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TUNNEL DESIGN

GEOTECHNICAL ENGINEERING

CONSTRUCTION MANAGEMENT

INSTRUMENTATION & MONITORING

WATERPROOFING & WATER CONTROL

TUNNEL REHABILITATION

MINING SUPPORT SERVICES

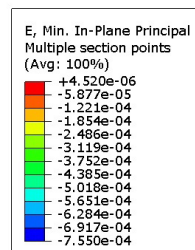


The ground plays a key role in sub-surface engineering; an accurate interpretation of its behaviour is essential. Dr. Sauer & Partners' expert geotechnical engineers provide the highest quality in geotechnical engineering services and value to our clients for both design and execution.

TECHNICAL EXPERTISE

Designs for underground structures rely on a thorough understanding of the geology and engineering behaviour of the ground. Our geotechnical expertise allows us to provide a variety of related geotechnical services that can be offered individually or as complete, integrated engineering solutions.

✓ Crossrail C305 Limmo Auxiliary Shaft – 40m deep, 27m OD

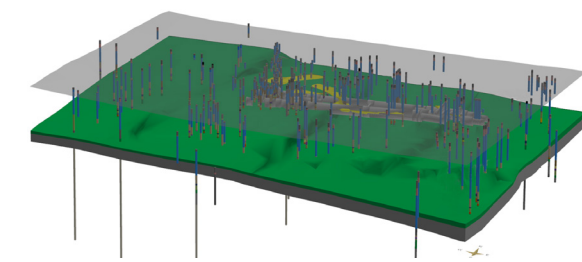


3D Finite Element Design Model

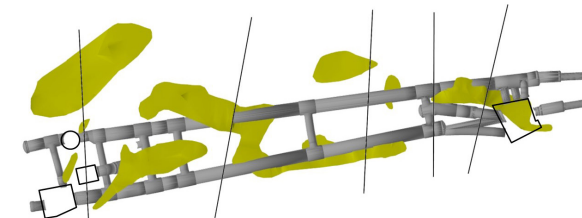


Completed Auxiliary Shaft

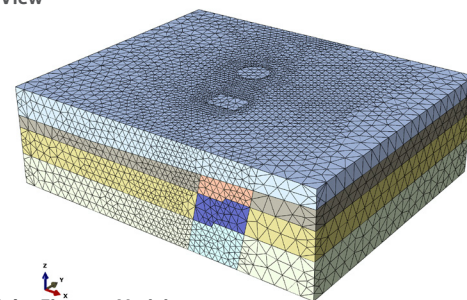
✓ Crossrail C435 Farringdon Station - Faulted Lambeth Group



Geological Model



Plan View



3D Finite Element Model

BENEFITS OF DR. SAUER & PARTNERS' ADVANCED GEOTECHNICAL ENGINEERING SERVICES:

- Time/Cost savings
- More efficient design
- Improved structural performance
- Improved deformation prediction
- Better understanding of soil/structure interaction
- Reduced need for additional investigation
- Increased asset protection management
- Geotechnical risk management
- Programme risk reduction
- Reduced uncertainties
- Improved construction efficiency

Dr. Sauer & Partners provides the complete range of services in the field of GeoEngineering. This includes the interpretation of the sub-surface conditions and the production of geological and engineering models through to detailed design and the supervision of construction works.

• DEEP EXCAVATIONS & RETAINING STRUCTURES

The choice of the optimal construction method that meets our clients' requirements triggers the process of identifying and delivering the most efficient design and construction solution for deep excavation and retaining structures.

• DEPRESSURISATION - DEWATERING

Underground projects often face unavoidable hydrogeological challenges. Dealing with in-situ water pressures and flows ahead of main construction works by means of engineered solutions, enable safe, fast and efficient excavation progress.

• GEOTECHNICAL RISK MANAGEMENT

Underground projects deal with inherent ground risks. We combine expert knowledge and advanced simulation tools to identify, mitigate and manage these risks throughout the lifecycle of a project.

• SETTLEMENT & IMPACT ASSESSMENT

Underground constructions have an impact on both subsurface and surface assets. Understanding, identifying, modelling, quantifying and mitigating this impact is essential for (third-party approvals and) the successful management of associated project risks.

• SLOPE STABILITY ANALYSIS

A solid understanding of geotechnical conditions is essential when dealing with unstable ground. Our experience and expertise covers a range of slope stability assessments and design solutions, varying from shallow cuts for temporary works to large-scale landslides.

• 3D GEOLOGICAL MODELLING

An accurate geological model sets the foundation for further engineering processes such as design, risk assessment and management, impact assessments or ground improvement. Our company combines expert geotechnical knowledge with modern simulation tools to provide the highest value to our clients.

• BOXES & PORTALS

Our design and construction solutions for box structures such as station or cross-over boxes as well as tunnel portals are based on detailed soil-structure interaction modelling using state-of-the-art finite element tools.



Λ TBM Launch Box

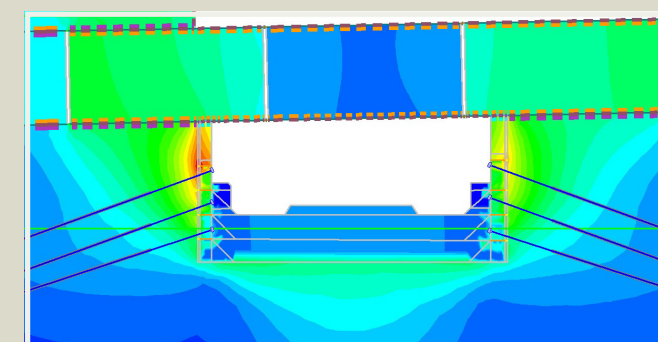
EVIDENCE OF DELIVERY

Eglinton Crosstown: Cedarvale Station Underpinning and SOE

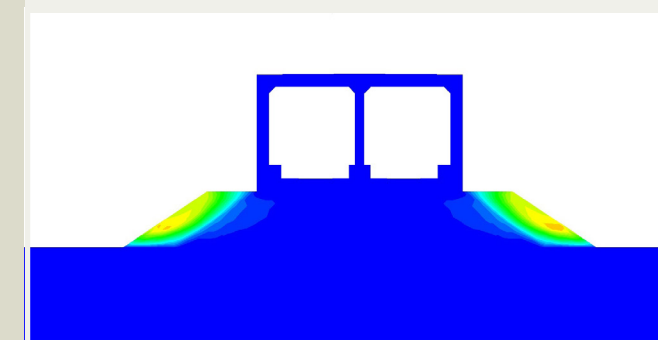
Cedarvale station is located on the Eglinton Crosstown Line of the Toronto Light Rail Transit, at an intersection with the Spadina Subway Line. The new station is located under the existing station box utilising a combination of mining and open-cut techniques.

The proposed solution included an underpinning scheme with six small galleries being mined underneath the existing, fully operational station box, to allow the installation of a series of steel girders to underpin the existing structure. After the completion of the underpinning works, the excavation of the new station is proposed as open-cut. The support of excavation consists of prestressed tie-backs, a thin shotcrete wall and a top prop.

Dr. Sauer & Partners delivered a feasibility design for the open-cut excavation and support as well as detailed design for the underpinning galleries and the temporary support elements. Our evaluation included a detailed assessment of the ground conditions, the impact of the works on the operational tunnel box as well as a stability assessment of the portal slopes.



Λ Finite Element Model of the Support of Excavation



Λ Slope Stability Assessment