Provide a Safe and Efficient Method to Enable Non-destructive Testing of Hidden Metallic Standalone Column

NetworkRail

What is the situation?

Network Rail's headline Business Critical Rules are 'Loss of safe environment' and 'Objects falling from height leading to injury'. These incidents occur at least once a period.

Following a spate of lighting columns failures an additional round of surveys were undertaken in 2015/16.

The findings showed that visual inspections are sufficiently robust so as to identify non-examined or hidden elements, but they do not address the necessary follow up explorations. Currently, these activities are undertaken through excavation and exposure of the hidden part.

Typical hidden inspection issues include, but are not limited to;

- Poor visibility and generally a lack of detail.
- Defect can not been seen.
- Limited ways to apply a condition marking index based on quantitative measures.

fig. 1

fig. 2

The problems with access solutions are:

- Volume of columns. i.e. 70,000 of them to inspect.
- Prioritisation.
- Control of additional paraphernalia that are added to the columns, i.e. signage, PA systems, plant pots.
- Undertaken in operational station environment.

fig. 3

Priority problems

Specific priority problems

- Safe methodology to ascertain appropriate condition data of lighting columns to reduce safety risks for the workforce and the public.
- To enable short, medium and long term asset management decisions through accurate data analysis and intelligence.
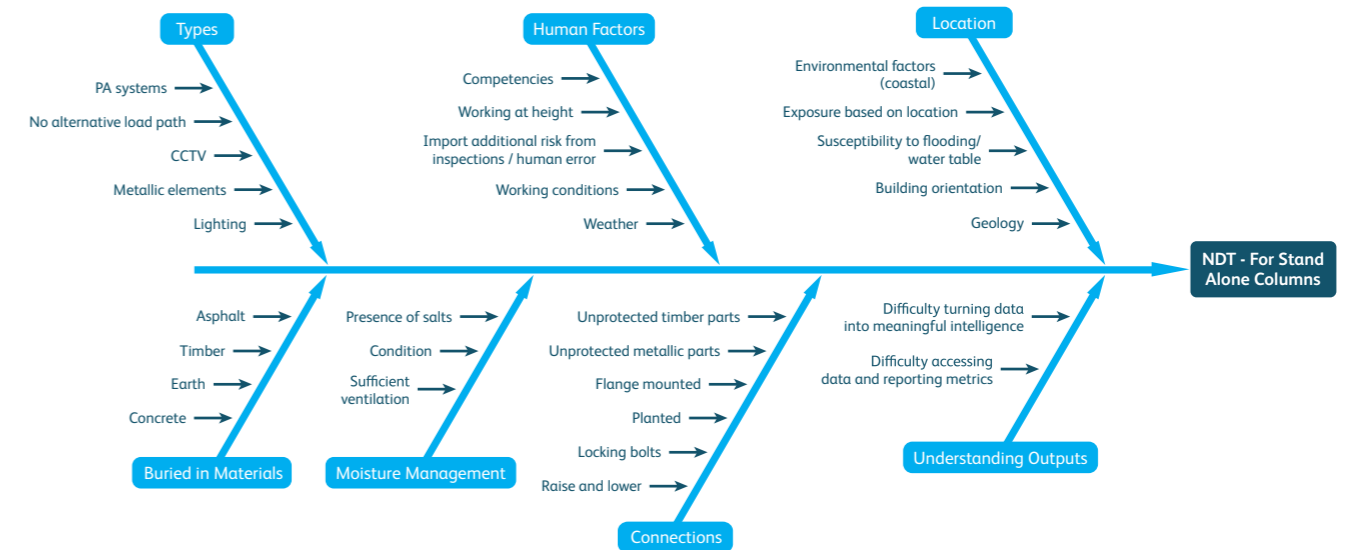
Related goals

- To inspect 50 % of assets with automated technology by CP7.
- To access all assets in order to collect the service and structural condition; whether physically or remotely by CP7.

Benefits

- Safe and efficient inspections / monitoring activities will help to complete the asset inventory and capture the status of the asset.
- Timely and effective inspections will help to reduce the number of failures thus improving the safety of the network.

Analysis of causes

Types
- PA systems
- No alternative load path
- CCTV
- Metallic elements
- Lighting

Human Factors
- Competencies
- Working at height
- Import additional risk from inspections / human error
- Working conditions
- Weather

Location
- Environmental factors (coastal)
- Exposure based on location
- Susceptibility to flooding/water table
- Building orientation
- Geology

Buried in Materials
- Asphalt
- Timber
- Earth
- Concrete

Moisture Management
- Presence of salts
- Condition
- Sufficient ventilation

Connections
- Unprotected timber parts
- Unprotected metallic parts
- Flange mounted
- Planted
- Locking bolts
- Raise and lower

Understanding Outputs
- Difficulty turning data into meaningful intelligence
- Difficulty accessing data and reporting metrics

NDT - For Stand Alone Columns

Specific research needs

The research needs to consider:

- Difficulty to inspect and to detect cracks, movement and deflection.
- How to inspect the hidden and inaccessible parts.
- How to inspect while a station is operational and in daylight.
- How to communicate the findings effectively to both technical experts and laypersons.
- A predictive tool to specify an ongoing risk based inspection regime.

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

Lack of safe methodologies to inspect

- Remote condition monitoring and early warning detection of asset failure is required for lighting columns. How can we identify what is normal and abnormal within lighting columns?
- How do other asset owners monitor their assets? Can we adopt any effective methods or techniques from other industries?
- What are the common failure modes for particular material types? What are the risks for these failure modes?
- Are there remote (hands off proxy) methods for collecting data? Is there something already available in other industries that we can implement?

Insufficient decision support tools

- How do we implement an asset risk register relating to extreme weather; based on location, asset condition and criticality?
- How can the findings be easily and clearly communicated to surveyors and Asset Engineers and give time-framed action recommendations?
- How can both new and current processes be managed better with decision support tools? What is required to develop a live bottom-up work-bank tool and how would this integrate with existing systems? How can intervention scenarios be modelled in order to support business planning?

Output Vision

- An inspection methodology and reporting solution that will allow Network Rail to fully understand the condition of its lighting columns with maximum safety, minimum cost and minimum disruption. The output should enable surveyors and Asset Engineers to clearly and easily understand the condition and enable them to make time framed decisions.