

OR/14/001 About the corroded asset failure - ferrous map

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Dearden, R A, Tye, A M and Marchant, A. 2013. User Guide for the corroded Asset failure. *British Geological Survey Internal Report*, OR/14/001.

Background

Underground ferrous assets are structures in the ground that contain iron, such as foundations, cabling and gas, water and oil pipelines. The failure of underground assets is a significant problem for both historical and newly placed underground infrastructure. The term 'failure' covers assets which will no longer work according to their original specification; failure of a pipe may mean it leaks, or failure of a foundation may mean that its bearing capacity is compromised. Failure may occur as a result of the following factors (Makar, 2000^[1]):

- Corrosion
- External loading (differential ground movement)
- Manufacturing flaws
- Internal pressure

This dataset focuses on the susceptibility of assets to fail as a result of corrosion resulting from aggressive soils and differential ground movement. The effect of soil corrosivity on ferrous assets is dependent on the soil type and specifically the concentration of soluble salts such as sulphate and chloride, pH, soil resistivity, water content, temperature and soil redox potential. Ferrous assets that are corroded by aggressive soils have a reduced material thickness, which increases the chance of failure. This is particularly the case where differential ground movement occurs, putting greater external pressure on assets (Eidinger, 1998^[2]). Ground movement can occur in a variety of scenarios due to the susceptibility of geological deposits to landslide, shrink-swell, compression, collapse, dissolution and to running sands.

The Corroded Asset Failure — Ferrous map considers the potential for ferrous asset failure as a result of aggressive soil conditions causing ferrous corrosion, and the potential for ground movement. It indicates where corroded ferrous assets are most likely to fail due to ground movement.

Water leaking from pipes has the potential to further worsen ground instability hazards causing additional instability to adjacent infrastructure. A map entitled 'Pipe Leakage Impacts' has been developed to complement the map described in this user guide. It provides an indication of where pipe leakage may worsen ground movement. Further information about this map is available at in Dearden et al., (2014)^[3].

Who might require this map?

The *Corroded Asset Failure — Ferrous* map is relevant to those asset managers who install, design and maintain ferrous assets. In particular the dataset will help:

- determine where assets are most susceptible to failure as a result of both aggressive soils and

- ground movement;
- prioritise investigations into where ferrous assets are most likely to fail, and
- assess where the specification of new ferrous assets may need to take into account corrosion and ground movement.

The dataset is relevant to professionals involved in subsurface asset management in water companies, construction and other utility companies. It may also be of interest to solicitors, loss adjusters and the insurance industry. The map is derived from datasets at a scale of 1:50 000.

About the dataset

Overview

There are two versions of the map; summary and detailed. The contents of these are described in Section

Detailed datasets

The *Corroded Asset Failure Ferrous* map (detailed) comprises one GIS layer called 'Ferrous_failure' that considers the potential for corroded assets to fail as a result of ground instability. It includes a summary map providing an overview of the susceptibility to failure as a result of the combined effect of aggressive soils and ground movement. It also includes a further seven sub-layers that provide more detailed information about the potential for corrosion and the type of ground movement that may occur. [Figure 1] illustrates the type of data provided.

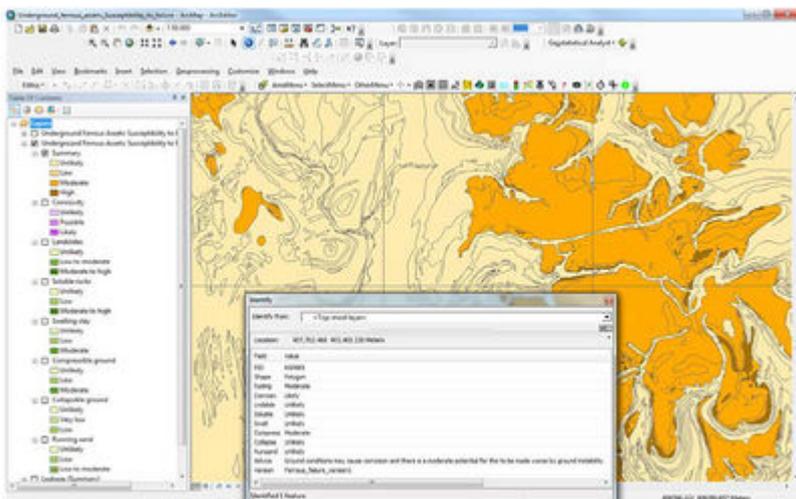


Figure 1 An example of the GIS layer that considers the potential for corroded assets to fail as a result of ground instability.

Summary datasets

The *Corroded Asset Failure - Ferrous* map (summary) comprises one GIS layer called 'Ferrous_failure_summary' that considers the potential for corroded assets to fail as a result of ground instability. This summary map provides an overview of the susceptibility to failure as a result of the combined effect of aggressive soils and ground movement, but it does not indicate which hazards are potentially present (Figure 2).

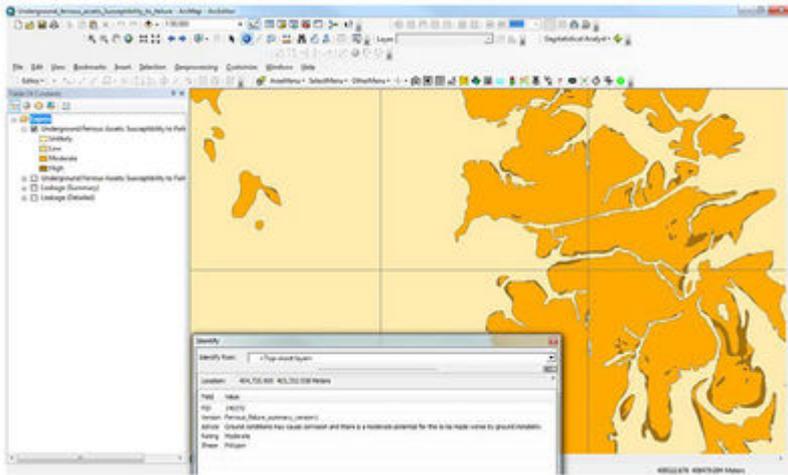


Figure 2 An example of the summary GIS layer that considers the potential for corroded assets to fail as a result of ground instability.

References

1. [↑](#) Makar, J M. 2000. A preliminary analysis of failures in grey cast iron water pipes. *Engineering Failure Analysis*. 7: 1, pp43-53.
2. [↑](#) Eidinger, J M. 1998. Water-distribution system In: The Loma Prieta, California, Earthquake of October 17, 1989-Lifelines. A J Schiff (ed), *US Geological Survey Professional Paper 1552-A*. pp. 63-78.
3. [↑](#) Dearden, R A, Tye, A M, and Marchant, A. 2014. User guide for the Pipe Leakage Impacts map. *British Geological Survey, Open Report, OR/14/010*.

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