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Trams – buses on rails?

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Journey Planner

Leave now

- What does the saying ‘buses on rails’ really mean?
- Our journey developing and delivering the tram management system for MML
- What can we draw from our experience?

Estimated journey time: 20 mins

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On-street:

On-street Segregated:

Off-street:

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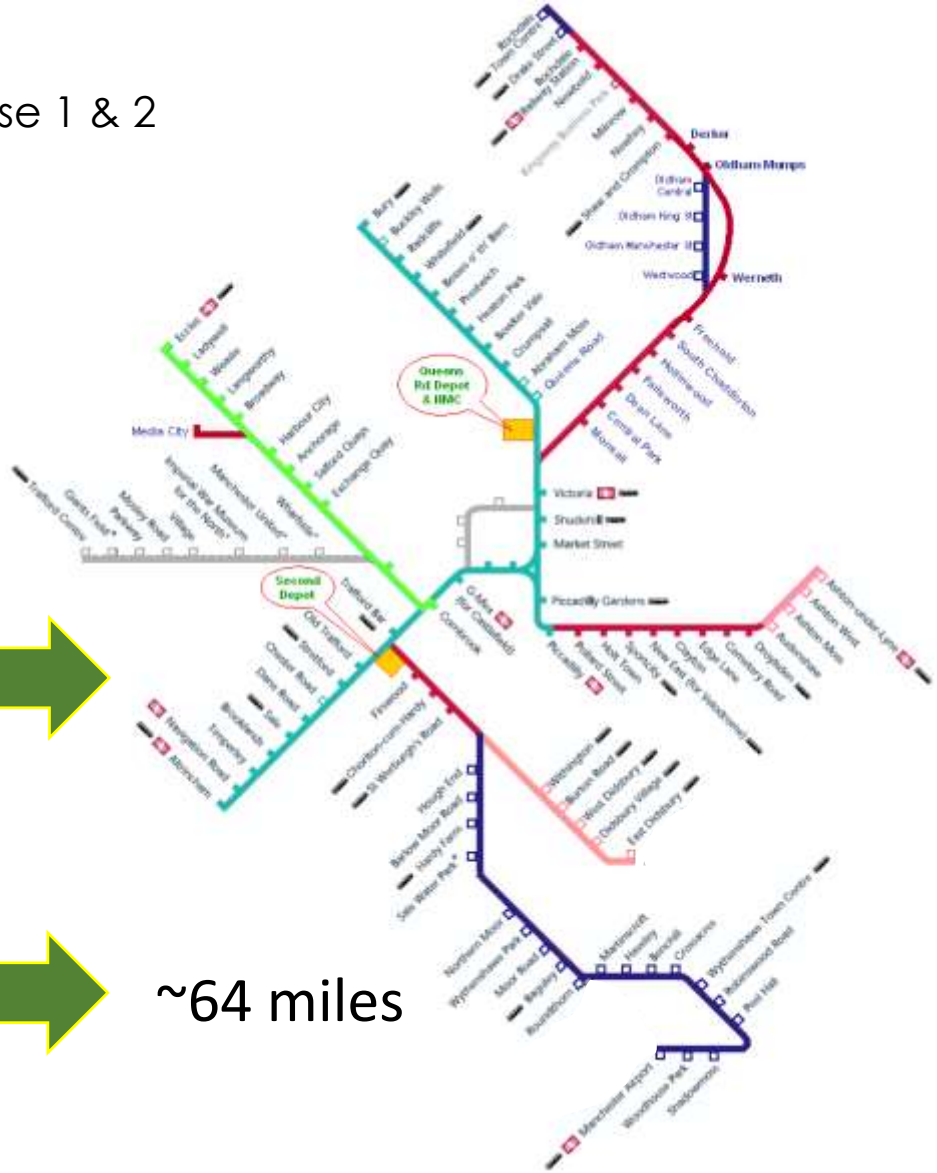
- MML Tram Management System (TMS) supplied to migrate the existing Phase 1 & 2 Network to Line of Sight Operation and support the Phase 3 Expansion



~24miles

~64 miles

Don't worry …
Its much more complicated than it looks !

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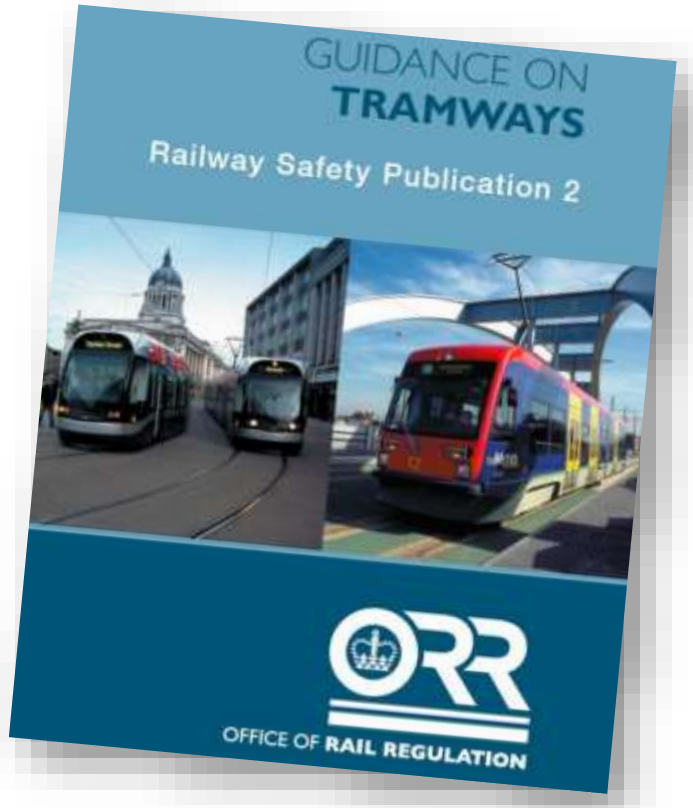
- **TMS in the Early Stages was perceived as *'Line Of Sight System'***
- RSP2 provided clear guidance for On-Street (Now superceded by LRSSB)
- *'Line-of-sight driving should be used on all on-street tramways. In this mode, a tram should be able to stop before a reasonably visible stationary obstruction with the service brake…'*
- Line of Sight was deemed the Primary Mitigation for most hazards
- On-street drivers used to expecting the unexpected – vigilance is high
- However, the expansion increasingly covered "Off-Street" of former heavy rail lines
- Little or no guidance for 'Off-Street'
- *'Where a tramway operates on a segregated right of way, any signalling may be similar to that used on a mainline railway.'*



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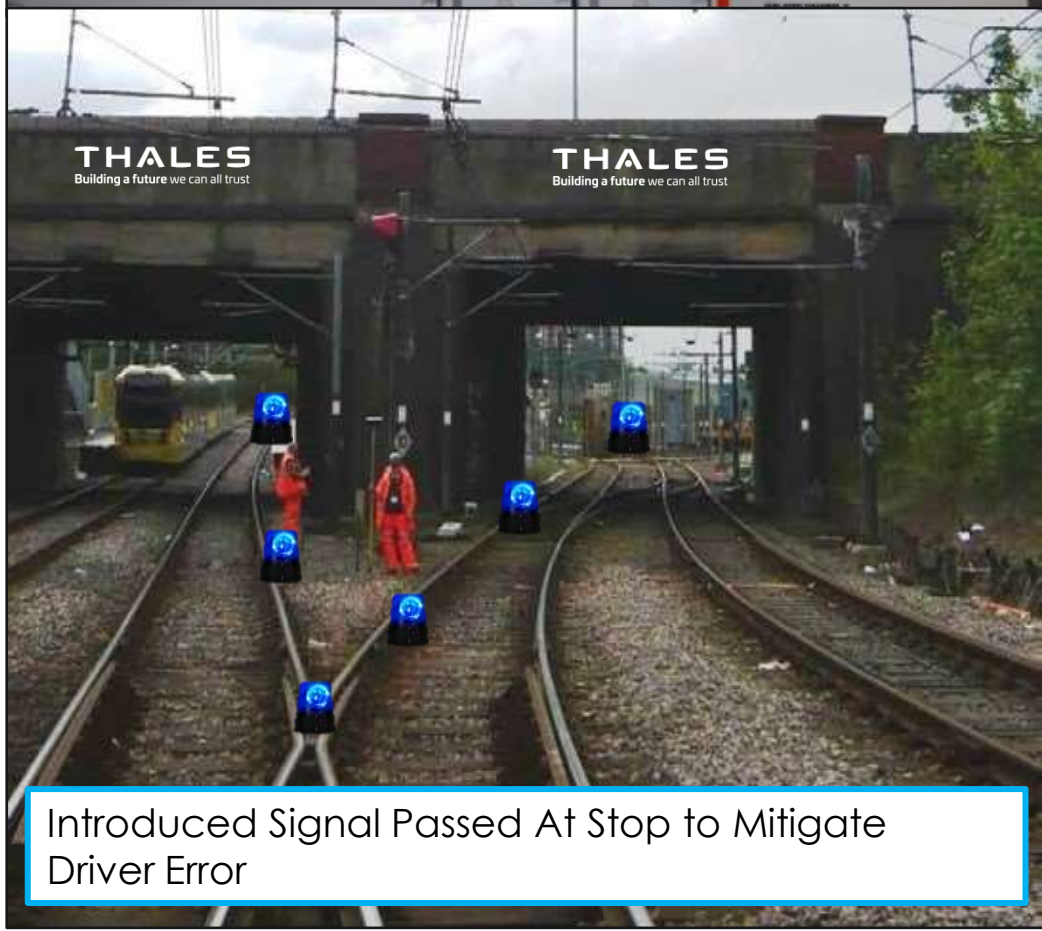
By the Mid-Stages the new challenges we faced comprised:

- High Throughput Requirements / High Speed Approaches
- Limited / Poor Sight Lines
- Heavy Rail Infrastructure

We recognised the following:

- Line of Sight not a complete mitigation for all hazards Off-Street at High Speeds
- The need to take account of human errors – loss of situational awareness etc
- The difference of driving Off-Street at Higher Speeds on heavy rail infrastructure – perceived vigilance
- Deployed additional mitigations against Human and System Error
- **TMS by the Mid-Stages was moving towards a System Safely Supporting a 'Line Of Sight System'**

Introduced GuardLogix…
Independent Conflict Monitoring to Mitigate Conflicting Routes/Signals/Points



Introduced Signal Passed At Stop to Mitigate Driver Error

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In the Later Stages we identified a system deficiency during testing, instigated a review of the System Design in the context of the **Hazards**

For tram, particularly off-street, what are the Hazards and what Safety Integrity Level (SIL) should they be mitigated to?

We recognised the need to provide a "System" that Safely supports a **"Line of Sight Operation"**, not just a **"Line of Sight System"** – subtle but important

In the absence of standards and guidance for Off-Street Tram Signalling, we instigated a process to determine the Signalling Functions and associated SIL.

We still rely on the Driver to mitigate hazards through LoS particularly on-street, but the system provides safety functions mitigate hazards consistently On and Off-street

By the Later stages we had fully recognised the need to provide additional mitigations beyond LoS delivered to their determined level of Safety Integrity

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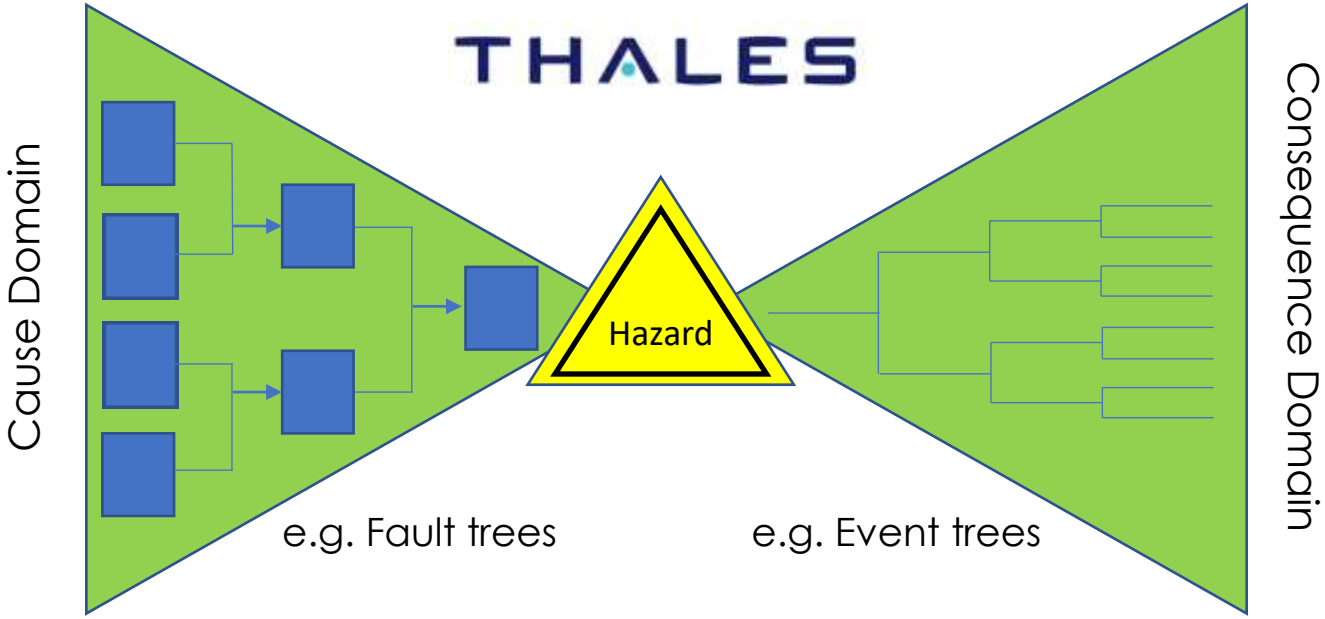
Identify, understand and manage the hazards



A system that safely supports the line of sight operating principle, taking account of the:

- Potential for human error
- Speed factor
- Functions relied upon for safety

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Thank you!

martin.smart@urbanandmainlines.com
sam.daw@urbanandmainlines.com

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