Wheel/Rail Interface Optimization: Toronto Transit Commission Program Design & Initial Findings

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Overview

- Project Background
- Project Objectives
- Project Approach
- Project Work Completed
- Project Interim Results

Project Background

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Project Background

- TTC Recognized several opportunities for improvements on its subway and LIM systems
  - Wheel life being dominated by the slid flats
  - Non-optimal lubrication
  - Rail surface damage on Subway and SRT (Lim System)
    - RCF, Corrugation, Rail Wear
  - Wheel/Rail Noise

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Project Background

- Treat the issues as being related instead of treating each separately
- ***Attack project as a team with complete participation and active involvement of all departments***

Project Objectives

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- Project Objectives

  - ✓ Reduce System Noise
  - ✓ Improve Wheel Life
  - ✓ Minimize and Control Rail Surface Damage
  - ✓ Improve System Lubrication Network

Project Approach

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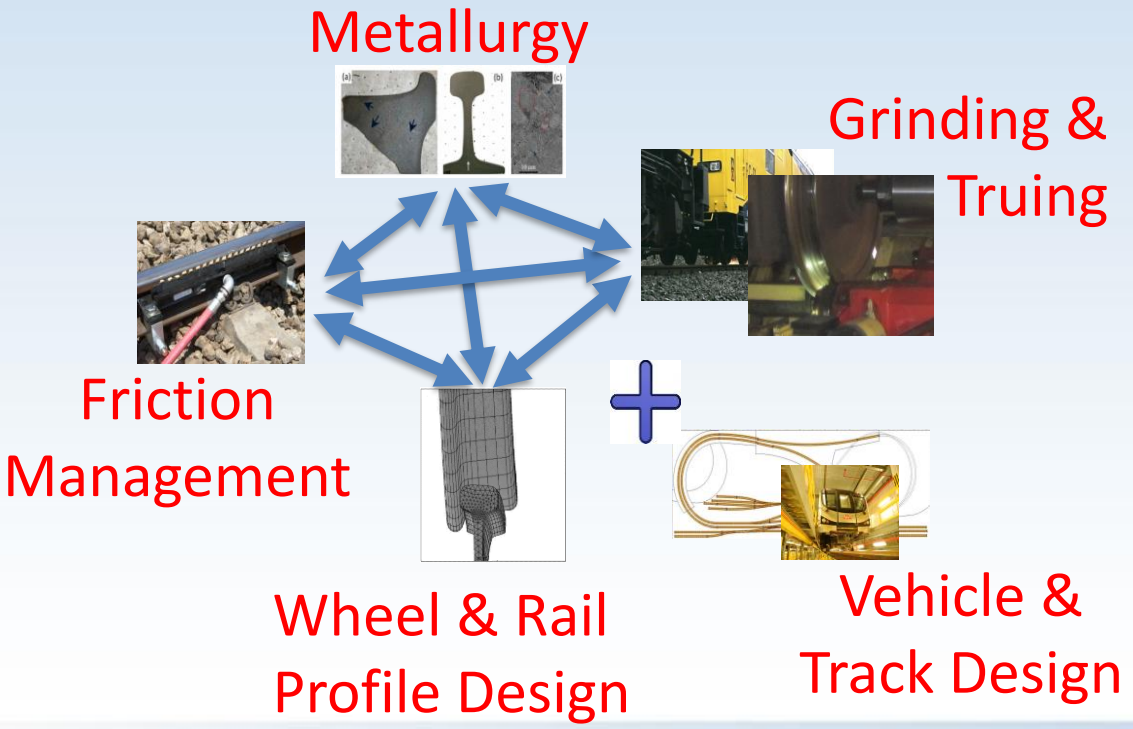
Project Objectives:

- ARM developed a project based around a systems approach with the Wheel/Rail Interface at its core



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- Project Approach:
  - Inspection of Existing Conditions
  - Education of Staff
  - Measure acoustics across system
  - Assess compatibilities of Wheel & Rail Profiles
  - Evaluate current state of Friction Management
  - Develop a Maintenance & Monitoring Plan

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System Assessment/Maintenance & Monitoring

Wheel/Rail Profile Compatibility

System Noise

Friction Mgt

ARM

Project

Team

ATSConsulting
acoustics, transportation + strategy

Don Eadie

Work Completed

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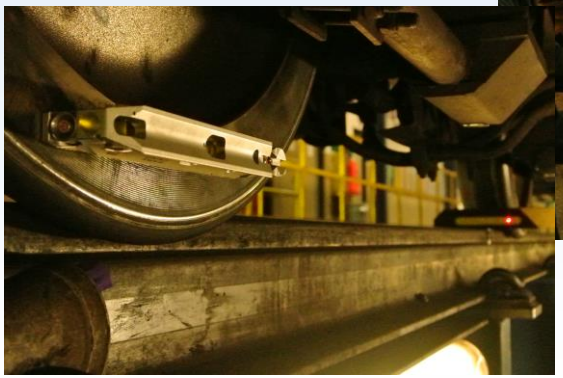
- **Vehicle Inspection**

Wheel Condition

Wheel Truing



Axle Alignment

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- **Track Inspection**

RCF

Restraining Rail Wear

Corrugations

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- **Lubrication Review**

Grease Application

Reservoir Condition

Flange Lubricator Efficacy

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- **Education**
  - **WRI Principles Course**
  - **4 One Day Classes**
  - ***Nearly 100 Attendees***

Insert Photo(s) From Short Course

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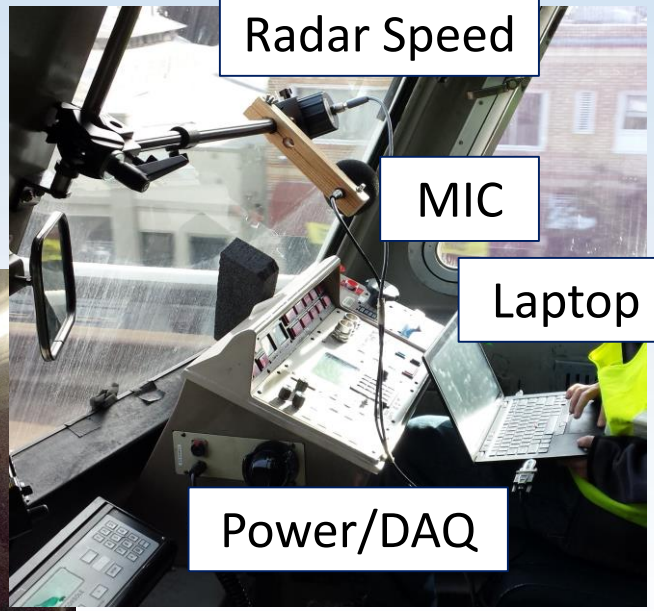
Acoustic Measurement Setup



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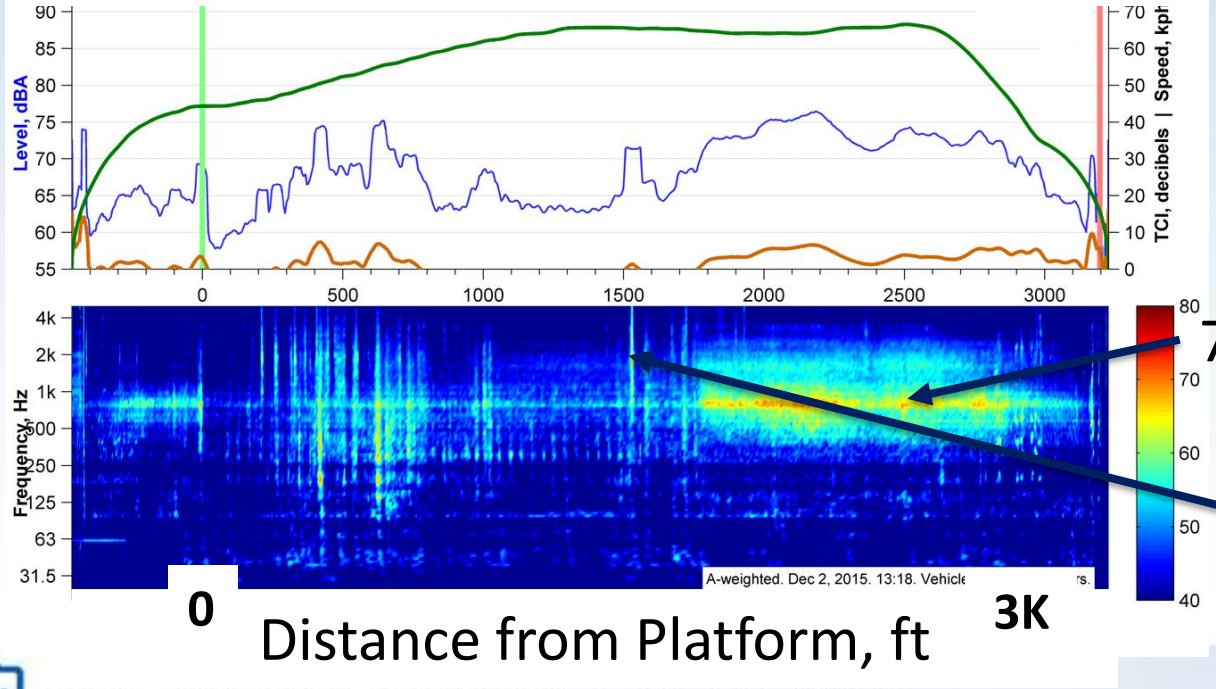
Example Acoustic Measurements



Awt, dBA

TCI, decibels

Speed, kph

770 Hz → 23 mm=0.9” Corrugations

Track joints (every 39’)

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Based On Most Recent Sound Level Measurements on dates 10/01/2015, 10/02/2015

Export Grinding Priorities List

Action	TCI Rating	serial Number	Priority	Date	Max Tci	Integral	DepartStat	Arrive Stat	B mp	E mp	Track	Length	Avg Speed	Avg Awt	Structures	Status
Grinding Report		016	1	10/01/2015	22.6	1.4	SFIA	SBRN	0.426	0.569	Y1	756	40	87.5	Aerial	Not Ground
Grinding Report		016	2	10/02/2015	18.8	2.8	BAYF	CAST	11.656	11.918	A1	1380	46	87.2	Aerial,Subway,Surface	Not Ground
Grinding Report		016	3	10/02/2015	18.0	2.8	16TH	24TH	9.816	10.127	M1	1644	47	89.5	Subway	Partial
Grinding Report		016	4	10/02/2015	18.4	2.3	WOAK	EMBR	1.694	2.762	M1	5636	68	81.5	Surface,Subway	Partial
Grinding Report		016	5	10/01/2015	18.1	0.5	SFIA	SBRN	0.356	0.418	Y1	329	33	83.9	Aerial	Not Ground
Grinding Report		016	6	10/01/2015	17.4	12.6	SFIA	SBRN	1.067	21.117	Y1	6638	46	82.5	Surface	Not Ground
Grinding Report		016	7	10/02/2015	17.4	2.4	19TH	MCAR	0.758	1.066	C1	1623	33	86.1	Subway	Not Ground
Grinding Report		016	8	10/01/2015	16.7	2.4	DALY	BALB	14.268	13.945	M2	1702	49	81.7	Aerial	Partial
Grinding Report		016	9	10/02/2015	16.6	0.5	FRMT	UCTY	23.665	23.596	A2	364	13	71.4	Surface	Not Ground
Grinding Report		016	10	10/01/2015	15.0	1.0	SFIA	SBRN	0.937	1.064	Y1	666	48	81.2	Surface	Not Ground
Grinding Report		016	11	10/02/2015	15.4	0.8	BALB	DALY	14.067	14.214	M1	773	46	80.3	Aerial	Not Ground
Grinding Report		016	12	10/02/2015	15.4	0.2	WOAK	EMBR	1.512	1.527	M1	78	25	80.3	Surface	Not Ground
Grinding Report		016	13	10/01/2015	14.1	6.3	24TH	16TH	10.570	9.831	M2	3902	43	86.7	Subway	Partial
Grinding Report		016	14	10/02/2015	14.0	4.3	ASHB	DBRK	4.240	4.955	R1	3777	45	85.9	Subway	Partial
Grinding Report		016	15	10/01/2015	14.7	3.5	16TH	CIVC	9.686	9.336	M2	1850	47	89.4	Subway	Partial
Grinding Report		016	16	10/02/2015	14.6	3.4	CIVC	16TH	8.986	9.302	M1	1668	47	90.0	Subway	Done
Grinding Report		016	17	10/02/2015	14.8	2.8	24TH	GLEN	10.697	11.060	M1	1917	48	87.2	Subway	Partial
Grinding Report		016	18	10/02/2015	14.6	0.8	CONC	PHIL	20.529	20.437	C2	489	25	74.7	Surface	Not Ground
Grinding Report		016	19	10/02/2015	14.0	0.4	BALB	DALY	13.752	13.792	M1	211	48	81.7	Subway,Surface	Done
Grinding Report		016	20	10/01/2015	14.9	0.1	SBRN	MLBR	24.144	24.160	W1	82	14	67.7	Surface	Not Ground
Grinding Report		016	21	10/01/2015	13.3	5.9	MLBR	SBRN	24.147	23.290	W3	4528	42	76.6	Surface	Not Ground
Grinding Report		016	22	10/02/2015	13.4	1.9	CAST	BAYF	11.942	11.772	L2	900	48	89.2	Surface,Subway	Not Ground
Grinding Report		016	23	10/01/2015	13.0	0.8	SSAN	COLM	17.235	17.090	W2	764	40	81.9	Subway,Surface	Not Ground
Grinding Report		016	24	10/01/2015	13.3	0.6	DALY	COLM	16.228	16.309	M3	426	24	72.7	Surface	Not Ground
Grinding Report		016	25	10/02/2015	13.0	0.5	PITT	NCON	23.600	23.527	C1	387	30	74.6	Surface	Not Ground
Grinding Report		016	26	10/01/2015	13.4	0.1	DALY	COLM	15.930	15.948	M3	94	34	77.7	Surface	Not Ground
Grinding Report		016	27	10/01/2015	12.5	4.8	SBRN	MLBR	23.191	24.105	W1	4824	41	74.8	Surface	Not Ground
Grinding Report		016	28	10/02/2015	12.0	1.8	DBRK	NBRK	5.293	5.511	R1	1147	32	83.7	Subway	Not Ground
Grinding Report		016	29	10/02/2015	12.4	1.5	EMBR	MONT	7.422	7.627	M1	1080	30	82.3	Subway	Partial
Grinding Report		016	30	10/01/2015	12.2	1.3	SBRN	SFIA	22.269	1.007	W1	874	47	79.0	Subway,Surface	Not Ground
Grinding Report		016	31	10/01/2015	12.8	0.9	BALB	GLEN	12.812	12.664	M2	783	48	86.1	Surface,Subway	Done
Grinding Report		016	32	10/02/2015	12.9	0.8	BAYF	CAST	11.253	11.423	A1	893	46	76.2	Surface	Not Ground
Grinding Report		016	33	10/01/2015	12.3	0.4	DALY	COLM	16.542	16.604	M3	327	35	75.6	Surface	Not Ground
Grinding Report		016	34	10/01/2015	12.5	0.0	DALY	COLM	16.320	16.328	M3	41	25	75.0	Surface	Not Ground
Grinding Report		016	35	10/01/2015	11.6	2.9	SBRN	SSAN	20.306	19.758	W2	2893	67	87.9	Subway	Not Ground
Grinding Report		016	36	10/01/2015	11.7	1.9	DALY	COLM	15.649	15.900	M3	1324	33	75.6	Aerial,Surface	Not Ground
Grinding Report		016	37	10/02/2015	11.9	1.7	NBRK	DBRK	5.533	5.301	R2	1223	34	83.1	Subway	Done

Reporting Based on Acoustic Measurements Including Grinding Priority Report

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- **Wheel/Rail Profile Analysis**

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- **Wheel/Rail Profile Analysis**

Project Interim Results

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- **Wayside Lubrication Opportunities for Improvement**
  - Large reservoir tanks where the grease may sit more than a year
  - Lubricator placement in curves
  - Older equipment that lacks accuracy to control grease application compared to current technology

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- **Recommended Gage Face Lubricator Actions**
  - Standardization of equipment
  - Proper placement of lubricator in curves

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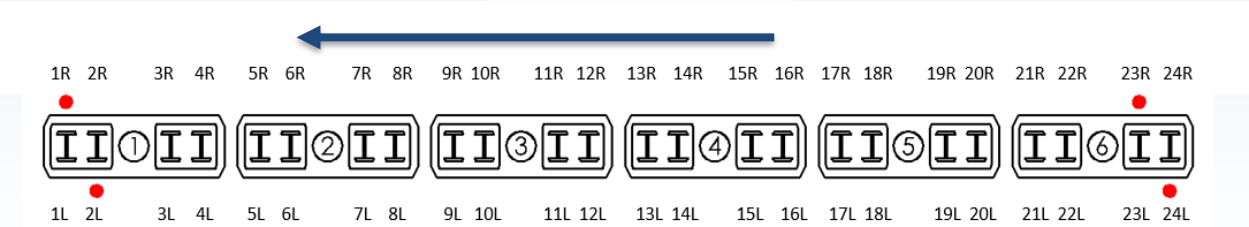
- **Vehicle Mounted Lubricator Opportunities for Improvement**
  - Current mounting locations provide insufficient wheel flange coverage



- Solid Stick Applicator

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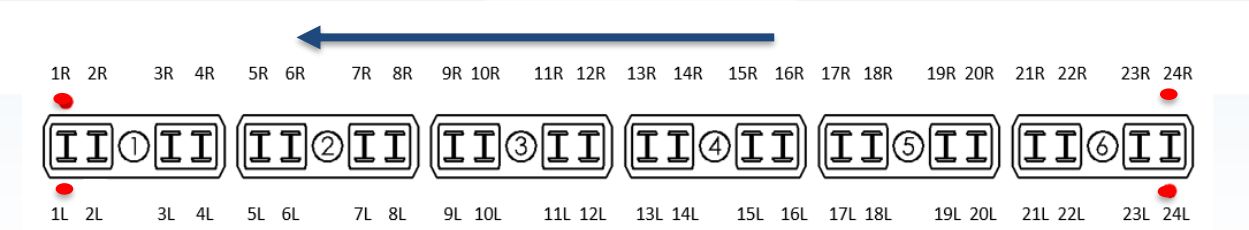
- **Recommended Train Mounted Friction Management**
  - Solid Sticks Placed Optimally Throughout Trainset



- Solid Stick Applicator

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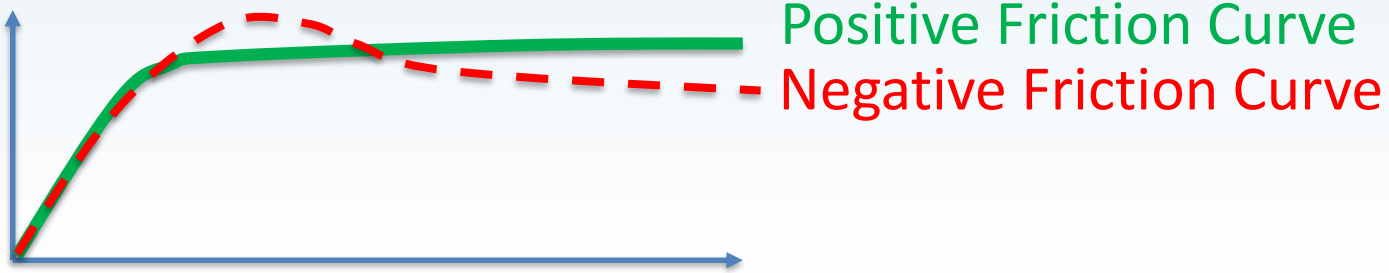
- **Top of Rail Friction Control**
  - Reduce rate of RCF occurrence and growth
  - Reduce rate of corrugation occurrence and growth



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  - **Don Eadie**