

Bank Station Capacity Upgrade – fact sheet 9

Tunnelling and ground movement

Introduction

London Underground has extensive experience of constructing tunnels, shafts and station boxes and in minimising the associated ground movement and the effects on buildings in the vicinity of works.

Settlement

Settlement is a term given to the way the ground moves around an excavation, such as a tunnel. Construction of tunnels, shafts and basements causes movements in the ground. Initial assessment of the buildings and utilities in the vicinity of the proposed Bank Station Capacity Upgrade (BSCU) has identified that the predicted settlement is unlikely to have a major detrimental effect on nearby buildings. There may however be some minor effects in some buildings, which could include surface cracking or doors sticking.

Assessment process

In order to understand the risk of damage to nearby buildings and utilities, established methods of assessment are used to assess the need for any mitigation works. Assessments are carried out in accordance with industry best practice and London Underground's established standards. This process is carried out in stages:

Stage 1: Scoping

Calculations are undertaken to identify the extent of the area where settlement may occur due to the proposed works. The results are presented as plan drawings setting out the 1mm surface movement contour with contours of worst case surface ground movement overlaid on the existing infrastructure. This assessment represents the worst case because the effect of buildings on the pattern of ground movement is ignored and conservative parameters are chosen which tend to overestimate ground movements.

Stage 2: Initial assessment

Buildings and other infrastructure within the area identified as being within the 1mm contour in Stage 1 are analysed using simple engineering models to determine the degree of damage that could reasonably be anticipated. This assessment is based on consideration of the strains likely to be induced within the structure. Listed buildings are also assessed for their structural and heritage sensitivity.

Stage 3: Detailed assessment

Detailed analysis of specific buildings or other infrastructure identified as being at risk of moderate damage or worse in Stage 2.

Mitigation measures

Depending on the findings of the assessment process the following types of mitigation may be undertaken during construction to protect buildings from the effects of ground movement:

Minimisation of ground movement at source

A range of measures will be used during tunnelling and excavation works to reduce the magnitude of ground movements generated. It is accepted industry practice that all reasonable measures are employed as a matter of course when undertaking works in an urban environment. This will be the case on the BSCU scheme.

Ground treatment measures

These comprise methods of reducing or modifying the ground movements generated by tunnelling, or excavation, by improving or changing the engineering response of the ground during works.

Categories of potential ground treatment include: compensation grouting, which is injecting grout into the ground above the tunnel to counteract the settlement, maintaining the building position; permeation or jet grouting, which involves creating a stiffer ground to reduce movement.

Structural measures

Structural measures require modification or strengthening of the building to better resist or accommodate ground movements. It is not expected that structural mitigation measures will be necessary on BSCU, except in isolated cases. In these instances, tunnelling will intersect deep foundations to buildings known as 'piles' which will require structural modification. Where structural modification of a building is required, discussions will be held with stakeholders on an individual basis.

Provisions in relation to listed buildings

Specific consideration will be given to buildings which are listed as being of special architectural or historic interest in order to protect the building and any sensitive heritage features contained within. The specific mitigation measures to be used for each building will be determined during the detailed design and construction phases, and will be tailored to the building and the risk presented to it.

Pre-construction defect surveys

Defect surveys can be undertaken prior to any work taking place so that any effects of any settlement to buildings can be monitored and addressed as appropriate. Defect surveys will be undertaken with the building owner's consent. A defect survey would usually be undertaken on any property predicted to experience 10mm or more of settlement before tunnelling works begin. This is a written and photographic record of the existing condition of finishes and structures and is carried out by an appropriately qualified engineer or surveyor working jointly for LUL and the owner of the building. Owners of properties where defect surveys are required are contacted in advance to arrange access. The survey will not be undertaken until shortly before the start of construction activities that could affect the building.

Monitoring

We will establish monitoring across the area potentially affected by the BSCU, to verify that construction effects fall within predicted parameters. The need for specific building monitoring would be determined on a case-by-case basis as part of the assessment process. Monitoring would begin before the start of the works and continue until movement attributable to the works has ceased to be measurable.

Consent to construct the BSCU will be provided through a Transport and Works Act Order (TWAO) application. This process requires formal consultation and the production of an Environmental Statement (ES).

The TWAO will include a general power to undertake protective works to affected properties. If a building has been identified as requiring protective works there will be a formal notification of the proposal. This is the formal notice required under the TWAO. There will also be a period of consultation with the landowner to provide information on the reasoning for and nature of any protective works.

Settlement deed

We are prepared, at a landowner's request, to enter into LUL's standard form of settlement deed with any landowner within the predicted 10mm contour who is concerned about settlement at their property. This will provide a binding commitment from LUL addressing settlement issues. However, those landowners who do not want to enter into a settlement deed with LUL will continue to benefit from our settlement policy as detailed above.

Further information

For more information visit: tfl.gov.uk/bank-consultation or email BankSCU@tfl.gov.uk
To receive this document in large print, audio or another language please call

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June 2014