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**Guidance on Railway Wheelset Tread, Gauging and Damage
Identification**

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Guidance on Railway Wheelset Tread, Gauging and Damage Identification

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Supply

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Guidance on Railway Wheelset Tread, Gauging and Damage Identification

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Part 1 Introduction

1.1 Purpose of this document

This document has been published by Rail Safety and Standards Board to give guidance on Wheelset Tread, Gauging and Damage Identification. This guidance is intended to assist duty holders in understanding their responsibilities in relation to Wheelset Tread, Gauging and Damage Identification. It does not constitute a recommended method of meeting any set of mandatory requirements.

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1.3 Approval and authorisation of this document

The content of this document was approved by:

Rolling Stock Standards Committee on 05 October 2007

This document was authorised by RSSB on 15 October 2007

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Part 2 Background

2.1 Development of the document

- 2.1.1 This document has been drafted under the auspices of the cross-industry Wheelset Best Practice Group, a technical sub-group of Vehicle Track System Interface Committee, and is designed to supersede MT162 and in part, MT288. It is envisaged that the residual data elements of MT288 will be absorbed into IB/TS0648, or other databases as appropriate.
- 2.1.2 This document gives guidance on the practices which should be followed to maintain standards and compliance with GM/RT2466 for wheel and tyre treads of a wheelset whilst it is fitted to a vehicle for operation over Network Rail managed infrastructure, in particular:
 - a) The standards to be applied during wheel profiling
 - b) The standards to be applied whilst in service
 - c) The tread gauges which can be used and their method of use
 - d) Permissible tread damage
 - e) Requirements for dealing with overheated wheels and derailed wheelsets
- 2.1.3 This document sets out arrangements for the recognition of tread damage, including rolling contact fatigue, requiring remedial attention, to be applied in-service and at maintenance.

2.2 Rationale

- 2.2.1 To maintain the safe operation of vehicles that run on Network Rail infrastructure, the controls that need to be put in place to manage wheelsets are mandated in GM/RT2466. This document gives guidance on the requirements of GM/RT2466 with regard to the dimensional and physical condition of wheel treads at re-profiling and in-service.
- 2.2.2. The identification of wear and tread damage and the subsequent appropriate action to be taken in accordance with this publication, will minimise further damage and reduce maintenance costs for both vehicles and the infrastructure.
- 2.2.3 This document supports the requirements of GM/RT2466.

2.3 Scope

- 2.3.1 The guidance in this document is relevant to organisations engaged in the inspection and maintenance of wheelsets.
- 2.3.2 The document identifies the dimensions that should be controlled and in some circumstances, the limits to be applied, either directly or by reference to other sources. Where no data is referenced it is the responsibility of the user to ensure suitable limits are established. It does not mandate the means of measurement. Gauges that have been traditionally used for this purpose have a BR Cat. No. and are identified in Appendix A.
- 2.3.3 This document gives guidance for the identification of tread damage requiring remedial attention on all rail-mounted vehicles except possession-only rail vehicles. It is applicable to tread damage on both monobloc and tyred wheels. This document does not cover requirements for resilient wheels.

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- 2.3.4 The user should set the examination frequencies in the maintenance plan to ensure that the mandatory safety limits in GM/RT2466 are not exceeded at any time.
- 2.3.5 Advice should be sought from a Technically Competent Authority for tread damage that is not covered by this document but is likely to affect the safety of a vehicle.

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Part 3 Guidance on Requirements at Wheelset Re-profiling

3.1 Application

- 3.1.1 When wheels are re-profiled, the wheel profile dimensions should conform with the data contained in the user's maintenance instructions - see 2.3.4. During re-profiling, clamps or restraints may be required to prevent the axlebox from rotating and these should be applied in accordance with the relevant lathe manufacturers instructions.

3.2 Profile type, tolerance and condition

- 3.2.1 The tread profile should be that applicable to the vehicle type as defined in the relevant user's maintenance instructions – see 2.3.4.
- 3.2.2 The profile tolerance should be in accordance with the relevant drawing. However, in general, dimensional tolerances will be ± 0.25 mm. Following re-profiling the tread surface including flanges should be free of visible defects such as cracks, cavities, flats or spalling and have a surface roughness no coarser than $12.5 \mu\text{m}$ (N10). To avoid excessive wheel material removal back flange wear up to a depth of 1mm is allowed to remain following re-profiling.
- 3.2.3 Details of the gauges that can be used to confirm that the profile is correct are shown in Figure A.2 of Appendix A. The gauge is held on the profile in contact with the flange back and tread surface. The Go / No-Go gauge should enter with the Go and not enter with the No-Go end between points K to L and M to N.

3.3 Profile alignment

- 3.3.1 The profiles of wheels on the same axle should be aligned relative to each other. There are presently no definitive limits for this, although railway undertakings should be aware that any misalignment of one profile relative to the other will affect wheelset conicity, and hence stability and curving performance: vehicle-specific tolerances may therefore be given on the wheelset assembly drawing or separate local procedure.
- 3.3.2 Details of gauges used to assess profile alignment are shown in Figure A.1 of Appendix A. The profile is checked by assessing the gaps between the tread and gauge at positions K to L and M to N. When the gauge is used on a wheelset carrying the weight of a vehicle, it may be necessary to fit the gauge to the profiles at the same height above the rail as the axle (that is 3 o'clock or 9 o'clock positions) and to release the brakes. This is to avoid errors due to axle deflection under load.

3.4 Tread run-out

- 3.4.1 Following re-profiling the tread run-out should be as detailed in the relevant user's maintenance instructions – see 2.3.4.

3.5 Wheel wobble

- 3.5.1 Following re-wheeling and/or re-tying the permissible wheel wobble should be in accordance with the overhaul limit specified in the relevant user's maintenance instructions. Following re-profiling the permissible wheel wobble should be in accordance with the repair limit specified in the relevant user's maintenance instructions – see 2.3.4.
- 3.5.2 GCU vehicles are permitted to have up to 0.75 mm wheel wobble at any time.

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3.6 Wheelset back-to-back

- 3.6.1 This is to be as specified in the relevant user's maintenance instructions – see 2.3.4. Assessment of the back-to-back dimension can be obtained with Go / No-Go gauges (shown in Figure A.4 of Appendix A) and feeler gauges or a calibrated internal micrometer.

3.7 Wheel diameter difference.

- 3.7.1 This is to be as specified in the relevant user's maintenance instructions – see 2.3.4.

3.8 Wheel rim / tyre thickness

- 3.8.1 This is to be as specified in the relevant user's maintenance instructions – see 2.3.4.

3.9 Throat thickness

- 3.9.1 Where appropriate this information is contained in the relevant user's maintenance instructions – see 2.3.4. For monobloc wheels, the throat thickness is the dimension between the root of the radius of the tread profile (flange root), and the underside of the flange-side wheel rim, measured at the narrowest point. The gauges used to assess the throat thickness are shown in Figures A.8 and A.9 of Appendix A. Measurements should be taken away from areas that have been machined during balancing of the wheel.
- 3.9.2 The minimum or scrapping throat thickness is set by the design strength of the wheel, and cannot therefore be infringed. The general limits are traditionally specified according to the size of the wheel bearings, although in reality they relate to axle loads and wheel forces.

3.10 Wheel tread roll-over

- 3.10.1 Following re-profiling there should be no tread roll-over.

3.11 Tyre security

- 3.11.1 Following re-profiling the tyre and retaining ring security should meet the requirements of IB/TP0001 Tyre Security Maintenance Procedures.

3.12 Witness marks

- 3.12.1 Tread profiles may be machined to remove the minimum amount of metal to restore the profile, leaving a witness mark as shown in Figure 1 is permissible. All visible cracks, cavities and hard spots are to be machined out.

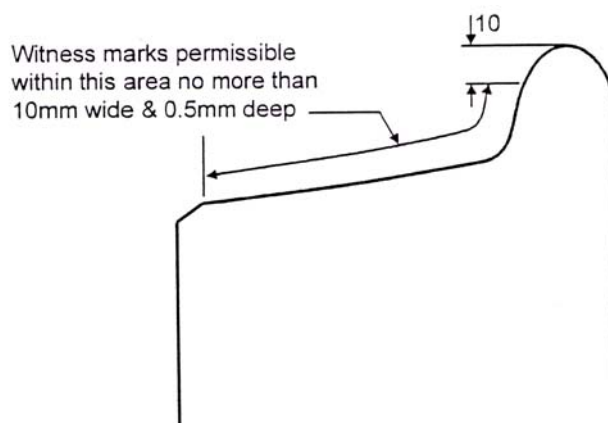


Figure 1 Permissible witness marks on re-profiled treads

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Part 4 Guidance on Requirements for Wheelset Tread Profiles in Service

4.1. Application

- 4.1.1 The requirements for the wheel tread profiles to be applied whilst the wheelsets are in service are detailed below.
- 4.1.2 Wheelset profiles should not exceed the tolerable criteria defined in GM/RT2466 at any time, including between inspections. To achieve this the limits in the relevant user's maintenance instructions, see 2.3.4, should define the examination intervals, so that normal rates of wear will not result in the mandatory safety limits being exceeded between planned examinations.

4.2 Profile tread condition

- 4.2.1 The profile and tread condition should conform to Part 6 of this document.

4.3 Flange height and thickness

- 4.3.1 These should not exceed the limits defined in the relevant user's maintenance instructions – see 2.3.4. These limits should ensure that the mandatory limits in GM/RT2466 are not exceeded between wheelset inspections. The gauges used to assess the flange thickness and height are shown in Figures A.3, A.10 and A.11 of Appendix A.
- 4.3.2 The gauge shown in Figure A.3 is used by opening out both slides. The gauge is held squarely on the flange back and drawn down onto the profile at right angles to the tread surface. The sliders are then moved to make contact with the tread and measurements taken.
- 4.3.3 The user may also choose to set alternative limits to suit their operational requirements, for example restricted flange height for economic tyre re-profiling, or to control vehicle stability as a result of increased conicity. However, the limits should not infringe the mandatory requirements of GM/RT2466.

4.4 Toe radius build-up / sharp flanges

- 4.4.1 Toe radius build-up and sharp flanges should not exceed the limits in Part 6 of this document.

4.5 Wheelset back-to-back dimension

- 4.5.1 Back-to-back dimension should not exceed the limits defined in the relevant user's maintenance instructions – see 2.3.4.

4.6 Wheel diameter

- 4.6.1 Diameter and diameter differentials should not exceed the limits defined in the relevant user's maintenance instructions – see 2.3.4.

4.7 Wheel rim / tyre thickness

- 4.7.1 Wheel rim / tyre thickness should not exceed the limits defined in the relevant user's maintenance instructions – see 2.3.4. Gauges used to assess the wheel rim and tyre thickness are shown in Figures A.7 and A.6 of Appendix A.

4.8 Throat thickness

- 4.8.1 When applicable to a wheel, the throat thickness should not exceed the limits defined in the relevant user's maintenance instructions – see 2.3.4.

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4.9 Wheel tread roll-over

- 4.9.1 Wheel tread roll-over (Figures 2 and 17) should not exceed 5 mm from the outer face of the wheel. Any cracks or defects present in the roll-over should not extend into the tread or the rim face.



Figure 2 Photograph of tread roll-over

4.10 Tyre security

- 4.10.1 The tyre and retaining ring security should be maintained by the application of the requirements specified in IB/TP0001.

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Part 5 Guidance on Wheelset Gauging Principles

5.1 Gauging following re-profiling

- 5.1.1 Following re-profiling it should be ensured that the requirements of Part 3 of this document are met. As a minimum, compliance with the following should be demonstrated:
- a) Tread profile
 - b) Profile surface finish
 - c) Tread run out
 - d) Wheel wobble
 - e) Wheelset back-to-back
 - f) Wheel diameter.
- 5.1.2 Generally, the machine tools used to re-profile wheels produce highly repeatable results and therefore it is not mandatory to carry out a full inspection of every wheelset. Traditionally the gauges listed in Appendix A have been used at least at the start of each shift and immediately following the change of the master profile. The individual dimensions will control the profile alignment and it is not necessary to carry out a specific check for this. However, it may be convenient to use a profile alignment tool as it allows a number of checks to be carried out simultaneously.
- 5.1.3 More modern machines have their own in-built measuring system that prints the result out on the completion of turning and hence no gauging is required, although use of profile alignment tools would again provide a useful back check that the correct profile has been applied. However, it is the user's responsibility to ensure that whatever gauging system is used the requirements of Part 3 are met.
- 5.1.4 In addition to the traditional gauges or the integrated measuring system of a machine, there are many alternative systems available such as electronic profile measurement tools for checking tread profiles.
- 5.1.5 The user is free to use an alternative system providing it can be demonstrated to provide the required level of repeatability and accuracy and it is subject to a calibration that conforms to the requirements of BS EN ISO 10012.

5.2 Wheelset gauging and inspection of tread condition – in service examination

- 5.2.1 The requirements for gauging and measurement are in accordance with GM/RT2466. For the various vehicles they operate, the limits defined in the relevant user's maintenance instructions should be set to ensure that under normal wear conditions the tolerable criteria set in GM/RT2466 will not be exceeded between planned examinations.
- 5.2.2 Any gauging procedure used to measure the applicable tolerable criteria should be fit for purpose and capable of demonstrating the required level of accuracy and confidence in compliance (see Part 4).

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- 5.2.3 The areas of the tread profile to be assessed should include the following:
- a) Flange thickness and height
 - b) Toe radius build-up or sharp flange gauging
 - c) Wheel rim / tyre thickness
 - d) Wheel diameter
 - e) Throat thickness
 - f) Profile condition, tread damage, tread roll-over and other abnormal type of damage.
- 5.2.4 The user is free to choose their own system of control but all equipment should be subject to a certified calibration system. Potential methods of achieving this are described below:
- a) Using Go / No Go gauges as described Appendix A, but with revised dimensions to take into account operational environments together with the maintenance regime applied so as not to exceed the limits quoted in GM/RT2466.
 - b) Rather than using gauges, the user can make routine measurements to monitor the wear trends and take appropriate action to ensure that the limits are not exceeded. Suitable gauges for carrying this out are listed in Appendix A.
 - c) Use of suitably calibrated trackside/remote monitoring systems that measure wheel dimensions on a regular basis and allow trends to be established. These systems are to be used as an aid to data capture and analysis but manual inspection should still be carried out to confirm results. Examples of types of system that are currently available are given below:
 - i) Laser and camera, track side based systems that record the tread profile as the vehicle passes over them. The profile data are processed to determine the critical dimensions and carry out analysis to identify wear trends.
 - ii) Wheel out-of-round measurements can be made by use of an instrumented knife rail and bar that makes contact with the flange tip of the wheel. Variations in flange height due to out-of-round will produce measured displacements of the bar.
- 5.2.5 Instrumentation of the running rail can record impact loads produced by a wheel. High loads are indicative of wheel defects such as shelling or flats. Generally these systems are used to protect the infrastructure but also provide information that could be used to monitor wheel condition. The results of such systems are speed dependant together with the ramp effect of the surround of the defect. An oval wheel at relatively low speed may not be identified if the measuring equipment was sited on a slow road such as in a depot.