Managing Wheelsets
A Freight Operator’s perspective

Paul D Antcliff
Head of Technical Standards
April 2014
Agenda

- Introduction
- Start Point
- Wheelset / Axle Design
- Axle Bearings
- Verification
- Identification
- Documentation / Data
- Maintenance
- In Service Attention, Remote Condition Monitoring
Introduction

- Professional Head of Engineering
- Head of technical standards
- Nominated post as Entity in Charge of Maintenance for DB Schenker Rail fleet and some non DB Schenker owned fleets
- Responsible for the engineering elements of train operation
- 41 years railway service/experience: BR Eastern Region, Railway Technical Centre, Freight Operating company
- Consolidation of 3 x BR Freight Companies, Rail Express Systems and Railfreight Distribution – English Welsh & Scottish Railways

- 20,000 + wagons, “Heinz 57” varieties

- Multiplicity of axle designs and manufacture, including those having plain bearings

- Multiplicity of bearing designs, including types that were obsolete even at that time

- Multiplicity of maintenance and overhaul frequencies, work practices and content
- Introduction
- Start Point
- Wheelset / Axle Design
- Bearings
- Verification
- Identification
- Documentation / Data
- Maintenance
- In Service Attention, Remote Condition Monitoring
Axle design codes used:

- **European (UIC)**
  - UIC type A and B, including the requirement to have corrosion protection

- **AAR**
  - Lower working stress levels than BASS 504, unpainted
  - Use of just 2 axle designs (utilising class E, class F bearings)

- **BR BASS 504**
  - Migration to lower working stress levels than BASS 504, unpainted
    - ... however, minor increase in unsprung mass
  - Removal of non preferred design features (lack of raised wheelseats, black forged, plain bearing journals, etc)
  - Rationalisation of axle designs to just 6 types (TF25, Ø150 x2, Ø140 x3)
Wheelset / Axle Design

- **Wheel Design:**
  - UIC according to wheel diameter requirements (including thermally resistant wheel design)
  - AAR currently 3 types, with view to rationalising to 2
  - BR wheels
    - Rationalised to 6 types (TF25, Ø150/Ø140 x2, Ø140 x3)
    - No tyred or spoked wheels
    - Rationalised to 2x wheel mounted brake disc design (except for specific UIC type wheelsets)

- **Current wheelset population:**
  - 33,000 comprising:
    - TF25: 3.7%
    - UIC: 25.4%
    - BR: 33.5%
    - AAR: 37.4%
Axle Bearings

- Consolidation / rationalisation of axle bearing overhaul policy – and to be coincident with axle test requirements
- Removal of plain bearings
- Move towards cartridge bearing units where possible
- Adoption of improvements in seal design
- Adoption of polymer cages
- Adoption of recommended greases
- Possible modification of TBUs to remove front dust cover requirement (and would assist in “roll by” examination at train departure)
- Full bore adaptors used in BR long link suspension applications
Verification

- **Consolidation of Policy**

- **New manufacture, overhaul**
  - Impact Test
  - Ultrasonic Test to check opacity, internal defects, near end & high angle scan
  - Magnetic Particle Inspection
  - Phased Plane Eddy Current Testing
  - Back force proving tests at wheel assembly

- **Maintenance**
  - No in-service testing
  - No reason to remove axle bearing front dust cover, other than at reprofiling

- **Frequency of Subsequent Overhaul / testing**
  - Backstop position of 8 or 12 years according to wheel type, operation, unless requiring rewheel prior to this
  - Axle testing to be coincident with bearing overhaul
Identification

- **Simplification**

- **Axle Bearings**
  - Date of last maintenance attention painted on axle bearing front dust cover
  - White cross signifies defective

- **Wheelset**
  - Tag fitted to an axle bearing fastener, identifying wheelset catalogue No, wheelset No.
  - No tags or other materials permitted on axle body
  - Clear painted bands to indicate MPI, ECT
  - Red band signifies defective – and to be put to scrap

- **Records**
  - Maximo, which incorporates European Wagon Traceability (EWT)
  - Details also marked on the wagon
Documentation / Data

- **Simplified documentation and reporting requirements**
  - DBSR Safety Management System, in particular Engineering Section
  - Wheelset Manual
  - Wheelset Standards document
  - Maintenance Plans
  - Train examination document

- **Data / Return of Experience - Suppliers**
  - Reporting real time of any defects/damage found
  - Access to update Maximo records
  - Quarterly process (DBS/EP/0230) for suppliers to forward data to update DBSR database
  - Simple/immediate production of graphical data from database
  - Annual reports for axles and axle bearings

- **Data / Return of Experience – Maintenance Locations/Train Examination**
  - Maintenance data forwarded to nominated persons
  - Data from train examination downloaded on daily basis into DBSR database

- **Wheelset Record Database**
  - Maximo (incorporating EWT)
### Bearing type 2 (AAR 6x11)

<table>
<thead>
<tr>
<th>Total inspected</th>
<th>Pass</th>
<th>Fail</th>
<th>Failure by type</th>
<th>Overall failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1641</td>
<td>1388</td>
<td>253</td>
<td>15%</td>
<td>16%</td>
</tr>
</tbody>
</table>

![Graph showing rejected bearings by defect code]

- The graph illustrates the number of rejected bearings by defect code.
- The total number of inspected bearings is 1641.
- Out of these, 1388 bearings passed, and 253 bearings failed.
- The overall failure rate is 16%.
- Failure by type shows that 15% of the failures are of a specific type.
Maintenance

- **Simplified**
  - Standardised throughout all maintenance plans
  - Bearing overhaul time backstop and wheelset overhaul are coincident

- **New Manufacture / Overhaul**
  - Reduced to a single document, containing all requirements except for proprietary details
  - Simplified to only that that is required

- **Maintenance**
  - Contained within the maintenance plan and the few associated DBSR documents
  - Simplified and concise as to what is required and when, and at the lowest level possible (ie, no need for removal of axle bearing front dust covers, etc)
  - European Visual Inspection Criteria (EVIC) applied every 4 years
  - Rationalised painting requirements
  - Includes repcoding
  - Includes actions following RCM interventions / received data
  - Access to Maximo database (to update, to view vehicle / wheelset data)
  - Introduction of digital gauging to (a) check for issues and (b) plan wheelset repcoding / rewheeling
- Introduction
- Start Point
- Wheelset / Axle Design
- Axle Bearings
- Verification
- Identification
- Documentation / Data
- Maintenance
- In Service Attention, Remote Condition Monitoring
In Service Attention, Remote Condition Monitoring

- Simplified document and rules for train examination

- Data from Network Rail’s Hot Axle Box Detector, Wheel Impact Load Detector Sites
  - Real time intervention
  - Off-line data
  - In the process of simplifying to single point of contact
  - Simplified intervention limits introduced
Managing Wheelsets - A Freight Operator’s perspective

In summary

1. Need to set a clear, long term strategy with specific identifiable goals (which may change as opportunities arise)

2. Understand what is / is not achievable, ie, reality check – move forward in manageable chunks

3. Cannot be achieved without help from all involved

4. Embrace and identify new technology as opportunities are presented

5. Return of Experience is a must to validate and understand issues