THE MASTERWORKS OF GEOTECHNICAL ENGINEERING

MIDAS Project Applications

GEOTECHNICAL

www.MidasUser.com

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THE MASTERWORKS OF GEOTECHNICAL ENGINEERING

MIDAS Project Applications

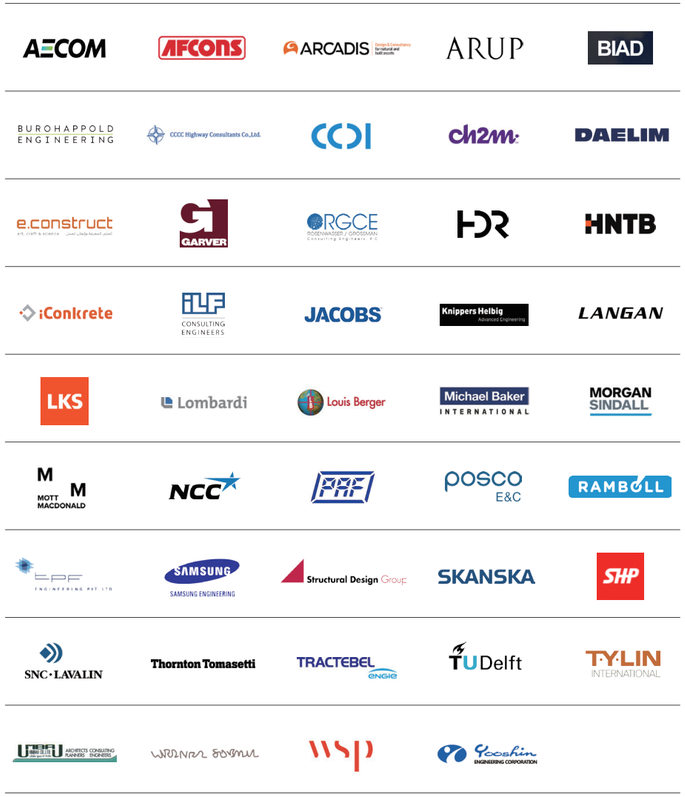
GEOTECHNICAL

MIDAS IT always strives for constant growth and progress with midas users who have made us a trusted leader in technology.

This project application book was published by MIDAS IT, but what MIDAS IT did was just collecting the masterworks of midas users. This book is dedicated to the midas users without whom it would not exist.

MIDAS IT will keep providing the world with utilitarian values that support human pursuit of happiness with our creative technology.

MIDAS Power Users



Contents

GTS NX

Bosphorus Third Bridge

Istanbul, Turkey

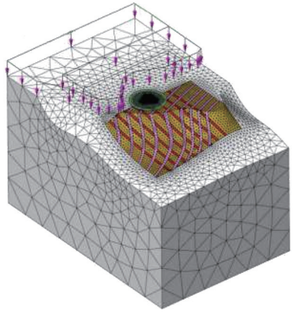
Owner	Republic of Turkey
General Contractor	Hyundai E&C / SK E&C
Engineering Consultant	Lombardi
Construction Period	2013 - 2015
Type of Project	Bridge Foundation
Size of Structure	1.4km Main Span, 2.2km Total Length

Main features used in this application

- Anchor block and ground approach of the cable stayed bridge
- Interface elements between shaft and soil

Description on this project

The Bosphorus Third Bridge is a part of the 260km long Northern Marmara Motorway. The bridge, which is 2.2km long with a main span of 1.4km, links Europe to Asia, north of Istanbul. With its width of 59m, this is the first bridge of the world that accommodates an 8-lane highway and a 2-lane railway at the same level.

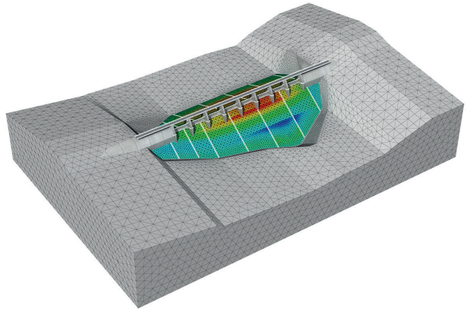


Lombardi			
Address	Via Giotto 36IT - 20145 Milano, Italy		
Introduction	In 1955, Dr. Giovanni Lombardi founded his consulting company for engineering services, cornerstone of the Lombardi Group. Today, the company cares for the life cycle of transport infrastructures and hydraulic works from the initial design phases to their operation.		
Website	www.lombardi.ch	**Email**	milano@lombardi.group

Buhang Dam

GTS NX

Gimcheon, Korea



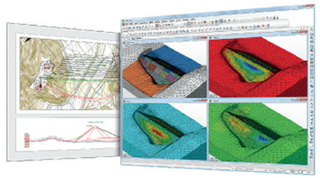
Owner	Korea Water Resources Corporation
Engineering Consultant	GS E&C
Construction Period	2006 - 2014
Type of Project	Concrete / Flood - Control Dam
Size of Structure	472m Length, 75m Height

Main features used in this application

- Evaluate the deformation and member force of cut - off wall due to water pressure
- Deformation and stress distribution with constitutive models

Description on this project

Buhang Dam is located in Gimcheon City, Gyeongsangbukdo, South Korea. After typhoon Rusa passed, a dam was deemed to be necessary to prevent flood damage. It is expected to contribute to the development of local communities through the supply of river maintenance water for dams and minimization of flood damage in the Gamcheon coastal area around Gimcheon City. It will also supply drinking water and agricultural water in Gwangcheon and Gumi.

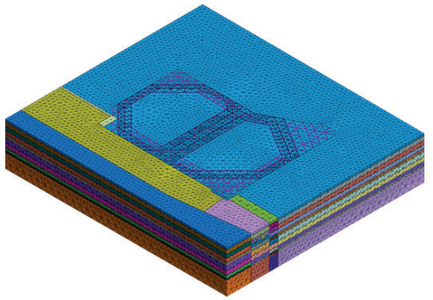


GS E&C	
Address	GRAN SEOUL, 33 Jong-ro, Jongno-gu, Seoul, Korea
Introduction	GS E&C has established its status as a top - ranking company domestically since its foundation in 1969 by achieving tremendous growth in the fields of architecture, civil engineering, housing, plant, environment and power plant.
Website	www.gsenc.com

Hangzhou a Block of Commercial - Financial Space Foundation Pit Works

GTS NX

Hangzhou, China



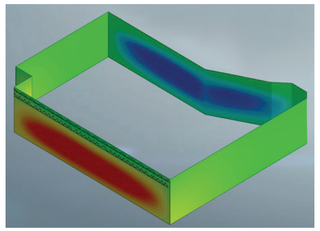
Engineering Consultant	Hangzhou Survey and Design Institute
Type of Project	Foundation
Size of Structure	20m Height, 26,000m^2 Area

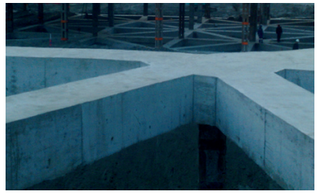
Main features used in this application

- 3D FEM analysis of the impact of excavation on the subway station and tunnel

Description on this project

The excavation area is about 26,000m^2 and a depth of 20.2m. The pile is constructed by using the bored piles. The excavation pit is surrounded by a building complex and the Metro Line 2 Qingchun Road Station. Analysis was required to verify the excavation will not affect adjacent structures.





Hangzhou Survey and Design Institute			
Address	China's Hangzhou City, Zhejiang Province, Wulin Gate Village on the 13th, China		
Introduction	Hangzhou Survey and Design Institute was built in 1984. Class A "Engineering Survey Certificate" and Class A "mapping qualification certificate" were issued by Ministry of Construction and State Bureau of Surveying and Mapping respectively. Hangzhou Survey and Design Institute actively participate in urban construction, subway, a large number of high-rise buildings and geotechnical engineering design.		
Website	www.hkance.com	**Email**	Hkance@mail.hz.zj.cn

Busan Subway Line 3 Tunnel

GTS NX

Busan, Korea

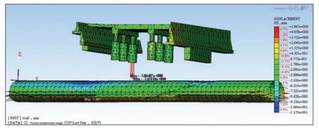
Owner	Busan Metro
Engineering Consultant	ORUM
Construction Period	Completed in 2005
Type of Project	Subway Tunnel
Size of Structure	18.1km Total Length

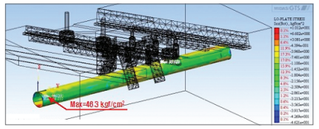
Main features used in this application

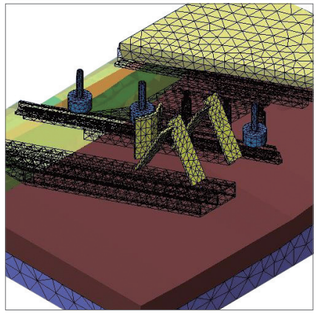
- Performing construction stage analysis to check the settlement while checking the initial support capacity for the fan plant structure

Description on this project

Two types of analysis were performed based on different 3D model files. The full underground structure was modeled to monitor the initial support capacity including rock bolts and shotcrete, at structural level. A construction sequences analysis of the fan plant was ran to obtain the general stability and settlements of the soil layers, at geotechnical level.







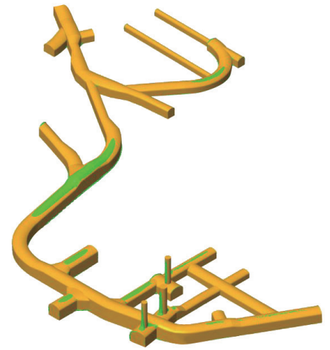
ORUM	
Address	201, 8th Orum Building, Geoje1-dong, 1493-6 beon-gi, Yonje-gu, Busan, Korea
Introduction	Orum creates economical and stable structures finding the most proper methods with fluent experiences in the field. The firm is specialized in Civil analysis and drawing, geotechnical investigation, and instrumentation.
Website	www.orumeng.com

Posiva's Onkalo

GTS NX

Eurajoki, Finland

General Contractor	Kalliorakennus Oy, SK-Kaivin Oy and Destia Oy
Engineering Consultant	Posiva
Construction Period	Under Construction
Type of Project	Nuclear Waste Disposal Facility
Size of Structure	455m Depth

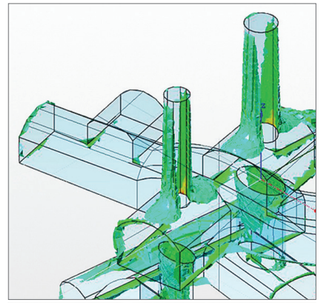


Main features used in this application

- Stability of hard rock excavations in depth up to 500m and to optimize rock support system
- Impact of vibration due to blasting and groundwater level on underground cavern

Description on this project

The Onkalo Spent Nuclear Fuel Repository is a deep tunnel system for the final disposal of spent nuclear fuel. It is first of such repository in the world. It is currently under construction at the Olkiluoto Nuclear Power Plant in the municipality of Eurajoki, on the west coast of Finland, by the company Posiva. It is based on the KBS - 3 method of nuclear waste burial developed in Sweden by Svensk Karnbranslehantering AB (SKB).

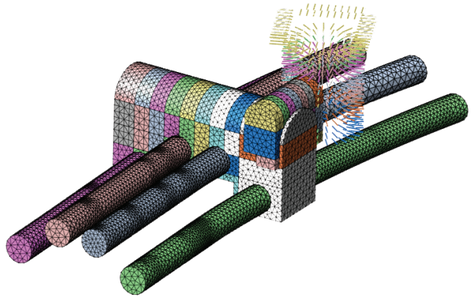


Posiva	
Address	Posiva Oy, Olkiluoto, FI - 27160 Eurajoki, Finland
Introduction	Posiva aims for safe, on-time and economically feasible final disposal of spent nuclear fuel, working according to the demands of the company's owners and other stakeholders. Posiva commits to the continuous improvement of the safety and quality of its operations, as well as to the fulfilment of the requirements of the society in full compliance with laws and regulations. The management of operational safety is carried out in a holistic and systematic manner.
Website	www.posiva.fi

ARC: Trans-Hudson Express Dyer Avenue Fan Plant

GTS NX

New York, USA



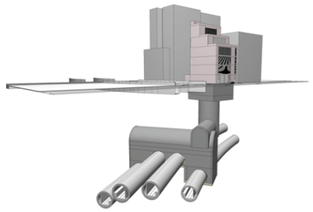
Engineering Consultant WSP | Parsons Brinckerhoff
Type of Project Fan Plant

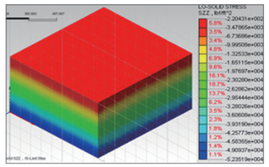
Main features used in this application

- Performing construction stage analysis to check the settlement while checking the initial support capacity for the fan plant structure

Description on this project

Two types of analysis were performed based on different 3D model files. The full underground structure was modeled to monitor the initial support capacity including rock bolts and shotcrete, at structural level. A construction sequences analysis of the fan plant was ran to obtain the general stability and settlements of the soil layers, at geotechnical level.





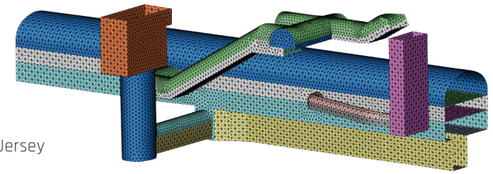
WSP | Parsons Brinckerhoff

Address	2202 N West Shore Blvd, Suite 300, Tampa, Florida 33607, USA
Introduction	Parsons Brinckerhoff is one of the world's leading engineering professional consulting firms. Their expertise ranges from environmental remediation to urban planning, from engineering iconic buildings to designing sustainable transport networks, and from developing the energy sources of the future.
Website	www.wsp-pb.com

Trans - Hudson Express

GTS NX

New York, USA



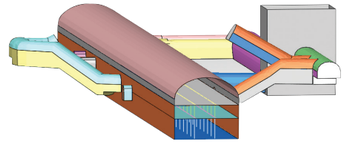
Owner NJ Transit and Port Authority of New York and New Jersey
General Contractor THE Partnership JV
Engineering Consultant ILF Consulting Engineers
Construction Period 2009 - 2010
Type of Project Rail Tunnel
Size of Structure
- Palisades Tunnels (1.6km Length)
- Hudson River Tunnels (2.3km Length)
- Manhattan Tunnels (2km Length)
- Station Cavern (29m Wide, 27m Height)

Main features used in this application

- Construction sequences of the subway complex
- Stability of lining structures and rock bolts

Description on this project

- NYPSE Caverns and Ancillary Tunnels
  - Evaluated geotechnical ground properties, geotechnical/geological models developed
  - Defined excavation stages/sequences
  - Designed initial ground support
  - Predicted surface settlements
  - Provided overbuild criteria to specify magnitude, distribution and location of loading due to future overbuild along both sides of 34th Street



ILF Consulting Engineers

Address	11710 Plaza America Drive Suite 2000 Reston, VA 20190, USA		
Introduction	ILF draws on its 50 years of experience to provide all of the engineering and design services required for the implementation of projects in its business areas. Every project is unique and has requirements specific to the client, business, and country. Successful design and planning comes through a well prepared engineering and design process.		
Website	www.ilf.com	**Email**	info.usa@ilf.com

Interchange near the Sokol Subway

Moscow, Russia

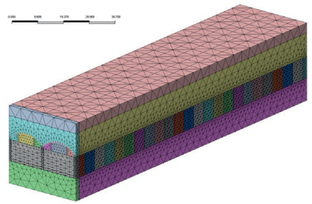
Owner	Government of Moscow
General Contractor	NPO 'Cosmos'
Engineering Consultant	Podzemproekt
Construction Period	2007 - 2015
Type of Project	Underground Tunnel
Size of Structure	• Reconstruction of the Leningrad Tunnel (660m Length, 12 - 14m Depth) • Construction of Volokolamsk Tunnel (1.73km Length, 20m Depth) • Construction of Overpasses (390m Length) • Construction Halabyan-Baltic Tunnel (1.94km Length, 22.5m Depth)

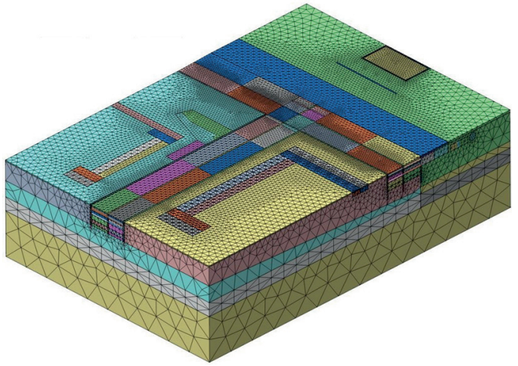
Main features used in this application

- Construction stage analysis
- Tunneling effects on adjacent structures

Description on this project

The construction is complicated by the fact that 20m deep tunnels performed open way in water - saturated sands and tested at an average distance of 10m from residential buildings. In this excavation, Halabyan - Baltic tunnel under two tunnels under the existing subway and the Leningrad highway tunnel runs closed method without stopping subway and vehicle traffic.





Podzemproekt			
Address	125040, 3rd Yamskogo Polya Str., 2, Moscow, Russia		
Introduction	Podzemproekt organization was founded in 2005. The main activity is the design calculation of building structures, foundations, basements and underground structures, as well as research in the field of construction theory, soil mechanics and rock mechanics of underground structures.		
Website	www.podzemproekt.ru	**Email**	mail@podzemproekt.ru

Cityringen
Copenhagen Metro

Copenhagen, Denmark

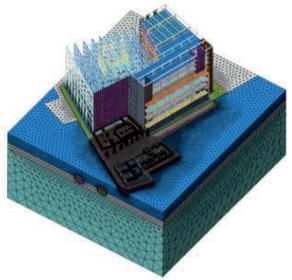
Owner	Metroselskabet
General Contractor	CMT COPENHAGEN METRO TEAM, Tecnimont Civil Construction, salini impregilo, SELI
Engineering Consultant	Lombardi
Construction Period	2011 - 2017
Type of Project	Building Risk Assessment for Subway Station and underpass of historical buildings
Size of the Structure	15.5km long twin single - track metro tunnels, 17 underground stations

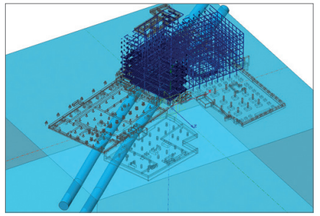
Main features used in this application

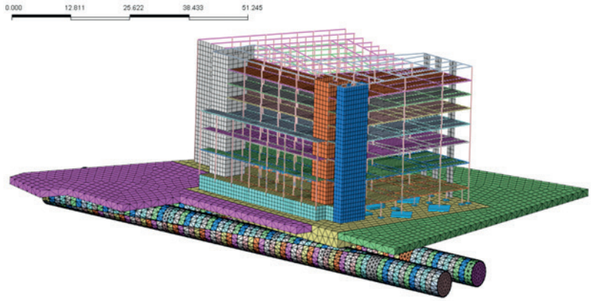
- Interaction between MIDAS family programs (Gen & GTS)
- Construction stage analysis for TBM

Description on this project

The Cityringen is a city circle metro - line, approximately 15.5km long and will serve major areas of the city of Copenhagen including the Danish Parliament, the Central Station, the City Hall, existing major S - train and metro stations and national monuments. The line will have driverless communication - based train control system, with stewards on board. A round trip is expected to take 23 minutes. The headway interval is expected to be 200 seconds, with 28 trains of 3 carriages running at 90km/h.







Lombardi

Address	Via Giotto 36IT - 20145 Milano, Italy		
Introduction	In 1955 Dr. Giovanni Lombardi founded his consulting company for engineering services, cornerstone of the Lombardi Group. Today, the company cares for the life cycle of transport infrastructures and hydraulic works from the initial design phases to their operation.		
Website	www.lombardi.ch	**Email**	milano@lombardi.group

King's Cross Station

London, UK

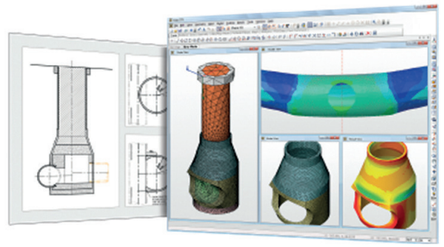
Owner	Network Rail
Architect	John McAslan + Partners
Engineering Consultant	Arup / Morgan Sindall
Construction Period	2008 - 2013
Type of Project	Railroad Station

Main features used in this application

- The section of the existing tunnel where the shaft intersects is strengthened with block work
- The cylindrical section of the shaft is built with segmental lining
- The tapered section of the shaft is built in 1m deep stages and lined with sprayed concrete

Description on this project

The redevelopment of King's Cross station in the city of London is turning a historic rail terminus into a dynamic transport hub. Arup's work as a lead consultant on King's Cross station embraced transport planning, multi-disciplinary engineering services, security, IT, lighting design, acoustics, visualization, and pedestrian modeling.



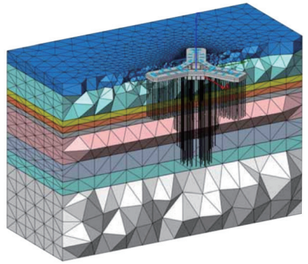
Arup			
Address	13 Fitzroy Street, London W1T 4BQ, UK		
Introduction	Arup is a multinational professional services firm headquartered in London which provides engineering, design, planning, project management and consulting services for all aspects of the built environment. The firm has over 14,000 staffs based in 92 offices across 42 countries, and has participated in projects in over 160 countries.		
Website	www.arup.com	**Email**	london@arup.com

Jeddah Tower

GTS NX

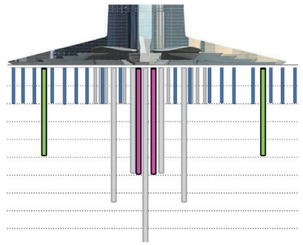
Jeddah, Saudi Arabia

Owner	Jeddah Economic Company / Kingdom Real Estate Development
General Contractor	Saudi Bin Laden Group
Architect	Adrian Smith + Gordon Gill Architecture
Engineering Consultant	LANGAN International / Thornton Tomasetti
Construction Period	Under Construction
Type of Project	Pile Foundation
Size of the Structure	1,008m Height



Main features used in this application

- Piled - raft foundation for high-rise building



Description on this project

Rising 1,000m (3,280 feet) into the Arabian sky, the tower will eclipse the reigning tallest building by 173m (568 feet). The first phase of the Kingdom City comprises the tower, a 65,000-square-m retail mall, and a 3,000+ car underground garage. LANGAN's role has included the development and oversight of the site subsurface investigation, final design of the piles in collaboration with the design team, storm water management, integration of the circulation, volume demands of the tower and retail building into the traffic master plan for Jeddah's Kingdom City.

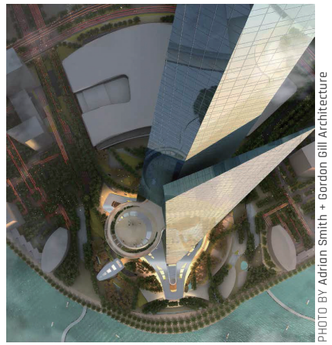


PHOTO BY Adrian Smith + Gordon Gill Architecture

LANGAN International

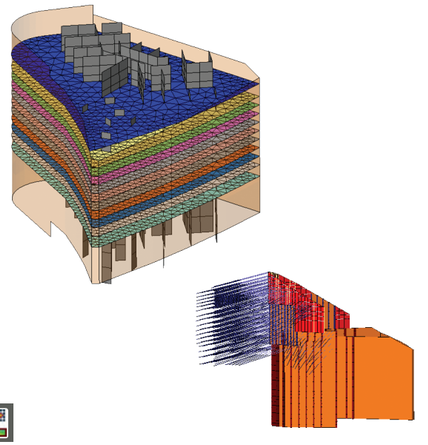
Address	300 Kimball Drive, 4th Floor Parsippany, New Jersey 07054-2172, USA
Introduction	Founded as a geotechnical specialty firm in 1970, LANGAN quickly became involved in many large, complex projects located throughout the eastern part of the USA. As their growth continued, they leveraged our highly technical base to expand into the civil engineering and environmental disciplines. LANGAN International was formed to support global clients and partner with the world's elite design and construction teams around the world.
Website	www.LANGAN.com
Email	info@LANGAN.com

Odeon Tower

GTS NX

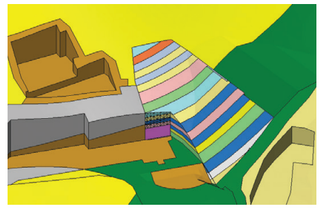
Monaco, Monaco

Owner	Group Marzocco
General Contractor	Vinci Construction France
Architect	Alexandre Giraldi
Engineering Consultant	Coyne et Bellier
Construction Period	2010 - 2015
Type of Project	Office Building Foundation
Size of Structure	170m Height (49-story)



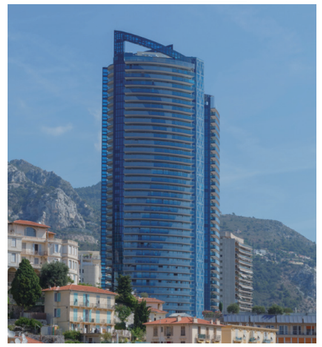
Main features used in this application

- Assessment of ground movements especially at adjacent building foundations
- Deep excavation in a sloping site and retaining system (especially arching effects on the uphill side)



Description on this project

The Odeon Tower is a double - skyscraper in the Principality of Monaco. It was the first high-rise in the city to be built since the 1980s. But high-rise constructions had been abandoned due to aesthetic concerns and criticism of over-development. 3D model of excavation and construction sequence was necessary to ensure adjacent school buildings will not be affected.



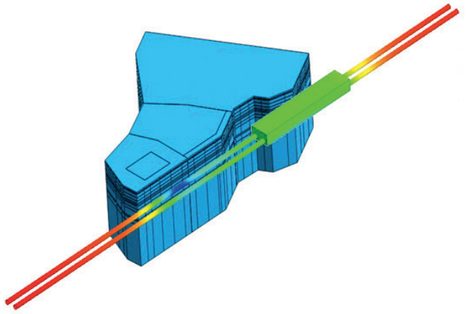
Coyne et Bellier

Address	Le Delage, 5, rue du 19 mars 1962, 92622 Gennevilliers CEDEX, France
Introduction	Coyne et Bellier is a global consulting and engineering firm based out of Gennevilliers, France. They specialize in infrastructure projects such as dams, nuclear and hydroelectric power plants, roads, tunnels and other below - surface facilities. The company also carries out environmental and social impact assessment. They operate out of 43 offices in Asia, Europe, the Americas, and Africa. The company was created by André Coyne and is a subsidiary of Tractebel.
Website	www.tractebel-engie.com

Hangzhou Yintai City Foundation Pit

GTS NX

Hangzhou, China



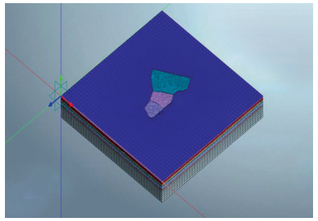
Owner	Intime Group
Engineering Consultant	East China Investigation and Design Institute
Construction Period	2013 - 2015
Type of Project	Foundation Pit
Size of Structure	400m Length, 1.3km Total Length

Main features used in this application

- The basic excavation depth of the project is 15.6m ~ 17.4m and the local pit depth is 23.7m. The commercial part is close to the Hangzhou subway station and shield tunnel (two adjacent to the subway station, two other near the shield tunnel), the envelope from the subway station and tunnel is 12m ~ 15.2m.

Description on this project

This project is located in Hangzhou Linping District. The foundation pit will use bored piles and will have irregular triangular shapes. The Foundation Pit was to be excavated by stages and most additionally consider 5 basements that will be used for commercial retail.



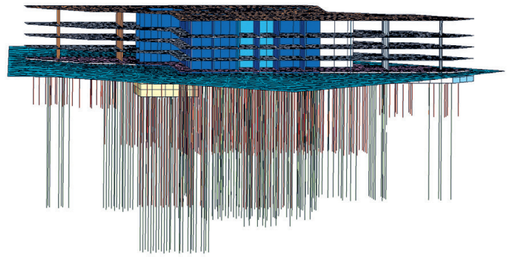
East China Investigation and Design Institute

Address	Zhejiang Hangzhou Higher Education Road 201, China		
Introduction	East China Investigation and Design Institute was established in 1954 which is the national institute of large-scale comprehensive survey and design units. In September 2008, it has been awarded a total of 21 sets of engineering design, including electricity, highway, waterway, municipal, water conservancy and marine industry.		
Website	www.ecidi.com	**Email**	hwyw@ecidi.com

Dubai Tower in Qatar

GTS NX

Doha, Qatar



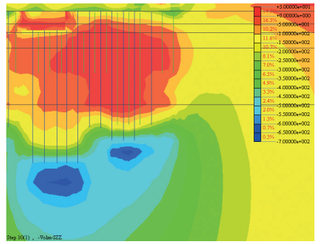
Owner	Sama Dubai (Dubai International Properties)
General Contractor	Al Habtoor - Al Jaber Joint Venture
Architect	RMJM
Engineering Consultant	Arcadis
Type of Project	Mixed-use Building Foundation
Size of Structure	439m Height (88-story)

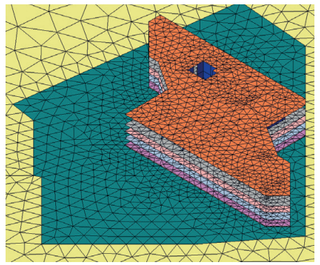
Main features used in this application

- Piled-raft foundation for high-rise building
- Analysis results for design (Settlements, raft forces and bending moments, pile forces and bending moments)

Description on this project

The proposed development for the Dubai Tower project comprises the construction of an approximately 80 floor high-rise tower with a mezzanine, ground floor and five basement levels. It will be the tallest structure in Qatar when it is complete. The tower was founded on soft sand and required the design of a piled raft in a 3D finite element model to fully understand the behavior.





Arcadis

Address	Arcadis House, 34 York Way, London N1 9AB, UK		
Introduction	Arcadis is an integrated engineering and environmental consultancy. Supported by a strong engineering, planning and transport capability, Arcadis has a long history of providing simple, straightforward and cost - effective advice to governmental, commercial and industrial clients in the UK and around the world.		
Website	www.arcadis.com	**Email**	UKenquiries@arcadis.com

Canton Tower Foundation Ditch

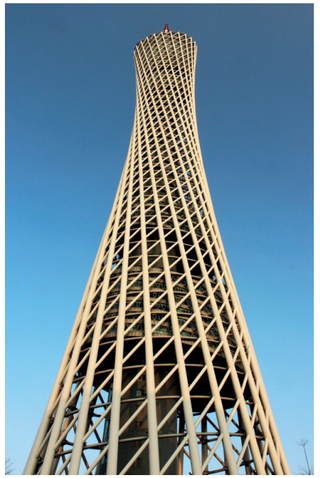
Guangzhou, China

Owner	Guangzhou New TV Tower
General Contractor	Guangzhou Municipal Construction Group JV / Shanghai Construction Group
Architect	Guangzhou Design Institute
Engineering Consultant	Arup
Construction Period	2005 - 2010
Type of Project	Observation & Television Transmission Tower
Size of Structure	600m Height

GTS NX

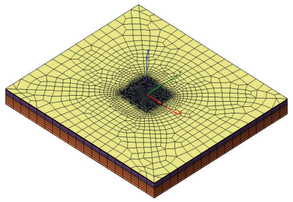
Main features used in this application

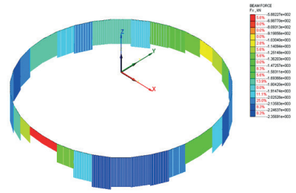
- Foundation pit excavation stability analysis



Description on this project

Canton Tower is constructed as a composite tube-in-tube design, featuring a reinforced concrete core containing all the tower's services and vertical transportation which set inside an outer structure made up of a steel lattice. The two structural components then support series of smaller structures suspended within the tower at different elevations. The slenderness of the tower's design makes it especially vulnerable to sway in the wind, and requires the inclusion of a tuned mass damper system. A 3D FEM model with dynamic loads and construction stages was used to verify the foundation's stability during construction and operational use.





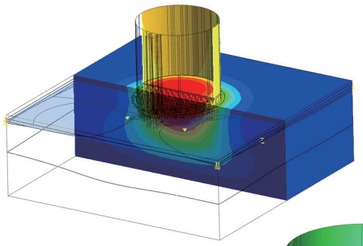
ARUP

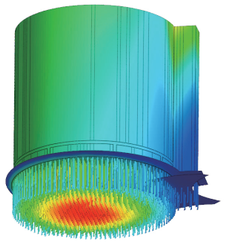
Address	Room 1301, Tower A Center Plaza 161 Linhexi Road Tianhe District, Guangzhou 510620, China		
Introduction	Arup is a multinational professional services firm headquartered in London which provides engineering, design, planning, project management and consulting services for all aspects of the built environment. The firm has over 14,000 staffs based in 92 offices across 42 countries, and has participated in projects in over 160 countries.		
Website	www.arup.com	**Email**	guangzhou@arup.com

Foundation of Sugar Silo

GTS NX

Gostyn, Poland





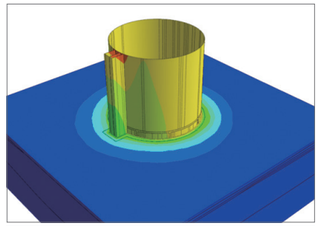
Engineering Consultant	GT Projekt
Construction Period	2012 - 2013
Type of Project	Silos Foundation
Size of Structure	50m Diameter, 70m Height, 80,000 tons Capacity

Main features used in this application

- Linear static analysis with construction stages
- Hardening soil material and soil - pile interface elements

Description on this project

Special solution was needed for the largest sugar silo in Poland because it would sit on soft soil. It was determined that more than 1,000 displacement piles was needed for the foundation following the design with advanced analysis.

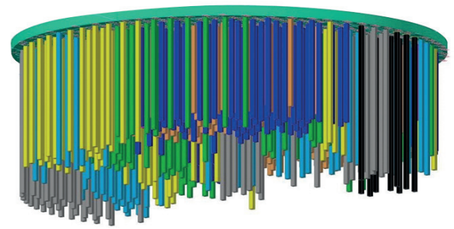


GT Projekt			
Address	Parkowa 4, Swadzim 62-080 Tarnowo Podgórne, Poland		
Introduction	GT Projekt is a consulting company operating since 1999, involved in many international projects. Main fields of activity are: civil and structural engineering, geotechnics, engineering geology and chemistry. GT Project is experienced in design, field investigation and laboratory test.		
Website	www.gtprojekt.pl	**Email**	info@gtprojekt.pl

Isothermal Tank - Liquefied Hydrocarbon Storage

GTS NX

Leningrad, Russia



Owner	NIPI gaspererabotka
Engineering Consultant	GEOTECH
Construction Period	Completed in 2012
Type of Project	Building Foundation
Size of Structure	20,000m³

Main features used in this application

- Nonlinear analysis with pile elements

Description on this project

Three - dimensional simulation of pile-raft foundation with elastic - plastic deformation of the ground model was considered. The number of foundation's final design used 497 piles, which were modeled with special pile elements in midas GTS NX.

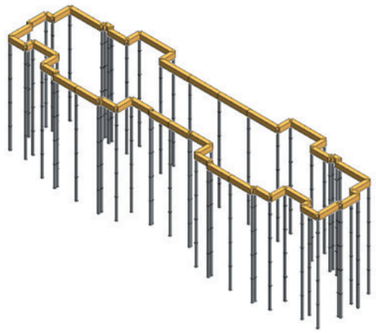
GEOTECH			
Address	350005, Pokrishkina str., 4/8, Krasnodar, Russia		
Introduction	GEOTECH includes many highly qualified specialists able to solve the most complicated architectural, structural and geotechnical tasks. The Company is divided into departments with narrow specializations. This is their major advantage because every single task solves by the professional team of architects, structural and geotechnical engineers.		
Website	www.geo-technics.com	**Email**	info@geo-technics.com

Hefei Metro Line 4

GTS NX

Anhui, China

Owner	Hefei Urban Mass Transit
Engineering Consultant	Traffic Planning and Design Institute of Anhui Province
Construction Period	Completed in 2015
Type of Projectt	Subway Tunnel
Size of Structure	68.2 × 17.2m (The Foundation pit)

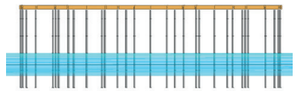


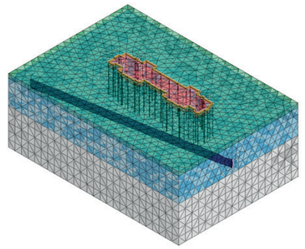
Main features used in this application

- Impact of shield construction on buildings

Description on this project

Hefei subway tunnel would be excavated next to a high-rise building with a 21m long pipe pile foundation. The building's foundation runs parallel to the tunnel excavation for an extended segment of the new project. Therefore, 3D FEM model was required to verify differential settlement on the existing structure.





Traffic Planning and Design Institute of Anhui Province

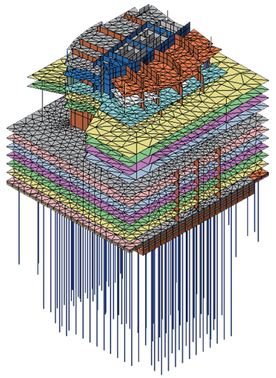
Address	No.180, Xiangzhuang Road, High-tech Zone, Hefei, Anhui Province, China
Introduction	The company was founded in 1960. At present, the company and its subsidiaries have engineering grade A, engineering survey comprehensive grade A, road industry design class A, water transportation industry design grade A, municipal industry professional grade A and construction industry class A.
Website	www.acdi.ah.cn

Pentominium Residential Development

GTS NX

Dubai, UAE

Owner	Trident International Holdings
General Contractor	Arabian Construction Company - Hitachi Plant Technologies
Engineering Consultant	Arcadis
Construction Period	Under Construction
Type of Project	Residential Building Foundation
Size of Structure	516m Height (122-story)

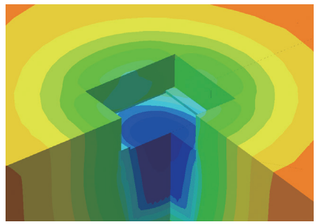


Main features used in this application

- Piled - raft foundation for high - rise building
- Analysis results for design
  (Settlements, raft forces and bending moments, pile forces and bending moments)

Description on this project

The Pentominium Residential Development is located on the west side of the creek in Dubai. The development comprises the construction of an approximately 120 story high-rise tower inter-linked by low level podium structure housing up to 7 basement levels. The Pentominium Tower will be founded on a piled raft and required a 3D finite element model to fully understand the behavior of the foundation interaction with surrounding soil.



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