Tram-train in the UK?

INCOSE
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Network Rail

What is a tram train?

- "*a light rail vehicle capable of operating on a street tramway and a conventional railway*"

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What is tram train?

- A combination of train qualities in a tram
- through inner city streets
  - boarding at street level
- on main railway track
  - Mixing with heavy rail traffic
- Karlsruhe-model

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Development in Europe

- 1961 – Conversion of Albtalbahn narrow gauge to tramway, Karlsruhe
- 1991- Bretten line converted to tram train, Karlsruhe
- 1991-2008 – Expansion of Karlsruhe network to over 500km
- 1990s – Expansion in Germany – Saarbrucken, Kassel, Zwickau
- 2000 onwards – Netherlands , France
  - RandstadtRail, Gouda, Paris, Mulhouse, Lyon and more
- All dual voltage electric except Kassel – Diesel/electric trams and Zwickau – diesel DMUs

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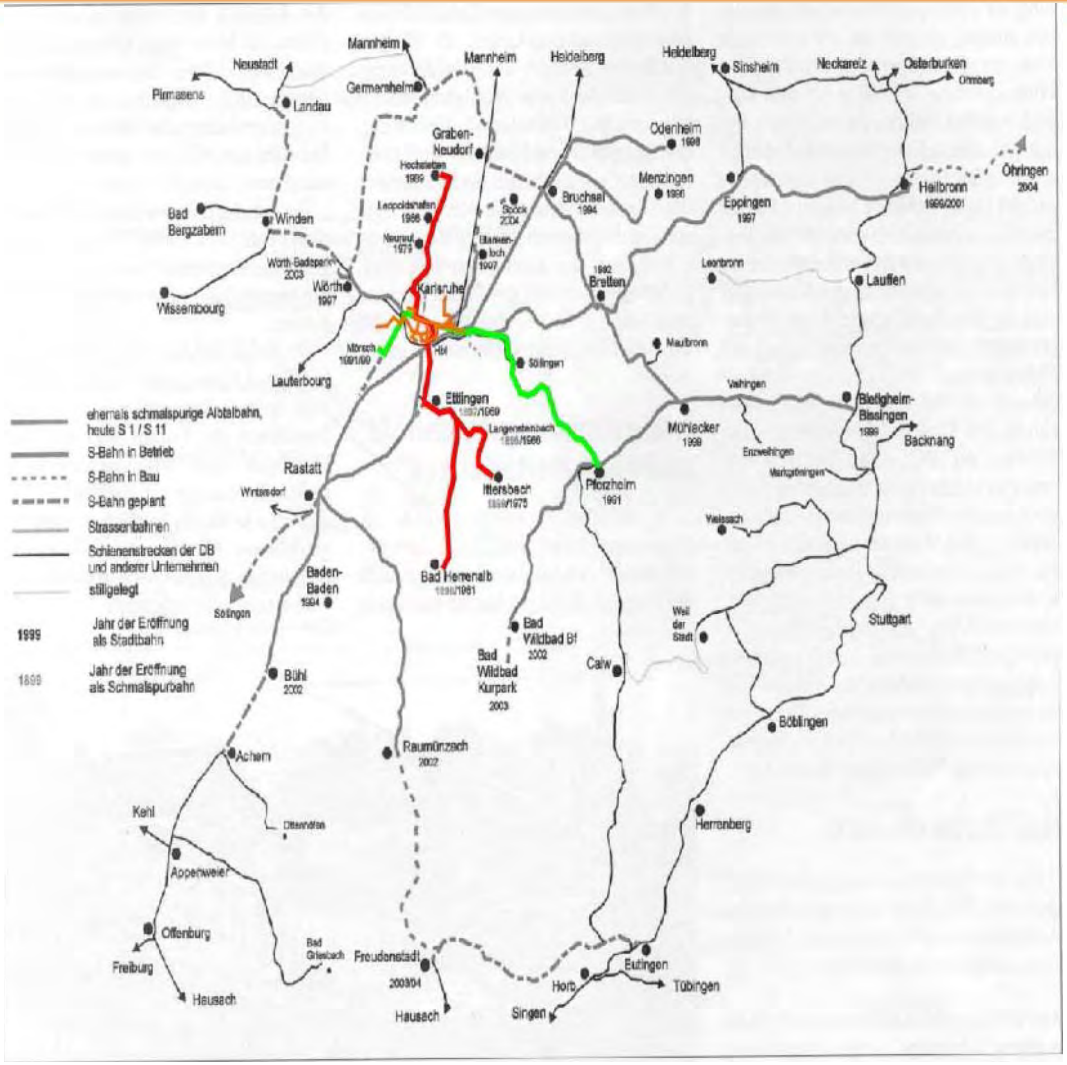
Development of the Tram-train network in Karlsruhe, Germany.

1991



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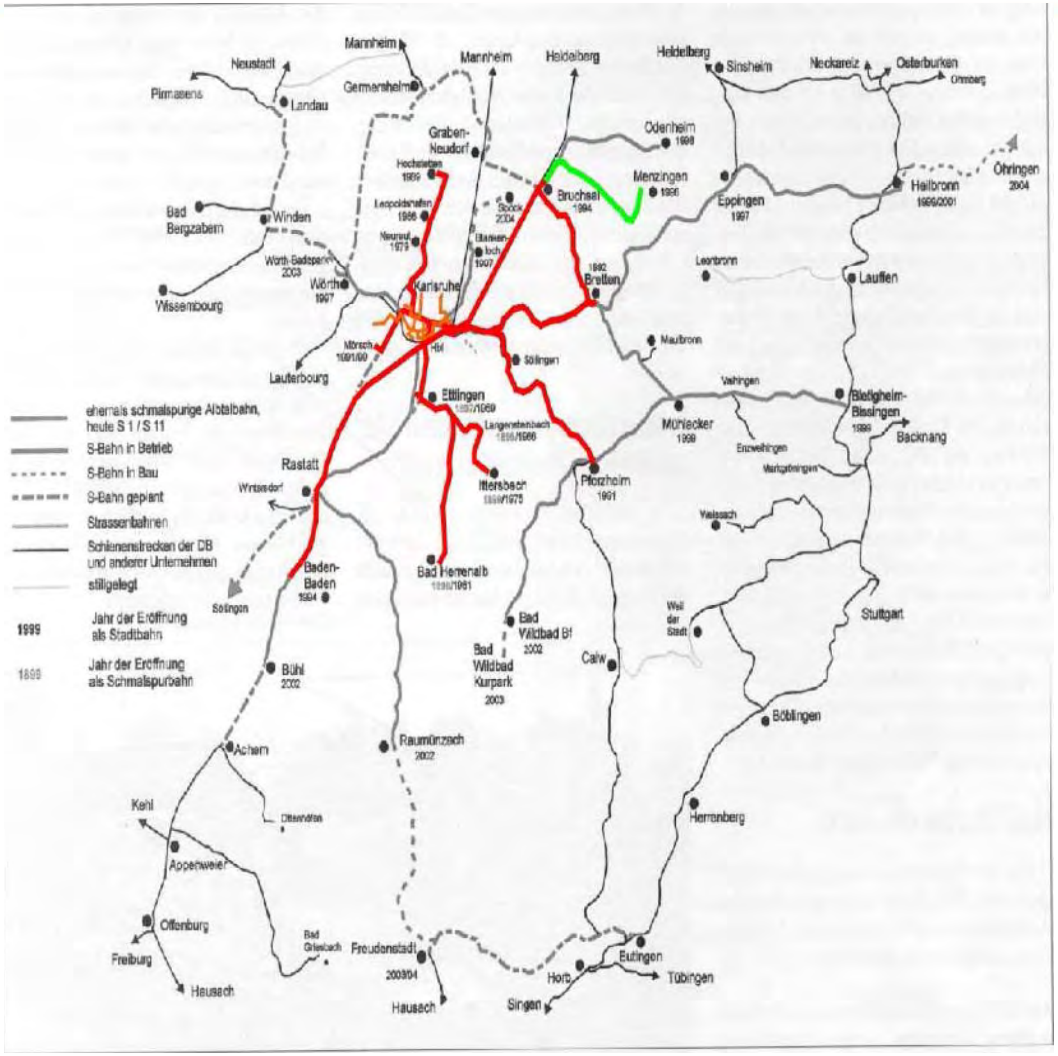
Development of the Tram-train network in Karlsruhe, Germany.

1996



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Development of the Tram-train network in Karlsruhe, Germany.

2003-
2007

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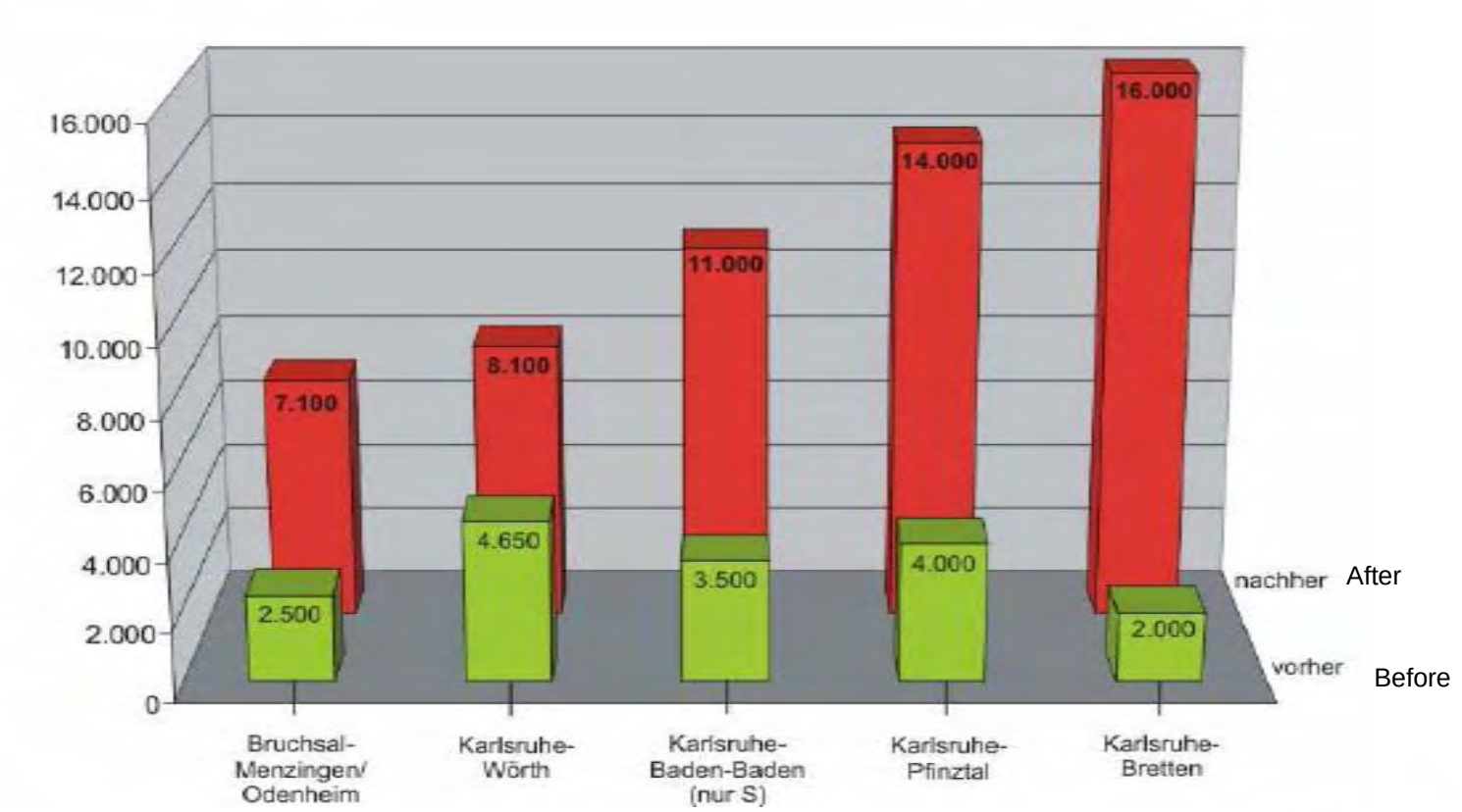
Karlsruhe growth 1992 - 2003



Passengers / day

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Short film

A UK tram-train trial

Objectives

1. Understand the changes to industry costs of operating a lighter weight vehicle with track brakes on the national rail network
2. Determine changes to technical standards required both to allow inter-running of light weight tram vehicles with heavy rail passenger and freight traffic and to gain the maximum cost benefit from tram-train operation
3. Gauge passenger perception and acceptance of light rail tram-train services
4. Determine the practical and operational issues of extending tram-trains from the national rail network to on-street running

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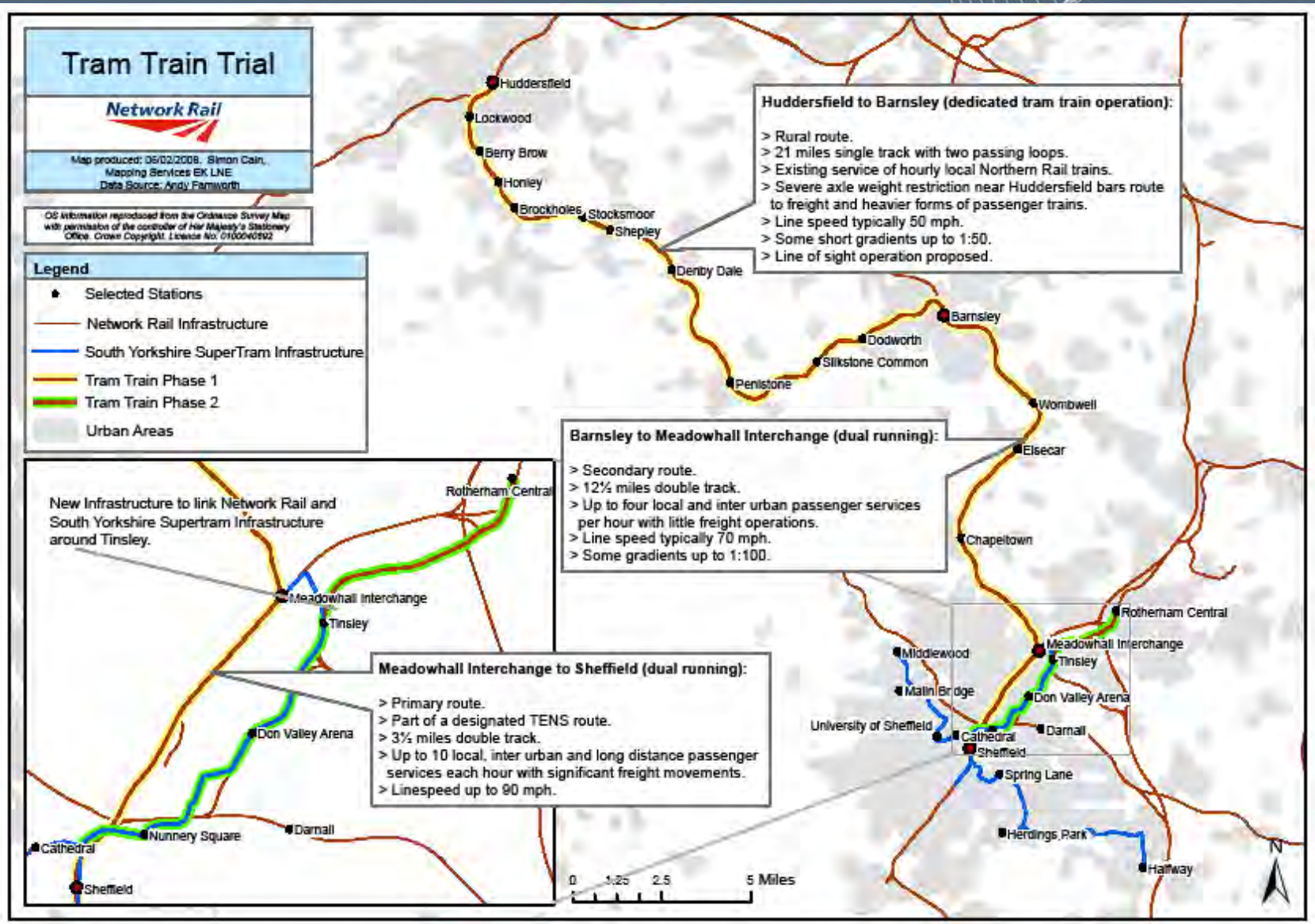
Tram-train trial route selection



The challenges posed by light rail operating in a heavy rail environment – system issues

- **lighter car body construction**
  - does not comply with requirements railway rolling stock
- **low weight**
  - Light rail vehicle detection experience
- **low floor**
  - High platforms (915mm)
- **small wheels, increased back to back**
  - risk derailment in switches and crossings
  - Risk of derailment on curves
- **Operation**
  - Road to timetabled rail

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Lighter car body construction

- **problem**: strength car body for a light rail vehicle is 40% of requirement railway rolling stock
  - increased risk casualties during collision
- **typical mitigation**: better train protection
  - Dutch fitted (ATB) automatic train protection system monitors drivers action, automatic emergency brake
  - Tram-train trial is planning to fit TPWS
  - Use of track brake at level crossings
  - integral safety plan using a risk based approach

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Low weight

- **problem**: insufficient electrical contact between wheel and rail (“loss of shunt”) due to low weight
  - failing vehicle detection by “track-circuits”
    - not working level-crossing warning installations (barriers/warning lights/bells)
    - conflicting train movements
- **typical mitigation**: train detection independent of electrical contact
  - application of axle-counters
  - experience of operating TI21
  - Track circuit actuators

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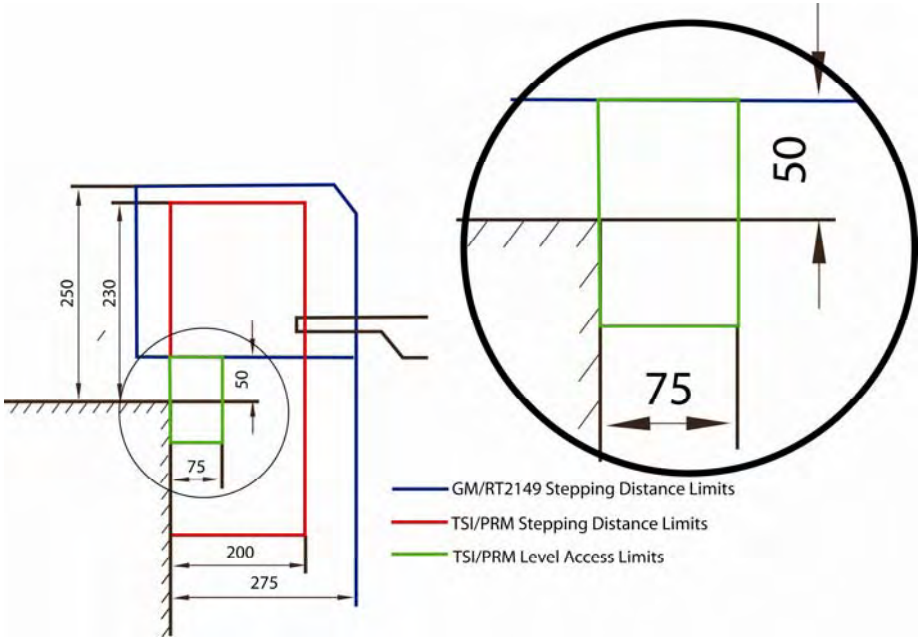
low floor

- **problem**: existing platforms are too high
- **Typical mitigation**: build low platforms closer to track
  - lower existing high platforms
  - provide opposite existing platforms
  - extension of lateral platform
  - alongside track without existing platform

low floor and level access

- Group Standards
- EU Interoperability
- 4’ fencing



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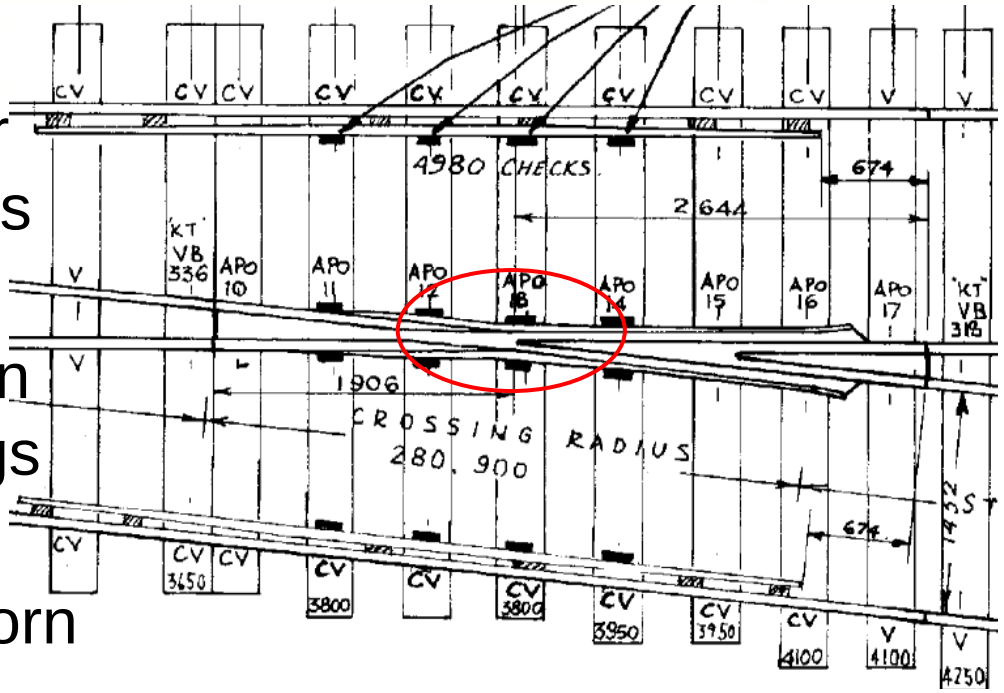
Wheel rail interface

- **problem**: wheels smaller than railway requirements
  - derailment risk due to insufficient guidance in switches and crossings
- **mitigation**: review of tolerances in new and worn situation
- **measure**: reducing groove width of frog in new situation



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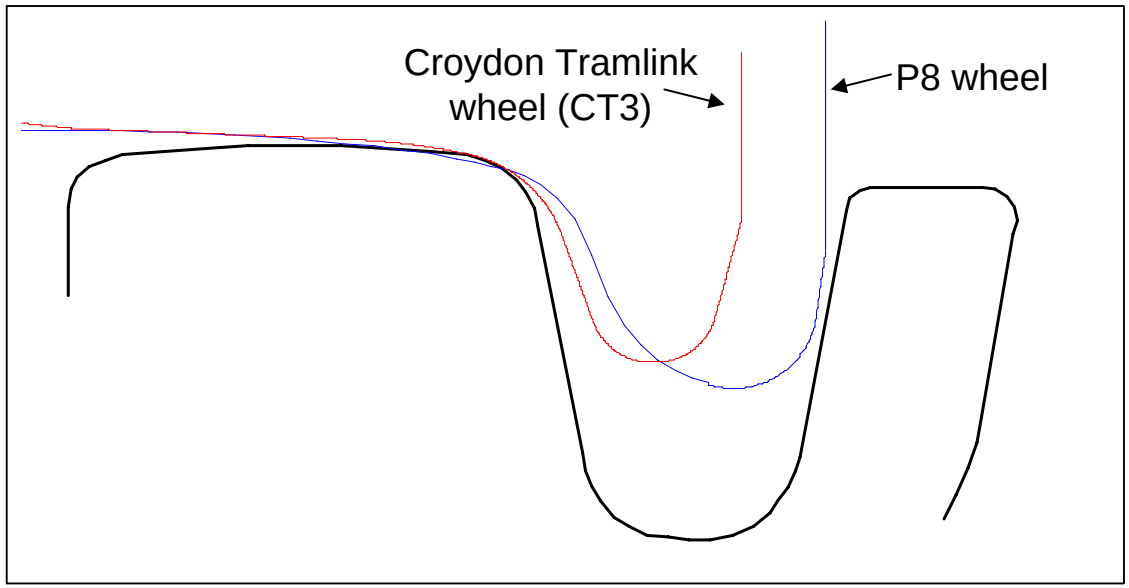
Wheel/rail differences

- **Problem**: Tram requirements are different from ‘heavy rail’:
  - Thinner flanges (wider flange ‘back-to-back’ dimensions) for running on grooved rail
  - Shallower flange heights/shapes for grooved rail and flange tip running



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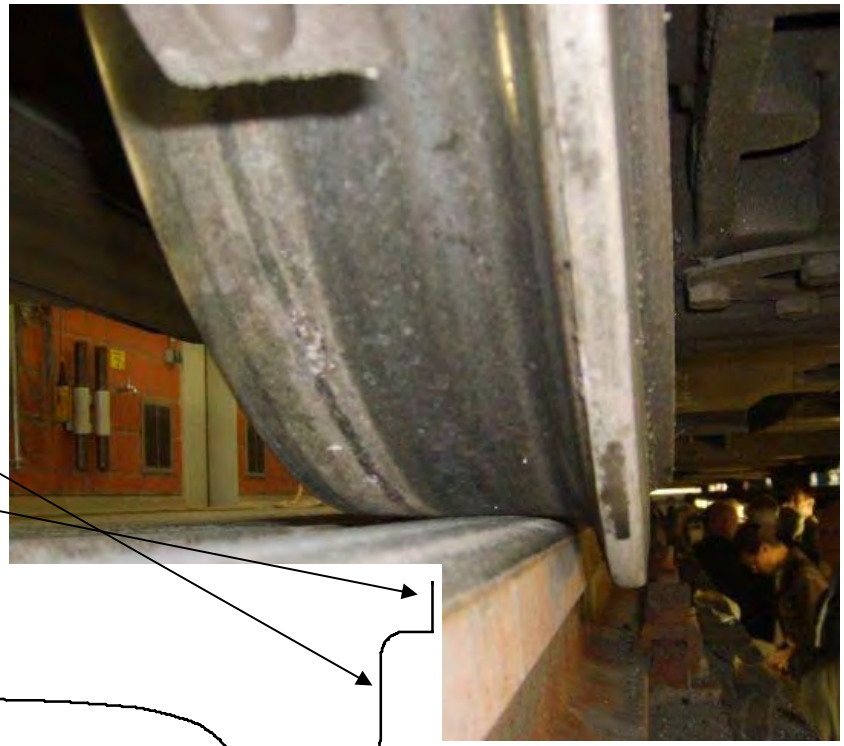
Tram train wheelset characteristics

- **mitigation**: European rail systems use raised check rails on curves and S&C
- Tram train wheel profiles have a ‘stepped’ flangeback to give 2 back-to-back dimensions
  - 1380mm at running rail height
  - 1360 at check rail height



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UK specific mitigation

- Absence of raised check rails means that a stepped flange back cannot be used (unless we fit them)
- Possible solutions for trial
  - Use a P8 wheel profile
    - Does not test true tram train operation- still only a train, just shaped like a tram (from a WRI perspective)
  - Use a tram wheel profile, but use a 1360mm back-to back
    - Still does not test tram train operation- looks a bit more like a tram
    - Would test curving performance & wear of profile
    - Restricted to operation on NR infrastructure, could not run ‘on street’
  - Use a tram or tram train wheel profile with a 1380mm back-to-back
    - True tram train operation
    - But
      - Would it be possible to operate without raised check rails (particularly S&C)?
      - Are there solutions apart from raised check rails?
      - What are the risks of operation with wider back-to-back spacing, and what would need to be done to gain approval?

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Organisational and legal system issues associated with Phase II

- Who owns the infrastructure?
- Who owns the vehicles?
- Who manages the reconstruction?
- Who is responsible for safety?
- Can operations of train and light rail be mixed?
- Who pays for it all?
- Who takes the political responsibility?

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Outputs

- Risk analysis of tram train operation
  - Acceptable crash worthiness
  - Acceptable train detection system
  - Acceptable wheel profile
- Standards for tram train operation established with UK Tram and ORR (HMRI)
- Benefits of tram train operation quantified to inform promoters of tram train schemes
- Guidelines on the suitability of tram train for potential applications produced

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