Rail Industry Seminar– Issues Relating to Recent Freight Train Derailments

6 March 2015

EU & GB standards

Bridget Eickhoff

Chairman Infrastructure Standards Committee

Key EU and GB Standards

- Infrastructure - track geometry related
  - TSI INF
  - RGS GC/RT5021
  - EN13848 (various parts)

- Rolling Stock – vehicle approvals / testing
  - WAG TSI
  - RGS GM/RT2141
  - EN14363

Track Geometry Standards – Track Twist

- Track twist (EN13848:1)
  - *"The algebraic difference between two cross levels taken at a defined distance apart, usually expressed as a gradient between the two points of measurement"*
  - Assumed to be loaded track condition
- Described as 1 in x, y % or z mm/m (z ‰)
- TSI requires track twist to be measured over at least one base between 2m and 5m
  - Limits are referenced from EN13848-5
- Network Rail normal reporting base is 3m
  - Limits (and actions) are consistent with TSI / EN

Extract from GC/RT5021

Twist fault	Action
1 in 90 or worse	Stop all traffic immediately and correct fault
Between 1 in 91 and 1 in 125	Correct fault within 36 hours of discovery
Between 1 in 126 and 1 in 199	Radius < 400 m: Correct fault within one week of discovery Radius ≥ 400 m: Correct fault within two weeks of discovery

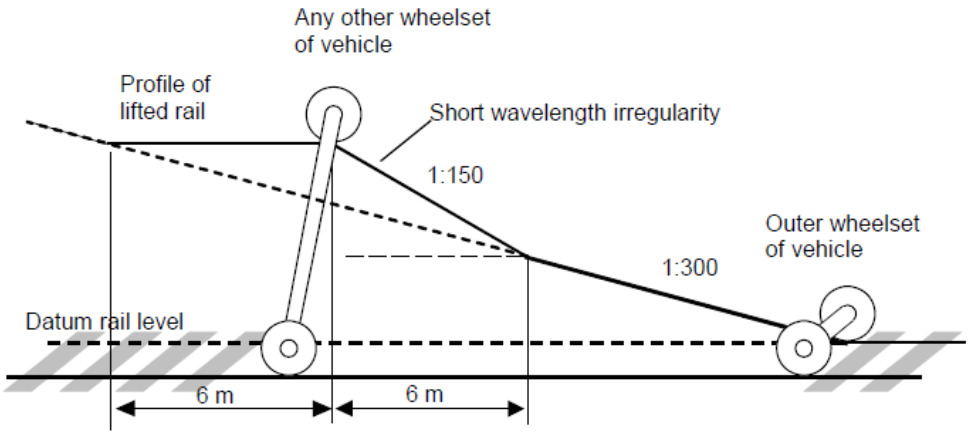
Table 2 Minimum action on discovery of twist fault

Vehicle Testing Standards – Twisted Track

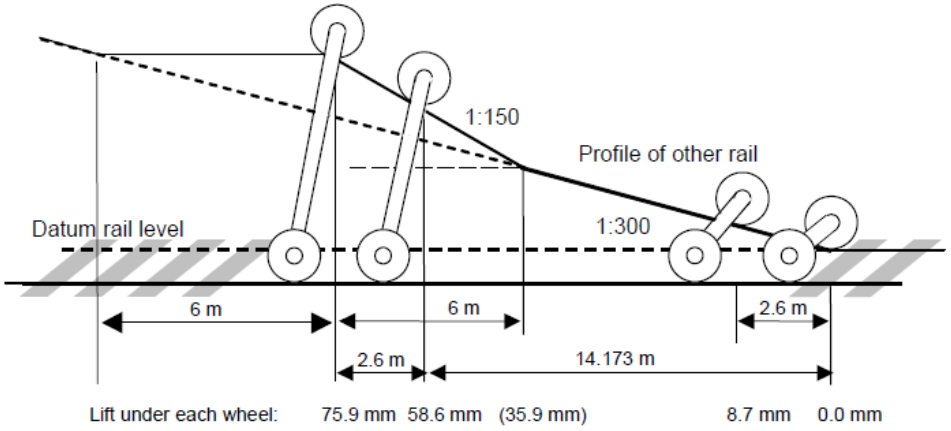
- All requirements derive from European Committee ORE B55 which worked from 1960s to 1980s
- WAG TSI (Clause 4.2.3.5.1 / 6.2.2.2) refers to
  - EN14363:2005 (revised version expected 2015 /2016)
  - EN includes 3 methods (all derived from B55)
- GM/RT2141 uses ‘Method 3’
  - Bogie rotation test (to ensure wheelsets can rotate on curve entry)
  - ΔQ/Q ‘twist’ test – laboratory based
  - Defined twist imposed on vehicle wheels by jacking
  - Maximum unloading (on worst wheel) of 60% → 40% load remaining
- All 3 methods are approximately equivalent
  - Depends on details of wheelset spacing, bogie spacing etc
- This is separate from the ‘dynamic’ ride test where GB methods are different from TSI / EN

Twist Requirements for Vehicle Testing

- Diagrams from GM/RC2641
  - 2-axle vehicle
  - Bogie vehicle
- Worst orientation must be considered
  - Deals with design asymmetry
- Worst location of short wave input must be considered
- Advice on load conditions

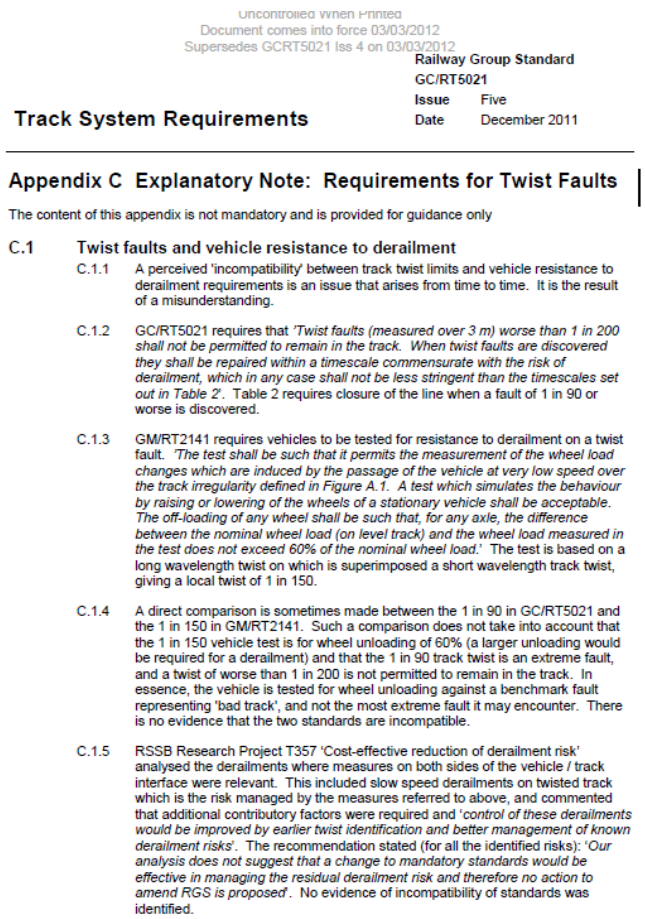


Worst case twist for typical bogie passenger vehicle
(bogie wheelbase 2.6 m, bogie centre spacing 14.173 m)



Comparison of Track / Vehicle Requirements

- Apparent inconsistency
  - ‘Close the line’ twist is 1 in 90
  - Track twist base is 3m
  - Vehicle is ‘only’ tested on 1 in 150
  - Vehicle / bogie wheelbase varies
- However:
  - At 1 in 150 twist 40% wheel load remains – this is a long way from derailment
  - Track twist worse than 1 in 200 requires ‘immediate’ attention
  - Track / vehicle requirements are ‘benchmarks’ and have been shown to be consistent
  - See conclusions of T357 & Appendix C of GC/RT5021



Uncontrolled When Printed
Document comes into force 03/03/2012
Supersedes GCRT5021 Iss 4 on 03/03/2012

Railway Group Standard
GC/RT5021
Issue Five
Date December 2011

Track System Requirements

Appendix C Explanatory Note: Requirements for Twist Faults

The content of this appendix is not mandatory and is provided for guidance only

C.1 Twist faults and vehicle resistance to derailment

C.1.1 A perceived 'incompatibility' between track twist limits and vehicle resistance to derailment requirements is an issue that arises from time to time. It is the result of a misunderstanding.

C.1.2 GC/RT5021 requires that *'Twist faults (measured over 3 m) worse than 1 in 200 shall not be permitted to remain in the track. When twist faults are discovered they shall be repaired within a timescale commensurate with the risk of derailment, which in any case shall not be less stringent than the timescales set out in Table 2'*. Table 2 requires closure of the line when a fault of 1 in 90 or worse is discovered.

C.1.3 GM/RT2141 requires vehicles to be tested for resistance to derailment on a twist fault. *'The test shall be such that it permits the measurement of the wheel load changes which are induced by the passage of the vehicle at very low speed over the track irregularity defined in Figure A.1. A test which simulates the behaviour by raising or lowering of the wheels of a stationary vehicle shall be acceptable. The off-loading of any wheel shall be such that, for any axle, the difference between the nominal wheel load (on level track) and the wheel load measured in the test does not exceed 60% of the nominal wheel load.'* The test is based on a long wavelength twist on which is superimposed a short wavelength track twist, giving a local twist of 1 in 150.

C.1.4 A direct comparison is sometimes made between the 1 in 90 in GC/RT5021 and the 1 in 150 in GM/RT2141. Such a comparison does not take into account that the 1 in 150 vehicle test is for wheel unloading of 60% (a larger unloading would be required for a derailment) and that the 1 in 90 track twist is an extreme fault, and a twist of worse than 1 in 200 is not permitted to remain in the track. In essence, the vehicle is tested for wheel unloading against a benchmark fault representing 'bad track', and not the most extreme fault it may encounter. There is no evidence that the two standards are incompatible.

C.1.5 RSSB Research Project T357 'Cost-effective reduction of derailment risk' analysed the derailments where measures on both sides of the vehicle / track interface were relevant. This included slow speed derailments on twisted track which is the risk managed by the measures referred to above, and commented that additional contributory factors were required and '*control of these derailments would be improved by earlier twist identification and better management of known derailment risks*'. The recommendation stated (for all the identified risks): '*Our analysis does not suggest that a change to mandatory standards would be effective in managing the residual derailment risk and therefore no action to amend RGS is proposed*'. No evidence of incompatibility of standards was identified.

- But has anything changed to challenge this conclusion?