NYCT Maintenance Innovation Using Research

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National Research Council, Canada
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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
NYCT – Track Geometry Car and Host Site #7 Line

- 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

[Bar chart showing BOF values for different months from April 2017 to March 2018, with categories for values less than 7 and greater than or equal to 18.]
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

- 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
Information provided by NYCT

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

Steel filings visible

NO steel filings visible

Wide flangeway visible

Guard rail replaced with new one on April 24, 2017; flangeway tightened

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 vibration has a frequency about 40Hz
- Estimated frequency by the surface feature wavelength:
  Speed=36 mph
  Wave length =16 in
  Frequency=36*1.47*12/16= 39 Hz
IWS Force vs Track Geometry

Priority 1 dip

TGC runs on October 23, 2017

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1.5 in dip (283+79)
An IWS run on March 20, 2018 confirmed that the force peak has been removed.
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
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
Thank You

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