

Oliver Stewart
Senior Executive, RAIB Relationship and
Recommendation Handling

8 February 2019



Mr Andrew Hall
Deputy Chief Inspector of Rail Accidents
Cullen House
Berkshire Copse Rd
Aldershot
Hampshire GU11 2HP

Dear Andrew,

Freight train derailment at Angerstein Junction, 2 April 2014

I write to provide an update¹ on the action taken in respect of recommendation 4 addressed to ORR in the above report, published on 12 August 2015.

The annex to this letter provides details of the action taken regarding the recommendations. The status of recommendation 4 is '**Implemented**'. We do not propose to take any further action in respect of recommendation 4, unless we become aware that any of the information provided becomes inaccurate, in which case I will write to you again.

We will publish this response on the ORR website on 11 February 2019.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Oliver Stewart', written in a cursive style.

Oliver Stewart

¹ In accordance with Regulation 12(2)(b) of the Railways (Accident Investigation and Reporting) Regulations 2005

Recommendation 4

The intention of this recommendation is to review whether the historic track twist measurement base (3 metres) is still a sufficient control for track twist risk applicable to current rolling stock. The RAIB notes that this recommendation could be informed by the joint industry action taken in response to ORR's letter of 5 December 2014 (paragraph 163).

Network Rail should liaise with RSSB to review whether the existing 3 metre measurement base used for identification of track twist is sufficient for managing the derailment risk applicable to rolling stock currently operating on Network Rail infrastructure. If found to be inadequate or insufficient, Network Rail should:

- update its process for assessing track twist by the inclusion of additional and/or alternative measurement bases; and
- implement a time-bound plan to apply the new process to all of its infrastructure.

ORR decision

1. We have reviewed the work of the cross industry freight derailment working group (XIFDWG) on the appropriateness of the 3m twist base-length. This included the work Network Rail has done that they refer to in their closure statement and related work by Huddersfield University – Institute of Rail Research (IRR). We have accepted the findings of this work and provided the following response to Network Rail:

We note the contents of the report and the final conclusion that there is no sustainable evidence to suggest that an alternative track twist measurement should be implemented. We also note that this conclusion is made within the context of Network Rail's existing safety management system, and we recommend Network Rail continues its focus on ensuring that risk arising from the track asset is managed in accordance with those requirements. We believe that once this work is accepted by XIFDWG, it has the potential to satisfy the requirements of recommendation 4 of RAIB's Angerstein Report [\(11/2015\)](#). We will formally consider this when Network Rail submits this work as part of its response.

2. The work was presented at the last XIFDWG meeting and accepted and endorsed by that group.

3. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- Taken the recommendation into consideration; and
- has taken action to implement it.

Status: Implemented.

Previously reported to RAIB

4. On 6 July 2016 ORR reported whilst it was satisfied that Network Rail's initial response demonstrated that work was progressing, it noted that the wider input of the industry was required to implement the recommendation. It was also unclear how Network Rail would move to implementation of the recommendation by 23 December 2016, and ORR had sought further information from the end implementer about this.

Update

5. Network Rail provided the following closure statement on 18 December 2018:

The current base line is 3m. This is in line with Railway Groups Standards (RGS) as well as the Technical Specification Interoperability Infrastructure (TSI Inf).

*The TSI Inf. 2014 directs requirements in point 4.2.8.3 to EN13848-1 Point 4.6 and directs the requirements on limits to EN13848-5 point 8.8. The TSI also stipulates that *'The infrastructure manager shall set out in the maintenance plan the base-length on which it will measure the track in order to check compliance with this requirement. The base-length of measurement shall include at least one base between 2 and 5 m.'**

Both NR & RGS standards are compliant to all 3 of these clauses.

The limits on twist stipulated in EN13848-5 point 8.8 conform to the UIC report ORE B55 RP8, a 20 year study into the derailment of twist across all of Europe. The limits are summarised into a graph of IAL values in mm/m over base length. Two curves are presented dependent upon curvature of the track as depicted in Chart 1 below

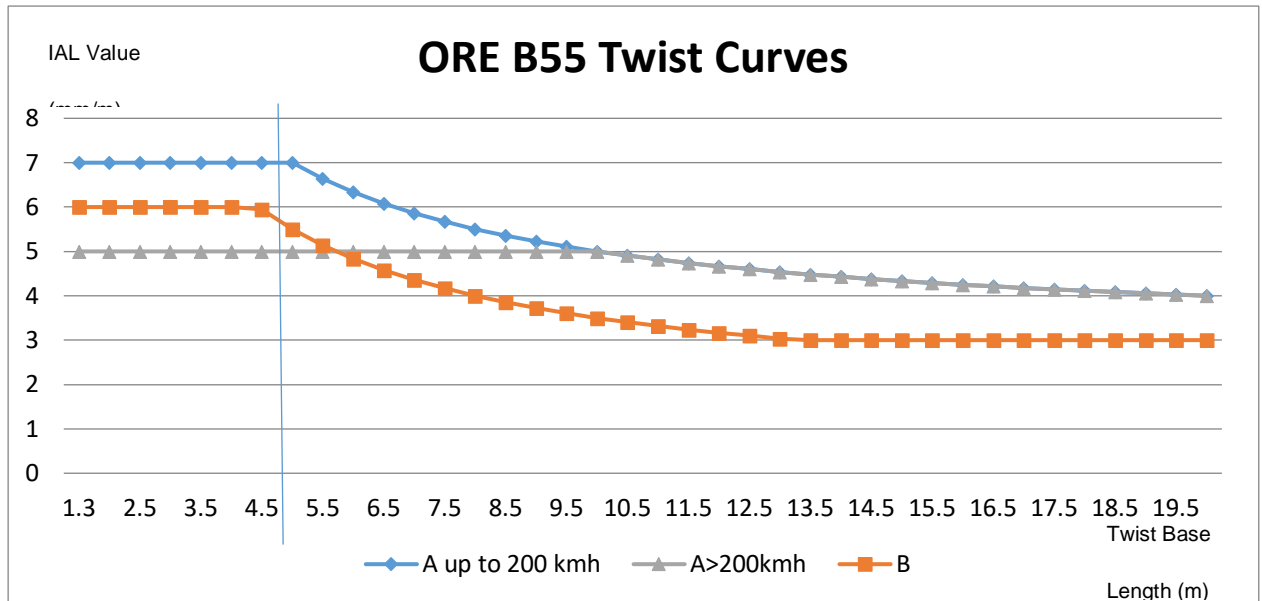


Chart 1

The curves A and B are chosen dependent upon the following:-

1) Limit twist = $((20/\ell) + 3)$ for $u \leq (r - 100)/2$ (curve A)
with a maximum value of:
7 mm/m for lines designed for speed $V \leq 200$ km/h;
5 mm/m for lines designed for speed $V > 200$ km/h;

2) Limit twist = $((20/\ell) + 1,5)$ for $(r - 100)/2 < u < (r - 50)/1,5$ (curve B)
with a maximum value of 6 mm/m and a minimum value of 3 mm/m.

For both equations:

ℓ is the twist base-length, with $1,3 \text{ m} \leq \ell \leq 20 \text{ m}$;

u is the cross level (in mm);

r is the curve radius (in m).

Undertaking an analysis of twist fault statistics in the UK yielded a section of track over 100 miles in length that held the highest number of Intervention Level Faults. The raw data from the track recording train was utilised to reverse engineer twist calculation for 3m, compare this with the exceedance report and then replicate to produce exceedances for other base lengths.

Chart 2 below depicts the distribution of exceedances detected against base length.

Of interest is that there are no exceedances calculated for base lengths greater than 3m.

This analysis was verified with the Cross Industry Working Group. Their independent investigation also reverse engineered track recording data for 3m and repeated the calculation for sub 3m and post 3m base lengths. The study then undertook Vampire modelling to ascertain the derailment risk increase with respect to twist measurements found in the different base lengths. The study was undertaken with the most susceptible vehicle, the JHAI Hopper Wagon, bogie spacing 9.45m and axle spacing 2.0m.

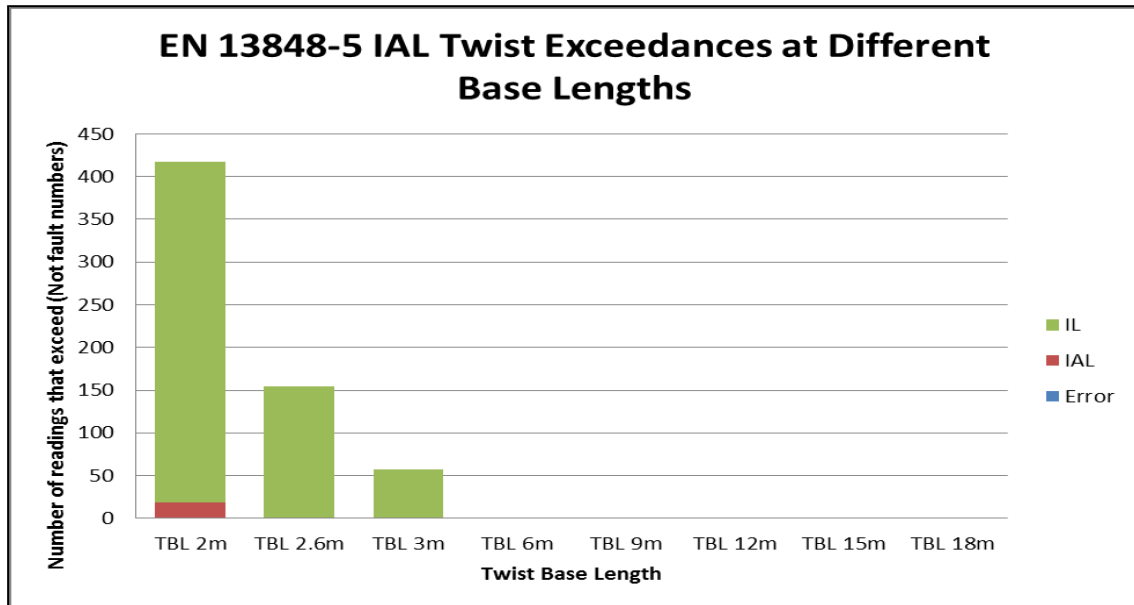


Chart 2

The findings of the group confirmed that twist measurements taken with sub 3m base lengths have an increase in the number of exceedances in respect to the twist ratio limits for both Network Rail and ORE B55 (i.e EN13848-5 and hence the TSI). However the increase in derailment risk is less than a 5% increase with respect to the Y/Q ratio and this increase is still well clear of the Y/Q limit of the group standard GM/RT/2141. The group has recommended to the RSSB that no further study is required to challenge Railway Group standards and hence TSI or Network Rail standards.

Chart 3 from this study is depicted below showing both increase in exceedances and associated Y/Q ratio.

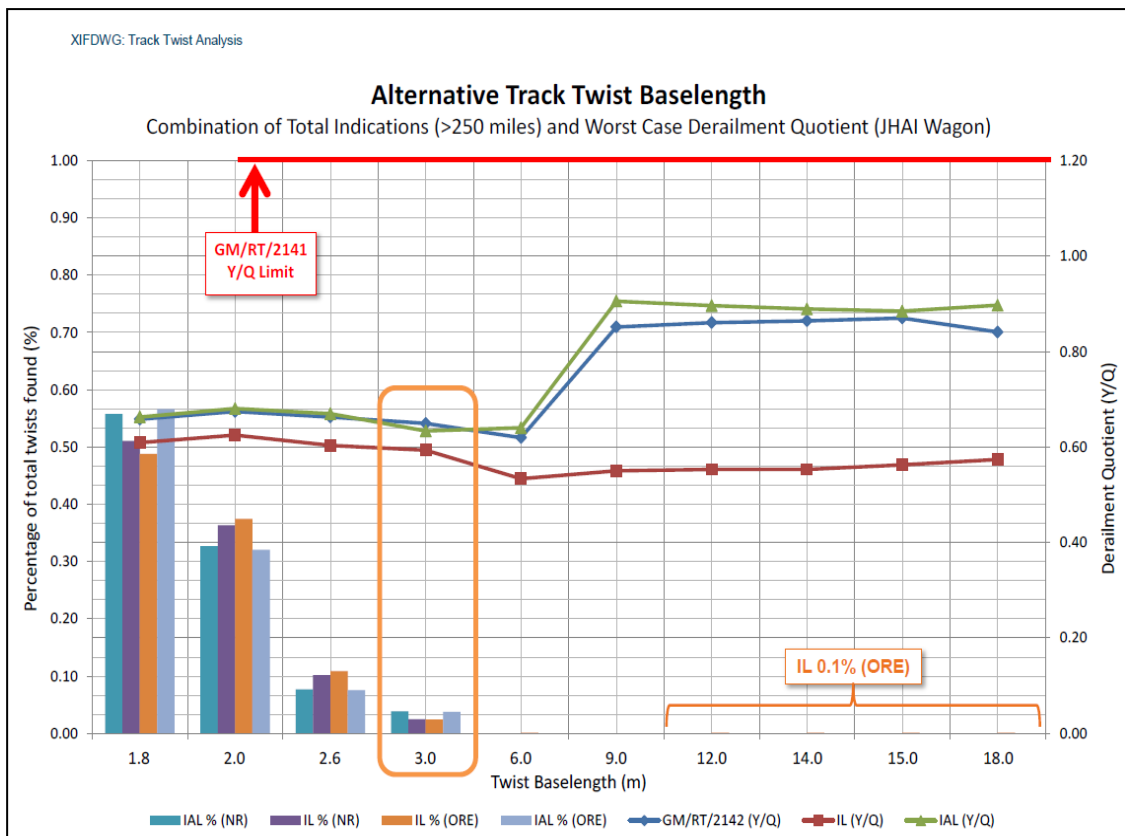


Chart 3

Conclusion

Following this review, the existing 3m base line for measuring track twist remains valid and is sufficient for managing and controlling the risk to derailment of rolling stock.

Whilst the number of track twist exceedances increases with base length measurements lower than 3m, this does not translate into an increase in derailment risk, as the Y/Q ratio only increases marginally in proportion but remains significantly clear of the group standard limit of 1.2.

Therefore any reduction on base length below 3m would invoke a disproportionate increase in maintenance resource requirements to offset minimal increase in derailment risk.

The considered response of the Chief Track & Lineside Engineer is that the above provision for the recommendation is sufficiently addressed. The intent of this recommendation has been met and therefore is considered CLOSED.

Previously reported to RAIB

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Network Rail should liaise with RSSB to review whether the existing 3 metre measurement base used for identification of track twist is sufficient for managing the derailment risk applicable to rolling stock currently operating on Network Rail infrastructure. If found to be inadequate or insufficient, Network Rail should:

- update its process for assessing track twist by the inclusion of additional and/or alternative measurement bases; and
- implement a time-bound plan to apply the new process to all of its infrastructure.

ORR decision

1. Whilst ORR is satisfied that Network Rail's initial response demonstrates that work is progressing, it notes that the wider input of the industry is required to implement the recommendation. It is also unclear how Network Rail will move to implementation of the recommendation by 23 December 2016, and ORR has sought further information from the end implementer about this.

2. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- taken the recommendation into consideration; and
- is taking action to implement it, but ORR has yet to be provided with a timebound plan.

Status: Progressing. ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.

Information in support of ORR decision

3. On 17 December 2015 Network Rail provided the following initial response:

a. The process to be applied to the review/consideration

- i. *Review the guidance currently provided within Network Rail standards, Group Standards & the TSI.*
- ii. *Review the current wheel base distribution of UK fleet*

- iii. *Examine areas of different known twist density & apply additional twist calculations of appropriate base lengths to ascertain if there are additional risks exposed by this undertaking.*

b. The rigor to be applied to understanding potential issues

- i. *Do the current standards & existing bow ties to date provide clarity on the risks associated with the measurement of Twist & do they provide guidance on limits for different base lengths*
- ii. *What is the density of wheel base with UK fleet? How does this compare with existing measurements? Are there any identified gaps.*
- iii. *What are the outcomes of measuring different wheel base twists to the test cases? Has more twist been detected that exceed the researched associated exceedance limits..?*

c. The person proposed to be involved in the review/considerations

- i. *STE, Principal Track Engineer with liaison with RSSB*
- ii. *STE, Principal Track Engineer with liaison with RSSB*
- iii. *STE, Principal Track Engineer with liaison with RSSB*

d. How the outcomes of the review/consideration will be documented

- i. *If adequate, summarise the salient points in the closure statement. If inadequate, set a programme to undertake an update to the standards as appropriate*
- ii. *Summarise in a report the current state of the art & found deficiencies. Set a programme to conduct any changes to the recording fleet functionality if appropriate & estimate the cost & supplier availability to implement,*
- iii. *Produce a summary report outlining any gaps of coverage the current systems provide. This will feed into 4.4.2*

Liaison will be through the cross-industry working group which has already been requested to consider this aspect of asset management. Only when the output from this group is reported will consideration be given to the impact on Network Rail processes and procedures.

Network Rail expects to complete this work by 23 December 2016.

ORR subsequently met with Network Rail to discuss its work to explore the appropriateness of measuring track twist at a baseline length longer or shorter than the current 3 metres. Network Rail reported some progress in reviewing the impact of shorter and longer measurement baselines on fault identification, but that its work does not currently take account of vehicle characteristics. It was agreed that Network

Rail should ensure that its emerging findings are shared with the XIFDWG and that the XIFDWG's relevant workstream is looking at both shorter and longer measurement bases. Once this work is complete, and the outcome known, Network Rail will be able to address the detail of this recommendation. More information about the XIFDWG programme of work can be found in paragraphs 13 and 14 above.