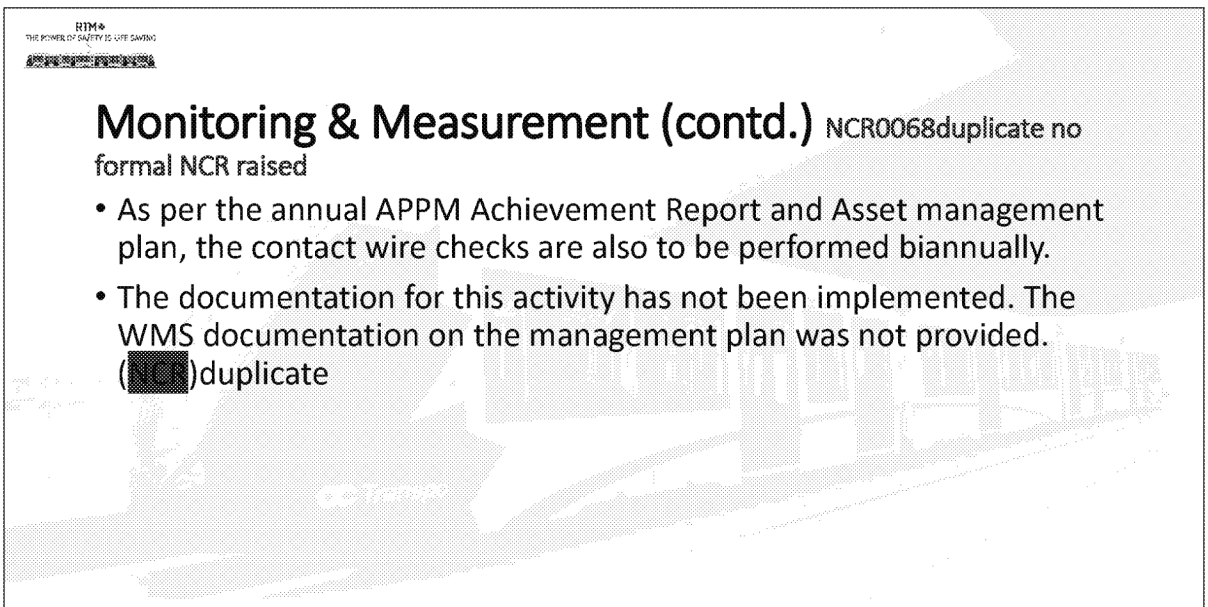
Monitoring & Measurement (contd.) NCR0068duplicate no formal NCR raised

- As per the annual APPM Achievement Report and Asset management plan, the contact wire checks are also to be performed biannually.
- The documentation for this activity has not been implemented. The WMS documentation on the management plan was not provided. ([redacted])duplicate



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Monitoring & Measurement – Alstom Response **NCR0068duplicate no formal NCR**

- The Asset Management Plan (including OCS) was submitted to RTM on December 31st 2019.
  - The requirements for contact wire checks included state (page 32):

	Contact Wire	OCS Height and Stagger control – Track Tracer	OTT-OCS10-MTN10-WMS-003

  - Additionally as part of the Annual APPM Achievement Report - OTT-GNR-ENG10-REP-002), (page 35)

Contact Wire	OTT-OCS10-MTN10-WMS-003	Height and Stagger measures Min height : 4200mm Stagger in curves : varies 100 to 450 mm Maxi stagger: ± 300 mm	Preventive Maintenance activities that are being carried out to avoid service disruption	Maintenance must be carried out as indicated in WMS.

4.2 References and Clarification

The following are the references of the Work Method Statement that we use as part of ALSTOM preventive Maintenance activities.

OTT-OCS10-MTN10-WMS-001-3M- OCS Specific Inspection

OTT-OCS10-MTN10-WMS-002-6M- OCS Tensioning devices and Fixed Terminals Inspection

OTT-OCS10-MTN10-WMS-003-6M- OCS Height and Stagger control – Track Tracer

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Monitoring & Measurement – Alstom Response

- TrackTracer, CatenaryTracer measurement performed in accordance with user manual

TRACK AND CATENARY GEOMETRY MEASUREMENT SYSTEM VEHICLE
USER AND MAINTENANCE MANUAL

Rev.	Date	Author	Verified by	Approved by	Confidentiality level
A0	14/01/2019	M. WILLAERT	T. PEIRATS		
A1	17/01/2019	M. WILLAERT	T. PEIRATS		
A2					

Confidentiality levels: PU (PUBLIC) - RE-Entity (RESTRICTED to Entity to be specified) - CO (CONFIDENTIAL)

Project name: OTTAWA				Document Ref :
Track Tracer				
DTP No :	PBS	ABS	No	

Corrective Maintenance

- There is no Alstom-initiated Corrective maintenance procedure documented at the time of this audit. (OFI)
  - Audit Note: The Preventive Maintenance WMS documents provides some corrective action guidance to Power Techs for some of the issues that are encountered during their work. But this is considered neither exhaustive nor complete.
- Supplier manuals (MVA-54-0-S017-MAN-1000_0) and drawings from OLRTC are referenced in the WMS's drafted for OCS Maintenance to correct non-conformances that occur.
  - Audit Note: Alstom stated during the audit they had not received all the necessary assembly and cross-section drawings for the Overhead Catenary System in order to finalize and complete the remaining maintenance documents.

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Monitoring & Measurement – Alstom Response

- Supplier manual MVA-54-0-S017-MAN-1000 does not have satisfactory level of detail to produce corrective WMS.
- Technical information to support the creation of corrective WMS has not been provided by RTM. Refer to letter ALSMNT-RTM-0241.
- Basic design documentation:
  - Assembly drawings - Not received
  - Technical specifications (in order to purchase to tier2 suppliers) - Only bills of material received
  - RAMS studies - Report provided but the data about OCS are not compliant and fit for purpose with the equipment installed in Ottawa
- Detailed design documentation:
  - Set up of the tensioning devices - Abacus (measurements table) per pole not received
  - Pole and assembly load calculations - Not received
  - Hazard Analysis log - Not received
- Detailed Installation & Commissioning Records:
  - Wire height, stagger and gradient report - Only provided for select pole locations
- Maintenance documentation:
  - Preventive maintenance plan - Incomplete and missing details
  - Corrective maintenance plan - Procedure not received => WMS to be created when defects are encountered
  - Spare parts list - Consumable list not received. Tools list received but without references (only generic names)
  - Maintenance records from before RSAD - Not received

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Failure Response

- Service request for OCS failures are logged as a work order in IMIRS.
- A service order is then issued on GSI - Alstom's MMS and closes the work order once it has been corrected.
- Evidence of GSI service order (500314519)/ IMIRS work order (32873)for OCS Dropper wire repair/replacement was provided.
- Failure response for the non-conformance incident was compliant with PA requirement. Work order was logged 3/23/2020 7:19 PM, responded to at 3/23/2020 7:25 PM and completion comments at 24.03.2020 04:36:35. Work order was completed at 3/24/2020 8:33 PM before the due date logged on IMIRS.
- **42% of Corrective Maintenance work orders were completed after the due date specified in IMIRS. (OFI)***

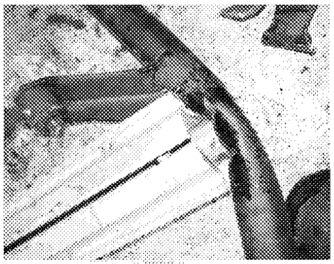
***RTM reserves the right to revisit this finding based on analysis with KMP requirements.**

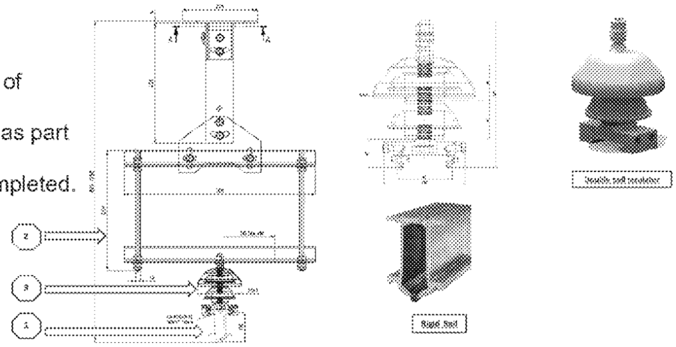
Failure Rectificatoion – Alstom Response

- Response or rectification time?
- Numerous Construction Contractor Defects discussed as part of audit discussion
  - 2020-01-16 - St Laurent rigid rail de-wirement
  - 2020-02-26 - Parafil failure near 108+078
  - 2020-03-16 - OCS broken insulator at Tremblay
  - 2020-04-28 - OCS broken insulator near Lees
  - 2020-03-21 - OCS isolator near Tremblay
  - General - Loose fasteners, turnbuckles & missing split pins

2020-01-16 - St Laurent rigid rail de-wirement

- Root cause:
  - Rigid rail dropped due to loosening of fasteners.
  - Fasteners not torqued and marked as part of original build.
  - Maintenance prior to RSAD not completed.
  - CC Defect

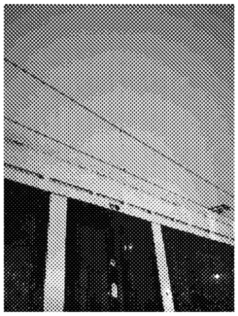


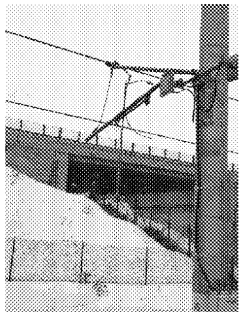


- Recommendations:
  - Review of fastening system and explore enhancements
  - Systemwide torque tightening and marking campaign
    - Performed by Construction Contractor as part of remedial plan
    - Records pending from RTM

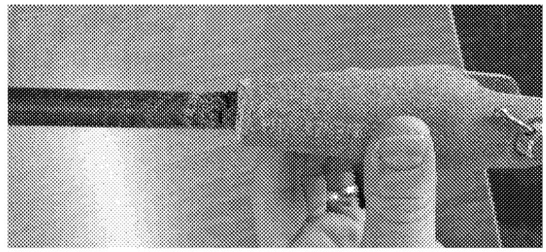
2020-02-26 - Parafil failure near 108+078

- Root cause:
  - Parafil ropes failed due deterioration of outer protective sheath.
  - Incorrect material and/or environmental contaminants.
  - Electrical tracking
  - CC Defect





- Recommendations:
  - Test damaged and failed parafils to determine root cause
  - Investigate improved parafil ropes
  - Parafil rope replacement campaign
    - Performed by Construction Contractor as part of remedial plan
    - Records pending from RTM



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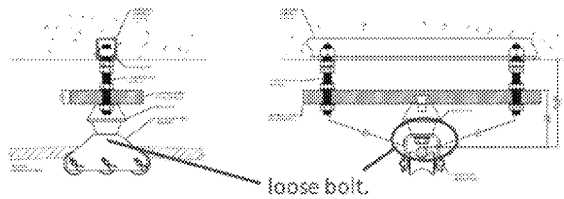
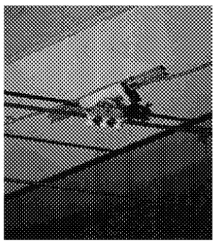
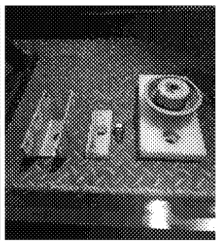
2020-03-16 - OCS broken insulator at Tremblay

- Root cause:
  - Fixing hidden by contact wire and thereby not accessible as part of maintenance
  - Fixings not secured during original assembly.
  - CC Defect







- Recommendations:
  - Review of fastening system and explore enhancements
  - Obtain build records to confirm torque tightening of pulley supports during assembly
  - If no records, conduct systemwide removal and reinstallation of all pulley supports. Ensure torque tightening and marking performed with suitable record
    - Insulators re-tightened by Construction Contractor as part of remedial plan
    - Records pending from RTM

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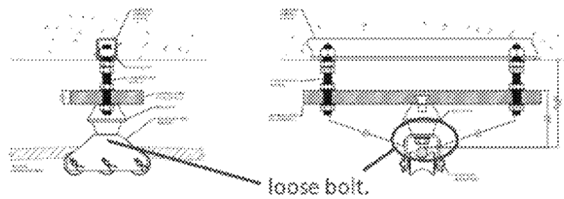
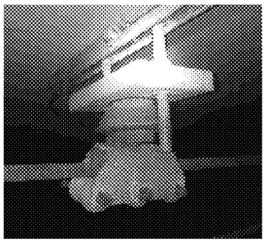
2020-04-28 - OCS broken insulator near Lees

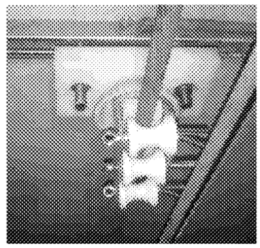
- Root cause:
  - Fixing hidden by contact wire and thereby not accessible as part of maintenance
  - Fixings not secured during original assembly.
  - CC Defect



Found loose



After repair

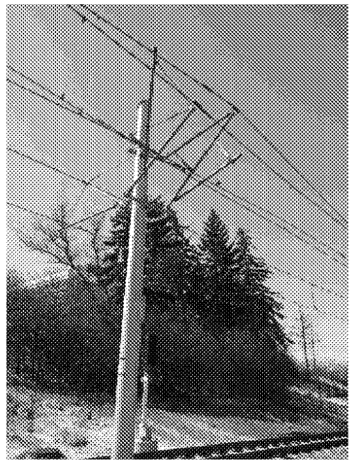


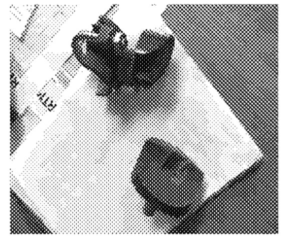
- Recommendations:
  - Review of fastening system and explore enhancements
  - Obtain build records to confirm torque tightening of pulley supports during assembly
  - If no records, conduct systemwide removal and reinstallation of all pulley supports. Ensure torque tightening and marking performed with suitable record
    - insulators re-tightened by Construction Contractor as part of remedial plan
    - Records pending from RTM

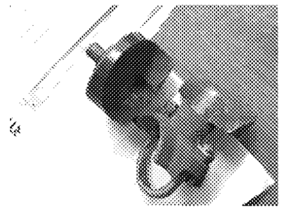
2020-03-21 - OCS isolator near Tremblay

- Root cause:
  - Isolator failed likely due to material issue.
  - CC Defect

- Recommendations:
  - Test material of failed isolators to determine root cause
  - Review suitability of assembly by design and original construction

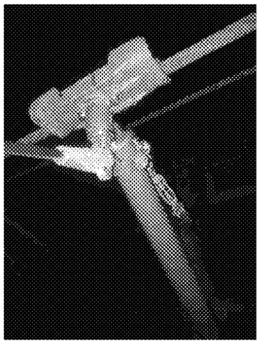
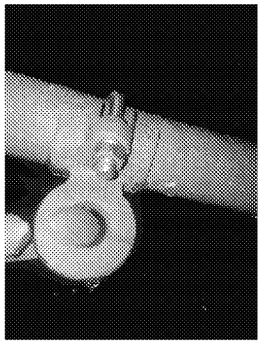
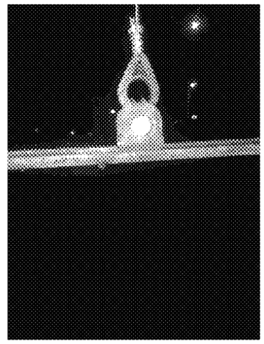
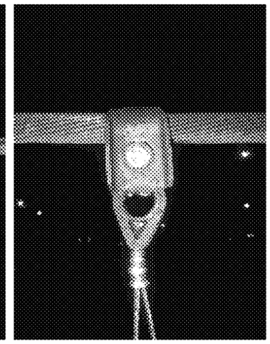




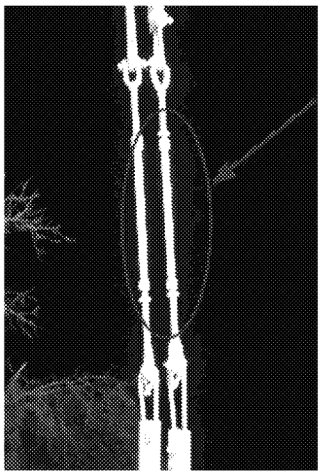


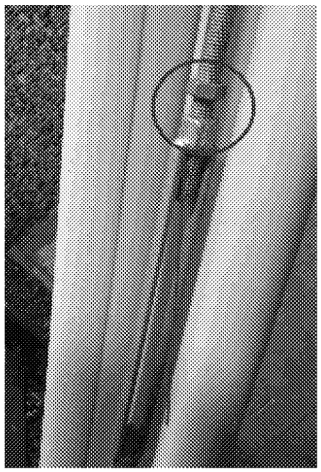
Loose fasteners from construction (nuts and bolts)

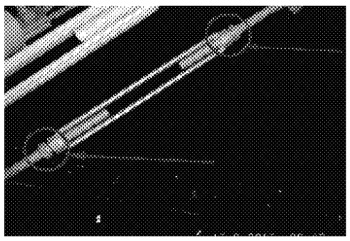
- No torque marks applied during construction
- Notified RTM of issues with torque tightness on June 20, 2019 in Systra Report
- CC Defects

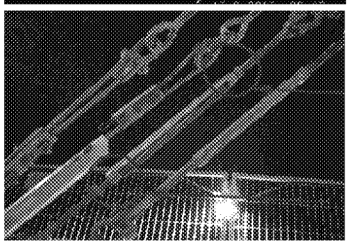





Loose Turnbuckles from construction









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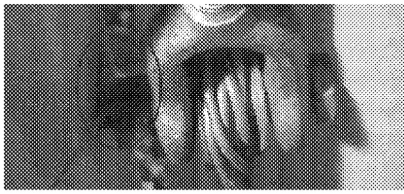
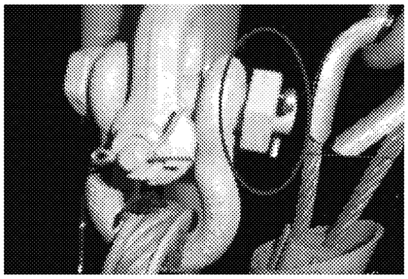
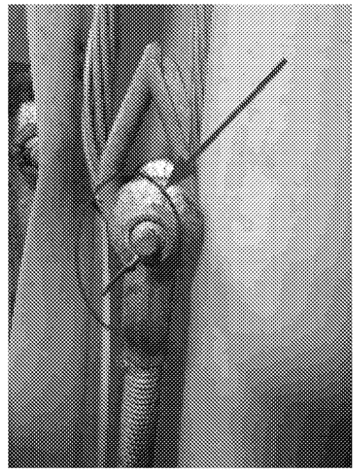
Incorrectly installed split pins from construction







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Preventive Maintenance

- Alstom's Asset Management Plan (ENG-SV-OTT-PRO-001) details maintenance activities for the OCS assets and the maintenance frequency. (C)
- WMS documents are referenced based on the frequency of the maintenance activities: *Monthly, Quarterly, Biannual and Annual and 5 years*.(C)
- A Preventive Maintenance Schedule MTN-SV-OTT-MAN-001 which contains all the maintenance activities to be performed on the OCS was provided. (C)

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Preventive Maintenance (contd.)NCR0068

- Only five (5) of the nine (9) referenced WMS in the Asset Management Plan have been drafted and implemented.
- A WMS for the 6 M OCS Height and Stagger control (OTT-OCS10-MTN10-WMS-003) Maintenance Activity has not been implemented.

[redacted]

  - Audit Note: The basis used by Alstom to determine the correct frequencies for these activities and how they relate to the vendor O&M manual are not presently understood. *Are the frequencies based on a notional requirement, or one supported by data?*

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Preventive Maintenance – Alstom Response

- All maintenance instructions needed are available.
- Outstanding instructions are for activities not yet due.
- 6M OCS Height and Stagger control (OTT-OCS10-MTN10-WMS-003) is performed via TrackTracer, CatenaryTracer.

Document Number	Document	Comment	Date Released
OTT-OCS-MTN10-WMS-007	Monthly visual OCS inspection	Released	11-Nov-18
OTT-OCS-MTN10-WMS-009	Monthly OCS inspection (Yard)	Released	04-Sep-19
OTT-OCS-MTN10-WMS-001	Quarterly OCS Specific Inspection	Released	20-Oct-18
OTT-OCS-MTN10-WMS-002	6 Month OCS Tensioning Device and Fixed Terminal Inspection	Released	11-Nov-18
OTT-OCS-MTN10-WMS-006	Yearly YODS/MODS Electrical Inspection	Released	11-Jan-18
OTT-OCS-MTN10-WMS-003	6 month OCS height and stagger control – Track Tracer	Released	17-Jan-19
OTT-OCS-MTN10-WMS-005	Annual OCS Inspection	Inspection due by Sept. 2020. WMS creation in progress and will be released prior.	22-Jun-20
OTT-OCS-MTN10-WMS-004	Annual Grounding & Bonding System	Inspection due by Sept. 2020. WMS creation in progress and will be released prior.	Draft
OTT-OCS-MTN10-WMS-008	5 Year OCS Contact Wire Diameter Control	Activity due in 2024. WMS will be released prior. First measurement will be done as part of yearly	To be written

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Preventive Maintenance – Alstom Response

- 1st CatenaryTracer measurement campaign performed March 20th 2020.
  - CatenaryTracer report provided under contract letter ALSMNT-RTM-0247, dated April 24th 2020 which included report: HUB-0.0-M700-ALS-000-00009 - Ottawa Height and Stagger Analysis
- 2nd CatenaryTracer measurement campaign performed June 13th 2020
  - Analysis of data pending.

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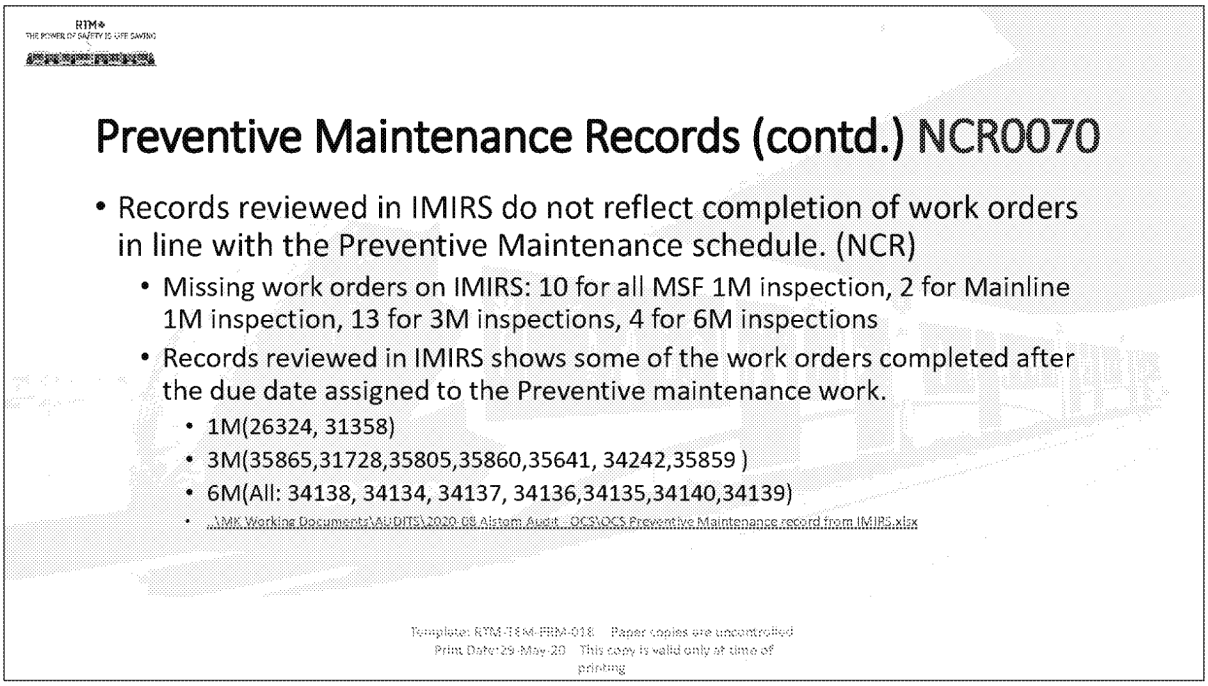
Preventive Maintenance – Alstom Response

- Height & Stagger Report Conclusion
  - **<u>Height variations appear:</u>**
    - on sections with a speed profile greater than 60KPH.
    - in unobstructed areas, where the contact wire is mounted to more than 5.50 meters.
  - These height variations are not necessary, it is advisable to maintain an average height on the same section so as not to cause fatigue of the mechanical components of the installation and thus prevent the risk of tearing off.
  - The nominal height of the contact wire of the flexible catenary should be on the whole line, excluding obstacle zones, set at 4.50 meters and 4.20 meters for the rigid catenary in tunnels.
  - **<u>The stagger of the contact wire</u>** in the entire line is irregular and does not allow a correct wear of the friction strip, thus causing an anticipated wear on certain zones of the strip facilitating the creation of grooves and thus the creation of electric arcs.
  - It is imperative to set up a correct stagger of the catenary over the entire line by prioritizing the flexible / rigid transition as well as the entire rigid catenary.
  - The abnormal wear of the friction strip present on the pantographs cannot be resolved without proper adjustment as it should have been during the installation phase of the project (refer to as-built).



Expectation: 10 1M MSF INSPECTION
10 1M MAINLINE INSPECTION
26 3M INSPECTION BOTH FOR MAINLINE AND MSF
11 6M INSPECTION MAINLINE AND MSF

REALITY: 0 1M MSF INSPECTION (6 PREV certificates were provided)
8 1M MAINLINE INSPECTION(5 Prev. certs. provided)
13 3M INSPECTION(10 Prev. provided)
7 6M INSPECTION (8 Prev. provided)

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Preventive Maintenance – Alstom Response **NCR0070**

OLRT OCS MAINTENANCE PLAN				ALSTOM MAINTENANCE PLAN	
Flexible catenary					
6M	**MVA-54-0-S017-MAN-1000 Revision A**	Check	Mechanical tension Cantilevers geometry Insulators cleaning Droppers geometry Possible strikes and wear	Covered by AT 1M and 3M inspection => <u>over maintenance</u>	OTT-OCS10-MTN10-WMS-007, 9 & OTT-OCS-MTN10-WMS-001
		Adjust	Self-tensioning devices Overlaps and crossovers leveling	Covered by AT 6M inspection	OTT-OCS-MTN10-WMS-002
1Y	**MVA-54-0-S017-MAN-1000 Revision B**	Measure	Catenary geometry: heights and staggers.	Covered by AT 6M Track tracer measurements => <u>over maintenance</u>	CatenaryTracer/ HealthHub system OTT-OCS10-MTN10-WMS-003
			Contact wire wear	Covered by AT 1Y OCS maintenance	OTT-OCS-MTN10-WMS-006
5Y	**MVA-54-0-S017-MAN-1000 Revision C**	Replace	Damaged, old and worn materials	Covered by AT 1M and 3M inspection => <u>over maintenance</u>	OTT-OCS10-MTN10-WMS-007, 9 & OTT-OCS-MTN10-WMS-001
Rigid catenary					
6M**	**MVA-54-0-S017-MAN-1000**	Check	General visual check of the installation and the pantograph. Check all catenary components	Covered by AT 1M and 3M inspection => <u>over maintenance</u>	OTT-OCS10-MTN10-WMS-007, 9 & OTT-OCS-MTN10-WMS-001
		Measure	Contact wire wear	[redacted]	OTT-OCS-MTN10-WMS-006
		Adjust	Torque of bolts Check all the supports Heights, staggers, overlaps leveling. Electrical adjustments	Covered by AT 3M inspection => <u>over maintenance</u>	OTT-OCS-MTN10-WMS-001

ALSTOM

Preventive Maintenance – Alstom Response **NCR0070**

- 1M & 3M OCS inspections
- All over maintenance activities compared to ORLT OCS maintenance requirement as per MVA-54-0-S017-MAN-1000

ML 1M Inspection

Maintenance Item	Order	Completion date
IF 1M OCS MAINLINE INSPECTION	60479583	06/14/2020
IF 1M OCS MAINLINE INSPECTION	60461398	05/21/2020
IF 1M OCS MAINLINE INSPECTION	60448219	04/24/2020
IF 1M OCS MAINLINE INSPECTION	60433871	04/02/2020
IF 1M OCS MAINLINE INSPECTION	60384110	03/09/2020
IF 1M OCS MAINLINE INSPECTION	60326532	01/20/2020
IF 1M OCS MAINLINE INSPECTION	60294276	11/20/2019
IF 1M OCS MAINLINE INSPECTION	60257250	10/18/2019
IF 1M OCS MAINLINE INSPECTION	60229592	08/23/2019

MSF 1M Inspection

Maintenance Item	Order	Completion date
IF 1M OCS BMSF INSPECTION	60479582	06/11/2020
IF 1M OCS BMSF INSPECTION	60461397	05/21/2020
IF 1M OCS BMSF INSPECTION	60448218	04/28/2020
IF 1M OCS BMSF INSPECTION	60433870	03/30/2020
IF 1M OCS BMSF INSPECTION	60389097	03/03/2020
IF 1M OCS BMSF INSPECTION	60346826	01/25/2020
IF 1M OCS BMSF INSPECTION	60332838	12/10/2019
IF 1M OCS BMSF INSPECTION	60288260	11/27/2019
IF 1M OCS BMSF INSPECTION	60257249	10/03/2019
IF 1M OCS BMSF INSPECTION	60229591	08/25/2019

3M Inspection

Maintenance Item	Order	Completion date
IF 3M OCS BCTR SPECIFIC INSPECTION	60300100	04/20/2020
IF 3M OCS L01L02 SPECIFIC INSPECTION	60337865	12/13/2019
IF 3M OCS L01L02 SPECIFIC INSPECTION	60425215	04/08/2020
IF 3M OCS L02L03 SPECIFIC INSPECTION	60337879	12/05/2019
IF 3M OCS L02L03 SPECIFIC INSPECTION	60417880	03/31/2020
IF 3M OCS L03L04 SPECIFIC INSPECTION	60337880	03/12/2020
IF 3M OCS L04L04 SPECIFIC INSPECTION	60344467	04/08/2020
IF 3M OCS L05L06 SPECIFIC INSPECTION	60337881	04/17/2020
IF 3M OCS L06L07 SPECIFIC INSPECTION	60337882	04/07/2020
IF 3M OCS L07L07 SPECIFIC INSPECTION	60344469	04/14/2020
IF 3M OCS L07L08 SPECIFIC INSPECTION	60337883	12/13/2019
IF 3M OCS L07L08 SPECIFIC INSPECTION	60425216	04/07/2020

ALSTOM

Preventive Maintenance – Alstom Response **NCR0070**

- 6M OCS inspections
- Balance weight assembly (BWA) adjustment scheduled to coincide with spring and fall seasons when temperature is at neutral point between summer and winter.

6M Inspection		
Maintenance Item	Order	Completion date
IF 6M OCS BMSF H&S MANUAL	60270196	11/27/2019
IF 6M OCS ML&BCTR TRK01 H&S W/ TT	60270197	02/27/2020
IF 6M OCS ML&BCTR TRK02 H&S W/ TT	60270198	02/27/2020
IF 6M OCS L01L02 BWA,SPR & FT INSPECTION	60283868	04/06/2020
IF 6M OCS L02L03 BWA,SPR & FT INSPECTION	60283869	04/06/2020
IF 6M OCS L03L04 BWA,SPR & FT INSPECTION	60283870	04/06/2020
IF 6M OCS L04L05 BWA,SPR & FT INSPECTION	60283871	04/06/2020
IF 6M OCS L05L06 BWA,SPR & FT INSPECTION	60283872	04/06/2020
IF 6M OCS L06L07 BWA,SPR & FT INSPECTION	60283873	04/06/2020
IF 6M OCS L07L08 BWA,SPR & FT INSPECTION	60291016	04/06/2020
IF 6M OCS BMSF BWA,SPR & FT INSPECTION	60291017	04/27/2020

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[redacted]

Maintenance Documentation – Audit Team Observations

- In 2016, Alstom commenced work to develop the maintenance documentation that would be needed to govern the maintenance of the OCS.
- Development of these documents commenced from OCS IFC level materials in 2016/17. This was subsequently stopped by Alstom for lack of as-built information.
- It is unclear why the momentum obtained could not continue, as it may have provided opportunities for the development of the full suite of maintenance documents and training materials for Power Technicians prior to revenue service.

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Maintenance Equipment – Audit Team Observations

- Since the beginning of Revenue Service, Alstom were unable to release staff from their roles in order to complete driving courses and the exam needed to drive the RTM provided OCS Hi-Rail vehicle.
- Alstom has one (1) qualified driver (as opposed to the intended 4) and the training of the others remains on hold for pandemic reasons.
- Apart from the OCS truck, there are no other road vehicles that can be used for OCS maintenance (other than those provided by a subcontractor). Alstom did not order a hi-rail bucket vehicle until the third week of May 2020, 10 months into Revenue Service.

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Maintenance Equipment – Alstom Response

- The following people within Alstom's maintenance team have a DZ drivers license & or OCS Hi-Rail Truck Operator training.
  - Note that the DZ license is only required to drive the vehicle on the road. If leaving from the MSF via the track a DZ license is not required.
- Team shifts are structured to ensure that the necessary skills are available as required.

Name	Date of Training	
	DZ license	OCS Hi-Rail Truck Operator
Ryan King	2018-11-22	
Maxim Bergeron	2018-11-28	
Elvis D'Silva	2017-10-19	2019-05-22
Doug Legere	2019-07-29	2020-06-13
Alex Trafford	2017-03-02	2020-03-12
Jordan Sauve	2018-06-29	2020-06-13
Paul Bissonnette	2020-01-09	
Marlon Stewart		2019-11-21
Larry Poitras		2019-12-11
Simon Kendall		2019-11-21
Damien Lamy		2017-12-18
Jeremy McCoy		2017-12-18

- Alstom has always had two vehicles to support OCS maintenance activities which has been more than sufficient to deliver the maintenance and equally address Construction Contractor Defects.
- The availability of an OCS vehicle and capable drivers has been continuous throughout despite the poor reliability performance of the OCS truck provided by RTM.

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Calibration & Equipment Certification

- The warehouse team manages the process for ensuring that tools and equipment used to perform maintenance tasks are calibrated and certified.
- Tools such as hoists, slings, and shackles that require certification are sent to an external provider (laboratory). (C)
- Evidence of an inspection report for tools such as slings, lifting beams from January 2020 was provided. (C)
- Calibration stickers on tools and measuring equipment have provide information on the calibration status of the equipment.
  - Audit Note: A review of the required list of calibrated equipment necessary to maintain the OCS system will be completed during the Monitoring and Measurement Audit.

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Availability of Replacement Parts

- A spare part list has been developed which contains information such as the DTR number of items, total quantity required by Engineering and the actual stock quantity.
- Alstom noted that some of these contractually mandated stock was used by OLRTC during the last shutdown maintenance.
- The actual stock quantity for all the parts on the list provided was lower than the quantity required by Engineering. (OFI)
- ..\MK Working Documents\AUDITS\2020-08 Alstom Audit - OCS\List of OCS spare parts.xlsx

Availability of Replacement Parts – Alstom Response

- Shortage of OCS parts due to the following reasons
  - Non-delivery of original capital spares from Construction Contract (via RTM).
  - Construction Contractor borrowing parts via RTM, see letter ALSMNT-RTM-0260.
- Alstom will issue RTM with zero value purchase orders to track outstanding items to be provided by RTM.

ALSTOM

Availability of Replacement Parts – Alstom Response

- Non-delivery of Capital Spares
- Outstanding parts list provided to RTM October, 2019
  - No deliveries of OCS parts since RSAD.
- Status of deliveries (all capital spares including OCS)

TOTAL RECEIVED LINES: 88%	Total Lines To Be Transferred	Total Lines Received	Total Lines Remaining
TOTAL RECEIVED QUANTITIES: 37.16%	916	805	111

- Status of deliveries (OCS/MVA)

OCS/MVA: TOTAL RECEIVED LINES: 59%	Total Lines To Be Transferred	Total Lines Received	Total Lines Remaining
TOTAL RECEIVED QUANTITIES: 48%	138	81	57

ALSTOM

Availability of Replacement Parts – Alstom Response

- Letter ALSMNT-RTM-0260

Dear Mr. Messel,

Alstom is writing concerning the recent request by RTG for OCS spares in support of Shutdown activities that occurred on May 2-3, 2020 and to take place May 9 – 13, 2020.

On May 1, 2020, RTG requested to have access to Alstom's OCS spares inventory for the System Shutdowns. In order for Alstom to support, Alstom requires that all requests of this nature come from RTM directly.

The spares in Alstom's inventory are necessary for the proper performance of the MSC Activities. In the event Alstom requires these spares, but does not have access to them or is waiting their return or delivery, Alstom shall in no way be held responsible for any resulting non-performance.

Material No.	Manuf. No.	Description	Qty Requested	Current Stock	Stock Remaining
DTR0000513345	HKL-01.1 DROPPER	Dropper clamp HKL-01.1 for contact wire	50	203	153
DTR0000513346	HKL-03.2 DROPPER	Dropper clamp HKL-03.2 for messenger wire	50	131	81
DTR0000490930	11T2	TERMINAL FOR CABLE 11	49	49	0
DTR0000490931	PA11T2	m. INSULATED PARAFIL CABLE 11	5	5	0
DTR0000490923	239235	MOVABLE HOLDER WITH INSULATOR	3	20	17
WAITING DTR CREATION	8WL5548-4F	SECTION INSULATOR 3KV	1	1	0
DTR0000491208	PUL-ASS-MW-610	MW PULLEY ASSEMBLY 610 BLOCK	2	2	0
DTR0000491209	PUL-ASS-CW-610	CW PULLEY ASSEMBLY 610 BLOCK	2	2	0

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Field Audit

- A field audit of the Power Team completing a Bi-Annual OCS Height & Stagger Manual Measurements maintenance inspection was scheduled for Thursday, May 28th, however this could not be completed as this task was not performed.
  - RTM will be scheduling a follow up audit to ensure the field observation portion is completed.
  - The audit report will them be amended to reflect the findings.

Field Audit – Alstom Response

- The second CatenaryTracer survey was conducted on 13-June-2020.
  - RTM did not take the opportunity to witness the campaign.
  - The next survey will be in 6 months according to the frequency proposed in the APPM Report, Ref: OTT-GNR-ENG10-REP-002, and ENG-SV-OTT-PRO-001.

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Closing Comments

- The audit team have identified three key areas where Alstom's performance with respect to OCS maintenance is deficient.
  - #1. Training and continued development of skills of the Power Technicians
  - #2. Development of maintenance procedures and supporting documentation
  - #3. Structure of the Preventive Maintenance program.

Alstom had a contractual obligation to be prepared to perform OCS maintenance at the Revenue Service Availability Date (August 31st, 2019). Based on the findings of this audit, RTM concludes that Alstom failed to do so.

ALSTOM

Closing Comments – Alstom Response

- Alstom disagrees with the findings of RTMs audit.
- Opportunity to review scheduling of the OCS maintenance to bring in line with the frequencies specified in the OLRTC manual MVA-54-0-S017-MAN-1000.
  - **Action:** Alstom to review periodicities to address over maintenance and opportunities for improved methods of data collection (ie/ wire wear via CatenaryTracer instead of manual measurement).
- Capital spare materials still have not been provided by Construction Contractor via RTM nearly a year after RSAD.
  - **Action**: RTM to provide outstanding materials from Construction Contractor.

Closing Comments – Alstom Response

- As-built drawings not available to support creation of detailed corrective WMS.
  - **Action**: RTM to provide outstanding documentation
- Insufficient installation and maintenance records provided prior to RSAD to establish optimal maintenance frequency based on return of experience leading up to RSAD.
  - **Action**: RTM to provide outstanding records
- Inadequate maintenance of OCS truck by RTM to support maintenance activities.
  - **Action:** RTM to provide information required to allow Alstom to take control of OCS truck
- Insufficient engineering windows based on service schedule agreed between OCT and RTM to support Anticipated Engineering windows. Permitting process (TOP/ TPIP) further reduces available maintenance time.
  - Anticipated windows versus actual times discussed at great length during the audit. Richard Catlow stated that he does not believe there is sufficient engineering time to maintain this system long terms.
  - **Action:** RTM to work with OCT to improve engineering window available via 1) schedule and 2) permitting process

THANK YOU.
COMMENTS/QUESTIONS

Engineering Hours

Engineering Hours - Contract

MSC Attachment 47 - Interfaces
Ottawa Light Rail Transit Project **Execution Copy**

Operations Maintenance Interface

Nightworks

Anticipated work windows for the main line guideway and safety critical systems are as follows:

- Sun night 23:30 (Sun) to 04:30 (5 hours)
- Mon to Thu nights 01:30 to 04:30 * (3 hours)
- Fri night 02:30 to 05:30 * (3 hours)
- Sat night02:30 to 07:30 * (5 hours)

Engineering Hours - Reality

- Data taken from Track Occupation Permits (TOP) from period between 1st October, 2019 to 31st March, 2020. Outliers removed (ie/ new years, xmas, snow events, etc…)
- Note to perform OCS work a Traction Power Isolation Permit (TPIP) is required consuming further engineering hours available.
- Cancellations excluded from dataset but further contribute to a loss of access to the system for maintenance. For example, stage 2 vehicle testing, Thales testing, snow management, etc…

	MSC Contract	Service Schedule			Actual	
Nights	Anticipated Hours	From	To	Time planned	Engineering Hours (Average)	% of Engineering Hours
Tuesday to Friday	3	01:44	03:55	02:11	01:47:51	60%
Saturday	3	01:45	04:45	03:00	01:43:44	58%
Sunday	5	02:39	06:30	03:51	03:12:26	64%
Sunday to Monday	5	23:34	03:55	04:21	02:32:47	51%

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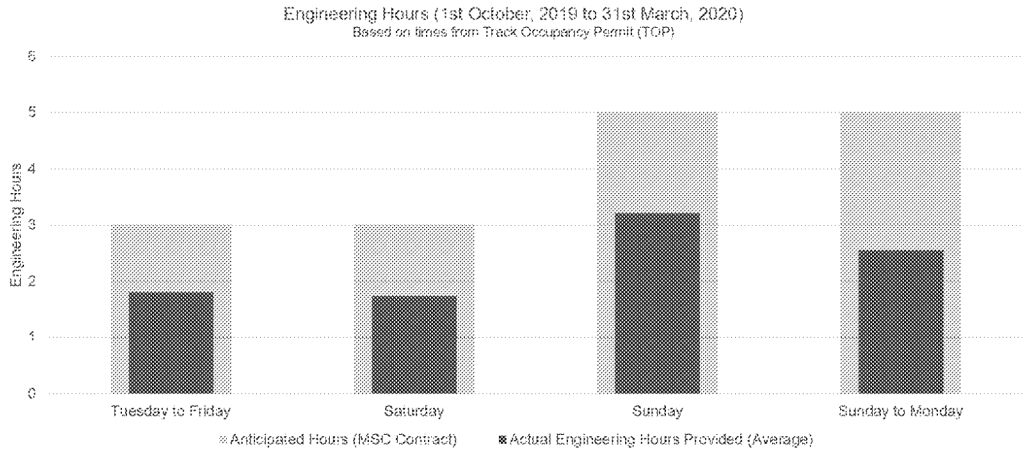
Engineering Hours - Reality



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