NYCT Maintenance Innovation Using Research

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Ottawa, Canada

Key Presentation Take-Aways

- A collaborative research program was developed to demonstrate opportunities and benefits of integrated data analytics.
- Several technologies for continuously monitoring wheel/rail performance have been installed at NYCT on Flushing Line 7.
- These have been effective in identifying problem areas, practices and validating remedial efforts

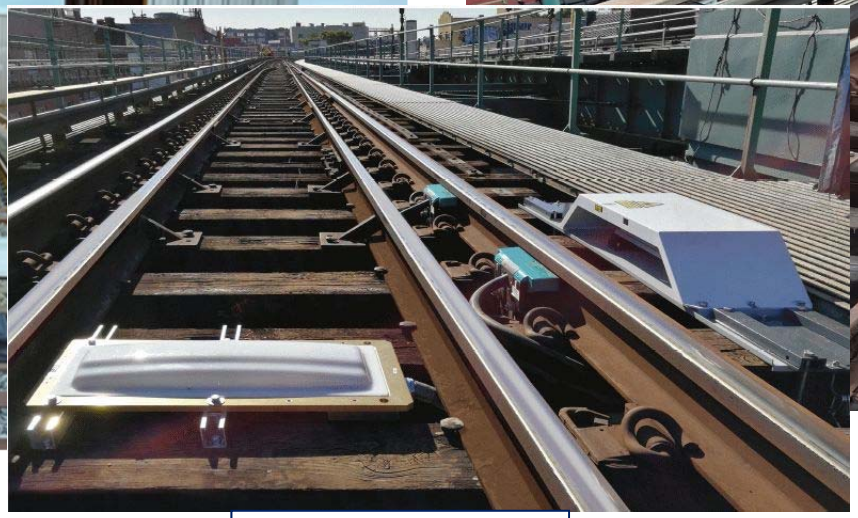
Collaborative Research Team

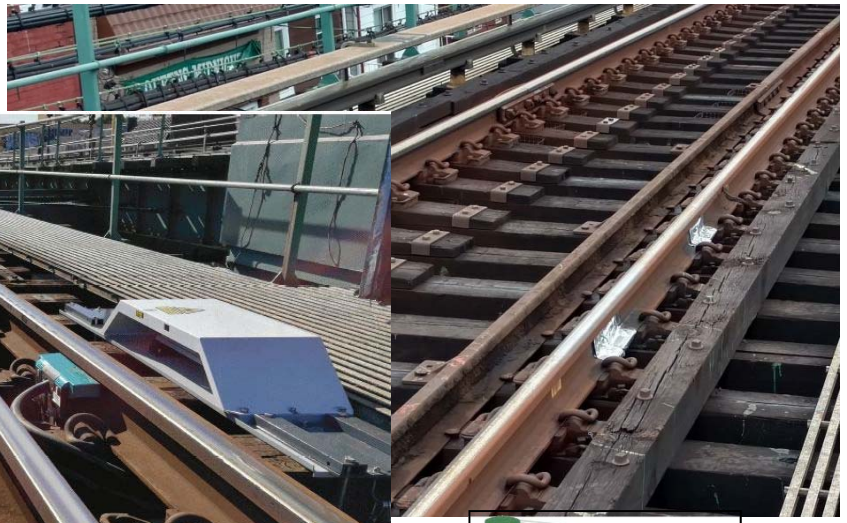
Data Collection Consist (DCC)

- 2 instrumented wheelsets
- Give accurate measurements of wheel/rail contact forces (vertical, longitudinal, lateral)

- Accelerometers, acoustic recording equipment and propulsion energy recording equipment
- Part of an 11 car consist in revenue service

Wayside Technologies





KLD LABS
MEASUREMENT TECHNOLOGIES

WID WAYSIDE INSPECTION DEVICES

INSTRUMENTATION SERVICES, INC.

NYCT – Track Geometry Car and Host Site #7 Line

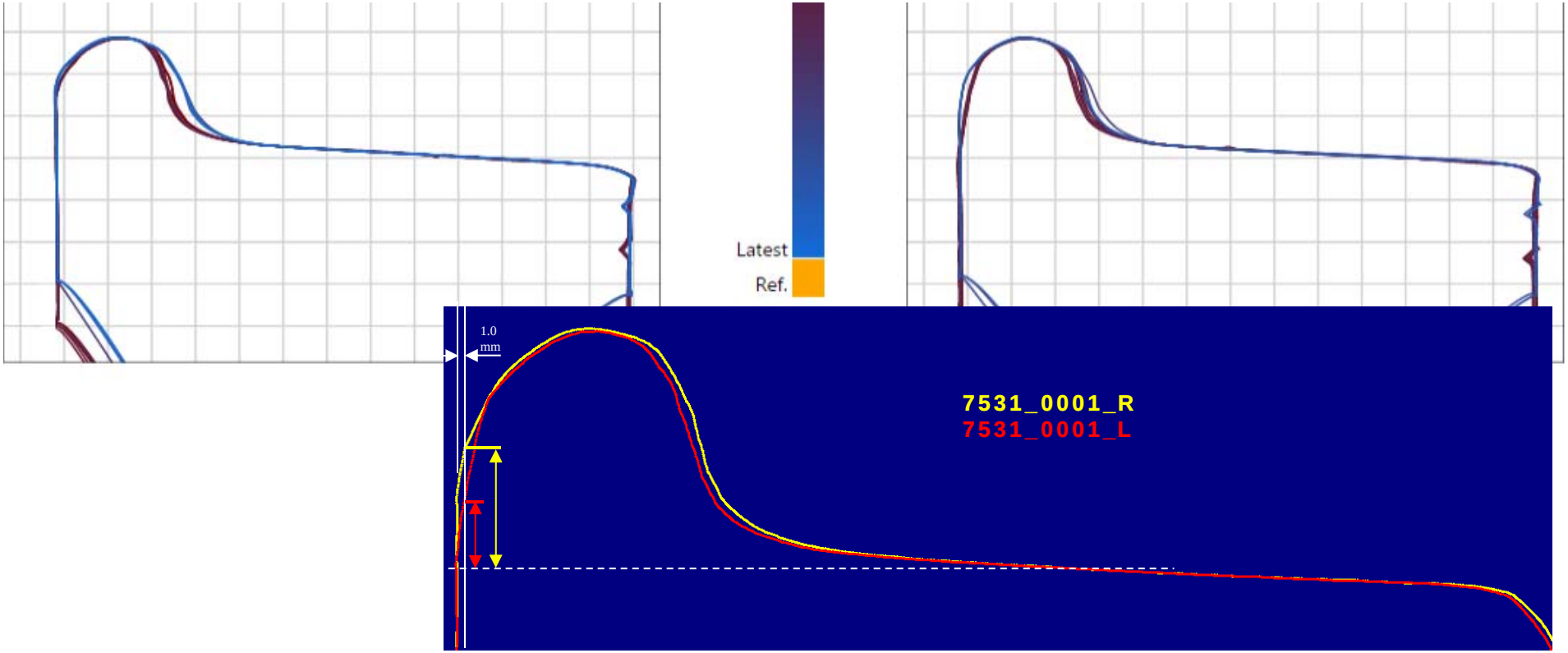
Flushing Line At A Glance

- 27.5 Miles of Track
- 22 Stations
  - 34th Street-Hudson Yards opened in September, 2015
- Average Daily Ridership:
  - Weekday = 525,000
  - Saturday = 350,000
  - Sunday = 300,000
- 7 line (tied with the 6 line) has the most frequency of service in the entire system.
- 27 Trains per hour in each direction during Weekday Peak

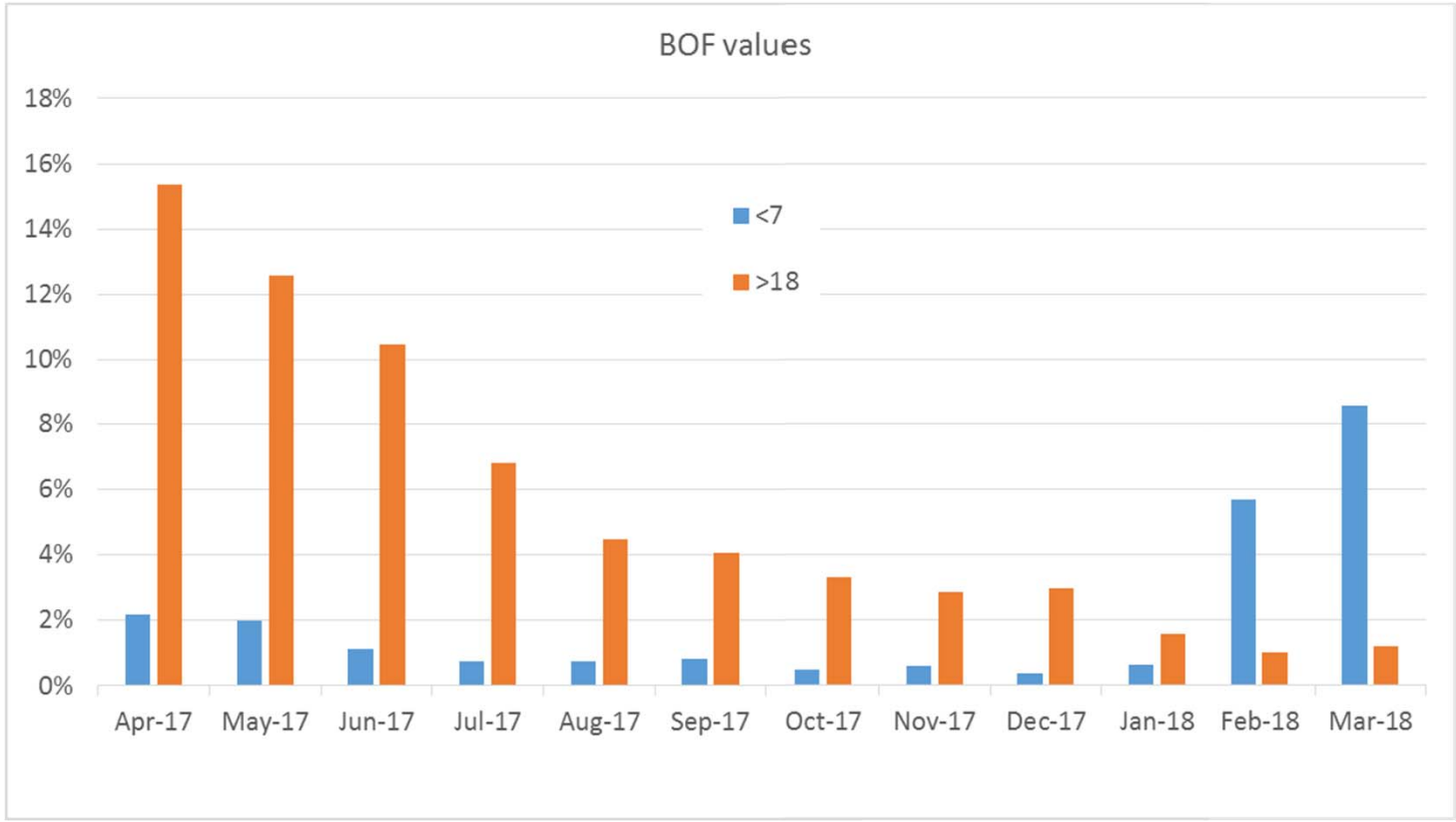
Track Geometry Car

WHEEL WEAR ANALYTICS

Back of Flange Wear



Back of Flange Values

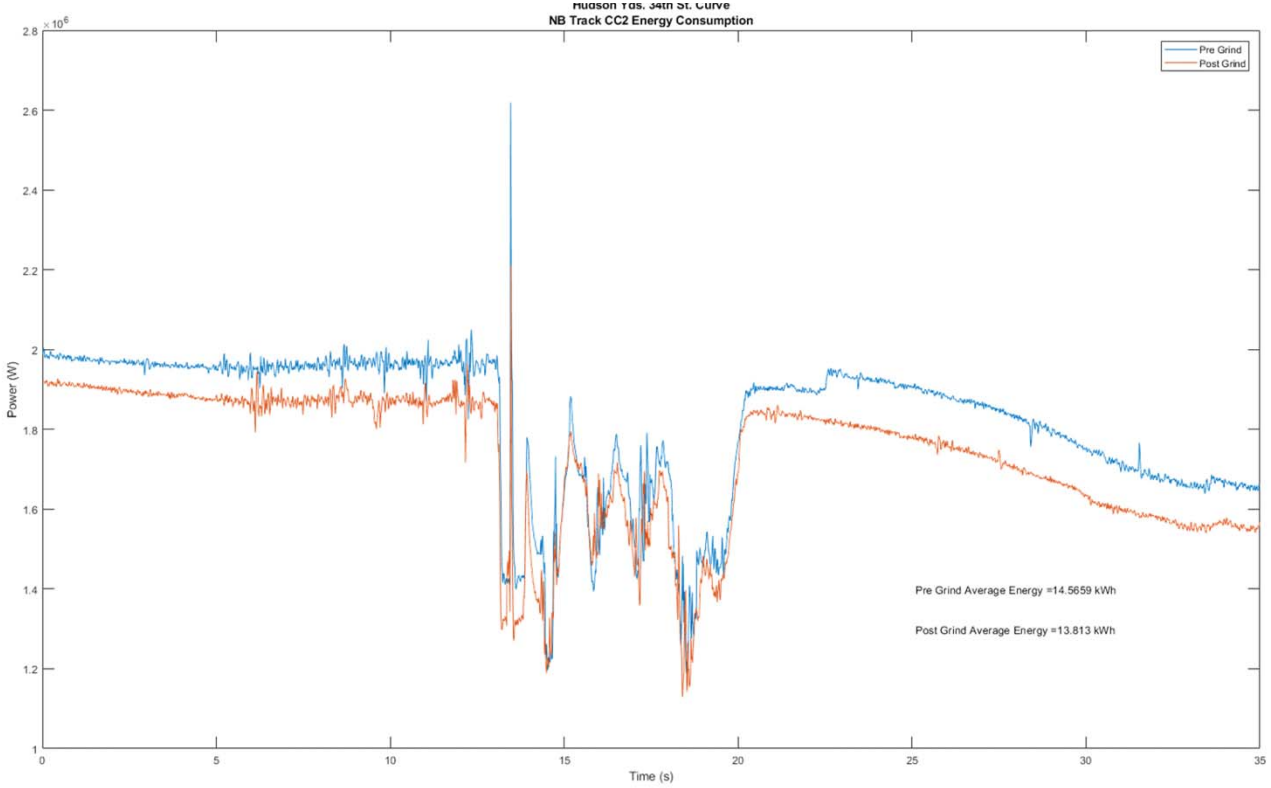


THE IMPACT OF RAIL CORRUGATION ON ENERGY CONSUMPTION

Keith Cummings – Dayton T. Brown

NB Track CC2 Energy Consumption

Hudson Yds. 34th St. Curve



Approx 5%

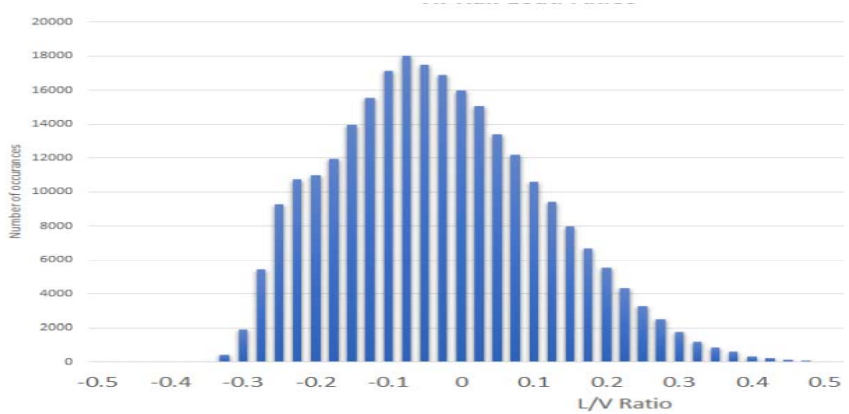
OUTCOMES FROM THE TBOGI AND L/V WAYSIDE SYSTEMS

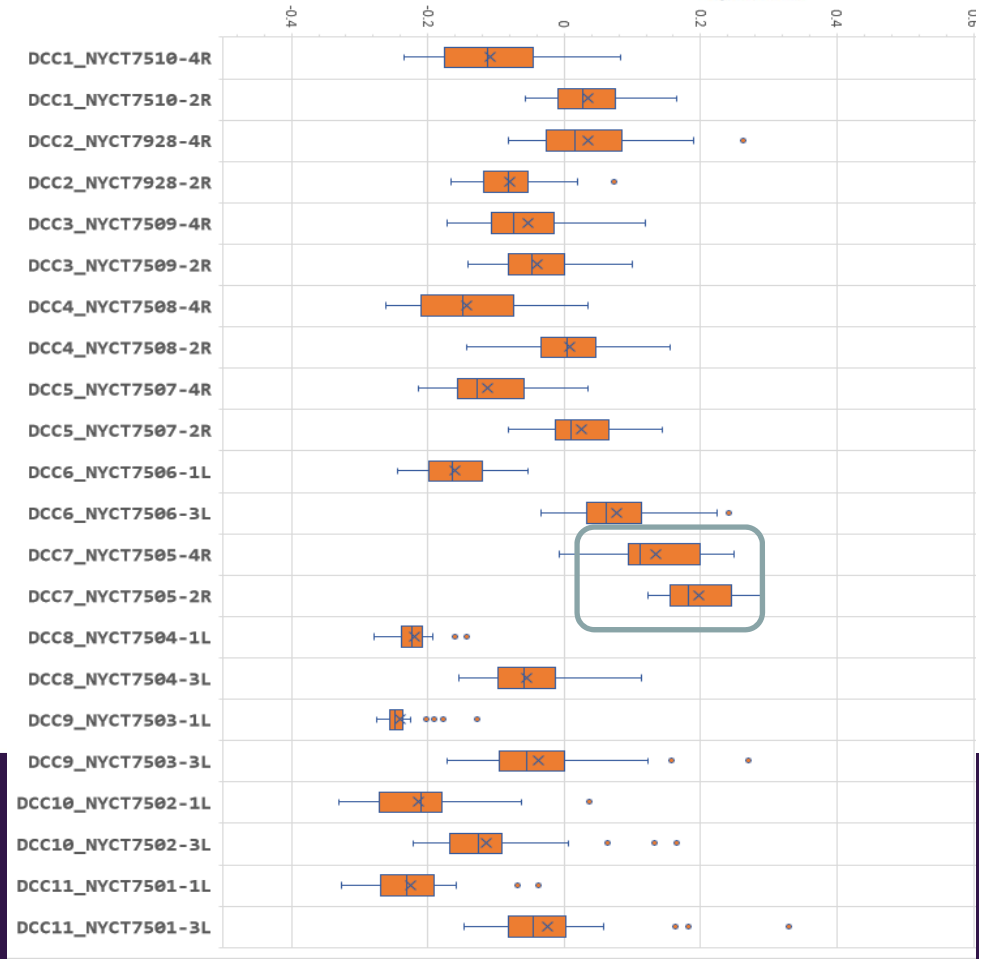
Eric Magel and Merrina Zhang – NRC Canada
Denis D'Aoust – Wayside Inspection Devices
John Mazza - Instrumentation Services Inc.

L/V Values for DCC cars

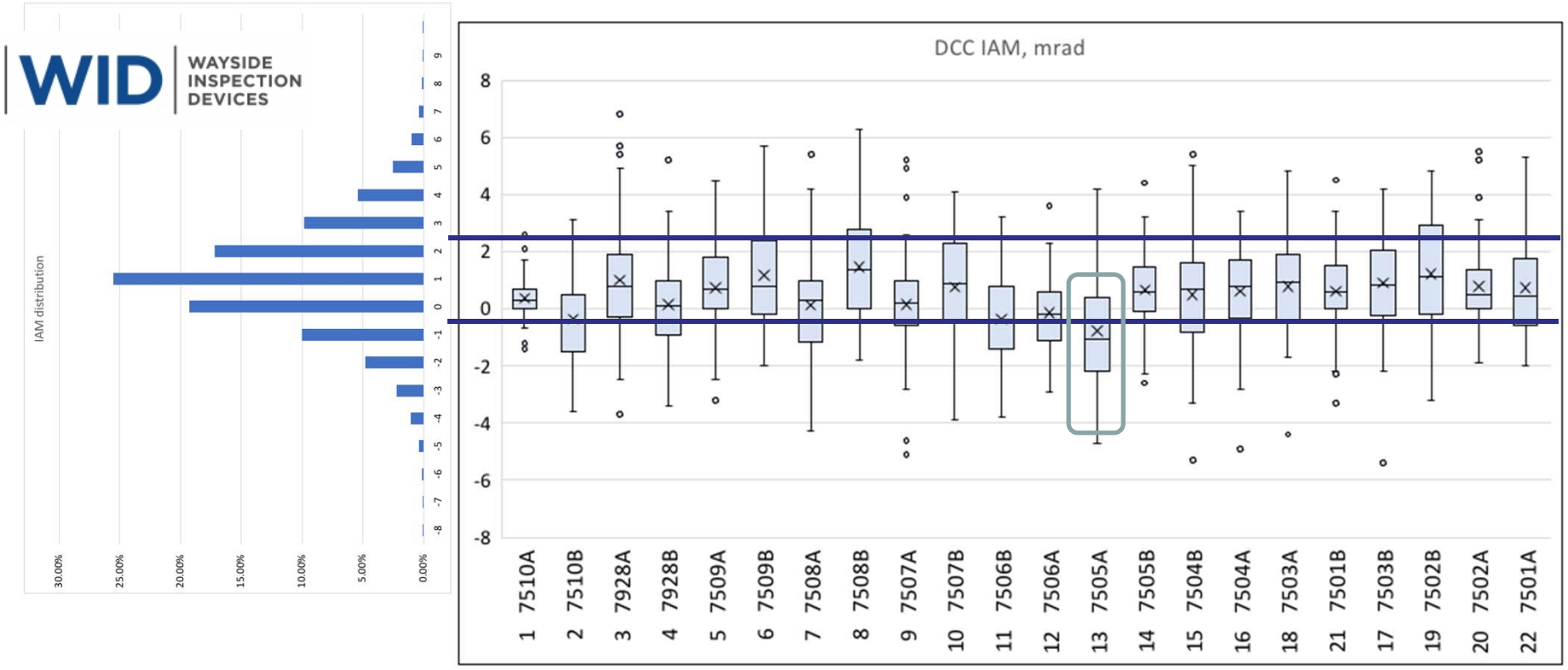
INSTRUMENTATION SERVICES, INC.

- Shows L/V values for DCC compared with distribution for entire fleet.
- Identifies car 7505 as an outlier.





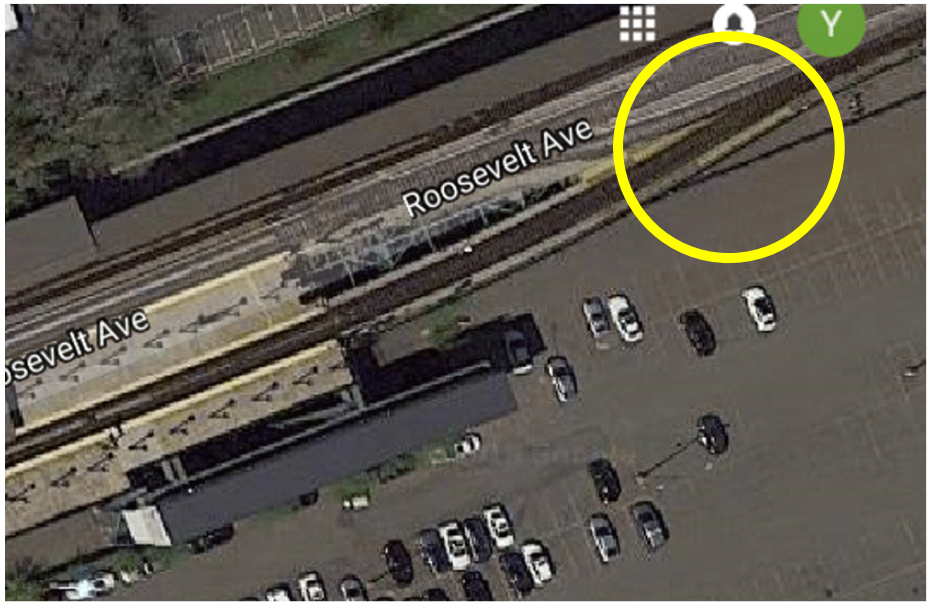
DCC Interaxle Misalignment



W/R FORCES MEASURED BY IWS

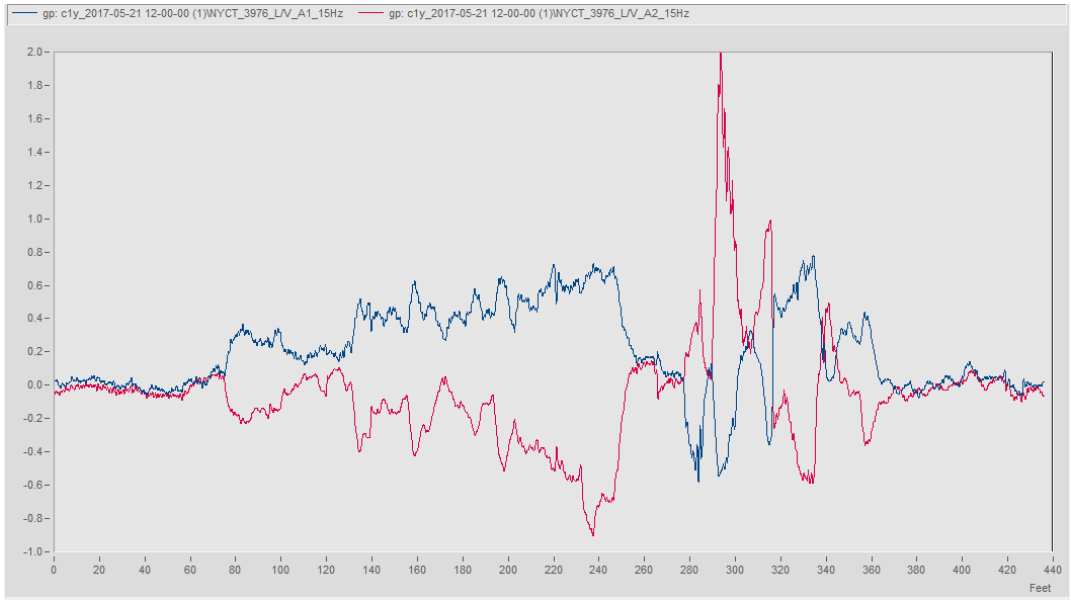
Yan Liu – NRC Canada

High Force due to Tight Flangeway Clearance at Turnouts

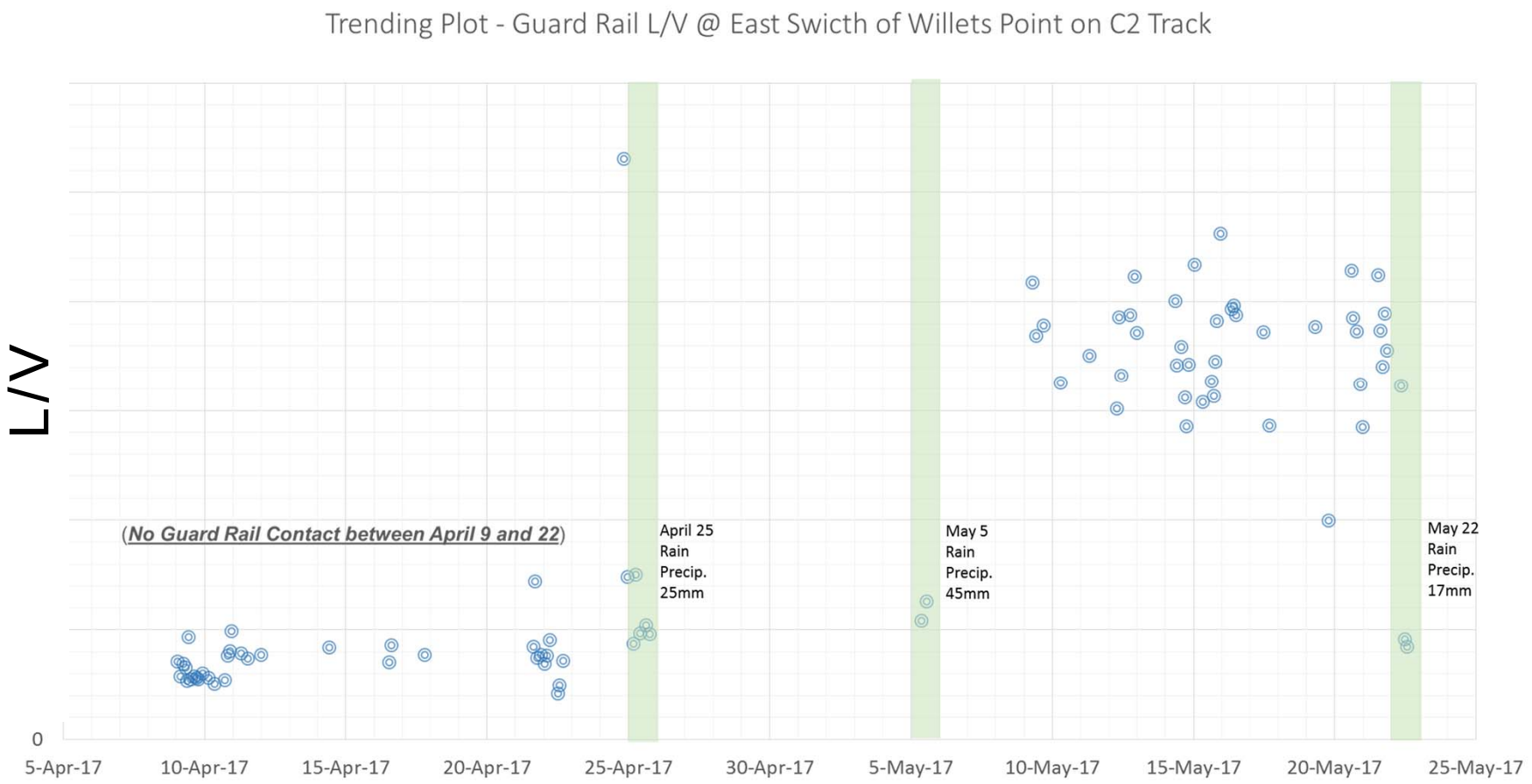


Turnout N/O Willets Point where high IWS forces were identified

09 April 2017

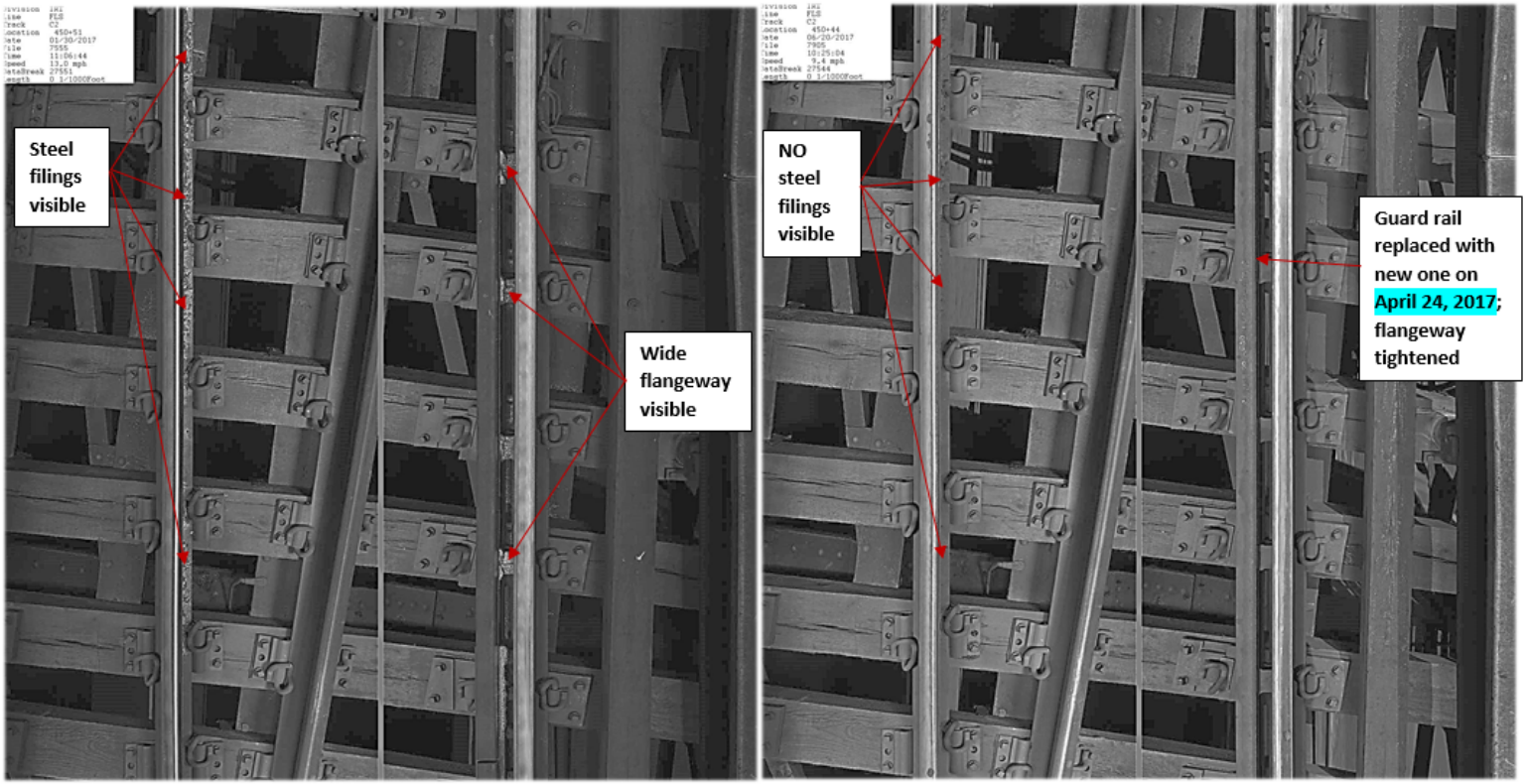


21 May 2017


Trending Plot - Guard Rail L/V @ East Swicth of Willets Point on C2 Track
L/V
0
(No Guard Rail Contact between April 9 and 22)
April 25
Rain
Precip.
25mm
May 5
Rain
Precip.
45mm
May 22
Rain
Precip.
17mm
5-Apr-17
10-Apr-17
15-Apr-17
20-Apr-17
25-Apr-17
30-Apr-17
5-May-17
10-May-17
15-May-17
20-May-17
25-May-17

Information provided by NYCT

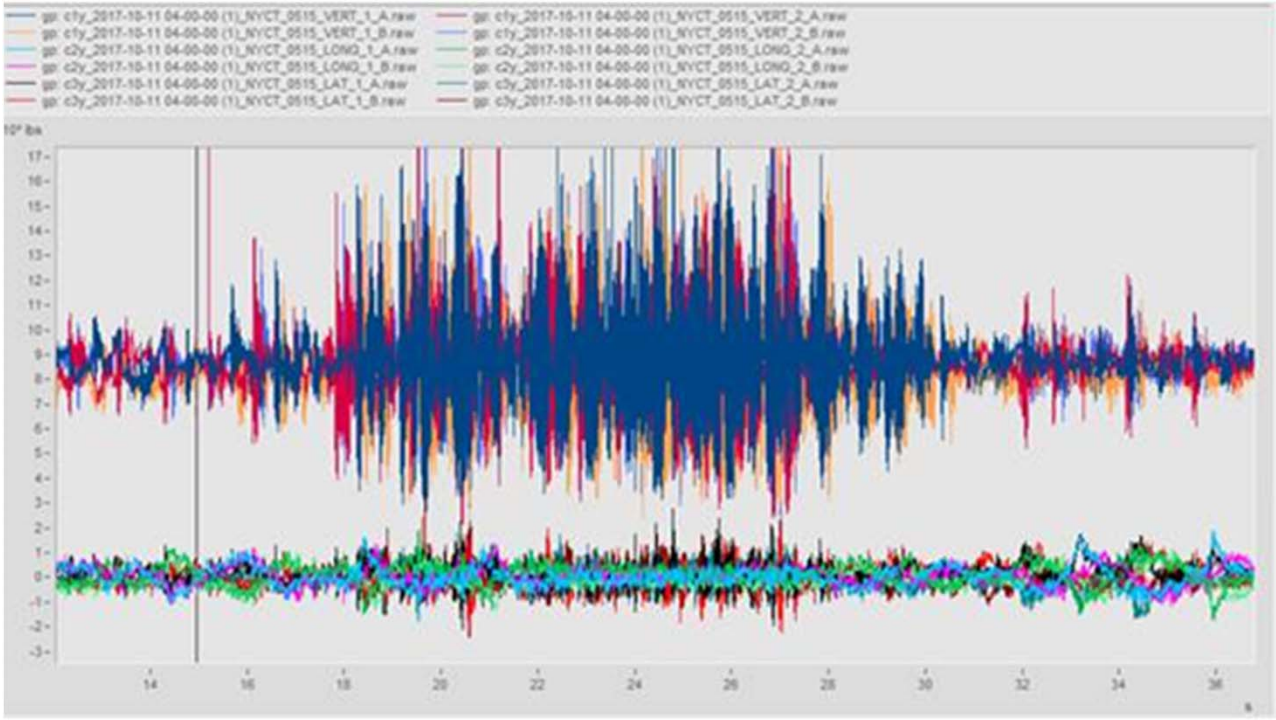
Track C2 N/O Willets Point, Switch 755B - January 30 vs. June 20, 2017

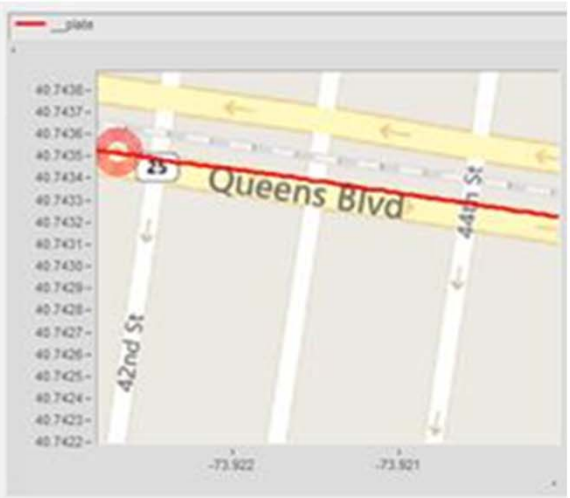


N/O Willets Point, Sw. 755B, track C2
January 30, 2017

N/O Willets Point, Sw. 755B, track C2
June 20, 2017

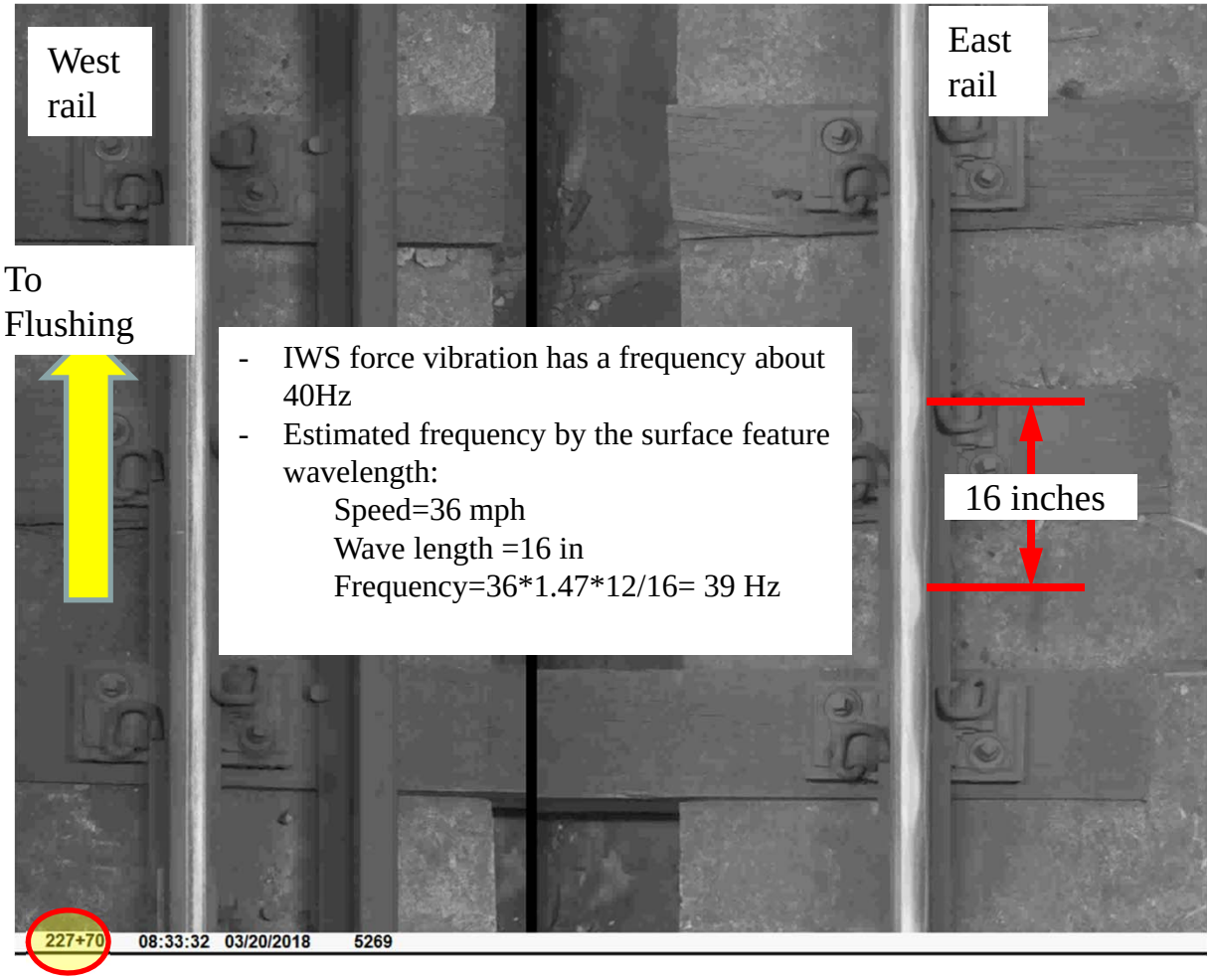
2g Vertical Force Oscillation





November 2017

- Track gauge: 0.3” to 0.4” tight.
- All the running rails are 39’ long, bolted
- 20+ running rails replaced btw Dec. 2017 and Feb.2018
- New rails are interspersed with old ones

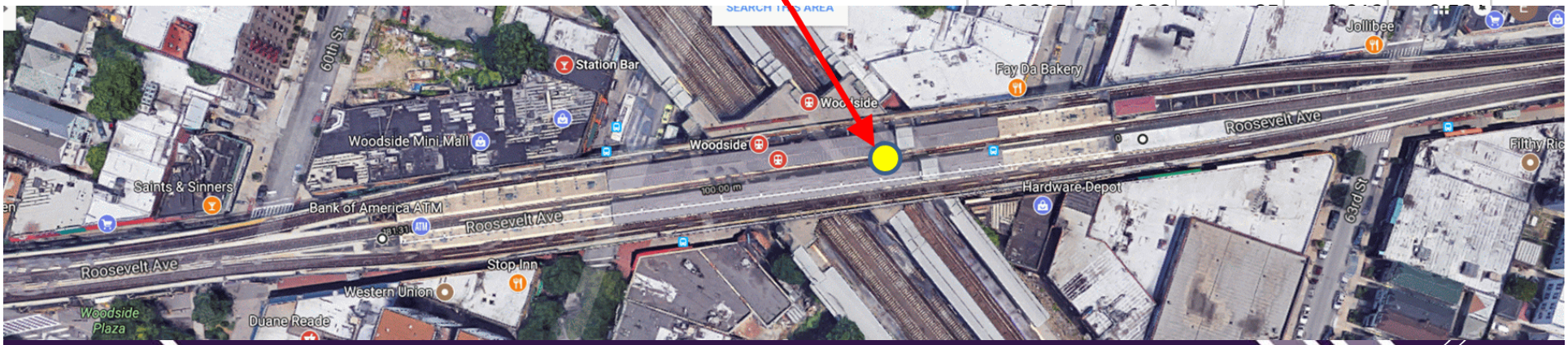


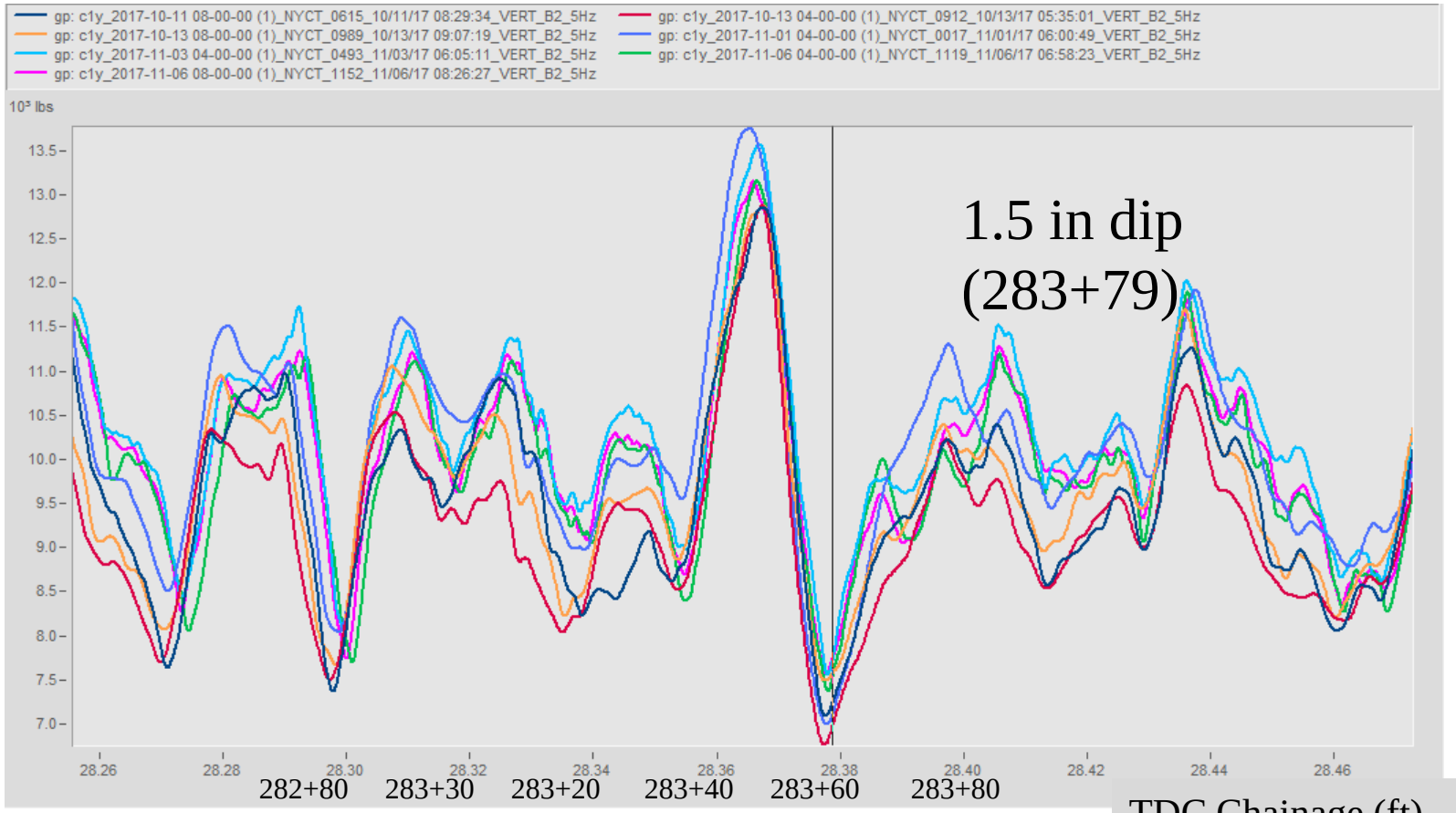
IWS Force vs Track Geometry

TGC runs on <u>October 23, 2017</u>

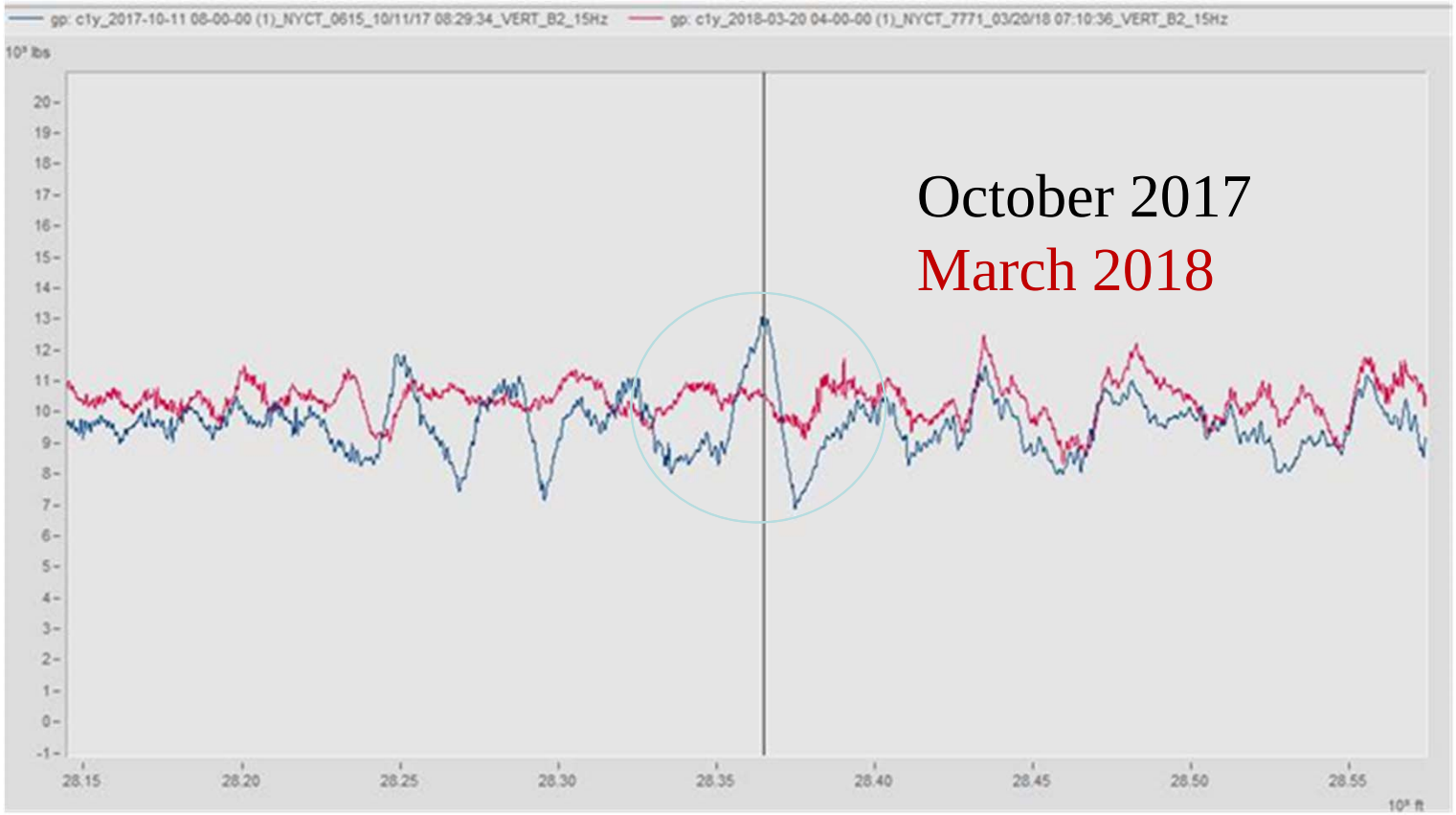
Priority 1 dip

From DATA file of NYCT Spet TG run				
28371	283	71	-0.547	-0.383
28372	283	72	-0.633	-0.598
28373	283	73	-0.703	-0.805
28374	283	74	-0.762	-0.992
28375	283	75	-0.805	-1.164
28376	283	76	-0.828	-1.316
28377	283	77	-0.848	-1.43
28378	283	78	-0.855	-1.504
28379	283	79	-0.816	-1.551
28380	283	80	-0.742	-1.543
28381	283	81	-0.625	-1.48
28382	283	82	-0.473	-1.352
28383	283	83	-0.309	-1.133
28384	283	84	-0.156	-0.84




gp: c1y_2017-10-11 08-00-00 (1)_NYCT_0615_10/11/17 08:29:34_VERT_B2_5Hz
gp: c1y_2017-10-13 08-00-00 (1)_NYCT_0989_10/13/17 09:07:19_VERT_B2_5Hz
gp: c1y_2017-11-03 04-00-00 (1)_NYCT_0493_11/03/17 06:05:11_VERT_B2_5Hz
gp: c1y_2017-11-06 08-00-00 (1)_NYCT_1152_11/06/17 08:26:27_VERT_B2_5Hz
gp: c1y_2017-10-13 04-00-00 (1)_NYCT_0912_10/13/17 05:35:01_VERT_B2_5Hz
gp: c1y_2017-11-01 04-00-00 (1)_NYCT_0017_11/01/17 06:00:49_VERT_B2_5Hz
gp: c1y_2017-11-06 04-00-00 (1)_NYCT_1119_11/06/17 06:58:23_VERT_B2_5Hz
10³ lbs
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
28.26
28.28
28.30
28.32
28.34
28.36
28.38
28.40
28.42
28.44
28.46
1.5 in dip
(283+79)
282+80
284+00
283+30
283+20
283+40
283+60
283+80
TDC Chainage (ft)
South bound

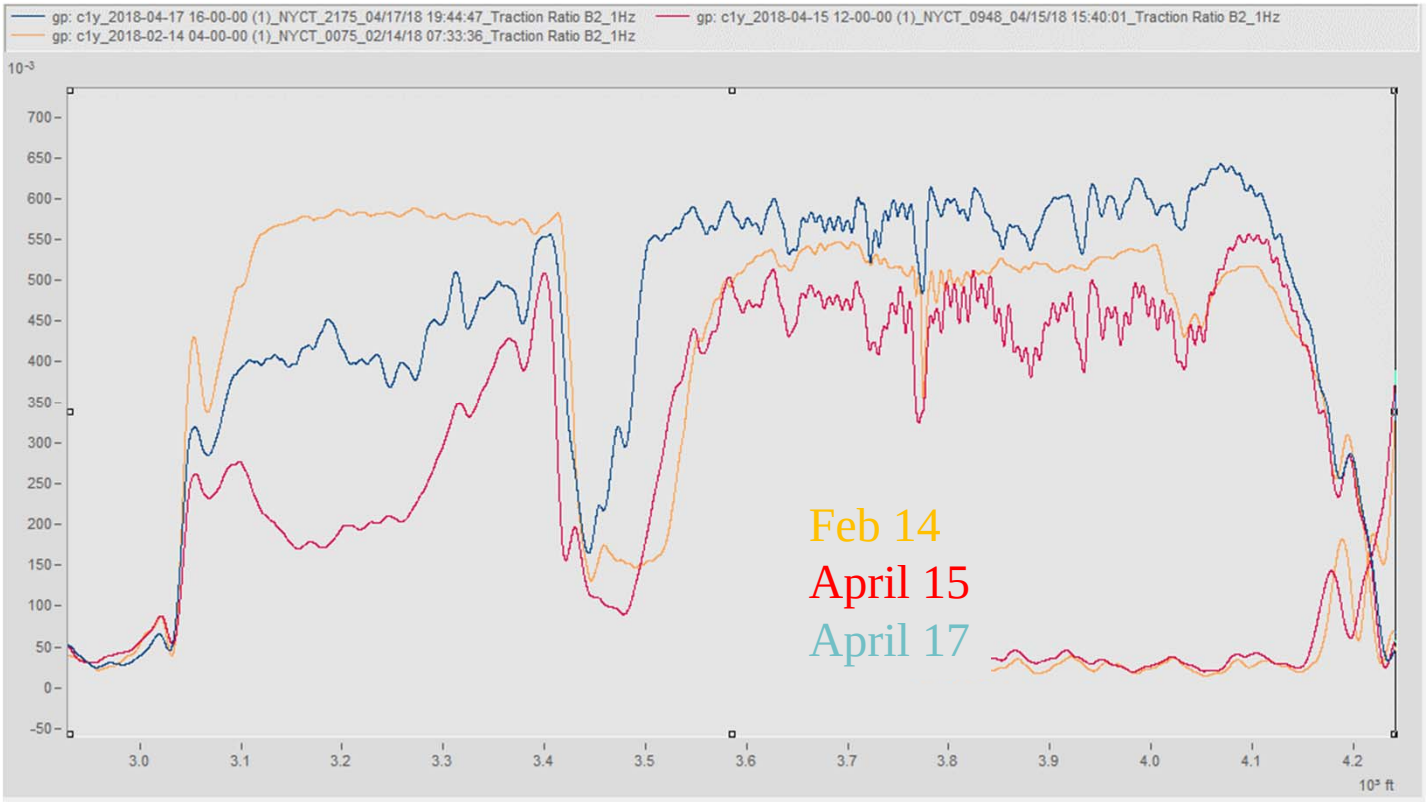
An IWS run on March 20, 2018 confirmed that the force peak has been removed



Traction Coefficient – CC1

TOR-FM reduces T/N, but there is quite a variation from day to day.

Appears to have a significant effect only on first third of curve at current settings.



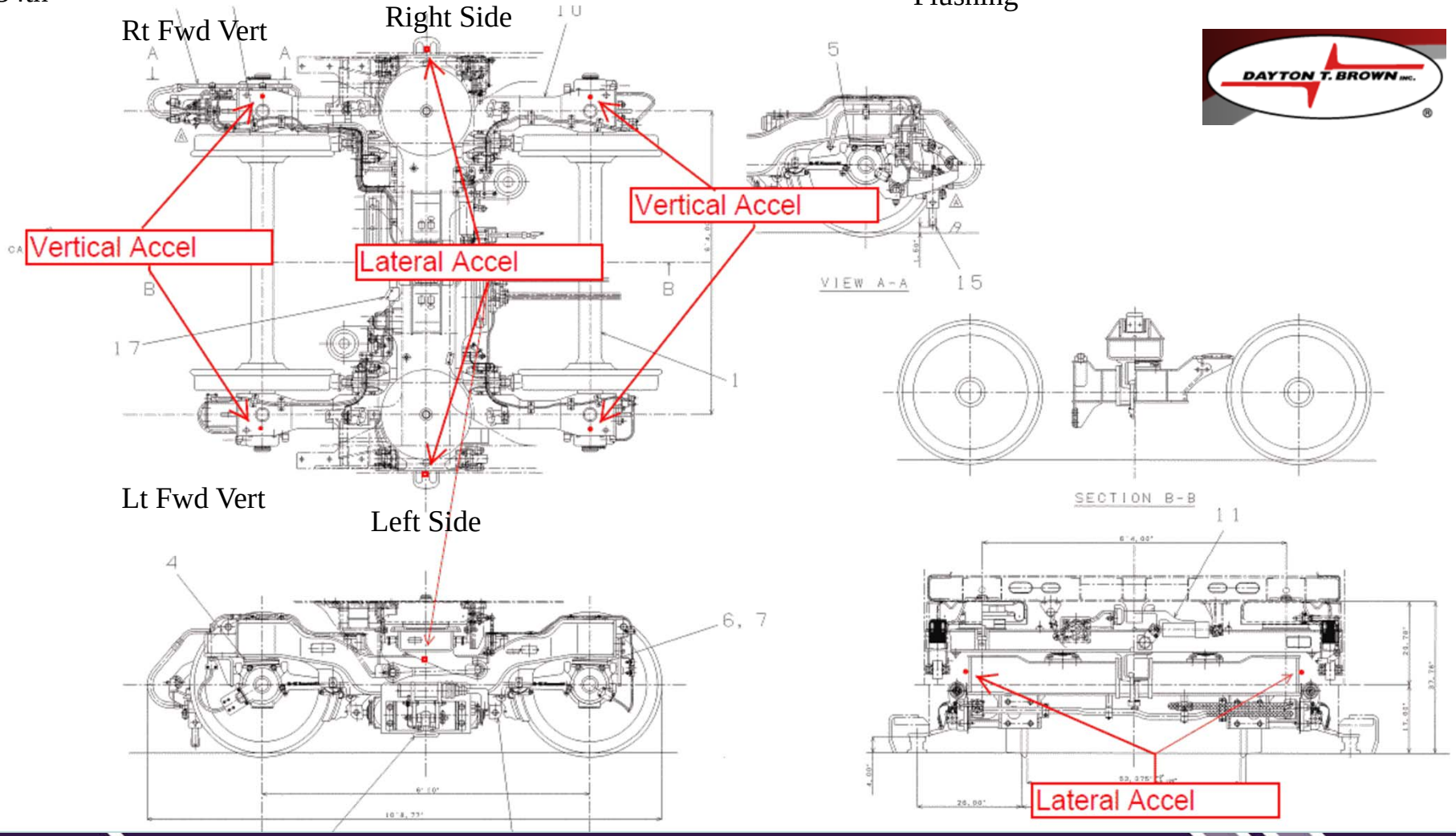
MEASURED ACCELERATIONS AND WHEEL/RAIL NOISE MEASUREMENTS

Keith Cummings - Dayton T. Brown
Hugh Saurenman and Shawn Duenas – ATS Consulting
Raman Pall – NRC, Canada

34th ⟷ Flushing

Rt Fwd Vert

Right Side

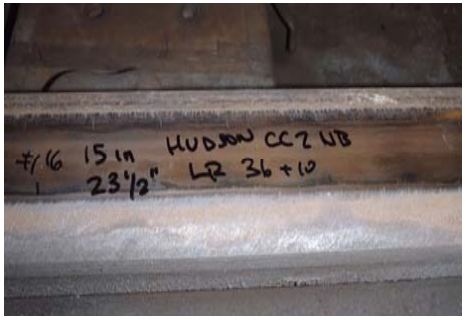


Lt Fwd Vert

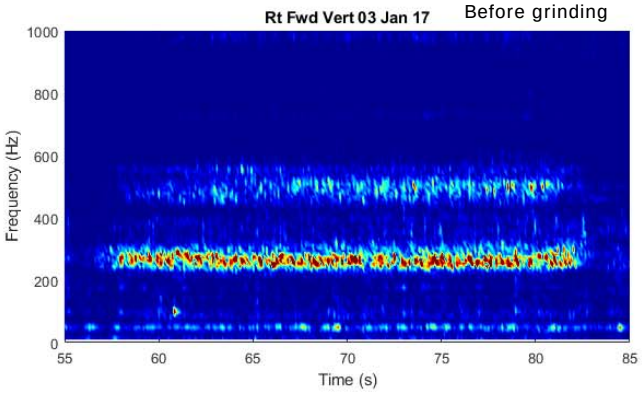
Left Side

ATSConsulting
acoustics, transportation + strategy

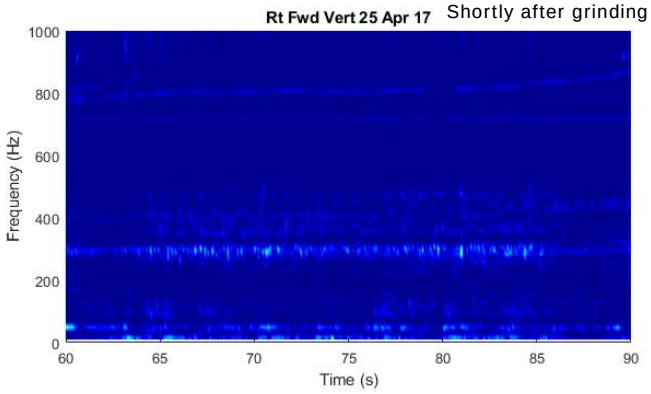
Approximately 280Hz at 29mph equates to 1.8 inch wavelength



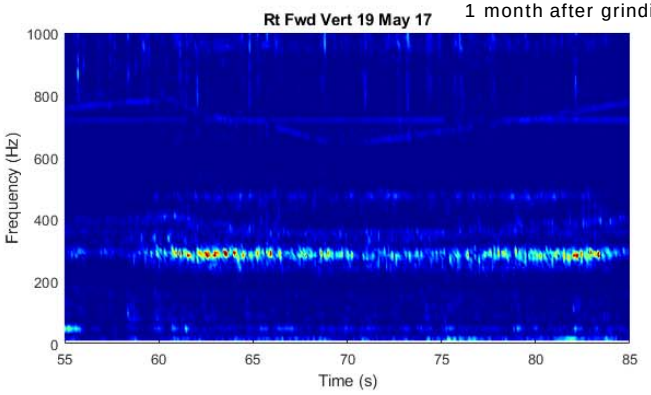
Wavelength averages 1.6 inches in this photo



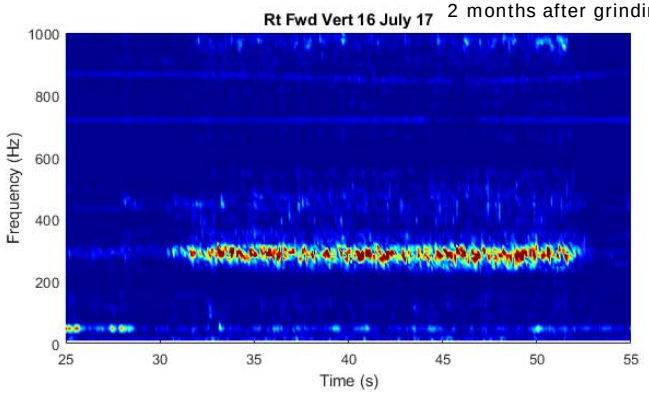
Before grinding



Shortly after grinding



1 month after grinding

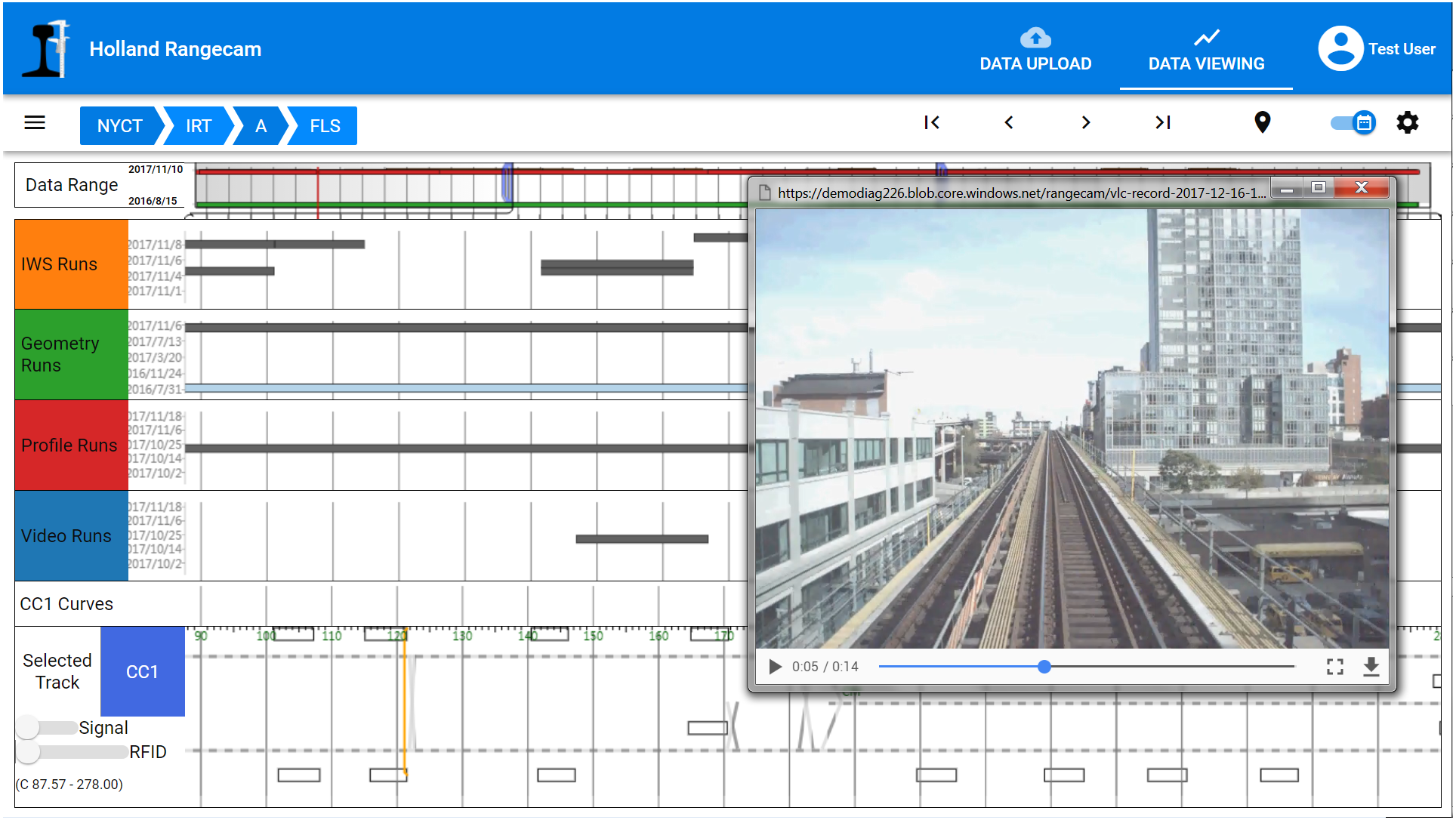


2 months after grinding

Future Steps

- Complete wheel/rail contact analytics
  - Effective conicity, Contact Stress, Wear, Optimal Shapes
- Impact of test wheel profile on forces and wear
- Impact of friction management at Hudson 34th curve
- Reporting

- Longer term: automatic import, alignment, analysis and reporting


Holland Rangecam
DATA UPLOAD
DATA VIEWING
Test User
NYCT
IRT
A
FLS
Data Range
2017/11/10
2016/8/15
IWS Runs
Geometry Runs
Profile Runs
Video Runs
CC1 Curves
Selected Track
CC1
Signal
RFID
(C 87.57 - 278.00)
https://demodiag226.blob.core.windows.net/rangecam/vlc-record-2017-12-16-1...
0:05 / 0:14


Holland Rangecam
DATA UPLOAD
DATA VIEWING
Test User
NYCT
IRT
A
FLS
C2
Data Range
2017/11/10
2016/8/15
Geometry Runs
2017/7/13
IWS Runs
2017/11/6
Cross Level
Track Gauge
Lat 1A
Long 1A
Vert 1A
L/V 1A
T/N 1A
Speed A
C2 Curves
7.45
28.96
Selected Track
C2
Signal
RFID
43.30 - 166.93
150
160
COURT SQ
QUEEN

Thank You

Eric E. Magel

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