Track desktop assessments for line speed improvements

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THIS PRESENTATION WILL:

• Show ways to analyse and scope track works to facilitate raising the line speed from the safety of the desktop without exposing people to the risks of going on to the track (Safety by Design);

• Look at challenges, risks and lessons learnt.
BEFORE YOU START THE SCOPING STUDY

- Acquire clear Client requirements – the RAM(T) sets the rules in addition to mandated standards

- Study the “Checklist of requirements” in NR/L2/SIG/30021 Appendix A as this is used for the ‘Entry Into Service’ commissioning acceptance

- Study section 19 of NR/L2/TRK/2102 “Raising of Speed or Axle Weight on existing track” as this gives specific rules on componentry restrictions

- Study NR/L2/TRK/001/mod13 “Confirming track is safe for selected line speed after work” as this covers competencies and authority levels to raise the permissible speed
BEFORE YOU START THE SCOPING STUDY

• ‘Cab ride’ by using a recent HD video (produced by some local Ops teams e.g. as for Northern Hub project)
BEFORE YOU START THE SCOPING STUDY

Consult the TME to discuss the scheme proposals and include the ‘standard list of questions’ pertinent to “what if the speed is raised, the tonnage is increased and the track category raised”

Are there any:

- existing, or sites at risk of, a TSR or ESR being implemented due to condition of track (rail, sleepers, ballast, formation) including structures or earthworks deficiencies;

- track componentry condition concerns (S&C and Plain Line, included or in addition to ‘2102 Section 19, e.g. SHC sleepers, side wear, rail depth, RCF);

- specific formation or drainage issues;

- tight clearances being specifically monitored;

- known substandard ballast depth issues particularly on underline structures;

- registered eighths;

- locations where tamping is prohibited;

- fencing that would require renewal or repair as a result of a Track Category rise.
WHY THE TME IS A VITAL INTERFACE

- Holds the key role as track asset maintainer and has ultimate ‘Safety of Line’ responsibility

- Will not be over-ruled by the RAM(T)

- Will (should) know the patch and all existing problem statements and renewals proposals plus ‘join the dots’ with regards to validity of all desktop data collected

- Signs off the Track Certificate for authorising raising the PSR as required by NR/L2/TRK/001/mod13

<table>
<thead>
<tr>
<th>10</th>
<th>Raise permissible or enhanced permissible speed</th>
<th>Tr13</th>
<th>Any</th>
<th>Level 4 (note 4)</th>
<th>Before removing permanent speed restriction (PSR)</th>
<th>TEF3203</th>
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Notes:
1. If an inspection is required to raise or remove a speed, the engineering work review can be combined with the raise/remove speed inspection. The authority required for the highest risk work shall be applied.
2. If work not planned in Ellipse, use TEF3202.
3. Where the Multipurpose Stoneblower is used on S&C and the line is to be opened at 90mph or above, the inspection shall be undertaken by a Level 4 TME or other Level 4 authorised by the RAM[T].
4. Only the TME or RAM[Track] is permitted to undertake this task.
OVERVIEW OF TRACK STUDY REQUIREMENTS

- Track category changes
- Track horizontal geometry design for proposed line speed
- Track quality vertical (top) and horizontal (line)
- Track construction and componentry compliance
- Gauging for structural and passing clearances
- Concerns raised by the TME and RAM(T)
- Track work being triggered by other disciplines such as structures and earthworks or constrained by Signalling or OLE
**TRACK CATEGORY**

- Defined by speed and EMGTPA and is obtained from the table in NR/L2/TRK/2102.

- Maintenance inspection regimes are most significantly affected by a change from track category 3 or 4 to category 2 (doubles inspection frequencies).

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**Table 1 – Minimum Frequency of Basic Visual Inspections**

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<td>Twice per week</td>
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<td>Flat bottom rail on concrete or steel sleepers 1 with pandrol, SHC or vossloh fastenings</td>
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1. pandrol is a brand of fish plates (rail fastener) used in railway signaling and track structures.
TRACK CATEGORY

• Defines componentry specification for new build

• Defines fencing specification

• Does not effect track geometry quality Standard Deviation band as this is only related to maximum permissible speed

• Defines minimum action codes for rail defects
HORIZONTAL GEOMETRY ‘DESIGN’

- 3rd Way Analysis is an Excel programme which utilises track recording data derived from a TRV
- It was originally produced to provide quality assurance checks for WCRM installations
- It gives triggers in graphical form and RAG format of exceedances to pre-set limits/rules of Cant, Deficiency, E/D ratio, RoGD & E
- Where 3rd Way Analysis defines re-canting or realignment (curve flattening) is required then a survey and design will be required (not necessarily full Topo survey, consider RILA)
- It will confirm where an LSI is possible without any physical surveys or track works being required from a horizontal geometry design alignment perspective
- Track-Ex and VAMPIRE modelling will consider Cant/ Deficiency ratios and side wear and RCF wear rates
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**3rd Way Analysis RAG output**
3rd Way Analysis horizontal geometry triggers output
### TRACK GEOMETRY QUALITY

- It is speed related and not affected by Track Category

- Predicted Track Quality Standard Deviations for the proposed line speed can be produced by utilising TRV track recording data and running it through an Excel programme which reports in a RAG format and other statistical forms

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<th>Data Date</th>
<th>Current TQ</th>
<th>Predicted TQ - No work</th>
<th>Number of 1/8ths</th>
<th>Target TQ - After work</th>
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TRACK GEOMETRY QUALITY

• It is essential to consider historical TQ behaviour and deterioration rates and whether any intervention scoped is likely to be durable

Stable TQ

Unstable TQ
ROUTE EVALUATION

Provides:

- trackbed treatments required for the current line speed and for achieving and sustaining the proposed line speeds;

Supplementary Process Analyses/ Recent Developments:

- Dynamic loading analysis using HSTRC recordings;
- Trackbed and Earthworks diagnostics process using CCQ charts;
- Advanced GPR analysis using Hydraulic Conductivity (ballast ability to drain);
- Ballast fouling assessment using pixel recognition software;
- Ballast return prediction;
- Settlement calculation using historical HSTRC recordings;
- Rate of change of track system stiffness;
- Noise and vibration analysis using HSTRC data.
Route Evaluation output example
COMPONENTRY

- Utilise TME, Section Manager and Patroller’s cab ride and walk-out reports
- TME problem statements and renewals proposals
- HD video
- OmniInspector
- LADS (Linear Asset Decision Support)
  Current and historic track asset data is graphically presented, compared and analysed
GAUGING

- TiCled
- Gauge capability database
- Sectional Appendix
- ClearRoute
- DGauge’s Phx rail
- Structure Gauging Train
- TRV 6 foot measurements
- TME records
OTHER OPTIONS

• 5 mile diagrams are useful for vertical curves locations

• The Rail Infrastructure Network Model (RINM) is a Network Model of the railway. The Geo-RINM Viewer is an online tool that shows the location, and condition, of Network Rail assets in the real world

• LIDAR survey

• RILA survey

• Ground Probing Radar (GPR)

• 3D visualisation model
A multi-discipline constraints diagram can show:

- Attainable speed, acceleration capability and braking performance;
- Driveability, coasting, defensive driving;
- Signal spacing;
- Signal sighting;
- Signage;
- Linespeed profile (existing and proposed);
- Structures, stations, level crossings;
- Ops timetabling, platforming, passing loops and section running times obtained from TIP modelling (Train and Infrastructure Performance).
CHALLENGES AND LESSONS LEARNT

What Cant to Cant Deficiency ratio should be applied where designs are required, or where existing cant is to be maintained as the design?

There isn’t consistent or clear guidance in standards or from HQ or RAM’s……

- Maximise deficiency?
- ‘2102 says Deficiency to be “between 60% and 100% of the applied cant in continuously welded track” which is a wide range
- 50/50 ratio?
- Deficiency maximum of 50mm > cant?
- Track-Ex and Vampire modelling seem to ‘favour’ deficiency
- Higher deficiency applies increased forces on track components – when is it an issue?
- Higher deficiency affects passenger comfort – when is it an issue?
CHALLENGES AND LESSONS LEARNT

• Which are the best analysis tools and which should be adopted for future LSI projects? Options are fragmented and some overlap/duplicate

• Regular rotation of TME’s can effect thorough knowledge of the patch being transferred to the project

• 3rd way analysis excel programme is not owned, version controlled or validated after various user modifications

• PTQ excel programme is not owned, version controlled or validated after various user modifications (this is also linked into the Route Evaluation programme)

• Increased service patterns and hence increased EMGTPA are not generally considered outside of the section having an LSI – how is the track validated as fit for purpose?

• Inadequate requirements provided in PRS or RRS

• Accurate new train consists and EMGTPA is hard to attain from TOC’s and Sponsors

• Inadequate integration of whole route works on LSI sections means inefficiencies
CHALLENGES AND LESSONS LEARNT

• Exclusions from ‘2102 section 19 means some subjective decisions are made, e.g. pre 1976 rail, SHC fastenings

• Seamless staged handback via the AMP process of LSI works is required and immediate maintenance to the new LSI by the maintainer is essential

• What defect liability period is appropriate?

• Should a project be expected to conduct a walk-over survey when the maintenance organisation should know their asset and have robust records and when Network Rail have the likes of LADS and RINM?

• Should a project have to rectify existing non conformances like blocked drains that can effect TQ and existing sub-standard ballast profiles and lack of ballast retention?

• Platforms never seem to be clear – they certainly aren’t part of a Permanent Way!

• Gauging still seems incredibly complex but still gives ‘standard results’