In-Service Track Condition Monitoring
An Overview

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Aims of the Project

- Vehicle mounted instrumentation
- Logs inertial measurements to hard disk
- Collection of data from day-to-day operation of the vehicle

Main goals:

- Identification of track degradation at critical zones (bridges, transitions, etc)
- Analysis of effectiveness of maintenance
Current in-service project

Southern Class 377 Electrostar
Work to Date

- All Southern equipment designed and built
- All equipment now installed on train
- Vertical displacement processing complete
- Further processing in development
- Focused study on a site in Fishbourne, Sussex, UK
Data Processing

- Data management software
  - Allows extraction of every pass of a train through a specified area
- Matlab processing is progressing well
  - Calculation of vertical displacement
  - Model based on bogie dynamics
  - Alignment of waveforms in same location
  - Work in progress for automated fault detection and assessment
### Data Management Software

![Image of software interface showing data management features](image)

**Graph Viewer:**
- **X-Acceleration**
- **Y-Acceleration**
- **Z-Acceleration**
- **X-Rotation**
- **Y-Rotation**
- **Z-Rotation**
- **Tachos Speed**

- Table showing data points, timestamps, and values for different accelerations and rotations.
Case Study

- Fishbourne, Sussex
Direction of Travel

Renewed Section

Platform Extent

Mean Top 35 m [mm]

Distance [m]

B’ham IMU (19/12/12)

NMT F (21/08/12)

New Fishbourne L/C

Blackboy Lane L/C
Good alignment up to renewed section
Good alignment after renewed section

B’ham IMU (19/12/12)
NMT\(_F\) (21/08/12)

New Fishbourne L/C
Improvement

- The match to the NMT data is good but not perfect
- Data uses pitch-rate gyroscope only
- Accelerometer gives better short wavelength results
- Kalman filter used to model the bogie and ‘blend’ the accelerometer and gyro together
Bogie Model

- ~2.5m

- Large rotation, no vertical displacement

- No rotation, large vertical displacement

Also plan to account for primary suspension and damping
Fine alignment of displacement waveforms
1 – Peaks and troughs found
3 – Comparisons are made between close peaks/troughs and scores are given

Total Score = 54
Comparing multiple passes

• Now waveforms can be aligned we can compare them
• Can see degradation over a period of several weeks or months
Can see two areas of degradation which worsen over time