Tenanted Arches

What is the situation?

Access problems combined with the difficulty of examining elevated railway structure elements, mean that many of the inherent risks of tenanted arches across the rail network are unknown and unquantified.

Inspection access to tenanted arches is often limited as past contracts didn't include access requirements. The arches are often lined to provide adequate conditions tenants, but the lining conceals the structural elements and any possible defects. Consequently, the lining needs to be temporarily removed for examination.

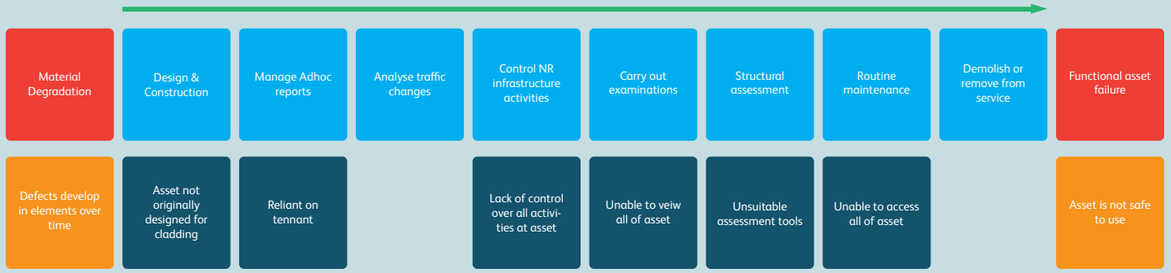
10,425 tenanted arches in structures portfolio

Assessment tools developed in 1970's calculate capacity based on Ultimate Limit State (ULS), whereas modern thinking believes Service Limit State (SLS) could be more relevant to the management and service life of masonry arches.

fig. 1

fig. 2

Analysis of causes



Priority problems

Specific priority problems

- Assets not originally design for cladding.
- Unable to view all of asset .
- Unable to access structure.
- Size of issue not truly understood.
- Tenant safety.
- Understanding of masonry arch capability.
- Moisture / damp degrading masonry / mortar.

Related goals

- Remote monitoring.
- Reduced number of defects by slowing or preventing material degradation.
- Inspection with-out removing cladding.
- Protection of tenant.
- Improved understanding of masonry arch behaviour.

Benefits

- Don't need to access arches for inspections.
- Reduced need for maintenance.
- Improved neighbour relations.
- Improved safety of tenants.
- Safer running of trains.

Scope

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

- Remote condition monitoring: Any technology installed during an arch refurbishment will need to identify defects with the same accuracy as the intrusive, cladding-removal method that we use today.
- Technology that can restore or improve the condition and capability of an arch. This solution should be cost-effective, compared with an intrusive examination, but also deliver a high degree of confidence that its use will reduce the volume and number of defects to measurable levels.
- Hidden inspection techniques: A solution that can detect defects in masonry without the need to remove cladding. Any technology identified or developed must identify defects with the same accuracy as current methods, where cladding has been removed.
- Improved detection of defects, and a better understanding of the deterioration and impact of masonry defects. Identify or develop a technology that detects masonry defects earlier in their development. To do this we need a better understanding of how masonry deteriorates and also knowledge of the turning-point at which the level of risk from the defect is no longer acceptable.
- The development of a standard design to Line systems that form a protective barrier. This design solution must take account other T&I developments as any protective barrier solution will also block access to perform maintenance and repairs to the arch face.
- Development of an improved masonry arch assessment tool to understand the impact of defects and condition on asset capability.

Expected impact & benefits

Primary Benefit

- Reduction in the risk profile of tenanted masonry arch structures to both the occupying tenants and the railway.

SecondaryBenefits

- Improved tenant relationships.
- Reduction in examination cost.
- Reduction in examination non-compliance on tenanted arches.
- Improved asset management of masonry arches, possibly including increased capability.
- Development of improved examination process for use on all masonry assets.