Self-maintaining Materials

What is the situation?

Network Rail owns a wide variety of buildings and structures that are in an ageing state, in need of regular remediation works to keep them in use.

As the assets weather over time, the structural capability can decrease as the materials corrode. In order to counter this, repairs are carried out to ensure that the existing structure stays in its serviceable state and allow the railway to continue performing.

At present there is an increasing demand for the use of these assets and a reduction in the availability of access to maintain these buildings. Although current repair methods are satisfactory and meet the requirements, there is a need to review the way in which we attempt these repairs in order to meet the demands of the future.

The future railway shows an increased capacity with an ever reducing opportunity for possessions and therefore access to the railway for repairs and maintenance. As the working dynamic changes, we must adapt our approach with more innovative ways in which we, as a company, can develop our processes to match this changing landscape.

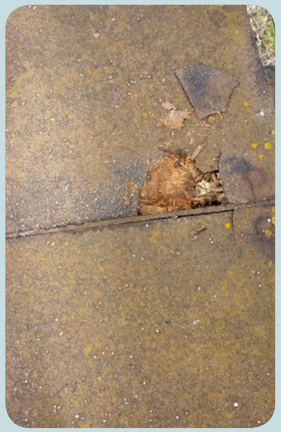


fig. 1

fig. 2

fig. 3

Priority problems

Specific priority problems

- Cracking in materials which degrade the structural capacity of the critical assets.
- Engineers are given less access time to repair structures and buildings.
- People are put in danger by working lineside or at height.
- Faults in surfaces are the largest problem area that Network Rail faces at present.

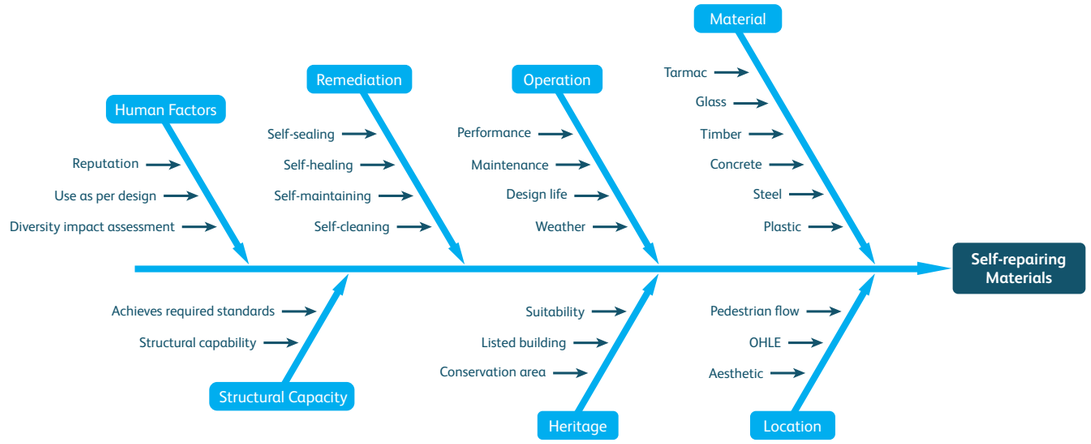
Related goals

- Reduce the number of repairs that require engineer intervention.
- Reduce the materials needed for repairs.
- Reduce the time and effort required to repair assets.

Benefits

- Reduce the amount of time internal structural elements are exposed.
- Reduction in volume of material created, therefore environmental benefit.
- Increase in time between repairs.
- Reduction in material cost for repairs.
- Reduction in working time on repairs.

Analysis of causes



Scope

The scope is to create and demonstrate the use of materials that can be implemented safely within the buildings and architecture portfolio, by non-specialised workers, which will maintain or improve the structural capacity and/or the serviceable state of the building, whilst having the ability to repair itself without the need for intervention or remediation works.

The new repair methods should allow for a similar or reduced volume of materials required whilst maintaining the same structural capacity.

Within Network Rail there are many assets that are gradually reaching their life expiry and there is a real appetite to explore any technologies which could be retrofitted to allow the assets to self-maintain, bringing them into the 21st Century.

Specific research needs

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

- What innovative material solutions can be provided in order to reduce the need for preventative remediation works to take place on structures? And how this can be applied to the existing infrastructure?
- The research should look into different materials, and how each of them can be maintained or healed without the need for intervention.
    1. Concrete – beams that support loads with cracks in them.
    2. Timber – cracking timber struts.
    3. Platform surfaces – cracked/pot holed tarmacked surfaces.
    4. Steel – exposed steel columns.
- What are the repair solutions for the various different proposals and how strong will these be post self-repair?
- Is there a retrofit piece of technology to go on our existing infrastructure that would be able to implement the self-maintaining infrastructure to increase the asset life?
- Explore the various materials and how they can be self-cleaned at a variety of angles and inclinations without extra work required.