



# Natural Cavities & Mining Databases

Ground Instability Data available from Stantec

## Introduction

Ground instability poses health & safety risks to people and can lead to subsidence damage of existing services, infrastructure and buildings, as well as new-build. Stantec holds readily accessible extensive databases of natural cavities and mining cavities that can be used to quickly identify locations that require special attention.

The National Planning Policy Framework (NPPF) issued in February 2019 refers to the need to address land instability issues to prevent unacceptable risks. The Stantec databases form an important archive for reference:

- Regulators can determine areas that are prone to cavities which may form pollution pathways causing impacts upon controlled waters or where land usage has potential to cause harm to aquifers and require groundwater protection.
- Planning and building control officers can be alerted where cavities are likely to occur to ensure that the new site development is suitable for the ground conditions present, and that an adequate site investigation has been undertaken by a competent person.
- Land owners and developers are responsible for securing a safe development where sites may be affected by contamination or land instability issues. It is, therefore, important to engage competent professional advisors that check the cavity databases to assess possible impacts upon site development proposals and whether special precautions may be necessary for foundations, infrastructure and drainage (SUDS).
- Insurers and loss adjusters can use the data in connection with subsidence insurance claims to help determine causation and remedial solutions.

The databases can be used to satisfy NPPF (2019) requirements Clause 178 for a site potentially at risk from ground instability. The aspects considered with regards to ground instability are related to: Cavities (Natural and Artificial). The databases are referred to within a variety of published works e.g. CIRIA Report C574 Engineering in Chalk (2002) and the ICE Manual of Geotechnical Engineering (2012). The databases are also referenced within a series of published papers by Stantec staff.

## Contact

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## Stantec Natural Cavities & Mining Cavities Databases

The original databases were compiled as part of national studies published in the early 1990s. The aim was to assess the degree of hazard and the impact of natural cavities and mining cavities upon planning and development. The current updated natural cavities database contains in excess of 32,000 records and there are more than 15,000 mining cavity records with new records added each year.

### What natural cavity types are included and how are they recorded?



The natural cavity types include those formed by dissolution processes (karst features in limestone, chalk, salt and gypsum), cambering (gulls/fissures), marine erosion (sea caves) and other processes such as, soil piping and fault/fissure erosion. Records typically consist of a national grid reference (NGR) that defines the position of an individual cavity or group of cavities. Stantec's archive records may also include information on the cavity address, geology, process of formation, number, type, shape, dimensions, infills, subsidence activity etc.

### What mining cavity types are included and how are they recorded?

The database includes mines excavated for the extraction of non-ferrous metals (e.g. fluorite, calcite and barites), rock (e.g. slate, chalk, limestone, oil-shale, fuller's earth, coprolite and non-coalfield fireclays), iron (non-coalfield) and evaporates (e.g. salt and gypsum). Records typically consist of a NGR that defines the position of a mine entrance (e.g. shaft or adit) or a subsidence location (crown hole). However, for larger areas of mining the location is instead represented by clusters of points that cover the area of known mined ground. Stantec's archives hold a large body of background reference information.

## Data Sources

### 1. Factual Database Search Report (from £350 plus VAT for a combined search of the two databases)

Provides a factual listing of cavities recorded within an agreed radius of a site location detailing the NGR & distance/direction from the site, geology, address, number & type of cavity and source of data. Bespoke data sets can be supplied for larger or linear sites. GIS data sets can be supplied under licence as well.

### 2. Standard Interpretative Cavities Occurrence Assessment (COA) Report (from £850 plus VAT)

Building on the factual report as per (1) above, a detailed assessment of the potential for cavity occurrence at the site location is carried out by undertaking a review of desk study based geological, hydrogeological and geomorphological data pertaining to the site. If site historical maps are available, then these can be viewed as well. The potential for natural cavities and/or mining cavities to be present is then assessed as a hazard rating (Low to Very High) based on the Dr C Edmonds Subsidence Hazard Mapping formula with recommendations for follow-on investigations or remedial measures as appropriate.

### 3. Extended Interpretative Cavities Occurrence Assessment (COA) Reports (from £1,400 plus VAT)

#### 3.1 With Ground Investigation Data Analysis

Enhancing the report as set out in (2) above, ground investigation data can be provided to allow Stantec to gain a greater understanding of the ground conditions at your site to provide a more detailed, site specific hazard assessment.

#### 3.2 With Historical Archival Research

Enhancing the reports as set out in (2) above, a detailed historical archive review can also be undertaken. The review usually requires a visit to the Records Office/Local Studies Library to study locally available historical documents, mostly pre-dating the published OS maps. This is particularly relevant for sites potentially underlain by historical mine workings to establish the subsidence risk level.



### 4. Interpretative COA with detailed Historical Archival Research which includes a GIS solution hazard map (from £1,950 plus VAT)

The evolution of computer software and Stantec's on-going research into natural and mining cavities permits us to produce site specific GIS hazard analysis and maps. This is undertaken by building up multiple layers of data to provide an overall hazard score from each layer. These have been applied for large development sites, infrastructure corridors and regional land use planning.

## Follow-on Services

Where required, Stantec can provide varying levels of advice relating to the occurrence and hazard posed by natural and mining cavities based on extensive experience. The particular characteristics of land that may be unstable are not always fully understood by non-specialist land instability practitioners and therefore obtaining reliable advice is important.

The services offered by Stantec include:

- Purpose designing a ground investigation to detect cavities and interpretive 2D/3D modelling of the ground conditions. Depending upon the cavity, target exploratory holes will need to be appropriately spaced and taken to particular depths in order to evaluate the presence or absence of cavities. The cavity characteristics will also determine whether and what type of geophysical surveying is suitable. Experience has also been gained in using down-hole techniques to view, measure and assess cavity stability, as well as the ability to survey underground openings and mines.
- Advice can be provided in relation to remedial measures (e.g. underpinning or the use of cementitious/resin grouting), monitoring (including automated and remote methods) and validation testing of treatment schemes.
- Expert witness services can be provided by in-house specialists for cases involving ground movement over cavities/mines/tunnels/quarries/slopes by water escapes/flooding/loading/excavation causing ground movement, structural damage and other losses.

*The Natural Cavities & Mining Cavities Databases have been compiled by Stantec (Stantec Cavities Databases). They contain information collected since the 1980s from multiple sources including: academic publications, public/business organisations, online resources and commercial project experience. The databases are managed and updated with new records at regular intervals. The Stantec Cavities Databases provide information to aid further assessment and should not be used alone to make final decisions on investment or construction on a site as further investigation may be necessary. Given the challenges of source data diversity, quality and age the Stantec Cavities Databases cannot guarantee to contain a complete set of information relevant to a site, sometimes records may have been inaccurately positioned, incorrectly interpreted or missed. The data is not intended to be used in place of obtaining professional advice for a specific project. The Stantec Cavities Databases are copyrighted and shall be treated as confidential information and must not, without the prior written consent of Stantec, be disclosed to a third party.*