Oasys
YOUR IDEAS BROUGHT TO LIFE

Frew Alp

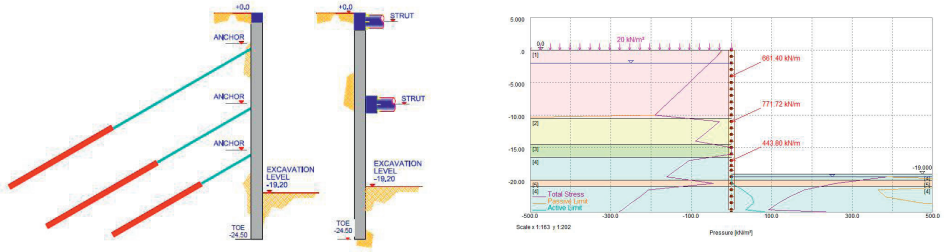
Emirates Pearl Tower - Temporary Shoring System Design

Emirates Pearl Hotel & Bab El Qasr Development Project is currently the deepest dig in Abu Dhabi and a very specialised project due to the excavation's depth and close proximity of the sea and nearby building. NSCC carried out the design and construction of the temporary shoring system and the piling works for the Emirates Pearl Tower and Bab El Qasr Hotel.

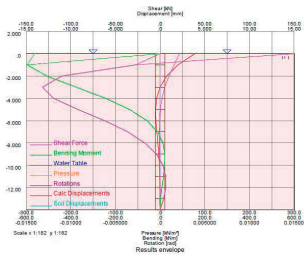
The shoring system for the two projects was carried out together in order to eliminate the shoring works for the common boundary between the two plots resulting in reduced cost for the two projects.

The shoring design was carried out using Oasys Frew. Frew gives the user the power to design a wide range of embedded retaining walls in a variety of soil types, under an assortment of loading conditions. The required toe level and the bending moment distribution based on the B.S. 8002 were obtained.

Along with the capacity and section analysis, a lateral pile analysis was carried out using Oasys Alp. Detailed soil / pile interaction analyses were carried out to evaluate the shear forces and bending moments in the piles due to applied lateral loads. The piles were structurally designed for the combined action of lateral and axial loading



Oasys Frew shoring analysis



Oasys Alp pile analysis

Xdisp

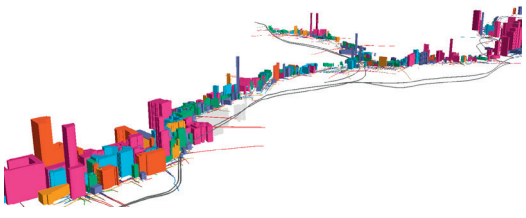
Crossrail - Heritage building damage assessment and monitoring

Crossrail is a 73-mile rail development that will provide a high-frequency commuter passenger service, linking east and west London. The new route will ease congestion on the current tube system, running up to 24 trains per hour in each direction.

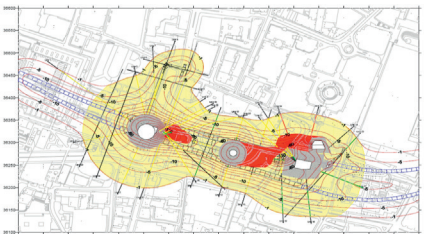
Tunnelling and excavations cause movement in the ground - a major issue for the designers. Xdisp has been used to conduct the damage assessment process for the hundreds of listed buildings that are potentially affected by tunnelling and excavation work relating to Crossrail.

During large infrastructure projects such as Crossrail, issues often arise due to the large quantity of assessments that are required. Especially when the design of the infrastructure evolves continuously, requiring constant update of the assessments. What's the solution?

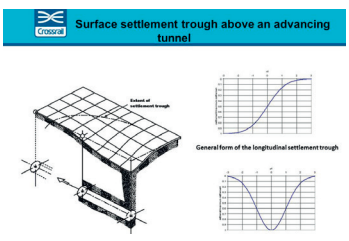
To automate. Xdisp has the compatibility to be used alongside Office applications. Reporter is an Office add-in application, developed by the Arup-Atkins Crossrail C122 team. The Reporter templates were set-up in Word with links to the database to automatically compile the relevant sections of the report with building and heritage descriptions, images, maps and cross-sections, analysis output. The graphical outputs and results from Xdisp were also automatically incorporated into these reports.



Total Asset Numbers in database: 16,627



Oasys Xdisp settlement contours exported to CAD



Surface settlement trough above an advancing tunnel

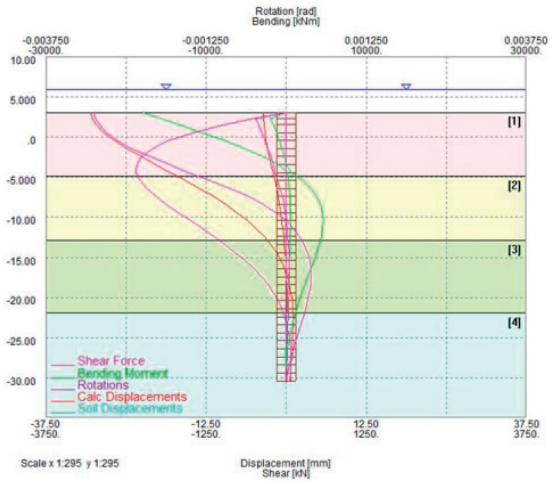
Pdisp AdSec Frew Alp

The Pinnacle – Foundation Design

The Pinnacle was a 63 storey landmark building in London that made it past the piling stage but was halted in March 2012 when workers began excavating deep down, due to problems regarding the pre-let. The proposed building had a gross floor area of 138,000m2 including 3 basement levels. Where required, the new basement walls were to be constructed within asecant pile wall.

The proposed building will be founded on a combination of piles founded in the London Clay and the Thanet Sand strata. Where required, the new basement walls are to be constructed within a secant pile wall.

The foundations consisted of the deepest and largest built to date in the City of London at 2.4m diameter, 63m long bored piles base grouted in the Thanet Sand. Reuse of the existing underreamed piled foundations in London Clay supplemented by new large diameter bored piles and minipiles was adopted over part of the site.

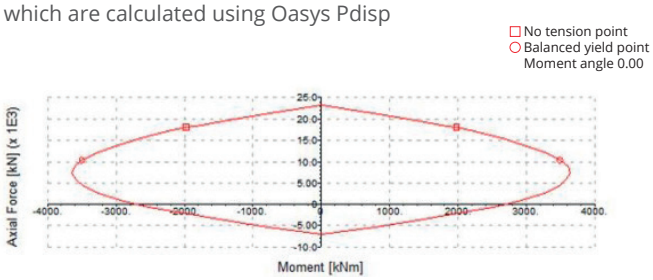


The bearing piles are also designed to resist applied lateral loads due to out of balance earth pressures and wind load. In addition, the bearing piles must be designed for moments applied due to eccentricity of the connection between the pile and columns due to positional tolerances.

An assessment has been made of the effect of lateral loading and moments applied to the piles using Oasys Alp.

For the tension piles, linear elastic method is used to model the behaviour of the reinforced pile and to calculate the tensile forces generated in the pile, the maximum tensile force and required tension reinforcement. This requires an understanding of the likely heave movements in the ground and the variation of these with depth, which are calculated using Oasys Pdisp

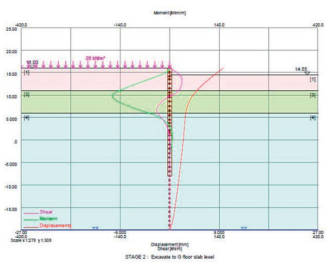
Consequently, pile reinforcement design has been considered in both the lateral load and bending moment design and the tension design described.

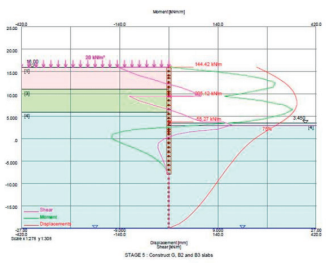


The section capacity of each pile has been checked using Force-Moment Interaction charts created using Oasys AdSec .

The shear reinforcement in the piles is provided in the form of helical link bars. The shear force is the sum of the out-of-balance earth force and the shear due to eccentric column loading. The shear due to eccentric column loading has been calculated using the Oasys Alp analysis.

The secant pile wall is designed using both unfactored soil parameters for Serviceability (SLS) and factored soil parameters for the Ultimate Limit State (ULS) in accordance with BS 8002:1994 and CIRIA C580. Oasys Frew was used to analyse the wall and calculate the bending moments, shear forces and deflections of the wall, as well as the prop forces.





The design methodology for vertical load considers both total and effective stress design.

Shaft capacity is only assumed below the excavation level. For the effective stress design, the input horizontal effective stresses are those calculated from the Frew retaining wall analyses. Because the wall is carrying vertical loading, wall friction may not be generated on the back of the wall. Therefore, no benefit of wall friction (δ = 0) is taken on the active side in the Frew analyses.