High Output Tunnel Repairs and Enlargement

What is the situation?

fig. 1

Access time for inspection and repair is reducing as railway passenger and freight traffic continues to rise.

The current forecast for 2030 is 34% increase in passenger traffic and 40% increase in freight traffic compared to a 2005 baseline. Reduced possession availability to accomplish tunnel remediation will result in more extensive time, cost consuming and complex repairs as assets get older.

Replacement of tunnels is uneconomical. Our current policy is to maintain the tunnels for continued serviceability. In view of this, the proactive and effective maintenance and upgrading of these structures to extend service life are seen as a major priority to facilitate the UK and Europe's rail transport ambitions.

To appropriately manage the risks associated with tunnel assets, it will be necessary to develop new repairing, strengthening and upgrading methods which cause less traffic disturbance. Fast installation is required due to short track access time.

Current repair methods and access arrangements aren't appropriate to meet predicted railway use. Furthermore, gauge constraints within tunnels prohibit line speed improvements, gauge enhancement and electrification projects; and the necessity for tunnel enlargement is growing to allow future increases in railway utilisation.

fig. 2

Priority problems

Specific priority problems

- Insufficient access to maintain the tunnels at a sustainable rate to maintain serviceability and safety.
- Current repair methods are becoming inadequate given high rate of degradation of tunnel assets.
- Low achievable volumes of maintenance.
- Linespeed improvements, electrification and gauge enhancement requirements for larger bores.

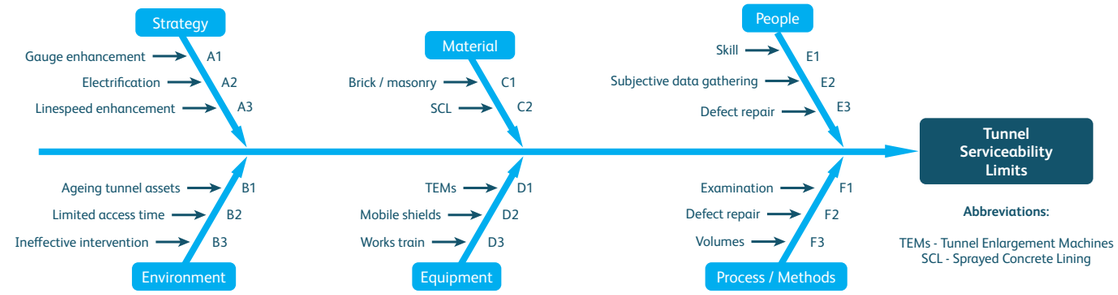
Related goals

- Equipment to maintain adjacent line open, therefore higher repair outputs can be achieved.
- More advanced repair materials delivered through mechanised means.
- High output tunnel repair methods.
- Tunnel enlargement machines that enable tunnel enlargement that support the higher track utilisation in the future.

Benefits

- Reduced railway disruption during maintenance work.
- Sustainability with maintaining tunnel condition i.e. required level of serviceability as the assets age.
- Reduced overall cost of repair per square metre.
- Reduced railway disruption during work by implementing tunnel-in-tunnel concept. Compliance with technical specifications for interoperability for Interoperability. In line with our strategy streams.

Analysis of causes



Scope

Staged methods with minimum disturbance to traffic must be developed for the replacement and strengthening of tunnel linings. Additionally, a concept based on mechanisation, with whole tunnel improvement should be developed. The method should allow trains to run, following a tunnel-in-tunnel method for improvement works or adjacent line open for maintenance works. These would allow 24hour work time, as traffic is protected from work zones. The improvement works would focus on the replacement of original lining.

Specific research needs

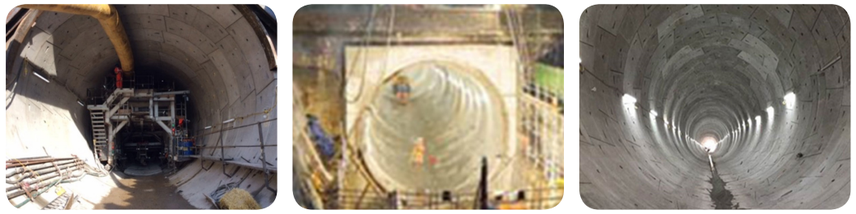
To address these challenges it is expected that R&D actions will need to address the following aspects:

- How can tunnel relining be carried out with minimum impact to rail traffic, taking into account the need for a continuous power supply to train traffic from both overhead and 3rd rail?
- What alternative method of gauge enhancement and tunnel lining replacement could be implemented to arrest condition of an ageing and degrading asset?
- How can large scale maintenance to brick lined tunnels be carried out, whilst having the minimum impact to services?

Expected impact & benefits

- Tunnel linings replacement can be programmed to arrest the degradation of an ageing asset.
- Allows tunnel re-lining to be carried out without the need for long blockades.
- Reduces the need for emergency access to the railway for urgent defect repairs, avoiding impact to services.
- Less water ingress that causes defects to other asset types, e.g. OLE and track.

Farnworth Tunnel
Open face tunnelling, long blockade required.



Tunnel Enlargement Machines
Tunnel-in-tunnel concept, maintain railway operation.