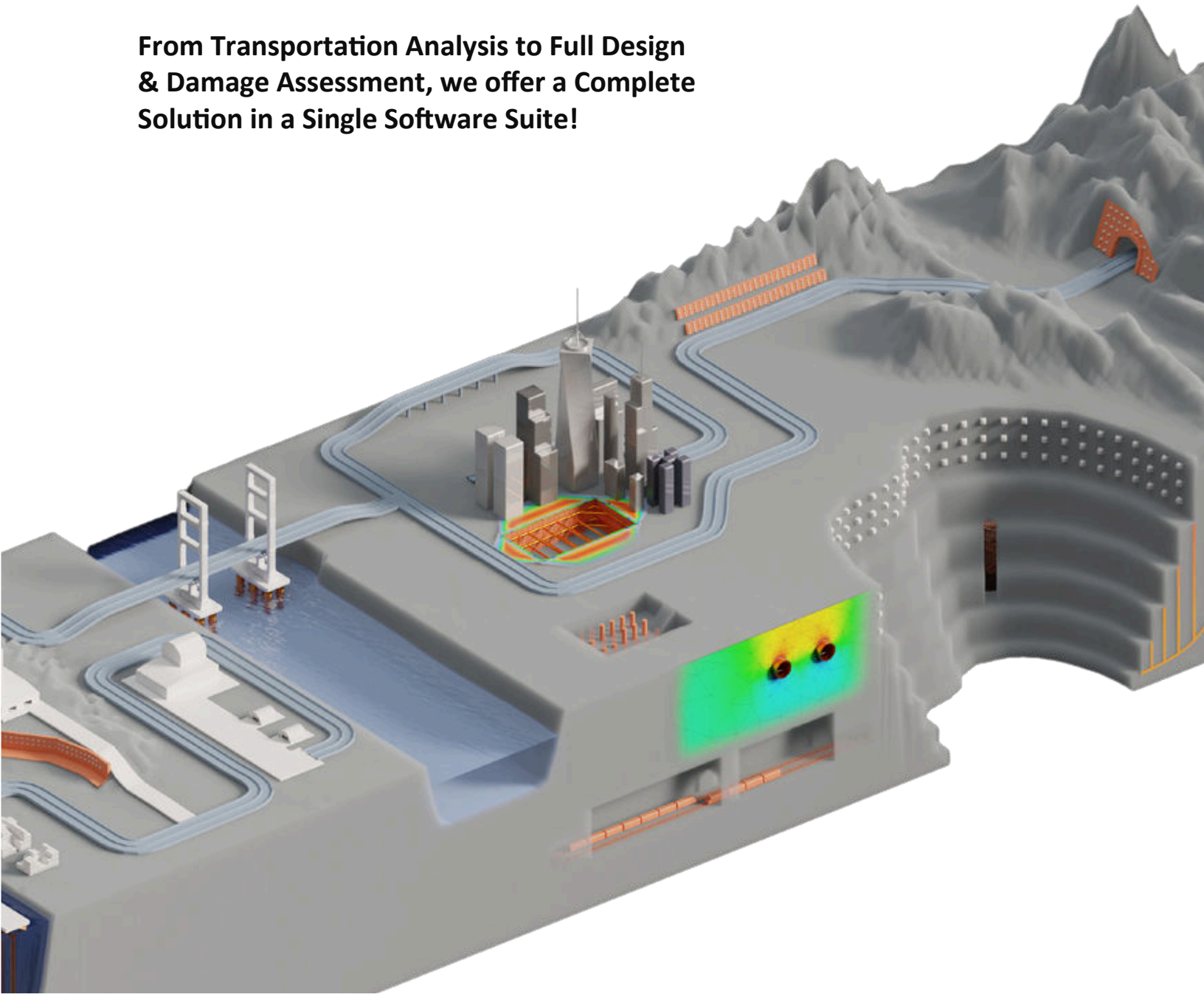




DEEPEX - DEEP EXCAVATIONS & TUNNEL DESIGN  
SOFTWARE DEEPEX 3D CITY PACKAGE

# ONE PLACE TO OVERCOME SUBWAY DESIGN CHALLENGES

From Transportation Analysis to Full Design  
& Damage Assessment, we offer a Complete  
Solution in a Single Software Suite!



# YOUR VISION BECOMES REALITY!

How many different software do you use for the design of a Metro Line? How long does it take you to perform a full transportation analysis, locate the best positions for the new stations and design the stations and tunnels? What about the potential risks and damages? Could it be weeks, or months?

**With DeepEX 3D City you can model an entire metro line in as little as a couple of HOURS!**

**DeepEX** has been the ultimate software solution for the design of deep excavation projects for years! We are proud to announce that our latest package allows us to model entire cities and tunneling projects, offering a complete solution for metro design challenges! Now you can bring in your whole city map with all buildings and surface elevations from Google, perform transportation analysis and place your ideal station locations in the city map automatically, create fast your tunnel alignments, analyze and optimize the whole model, and review the expected damages and repair costs for each building affected by your tunnel line with a click of a single button!

**Save time and effort and gain a competitive edge in preliminary and final project design!**

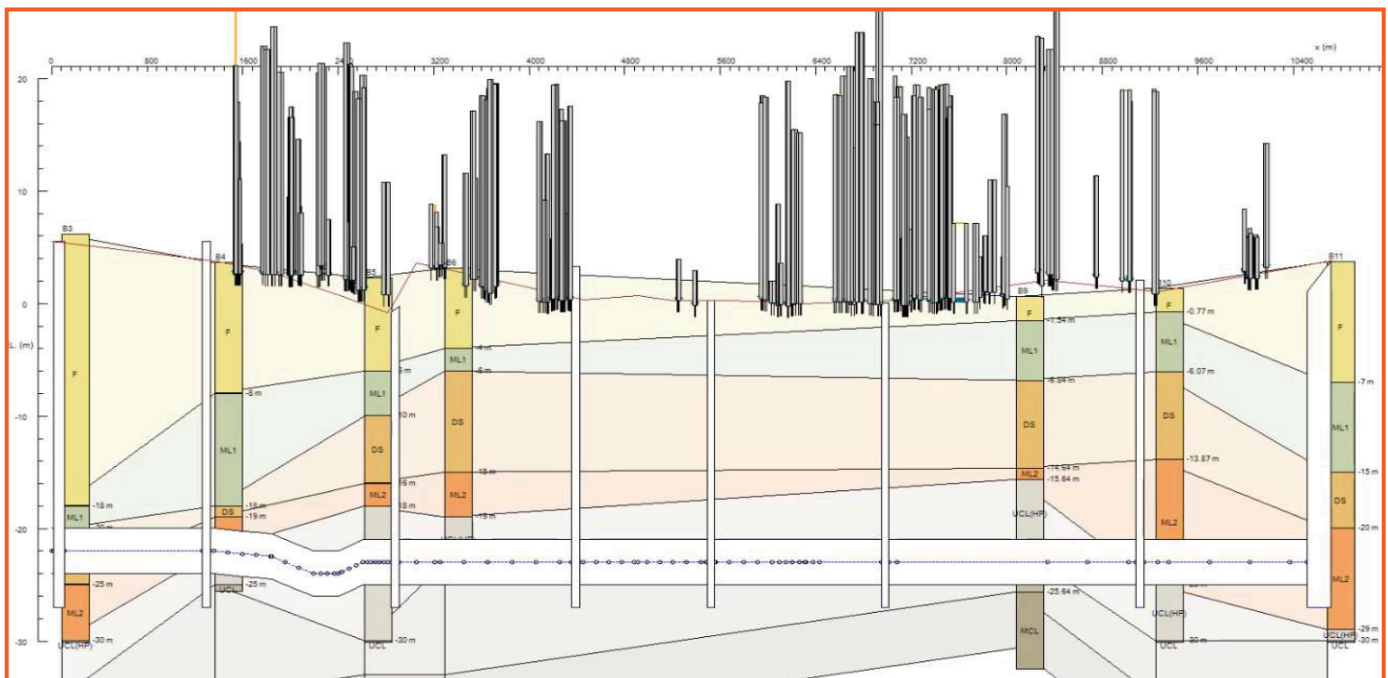


Fig. 1: Tunnel Alignment with Boring Locations in DeepEX

# DESIGN TUNNELS AND UTILITY LINES

## Are you designing transport or utility tunnels?

With the DeepEX 3D City package you can design any tunnel type, from cut-and-cover tunnels to more composite tunnel sections, tunnels constructed with the Tunnel Boring Machine Method (TBM Tunnels) or the Sequential Excavation Method (SEM - NATM Tunnels) considering full soil structure interaction! Now you can simulate all your tunnel and utility lines and monitor the impact of your deep excavation projects.

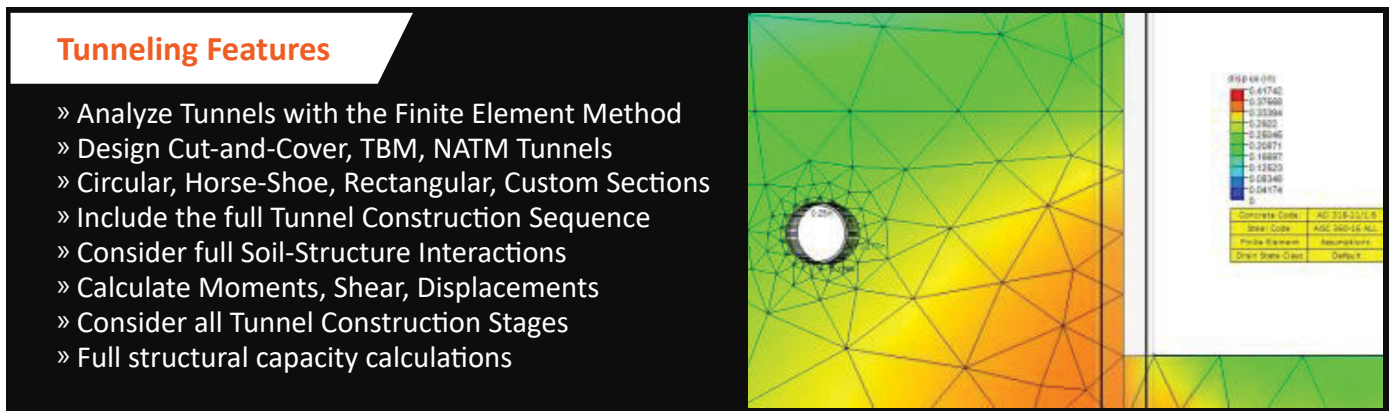


Fig. 2: Natural Gas Pipeline in DeepEX

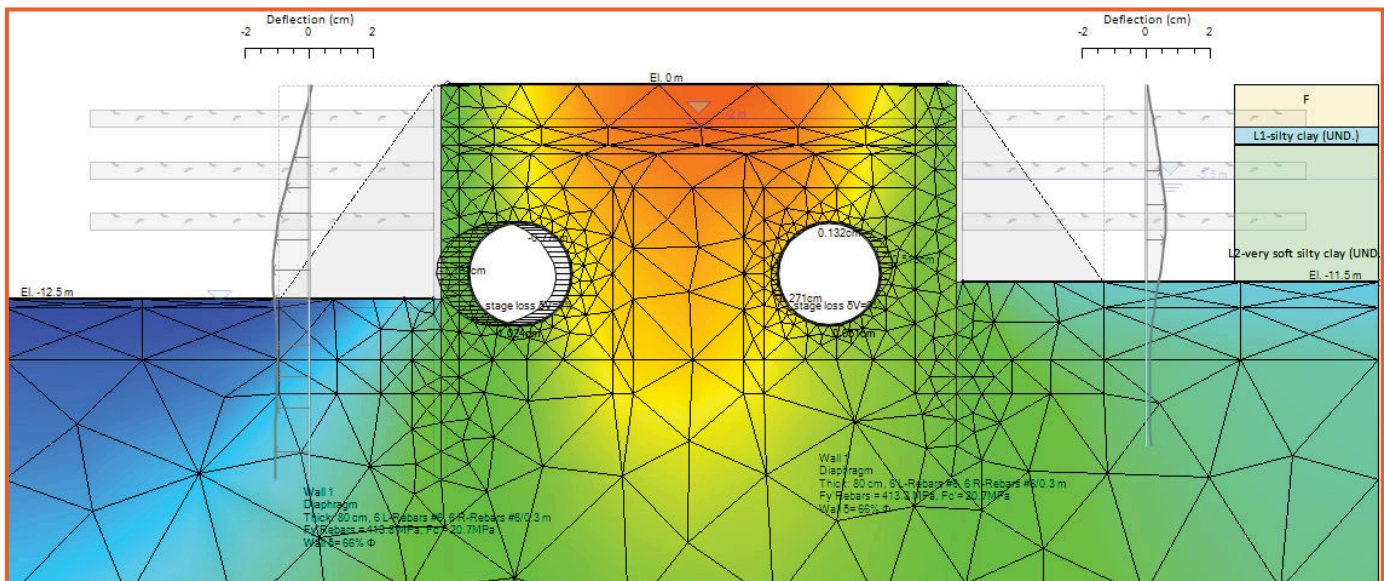


Fig. 3: Twin Tunnels – FEM Analysis in DeepEX

# STRUCTURAL TUNNEL DESIGN

Do you need to have full structural checks of your tunnel lining?

Save time as DeepEX calculates the structural capacity of a wide variety of tunnel lining sections. From concrete, corrugated sheets, to steel ribs, all sections can be analyzed for combined axial and bending moment loads. Wizards allow you to model typical tunneling arrangements with or without rock bolting quickly.

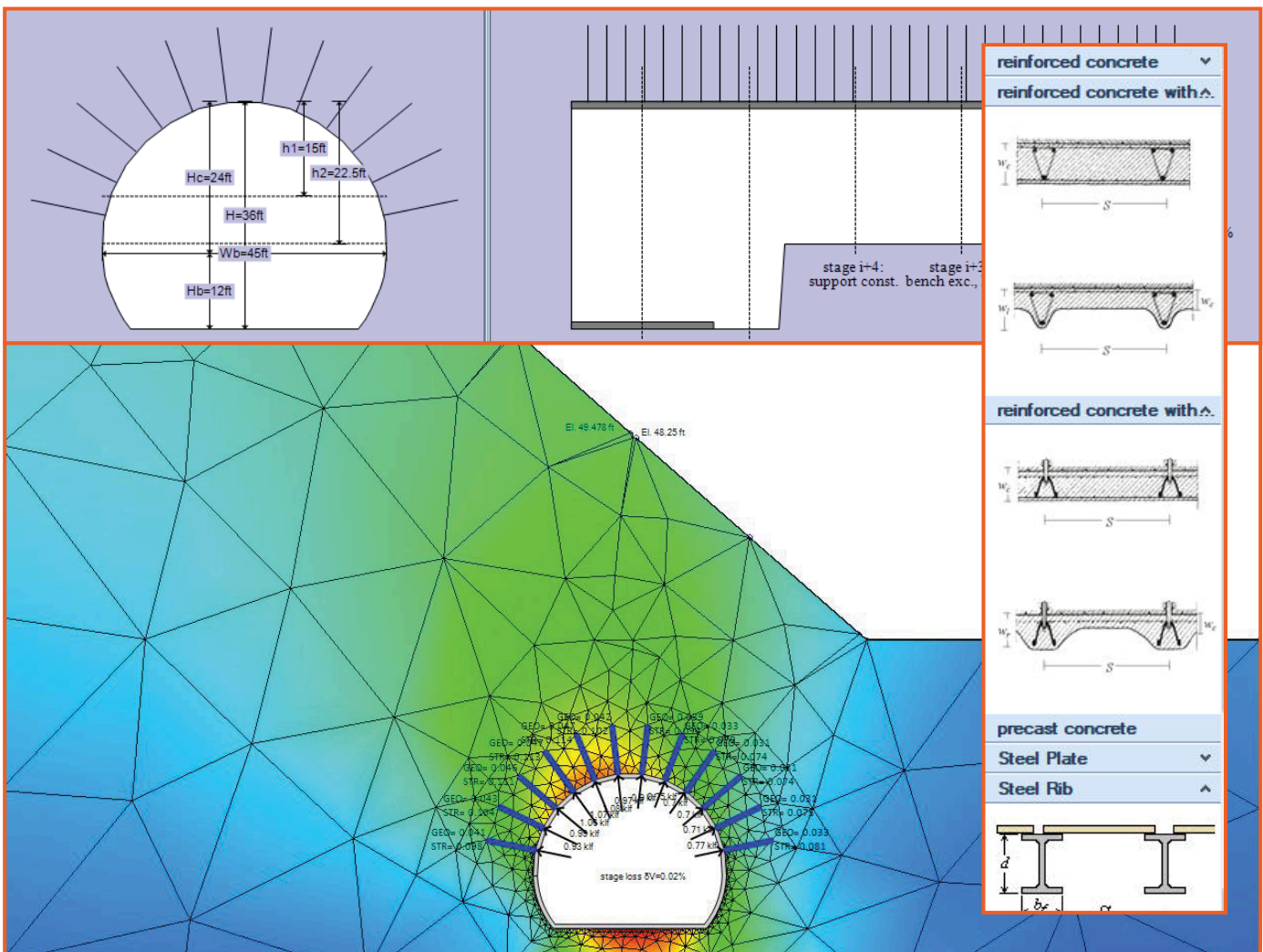


Fig. 4: NATM Tunnel with Rock Bolts and Wizard with DeepEX with different lining section options

# DESIGN STATIONS FROM 2D SECTIONS TO FULL 3D EXCAVATION MODELS

Do you wish to design your full deep excavation project in a single software file?

With the DeepEX 3D City package, you can generate any deep excavation perimeter and design the whole excavation model with a click, including all construction stages. Any model can be created in seconds with the software Wizards. The user can review all analysis results, project cost estimation, structural checks, steel connection checks and more in tables and graphically on the model area. Impress your clients and discover construction challenges with the 3D Model Visualization.

## 2D – 3D Model Features

- » Generate, Analyze & Optimize 2D Sections
- » Generate, Analyze & Optimize 3D Models
- » Limit Equilibrium – Non-Linear – Finite Element Analysis
- » Review all Result Graphs & Structural Checks
- » Review Cost Estimation Report
- » Check and Optimize all Steel Connections
- » Import City Map from Google
- » Import all Buildings from Google
- » Automatically generate 2D Cut Sections
- » Export 3D Model Holograms

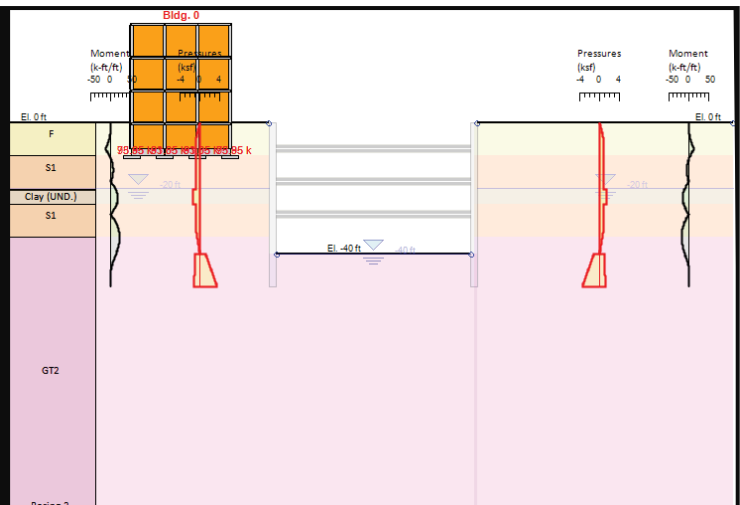


Fig.5: Excavation with Internal Bracing: 2D Section Analysis

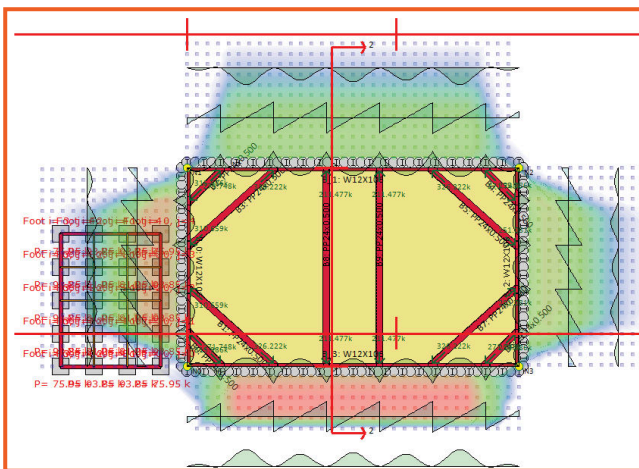


Fig. 6: Excavation with Struts: 3D Frame

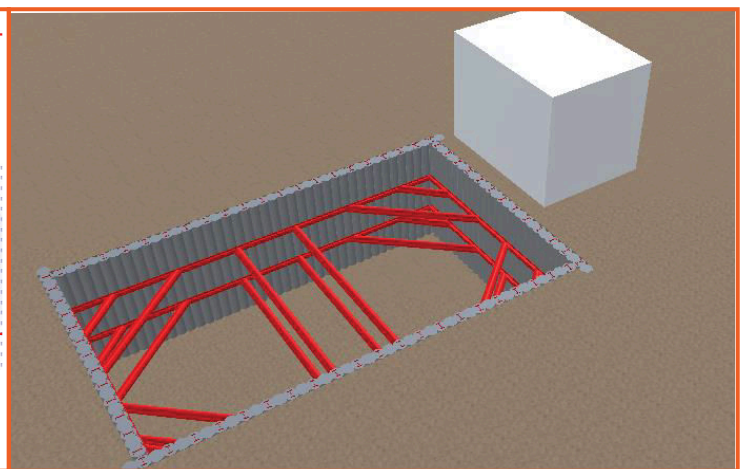


Fig. 7: Excavation with Struts: 3D Model Hologram



# PREDICT THE COSTS & BENEFITS BEFORE THE ACTUAL DESIGN

## How can we estimate the tunneling project cost and benefits?

Estimating a route's cost and benefits can be highly challenging at a planning level. DeepEX simplifies the process by providing cost estimation procedures for the station and tunneling works based on established research works and real tunneling experience. The cost estimates can range from preliminary to quite detailed and even include the potential cost of deformation damage induced on existing structures.

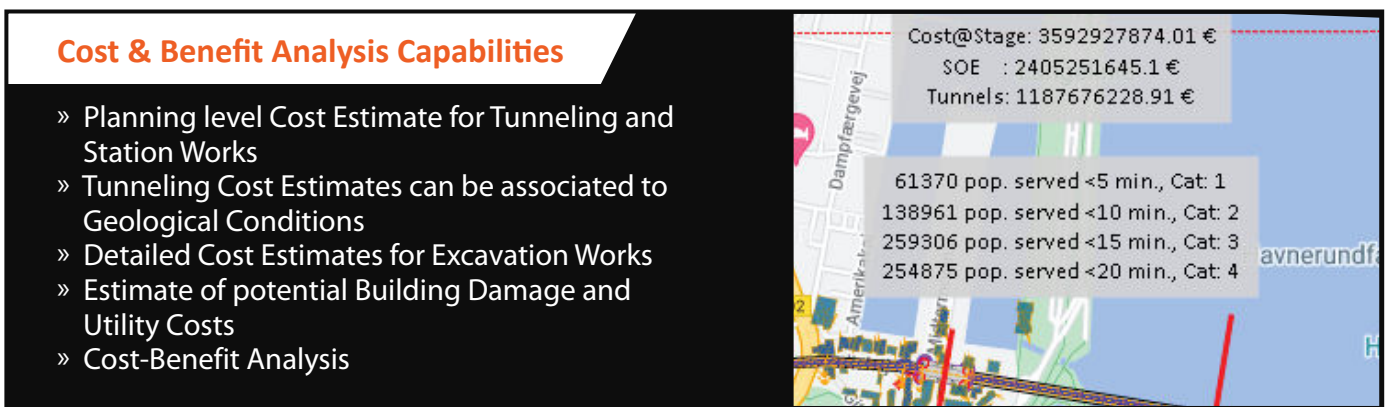


Fig. 10: Excavation and Tunneling Costs



Fig. 11: Planning Level Cost & Service Analysis for M5 Copenhagen proposed Metro Line

# IMPORT IN MAPS, STRUCTURES & ELEVATIONS FROM GOOGLE, UTILITIES FROM QGIS

How long does it take you to search and apply all existing buildings in your design?  
What about utilities?

With the DeepEX 3D City package, you can import all existing structures, surface elevations, utilities, and more directly in the model area with a click of a button! All buildings maps and elevations can be directly imported from Google or CadMapper, and city utilities can be imported from QGIS! Save time and effort in your preliminary metro route designs and be competitive.

## DeepEX Import Capabilities

- » Import buildings from Google
- » Import buildings from CadMapper.com
- » Estimate Building Dimensions and Loads
- » Draw a Project Region directly on the Map
- » Import Surface Elevations
- » Import Utility Lines

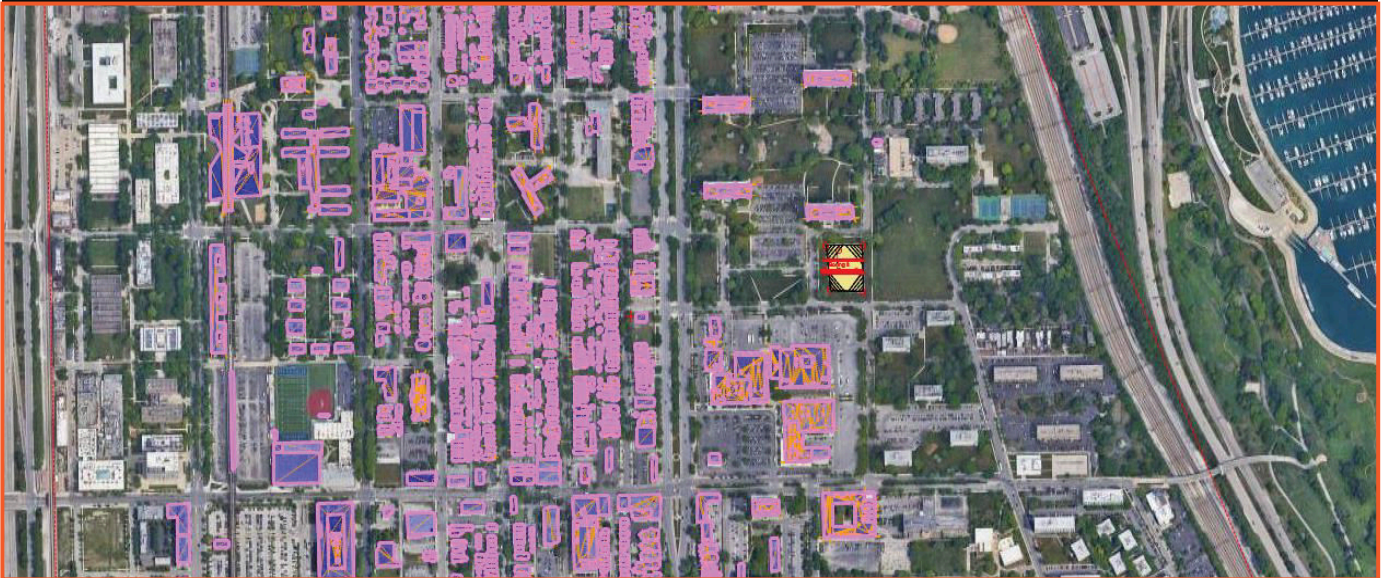


Fig. 12: Imported Buildings from Google, Chicago, USA





# PREDICT THE DAMAGE ON EXISTING BUILDINGS

Are you worried about the impact of your metro station's excavation to adjacent buildings?

With the DeepEX 3D City package, you can perform a damage assessment on any building adjacent to your excavation site. The software can estimate the settlements below the building and calculate critical strains, crack widths, angular distortions and damage categories for each structure wall.

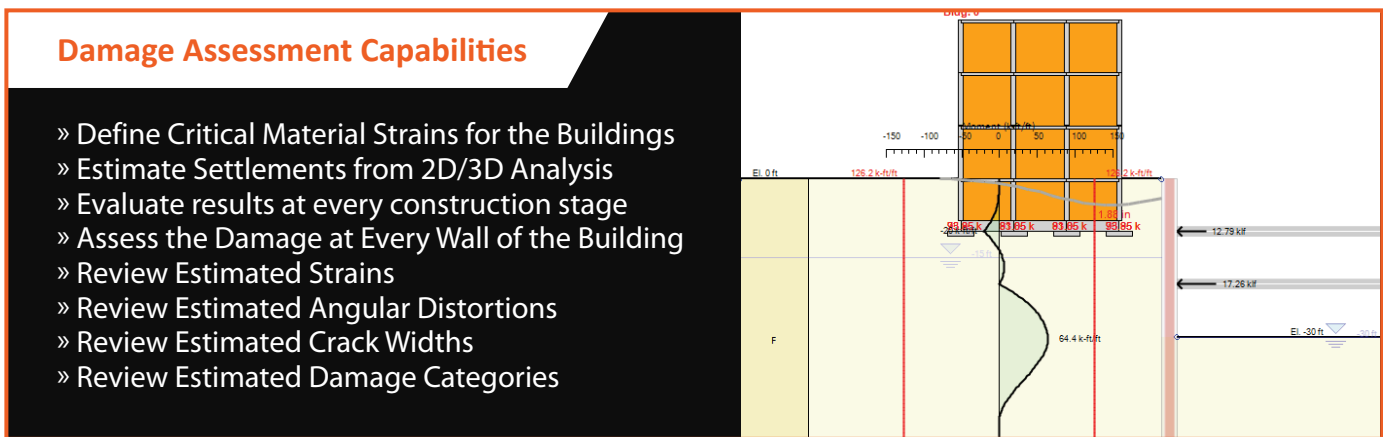


Fig. 15: Excavation Adjacent to a Building

|                                                    | $\epsilon.P.$ Max | $\beta$  | $\theta.out$ | $\gamma.Max$ | $\gamma.Ave$ | C.p (in) | C.t (in) | Cr.p (in) | Cr.t (in) | Damage Cat  | Dam. Crack width |
|----------------------------------------------------|-------------------|----------|--------------|--------------|--------------|----------|----------|-----------|-----------|-------------|------------------|
| Bottom side continuous basement wall               | 0                 | 0        | 0            | 0            | 0            | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |
| Left side continuous basement wall                 | 9.9E-05           | 8.1E-05  | 0            | 0.000219     | 0.00011      | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |
| Right side continuous basement wall                | 0.002743          | 0.002243 | 0            | 0.006082     | 0.003041     | 0.3824   | 0.677    | 0.2549    | 0.4514    | Moderate    | Moderate         |
| Top side continuous basement wall                  | 0.000897          | 0.000535 | 0            | 0.002268     | 0.001134     | 0.0691   | 0.0174   | 0.046     | 0.0116    | Slight      | Slight           |
| Exterior wall at floor 1El. 0, (-8, 0 to -18,0)    | 0                 | 0        | 0            | 0            | 0            | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |
| Exterior wall at floor 1El. 0, (-18, 40 to -8,40)  | 0.005064          | 0.001278 | 0            | 0.007412     | 0.009203     | 0.7144   | 0.13     | 0.4763    | 0.0867    | Moderate    | Moderate         |
| Exterior wall at floor 1El. 0, (-18, 0 to -28,0)   | 0                 | 0        | 0            | 0            | 0            | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |
| Exterior wall at floor 1El. 0, (-28, 40 to -18,40) | 0.002097          | 1E-05    | 0            | 6.1E-05      | 0.004055     | =        | 0        | =         | 0         | Very sev... | Very sev...      |
| Exterior wall at floor 1El. 0, (-28, 0 to -38,0)   | 0                 | 0        | 0            | 0            | 0            | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |
| Exterior wall at floor 1El. 0, (-38, 40 to -28,40) | 0.000288          | 0        | 0            | 0            | 0            | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |
| Exterior wall at floor 1El. 0, (-8, 10 to -8,0)    | 0.012311          | 0.001294 | 0            | 0.007506     | 0.023182     | 1.8055   | 0.109    | 1.2037    | 0.0727    | Very sev... | Very sev...      |
| Exterior wall at floor 1El. 0, (-38, 0 to -38,10)  | 0                 | 0        | 0            | 0            | 0            | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |
| Exterior wall at floor 1El. 0, (-8, 20 to -8,10)   | 0.001202          | 0.000115 | 0            | 0.00067      | 0.002277     | 0.0605   | 0        | 0.0403    | 0         | Slight      | Slight           |
| Exterior wall at floor 1El. 0, (-38, 10 to -38,20) | 0.000746          | 0.000392 | 0            | 0.002274     | 0.00098      | 0.0217   | 0        | 0.0145    | 0         | Very slight | Very slight      |
| Exterior wall at floor 1El. 0, (-8, 30 to -8,20)   | 0                 | 0        | 0            | 0            | 0            | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |
| Exterior wall at floor 1El. 0, (-38, 20 to -38,30) | 0                 | 0        | 0            | 0            | 0            | 0        | 0        | 0         | 0         | Negligibe   | Negligibe        |

Fig. 16: Sample Building Damage Assessment Result Summary

# CHECK YOUR CONSTRUCTION IN REAL TIME

Do you wish to back-check your deep excavation design based on monitoring data during the construction?

With the DeepEX 3D City package you can import data from our SiteMaster software inclinometers and connect load cells and strain gages. You can perform live structural and geotechnical checks on anchors, walers, and struts, examine structures against predetermined displacement limits and display graphs in 2D sections and plan view.

## Monitoring Options

- » Import Inclinometer readings from SiteMaster
- » Associate Inclinometers with Construction Stages
- » Calculate Bending Moments from Inclinometers
- » Perform Live Checks on all Supports and Walers
- » Check Models under Predefined Displacements
- » Display Graphs in 2D Sections and 3D Plan View
- » Compare Building Deformations against Established Limits

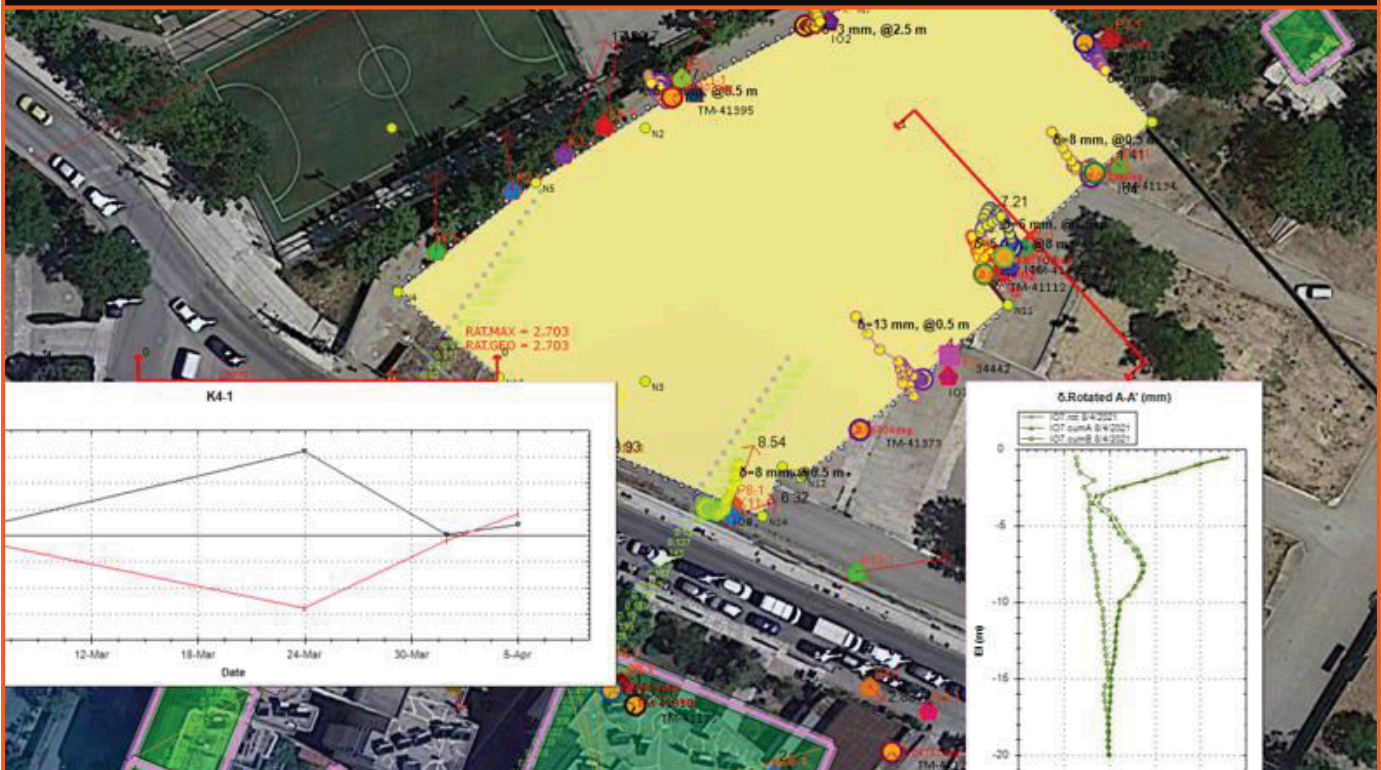


Fig. 17: Excavation Site with Inclinometer Locations & Readings

# VISUALIZE YOUR PROJECT IN AR AND VR – IMPRESS YOUR CLIENTS

Do you wish to see what you design in real-life space?

With the DeepEX 3D City you can export the full 3D-generated model hologram, with all city buildings, tunnels and stations. View the designed model with all construction stages in your desktop or with AR and VR headsets, locate potential issues and conflicts and impress your clients!

## 3D Visualization Capabilities

» Generate 3D Model Holograms

» Review all Construction Stages

» Navigate inside the Project with Voice Commands



Fig. 18: 3D Hologram – Metro Station & Tunnels in Copenhagen, Denmark

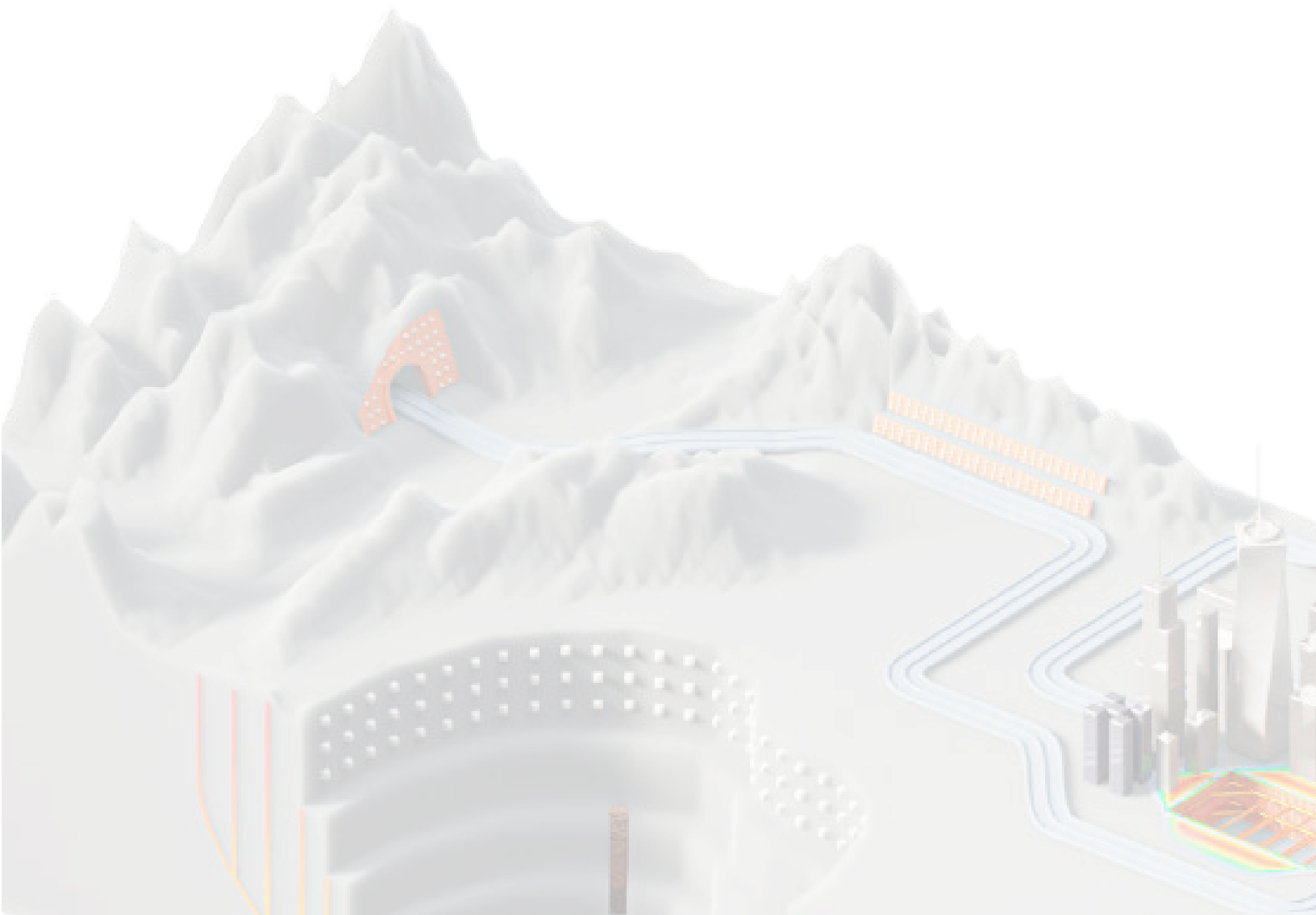
# ACCESS NOW THE MOST POWERFUL DEEPEX PACKAGE

## How do access all the above modules and capabilities?

Get now or get upgraded to our DeepEX 3D City package, the most complete DeepEX version ever built, and get access to all the software capabilities! Packed with the latest codes and accompanied by personal and professional technical support from our leading experts, DeepEX 3D City can be your everyday tool for simple and complex deep excavation and tunneling design works.

| Capabilities                                                     | DeepEX 3D City |
|------------------------------------------------------------------|----------------|
| Model New Subway Lines                                           | ✓              |
| Construction & Cost Benefit Analysis for New Subway Lines        | ✓              |
| Transportation Demand & Service Analysis                         | ✓              |
| Design Tunnels & Utility Lines (SEM, TBM, Cut-and-Cover)         | ✓              |
| Estimate Settlements along Tunnel Lines                          | ✓              |
| Damage Assessment on Existing Infrastructure                     | ✓              |
| Design Metro Station Excavations (2D & 3D Models)                | ✓              |
| Import City Maps and Elevations from Google                      | ✓              |
| Import City Buildings and Elevations from DXF (CadMapper)        | ✓              |
| Import City Utilities from QGIS                                  | ✓              |
| Visualize in 3D, Virtual Reality, Augmented Reality              | ✓              |
| Design Deep Excavations & Retaining Wall Structures              | ✓              |
| Perform Limit Equilibrium – Non-Linear – Finite Element Analysis | ✓              |
| Integration with Monitoring Data                                 | ✓              |
| Deep Maintenance – Technical Support (12 Months)                 | ✓              |

Contact us at [sales@deepexcavation.com](mailto:sales@deepexcavation.com) and get an offer to purchase or upgrade to our complete solution!



-  +1-206-279-3300
-  [sales@deepexcavation.com](mailto:sales@deepexcavation.com)
-  [www.deepexcavation.com](http://www.deepexcavation.com)
-  Deep Excavation LLC 240 W 35th Street, Suite 1004 New York, NY, 10001 U.S.A