



Technical Guidance Note

TGN01/2019

Findings from a large subsidence event on a residential estate

Background

In March 2016, a subsidence event affecting a number of properties occurred within a residential housing estate in north-east England. The Coal Authority accepted a number of subsidence claims and demolished 18 properties.

Subsidence monitoring of fixed installations on properties, ground and highway infrastructure, recorded progressive vertical subsidence of 70mm through to completion of ground stabilisation works in May 2018.

Total vertical downward movement, inclusive of the initial subsidence effects, reported between April 2016 and May 2018 has been assessed to be in the range of 320–600mm.

A deposited High Main coal mining plan shows one roadway within potential influencing distance of this area. Historical coal mining is recorded beneath the area of subsidence in several seams between 38m (High Main seam) and 257m (Three Quarters seam) depth.

Ground investigations

Findings from the ground investigations undertaken by the Coal Authority proved that the High Main coal seam had been worked extensively, in excess of 75% in plan area, at a moderately shallow depth of between 34.0m and 43.0m BGL to seam floor.

Within the subsidence epicentre, 96% of the boreholes encountered voiding, broken or collapsed ground.

Rock cores determined the intact seam thickness of the High Main beneath the estate to be in the range of 2.70m to 3.37m. Later rotary open holes suggest that seam thickness could reach 4.0m.

The rock mass (the High Main Post) above the coal seam at this location was found to be weak, laminated, weathered and fractured.

Within the epicentre the rock cover to extraction thickness ratio ranges between 12.3 for a 2.70m extraction thickness (rock cover of 33.30m) and 9.7 for a 3.37m extraction thickness (rock cover of 32.63m).

An 'areal subsidence' event

The subsidence is considered to be an 'areal subsidence' event resulting from roof and pillar failure within the mine workings of the High Main coal seam. The weak, weathered sandstone forming the roof of the workings would have progressively deteriorated and collapsed since the abandonment of the mine workings.

This deterioration increased and redistributed the loading on the remaining coal pillars, which would have been of marginal stability at the time of mining due to the high degree of extraction, resulting in the failure of the remaining coal pillars and subsequent ground movements and subsidence at the surface.

Considerations

1. Historical mining plans are invaluable but don't always give a true representation of the coal workings that have actually been undertaken underground. Consider that:
 - areas mined may vary from those shown on historical plans
 - the extent of the extraction and coal seam thickness may vary from those shown on historical plans and across a site
 - plans held in historical records may not be the final abandonment plans for the seams and the mine
 - not all historical coal workings are recorded
2. Both desk-based research and ground investigations should be undertaken to confirm the:
 - potential for unrecorded coal workings
 - accuracy of the coal mining plans that could impact on the development
 - competence and current condition of the geology overlaying the coal workings
 - potential effects of groundwater, including assessment of recovering levels post mining which may still be taking place today
3. The 10 times rock cover guidance outline in CIRIA SP32 is only a 'rule of thumb' for crown hole collapses. Other subsidence mechanisms can occur, such as pillar failure, for which the 10 times rock cover rule of thumb is not an appropriate guide.

**For more information, please contact us on 0345 762 6848 or visit our website
www.gov.uk/coalauthority**

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