

GENERAL STATEMENT OF QUALIFICATIONS INTERNATIONAL





SUSTAINABLE DESIGN

Langan professionals design solutions that maintain the inherent connections between structures and their natural surroundings. The result - sustainable communities for future generations to live, work and play.

HEALTH & SAFETY

Langan is committed to providing a healthy and safe working environment. Langan's goal is to be SAFE (Stay Accident Free Everyday).





Nine Elms Square, London, United Kingdom

Firm Profile

Representative International Projects

Representative North America Projects



Al Maryah Central/The Galleria, Abu Dhabi, UAE

Firm Profile

CORPORATE SUMMARY

INTEGRATED SOLUTIONS. MEASURABLE VALUE.

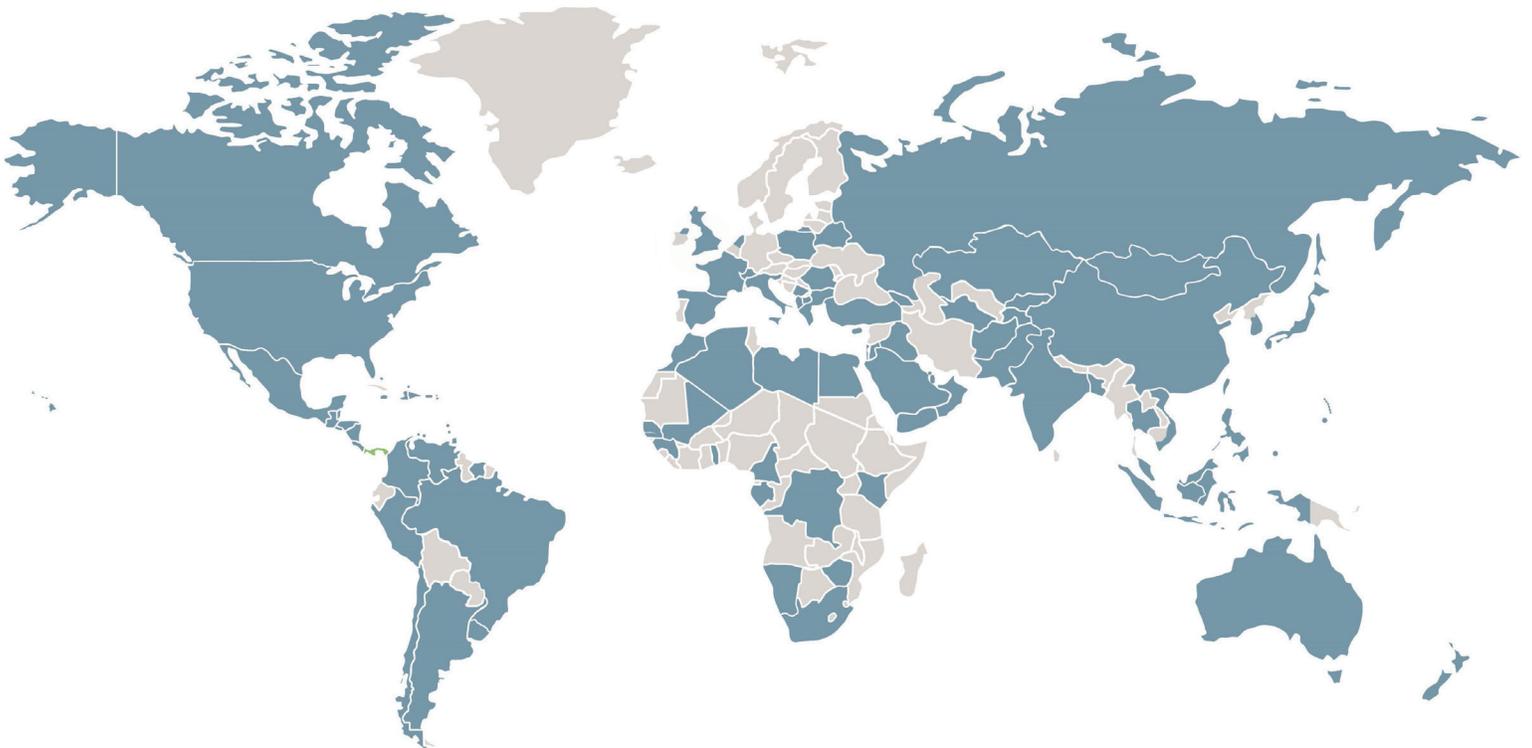
Langan provides an integrated mix of engineering and environmental consulting services in support of land development projects, corporate real estate portfolios, and the energy industry. Our clients include developers, property owners, public agencies, corporations, institutions, and energy companies around the world.

Founded in 1970, Langan employs over 1,300 professionals in its Parsippany, NJ headquarters and among regional offices in:

- New York, NY
- White Plains, NY
- New Haven, CT
- Boston, MA
- Lawrenceville, NJ
- Philadelphia, PA
- Bethlehem, PA
- Doylestown, PA
- Pittsburgh, PA
- Cleveland, OH
- Chicago, IL
- Arlington, VA
- Denver, CO
- Houston, TX
- Dallas, TX
- Austin, TX
- Tyler, TX
- Phoenix, AZ
- San Francisco, CA
- Oakland, CA
- Sacramento, CA
- San Jose, CA
- Santa Barbara, CA
- Los Angeles, CA
- Irvine, CA
- Seattle, WA
- Miami, FL
- Fort Lauderdale, FL
- Tampa, FL
- Orlando, FL
- West Palm Beach, FL

Langan International, the firm's wholly owned subsidiary headquartered in New York City, provides all firm services for projects in the Middle East, Eastern Europe, Latin America, and the Caribbean. Langan International regional locations are in:

- Athens
- Calgary
- Dubai
- London
- Panama



Blue denotes countries where Langan has worked



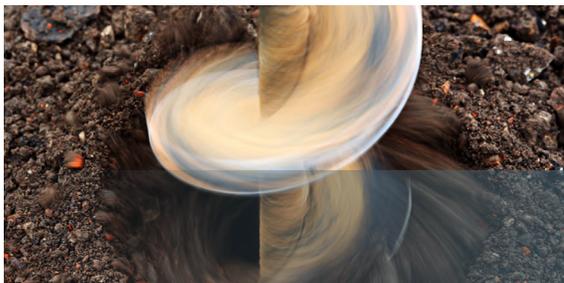
SITE/CIVIL

RESPONSIVENESS THAT DELIVERS RESULTS

Langan's site/civil engineers work closely with the design team to develop final designs that minimize disturbances, permitting requirements, and cost. Our quality submittals lead to rapid permit approvals. Langan staff observes construction to ensure adherence to our design criteria and simplify the permit termination process.

SITE/CIVIL SERVICES:

- Site Feasibility Studies & Conceptual Plans
- Grading & Drainage Design
- Erosion & Sediment Control Plans/Permits/Inspection
- Site Restoration Plans & Analysis
- Post-Construction Stormwater Earthwork Analysis
- Construction Observation
- Utility Infrastructure Designs
- Landscape Plans
- Hydrologic & Hydraulic Studies
- Waterfront Systems Designs
- Property Acquisition Support
- Regulatory Coordination/Compliance
- CADD/GIS/Computer Animations



GEOTECHNICAL

SUBSURFACE SOLUTIONS

Langan was founded as a geotechnical consulting company in 1970, and geotechnical engineering remains a core discipline at Langan today. We work closely with our clients and the permitting, design, and construction teams to engineer cost-effective geotechnical solutions appropriate for proposed infrastructure by considering permitting constraints and site conditions.

GEOTECHNICAL SERVICES:

- Subsurface Investigations
- Slope Stability Analysis
- Crossing Design Using Trenchless Techniques
- Subsurface Utility Engineering
- Earthquake/Seismic
- Materials Analysis
- Foundation Design
- Retaining Structures
- Soil Improvement/Ground Modification
- Dewatering Design & Permitting
- Excavation Support & Underpinning Design
- Geological Mapping of Rock Slopes
- Mine Investigations
- Earth & Rock Fill Dams
- Tunnels/Microtunneling
- Seawalls, Piers, & Bulkheads
- Pre-Construction Conditions Surveys
- Construction Observation
- Forensic Engineering/Expert Testimony
- Geotechnical Hazard Assessment Tool



ENVIRONMENTAL

TECHNICAL AND REGULATORY ADVOCACY

Langan works with project teams to provide leading-edge, focused, streamlined investigations and risk-based remediation. We excel in promoting and gaining regulatory acceptance of risk based strategies to obtain cost effective site closures. Langan possesses expertise in a wide variety of projects including state Voluntary Programs, Brownfields, RCRA, Hazardous Building Materials, State and Federal Superfund, Manufactured Gas Plants (MGP) and Storage Tank programs.

ENVIRONMENTAL SERVICES:

- Risk-Based Corrective Action
- Brownfields
- Storage Tank Management
- Due Diligence Support
- Environmental Assessments
- Site Characterization
- Permitting/Regulatory Approvals
- Remediation Design/Oversight
- Water Resources/Supply
- Hydrological Investigations
- Wastewater and Stormwater Permitting
- Air Modeling
- GIS/Database Management
- Environmental Impact Statements (EIS)
- Manufactured Gas Plant Remediation
- Asbestos/Lead-Based Paint Abatement
- Management of PCB-Containing Materials
- Indoor Air Quality/Mold
- Demolition
- Waste Management
- Compliance Auditing
- Ecological Risk Assessment
- Human Health Risk Assessment
- Site Feasibility Studies
- Remediation by Natural Attenuation
- Expert Witness
- Exposure Assessments



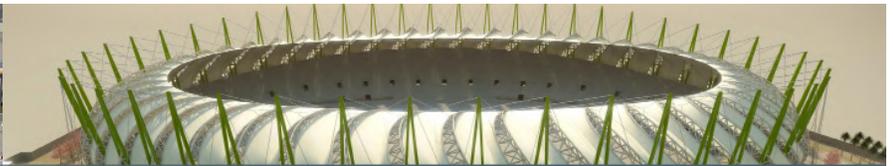
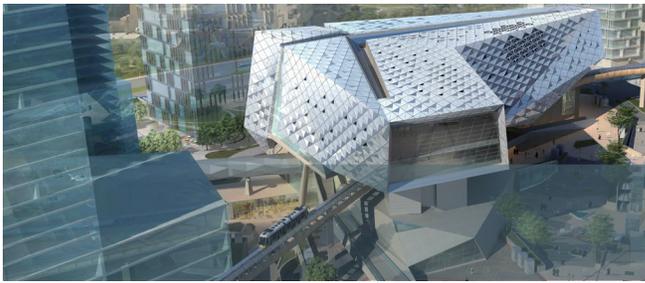
SURVEYING, SCANNING, & MAPPING

CUTTING-EDGE TECHNOLOGY & EFFICIENCY

Our field crews utilize state-of-the-art surveying equipment including a new Pegasus mobile mapping system, 3D laser scanning, global positioning systems (GPS), robotic and prismless total stations, single and multi-beam echo sounders, drones, and side-scan sonar. Langan's mobile mapping and 3D scanning programs are integral for asset management, as-built information, and preliminary development for all aspects of the industry. Use of the most recent technology in the field allows our crews to be more productive and achieve greater accuracy. Field crews have mobile internet capabilities through field laptops and our advanced equipment to accommodate data analysis and design changes in real time, which is crucial in oil and gas field operations.

SURVEYING SERVICES:

- Well Plat Surveys
- Topographic Surveys
- Boundary, Right-of-Way, & Corridor Surveys
- ALTA/ACSM Land Title Surveys
- Utility Surveys
- GPS Surveys
- Hydrographic/Bathymetric Surveys
- Highway/Route Surveys
- Construction Stake-Out
- As-Built Surveys
- Photogrammetric Control
- GIS/LIS Data Acquisition
- Geographical Information Systems
- Deformation/Monitoring Surveys
- Utility/Thermal Scanning



PARKING ANALYSIS & DESIGN

OPERATIONAL, FUNCTIONAL, SECURE

Langan has a broad background in all phases of parking design, revenue control systems, and security design for both open lot and enclosed structures. From conceptual plans for developers, to interaction in the design process with noted architects, to integration of parking design with structural engineers, the goal is to provide complete and innovative designs.

With a background soundly founded on operational standards, Langan can provide the latest in revenue control systems, green lighting systems, advanced security orientation, and safety. Our garage management office plans help integrate all the functioning systems necessary to efficiently run the modern garage.

In keeping up with the latest technology, Langan can provide information and design of a multitude of mechanical, automatic, and robotic garage concepts, enabling the future to be realized today.

PARKING ANALYSIS AND DESIGN SERVICES:

- Develop Parking Demand Projections
- Conceptual Design Options
- Garage Massing and Layout
- Striping Plans for Existing Environments
- Maximum Garage Density
- Utilization of Self Park and Valet Systems
- Integration with Traffic Environment
- Expert Witness and Testimony
- Effective Revenue Control Systems
- ADA Compliance Design
- Security Systems and Monitoring
- Pedestrian Drop Off and Waiting Zones
- Pedestrian Safety in the Garage Environment
- Vertical Transportation and Connection to Adjoining Spaces
- Green Lighting and Energy Efficiency
- Signage and Way Finding
- Review of Existing Environments for Maximum Usage



TRAFFIC/TRANSPORTATION

SAFE. EFFICIENT. INNOVATIVE.

Langan's transportation engineering and planning work includes highway and local street design, as well as the design of parking, transit, and non-motorized transportation facilities. For the planning and design of these types of facilities we have provided simulation modeling, master plans, traffic impact studies, operational analysis, signal design, traffic calming measures, signage and wayfinding studies, origin/destination surveys, travel demand modeling, corridor studies, urban transportation plans, transit station and route planning, terminal planning, bikeway planning, and permitting services through counties, municipalities, and the various transportation agencies.

TRANSPORTATION SERVICES:

- Vehicular Traffic Studies
- Stadium and Event Planning
- Traffic Modeling & Simulation
- Master Planning
- Transit Studies
- Station Planning
- Parking Studies
- Corridor Studies
- Site Access / Site Engineering
- Airport Studies
- Site Feasibility Studies
- Streetscape Improvements
- Traffic Calming
- Value Engineering
- Bicycle & Pedestrian Safety Studies
- Toll Facilities
- Urban Development
- Grading & Roadway Design
- Infrastructure Rehabilitation
- Cost Estimates



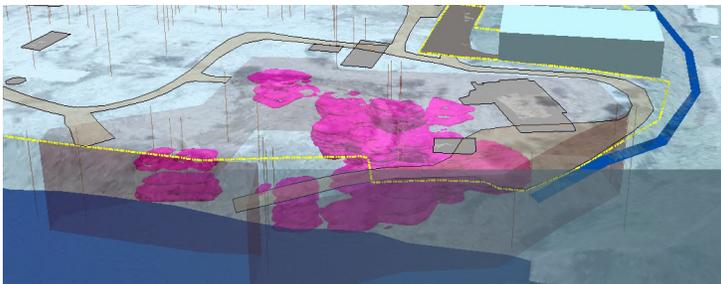
WATERFRONT & MARINE

LEADING EDGE AT THE WATER'S EDGE

Langan works with property owners and their design teams to assess and rejuvenate waterfront sites. We evaluate shorelines and waterfront structures to determine the best approach for reuse, replacement, or new construction. Our waterfront engineers and marine specialists develop tailored design solutions. And with offices strategically located near major bodies of water, Langan is able to serve clients in coastal regions around the world.

WATERFRONT ENGINEERING SERVICES:

- Bulkhead, Wharf, and Pier/Platform Design
- Structural Inspection
- Repair and Remediation Design
- Shoreline Revetment and Slope/Embankment Stabilization
- Flood Protection Studies and Design
- Dredging Design and Oversight
- Stream Restoration and Bioengineering
- Permitting
- Wetland Delineation and Mitigation
- Wildlife Habitat Assessments and Surveys



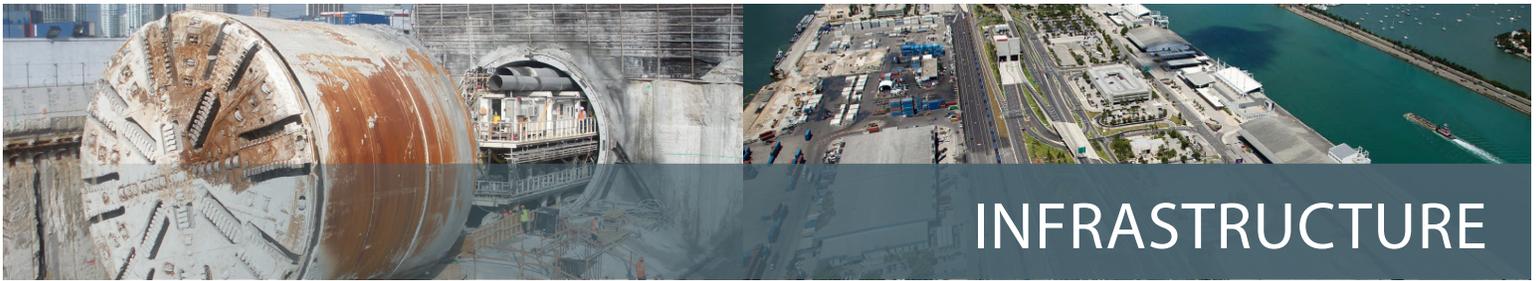
GIS/DATA MANAGEMENT

CUTTING-EDGE DATA VISUALIZATION

Langan utilizes the latest CADD, GIS, and Data Management software applications to analyze and design cost-effective solutions to our clients' problems. Our CADD-GIS group provides custom training, programming, and technical support to both our staff and to our clients in Autodesk's Map, Land Desktop and Civil 3D, as well as ESRI's ArcGIS suite of applications including ArcMap, ArcEditor, and ArcInfo and their assorted extensions. Langan utilizes SITEOPS software for value engineering and to provide design optimization of land development projects. We use Earthsoft's EQulS Chemistry and Geology products to manage large datasets for our environmental and geotechnical clients, and use GIS, Rockworks, GMS and EVS to visualize the data. Langan also uses 3D Studio and various post production products to generate computer generated animations of our clients' projects, allowing them to see the virtual design before construction.

GIS/DATA MANAGEMENT SERVICES:

- Software Integration and Technical Support
- Custom Programming
- Software Training
- Web Design
- CADD Conversions
- GIS Mapping
- 3D Animations
- Data Entry



INFRASTRUCTURE

AN IMPACT PLAYER ON THE TEAM

The engineers and environmental scientists at Langan have vast experience with respect to infrastructure design and consulting. Because of our knowledge and experience, we are an ideal choice for a sub-consultant to construction companies, engineering firms, and architects that specialize in infrastructure programs. Given Langan's nationwide office locations primarily in densely populated urban areas, we are strategically situated to be a local consultant on projects in places like the Washington DC region, New York City and the five boroughs, all of New Jersey, the state of Connecticut, Philadelphia and Eastern Pennsylvania, Miami, and California. As a result, Langan has been a key player in some of the largest, most significant infrastructure projects both in the United States and overseas, encompassing highways, bridges, rail, major transportation hubs, airports, utilities, port facilities, and flood prevention.

LANGAN INFRASTRUCTURE PROJECT TYPES:

- Rail/Transit
- Bridges/Tunnels
- Port/Marine
- Airports
- Tunnels
- Water/Wastewater
- Roadways
- Utilities
- Energy
- Flood Prevention



LENDERS TECHNICAL ADVISORY SERVICES

THE CONCESSIONAIRE'S CONSULTANT

As a cutting-edge leader in site development and redevelopment engineering services, Langan has served as Lenders Technical Advisor (LTA) to numerous privately financed and public-private partnerships (PPP) for large infrastructure concession projects both in the United States and overseas. Services provided have included due diligence; Phase I and Phase II investigations; evaluation of designs, construction means and methods, and project schedule and budget; and reporting and approval of loan drawdowns.

In addition, Langan has significant experience in PPP projects in the United States. Specifically, the firm has provided services for the Penn Station Redevelopment, West Side Yards Redevelopment, and Hudson River Park in New York City.

Notable international projects on which Langan has provided technical advisory services to lenders include:

- EKPPT Motorway – Served as LTA for a 2.1-billion Euro, 365-kilometer motorway in Greece. The project reached financial closing in August 2008.
- Rion-Antirion Bridge – Served as LTA for a 750-million Euro, 3.3-kilometer cable-stay bridge in Greece. The project was awarded the 2007 Opal Award, one of the most prestigious honors in civil engineering.
- Ionia Odos Motorway – Served as LTA for a 1.1-billion Euro, 196-kilometer motorway in Greece.
- Chacao Channel Bridge – Served as Design Checker for a \$700-million, 2.4-kilometer suspension bridge.

“As a result of their invaluable contributions on this world-class project, I would highly recommend Langan for any major project.”

-- J.P. Teyssandier, Managing Director and Chairman of the Board of Gefyra S.A., a Joint Venture lead by VINCI Group, Paris, France

LANGAN

... ACEC

AMERICAN COUNCIL OF ENGINEERING COMPANIES

PROJECT AWARDS

50 Years of Excellence

- 2021 American Dream Meadowlands, East Rutherford, NJ
- 2021 Federal Mall, Chiriqui, Panama
- 2021 Waterline Square, New York, NY
- 2020 Hudson Yards, New York, NY
- 2020 TWA Flight Center Hotel, Jamaica, NY
- 2020 William Paterson University Skyline Hall, Wayne, NJ
- 2020 Trenton Central High School, Trenton, NJ
- 2019 Olympia Odos Motorway, North Peloponnese Coast, Greece
- 2019 Rutgers Richard Weeks Hall of Engineering, Piscataway, NJ
- 2019 700 Jackson Redevelopment and Resiliency Park, Hoboken, NJ
- 2019 LogistiCenter@Logan, Logan Township, NJ
- 2018 Accurate Box, Paterson, NJ
- 2018 Dwight Englewood School, Englewood, NJ
- 2018 Cranbury Logistics Center, Cranbury, NJ
- 2018 1501 Voorhies Avenue, Brooklyn, NY
- 2017 St. Patrick's Cathedral Restoration, New York, NY
- 2017 56 Leonard Street, New York, NY
- 2017 365 Bond Street, Brooklyn, NY
- 2017 Elizabeth Logistics Center, Elizabeth, NJ
- 2017 Foundations for the Future – More Than 25 Higher Education Projects in the Garden State, NJ
- 2016 Hudson Park & Boulevard, Phase I, New York, NY
- 2016 Slurry Wall Re-Support, National September 11 Memorial & Museum, New York, NY
- 2016 World's Fair – New York State Pavilion, Flushing Meadows, NY
- 2015 PortMiami Tunnel, Miami, FL
- 2015 Goya Headquarters, Jersey City, NJ
- 2015 New York Police Department – New Academy, Queens, NY
- 2014 Cooper Medical School of Rowan University and MD Anderson Cancer Center at Cooper, Camden, NJ
- 2014 Rutgers University Livingston Campus Revitalization, Piscataway, NJ
- 2014 Barclays Center, Brooklyn, NY
- 2013 FDR Four Freedoms Park, Roosevelt Island, NY
- 2013 Duke Farms, Hillsborough, NJ
- 2013 Al Falah Community Development, Abu Dhabi, UAE
- 2013 Governors Island Survey, New York, NY
- 2012 Bayonne Crossing, Bayonne, NJ
- 2012 Montclair State University Residences, Montclair, NJ
- 2012 Mott Haven Educational Campus, Bronx, NY
- 2011 New Meadowlands Stadium, East Rutherford, NJ
- 2011 Porsche Northeast Regional Support Center, Palmer Township, PA
- 2011 107-111 Lawrence Street (The Brooklynier), Brooklyn, NY
- 2011 Mannington Mills Remediation and Wetland Mitigation, Salem, NJ
- 2011 Herron Park Playground, Philadelphia, PA
- 2011 30th Street Station: Surveying Keeps a Station on Track, Philadelphia, PA
- 2010 77 Hudson, Jersey City, NJ
- 2010 Garfield Education Complex, Garfield, NJ
- 2009 Jets Training Facility, Florham Park, NJ
- 2009 J Ponds In-Situ Stabilization/Solidification, Paulsboro, NJ
- 2009 Federal Hall National Memorial, New York, NY
- 2009 Pier 17 Redevelopment, New York, NY
- 2009 Blue Back Square, West Hartford, CT
- 2008 The Prudential Center, Newark, NJ
- 2008 IAC/InterActiveCorp Headquarters Building, New York, NY
- 2007 Science Park High School, Newark, NJ
- 2007 Riverdale Crossing, Riverdale, NJ
- 2007 505 Greenwich Street, New York, NY
- 2007 The Shops at Atlas Park, Glendale, NY
- 2007 Turnberry Place, Las Vegas, NV
- 2006 Columbia University Residence – 2700 Broadway, New York, NY
- 2006 Nolen Greenhouses for Living Collections at The New York Botanical Gardens, Bronx, NY
- 2006 Former American Standard Trenton Pottery, Hamilton Township, NJ
- 2005 Rion-Antirion Bridge – Corinthian Straits, Greece
- 2005 Four Seasons Hotel and Tower, Miami, FL
- 2005 Solving the Engineering Puzzle for New Jersey's Schools, Multiple Locations, NJ
- 2004 Engineering the Foundation for New Jersey's Educational Future, Multiple Locations, NJ
- 2003 St. John's University Master Plan, Jamaica, Queens, NY
- 2003 Reuters Comes to Times Square, New York, NY
- 2003 Gateway Center Wetland Restoration, Brooklyn, NY
- 2003 River Sharks Baseball Stadium, Camden, NJ
- 2002 Watchung Square Mall Slope Stabilization, Watchung, NJ
- 2002 Target Store, Plymouth Meeting, PA
- 2002 PS-6 School Construction, Staten Island, NY
- 2001 Sotheby's Manhattan Headquarters Expansion, New York, NY
- 2001 Remediation of a Manufactured Gas Plant, Trenton, NJ
- 2000 Jersey Gardens Mall, Elizabeth, NJ
- 2000 Colgate Waterfront Redevelopment, Jersey City, NJ



EKPPT - Olympia Odos Motorway, Peloponnese, Greece

Representative International Projects

SERVICES:

- Survey including 3-D Revit
- Geotechnical Investigation
- Environmental Site Investigation
- Environmental Impact Assessment
- Construction Environmental Management Plan
- Finite Element Model
- Construction Documents and Administration during Enabling Works

LOCATION:

*Al Maryah Island, Abu Dhabi,
United Arab Emirates (UAE)*

CLIENT:

Gulf Related

ARCHITECT:

Elkus Manfredi Architects



Al Maryah Central, a dynamic, mixed-use development on Al Maryah Island will encompass nearly 2.3 million square feet of premier shopping, world class dining and will seamlessly link to luxury hotels, the proposed mall, residential and commercial towers. Benefitting from Al Maryah's development as the new centerpiece of Abu Dhabi's commercial, retail and leading residential area, Al Maryah Central will become a first class attraction for Abu Dhabi.

Langan was retained to carry out full scale geotechnical and environmental investigations and provide geotechnical recommendations for foundation design, Environmental Site Investigation, Environmental Impact Assessment and Construction Environmental Management Plan.

Langan also developed a 3D Revit survey model based on the extensive physical survey data collected at the site and surrounding areas. Langan provided engineering support during detail design, which incorporated a three-dimensional finite element model (FEM) using Plaxis/Midas GTS. Additional services during foundation works included issuance of technical specifications and providing site oversight.

SERVICES:

- *Site/Civil Engineering*

LOCATION:

Dubai, United Arab Emirates (UAE)

CLIENT:

Dubai Future Foundation

ARCHITECT:

*Killa Design
Gensler*

STRATEGIC PARTNER:

*Thornton Tomasetti
Syska Hennesy Group
e.construct*

AWARDS:

*2018 CTBUH Tall Building Awards,
Innovation Award: Finalist
2018 ACEC New York Engineering
Excellence: Diamond Award
2017 American Architecture Prize,
Architectural Design/Other Architecture*



Office of the Future is the first inhabited, fully-functional, 3D-printed building in the world. The project showcases a range of innovative designs that make it more sustainable, captivating, and pleasant to work in.

The entire structure was printed using a massive 3D-printer measuring 120 feet long, 40 feet wide, and 20 feet high. The printer featured an automated robotic arm to implement the printing process. Printing took 17 days and installation was done in 2 days. Subsequent work on the building services, interiors, and landscape was completed in 3 months.

Langan provided site/civil engineering services for the project. We provided the detailed design of the stormwater conveyance system to connect any building roof leaders and any site drainage to the existing storm sewer system. Site grading and drainage plan and a site utility plan were also performed.

Dubai's 3D Printing Strategy aims to have 30 percent of the city's buildings 3D printed by 2030.

**DUBAI CREEK HARBOUR
CREEK GATE TOWERS – UAE**

SERVICES:

- *Geotechnical Engineering*

LOCATION:

Dubai, United Arab Emirates (UAE)

CLIENT:

Emaar Properties

ARCHITECT:

NORR

STRATEGIC PARTNER:

Hill International



Credit: NORR Group

Integrating a smart, green city, while building on cultural heritage, is the goal of the new Dubai Creek Harbour development. The 113 million SF project will contain 9 different districts and is expected to take 30 years to build. The mixed-use development will include waterfront eco-resorts, a marina and yacht club, commercial and retail spaces, luxury residences, and educational amenities.

Creek Gate Towers, two of the project's most anticipated residential buildings, will each rise 30-stories, house over 400 luxury apartments, and offer spectacular views of Dubai Creek Tower, a magnificent gravity-defying structure unparalleled in weight and strength.

Langan reviewed previous geotechnical reports and developed a 3D geotechnical Finite Element Method (FEM) model, of the towers' foundations, podiums and the surrounding soil and rock. The purpose of the FEM analysis was to estimate settlements at the foundation level, as well as the strength of the pile springs, which are vital to the structural model. The FEM model also simulated the base gravity service load combination.

Langan prepared a final report to summarize findings and results, which included interpretation of subsurface conditions, derivation of soil, rock and interface properties, description and assumptions of the FEM model, analysis results and calculated pile springs, recommendations for transient load analysis, and lateral load analysis results.

MIDDLE SCHOOL OF THE AMERICAN SCHOOL OF DUBAI - UAE

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Topographical Surveying*

LOCATION:

Al Barsha, Dubai, United Arab Emirates (UAE)

OWNER:

The American School of Dubai

ARCHITECT:

HOK

STRATEGIC PARTNERS:

e.construct



Credit: HOK

The American School of Dubai (ASD) is an independent, not-for-profit, Pre-K through 12th grade, international school. Based on a United States curriculum, ASD provides learning experiences designed to promote the maximum potential of its students. Good Schools Guide International has recognized it as "One of the best thought-of and long established schools in Dubai".

ASD has secured the adjacent site to their Al Barsha Campus for the development of the Middle School. The area of the site is 15,517 square meters (167,022 SF), and will include a new school, landscaped educational stormwater management area, and parking and drop off areas.

Langan provided multidisciplinary services for the project, including site/civil engineering, geotechnical engineering and surveying. Our site/civil engineering schematic design services consisted of site utility routing and connection designs to the public infrastructure, assistance with site grading and stormwater management design. Our geotechnical engineering services comprised scoping the geotechnical investigation, evaluating the proposals of the geotechnical contractors and reviewing the factual and interpretive geotechnical reports. Additionally, Langan also scoped the topographical survey and reviewed the pertinent report.

AL FALAH RESIDENTIAL COMMUNITY – UAE

SERVICES:

- *Geotechnical Engineering*
- *Site Investigation Evaluations*
- *Peer Review*

LOCATION:

*Abu Dhabi, United Arab Emirates
(UAE)*

CLIENTS:

*ALDAR
Fluor Mideast Ltd.*

COST:

\$4.4 billion (Construction est.)

AWARDS:

*2013 American Council of Engineering
Companies Gold Award – Special
Projects*



Al Falah is a 1,200-hectare master planned community for UAE nationals as part of the Plan Abu Dhabi 2030 directive. The new development will provide over 5,000 homes for UAE families.

Located to the east of Abu Dhabi International Airport and the Abu Dhabi-Dubai highway, Al Falah includes five “villages,” each with its own village center, schools, and mosques, and a “town center,” the focal point of the development, with civic buildings, a retail mall, a hospital, commercial office space, a hotel, and a sports and leisure complex. Residents will have access to excellent quality education, with 15 schools for children of all ages from early learning through high school.

Langan engineers provided geotechnical and geophysical services for the project. Services included a preliminary review of an existing soil investigation, scope development for an overall investigation, oversight of over 2,000 test borings and laboratory testing, development and oversight of a comprehensive geophysical program to detect cavities, and geotechnical engineering and interpretive reporting. Langan field engineers also review and respond to field conditions during construction, providing rapid responses to actual construction conditions.

SERVICES:

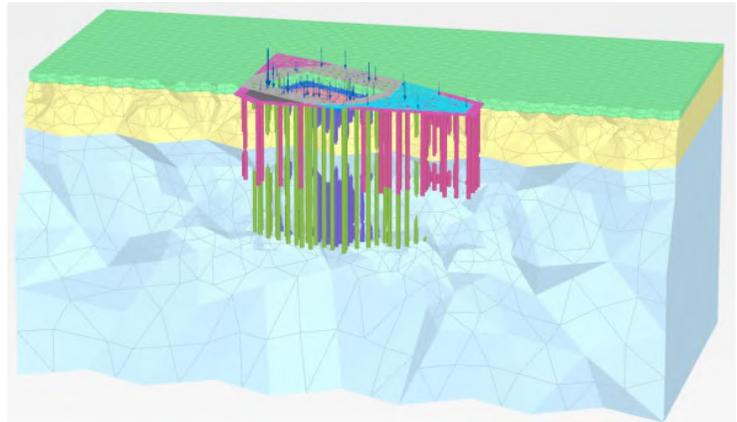
- *Geotechnical Analyses*
- *Design Computations*
- *Seismic Analysis*

LOCATION:

Dubai, United Arab Emirates (UAE)

ARCHITECT:

NORR Architects and Engineers



Langan reviewed factual data from subsurface investigations and the proposed foundation design for the new 70-story-super-tall hotel tower including a basement level and ten podium levels. Langan completed an independent evaluation of the geotechnical design parameters, performed detailed 3D Finite Element Modeling of the foundations, and provided vertical and horizontal equivalent foundation springs to the structural engineer for a detailed soil-foundation-structure interaction analysis.

We performed a probabilistic seismic hazard analysis (PSHA) and a deterministic seismic hazard analysis (DSHA) for the site to develop horizontal and vertical site-specific spectra for reference rock conditions and at foundation level, for three different ground-shaking levels. We developed a suite of 11 time series (2 horizontal and 1 vertical components each) spectrally matched to the target acceleration spectrum, following the ASCE 7-16 guidelines.

SERVICES:

- *Geotechnical Engineering*
- *Soil Investigation*
- *Topographical Survey*
- *Enabling Work Supervision*

LOCATION:

*Al Maryah Island, Abu Dhabi
United Arab Emirates (UAE)*

CLIENTS:

*PLP Architects
Thornton Tomasetti
John Buck International (JBI)
Mubadala*



Al Maryah Island, a man-made island reclaimed mainly by pipe dredging, is the core of Abu Dhabi's new Central Business District (CBD) as designated by the Urban Planning Council in Plan Abu Dhabi 2030. The island has been classified as an investment zone by the Executive Council of Abu Dhabi. The Al Maryah Island Four Seasons Hotel project will include the design and construction of a 33-story hotel and a serviced apartment building on the 10,405 square meter site within Al Maryah Island's planned financial district.

Langan reviewed available information for the site obtained from various sources including information from existing files, project team interviews and historical data from local resources.

The geotechnical engineering scope included soil investigation scoping, subcontracting and supervision. Langan also developed a factual and interpretive soil investigation report that included foundation analyses and geotechnical recommendations related to dewatering, excavation and shoring. Langan developed the scope for the topographical survey and subcontracted/supervised the field work that included a resolution to conflicting bench marks on the island.

In addition, Langan provided services related to the review and supervision of the enabling work that included shoring, dewatering, and excavation. Responsibilities included (but were not limited to):

- Coordination and collaboration with project consultants during all enabling works
- Review of all submittals related to piling, shoring, dewatering and excavation
- Monitoring and inspection of all shoring work and construction
- Review of all piling types, installation procedures and testing

Langan's presence on-site and engineering/management support – in both the United Arab Emirates and United States – enabled project issues to be resolved almost immediately. As a result, the project proceeded without delays.

SERVICES:

- *3D Finite Element Analysis*
- *Geotechnical Engineering*

LOCATION:

Dubai, United Arab Emirates (UAE)

CLIENT:

NORR Group Consultants International Limited

ARCHITECT:

Skidmore, Owings & Merrill (SOM)



Credit: Skidmore, Owings & Merrill

This super-tall structure is located between the EMAAR Square and the Burj Khalifa/Dubai Mall Metro Station in downtown Dubai. The main development consists of two 240-meter towers, linked together via a two-story boat-shaped bridge near the top. The towers will house serviced apartments and a hotel, and be surrounded by a common multi-level podium structure. The structure will also share common basement levels for site utilities and parking.

Langan was hired to assist the structural engineer in obtaining the Dubai Municipality approval for the foundation design of the development within a very short time frame. Langan performed a 3D finite element analysis to evaluate the adequacy and performance of the foundation, coordinated with the structural engineer to properly incorporate the foundation flexibility in the structural design, and assisted the structural engineer to satisfy the Dubai Municipality appointed peer-reviewer. Langan was successful in securing approval from the Municipality.

SERVICES:

- *Geotechnical Foundation and Review*

LOCATION:

Abu Dhabi, United Arab Emirates (UAE)

CLIENT:

HOK/Bloom



The development consists of one hotel structure, two low-rise office structures, several low-rise residential structures, and assorted structural plazas over one level of below-grade parking. The focal point of the project will be a five star hotel with an iconic sloping shape, and an architecturally sloping expressed exoskeleton structure.

Langan was retained to provide a peer review of the geotechnical and foundation design, and to respond to some queries raised by the structural engineer. Langan provided various recommendations to enhance the foundation performance, and requested that additional seismic testing and analyses be performed to further delineate the potentially liquefiable layers within the subsurface profile.

Typical column loads within the hotel / residential structures, office structures, and plaza structures are anticipated to be on the order of 1,000 kips, 2,000 kips, and 750 kips, respectively. Finished exterior grade elevations will be at about el +3 meters. The proposed basement will have a finished floor elevation (FFE) of el -2.24 meters.

SERVICES:

- *Geotechnical Engineering*

LOCATION:

Dubai, United Arab Emirates (UAE)

CLIENT:

Ramboll Middle East

ARCHITECT:

Aedas Architects

STRATEGIC PARTNER:

Damac Heights



Credit: Aedas Architects

Located in the Dubai Marina, this 85-floor (335-meter tall) skyscraper will be the tallest tower in its vicinity. The curved shape of the tower improves views past its densely located neighbors and boasts facilities that include a private gymnasium, indoor swimming pool, car facilities and parking.

Langan's services included a geotechnical review of the enabling work for the development related to dewatering issues at the project site and movement of the diaphragm wall of the adjacent Diamond Tower. We reviewed the architectural plans, shoring designs and system calculations, structural drawings, dewatering monitoring reports, and site photography.

Based on our review of the various documents and conversations with our client, Langan concluded that the deflection of the Diamond Tower diaphragm wall was the direct result of an inadequate shoring design and lack of proper monitoring during excavation.

SERVICES:

- *Geotechnical Engineering Peer Review*

LOCATION:

Dubai, United Arab Emirates (UAE)

OWNERS:

*Investment Corporation of Dubai
Ithra Dubai*

CONSULTANT TEAM:

*Mace International Ltd.
Nikken Sekkei
WSP Middle East*

CONTRACTOR:

ALEC



Credit: Mace Group

Located at the heart of the new business district, One Za'abeel features a residential and commercial tower linked together by the world's largest cantilever bridge, "The Link", suspended 124 meters above the ground. The towers stand at 304 and 241 meters and straddle the busy six lane bridge below. With a total area of 480,000 square meters, the two-tower high-rise incorporates luxury residences, a luxury hotel, office spaces, a retail podium and a panoramic sky concourse and feature seven-story, 28 meter deep basements connected by two tunnels located within three meters of existing live elevated highways.

Langan provided geotechnical engineering peer review services for the iconic project. We reviewed factual and interpretive geotechnical reports, temporary works design, temporary works contractors' bids and design submissions, permanent sub-structure works design and permanent sub-structure works contractors' bids and design submissions.

**K-12 SCHOOL (AUSS) – UAE
AMERICAN UNIVERSITY OF SHARJAH**

SERVICES:

- *Site/Civil Engineering*
- *Traffic Engineering*

LOCATION:

Sharjah, United Arab Emirates (UAE)

CLIENT:

Perkins Eastman



Outline of AUSS (Red) and
Proposed K-12 School (Yellow)

Langan provided master planning and schematic design services for the proposed American University of Sharjah K-12 School (AUSS).

The project will include a new 1,800 student K-12 school with supporting ancillary facilities and a new faculty housing development comprising 180 townhouses. The project site is on an undeveloped 85-acre desert plot in the northeast corner of the university's campus, just south of Sharjah International Airport.

During the master planning and schematic design, Langan provided site/civil engineering and traffic engineering to develop site plans, roadway layouts, site circulation plans, utility infrastructure design and grading/drainage design. The project will be constructed in two phases. During Phase I, the main administration building, grade-school buildings and athletic fields will be constructed. During Phase 2, the middle school, high school and faculty housing will be constructed. Because buildings constructed during Phase 1 will be in use during Phase 2, careful planning and strategic designs will be required to minimize disturbances to daily school operations.

Langan worked closely with the project design team to develop a "green" project site that recognizes water scarcity in the region and embraces conservation through sustainable design applications.

DUBAI SILICON OASIS DATA CENTER – UAE

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Landscape Architecture*
- *Construction Administration*

LOCATION:

Dubai, United Arab Emirates (UAE)

CLIENT:

Nova Consultants

ARCHITECT:

Gensler



Langan was retained to provide multiple engineering services for this new design-build data center. The new Tier III facility includes a two-story, 3,000 square meter footprint building with a 1,500 square meter outdoor equipment yard on a 75,000 square meter “green field” site.

Our geotechnical engineering scope included a soil investigation and a report with foundations recommendations; subcontracting, construction supervision support and administration services.

Langan’s site/civil engineers reviewed and verified available information as obtained from various local sources and assisted the project team in the design development process. We addressed issues such as site layout, roadways, grading, mass excavation, earthwork, drainage, stormwater management and utility connections. We assisted the team in addressing the technical aspects of the design and prepared design drawings for review by the project team including plans for site layout, roadway, grading and drainage, utility, erosion and sediment control plans.

During the design process, Langan worked with the team addressing the LEED and/or Estidama (UAE’s sustainability development initiative) certification requirements and prepared supporting documentation for the relevant site credits, as necessary.

Langan’s landscape architects will develop the schematic landscape design for open spaces including options for pedestrian paths, on-site roadways and building entry areas.

SERVICES:

- *Geotechnical Engineering*

LOCATION:

*Deira, Dubai, United Arab Emirates
(UAE)*

CLIENT:

Robert Bird Group

STRATEGIC PARTNER:

Laing O'Rourke



The Aloft City Centre is a new hotel developed by Majid Al Futtaim adjacent to the existing Deira City Centre Mall. Situated on the southern side of the mall, off Baniyas Road, the hotel will include a mix of standard rooms and suites, and will offer views to the Dubai Creek Gold and Yacht Club, Dubai Creek, and the skyline of Dubai.

The project comprises a B+G+14 structure on the congested site at Deira City Centre. The ten floors of guest rooms will sit over a podium, in a double loaded configuration allowing a total of 304 hotel rooms. There are numerous challenges around the construction relating to interfaces with the existing buildings and continuity of vehicle traffic on a road straddled by the project.

Langan provided full geotechnical engineering services on the project. We reviewed the existing subsurface investigation information from adjacent parts of the development and provided advice to our client, Robert Bird Group, on the scoping brief including, as necessary, borehole and trial pit investigations. We reviewed all subsurface investigation data, interpretive reports and foundation recommendations – including consideration of options suitable for the constrained site. In addition, we advised on the shoring of the excavation.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Conceptual Transportation Design*
- *Infrastructure Design*

LOCATION:

Al Ain, Abu Dhabi, United Arab Emirates (UAE)

CLIENT:

Broadway Malyan

ARCHITECTS:

*Pattern Design Limited
(Stadium Architect)*
*Mark Habre & Associates
(Architect of Record)*

STRATEGIC PARTNERS:

*WSP
Thornton Tomasetti
Mott MacDonald
Hoare Lea*



As part of the UAE's "Plan Al Ain 2030", Langan provided engineering services for a new, world class 25,000 seat stadium to house the Al Ain Football Club.

Langan geotechnical engineers provided design services for Phase 1.1 (stadium), including development of the subsurface investigation program, review of borings, laboratory tests, and geophysical testing. Geotechnical reporting included an evaluation of geologic hazards such as subsurface solution cavities and recommendations for foundations and earthwork.

Langan's site/civil engineers provided services for the infrastructure design of Phase 1.1 and 1.2 (residential), and designed stormwater collection and conveyance systems, sanitary sewer system, and internal road networks. Langan coordinated with the local agencies to help secure the utility network operating centers and with the design team to route the electric, telecom and chilled water/steam lines. Langan also prepared earthwork calculations, site demolition and mass grading plans for the site.

Langan's traffic engineers provided conceptual transportation design services, which included analyzing on-site vehicular/pedestrian movements and parking/access.

SERVICES:

- *Seismic Engineering*

LOCATION:

*Port Zayed, Abu Dhabi,
United Arab Emirates (UAE)*

ARCHITECTS:

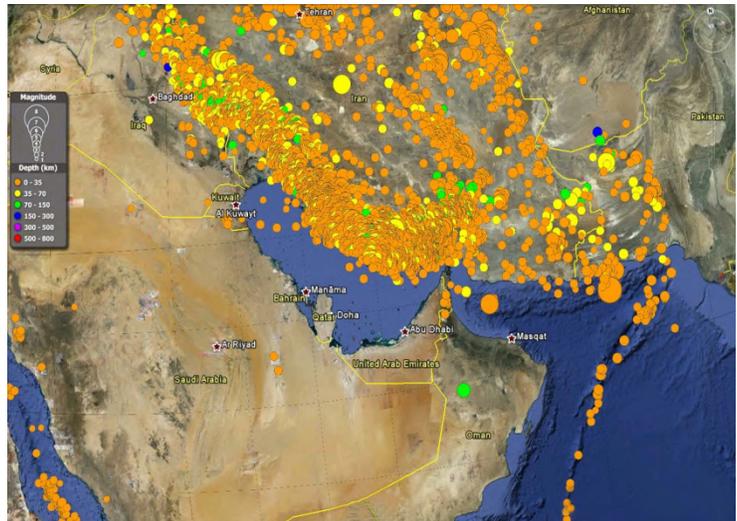
*Adamson Associates Architects
(Architect of Record)
UNStudio (Base Building Shell and
Core)
Diller Scofidio + Renfro (Public Spaces)*

CLIENT:

Twofour54

STRATEGIC PARTNER:

Buro Happold



Langan's earthquake engineering group completed a geotechnical earthquake engineering study for the "twofour54" area of the proposed Abu Dhabi Media Zone.

The proposed development has a footprint of approximately 105,000 square meters and is comprised of five- to twelve-story commercial towers on top of three- to four-level podiums with two-level basements.

Langan was retained to evaluate the seismic hazard at the site and develop seismic design criteria per the International Building Code and ASCE-7 seismic design provisions for site-specific seismic studies.

Langan's specific scope of services included review of available structural and geotechnical reports, review of seismicity and tectonics of the region, performance of probabilistic seismic hazard analyses for the site, evaluation of the liquefaction potential and associated deformations, design of acceleration recommendations and preparation of a geotechnical earthquake engineering report for the client.

SERVICES:

- *Geotechnical Engineering Review*

LOCATION:

*Abu Dhabi, United Arab Emirates
(UAE)*

CLIENT:

Robert Bird Group



Langan presented a letter-report summarizing the results of a geotechnical engineering review for the proposed Saadiyat Island Beach Villas project.

The site is located along the western coast of Saadiyat Island on the Abu Dhabi Emirate, northeast of the main island of Abu Dhabi and is separated by a roadway and designated in two parcels: Site 1 (western portion) and Site 2 (eastern portion). The proposed development includes villas along the perimeter of Site 1 and Site 2, and multiple residential buildings in the center of Site 1.

The purpose of Langan's study was to review previously reported geotechnical information and ground improvement work, and perform analyses of proposed foundation options for the proposed villas; provide settlement estimates of the proposed foundation support options founded on the subsurface material improved by dynamic compaction and provide foundation optimization suggestions.

The majority of the site was originally inundated by water with isolated high spots. The focus of the review was specific to the villa structures within the subject site.

SERVICES:

- *Transportation and Traffic Engineering*
- *Parking Design*
- *Geotechnical Engineering*
- *Site/Civil Engineering*

LOCATION:

*Al Maryah Island, Abu Dhabi,
United Arab Emirates (UAE)*

CLIENT:

Al Hilal Bank

STRATEGIC PARTNERS:

*Goettsch Partners
DeSimone Consulting Engineers
Environmental Systems Design, Inc.
Al Fara'a General Contracting Co.*

AWARD:

*2015 CTBUH Best Tall Building Finalist
Award*



Langan provided geotechnical, site/civil, traffic engineering, and parking design services for the Al Hilal Bank Tower. The project includes development of a 24-story commercial tower with nearly 68,000 square meters of gross floor area and associated basement and above-ground car parking, landscaped park areas, and podium-level retail areas.

Langan's traffic engineering and transportation planning services related to the site's parking and traffic requirements. Parking layouts were designed to allow parking on the interior ramps to lessen the overall depth of the 8.5 story under and above ground garage. Access control configurations were developed to improve ingress/egress on two sides of the site. The result was improved circulation and a reduction in queues both inside and outside the site.

Langan prepared a Traffic Impact Study for this development, evaluated traffic flow conditions for the roadways on Al Maryah Island, and made recommendations for modifying lane configurations and signal timing to optimize operations.

As the project's geotechnical engineer-of-record, Langan developed a detailed site investigation that specified the depth, location and number of borings to define geological conditions at the site. Langan also specified the type and frequency of in-situ testing and provided supervision of the soil investigation, and provided a factual report with recommendations.

Site/civil engineering services included stormwater management, grading and drainage design, utilities design and providing oversight support to the developer and the local survey company in resolving topographical and boundary survey issues for the project plot.

DUBAI-JEBEL ALI RESIDENTIAL DEVELOPMENT MASTER PLAN – UAE

SERVICES:

- *Landscape Architecture*
- *Preliminary Geotechnical Evaluations*
- *Conceptual Master Plan*
- *Site/Civil Engineering*
- *Sustainable Principles*

LOCATION:

Dubai, United Arab Emirates (UAE)

CLIENT:

*BGM
Jebel Ali Properties*

ARCHITECT:

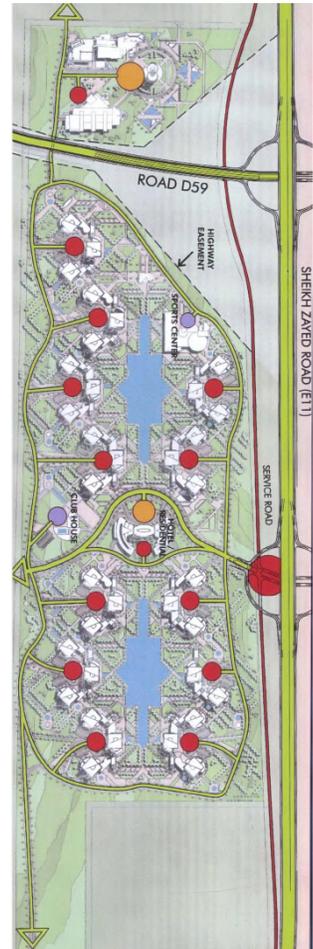
BGM



The 120-hectare development is to include a large central cluster of buildings including a mixed-use 50-story hotel/residential tower sited on axis with the two major water features. This central cluster is surrounded by a dozen residential tower clusters that range in height from one to 38-stories, a sports center, retail/entertainment center and a community clubhouse set amidst smaller water bodies and a landscaped open space. The site plan includes palm-lined boulevards, promenades along the edge of the geometric water bodies, acclimatized plantings and water features that further increase the thermal comfort of residents and visitors.

The sustainable design principles that were developed revolved around harvesting cool breezes from the sea to improve the exterior environment on the site by providing thermal comfort and reducing cooling loads within buildings. Building massing was developed and oriented to channel cooling breezes towards the major public outdoor spaces, while shielding the development from hotter winds originating in the desert around the site. The climate responsive landscape was designed with acclimatized plantings that have low water and maintenance requirements and would be irrigated by gray water that originates on the site.

Langan assisted in the development of the master plan and sustainable design principles for the Jebel Ali Residential Development at the crossroads of Sheikh Zayed Road and Road D59 in Dubai.



ZAYED MILITARY HOSPITAL – UAE

SERVICES:

- *Site/Civil Engineering*
- *Infrastructure Engineering*

LOCATION:

*Abu Dhabi, United Arab Emirates
(UAE)*

CLIENT:

Abu Dhabi Command of Military Works

ARCHITECT:

Leo A Daly



Credit: Leo A Daly

Langan was retained to provide site/civil and infrastructure engineering services to help facilitate plans for the new Zayed Military Hospital in Abu Dhabi. The new hospital will be a teaching facility comprised of 260 single-patient bedrooms, and will provide a variety of treatment services in cardiology, trauma, and burn care. The project campus also includes separate buildings for an outpatient clinic, a mosque, women's dormitory, 40-bed psychiatric center, military police facilities, and a central utility plant.

Langan assisted in the conceptual master planning through full design development. We provided design of the site earthwork, grading and drainage, stormwater management, an engineered site layout, roadway materials, regulatory signage, and the site-wide infrastructure – including a 500,000 gallon water storage tank and a utility corridor – in order to accommodate future expansion to the hospital and clinic.

Of three original design concepts, the “wadis” concept (meaning *canyons* in Arabic), was ultimately selected by the client. Inspired by the dramatic rock formations that meander through the regional geography, the building and site designs reflect the curves of the landscape, while pedestrian paths and roadways converge in the manner of water during a rain storm. Langan's grading and stormwater management design is incorporated into this site-sensitive vision.

AL MAFRAQ HOSPITAL EXPANSION – UAE

SERVICES:

- *Geotechnical Engineering*
- *Value Engineering*

LOCATION:

*Al Mafraq, Abu Dhabi,
United Arab Emirates (UAE)*

CLIENT:

*Al Habtoor-Murray & Roberts Joint
Venture*

ARCHITECT:

Stantec

STRATEGIC PARTNERS:

*Murray & Roberts Contractors Middle
East (HLMR)*



Established in 1983 and located approximately 35 kilometers southeast of the UAE's capital city of Abu Dhabi, the Al Mafraq Hospital is dedicated to the highest standard of medical care in the region. Construction objectives include the addition of 139 rooms (529 beds), an underground parking facility for 1,300 vehicles, and four patient towers each dedicated to different care services.

Langan engineers initially provided value engineering services during the design-build competition under multiple contractor teams for evaluation of site, civil, infrastructure and geotechnical design elements based on the conceptual plans prepared by a previous designer. Services also included close coordination with the tender selection team for presentations and meetings.

Langan later provided geotechnical engineering services that included calibration of Dynamic Cone Penetrometer Test results with standard geotechnical boreholes and preparation of interpretive reports verifying bearing capacities required by the project specification.

ABU DHABI FINANCIAL CENTER SOUTH CAR PARK GARAGE REDESIGN – UAE

SERVICES:

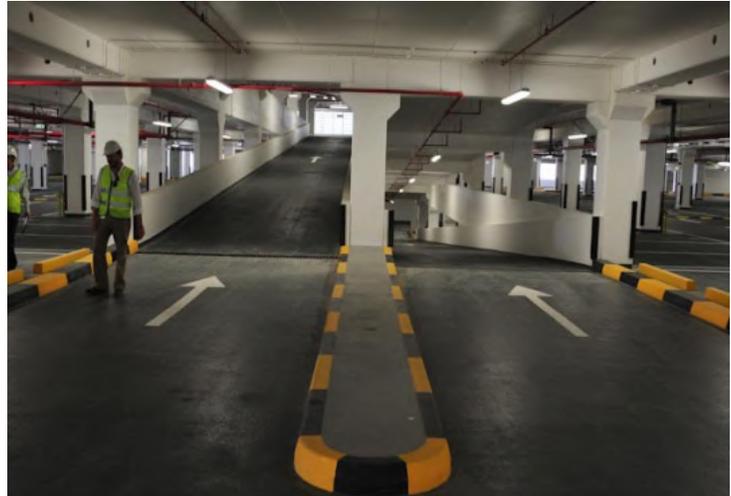
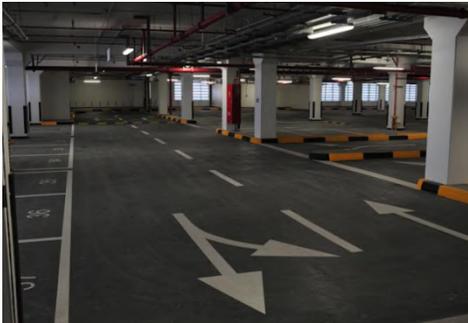
- *Transportation Engineering*
- *Parking Design*

LOCATION:

*Al Maryah Island, Abu Dhabi,
United Arab Emirates (UAE)*

CLIENT:

Goettsch Partners



Langan provided traffic and parking design services at the South Car Park of the Abu Dhabi Financial Center. Langan's transportation/parking team presented the client with three options to modify the column layout and roadway alignment to improve operations at the site. Each option outlined the benefits and disadvantages for the individual scenarios and was advanced into the design process.

Langan's scope of services included a site visit, review of existing conditions, evaluation of access needs, preparation of ramp wall elevations, direction signage plans and an evaluation of parking geometry.

At the conclusion of the project, Langan prepared bid documentation and construction drawings showing all proposed modifications to the garage and specifications for traffic and parking operations.

**ICONIC ROOF, SECURITY WALLS AND COLONNADE – UAE
ZAYED UNIVERSITY**

SERVICES:

- *Geotechnical Engineering*
- *Foundation Recommendations*

LOCATION:

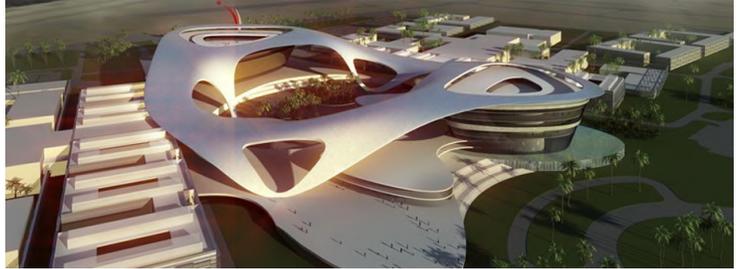
*Abu Dhabi, United Arab Emirates
(UAE)*

CLIENT:

*Al Habtoor
Murray & Roberts Joint Venture*

ARCHITECT:

Robert Bird Group



Langan prepared a letter-report summarizing the results of a geotechnical engineering study for the proposed iconic roof feature at the new campus of Zayed University. The purposes of the study were to review available geotechnical information provided to Langan by the client, review foundation loading and design information, and provide foundation recommendations for the proposed temporary trestle props, colonnade, and female/male security walls.

The roof, which is designed to provide protection against the sun, is an oval-shaped, steel structure spanning about 400 meters in longitudinal direction and approximately 190 meters in lateral direction. Temporary trestle props with factored loads between approximately 50 to 220-tons will be used during erection of the proposed roof.

A layer of very soft to soft-sandy lean clay with sand was encountered near the surface at the site. Due to the soft and compressible nature of the lean clay, the allowable bearing pressure must be limited and settlement must be planned and properly managed if footings are to be founded on the sand layer immediately above the lean clay.

MUSHRIF HEIGHTS LANDFILL DEVELOPMENT – UAE

SERVICES:

- *Geotechnical Engineering*
- *Environmental Engineering*
- *Site/Civil Engineering*
- *Landscaping*
- *Stormwater Management Design*

LOCATION:

Mushrif Heights, Dubai, United Arab Emirates (UAE)

CLIENT:

Emaar



The proposed development is about 20 kilometers east of the Arabian Gulf shore. The approximately 420-hectare property is rectangular in shape. Approximately 50% of the site was used as a former sand/sandstone quarry and subsequently backfilled with construction debris material, as well as potential municipal solid waste.

Langan performed an engineering peer review and analytical study of the environmental, geotechnical, and site/civil conditions at the site, and provided recommendations for ground improvement methods, foundation systems, and environmental controls for the different phases and development scenarios of the project. Langan also provided conceptual grading plans for the site, and recommendations for future environmental and geotechnical testing for the different development phases.

The challenges faced by Langan were the limited subsurface information available and the difficulties in obtaining additional information. Therefore, experience and judgment played a significant role in the review and evaluation.

MINA ZAYED WATERFRONT DEVELOPMENT – UAE

SERVICES:

- *Geotechnical Engineering and Foundation Peer Review*

LOCATION:

Abu Dhabi, United Arab Emirates (UAE)

CLIENTS:

*Mubadala Development Company
MGM Mirage Hospitality*

ARCHITECT:

Rafael Viñoly Architects

STRATEGIC PARTNERS:

*DeSimone Consulting Engineers
Thornton Tomasetti
Sasaki*



Langan is provided geotechnical engineering and foundation-related peer review services for this iconic structure, the center piece of a 27-hectare mixed-use waterfront redevelopment on reclaimed land. The MGM complex is a 26-story circular structure with four basement levels at the end of an existing pier that extends into Gulf waters.

The complex is approximately 32,500 square meters and will contain three separate hotels, including:

- The Bellagio Hotel and Residences
- Skylofts Hotel and Residences
- MGM Grand Hotel and Residences

Langan is reviewing soils investigation and interpretive reports, and recommendations for foundation dewatering. Challenges include determining the appropriate shoring and dewatering system under difficult subsurface conditions consisting of weak and fractured rock.

Langan used its local experience to review the viability of the proposed design and to identify potential solutions to allow excavation in an effective and efficient manner.

SERVICES:

- *Geotechnical Engineering*
- *Peer Review*

LOCATION:

*Abu Dhabi, United Arab Emirates
(UAE)*

CLIENT:

Emirates Land Group, LLC



The project consists of the construction of a 15-story tower with four below-grade basements. The building is designed to be supported on rafts supplemented with tension piles for uplift. Diaphragm wall with anchors was used as a shoring system. The immediately adjacent site (common boundary) was going to be constructed at the same time and it was decided that no diaphragm wall will be constructed at the common boundary. The adjacent site was put on hold after completion of the diaphragm wall and no dewatering was conducted for that site. During diaphragm wall construction at the site, a void was encountered and required additional amount of concrete to be filled. The site is excavated to about 20 meters below grade but water inflow into the site could not be properly controlled to allow construction of the raft.

Langan was retained by the developer to advise/provide recommendations on:

- The possible cause(s) of the problem.
- The possible impact on the current foundation system
- Recommendations for additional testing
- Recommendations for remediation (possibly after the additional testing, if required)
- Supervision of additional testing and remediation by an experienced geotechnical engineer

Langan issued a detailed report addressing all of the above points.

RAS AL KHAIMA (RAK) ROAD TO AL MADAM TRUCK ROAD – UAE

SERVICES:

- *Geotechnical Engineering*
- *Geotechnical Desktop Study*

LOCATION:

Ras Al Khaima, United Arab Emirates (UAE)

CLIENT:

RW Armstrong



Due to the phenomenal growth of the United Arab Emirates through the past several decades, many of the highway systems in the country have reached their traffic capacity. The Ministry of Public Works has envisioned the need for upgrading the existing road network to increase capacity and provide facilities that enhance traffic safety.

The proposed 120 kilometer long truck road has been mainly proposed to remove the heavy vehicles from the internal road network in RAK city. The proposed truck road passes through sand dunes, small valleys and foot hill slopes.

Langan has been retained to perform a desktop study of all existing geotechnical data within the project vicinity, prepare a scope for additional soil investigation, part-time supervision of the soil investigation laboratory and prepare a geotechnical interpretive report.

THE RED SEA PROJECT GEOTECHNICAL CONSULTANCY ON-CALL – KSA

SERVICES:

- *Geotechnical Engineering*
- *Earthquake/Seismic Engineering*
- *Data Management*

LOCATION:

Red Sea Coast, Kingdom of Saudi Arabia (KSA)

CLIENT:

The Red Sea Development Company

ARCHITECT:

Foster + Partners

STRATEGIC PARTNERS:

*KEO International Consultants
Mott MacDonald
Stantec
Arcadis
Jacobs*



Offering a diverse array of seamless personalized experiences, The Red Sea Project is being recognized as the world's most ambitious and exciting tourism and hospitality projects to date. The site comprises an archipelago of more than 90 unspoiled islands covering 28,000 km² of coastline, dormant volcanoes, rich nature and marine habitats, and ancient archaeological sites. Once complete, it will offer visitors the exclusive opportunity to explore a uniquely diverse region of the world, including experiences for nature lovers, outdoor adventurers, cultural explorers and wellness seekers.

Langan is providing geotechnical engineering services as part of a project-wide call-off agreement. Under the contract, our services include geotechnical design/review, desktop review of existing ground investigations, scoping and interpretation of further ground investigations to provide advice to the design teams, as well as support to tendering processes.

Currently, we are providing geotechnical engineering services for the following projects:

Southern Dunes

Southern Dunes is a luxury resort that will accommodate an overall of 40 luxury hotel keys as well as 40 luxury villas overlooking a multiple variety of captivating views. The development comprises low rise buildings integrated within the natural terrain, with limited interference to existing dune profiles.

Shurayrah Island

The development at Shurayrah Island includes the design and construction of 11 luxury hotels, a marina, a golf course with villas and a club house, site-wide landscaping and supporting utility and transport infrastructure. The existing site levels are only just above sea level with inundation of parts of the island happening at high tide. The development involves significant raising of ground elevations by placement of excavated/dredged material to form the lagoon at the western end of the island. Additional fill material will be imported from borrow pits on the mainland as there are restrictions on dredging sea bed materials due to the site's marine sensitivity.

ARAMCO SOUTH DHAHRAN HOUSING DEVELOPMENT – KSA

SERVICES:

- *Site/Civil Engineering*

LOCATION:

*Dhahran, Kingdom of Saudi Arabia
(KSA)*

CLIENT:

Aramco Services Company

ARCHITECT:

Perkins Eastman

STRATEGIC PARTNER:

DeSimone Consulting Engineers



Credit: Perkins Eastman

The 1,045 hectare housing development is a multi-phase project to design housing, residential facilities, schools, mosques, health facilities, government offices, recreation facilities, municipal buildings, fire stations, playgrounds, and open spaces for Aramco Services Company. Located in KSA's eastern province, the project's key design elements include a detailed master plan outlining the utility and roadway infrastructure and building locations. At each location the design includes site layout, geotechnical earthwork, and grading. The design of stormwater drainage, potable water, waste water, irrigation, power and telecommunications services are integrated within the master plan infrastructure.

Langan's site/civil engineers provided services during Phase 1 and Phase 2 of the master plan development. Our scope included a review of available information, site assessments, and code reviews for local regulations and zoning. Our team was involved with both the concept and design development. Both phases of the project involved coordination with the client, architect, and MEP engineer for all building sites. We developed final designs for roads, parking lot layouts, site grading, utility design, and stormwater management systems. The development of these sites helped assist the design team in refining the master plan layout.

JEDDAH TOWER (FORMERLY KINGDOM TOWER) – KSA

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Transportation Engineering*
- *Traffic Analyses and Modeling*
- *Parking Design*

LOCATION:

*Jeddah, Kingdom of Saudi Arabia
(KSA)*

CLIENT:

Jeddah Economic Company

ARCHITECT:

Adrian Smith + Gordon Gill Architecture

STRATEGIC PARTNERS:

*Thornton Tomasetti
RWDI Consulting Engineers*

Rising 1,000 meters into the Arabian sky, Jeddah Tower will eclipse the reigning tallest building by 173 meters. The first phase of the Kingdom City comprises the Tower, a 65,000 square meter retail mall and a 3,000+ car underground garage.

Langan was appointed as geotechnical, site/civil and traffic engineer and parking planner for the first phase of the development.

Langan's role as the geotechnical engineer included the development and oversight of the site subsurface investigation, 3D finite element modeling of the soil-foundation structure interaction, settlement predictions of the foundation performance, development and oversight of full-scale load testing and final design of the piles in collaboration with the design team.

Langan's role as the traffic and parking planning consultant integrates the circulation and volume demands of the Tower and the retail building into the traffic master plan for Jeddah's Kingdom City. A major challenge was to incorporate a sophisticated vehicular security screening station into the internal road network. Langan's parking design included the preliminary column grid, to maximize parking density and circulation elements. Design of the interweaved driveways and three main access helixes was essential to the project to keep on-site traffic flowing to the three drop-off/pick-up zones and the three underground parking levels. Traffic modeling extended off-site to multiple intersections in the surrounding area.

The civil engineering challenge for the Tower site was the stormwater management. Various schemes were studied including the discharge into a reflecting pond. Our stormwater management plan utilized U.S. standards for water quality improvement prior to discharge.

Jeddah Tower is projected to be the tallest tower in the world.



*Images © Jeddah
Economic Company/
Adrian Smith + Gordon
Gill Architecture*

KING ABDULLAH FINANCIAL DISTRICT (KAFD) – KSA

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Traffic Engineering*
- *Parking Design*

LOCATION:

*Riyadh, Kingdom of Saudi Arabia
(KSA)*

OWNER:

Riyadh Investment Company

ARCHITECT:

Adrian Smith + Gordon Gill Architecture

STRATEGIC PARTNER:

*Saudi Binladin Group
Hill International*



KAFD, a 1.6 million square meter development, will be the home of Saudi Arabia's Financial District. Langan provided site/civil engineering design services for two parcels, 3.10 and 5.03, which consists of two mixed-use buildings totaling 114,973 square meters of office, residential, retail and parking space.

Engineering design was performed in accordance with applicable code regulatory requirements and the KAFD master plan.

Langan supported the project team through the phased design-build process and created budgets for concept design, design development and final design phases.

For the geotechnical engineering, Langan developed a detailed site investigation scope appropriate for the local geology and tailored to the planned development. Langan specified the number of borings, their location and their depth as well as the in-situ and laboratory testing program. A formal geotechnical engineering report was also issued to the client with a compilation of evaluations, results and interim recommendations.

Site/civil and traffic/parking engineering designers contributed to the project's integrated approach to site elements, which were paramount to achieving the artistic vision for the project's vision for pedestrian and public spaces and overall project aesthetic.

**KING ABDULLAH FINANCIAL DISTRICT
AHLAMANA (PLOT 5.03) - KSA**

SERVICES:

- *Geotechnical Engineering*

LOCATION:

*Riyadh, Kingdom of Saudi Arabia
(KSA)*

OWNER:

Riyadh Investment Company

ARCHITECT:

Adrian Smith + Gordon Gill Architecture

STRATEGIC PARTNERS:

*Saudi Binladin Group
Thornton Tomasetti*



Credit: Adrian Smith + Gordon Gill Architecture

Langan provided geotechnical engineering services for a mixed-use residential, office, and retail building located within the southern portion of the King Abdullah Financial District. Ahlamana (the Arabic word for “our dream,” a reference to an Arabic figure that informed the design) consists of two structures, a 26-story (105 meter) residential tower and a 15-story (78 meter) office tower. Four basement levels are planned for about two-thirds of the parcel and a fifth basement level for the remainder of the parcel. The total footprint for the location is approximately 5,700 square meters.

Langan’s subsurface investigation observed significant rock fracturing during drilling. Our engineers calculated that the fractured spaces between rocks would compress and result in foundation settlement. We recommended a continuous concrete mat extending across the entire site. Additional services included calculations and recommendations for permanent control of groundwater, a seismic evaluation, backfill and compaction, and a site-specific investigation to better understand conditions at the site.

**KING ABDULLAH FINANCIAL DISTRICT
HILAL TOWER (PLOT 3.10) – KSA**

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Traffic Engineering*
- *Parking Design*

LOCATION:

*Riyadh, Kingdom of Saudi Arabia
(KSA)*

OWNER:

Riyadh Investment Company

ARCHITECT:

Adrian Smith + Gordon Gill Architecture

STRATEGIC PARTNERS:

*Saudi Binladin Group
Thornton Tomasetti*



Credit: Adrian Smith + Gordon Gill Architecture

Hilal Tower (whose name features the Arabic word for “crescent,” a reference to the building’s C-shaped window frames) is a 32-story, 138 meter tall structure located within the southern portion of the 1.6 million square-meter King Abdullah Financial District development. The mixed-use structure provides space for offices, residences, and retail. Sustainable design elements include the utilization of locally sourced materials, greywater recycling systems for landscape irrigation, and shading elements to protect residents against excessive heat.

Langan completed a detailed subsurface investigation and provided recommendations for a mat foundation to assist with potentially challenging voids and collapsed rock in the area’s limestone geology. Our report specified the number of borings and boring types, their location and their depth as well as specifics for an in-situ and laboratory testing program. A formal geotechnical engineering report was issued to the client with seismic evaluations, laboratory results, and recommendations for permanent groundwater controls.

Langan’s site/civil and traffic/parking engineering services were an integral part of concept through final design plans and were paramount to achieving the aesthetic vision for the project. Our site/civil services included site grading, stormwater management, and pavement design. Langan’s traffic and engineering services included calculations for parking spaces and four levels of underground parking, driveway and road design, and designs for security check points.

RIYADH RESIDENTIAL DEVELOPMENT – KSA

SERVICES:

- *Master Plan Level Geotechnical Evaluations*
- *Master Plan Level Site/ Civil Engineering*
- *Traffic Engineering and Parking Design*
- *Sustainable Principles*

LOCATION:

Riyadh, Kingdom of Saudi Arabia (KSA)

CLIENT:

Confidential

ARCHITECT:

Munoz + Albin Architecture and Planning



This over 130,000 SM site is being developed in two stages and will provide a secure oasis on the outskirts of Riyadh. The centerpiece of the development will be a large central amenity building at the end of a heavily landscaped wide-well pedestrian path. The central amenity building and path will be surrounded by several large swimming pools and varying densities of residential housing. The entire site combines high-level security with a resort quality ambiance.

Langan specifically provided a multi-disciplinary team to assist in the development of the sustainable master plan.

Geotechnical engineering services included soil investigation, investigation data review, and recommendations for foundation designs.

Our site/civil engineers developed the site grading scheme, an overall stormwater management scheme, water distribution and sanitary sewer systems. To complete the utility master plan, Langan also commissioned a site electrical distribution subcontractor and coordinated the entire site's IT system.

Traffic engineering services included roadway design, entrance and exit movement optimization, revenue control equipment design, circulation patterns, and parking area geometry elevations for below grade parking.

Given the project's high standard for sustainability Langan's LEED accredited professionals coordinated grey and black water treatment systems with the irrigation water system to provide the most efficient use of water possible.

MUSEUM OF THE BUILT ENVIRONMENT – KSA

SERVICES:

- *Transportation Engineering*
- *Parking Design*
- *Site/Civil Engineering*

LOCATION:

*Riyadh, Kingdom of Saudi Arabia
(KSA)*

CLIENT:

Al Ra'idah Investment Company

ARCHITECT:

FXCollaborative

STRATEGIC PARTNERS:

*Thornton Tomasetti
DeSimone Consulting Engineers*



Credit: FXCollaborative

Langan provided site/civil and traffic/parking engineering services for the approximately 31,580 square meter Museum of the Built Environment. The Museum will host permanent and temporary exhibitions that interpret the historical experience of Arts and Architecture in the Arabian Peninsula and will educate visitors on the important role that social, economic and environmental issues have played in the region. The Museum houses permanent galleries as well as temporary exhibitions.

Langan's site/civil scope included schematic design that included review of the site survey, utilities and design standards for grading and stormwater management for the site's plaza and open spaces.

Traffic/parking engineering services included support for the museum's interior parking and exterior access/circulation. Key parking elements included vehicular access from adjacent streets to the parking garages, parking layout, curbside drop-offs and security considerations.

**KING ABDULLAH INTERNATIONAL FOUNDATION FOR HUMANITARIAN
ACTIVITIES KING ABDULLAH FOUNDATION COMPLEX PROJECT – KSA**

SERVICES:

- *Geotechnical Engineering*
- *Traffic Planning*
- *Parking Design*
- *Traffic Impact Study*

LOCATION:

*Jeddah, Kingdom of Saudi Arabia
(KSA)*

CLIENT:

Saudi Diyar Consultants

ARCHITECT:

ARUP



The Foundation Complex Project is the new headquarters for the King Abdullah International Foundation for Charity and Humanitarian Activities. The complex is made up of offices, a convention center, a hotel, and a centrally located mosque. Parking is provided for over 1,000 vehicles.

Langan's transportation department provided site design criteria and circulation requirements for the three entrance/exit access points, internal roadways, drop-off areas, parking lots/garages, ramps and pedestrian paths. Deliverables included designs for the traffic and parking elements of the site, and a comprehensive traffic and parking report. Langan also managed our subconsultant's completion of a Traffic Impact Study for the site and regional road network.

The need to provide parking for such a dense development was met through the use of shared parking principles as well as efficient parking layouts in the lots and garages. Site access points and roadways were designed to accommodate cars, limousines, trucks, buses and emergency services vehicles.

Our geotechnical engineering services included a review of previously compiled Phase 1 and 2 data, soil investigation scoping, a factual report review, foundation analysis and contract administration. We also completed geotechnical interpretive report and attended project meetings.

SERVICES:

- *Third Party Dewatering and Geotechnical Review Services*
- *3D Finite Element Analyses*

LOCATION:

Jeddah, Kingdom of Saudi Arabia (KSA)

CLIENT:

*Saudi Diyar/Cayan Development
Turner International Middle East*



The Lamar Towers are comprised of two structures with two below-grade basements. The buildings rise above a podium level and form a V shape looking out into the Red Sea. Once built, the towers will be the first skyscrapers in Saudi Arabia's western region. Tower 1 will be 322 meters tall with 72 floors above ground and Tower 2 will be 293 meters tall with 62 floors above ground.

Lagan conducted a third-party review of all recommendations and executions pertaining to the dewatering aspects of the site to insure that proper recommendations and construction techniques were employed.

Lagan's scope of work included a review of all relevant and available project information including building geometry, soil investigation reporting, dewatering design, hydro-geological analyses and grouting design.

Due to the porous nature of the underlying coral, the site was further divided into four sections (by diaphragm walls) to facilitate dewatering. The shoring system consisted of a diaphragm wall along the perimeter. In addition, blanket grouting was performed in each section to further reduce the pumping requirement.

Lagan was in general agreement with the proposed and implemented schemes. Some additional clarifications and recommendations were provided to enhance the operation and monitoring.

SERVICES:

- *Geotechnical Engineering*
- *Seismic Hazard Analysis*

LOCATION:

Jubail, Kingdom of Saudi Arabia (KSA)

CLIENT:

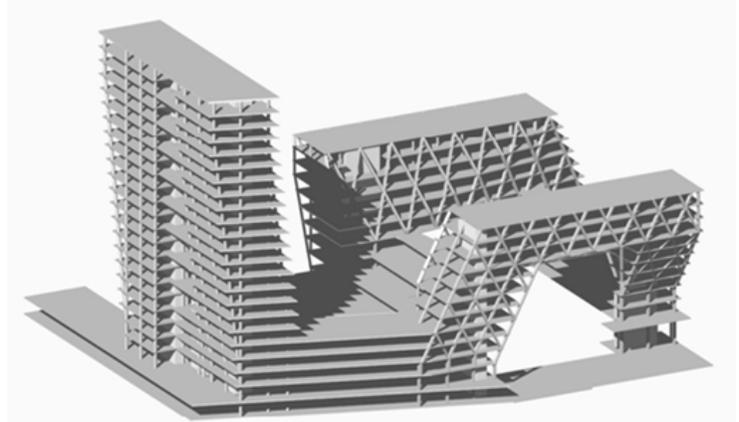
Saudi Basic Industries Corporation (SABIC)

ARCHITECT:

Henning Larsen Architects

STRATEGIC PARTNER:

Thornton Tomasetti



This waterfront development is located in the vicinity of Marmudah Bay in Jubail, KSA. The structure consists of a 22-story office tower, a 13-story quadrangle office block bridging over public realm areas, retail, a multi-story car park, and auditorium.

Langan developed detailed specifications and scope of works for the project's geotechnical investigation. We provided fulltime oversight during construction and prepared a detailed interpretive geotechnical report for the development.

We also performed a seismic hazard analyses in conjunction with our geotechnical services. Our scope included deterministic seismic hazard analysis (DSHA) and probabilistic seismic hazard analysis (PSHA), which systematically accounts for the uncertainties of the location, recurrence intervals, and magnitudes of future earthquakes.

In accordance with Saudi Building Code and ASCE 7-05, Langan estimated site-specific uniform hazard spectra for two percent probability of exceedance in 50 years for the site. Site-specific response spectra for Maximum Considered Earthquake (MCE) and Design Earthquake (DE) were also developed.

SERVICES:

- *Parking and Traffic Engineering*

LOCATION:

*Jeddah, Kingdom of Saudi Arabia
(KSA)*

CLIENT:

Keppel Al Numu

ARCHITECT:

Saudi Diyar Consultants



The landmark 320-meter twin towers (approximately 80-stories each) reside on approximately 3.6 hectares along the Corniche in Jeddah. The proposed development will have 993 luxurious waterfront apartments with most of the units facing the Red Sea.

Langan's parking and traffic engineers are providing services during the development of design options for the parking garage, access drives, ramps, as well as connections to the local road system. Scope of work includes:

- Review of proposed access, circulation, and parking schemes.
- Collaboration with the design team to provide mark-up sketches commenting on any potential design inefficiencies and alternative concepts.
- Review of access control points, vehicle queuing/ storage requirements, processing times, peak hour demands and capacity, as well as interface with local road system.
- Estimation of peak hour traffic flows in and out of the development.

Deliverables included mark-ups; alternative concept sketches; technical memorandums summarizing proposed parking scheme and operations, and traffic analysis summaries.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*

LOCATION:

Jabal Al Kalah, Kingdom of Saudi Arabia (KSA)

OWNER:

Ministry of Islamic Affairs

STRATEGIC PARTNERS:

*Thornton Tomasetti
Turner Arabia*



The King Abdul Aziz Waqf project site is in front of the holy Mosque (Al Maran Ash Shanf) in Makkah. The complex has a footprint of approximately 29,500 square meters.

The complex consists of a 17-story central podium and five towers that will vary in height from two to seven to 35-stories above the podium. Building column dead plus live loads range from 6,000 to 16,000 kips.

Langan provided a peer review of the proposed foundation system. We developed a supplemental drilling program and provided coordination and full time controlled inspection of the supplemental drilling work. Langan performed an engineering evaluation of the collected information and developed recommendations for foundation support and groundwater control.

WASTEWATER TREATMENT PLANT IMPROVEMENTS – KSA

SERVICES:

- *Environmental Site Assessment*
- *Remedial Feasibility Study*

LOCATION:

Eastern Province, Kingdom of Saudi Arabia (KSA)

CLIENT:

Saudi Aramco



Langan assisted Saudi Aramco with a study aimed at developing a strategy to treat spent caustic streams that normally require treatment and disposal at overseas facilities. The study also developed cost effective strategies for treatment of hydrogen sulfide (H₂S) streams. The study reviewed a number of alternative treatment systems including:

- Spent caustic treatment alternatives explored included: wet air oxidation (WAO), chemical oxidation, acidification/stripping, and more;
- H₂S treatment alternatives included traditional stripping, Mechanical Dissolved Gas Flotation (DGF), Chemical oxidation using Hydrogen Peroxide, Chemical treatment using a hydrogen sulfide scavenger.

The project included review of the current effluent streams, review of a variety of treatment alternatives (including cost, constructability, maintenance, etc.), coordination with Saudi Aramco departments and facilities, and design of an appropriate alternative. The team also developed the basis of design for each system and prepared the appropriate Design Basis Scoping Paper (DBSP) on behalf of Saudi Aramco. The detailed design included extensive details on a regional wet air oxidation system (for caustic streams) and a scavenger system for H₂S streams. Other alternatives should represent significant life cycle savings over current disposal and treatment strategies. Saudi Aramco has plans to implement the recommended strategy at this time.

SERVICES:

- *Gas Migration Engineering Assessment*
- *Remedial Measures Assessment*

LOCATION:

South Dhahran, Kingdom of Saudi Arabia (KSA)

CLIENT:

Saudi Aramco



Langan performed a gas migration engineering assessment for the proposed Corporate Data Centre. During the initial phases of construction, buried landfill was encountered, resulting in the release of noxious odors. Given the health and safety concerns related to landfill gas migration, the purpose of the environmental investigation was to identify whether hazardous gaseous contaminants were present and migrating from the buried landfill to the proposed Corporate Data Centre site.

The project involved a comprehensive historical data collection and review effort in order to evaluate the contents and limits of the landfill, a field investigation that involved the procurement, management, and oversight of international sub-consultants to install landfill gas monitoring wells, and an analytical laboratory-testing program. Organization and coordination of international work force; procurement of local sub-consultants; performance of engineering assessment concurrently with early stages of building construction; identification of problem and development of gas mitigation options after building design complete.

The migration of landfill gas to the proposed Corporate Data Centre site was confirmed. The Langan-Mustang Team presented Saudi Aramco with three gas mitigation options in order to reduce the health and safety concerns related to the landfill gas: Relocation of the Corporate Data Centre off-site, relocation on-site or installation of an extensive perimeter and sub-slab gas migration system. Saudi Aramco opted to move the Corporate Data Centre to another location off-site.

**OILY PONDS CLEANUP
SOUTHERN AREA OIL OPERATIONS – KSA**

SERVICES:

- *Environmental Site Assessment*
- *Remedial Feasibility Study*

LOCATION:

Eastern Province, Kingdom of Saudi Arabia (KSA)

CLIENT:

Saudi Aramco



Langan assisted Saudi Aramco with the environmental site assessment, human health risk assessment, and remedial program development of unlined oil recovery ponds at 36 gas-oil separating plants (GOSPs) within the Southern Area Oil Operations.

The project involved comprehensive site reconnaissance at each GOSP site aimed at identifying oily ponds that may require remediation and procurement, management, and oversight of international sub-consultants to perform a field investigation and analytical laboratory-testing program at two representative GOSP sites. Impacts to site soil and groundwater were evaluated and incorporated into a human health risk assessment aimed at identifying potential human and environmental risks resulting from the existing site conditions. Industrial soil and groundwater cleanup criteria were calculated for use as site remediation standards, the first such set of environmental cleanup standards adopted by Saudi Aramco.

A comprehensive feasibility study was conducted to evaluate potential remedial alternatives and identify the most appropriate remedial strategy for the cleanup of the oily ponds. The recommended remedial strategies were then incorporated into an overall remedial program for the 36 facilities. A conceptual remedial cost estimate was prepared to assist Aramco in future project planning purposes.

Saudi Aramco was highly satisfied with Langan's performance on the project. The recommended remedial program resulted in a 75% reduction in previously estimated remedial costs and provided the potential for additional earnings through the sustainable recovery of oil products. Organization and coordination of international work force; procurement of local sub-consultants; remedial cost limitations and accelerated project schedule. Despite unanticipated delays in project mobilization, Langan was able to meet all previously defined project milestones and deadlines to allow Saudi Aramco to incorporate remedial costs in budget.

HEART OF DOHA (PHASE 1A) – QATAR

SERVICES:

- *Geotechnical Engineering*
- *Enabling Work Supervision:*
 - *Shoring*
 - *Dewatering*
 - *Excavation*
 - *Piling*
- *Enabling Work Submittal Review*

LOCATION:

Doha, Qatar

CLIENT:

Burns & McDonnell



Covering approximately 35 hectares in the center of Doha, the Heart of Doha project is an ambitious urban redevelopment project that aims to reduce the city's current urban sprawl. Plans include an underground city and the interlinking of above-ground communities that retain the city's vibrancy and colorful lifestyle. Improvements have been designed to encourage and enhance Doha's cultural legacy based on five pillars of heritage and culture, innovation, sustainability, enrichment and environment.

Langan provided geotechnical engineering services for Phase 1A of this project. Responsibilities included supervision and review services associated with the enabling work including: shoring, dewatering, excavation and piling involving approximately 70,000 square meters and two to three below-grade basement levels. A deeper excavation is also planned within the main excavation area to support various utilities and associated tunnels.

Additional responsibilities included:

- Coordination and collaboration with project consultants during all enabling works
- Review of all submittals related to piling, shoring, dewatering and excavation
- Monitoring and inspection of all shoring work and construction
- Monitoring of all tieback texts, grout placement, stressing and de-tensioning operations
- Review of all piling types, installation procedures and testing (including O-cell testing)

Langan engineers provided full-time on-site support in the United Arab Emirates and in the United States. As a result, the project proceeded without delays.

FOUR SEASONS HOTEL – KINGDOM OF BAHRAIN

SERVICES:

- *Site/Civil Engineering*
- *Transportation Engineering*
- *Geotechnical Peer Review*
- *Parking Design*

LOCATION:

*Bahrain Bay, Manama,
Kingdom of Bahrain*

CLIENT:

*Signature Hotels Management
Company S.P.C.*

ARCHITECT:

Skidmore, Owings & Merrill (SOM)

STRATEGIC PARTNER:

Werner Sobek



Credit: SOM | Future Brand

Langan provided site/civil engineering and transportation/parking services for the design of the iconic Four Seasons Hotel. The project consists of a 50-story, approximately 218-meter hotel tower with associated guest amenities, surface and basement level parking and outdoor facilities on a self-contained and reclaimed island in Bahrain Bay.

Services include infrastructure design, grading and stormwater management design, transportation planning, parking and circulation design, and the preparation of a traffic impact study (TIS) for the Four Seasons site. Langan will also provide geotechnical peer review to evaluate potential cost savings in the existing foundation system design.

Parking design includes security oriented access control for ingress/egress from the island. The lower level parking includes separate zones for restricted use and valet service.

The project will be designed, permitted and constructed in a fast-tracked schedule and will be an integral part of the overall Bahrain Bay development.

Four Seasons Hotel is the tallest tower in the Kingdom of Bahrain.

SERVICES:

- *Transportation Master Planning Analysis*
- *Utility Master Plan*

LOCATION:

Sana'a, Yemen

OWNER:

Al Yemenia Al Watariah Real Estate Investment and Development Company – a Joint-Venture between Qatari Diar and Shibam Holding

CLIENT:

Zeidler Partnership Architects



The Al Rayyan Hills project is perched on top of a plateau that resides 90 meters above this capital city, situated on the southeast quadrant of the Arabian Peninsula. This 43 hectare mixed-use project – consisting of 204 residential villas, 72 townhouses, 194 apartment units, 2,227 square meters of retail space and commercial facilities, 24,800 square meters of office space and a five-star boutique hotel – commands panoramic views of the new and old portions of the city.

Langan conducted a traffic analysis of the preliminary master plan and made recommendations to improve interior vehicular circulation, separate residential and commercial traffic, and improve the geometry of the major intersections within the project. We also assisted the master planner in establishing the number of parking spaces required throughout the project, focusing on each of the major site plan components, and determined how to best distribute the spaces to minimize walking distances to the destination points. Langan provided geometric, signage and signalization recommendations to improve the intersections where the proposed ingress and egress roads tie to the abutting existing city roads.

Langan prepared the utility master plan for this project to assist the master planner in locating the utility corridors, the potable water reservoir, the reuse waste water treatment plan, the rain water harvesting reservoir and the 33 KV electrical substation, to ensure that these elements were placed in locations that allow them to be blended into the aesthetic fabric of the project. We coordinated extensively with the Minister and Cabinet of Sana'a Municipality, the Ministry of Water and Environment, the Ministry of Electricity and Energy, the local telecommunications corporation and the General Investment Authority to identify the available utility connection points and the required improvements.

Langan has utilized the data collected from these agencies to prepare hydraulic models to calculate the expected potable water demand, the irrigation demand, and the sanitary sewage loading. We developed a water budget, potable water distribution system, sanitary sewage collection and transmission system and power distribution grid to serve this state-of-the-art environmentally sustainable project.

EMAAR MISR - UPTOWN CAIRO, VILLAGES Z3 & Z5

SERVICES:

- Site/Civil Engineering

LOCATION:

Mokattam, Cairo, Egypt

CLIENT:

Emaar Misr

ARCHITECT:

EDSA



Uptown Cairo covers a surface of some 4.5 million square meters. The site rests on the foothills of Mokkatam, a large hill overlooking the greater Cairo area. At 200 meters above sea level Uptown has the unique position of being in the heart of Cairo, while also being isolated enough to seem disconnected from its urban areas. The Emaar Misr project features several unique residential buildings, internal access and circulation roadways, surface parking areas and landscape areas. This mixed use project hosts a variety of community comforts and services, based in and around a thriving town center. In total, the infrastructure of Emaar Misr is estimated be worth around 2.5 billion EGP.

As part of site/civil engineering services, Langan prepared drainage plans showing the proposed location of drainage inlets, pipes and outfalls. During the design development phase of the project, we prepared plans to refine and further advance the stormwater drainage collection and conveyance system and coordinated with the mechanical, electrical, and plumbing consultant for roof drain and building drainage connection points.

The completed design development design provided the entire project team with a complete drainage system layout with pipe diameters, slopes and depths and the planned drainage inlet structures.

LEAD EXPOSURE ABATEMENT PLAN – EGYPT

SERVICES:

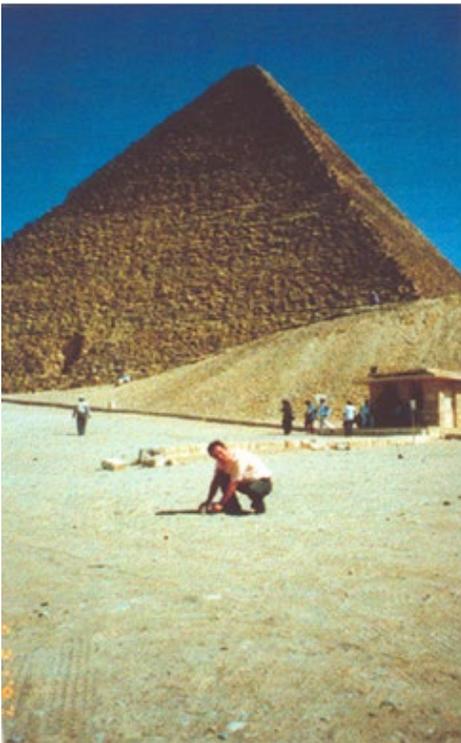
- *Risk Assessment*
- *Behavioral Study*
- *Environmental Sampling*

LOCATION:

Cairo, Egypt

CLIENT:

*Camp Dresser & McKee International
for the United States Agency for
International Development (USAID)*



Langan was retained by Camp Dresser & McKee International (CDM) as a prime contractor for the United States Agency for International Development (USAID) to provide technical and professional services for the Environmental Health Project (EHP). The EHP is a USAID funded project that helps development organizations to address industrial transition environment related health problems.

Lead is a naturally occurring, toxic heavy metal present at background levels in many environments and at elevated concentrations in many cities of the developing and developed world. Children and adults who are exposed to lead through contaminated soil, dust, air, water, food and other media will generally develop elevated levels of lead in their blood. Blood levels as low as 10 micrograms per deciliter (ug/dl) are now known to have serious adverse effects on the neurological, social and mental development of young children and increased hypertension in middle-aged men.

Langan's role was to provide the environmental technical assistance required by the Egypt Environmental Affairs Agency (EEAA) for preparing the plan. This assistance consisted of: 1) conducting an environmental risk assessment; 2) conducting a children behavioral study; and 3) designing and implementing a sampling and analysis plan to characterize lead contamination in the various environmental media in the Greater Cairo metropolitan area. The plan presents an analysis of the potential pathways by which children and adults in Cairo may be exposed to lead.

The ultimate goal of the subject plan is to develop a set of interventions that will reduce exposure to lead in Cairo and to incorporate those interventions into an abatement plan that identifies appropriate stakeholders, responsibilities and time tables for implementing the interventions.

Langan performed the required environmental assessment and the associated investigation of exposure-related behavior in a very timely manner. We completed the sampling protocol, which consisted of collecting more than 500 samples throughout Cairo from different media, in less than one month. The sampling media include soil, dust, water, paint, food, cosmetics and medicine in addition to the associated QA/QC samples. Langan's efforts in this assignment also included logistic coordination with the Government of Egypt and all other local involved parties as well as domestic coordination related to importing environmental samples into the United States for laboratory analysis.

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Seismic Analysis*

LOCATION:

Basrah, Iraq

CLIENT:

Iraqi Ministry of Youth and Sport

ARCHITECTS:

*HOK
RMC-Partners*

STRATEGIC PARTNERS:

*Abdullah Al-Jiburi
Thornton Tomasetti
WSP
Lloyd Engineering
Cini-Little*



Credit: HOK

Basrah Sports City is a 145 hectare complex of world class stadiums, training facilities, exhibition halls and entertainment venues. The main structures, set to host the 2015 Gulf Cup of Nations game, include a 65,000 seat stadium, a 10,000 seat secondary stadium, and four training fields, all constructed under a single design-build contract.

Langan provided site/civil engineering for the complex, as well as consulting services on geotechnical and seismic hazard assessments for the structures. The infrastructure includes storm and sanitary sewers, water supply, telecommunications, electric distribution and roadways.

The site was part of the former delta region, with several major waterways emptying into the Gulf. As a result the site is underlain by soft, compressible material that will settle up to 50 centimeters under new fill material to be used to raise grades. Langan assisted with design of a surcharge program to stabilize the site.

As the dry climate provides very little total annual rainfall (but short intense storms during a short rainy season), Langan designed the stormwater system as a system of open channels with limited piping in the large open parking fields to efficiently convey the runoff.

The design-build contract stipulated a 32-month schedule to complete all required Phase 1 work to allow the complex to be ready to host the 2013 Gulf Games.

AL MENAA SPORTS COMPLEX – IRAQ

SERVICES:

- *Geotechnical Engineering*
- *Road/Parking Design*
- *Foundation Recommendations*
- *Site/Civil Engineering*
- *Design Evaluations and Recommendations*
- *Construction Administration*

LOCATION:

Al Menaa, Basrah, Iraq

OWNER:

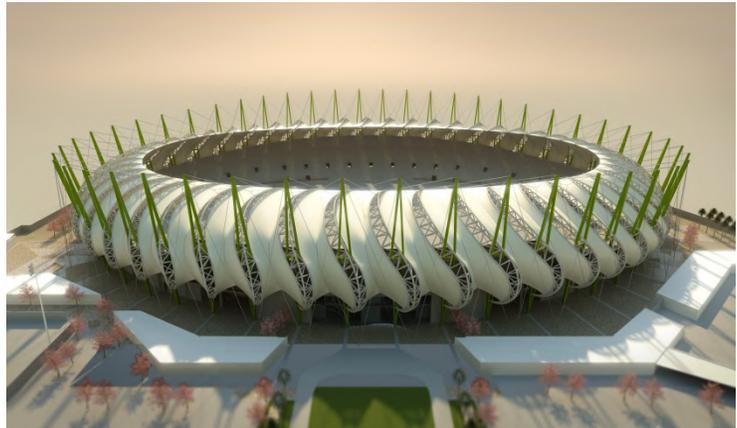
Iraqi Ministry of Youth and Sport

ARCHITECT:

HOK

STRATEGIC PARTNERS:

*Anwar Soura
Thornton Tomasetti
WSP*



Credit: HOK

Commissioned by the Iraqi Ministry of Youth and Sport, the 30,000-seat soccer stadium, training fields, roads, plazas and parking are being constructed under a design-build contract. The wave and sail concept for the Al Menaa Sports Complex reflects the culture and heritage of Basrah, which has a rich nautical tradition as Iraq's port city. The total site area is about 9.7 hectares. This small site is tucked into the surrounding neighborhood requiring careful consideration of site access and crowd control.

Langan provided site/civil and geotechnical engineering services during the tender, design and construction phases of this project. Our geotechnical scope of services included development of the subsurface investigation program including field investigation, interpretation of field results to determine an efficient foundation system for the building, geotechnical and construction administration. The site is underlain by soft river deposits typical of Basrah, requiring a pile foundation for the stadium structure, and a pre-load program to control long-term settlement of pitches and smaller building construction on mat foundations.

Our site/civil services included design of site-wide storm grading and drainage, sanitary sewers, water supply and water distribution; road and parking designs. We also provided services to appurtenant structures such as loading docks, ticket and concession stands, booths and stadium security (hydraulic bollards, guard stations, etc.). The site is located in the flat river delta with high groundwater, making drainage difficult. Our team utilized overland flow to minimize construction expenses.

SERVICES:

- *Geotechnical Engineering*
- *Foundation Recommendations*
- *Site/Civil Engineering*
- *Design Evaluations and Recommendations*
- *Construction Administration*

LOCATION:

Najaf, Iraq

OWNER:

Iraqi Ministry of Youth and Sport

ARCHITECT:

HOK

STRATEGIC PARTNERS:

*Anwar Soura
Thornton Tomasetti*



Credit: HOK

Commissioned by the Iraqi Ministry of Youth and Sport, the 31,000-seat Al Najaf sports complex is located about 100-miles south of Baghdad. The complex, which is composed of the stadium, training fields, roads, plazas and parking is being constructed under a design-build contract. The total site area for this project is approximately 15 hectares.

Langan provided site/civil and geotechnical engineering services during the design and construction phases of this project. Our geotechnical scope of services included development of the subsurface investigation program including field investigation, interpretation of field results to determine an efficient foundation system for the building, geotechnical report and construction administration. The stadium will be constructed on up to four meters of engineered fill, designed to permit the use of shallow foundations.

Our site/civil services related to all aspects of the complex including design of site-wide storm grading and drainage, sanitary sewers, water supply and water distribution; road and parking designs. We also provided services to appurtenant structures such as loading docks, ticket and concession stands, booths and stadium security (hydraulic bollards, guard stations, etc.). To minimize costs, our engineers are exploring infiltration areas to limit stormwater piping.

SATHER AIR FORCE BASE DESIGN-BUILD SUPPORT FACILITY – IRAQ

SERVICES:

- *Site/ Civil Engineering*
- *Geotechnical Engineering*

LOCATION:

Baghdad, Iraq

OWNER:

The U.S. Department of State, Office of Overseas Building Operations (OBO)

DESIGN-BUILD TEAM:

*Lakeshore Contracting
Sorg Architects*



Langan provided design-build site/civil and geotechnical services for temporary housing and infrastructure improvements.

The project included the construction of several hundred containerized housing units (CHU's) and associated utility services. Several guard towers, a fire station, water wells, mail screening facilities ammo bunkers, dog kennels and perimeter security upgrades were also planned for the project.

The scope of engineering work included construction phasing, demolition design, site layout, grading, utility infrastructure design, and stormwater management planning.

On-site utility infrastructure included self-sustaining systems such as power generation plants, water wells, reverse osmosis water purification units, wastewater treatment plants and sewer pump stations. Through a complex multiphase project sequence, the work was constructed without interruption to daily base operations.

SERVICES:

- *Geotechnical Engineering*
- *Foundation Design*
- *Seismic Evaluations*
- *Construction Administration*

LOCATION:

Upper Worli, Mumbai, India

CLIENT:

Lodha Group

ARCHITECT:

Pei Cobb Freed & Partners

STRATEGIC PARTNER:

LERA



Rising over 280 meters above the Arabian Sea, the World One Tower will be the iconic tower of Lodha Place, the 7.3 hectare development. The project incorporates sustainable features such as green roofs and rainwater harvesting systems. It is anticipated that the tower will obtain a LEED Gold rating and be one of the only 100+ storied buildings in the world to have this certification.

Langan is serving as the geotechnical consultant for the project. Langan's role included the development of a subsurface investigation program, foundation evaluation, 3D finite element analysis, seismic hazard analyses, and construction administration.

The project's challenges, which included highly variable subsurface conditions, were overcome by Langan's comprehensive investigation program. The investigation included numerous borings, pressuremeter tests, laboratory tests, and two instrumented, high capacity, pile load tests loaded to over 30 MN (3,000 tons).

In addition, Langan's Probabilistic Seismic Hazard Analysis (PSHA) allowed the structural design of this super-tall tower to be performed using the seismic requirements of the International Building Code, as opposed to the local seismic code, setting a precedent for the design of high-rise structures in Mumbai.



SERVICES:

- *Geotechnical Engineering*
- *Subsurface Investigation*
- *Foundation Evaluation*

LOCATION:

Goregaon, Mumbai, India

CLIENT:

Oberoi Construction

STRATEGIC PARTNERS:

*Larsen & Toubro Ltd.
LERA*

AWARDS:

*2014 Construction Week India Awards
– High-Rise Project of the Year
2013 CNBC AWAAZ Real Estate
Award – Best 50% Complete
Residential Project, Luxury Segment
2012 Brands Academy SAARC and
ASEAN Real Estate Awards – Best
Upcoming Luxury Residential Project in
Mumbai
2012 Estate Awards in Association with
Bloomberg TV – Residential Project of
the Year, West India*



Oberoi Exquisite encompasses three 50-story residential towers and is part of the 170 meter tall Oberoi Garden City development. Amenities for the complex include swimming pool, tennis court, clubhouse, skating rink, verdant gardens and children's play area. The development encapsulates contemporary aesthetics, innovative construction techniques and materials.

Langan's geotechnical engineers reviewed all existing documentation for the project site including boring logs, site history documentation, subsurface geologic formations and existing seismic risk assessment reports. We also performed a 3-D finite element analysis to evaluate the feasibility of a shallow foundation system.

Langan also worked with the local geotechnical consultant in Mumbai to prepare a final geotechnical and foundation design report for the development.

**THREE SIXTY WEST – INDIA
(FORMERLY OASIS TOWERS)**

SERVICES:

- *Geotechnical Engineering*
- *3D Numerical Modeling Analyses*

LOCATION:

Worli, Mumbai, India

CLIENT:

*Oasis Realty, a joint venture between
Sahana and Oberoi Realty*

ARCHITECT:

Kohn Pedersen Fox Associates

STRATEGIC PARTNER:

LERA



Credit: Wordsearch/River Film

Three Sixty West consists of a 361-meter tall, 85-story luxury residential structure, and a mixed-use, 53-story tower with hotel, office and retail spaces. A seven-story podium will connect the two towers over the entire 11,500 SM footprint. Once completed, the taller tower will be the second tallest tower in India.

Our geotechnical services included development of a subsurface investigation program and design team coordination. We worked to create an optimal depth of foundation that would provide the client with the necessary foundation support, while satisfying the client's need for optimal cost-effective design.

In addition, Langan performed advanced 3D numerical analyses to provide foundation recommendations and construction recommendations to the design team. Langan will assist the client in providing the technical support and documentation, as needed, for approval of the design by the High-Rise Committee.

SERVICES:

- *Geotechnical Engineering*
- *Subsurface Investigation*
- *Test Pile and Load Test Program*

LOCATION:

Worli, Mumbai, India

CLIENT:

I-Ven Realty Limited

STRATEGIC PARTNER:

LERA



This mixed-use residential project consists of twin 60-story, 755 FT (230 meter) towers with a five-story podium and two basement levels. Each tower will contain 450,000 GSF excluding podium functions.

Langan provided geotechnical engineering services that included the review of existing boring and foundation reports and published information on the engineering properties of the various geologic formations within the site. We reviewed the seismic risk assessments made in the reports and the performed a supplementary subsurface investigation once the tower had been sited on the development parcel.

Langan developed design parameters for a shallow mat foundation in-lieu of more conventional and expensive bored piles. We also provided all technical support for the application to (and subsequent approval by) the Mumbai Hi-Rise Committee.

This project was designed but – to date – has not moved into the construction phase.

SERVICES:

- *Geotechnical Peer Review*

LOCATION:

Mumbai, India

CLIENT:

Nathani Supariwala Realty

ARCHITECT:

Skyline Architects

STRATEGIC PARTNER:

*Thornton Tomasetti
RWDI*



Credit: Skyline Architects

Located in the Mumbai Central area in South Mumbai and standing 72-stories, the luxury residential tower is supported on bored piles socketed in soft rock. The building has one basement level and features a fully-equipped sport and health club, an indoor jogging track, tennis courts, an outdoor swimming pool located 400 FT above ground level, a movie theatre, a private amphitheater, a children's play area and five levels of underground parking.

Langan provided geotechnical peer review and design assistance services for the project. Langan's services included reviewing subsurface investigation data and foundation design recommendation provided by the local geotechnical consultant and providing peer review comments.

Langan also peer reviewed pile compression and uplift capacity design calculations and field load test data provided by the local geotechnical consultant, and provided geotechnical engineering support to the design team.

The building earned a Green Homes Certification under the Indian Green Building Council for optimizing natural light and ventilation, reusing 100 percent of rainwater runoff and the installation of indigenous trees and plants for landscaping.

SERVICES:

- *Due Diligence*
- *Site/Civil Engineering*
- *Stormwater Analysis*
- *Geotechnical Engineering*
- *Environmental Engineering*
- *Traffic Planning*

LOCATION:

Bangalore, India

CLIENT:

Confidential



The new corporate site is an eight-hectare parcel within a 41-hectare master plan development located in the suburban section of Bangalore, India. The site consists of multiple 11-story buildings with four below-grade levels. The gross floor area is approximately 148,645 square meters.

Langan's work included general due diligence oversight with respect to site/civil, geotechnical, environmental and traffic engineering related issues for a proposed new office park for a corporate client. Langan reviewed the due diligence material and provided engineering related feedback for the site and the proposed development. Our results assisted the owner in making the go/no-go decision with respect to the development.

Langan performed a hydrologic and hydraulic analysis and an assessment of the potential flooding issues in and around the site. The conclusions of the summary report identified potential infrastructure improvements needed to address the problem areas during various rainfall frequencies and identified magnitudes of cost to design, permit and construct the infrastructure improvements for the different storm events.

Langan also prepared preliminary grading, drainage and utility design plans for the project. Langan coordinated with the due diligence team to review the critical deal points for the project. Langan provided a summary report with drawings and narrative to assist the client making their decisions for this site.

SERVICES:

- *Geotechnical Engineering*

LOCATION:

*Sudirman Central Business District,
Jakarta, Indonesia*

CLIENT:

PT Grahamas Adisentosa

ARCHITECTS:

*Smallwood, Reynolds, Stewart, Stewart
& Associates
PT Pandega Desain Weharima/
PDW Architects*

STRATEGIC PARTNERS:

*Thornton Tomasetti
PT Gistama Intisemesta*



Signature Tower Jakarta promises to be an Indonesian icon for the 21st century. Situated in the Sudirman Central Business District, the 111-story mixed-use tower will rise 638 meters above six below-grade parking levels. The development will include a six-star luxury hotel, observatory, office space, convention center and luxury retail mall. An existing vehicular tunnel will link the tower to an adjacent shopping mall.

Langan was appointed as the geotechnical engineer for the project. Our scope of services includes the development of the subsurface investigation program, geotechnical evaluations, and design recommendations for the basement walls and building foundation; 3D finite element analyses of the soil-foundation-structure interaction, site-specific seismic design criteria peer review, and geotechnical consultation during final design.

Signature Tower Jakarta is slated to be the tallest tower in Indonesia.

SERVICES:

- *Geotechnical Engineering*
- *Seismic Engineering*
- *Site/Civil Engineering*
- *Transportation and Parking Engineering*

LOCATION:

Kuala Lumpur, Malaysia

CLIENT:

*KLCC Holdings/Qatari Diar
(Joint Venture)*

ARCHITECT:

Pelli Clarke Pelli Architects

STRATEGIC PARTNER:

LERA



Langan is providing geotechnical, site/civil, transportation and parking engineering services for three development lots immediately adjacent to the Petronas Twin Towers.

The lots cover approximately 16,500 square meters and are comprised of four below-grade levels for parking, a six-level retail/entertainment podium and three towers. The towers will rise 278 to 370 meters above the surrounding central park. The gross built-up area is approximately 400,000 square meters. One tower will hold the first Fairmont Hotel & Resort in Malaysia and will include 750 guestrooms in the 62-story building.

Langan's role as the foreign geotechnical engineer includes design of the perimeter diaphragm wall, design of the foundations for the three towers plus the low-rise podium and garage, and collaboration on the pressure slab design for the parking garage. The site/civil engineering focus will primarily be on site grading, drainage and stormwater management.

The new development will create a significant increase in traffic and parking demands. Langan's transportation expertise will be tapped to provide consultation to the architect on a wide range of circulation, parking and delivery issues.

KUALA LUMPUR CITY CENTRE MENARA 3 PETRONAS – MALAYSIA

SERVICES:

- Geotechnical Peer Review
- 3D Finite Element Analysis

LOCATION:

Kuala Lumpur, Malaysia

CLIENT:

Kuala Lumpur City Centre Berhad

ARCHITECT:

Pelli Clarke Pelli Architects

COMPLETION DATES:

2012 (Construction)

AWARDS:

2019 CTBUH 50 Most Influential Tall Buildings



This 40 hectare development is within The Kuala Lumpur City Centre (the “city within a city”). Proposed construction consists of a 60-story high-rise tower with a podium and four basement levels. The lowest cellar level extends about 16 meters below the surrounding surface grade. The total area of the site is 14 hectares.

Langan provided a geotechnical peer review for the foundation system of the proposed tower and performed a 3D finite element analysis to verify the estimated total and differential settlements. Langan engineers also provided final recommendations on the suitability of the foundation system, which consist of pile-reinforced raft.



SERVICES:

- *Master Planning*
- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Traffic/Transportation Planning*

LOCATION:

Ho Chi Minh City, Vietnam

CLIENT:

MESA Group

ARCHITECT:

HKS



Langan participated in the comprehensive master planning for the 162 hectare mixed-use development west of Ho Chi Minh City. Bordering at the confluence of the Saigon and Dong Nai Rivers, the project involved the visioning and conceptual designs needed to integrate a section of undeveloped countryside into the vibrancy of Vietnam's largest city. The mixed-use development is expected to include a Central Business District, park spaces, housing including high-rise and low-rise buildings, a hospital, schools and sports/cultural facilities.

The site is underlain by soft and highly compressible clay and medium dense sand ranging in thickness from two to eight meters. Geotechnical considerations included foundation recommendations for buildings under and over six stories.

Our site/civil engineers participated in the review of the existing infrastructure, capacity of the existing utilities near the site, assessment of flood plain issues and overall stormwater management, and the impacts on developable areas. We also assisted in the development of the on-site vehicular plan, street network, bridge access, parking and pedestrian circulation.

SERVICES:

- *Foundation Peer Review*

LOCATION:

Ho Chi Minh City, Vietnam

CLIENT:

Bitexco

ARCHITECT:

Carlos Zapata Studios

STRATEGIC PARTNER:

LERA



The Financial Tower, owned by Bitexco, a wholly Vietnamese company, is a skyscraper with 68 floors (263 meters) above ground and seven cellar levels. The tower is located on an area of 6,000 square meters with the gross floor area of over 100,000 square meters above grade and more than 30,000 square meters below grade. Constructed of steel and glass, the building features include a heli-pad and lotus petal shaped structure, which is a symbol of new growth within Vietnamese culture.

Langan provided a peer review of the pile foundation design, the pile load tests and the pile installation depths. The site conditions consisted of deep deposits of relatively soft and compressible clay soils. The foundation system consisted of a continuous raft supported on a field of piles. Piles ranged up to 1,200 millimeters in diameter and ranged in depth from 70 to 85 meters. Full scale load tests were performed on single piles that became the basis for the final design. Langan developed recommendations to reduce the overall pile lengths without compromising the performance of the foundation. This resulted in a more constructible foundation as well as significant savings to the foundation cost.

**THE VIRIDIAN IN GREENHILLS
& THE ROYALTON AT CAPITOL COMMONS – PHILIPPINES**

SERVICES:

- *Geotechnical Peer Review*
- *Development of Site-Specific Earthquake Ground Motions*

LOCATION:

*San Juan City and Pasig City,
Philippines*

CLIENT:

Magnusson Klemencic Associates



These developments consist of mixed-use residential and commercial properties. Our services included a peer review of the geotechnical investigation, geotechnical and foundation engineering consultation, and development of a site-specific earthquake ground motions study.

The scope of Langan's services for the Viridian and Royalton Towers were similar. We developed site-specific ground motion design criteria of response spectra and spectrally compatible time series. We performed a Probabilistic Seismic Hazard Analysis and deterministic analysis. We also developed site-specific horizontal response spectra for the Maximum Considered Earthquake having a two percent probability of exceedance in 50 years with appropriate deterministic check (5 percent damping). A Serviceability Level Earthquake study was also completed with a 50 percent probability of exceedance in 30 years (2.5 percent damping) consistent with definitions presented in the 2010 TBI.

Langan developed seven pairs of spectrally matched horizontal time series for the MCE level of shaking for 14 time histories.

AVILA TOWERS AT CIRCULO VERDE – PHILIPPINES

SERVICES:

- *Geotechnical Consulting Services*
- *Developing Site-Specific Response Spectra and Time Histories*

LOCATION:

Quezon City, Philippines

CLIENT:

Magnusson Klemencic Associates



Langan is providing geotechnical consultation, developing site-specific response spectra and time histories for the structural evaluation and design of two towers. The towers are planned to be 45 and 29 stories. Soft and potentially liquefiable deposits underlie the site. The structures will be designed in accordance with the Tall Building Initiative Guidelines and ASCE 7-10 criteria.

SERVICES:

- *Geotechnical Engineering*
- *Foundation Design*
- *Site/Civil Engineering*
- *Environmental Engineering*

LOCATION:

London, United Kingdom

CLIENT:

*R&F Properties &
CC Land Holdings (Joint Venture)*

ARCHITECT & STRUCTURAL ENGINEER:

Skidmore, Owings & Merrill (SOM)



Credit: Skidmore, Owings & Merrill

Just south of the River Thames, the 10-acre former New Covent Garden Flower Market site is being redeveloped as a mixed-use development featuring 12 residential buildings and a Linear Park that will run from Vauxhall Bridge to the Battersea Power Station. The luxury residential towers will rise up to 55 floors above a deep, single level basement containing servicing and parking. Other facilities will include restaurants, bars, retail outlets, and commercial space.

Langan supported the ambitious design and construction program from the outset, assisting in the execution of a £1m geotechnical and geoenvironmental site investigation and a preliminary pile testing program. Working closely with the project architect, we completed complex Finite Element analyses to optimize pile group arrangements, seeking to facilitate rapid construction methods whilst ensuring associated settlements were within acceptable tolerances between adjacent buildings and the site-wide basement.

Discharge of pre-commencement planning conditions was a key constraint and we provided a range of technical submissions regarding drainage, contamination and piling. The site is also severed by a 1.75m diameter Victorian sewer, which the development wraps around. Langan assisted in approvals for construction activities around this sensitive Thames Water asset, working closely with various contractors to develop acceptable construction methods and sequences to protect the sewer.

Storm water attenuation, collecting water from across the extensive podium together with the foul water network was developed while working closely with the architect and engineering teams. Langan also helped facilitate construction and site logistics through negotiating S278 Agreements with Transportation for London for new accesses onto the adjacent road network.

TOTTENHAM HALE – UNITED KINGDOM

SERVICES:

- *Geoenvironmental Engineering*

LOCATION:

London, United Kingdom

CLIENT:

Argent Related

ARCHITECT:

*AHMM
Alison Brooks Architects
Pollard Thomas Edwards
Grant Associates*

STRATEGIC PARTNERS:

Whitby Wood



Credit: Glenn Howells Architecture

Tottenham Hale, a place known for its transport connections, will be reinvigorated into a pedestrian friendly area comprised of 1,030 new residential units – a mix of market sale, affordable and rental; retail spaces; co-working and office space; a new health centre and public space making it one of North London’s largest development projects. The new development is comprised of five sites: Welbourne, Ashley Road East, Ashley Road West, Ferry Island and North Island. This ambitious project is the first phase of a wider housing scheme centred on Tottenham and will include new community facilities, shops, cafes and restaurants

The five brownfield sites surround Tottenham Hale Station — serving London Underground’s Victoria Line, National Rail and potentially future Crossrail 2 links — and a bus interchange, which will remain operational during works. Below-ground obstructions on the sites include two large sewer mains, the buried fuel tanks of a former petrol station and the Victoria Line tunnels.

Langan’s geoenvironmental engineers design a Phase 2 Ground Investigation, oversaw the investigation and provide an interpretative report to support the planning application. We worked with the Geotechnical Engineers to enable an integrated Ground Investigation to be procured.

Discharge of pre-commencement planning conditions was a key constraint and we provided a range of technical submissions regarding, contamination, remediation and piling.

TOLWORTH TOWER – UNITED KINGDOM

SERVICES:

- *Geoenvironmental Engineering*

LOCATION:

London, United Kingdom

CLIENT:

Meadow Partners

ARCHITECT:

3DReid

STRATEGIC PARTNERS:

Whitby Wood



Credit: 3DReid

Tolworth Tower was designed as an office building by architect George Marsh of R. Seifert & Partners, and constructed in 1962-64. Its post and beam frame includes cantilevers, and the body of the structure is raised off the ground on pilotis (piers), one pair at each end of the rectangular building, with intermediate columns. At 22 storeys, Tolworth Tower was the tallest building for miles, and quickly became a local landmark. The ground level podium was used for retail from the start and is currently occupied by a Marks & Spencer supermarket, which will remain operational during the works.

The reuse design will create 261 residential units, ranging from studio apartments to three bedrooms. The building will also feature co-working space, resident's amenities will occupy the lower levels, and new retail space at the ground level.

Langan's geoenvironmental engineers design a Phase 2 Ground Investigation, oversaw the investigation and provide an interpretative report to support the planning application. We worked with the Geotechnical Engineers to enable an integrated Ground Investigation to be procured.

CANADA WATER PLOT L – UNITED KINGDOM

SERVICES:

- *Geoenvironmental Engineering*
- *Geotechnical Engineering*

LOCATION:

London, United Kingdom

CLIENT:

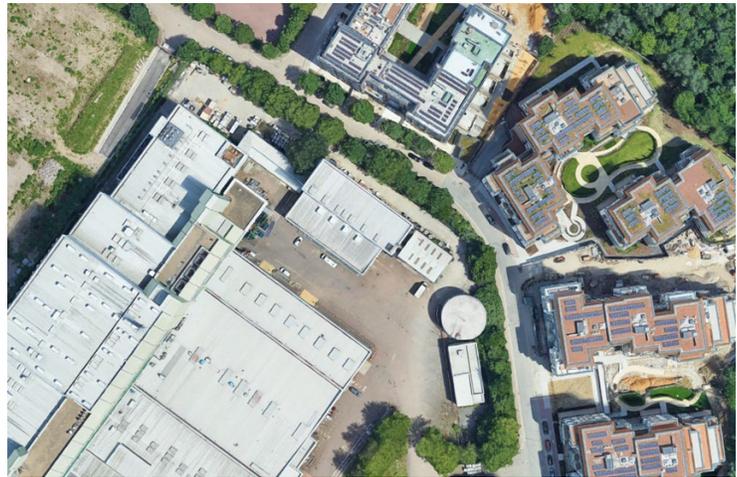
British Land

ARCHITECT:

Allies and Morrison

STRATEGIC PARTNERS:

Whitby Wood



The Canada Water Masterplan is a partnership between British Land, Southwark Council and the local community to create an outstanding new town centre for Southwark and London that complements the local area, making an active, positive, long-term contribution to local life.

The Masterplan covers 53 acres providing jobs, homes, offices, shops, public spaces and facilities and responds to the Greater London Authority (GLA) and Southwark Council's policy aspirations to deliver new homes and jobs at Canada Water. The new brownfield development is located within Development Zone L of the Canada Water Masterplan and is currently occupied by the Printworks, vacated by the Daily Mail in 2012 and now used as a nightclub and events space. The buildings will be demolished prior to redevelopment of the site. The Plot L redevelopment proposals include a new UKPN underground substation and three new residential blocks. The site is located approximately 450m east of Canada Water London Underground and Overground Station, in the northeast tip of the overall masterplan site.

The Harmsworth Quays printing works was originally built on the infilled site of Quebec Dock. Langan's engineers initially undertook a desk study to support the scoping of a ground investigation at the site to inform the foundation design, ground risks, and cost plan in support of the proposed below ground main sub-station UKPN (MSS) development on part of the plot. Based on the findings of the desk study a Phase 2 Ground Investigation was designed. Langan oversaw the investigation and provide an interpretative report to support the planning application. Integration with the Geotechnical Engineers enabled a combined Ground Investigation to be procured and foundation design to be progressed and cost plan reviewed.

CHISWELL STREET DEVELOPMENT – UNITED KINGDOM

SERVICES:

- *Technical Advisory Services*
- *Subsurface Evaluation*
- *Geotechnical Engineering*
- *Foundation Recommendations*

LOCATION:

London, United Kingdom

CLIENT:

Confidential

STRATEGIC PARTNER:

Severud Associates



Langan provided technical advisory services to the private developer with respect to foundation concepts, associated construction methods and costs for the proposed office development.

The site was occupied by a 17-story building with one basement level; proposed plans called for demolition of the existing buildings and construction of a 9-story building with one basement level, with column loads of up to 1250 tons.

Subsurface soils underlying the site consist of approximately 15 feet of surficial fill above a five to seven feet stratum of dense sandy gravel followed by a three foot layer of brown clay. Beneath the brown clay is the blue London Clay, which is in excess of 85 feet thick.

Langan reviewed available drawings and geotechnical information as well as laboratory test results and published data. Two foundation system alternatives were identified and evaluated: a mat foundation, and drilled piers extending into the London Clay.

SERVICES:

- *Geoenvironmental Engineering*

LOCATION:

London, United Kingdom

CLIENT:

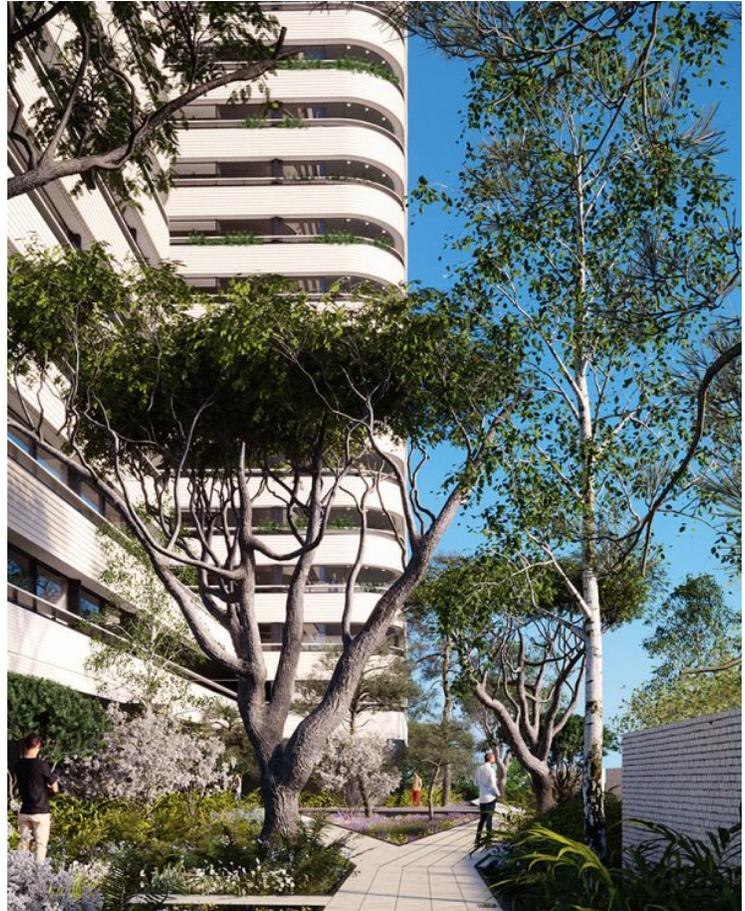
*HUB
Bridges Fund Management*

ARCHITECT:

Glenn Howells Architects

STRATEGIC PARTNERS:

*Whitby Wood
Henry Construction (Main Contractor)*



Credit: Glenn Howells Architecture

The Wembley Link is a built-to-rent scheme on Wembley High Street in Northern London consisting of two 17- and 19-storey brick buildings comprised of 256 apartments. The residential development replaces the derelict area previously owned by Network Rail alongside the Chiltern Railway, where overgrown land and disused garages made way for residential units and a new public garden. It's status as a 'link site' between Wembley Central and Wembley Stadium means that once completed, the development will assist in redefining the importance of Wembley's town centre, acting as a catalyst for further investment and activity along the High Road.

Langan's geoenvironmental engineers design a Phase 2 Ground Investigation, oversaw the investigation and provided an interpretative report to support the planning application. We worked with the geotechnical engineers to enable an integrated Ground Investigation to be procured.

IKITELLI INTEGRATED HEALTH CAMPUS – TURKEY

SERVICES:

- *Geotechnical Engineering*
- *Earthwork Value Engineering*
- *Traffic Engineering*

LOCATION:

Ikitelli, Istanbul, Turkey

CLIENT:

Renaissance Holding, A.S.

STRATEGIC PARTNER

VP Design Group



At 817,380 square meters, this world-class health complex will be the largest hospital in Europe by area. Located about 20 kilometers northwest of Istanbul, the complex is expected to serve as a vital link to the area's recent and rapid growth.

The project, which is being designed and developed using public-private-partnership delivery methodologies, consists of a core diagnostic and treatment building, six specialty towers, a physical therapy and rehabilitation building, psychiatric hospital, parking garage, and 2,700 patient beds. Ancillary development consists of courtyards, plazas, green space, and pedestrian walkways. Internal vehicular access driveway networks from the surrounding roadways will be designed to navigate the site.

Langan's geotechnical services included a review of existing geotechnical engineering reports, soil boring logs, and the provision of all necessary information to supply the data needed for the earthwork value engineering model.

In support of value engineering services, we prepared plans for conceptual grading and earthwork analyses utilizing AutoCAD Civil 3D and SITEOPS software.

Langan's engineers analyzed the project earthwork design in interim phases in line with the anticipated sequence of construction. The earthwork operations for each phase were evaluated and cut and fill quantity data for each phase was calculated. Langan also reviewed the existing geotechnical site information and provided input on the impact on the earthwork operations from the geotechnical engineering perspective. We evaluated the connectivity of the interim grading phases with each other and provided interim grading plans for each phase.

Langan's traffic engineers reviewed existing conditions and analyzed prior traffic studies and traffic volume data for the surrounding highways and roadways, proposed transportation infrastructure upgrade plans, and provided upgrades for peak hour circulation, parking demands, and site access.

ISTANBUL GRAND AIRPORT CITY DEVELOPMENT – TURKEY

SERVICES:

- Site/Civil Engineering
- Infrastructure Engineering
- Geotechnical Engineering
- Traffic Engineering

LOCATION:

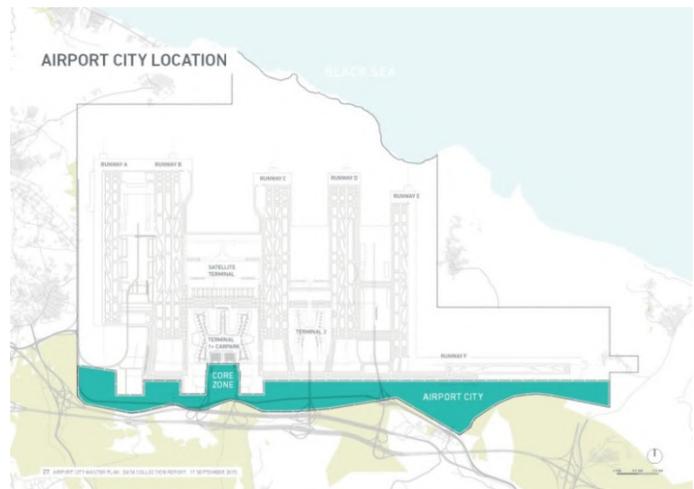
Istanbul, Turkey

CLIENT:

Istanbul Grand Airport (IGA)

ARCHITECT:

Perkins + Will



Langan was retained to provide multi-disciplinary engineering services for the Airport City mixed-use development as part of the new Istanbul Grand Airport Development; the largest airport development currently being undertaken in the world. Airport City is located on approximately 7,650 hectares near the Black Sea northwest of central Istanbul. The master plan study covers an approximately 690 hectare parcel that begins immediately south of the proposed terminal buildings and spans the entire length of the runways. Our services include site/civil, infrastructure, and geotechnical engineering support along with traffic design peer review services with the consultant team.

Our site/civil and infrastructure engineering support services included data collection, complex earthwork modeling and optimization, concept utility plan development, and client presentations. Our engineers prepared master plan level infrastructure plans coordinated with the airport site design and current construction, adjacent highway design, proposed site layout and building massing studies. We prepared utility infrastructure plans for potable and fire water networks, sewage and stormwater systems, and assisted with the telecom, gas, and electric networks. We also provided input into sustainability objectives for the master plan.

Langan's geotechnical engineers completed a geotechnical desktop study including a review of published information on the geology of the site, which includes data on the overburden soils and the underlying geologic formations to assist with the concept master plan development.

Langan's traffic engineers provided peer review and commentary for the preliminary travel demand estimates including data gathering techniques. In addition, technical input was provided for traffic circulation plans, highway connections, service roads, and parking access/egress plans.

Istanbul Grand Airport will be the largest airport in the world when completed.

US EMBASSY – NEW EMBASSY COMPOUND ANKARA, TURKEY

SERVICES:

- Site/Civil Engineering
- Traffic Engineering
- Surveying
- Title II Services

LOCATION:

Ankara, Turkey

CLIENT:

US Department of State, Office of Overseas Buildings Operations (OBO)

ARCHITECT:

Ennead Architects

STRATEGIC PARTNER:

LERA
GGN
Mason & Hanger



Credit: Ennead Architects

Langan provided site/civil, traffic, and survey design/engineering services for the new US Embassy in Ankara, Turkey. The proposed New Embassy Compound (NEC) will be built on a nine-acre urban site located in the Cukurambar area of Ankara.

The main features of the NEC will include a new office building, outdoor plazas and courtyards, cabana, swimming pool, recreation facilities, compound access centers, utility building, marine security guard residence, two underground parking garages, warehouse, shops, service court, and significant utility infrastructure. In an effort to meet the project's sustainability goals, Langan developed and designed a rainwater harvesting system to provide a non-potable water supply for irrigation.

The NEC site plan layout and hardscape design was influenced by and integrated with the surrounding neighborhood and local culture. The site/civil design faced several challenges, including highly expansive soils, deep excavations immediately adjacent to the property line (approximately 24 meters deep), and topographic constraints. The site slopes downward from west to east and drops in elevation 25 meters over a 300 meter span. Multiple stepped terraces and retaining walls were incorporated into the grading scheme to address these conditions while providing an ADA/ABA compliant accessible site.

Langan performed a traffic analysis for the adjacent roadways and nearby intersections. Findings and recommendations were presented in a traffic report for consideration during the design process. Langan also worked with a local land surveyor to prepare boundary, topographic, utility, and tree surveys for the site, which served as the base maps for the site architecture and landscape designs.

Langan is providing Title II services for the ongoing construction of the NEC. Title II tasks include general construction administration and coordination meetings, addressing contractor RFIs, submittal reviews, and record drawings. Construction is scheduled to be completed by summer of 2023.

SERVICES:

- *Geotechnical Engineering*
- *Finite Element Modeling (FEM)*

LOCATION:

Antalya, Turkey

CLIENT:

TACA + TA Group

ARCHITECT:

Nitelikli Tasarımlar Atölyesi (NITA)

STRATEGIC PARTNER:

Thornton Tomasetti

AWARD:

2017 ENR Global Best Projects: Cultural



Designed to host the World Botanic Expo 2016 in Antalya, Turkey, this 114 meter observation tower consists of three panoramic rooftop decks tapering into a single shaft at the building's base. Inspired by the ancient structure of "Hadrian's Gate" at the entrance of Antalya's old town, the structure features two panoramic elevators, which allow for views of the surrounding city. The 1,400-ton, four-level steel-and-glass observation platform, was constructed to 100% fit-out, including glass facade, interior finishes, and mechanical and electrical systems, at the ground level and, using cables, hoisted to the top. The Antalya viewing tower will continue to serve visitors long after the event, offering panoramic views of mountain, valley and sea.

Langan's geotechnical engineers prepared a review of pre-existing reports and recommendations for a supplementary exploration which included additional borings and laboratory testing in support of the tower's construction. The raft of the observation tower is supported on 145, one meter in diameter drilled piles that extend 31 meters below the raft.

Our FEM services examined the structure's foundation as it related to the area's topography. Our staff examined potential for future settlements, ground deformations, vertical reinforcements, wind loads, and effects of deep foundation elements beneath the tower.

SERVICES:

- *Geotechnical Engineering*
- *Slope Stability Study*
- *Finite Element Analysis*

LOCATION:

Istanbul, Turkey

CLIENT:

Ağaoğlu

STRATEGIC PARTNER:

LERA



Langan provided services for this residential/mixed-use complex spread over 3.5 hectares on the “European” side of Istanbul. Multiple residential buildings will provide spaces for approximately 4,790 units.

Challenges for the site included the coordination of information for multiple structures spread over a large project area and built upon high and steep sloping ground. The site’s highly fractured and weathered rock substrate (beneath overlying soil), the presence of groundwater within the sloped areas and the location’s potential for moderately-strong earthquakes provided additional challenges.

Langan’s analysis includes document review, independent evaluation of the strength and “elastic” properties of soil and rock, evaluations of the overall static and seismic slope stability of the site using the finite element and limit equilibrium methods. We calculated lateral earth pressures on multi-level foundation walls, assessed the sliding potential of all buildings and reviewed the foundation drainage system.

Langan also peer-reviewed a 3D finite element model of the geologic profile and proposed structures, worked with the local geotechnical engineer to ensure compliance with existing codes, and prepared an engineering report that summarizes approaches to the analysis and range of physical properties used. We presented the results to the client, and provided conclusions and recommendations regarding the adequacy of the design.

ZEYTINBURNU SEAPORT – TURKEY

SERVICES:

- *Master Planning Support Services*
- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Environmental Engineering*
- *Traffic Engineering*
- *Waterfront Engineering*

LOCATION:

Istanbul, Turkey

CLIENT:

Renaissance Development



Langan provided site/civil, traffic, environmental and geotechnical engineering services during the master planning stage of the 470,000 square meter seaport development project. The project includes land reclamation and construction of wave breakers, piers for cruise liners, marinas, residential buildings, hotels, retail buildings, below-grade parking garages, roadways and landscaping.

As part of the master planning and pre-concept design stage, Langan reviewed the available information for the site including review of earlier site survey documents, existing soil investigations, utilities and other relevant information. Based on the project's design goals, Langan provided multi-disciplinary support services to the master planner and the owner.

Site/civil engineering services included review of stormwater management requirements and a conceptual assessment to support the master plan.

Geotechnical engineering services included review of existing reports (soil investigation, slope stability, seismic and wave) to evaluate and develop a feasible cost-effective option. Key issues consisted of dredging sea-floor, hydraulic fill, fill placement, seismic risks, slope stabilization, foundations for buildings and waterfront structures (piers, wave breakers and bulkheads) and roadways. Concepts were developed for cruise ship facilities considering navigation, berthing structures and supporting utilities.

Langan's transportation engineers addressed issues related to the impacts and mitigation to existing and planned internal site roadways. Services included examination for access/circulation drives, drop-off areas and determination of parking requirements.

Langan's initial environmental engineering services included reviewing available reports (Environmental Impact Statement, water and dredge quality reports, laboratory data, etc.) and providing opinion on reuse, transportation, and/or disposal of suspected impacted soil and dredged material for the protection of public and environment.

SERVICES:

- *Geotechnical Engineering*
- *Seismic Hazard Analysis*

LOCATION:

Gebze, Turkey

CLIENT:

TURKCELL

STRATEGIC PARTNER:

Paradigm Structural Engineers



Langan conducted a site-specific earthquake ground motion study for the 15,000 SM Turkcell Data Center in the Gebze District of Kocaeli Province, Turkey

Considering the importance of the data center and the seismic activity of the region, Langan was engaged to review all available data and developed site-specific response spectra for the Maximum Considered Earthquake (MCE) and Design Earthquake (DE) in accordance with the provisions of the 2006 International Building Code. Probabilistic and deterministic seismic hazard analyses were performed.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Traffic Engineering*
- *Master Planning Services*

LOCATION:

Istanbul, Turkey

CLIENT:

LandDesign

ARCHITECT:

FXCollaborative



Langan was part of the design competition team for a marina development along Istanbul's waterfront. This 200,000 square-foot development includes a luxury yacht marina, waterfront shopping, hotel, and public greenspaces for leisure access.

Langan provided multi-disciplinary services including identification of possible infrastructure shortfalls and challenges prior to concept stage. Considerable focus is requested for sustainable design principles as well as steering design team plans toward concepts that will reduce construction costs and schedules.

Our geotechnical services include a review of existing subsurface data, preparation of specific guidelines for additional subsurface investigations, and the development of subsurface profiles depicting site conditions.

Langan's site/civil and infrastructure engineering services include conceptual designs for water distribution, stormwater, sewer, and utilities. We were also tasked to analyze existing topographic data and to complete connectivity studies of the existing infrastructure.

Our transportation, traffic, and parking support services include evaluating pedestrian, car, and truck demands for the site as well as the development of peak hour trip generation and parking generation projections based on international guidelines. In addition, we were tasked to evaluate security needs for site access, including queuing areas for vehicular and pedestrian traffic, and reviewed emergency vehicle access to various points at the marina.

TARLABASI 360 URBAN TRANSFORMATION PROJECT – TURKEY

SERVICES:

- *Site/Civil Engineering*
- *Civil Infrastructure Review*

LOCATION:

Istanbul, Turkey

CLIENT:

GAP Construction

ARCHITECT:

SKM Projects



Langan is providing infrastructure engineering services during the design development phase of this major urban transformation project located in the Tarlabasi neighborhood of the Beyoglu district. The 30,000 square meter site consists of eight adjacent lots and is being redeveloped for new office, retail and residential spaces.

Challenges for the project included close coordination with multi-disciplinary design teams on a fast track schedule, and design constraints introduced by the Archeology Board with regards to the preservation of historical buildings at the site.

Langan's services include creating the site/infrastructure engineering design standards for the overall development as well as peer review services during the full design development stage. Our work includes review of available information for the site, meetings with local engineers, planners and officials, review of site sustainability design and survey, and utility plans.

Langan is also working with the project team to provide documentation addressing specific civil issues for the infrastructure master plan including parking lots, access roads and utility issues.

Langan provided an optimized infrastructure design that was well received by the authorities and the client.

BATI SEHIR MIXED-USE DEVELOPMENT – TURKEY

SERVICES:

- *Site/Civil Engineering*
- *Infrastructure Engineering*
- *Earthwork Analysis*
- *Traffic Engineering*
- *Due Diligence*

LOCATION:

Istanbul, Turkey

CLIENT:

Ege Yapi

ARCHITECT:

DB Architects



Langan provided land development engineering services for this 800,000 square meter mixed-use development with residential, five-star hotel, retail, a high school, “Class A” office buildings and associated parking facilities. The 20-hectare vacant land site is within the industrial zones of the “European” side of Istanbul.

Langan reviewed available information for the site including site survey, existing soil investigations, utilities and other relevant civil, geotechnical, traffic and parking information.

Site/civil/infrastructure engineering services included reviewing existing site topography and optimization of grading and earthwork plans while working closely with project architect to maintain the design vision.

Traffic and parking engineers focused on physical access configurations for the site as well as an operational review of site circulation. Issues addressed include site access, vehicular and pedestrian circulation and parking requirements. Access/circulation drives, drop-off areas and parking requirement demands were also examined.

Langan’s geotechnical engineers examined all existing/pertinent information (past borings, maps, photos, etc.) and geologic maps. A preliminary geotechnical memorandum was provided to the client outlining subsurface conditions and geotechnical design aspects (feasible foundation support systems, seismic design parameters, fill material criteria, etc.).

ELEFSINA-KORINTHOS-PATRA-PYRGOS-TSAKONA (EKPPT) MOTORWAY – GREECE

SERVICES

- *Technical Advisory Services*
- *Project Finance*
- *Construction Methods*
- *Construction Schedule*
- *Civil Works*
- *Operation & Maintenance*
- *CAPEX/OPEX*
- *Heavy Maintenance*

LOCATION

Peloponnese, Greece

CONSORTIA-REFERENCES:

- *VINCI, France*
- *HOCHTIEF, Germany*
- *J&P-ETETH, Greece*

LENDERS-REFERENCES:

- *Alpha Bank*
- *Banco Comercial Português*
- *Calyon*
- *Ixis Corporate and Investment Bank*

PROJECT INCLUDES:

- *365 km of Motorway (284 km totally new, 81 km existing)*
- *32 km of tunnels*
- *9 mainline toll stations*
- *28 ramp toll plazas*
- *Over 14M m³ of cut and fill*

AWARDS:

2019 ASCE Outstanding Civil Engineering Achievement Award: Merit Award
2019 ACEC Engineering Excellence: Platinum Award



Credit: Olympia Odos S.A.

Langan is serving as technical advisor to the lenders (LTA) for the design, construction, financing, operation, maintenance and exploitation of the EKPPT motorway in Greece. The motorway will link Athens and Korinthos to the western end of the Peloponnese, including the Rion-Antirion Bridge, and significantly improve the safety of the existing road between Korinthos and Patra.

In our role as technical advisor, Langan reviews all aspects of the project including: the design, environmental, natural resources, and geotechnical issues; stakeholder relationships (concessionaire, contractor, designer, government, lenders, etc.); scheduling, construction methods, and costs as these pertain to construction, operation/routine maintenance and heavy maintenance for this 30-year long concession.

During the original tender phase and the more recent project restructuring, Langan worked closely with the concessionaire, lenders, contractor, and legal advisor. This included numerous design, schedule and financial review charrettes with the parties, along with top level review of major documents including the concession agreement, technical conditions, environmental terms, design-construction contract, operation-maintenance contract, and common terms agreement. Langan's key role was to evaluate the preliminary design, identify risks and associated mitigation measures, and opine on the assumptions, schedule and cost estimates.

RION-ANTIRION BRIDGE – GREECE

SERVICES:

- *Technical Advisory Services*
- *Project Finance*
- *Construction Methods*
- *Temporary Works*
- *Cost and Schedule*
- *Civil Works*
- *Geotechnical*
- *Environmental*
- *Dredging*
- *Underwater Cable Installation*
- *Off-shore Construction*
- *Drydocks*

LOCATION:

Corinthian Straits, Greece

CLIENTS:

Gefyra S.A
Bank of America
Bank of Tokyo-Mitsubishi (UK) Ltd.

AWARDS:

2014 International Federation of Consulting Engineers (FIDIC) – Award of Merit
2007 Deep Foundation Institute Outstanding Project Award
2006 International Association for Bridge and Structural Engineering Award for Outstanding Structure
2005 American Society of Civil Engineers Outstanding Civil Engineering Achievement Award
2005 American Council of Engineering Companies New York Diamond Award
2005 American Council of Engineering Companies National Grand Award



The Rion-Antirion Bridge is a €1 billion multi-span cable stayed bridge spanning the Gulf of Corinth in Greece. It consists of a 3.2 kilometer long deck constructed in an area of deep sea waters (65 m+), marginal soils and high seismicity. Construction involved dry docks, wet docks, deep dredging, underwater high-voltage cable relocation, soil improvement, tension leg barges and off-shore techniques for the float-out and final positioning of the 90-meter diameter pylon bases.

As a vital component of the Trans European Transportation Network, the bridge was conceived as a concession project (i.e. finance, design, build, operation and maintenance). The term of the agreement is 42 years – seven years for design and construction and 35 years for operation.

Financing was achieved through European Community funding, bank financing (European Investment Bank and commercial banks) and concessionaire's equity. The unique technical and construction aspects of the project added to the complexity of the financial negotiations.

Langan worked closely with the concessionaire, the lead arrangers (Bank of America) and the legal advisor to achieve financial closing in December 1997. During the pre-financial closing period, Langan's key role was to evaluate the conceptual design and determine whether the project could be completed within the contract schedule and cost. Following financial closing, Langan provided technical support throughout the bank syndication process.

Since early 1998, Langan has acted as technical advisor to the intercreditor Agent (Bank of Tokyo-Mitsubishi) responsible for oversight of all project issues and for reporting and approval of loan drawdowns. In its role as Technical Advisor, Langan was involved with all aspects of the project: design, environmental, natural resources, geotechnical, stakeholder relationships (concessionaire, contractor, designer, government, lenders, NGOs, etc.), scheduling, construction methods and cost evaluations.

RION-ANTIRION TOLL PLAZA – GREECE

SERVICES:

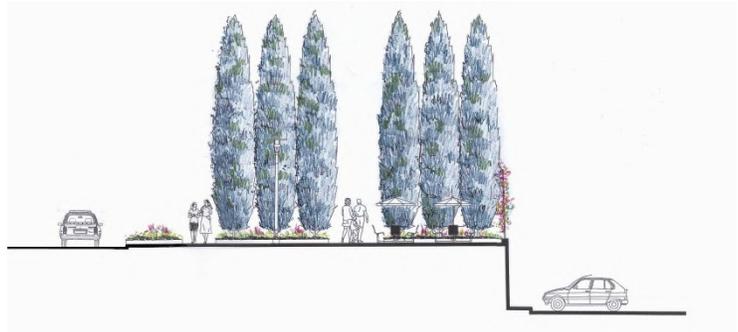
- *Landscape/ Site Architecture Design*
- *Paving Design*
- *Architectural Lighting Design*

LOCATION:

The Corinthian Straights, Greece

CLIENT:

Stamatios Lykos, AIA



Langan designed the pedestrian plaza, rest area and monument at the toll plaza in the Corinthian Straights Greece at the Rion-Antrion Bridge. Langan also provided geotechnical engineering services for this project, the plaza and paved areas that frame the new office and toll building. They were designed with bold, highway-scale geometric forms that would be conspicuous to travelers moving through the toll plaza at vehicular speeds. The paving is comprised of integral color concrete highlighted by white bands of Geffa stone laid in the traditional Byzantine pattern.

The bold, graphic elements of the plaza are continued in the planting with alternating bands of planting and paving, breaking down the scale to a more human oriented level. These generous, paved plaza spaces are set against lushly planted olive groves and bands of flowering perennials with picnic benches and seating. The landscape space ends in a large, circular space centered around a lighted sculpture that is built into the hillside at the far end of the plaza, offering visitors views of the surrounding hills and seascape.

The ceremonial overlook was designed as a 'truncated cone' shaped viewing platform that is overlooking the new bridge and is set at the end of a palm allee. The low, open platform is reached by a set of stairs or a spiral ramp that recalls the form of a nautilus shell. The sloping sides of the monument are made of rough-hewn Geffa stone blocks inscribed with the names of all the people involved with the bridge construction project.

SERVICES:

- *Technical Advisory Services*
- *Project Finance*
- *Construction Methods*
- *Construction Schedule*
- *Civil Works*
- *Operation & Maintenance*
- *CAPEX/OPEX*
- *Heavy Maintenance*

LOCATION:

*Antirrio to Ionnina and PATHE,
Metamorfoosi to Skarfia, Greece*

CLIENTS:

*AIAS Consortium
VINCI, France
J&P-ETETH, Greece*

Lenders

*HypoVereinsbank
Calyon
HSBC Bank Plc
ING Bank N.V.
Ixis Corporate Investment Bank*



Langan was retained as technical advisor to the lenders (LTA) for the tender preparation of the design, construction, financing, operation, maintenance and exploitation of the Ionia Odos motorway and PATHE motorway section from Metamorfoosi to Skarfia in Greece.

Langan worked closely with the concessionaire, the lenders, the contractor and the legal advisor during the pre-tender and tender phases. Langan's key role was to evaluate the conceptual design, identify risks and associated mitigation measures and determine whether the project could be done within the contract schedule and cost.

In its role as technical advisor, Langan reviewed all aspects of the project: preliminary design, environmental issues, natural resources, geotechnical, stakeholder relationships (concessionaire, contractor, designer, government, lenders, etc), scheduling, construction methods and costs as these pertain to construction, operation/routine maintenance and heavy maintenance for this 30-year long concession.

The project includes:

- The Ionia Odos Motorway Antirrio – Ionnina (196 km long, totally new motorway)
- The PATHE Motorway/section Athens – Maliakos (172.5 km long)
- The PATHE branch of Schimatari – Chalkida (11 km long)

KASTELLI INTERNATIONAL AIRPORT – GREECE

SERVICES:

- *Technical Advisory Services*
- *Project Finance*
- *Construction Methods*
- *Construction Schedule*
- *Civil Works*
- *Operation & Maintenance*
- *CAPEX/OPEX*
- *Heavy Maintenance*

LOCATION:

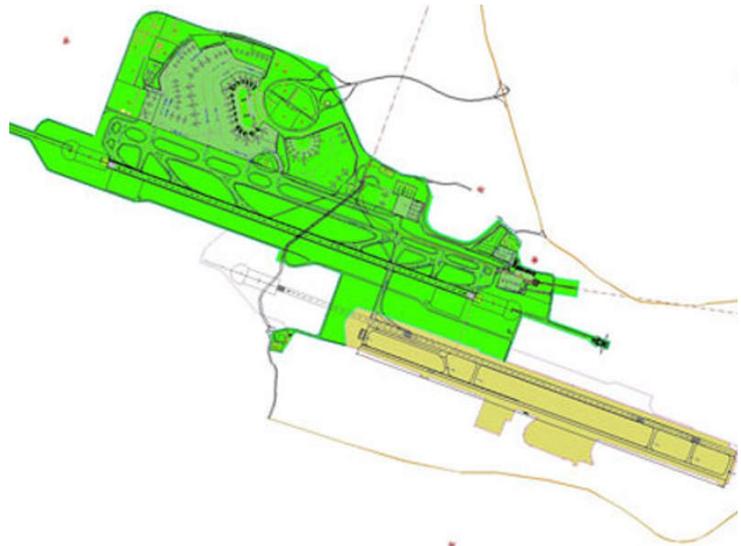
Kastelli, Heraklion, Crete, Greece

CLIENTS:

*GMR Airports
Gek Terna*

STRATEGIC PARTNERS:

*J & P Avax S.A.
Atkins Global*



Located on a 1,483-acre site, 360 meters above sea level in the north-west part of the city of Heraklion, the new Kastelli International Airport will include a 3,800-meter-long Category E runway and parallel Category E taxiway, three high-speed exit taxiways and two taxiways connecting the new airport with the existing military airport, which will remain operable. The airport is expected to serve over 15 million passengers a year and will have a minimum of five boarding bridges (Multiple Aircraft Ramp System - MARS), and 25 additional apron parking stands. The air traffic control station features state-of-the-art navigational aids and equipment of aircraft assistance while on land, a fully integrated waste management system and biological treatment plant serving the airport and the neighboring villages, rainwater/surface water storage, and a 400,000 SM commercial zone.

The concession development includes the design, finance, operation, and maintenance of a new airport and the financing and design-built of the airport's road connections with the existing network. Kastelli International Airport project will be a 35-year concession including a 48-month construction period.

Langan was retained one of the Consortia as the Lenders Technical Advisor (LTA) during the Tender Phase. The LTA services include review of all aspects of the project: the preliminary design; environmental, natural resources, and geotechnical issues; stakeholder relationships (concessionaire, contractor, designer, government, lenders, etc.); scheduling; construction methods; and costs as these pertain to construction and operation. For airport traffic and revenue issues, we collaborated with an airport-specialized consulting group acting as Traffic Advisor (TA).

TRILOGY LIMASSOL SEAFRONT - CYPRUS

SERVICES:

- *Geotechnical Engineering*

LOCATION:

Limassol, Cyprus

CLIENT:

Cybarco Development Ltd

ARCHITECT:

*J&A Philippou Architects Engineers LLC
WKK*

STRATEGIC PARTNER:

*Thornton Tomasetti
A.J. Pericleous LLC
Evripidou Engineers
Yfantis Engineering Ltd
Elemec Engineering Consultants*



Credit: Cybarco Development Ltd

Located in the heart of Limassol's affluent waterfront district, Trilogy features a "family of three towers" with a sea view from every window and an inner plaza consisting of restaurants, bars, and shops. The towers are 37 to 39 stories tall, and include 317 luxury residences, 52 state-of-the-art office spaces, underground parking, and gym/spa facilities.

Langan provided geotechnical and foundation engineering services for the proposed development. In summary Langan interpreted the results of the subsurface investigation study, designed the foundation, developed the corresponding construction specifications, designed and observed the field pile load test program, interpreted the corresponding results and confirmed the foundation design.

SERVICES:

- *Technical Advisory Services*
- *Project Finance*
- *Construction Methods*
- *Construction Schedule*
- *Civil Works*
- *Operation and Maintenance*
- *CAPEX/OPEX*
- *Heavy Maintenance*

LOCATION:

Cyprus

CLIENT:

KYNIRAS Consortium:

- *VINCI, France*
- *J&P-AVAX, Greece*
- *CYBARCO, Cyprus*

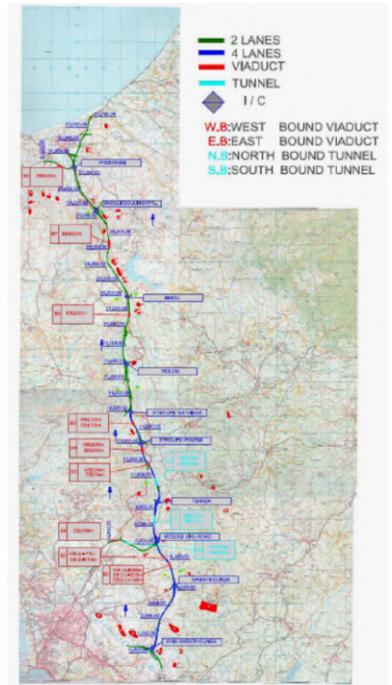
PROJECT HIGHLIGHTS:

- *15.0km of dual 2-lane motorway*
- *15.5km of 2-lane motorway on the main 31km route*
- *3.1km of 2-lane class A road on the Mesogi Link Road*
- *5.1km of link roads (Polis-Prodromi link, Polis-Limni link)*
- *11 interchanges*
- *26 underpasses and 9 overpasses*
- *9 viaducts and 3 tunnels*
- *Over 19M m³ of cut and fill*

Langan was appointed the Lender's Technical Advisor (LTA) for the design, construction, financing, operation, maintenance and exploitation of the Pafos-Polis motorway. The motorway will link Pafos and Polis to the western end of Cyprus and will provide a high quality motorway for the growing traffic in that region, enhancing development in the region by providing a transportation backbone.

Langan's involvement began during the Preferred Bidder stage of the Project. In our role as LTA, we reviewed all aspects of the project including design, environmental, natural resources, and geotechnical issues; stakeholder relationships (concessionaire, contractor, designer, government, etc.); scheduling; construction methods; payment mechanisms, and costs as these pertain to construction, operation/routine maintenance and heavy maintenance for this 30-year long availability payment concession, which includes a 54-month-period for design and construction.

Langan worked closely with the concessionaire and contractor and participated in numerous design, schedule, construction, and cost review meetings with the parties. Langan also performed top level review of major documents including the Invitation to Negotiation (ITN), Project Agreement, Tender Technical Submission and the Design-Construction Contract prepared for the Tender.



YONGSAN KOREA INTERNATIONAL BUSINESS DISTRICT

SERVICES:

- *Master Planning Services*
- *Transportation Planning*
- *Traffic Engineering*
- *Site/Civil Engineering*
- *Geotechnical Engineering*

LOCATION:

Yongsan, Seoul, Republic of Korea

ARCHITECT:

Asymptote Architecture



The proposed 2.8 million square meter site for the Yongsan International Business District is strategically and symbolically located within the heart and soul of Korea's historic capital city. The proposed new international business district includes world-class shopping, residential neighborhoods, cultural institutions, educational facilities and transportation, all sited in a large urban park along the Han River. Langan assisted the design team through the Master Plan Coordination Phase.

Transportation engineering services included major infrastructure improvement recommendations for the site. Our scope included proposed studies for realignment of existing roads and rail lines, additions to ferry service, new roads, pedways, bikeways, and transit routes that needed to be integrated into the overall master plan. Our scope included travel demand estimates, transportation system routing, evaluations for proposed networks and connections, recommendations for space programming and geometry of various elements (number and type of lanes, width of sidewalks, length of drop-off zones, number of parking spaces, transit station and route planning, etc.), land usage and open space plans addressing the site, transportation, circulation, parking and servicing issues, proposed transit strategies with links to future public system and modification of plan for all related elements, as required.

Our site/civil engineers worked with the design proposal team to coordinate plans for increased demands on basic utility services and public infrastructure. Services included review the site topographic and utility plan (as available) and review of the existing infrastructure within and surrounding the site.

Our proposed scope also included geotechnical and environmental support related to the site's waterfront location, historic flooding, re-use of a rail maintenance yard, tall buildings, development density, and proposed underground infrastructure (highways, railways, parking garages, etc.).

DOGOK-DONG OFFICE BUILDING – SOUTH KOREA

SERVICES:

- *Geotechnical Engineering*

LOCATION:

Kangnam-Ku, Seoul, South Korea

CLIENT:

Thornton Tomasetti



The project consisted of a high-rise office tower and a condominium tower covering a four-block area with eight levels of basement. Construction of the multi-level basements required an excavation of approximately 32 meters. Column loads within the office tower area ranged from about 1,200 tons to 2,000 tons, whereas column loads within the condominium tower were up to about 2,700 tons. An existing office tower, a subway tunnel and two city streets border the site.

Langan's scope of services included the analyses of test boring data and field permeability tests performed by a local Korean engineering firm and the identification of engineering parameters for the design of the foundation elements. Preliminary recommendations were provided; however, based on Langan's analyses, six (additional) deep borings were recommended to further define rock quality and structure with depth. The data was needed for the verification of the foundation design bearing pressures and lateral rock loads on perimeter foundation walls. The initial set of borings was determined to be too shallow.

In addition, Langan recommended a groundwater study to determine how drainage from nearby structures and the adjacent subway tunnel affected the design parameters of the Dogok-Dong groundwater control system.

INTERIM U.S. EMBASSY RENOVATION AND CONSTRUCTION - LIBYA

SERVICES:

- *Site/Civil Engineering*
- *Landscape Architecture*

LOCATION:

Tripoli, Libya

CLIENT:

US Department of State, Office of Overseas Buildings Operations (OBO)



The 4.5 hectare Interim US Embassy/Housing Compound is located approximately 11 kilometers southwest of downtown Tripoli. Langan is currently providing project management for site/civil and landscape architecture services associated with the renovation and upgrades he proposed development will include converting the eight existing residential buildings located in the Chancery Compound to office space and constructing a Main Compound Access Control (CAC), Service CAC, Consular CAC and a DEMARC building. Site development will also include converting southernmost building located in the Chancery Compound to a Chancery.

Site improvements primarily include a main entrance plaza, a consular garden adjacent to the walkway from the Consular CAC to the Chancery, parking areas constructed of a well-graded aggregate material for vehicles, and minor improvements to an existing parking lot in the Housing Compound for LES staff and visitors.

Access to the site will occur at each of the three CAC facilities. The Main CAC, located at the northwestern corner of the site, will screen the majority of the compound's visitors and LES staff. The Consular CAC will be located along the southern perimeter road and will handle consular activities for the compound. Service vehicles and deliveries will occur at the Service CAC located at the southeast corner of the site. The proposed DEMARC building will also be located along the southern perimeter road to meter and provide access to dry utility service connections.

SERVICES:

- Site/Civil Engineering
- Geotechnical Engineering
- Landscape Architecture

LOCATION:

Bishkek, Kyrgyzstan

CLIENT:

US Department of State, Office of Overseas Buildings Operations (OBO)

ARCHITECTS:

*Sorg Architects (Now DLR Group)
Karn Charuhas Chapman Twohey
(KCCT)*

STRATEGIC PARTNER:

ECCI Construction

COMPLETION DATES:

*June 2012 (Langan work est.)
2015 (Construction)*

COST:

*\$163,000,000 (Construction)
\$690,000 (Langan fee est.)*



Langan provided design-build site/civil engineering, geotechnical engineering, and landscape architecture design services for the design and construction of a New Embassy Compound (NEC) in Bishkek, Kyrgyzstan.

The project site was occupied by the existing US Embassy. The proposed NEC has to be constructed and fully operational while maintaining uninterrupted utility service, vehicle/pedestrian circulation and parking to the existing Embassy. Extensive collaboration and planning was necessary throughout the design process to develop a phasing strategy that would maintain existing operations and allow for an efficient and economical construction approach.

The project team faced numerous site/civil and geotechnical engineering challenges throughout the design process. Most challenges were largely due to the proximity to the existing Embassy to the Phase I construction limits, maintaining operations for the existing Embassy during construction, and poor subsurface conditions throughout the project site. The project team was also challenged with developing an efficient and economical utility design that would support both embassies concurrently and allow for different utility segments to be placed into or removed from service without interruption.

The NEC includes three new compound access control (CAC) structures, new office building (NOB), marine security guard quarters (MSGQ), warehouse building (WHE), utility building (UTL) and other supporting ancillary facilities. In addition, new perimeter walls, landscaping, and on-grade surface lots were provided. The project also incorporates the newly adopted Embassy Perimeter Improvement Concepts (EPIC) and design guidelines to help generate a softer transition at the site boundaries.



U.S. EMBASSY PHYSICAL SECURITY UPGRADES – ZIMBABWE

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*

LOCATION:

Harare, Zimbabwe

OWNER:

U.S. Department of State, Office of Overseas Buildings Operations (OBO)

DESIGN-BUILD TEAM:

*Sorg Architects
Trison Construction*



The existing U.S. Embassy compound in Zimbabwe, Africa is located in the central portion of the capital city of Harare. The project includes a number of proposed physical security upgrades to the embassy including new compound access control points, upgrading the existing sally port, installation of anti-ram barriers, FE/BR upgrades to portions of existing structure, and upgrading existing perimeter security features.

Langan is providing site/civil and geotechnical engineering services to the design-build team. Specific scope items include demolition plans, site layout, grading, and utility design for the upgrades at the site, performing a field subsurface geotechnical investigation and report with recommendations for building walls, foundations, floor slab, and site earthwork activities. Langan also managed and oversaw the boundary and topographic survey of the compound.

The proposed project will likely be built in phases so that security to the existing compound is maintained throughout construction. Limited site access, narrow alley ways, and poor infrastructure contribute to the complexity of the project.

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Environmental Site Assessment*
- *Foundation Design*

LOCATION:

Rabat, Morocco

CLIENT:

US Department of State, Office of Overseas Buildings Operations (OBO)

ARCHITECT:

*SmithGroupJJR
Page*

STRATEGIC PARTNER:

BL Harbert



The proposed New Embassy Compound (NEC) is located on a former orange grove site. The NEC includes main and service compound access control structures, a new office building with basement, marine security guard quarters, perimeter walls and a parking garage. In addition, recreational areas were designed for the enjoyment of the employees and their families.

Important design parameters included incorporating specific Department of State and local agency requirements. Site constraints included meeting the security requirements while designing the NEC to meet the needs of an updated compound within the limits of the property, attempting to minimize the amount of excavation required, as well as avoiding rock removal where possible.

Langan provided the necessary site/civil, environmental, and geotechnical engineering services to prepare design plans and written reports for approval by the Department of State's OBO department and local review agencies. The site assessment included interviews with local regulating and utility agencies, a geotechnical investigation and an environmental site assessment. The submittals included site design plans, grading plans, stormwater management measures, and utility plans. In addition, an environmental site assessment report and a geotechnical report for foundation and retaining wall recommendations were provided to OBO.

SERVICES:

- Geotechnical Engineering
- Geotechnical Peer Review

LOCATION:

Dakar, Senegal

CLIENT:

Confidential



The proposed development is within the “Horst de Diass” geological formation, which comprises mainly sand and gravel deposits, overlain by sand, gravel, and clay deposits of the Maastrichtian age. The surficial zone of the formation is constituted of “Laterite”, a pseudo-karstic ferruginous residual soil.

The proposed development will occupy an overall area of 2,000 hectares, and will be the first major development within this 30,000 hectare geological formation.

Construction difficulties were encountered when cavities, formed within the pseudo-karstic geological formation, were found within the site during earthwork operations. Construction operations were halted while the design team worked on a ground improvement scheme.

Langan served as the geotechnical consultant to the contractor, and provided the team with expert opinion on the geologic reasons for the formations of the cavities. Langan performed a peer review of the ground improvement recommendations by others, and provided more cost-effective recommendations, which were based on advanced finite element analyses and experience in karstic environments.

SERVICES:

- *Geotechnical Consultation and Recommendations*
- *Foundation Design*

LOCATION:

Tianjin, People's Republic of China

CLIENT:

*Middlebrook + Louie
(aka Louie International)*



Location of Tianjin

Bordering Beijing to the North-West and Bohai Gulf portion of the Yellow Sea to the East, Tianjin is China's 4th largest city by population.

Langan was retained by the client to provide design consultation for a large pharmaceutical plant. Our staff translated a geotechnical report prepared by a local geotechnical firm (from Cantonese to English), and provided supplemental recommendations for pile foundations. We prepared construction documents and specifications for this project and translated back to Cantonese all supplemental recommendations for use by the Chinese contractor.

SERVICES:

- *Environmental Remediation*
- *Vapor Intrusion Mitigation Design*
- *Construction Administration*
- *Construction Completion Report*

LOCATION:

*Chengdu City, Sichuan Province
People's Republic of China*

CLIENT:

Symantec Corporation



Credit: Tom Fox/SWA



Credit: Jonnu Singleton/SWA

Langan provided environmental consulting services to Symantec Corporation in support of its new research and development facility. The development includes two 20,000 square meters, 3- to 5- story buildings constructed in a former industrial area.

Groundwater investigations at the site identified volatile organic compounds (VOCs) at concentrations above acceptable indoor air vapor intrusion risk levels. To mitigate this risk, Langan designed a Vapor Intrusion Mitigation System (VMS) for the structures. The VMS included a vapor barrier installed directly beneath the building slab and a passive collection and venting layer of crushed rock below the membrane. The system collected the VOC vapors and vented them to outside the building via horizontal perforated pipes to riser exhaust pipes at the roof level. We prepared the design and specification package in English and Chinese in close coordination with the Local Design Institute in Chengdu.

During construction, Langan provided construction administration services. We met with the project team in Chengdu, reviewed contractor submittals, and responded to Request for Information bulletins. Once the VMS was completed, we prepared a report in conjunction with the Jian Li (the local construction inspection service) documenting acceptable installation of the VMS.

SERVICES:

- *Geotechnical Consulting*

LOCATION:

Dobrogea Region, Constanta, Romania

CLIENT:

Edrasis Construct Group S.R.L.



Langan provided geotechnical engineering consulting services for the construction of the new Constanta Bypass, which is part of the Pan-European Corridor IV (Berlin-Bucharest-Istanbul).

The project consists of the construction of approximately 23 kilometers of motorway including road works, bridges, underpasses, overpasses, embankments and culverts, and the rehabilitation of existing motorway infrastructure. Because of the ground's rather poor engineering properties, the Constanta Bypass construction required ground improvement of the upper six or so meters of soil to support several five to eleven meter-high bridge soil embankments. The total surface requiring ground improvement was about 300,000 square meters.

Langan provided to Edrasis (the contractor) geotechnical consulting services for designing and performing a Dynamic Compaction Pilot Test program to assess the applicability of the Dynamic Compaction ground improvement method. Dynamic Compaction would significantly reduce the Constanta Bypass construction time and costs. Langan reviewed the available project information including geotechnical reports, soil boring logs, project specifications, and drawings, designed with Edrasis the Pilot Test program, observed its implementation, and provided recommendations for the Dynamic Compaction production.

COPPER PROCESSING FACILITY – BULGARIA

SERVICES:

- *Environmental Health and Safety Audit*
- *Phase I and Phase II Environmental Assessment*
- *Environmental Risk Analysis*
- *Installation of Monitoring Wells*
- *Sampling Soil and Groundwater*
- *Remedial Action Evaluation*

LOCATION:

Sofia, Bulgaria

CLIENT:

Multinational Ferrous and Non-Ferrous Metal Producer



Langan conducted an environmental health and safety audit of a 190,000 square meter privatized copper processing facility, in order to obtain World Bank funding for needed improvements. The property contains a ten-story office building, a four-story laboratory and a 109,000 square meter factory building that contains casting furnaces, presses, mills and extrusion machinery. Smaller buildings and areas on the property include warehouses, maintenance sheds, fuel and chemical storage areas, and wastewater treatment systems.

The objectives of the environmental health and safety audit were to:

- Assess baseline environmental quality of soil and groundwater, and identify areas of concern that represent potential future liability
- Identify present activities that may impact baseline conditions in the future or represent a potential future liability
- Evaluate facility compliance with atmospheric and workplace air quality standards, wastewater discharge regulations, solid and hazardous waste handling and disposal regulations
- Evaluate Sofia Med Environmental Health and Safety (EHS) policies pursuant to the World Bank's International Finance Corporation (IFC) guidelines

Langan's scope of services included:

- Identification and selection of Bulgarian contractors to provide drilling and excavation services
- Identification and selection of a local Sofia laboratory to analyze soil, groundwater and sludge samples
- Identification and selection of Bulgarian professionals to provide surveying and environmental regulatory expertise (required by IFC)
- Evaluation of the adequacy of the proposed client investment program
- Meet with IFC representatives to assure an understanding of requirements
- Preparation of a report and action plan

STEEL MANUFACTURING FACILITY – BULGARIA

SERVICES:

- *Environmental Health and Safety Audit*
- *Phase I Environmental Assessment*
- *Environmental Risk Analysis*
- *Remedial Action Evaluation*

LOCATION:

Pernik, Bulgaria

CLIENT:

Confidential



Langan conducted a Phase 1 Environmental Assessment (EA) of the Stomana Industry SA steel production facility. The facility is approximately 400 hectares and includes modern electric arc furnaces and three older steel mills. Historical steel manufacturing operations were augmented by gas production from coal and lime production. Key environmental issues include:

Compliance with European soil and groundwater cleanup standards and environmental regulations for air, wastewater and groundwater discharges, and closure of the solid waste disposal facility. We are working with the client to develop an Environmental Management System (EMS).

Soil and potential groundwater contamination from the following areas of concern:

- Raw material separation and transfer area
- Former wastewater circulation pond area
- Gas manufacturing wastes
- Slag cooling and separation areas
- Construction and demolition debris
- Wastewater impoundments
- Underground tanks
- Abandoned fuel oil storage and transfer facility

Langan prepared an action plan to address the issues identified in the Phase 1 EA. We also assisted the client with their proposed purchase of additional property surrounding the facility.

SERVICES:

- *Geotechnical Engineering*
- *Finite Element Modeling*
- *Site/Civil Engineering*
- *Traffic and Parking Engineering*

LOCATION:

Grozny, Chechen Republic, Russia

CLIENT:

*MFC Akhmat Tower, LLC
Smart Building*

ARCHITECT:

Adrian Smith + Gordon Gill Architecture

STRATEGIC PARTNER:

Thornton Tomasetti



Credit: Adrian Smith + Gordon Gill Architecture

Modeled after the medieval military structures of the Nakh peoples of Chechnya, this mixed-use supertall skyscraper is 435 meters tall (108 floors) and has a total site area of approximately 245,000 square meters. The structure includes a tower base containing an atrium, lobbies, and below-grade basement parking for 1,274 vehicles.

Exposed to earthquake activity on par with California, wind conditions similar to Florida, and bedrock more than 150-meters below grade, Langan's geotechnical engineers faced extraordinary foundation design challenges. We developed a detailed site investigation program, employing field testing techniques not typically used in Russia. We completed a 3D Finite Element Modeling analysis to predict the appropriate bearing capacity and foundation settlement. To address the extreme seismic conditions, we performed a site specific seismic hazard assessment that incorporated active faults more than 1,600 miles from the project site. We developed acceleration time histories scaled to the site to allow for a performance-based design of the superstructure.

Langan's site/civil engineers supported the conceptual, schematic, and final design phases. Challenges included designs for complex grading, which incorporated extensive retaining walls and landscaped berms to allow access to the tower from two different levels. Our engineers also designed a storm drainage network, which utilizes stormwater lift stations to capture and treat stormwater runoff discharged into the Sunzha River.

Langan also provided traffic and parking engineering services that focused on trip generation, parking demand calculations, on-site access, and vehicular circulation. Our traffic engineers worked with the project team to incorporate vehicular and pedestrian needs into all phases of the design.

VASILIEVSKY ISLAND DEVELOPMENT – RUSSIA

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*

LOCATION:

*Vasiliievsky Island, St. Petersburg,
Russia*

CLIENT:

*Renaissance Construction and
Marine Façade Development Company
(Joint Venture)*

STRATEGIC PARTNER:

RWDI Consulting Engineers



This island is located west of St. Petersburg center at the far eastern shores of the Gulf of Finland. The project site includes the redevelopment of approximately 400,000 square meters (about 99-acres) of reclaimed waterfront on the south-western face of the island. Structures for the site include multiple high-rise residential towers (16- to 44-stories) with about 5,600 units. Additional site features include mixed-use commercial and retail spaces, primary schools, community health facilities, and spas.

Langan's geotechnical engineers examined all existing documentation and previous studies for evidence of soft sediments beneath the reclaimed fill. Our study included commentary on the suitability of subsurface conditions for shallow and deep foundation designs, and recommendations for ground improvements and reclamation methodology that would best assist the project's very tight construction schedule. Specific considerations such as design water levels, the effect of heavy winds on wave development with respect to shoreline protection were also reviewed. In addition the potential for differential settlements of the reclamation fill, and perimeter seawall foundation support were examined.

Langan's site/civil engineers reviewed the connectivity of the existing infrastructure (roads, drainage, electrical, etc.) with the proposed infrastructure development. In addition, 3-D earthwork models were created to analyze various reclamation level scenarios to provide recommendations on the optimal final reclamation level

GALKYNYSH GAS FIELD DEVELOPMENT (FORMERLY SOUTH YOLOTEN) – TURKMENISTAN

SERVICES:

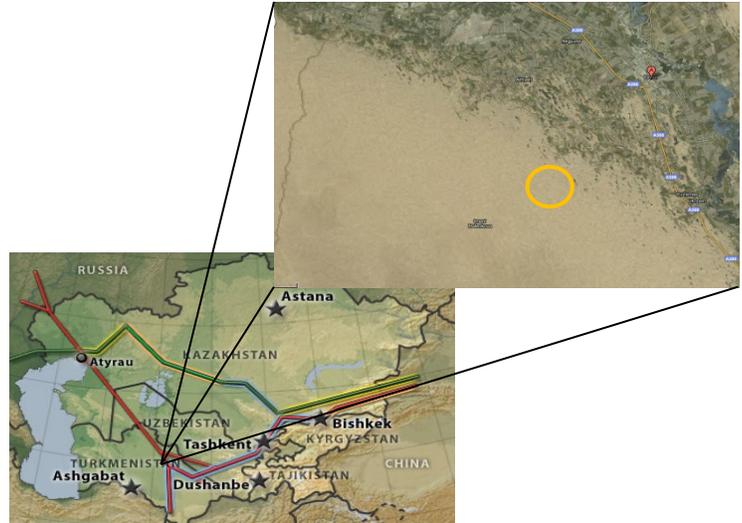
- *Geotechnical Engineering Peer Review*
- *Supervision of Dynamic Compaction Work*
- *Foundation Recommendations*

LOCATION:

Mary Province, Turkmenistan

CLIENT:

Petrofac International



Discovered in 2006, the Galkynysh Gas Field ranks among the world's five biggest reserves, with an estimated four to 14 trillion cubic meters of natural gas. In order to harness and utilize these resources, a new central processing facility (CPF), as well as the associated gas treatment units (GTUs) and transport pipelines need to be constructed. Cuts and fills in excess of 15 meters were required to create level grades for the construction of the proposed facilities

Langan originally became involved in the project in August 2010 by conducting a peer review of the existing geotechnical recommendations for the site. Based on our extensive experience with ground improvement, Langan recommended the use of dynamic compaction, in contrast to the original geotechnical recommendation for pile foundations, to address the thick uncontrolled fills at the site. Langan's recommendations created considerable time and financial savings for the project.

During the construction phase, Langan's role consisted of full-time on-site third party oversight of the dynamic compaction program and review of all technical reports generated by the specialty contractor. Additional issues addressed during construction included an assessment of the compaction-induced vibration levels at the adjacent construction site and overall evaluation of the level of effort needed to suitably improve the below-grade soils based on the varying fill thicknesses throughout the site.

ALMATY INTERNATIONAL MEDICAL CENTER - KAZAKHSTAN

SERVICES:

- *Site/Civil Engineering*
- *Traffic Engineering*

LOCATION:

Almaty, Kazakhstan

CLIENT:

*Almaty International Medical Center
Capital Partners*

ARCHITECT:

Skidmore, Owings & Merrill LLP

STRATEGIC PARTNERS:

*LERA
WSP
Populous
Turner International*



Credit: SOM/ATCHAIN

This 70,000 m² medical facility development includes a six-story hospital, medical school, research facility, hotel, mechanical and support facilities, and two levels of below-grade parking. The project was broken into three phases, with Langan's scope falling into Phase 1. Phase 1 included construction of the main hospital building, parking garage, central utility plant, and site infrastructure.

Langan's site/civil engineers prepared site layout, utility, grading and drainage plans; developed and incorporated a stormwater management strategy for the site; and provided permitting support to the local design firm.

The traffic group focused on on-site access, parking, and circulation. They assisted the project team in incorporating vehicular, pedestrian and parking needs into the design documents prepared for the site, buildings, and parking garages. This included assessment of peak hour travel demand estimates; creation of vehicular and pedestrian circulation diagrams; and advising on the location and size of drop-off zones.

RESURRECTION OF CHRIST CATHEDRAL – ALBANIA

SERVICES:

- *Geotechnical Engineering*
- *Controlled Inspection*
- *Foundation Recommendations*
- *Seismic Parameters*
- *Site/Civil Design*

LOCATION:

Tirana, Albania

CLIENT:

*Archbishop Anastasios
Archdiocesan of Tirana*

ARCHITECT:

Papadatos Associates



The Resurrection of Christ Orthodox Cathedral is one of the largest religious structures in the Balkans region of Europe. The building encompasses the cathedral, as well as a cultural center, library, museum, 150-foot bell tower, and three chapels. Langan provided geotechnical and site/civil services during design and construction of the complex. The project is located in the downtown area of Tirana, the capital of Albania, and is surrounded by government buildings.

We were also responsible for developing and coordinating drilling and test pits, providing controlled inspections for the investigation, and developing construction cost estimates related to the below grade perimeter support and foundations.

**US DEPARTMENT OF DEFENSE DEPENDENT SCHOOLS (DoDDS)
FACILITY – ITALY**

SERVICES:

- *Site/Civil Engineering*
- *Infrastructure Inventory and Design*
- *Geotechnical Investigation*

LOCATION:

Aviano, Italy

CLIENT:

United States Department of Defense

ARCHITECT:

Mitchell | Giurgola Architects, LLP



Langan provided site/civil and geotechnical engineering services for the demolition of 23 buildings and the construction of a new three-story elementary and high school. The design and engineering for the ten acre site allowed the existing on-site elementary and high schools and adjacent hospital to function during the construction process.

Civil engineering services included a design of the stormwater, water and sanitary systems. Geotechnical services included recommendations for foundation design and a sub-slab radon venting system.

US DEPARTMENT OF DEFENSE DEPENDENT SCHOOLS (DoDDS) – SPAIN

SERVICES:

- *Site/Civil Engineering*
- *Infrastructure Inventory and Design*
- *Geotechnical Investigation*
- *Foundation Design*
- *Asbestos Assessment*
- *Landscape Architecture*

LOCATION:

Rota, Spain

CLIENT:

United States Department of the Navy

ARCHITECT:

Mitchell | Giurgola Architects, LLP



Credit: Mitchell | Giurgola Architects, LLP

Langan provided master planning, site/civil and geotechnical engineering, landscape architecture, and environmental consulting services for the rehabilitation of the 25-acre DoDDS. We provided a cross-section of services on a variety of projects during our ten-year involvement.

For this project, Langan prepared an inventory of the existing infrastructure and designed proposed infrastructure and site improvements as part of a master plan design for the campus. Infrastructure design included stormwater, water, and sanitary systems.

Our geotechnical services began with a subsurface investigation of the on-site expansive soils. Based on the investigation, Langan provided geotechnical design recommendations to stabilize both the on-site soils and the existing building foundations that had cracked due to differential movement caused by the expansive soils.

Our environmental services included an assessment of asbestos-containing materials.

Langan's landscape architecture services included the development of the campus landscape around the proposed middle school and the completion of the campus landscape in the southern portions of the campus.

SERVICES:

- *Geotechnical Engineering Peer Review*

LOCATION:

Madrid, Spain

CLIENTS:

*Dragados
Fomento de Construcciones y
Contratas*

ARCHITECT:

Foster + Partners

STRATEGIC PARTNER:

LERA



Langan provided a geotechnical peer review for the foundation system for the 45-story Torre Cepsa. Langan reviewed the soil investigation report and laboratory testing data performed for the site. Langan determined that a continuous mat foundation was feasible in lieu of more expensive pile foundations.

Langan engineers determined settlement ranges for the foundation and approved soil strength parameters for the design of the mats.

Langan also provided advisory services on the foundation drainage system for the 12 meter deep parking garage structure.

COZUMEL CRUISE TERMINAL – MEXICO

SERVICES:

- *Geotechnical Quality Assurance*

LOCATION:

Cozumel, Mexico

CLIENT:

BergerABAM



The Cozumel Cruise Terminal extension and structural retrofit was part of the modernization effort triggered by the aftermath of hurricane Wilma in 2005. Located in Puerta Maya in Cozumel, it is the most popular cruise destination in the Caribbean. The pile supported T-shaped extension of the pier is about 385 meters long and 10 to 15 meters wide. In addition, the extension includes a 90 m walkway supported on 2,134 mm diameter pipe piles with large diameter passive rock anchors. The extended pier is capable of mooring three cruise ships.

Langan was engaged as the geotechnical subconsultant for the quality assurance of the design and construction of the pier. In this capacity, Langan was responsible for peer reviewing the foundation designs, construction methods, and quality control procedures implemented by the design-build team. As the geotechnical consultant, two of our key tasks where to oversee the foundation construction methods to ensure that they met the design requirements and to oversee the construction methodology in the challenging geotechnical conditions of Cozumel.

The key design challenges for this site where the upgraded hurricane performance requirements and shallow erratic bedrock conditions which can contain large underwater caves known locally as “xenotes.” Langan’s approach to geotechnical capacity evaluation based on practical experience, aided in creating an efficient, fluid construction schedule. At the same time, Langan’s involvement and oversight helped strengthen design and construction procedures for the project.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*

LOCATION:

Nayarit, Mexico

CLIENT:

RLD



Langan provided geotechnical and site/civil engineering services for the One & Only Resort in Compostela, Nayarit, Mexico. The proposed resort development consists of standalone suites, restaurants, spa, beach club, parking areas, and access roadways.

The One & Only Resort is part of the 265 hectare Mandarin Development located along the Mexican Pacific Coast approximately 45 minutes north of Puerto Vallarta and 25 minutes from Punta Mita. The site consists of 35 hectares of undeveloped, beachfront, tropically vegetated hills and valleys. Site features include moderate to very steep inland slopes and ocean cliffs, valleys and existing dirt roads.

Langan was hired to provide geological/geotechnical recommendations for the proposed resort development and site/civil engineering services for the access roadway to the resort and the golf cart paths for suites and remote areas of the resort access. The geological and geotechnical engineering services consisted of geologically mapping the site including slopes, performing a subsurface investigation with a local firm, including soil and rock testing and providing foundation, slope stability, landslide mitigation, coastal cliff retreat and retaining wall recommendations.

The site/civil engineering services consisted of the design of five kilometers of winding roadways and golf cart paths throughout the resort and stormwater conveyance design. Langan worked closely with the master planning architect and the landscape architect, to achieve the unique natural feel for the roadways, paths and drainage features required by such a unique project. Langan developed design standards based on local standards and common engineering practices that allowed for cost effective and safe designs that stayed true to the original architectural design intent and the client's vision for the project.

BANCA MIFEL, SOCIEDAD ANONIMA FIDEICOMIS – MEXICO

SERVICES:

- *Geotechnical Engineering*
- *Earthquake/Seismic Services*

LOCATION:

Mexico City, Mexico

CLIENT:

Diametro Arquitectos

STRATEGIC PARTNER:

MSP



Langan performed geotechnical and earthquake/seismic engineering services for a proposed development that consists of constructing a 24-story tower with six to seven levels of underground basements. The proposed development is in the area of Mexico City which is underlain by deep compressible Mexico City Clay. Our team performed a peer review of the geotechnical and foundation recommendations of the project and performed a study in order to develop site-specific response spectra and time histories for the structural evaluation and design of the tower

Our services included reviewing the recommendations made by the local geotechnical engineer and providing commentary and questions. Our review and input resulted in modifications to some of the original recommendations. We also performed probabilistic seismic hazard analysis (PSHA) and deterministic seismic hazard analysis to develop site-specific response spectra, per ASCE 7-10 and the Mexico City codes. We developed smooth, horizontal spectra for the Maximum Considered Earthquake, 125-year return period and the Service Level Earthquake levels of shaking at the ground surface and the proposed basement level.

SERVICES:

- *Coastal Dunes Classification and Management Plan*

LOCATION:

Costalegre, Jalisco, Mexico

CLIENT:

RLD



Desarrollo Vistas will be a self-sustaining, master planned community, located two hours from Puerto Vallarta. A seaside resort is proposed on property that stretches over 1,200 hectares of undeveloped land, with eight kilometers of beachfront. The development will be built with gratefulness and respect for the environment, and the natural elements of the property. Private residences, hotels, beach clubs, and a fisherman village are envisioned.

Langan services included:

- Preparation of a coastal dunes classification map in accordance with the 2103 Mexican Federal and State criteria.
- Field survey of transects performed through the coastal dunes.
- Preparation of a coastal dune management plan, in accordance with the federal government's coastal dune criteria and strategies, in order to provide management recommendations of existing coastal dunes so that the proposed development and existing coastal dunes system can co-exist.
- Evaluation of the proposed master plan and beach access plan in order to provide recommendations and strategies regarding the location and type of development proposed in the mapped coastal dune areas.

US EMBASSY – NEW EMBASSY COMPOUND MEXICO CITY, MEXICO

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Traffic/Transportation Engineering*
- *Survey*

LOCATION:

Mexico City, Mexico

CLIENT:

US Department of State, Office of Overseas Buildings Operations (OBO)

ARCHITECT:

*Tod Williams Billie Tsien Architects | Partners
Davis Brody Bond*

STRATEGIC PARTNER:

*Thornton Tomasetti
WSP
Michael Van Valkenburgh Associates*



Langan provided site/civil, geotechnical, traffic/transportation, and survey design/engineering services for a new US Embassy in Mexico City, Mexico. The proposed New Embassy Compound (NEC) will be built on an eight-acre urban site located in the Miguel Hidalgo section of Mexico City. The NEC was the first project designed under the State Department's recently adopted Excellence in Diplomatic Facilities guidelines and vision. The NEC site plan layout and hardscape design was influenced by and integrated with the surrounding neighborhood and local culture, and the large number of visa applicants visiting the Embassy daily.

The main features of the NEC will include a new office building, outdoor plazas and sunken courtyards, recreation facilities, compound access centers, utility building, marine security guard residence, underground parking garage, warehouse, shops, service court, and significant utility infrastructure. In an effort to meet the project's sustainability goals, Langan developed and designed a rainwater harvesting system to provide a non-potable water supply for mechanical cooling towers, flushing of fixtures, and irrigation. The rainwater harvesting system provides the project with a means to capture and reuse over 12,700,000 liters of stormwater annually for non-potable services.

The selected site for the NEC was a former Colgate-Palmolive manufacturing plant, which was still in operation during design development. The densely developed industrial site presented several design challenges for the project team, including completion of the geotechnical investigation, strategic and multistep excavation, earthwork, and grading and drainage designs.

Langan provided geotechnical and seismic engineering services for the design that included regional subsidence risk analysis, foundation and deep below-grade wall design parameters, and site-specific seismic and liquefaction analyses.

Langan provided traffic/transportation consultant services during the design and development of the multilevel underground parking garage and worked with a local land surveyor to prepare boundary, topographic, utility, and tree surveys for the site.

SERVICES:

- *Site/Civil Engineering*
- *Stormwater Management Design*
- *Lake Design Peer Review*
- *Hydrology Peer Review*
- *Wastewater Management Planning*
- *Hydrogeology Studies*
- *Estuary Improvements*
- *Geotechnical Peer Review*

LOCATION:

Tola, Rivas, Nicaragua

CLIENT:

Pellas Development Group

STRATEGIC PARTNER:

EDSA



Guacalito De La Isla is a proposed luxury residential, beach, equestrian and golf community currently under phased construction in Tola, Rivas, Nicaragua. The proposed development spanning over 675 hectares consists of nearly 565 residential units comprised of ocean front and ocean view lots, golf villas, hillside villas, equestrian lots and apartments and hotels consisting of 190 units. Amenities include an 18-hole golf course, a golf clubhouse, driving range, beach club, equestrian facility, service center, natural preserves, lakes and beach front.

Langan's services included the peer review of a drainage analysis performed by a local engineer, peer review of the golf course lake design and recommendations for improvements to an estuary area. Langan prepared conceptual roadway geometry and earthwork designs and a wastewater management plan for the entire development.

Langan prepared a hydrogeology study program and provided oversight of two local hydrogeologists to locate water supply sources both on the property and off-site to serve the project's future water demands.

COYOL FREE ZONE & BUSINESS PARK – COSTA RICA

SERVICES:

- *Geotechnical Peer Review*
- *Foundation Recommendations*
- *Soil Stabilization Study*
- *Ground Improvement Design*
- *Earthwork Balancing Plan*

LOCATION:

Alajuela, Costa Rica

CLIENT:

Coyol Free Zone & Business Park



Coyol Free Zone & Business Park is a light industrial business park development located on approximately 100 hectares of land near Alajuela (a few miles west of San Jose International Airport), Costa Rica.

Langan's services began with peer review of existing geotechnical studies that recommended the removal and exporting of more than four meters of surficial highly plastic clay and replacement with imported crushed stone backfill. Our initial review and field investigation provided a recommendation to reduce the removal to only 2 to 2 ½ meters while still achieving the foundation support and settlement criteria, resulting in significant immediate savings on earthwork costs. Construction of the next phase of mega-warehouse development proceeded with our recommendations and the structure foundations performed as expected, showing stability and no noticeable settlement.

We then proceeded with a more rigorous geotechnical evaluation and test program to chemically stabilize the on-site soils using lime, ultimately eliminating the need to export the highly plastic clays or import costly crushed stone. Once implemented on subsequent phases, our recommendations will result in hundreds of thousands to millions of dollars of savings over the life of the development.

Langan prepared a mass earthwork balancing plan utilizing the geotechnical ground improvement recommendations. The earthwork balancing plan provides an optimized approach to the overall project's long-term grading requirements based on least construction cost.

LIFE FREE ZONE AND BUSINESS PARK – COSTA RICA

SERVICES:

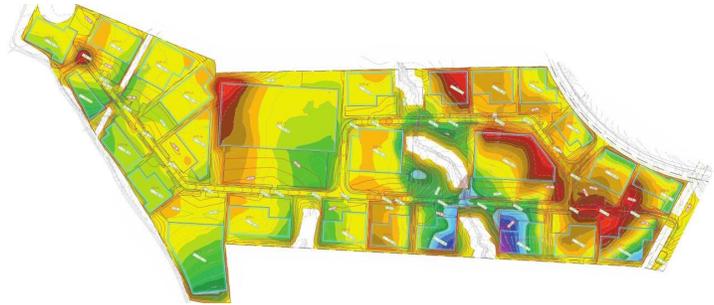
- *Master Site Plan Design*
- *Master Grading Design*
- *Earthwork Optimization*
- *Geotechnical Review*

LOCATION:

San Antonio, Alajuela, Costa Rica

CLIENT:

Garnier & Garnier



Life Free Zone and Business Park will be a mixed-use land development situated on about 37 hectares. The project is proposed to be divided into 26 development parcels.

Langan prepared a master site plan for the 26 individual parcels and the main internal access road. Building and on-lot parking areas were configured based on maximum allowable development densities in combination with topographic constraints. A mix of smaller and larger facilities was engineered to allow for flexibility in the client's marketing plan.

Langan utilized our regional soils knowledge, grading expertise and multiple grading design software applications to design and the grading and earthwork for the overall master-planned project. Our sophisticated master grading design provided the developer with a theoretically balanced earthwork plan that was optimized for least construction cost, while considering other technical or fixed project constraints.

Individual parcel cut and fill volumes were summarized to assist the developer with phasing of the construction to efficiently balance the market demand versus the infrastructure cost. Our design considered the need for improvement of the existing fatty clay soils with lime onsite rather than the more traditional approach of exporting the clays and replacing with imported engineered fill materials. Our design can save the client \$US millions in construction costs.

4TH BRIDGE OVER THE PANAMA CANAL – REPUBLIC OF PANAMA

SERVICES:

- *Geotechnical Engineering*
- *Seismic Consulting*

LOCATION:

Panama City, Republic of Panama

CLIENT:

T.Y. Lin International



Credit: T.Y. Lin International

The 4th Crossing over the Panama Canal includes a cable stayed bridge to cross the navigational channel for the Panama Canal with an unsupported main span of 510m and a total length of approximately 1,010m between expansion joints. The two main towers will have an inverted “Y” shape with a total height of approximately 185m, approximately 110m above the bridge deck, with a semi-harp configuration. The bridge will include six traffic lanes, three in each direction, and a central section that will accommodate two monorail lanes from Panama’s public metro rail lines. Combined the bridge deck will have a total width of 51m. A minimum vertical clearance of 75m with respect to MLWS will be required over the 350m of navigational channel that are being considered for the future 4th set of locks of the Panama Canal.

The main bridge will connect with Panama City’s traffic network through its east and west access viaducts. The east approach viaduct is approximately 475 meters long, and is divided into 10 spans. The west approach viaduct is approximately 714 meters long and is divided into eight spans. The bridge design, along with its access ramps and interchanges, must comply with standards for roadway performance and in addition with requirements for the monorail system for the future Metro Line 3. On the west approach, the bridge must connect with the Panamerican roadway expansion project and must account for a future connection to the Pacific Coast. On the east approach, the bridge must connect with the Albrook interchange, where the design must contemplate the connections to various key Panama City roadways.

Langan is providing geotechnical, geologic, and seismic consulting services for the project. Once completed, it will hold the world record for unsupported span length for a bridge 51-meters-wide. The foundation of the bridge, which crosses several geologic formations, is designed to withstand the highest axial and seismic loads for this type of structure.

SANTA MARIA GOLF & COUNTRY CLUB – REPUBLIC OF PANAMA

SERVICES:

- *Geotechnical Investigation*
- *Site/ Civil Engineering*
- *Stormwater Management Design*
- *Utility Design and Coordination*
- *Regulatory Permitting Coordination*
- *Offsite Roadway Improvements Design*
- *Wastewater Treatment Plant Design*
- *Hydrologic River Flood Modeling*
- *Bridge Design*

LOCATION:

Panama City, Republic of Panama

CLIENT:

Santa Maria Golf & Country Club

STRATEGIC PARTNER:

EDSA



The Santa Maria Golf & Country Club is a high-end mixed use development located on a 283-hectare site along the Corredor Sur highway. This upscale mixed-use development will include 400 single family residential lots, 3,300 high-density residential units, 450 medium-density residential units, an 18-hole Nicklaus Design golf course, 9,300 square meters of retail and restaurant space, and indoor and outdoor recreation areas.

The project site is an existing wetland and marsh with some freshwater mangroves with ground elevations that become inundated from the adjacent Juan Diaz River during extreme rainfall events. The site is underlain by six to ten meters of very compressible clay.

Langan's site/civil services include the preparation of conceptual site design plan, design development drawings, grading and drainage plans, water system and sanitary system plans in addition to detailed hydrologic and hydraulic evaluation of the drainage system. Langan has coordinated with multiple local consultants who prepared initial background studies for the development.

The wastewater conveyance system consists of approximately 6,100 meters of gravity sewer. Nine wastewater pump stations ranging from 0.01 MGD to 1.25 MGD were required due to the topography and the layout of the waterways with access bridges. Approximately 6,100 meters of force mains conveyed the wastewater to the treatment facility which provided beneficial re-use effluent water for the golf course irrigation.

Over ten million cubic meters of imported fill are required to raise the site above the anticipated 100-year flood elevations for the adjacent river. This monumental filling activity over very soft clay materials created a major site improvement issue for the client. Langan's geotechnical engineers evaluated and recommended innovative ground improvement measures to counter the over one meter of settlement anticipated to occur from the four to five meters of imported design fill on top of the compressible clay.

SERVICES:

- *Geotechnical Engineering*
- *Geologic Evaluations*
- *Site/Civil Engineering*
- *Grading & Earthwork Analysis*

LOCATION:

San Carlos, Republic of Panama

CLIENT:

Grupo Corcione

ARCHITECT:

Zurcher Arquitectos

STRATEGIC PARTNER:

EDSA



Developed on 77 hectares of land, Casamar will include a beach club, town center, sports complex, residences and a five-star hotel.

Langan developed a detailed subsurface investigation and laboratory testing plan. Geotechnical and geologic engineering evaluations were made relative to slope stability of the seaside cliffs. Geotechnical recommendations were provided relative to the anticipated long term stability of the slopes, the impact of construction on the slopes and the recommended building setbacks from the top of slope.

A grading plan and earthwork analysis isopach plan were prepared based on input from the geotechnical study with respect to sloping of cut and fill areas while maintaining sight visibility lines from the residences to the ocean. Our plan also yielded three additional residential units as compared to the original master plan.

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*

LOCATION:

Panama City, Republic of Panama

CLIENT:

Porta Norte Investments

ARCHITECT:

Edward McGrath

STRATEGIC PARTNER:

DPZ Partners – Planning Firm



Porta Norte is a 250-hectare development just north of Panama City, next to the Panama Golf Club and just 10 minutes from Tocumen International Airport. Inspired by the Old Quarter of Panama, this project was designed to harken back to the time when communities were tightly-woven networks. To achieve this, the design team looked to new urbanism - a concept founded on the belief that well-designed cities, towns, and neighborhoods build healthier and happier communities where businesses prosper.

A milestone project for the region, this urban development will feature residential and commercial spaces, parks, walkways, and a transit system.

Langan is providing site/civil and geotechnical engineering services including infrastructure design for the roadways as well as the storm drainage system, sanitary sewer system, and potable water system.

In addition to site infrastructure and utilities, Langan is also responsible for the conceptual grading, master grading, final grading, and slope stability designs.

Langan's local civil and geotechnical experience and US-based grading design expertise has enabled the team to effectively manage the challenges associated with land development over poor soil conditions and hilly terrain.

SERVICES:

- *Grading Design*
- *Earthwork Optimization*

LOCATION:

Lago Mar, Republic of Panama

CLIENT:

Grupo Equinox

ARCHITECT:

Arango Arquitectos

LAND PLANNER:

EDSA



Developed on 20 hectares along the pacific beaches near Lago Mar about 90 kilometers from Panama City, Ensenada will include vacation residences, a beach club and a hotel.

Langan designed the grading and optimized the earthwork for the project reducing the initial construction costs from \$3.5 million to \$1 million. Our design maintains the views and interaction envisioned by the land planner, architect and developer.

We also provided recommendations for cliff-side development.

SERVICES:

- Stormwater Master Plan
- Water System Peer Review
- Stream Pollution Treatment Design
- Earthwork and Grading Master Plan
- Geotechnical Review

LOCATION:

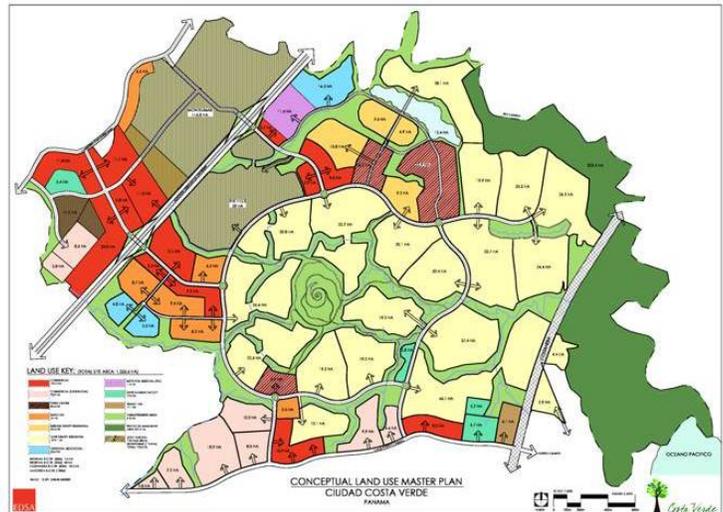
La Chorrera, Republic of Panama

CLIENT:

Hacienda El Limon

STRATEGIC PARTNER:

EDSA



Costa Verde is a 1,500 hectare mixed-use development that will serve a future population of 80,000-100,000 people.

Langan's services began with the preparation of a stormwater management master plan identifying major drainage infrastructure that should be provided to provide surface water quantity and quality controls and sustainability for the future buildout of this dense development project.

Langan prepared a conceptual treatment system, which would utilize manmade lakes and wetlands to improve the polluted stream quality. We also prepared a master earthwork and grading plan for 85 hectares of commercial development lands.

Langan provided a technical review of past poor earthwork filling operations that left land unsuitable for shallow foundations. We provided recommendations for ground improvement.

Langan provided water supply system peer review and solutions of problems encountered with the original design and construction of 76-centimeter water supply mains and distribution systems that were designed by others.

SERVICES:

- *Wastewater Infrastructure Alternative Analysis*
- *Wastewater Management Planning*
- *Codify Existing Data and Preliminary Assessment*
- *Wastewater Treatment Facility Planning and Phasing*
- *Geotechnical Engineering Peer Review*
- *Foundation System Evaluation & Testing Recommendations and Review*

LOCATION:

Rio Hato, Republic of Panama

CLIENT:

Buenaventura



Buenaventura is a luxury residential, beach, equestrian and golf community currently under phased construction. The development spanning over 342 hectares consists of nearly 1,100 residential units comprised of high density, single family lots, golf villas and hotel. Amenities include an 18-hole golf course, a golf clubhouse, driving range, beach club, tennis center, equestrian center, kid's zoo, service center, hotel, natural preserves, lakes and beach front.

Langan was retained by Buenaventura to prepare a wastewater management plan for the entire development to evaluate a cost effective means of wastewater conveyance and treatment. Alternatives were evaluated considering their life cycle costs and a recommendation was made to the owner that included state of the art technology.

After initial consultation with the owner regarding their existing, intermediate and ultimate needs, Langan analyzed eight wastewater infrastructure alternatives. Each alternative consisted of a combination of gravity mains and pump stations and wastewater treatment facilities. Sequencing batch reactors and membrane bioreactors were among the wastewater treatment technologies that were evaluated in detail. Based on the alternative analyses, Langan recommended a cost effective wastewater infrastructure alternative that met the needs of the owner for both the short and long term minimizing expansion costs in the future.

Langan also provided detailed geotechnical engineering peer review for the Puntarenas development within Buenaventura and became intimately involved in assisting the owner with the selection of the appropriate foundation system type. In addition, Langan provided dynamic foundation testing criteria recommendations that were used to evaluate ultimate capacity and resulted in the development of a more cost effective pile foundation element. Langan also evaluated the scope of a large scale geotechnical study proposed by others and assisted the owner in developing a more cost-effective scope while maintaining the integrity of the testing program.

SERVICES:

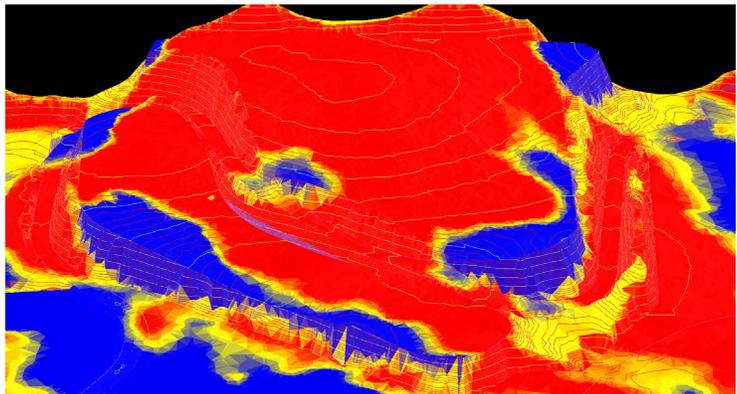
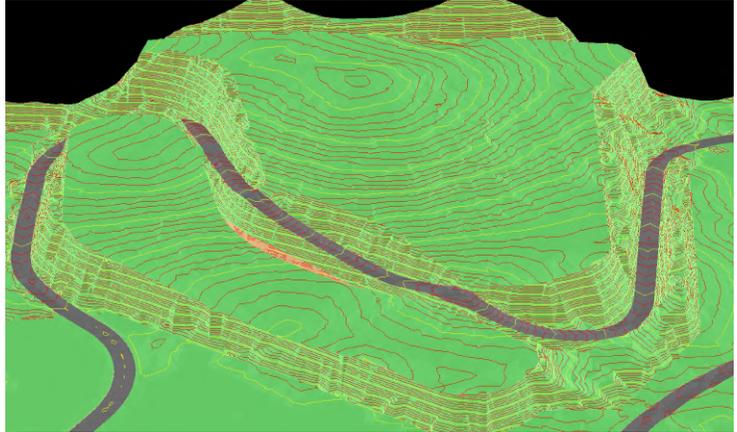
- *Master Site Plan Design*
- *Master Grading Design*
- *Earthwork Optimization*

LOCATION:

Vacamonte, Republic of Panama

CLIENT:

Provienda



The Vacamonte project is a low to middle income residential community and will be developed on 330 hectares about 20 km from Panama City. The project is proposed to be divided into about 10 macro-lotes, which will be developed as separate neighborhoods.

Langan prepared three master site layout and grading plans for the overall property with between 10 and 13 macro-lotes and the main internal collector “circumvalcion” roadway. A variety of macro-lote and circumvalacion roadway layouts were considered and analyzed.

Langan utilized our grading expertise and multiple grading design software applications to design the grading and earthwork for the overall master-planned project. Our sophisticated master grading design provided the developer with three different theoretically balanced earthwork plans that were optimized for least construction cost, while considering other technical or fixed project constraints.

Individual parcel cut and fill volumes were summarized to assist the developer with phasing of the construction to efficiently balance the market demand versus the infrastructure cost.

MANZANILLO INTERNATIONAL TERMINAL – REPUBLIC OF PANAMA

SERVICES:

- *Geotechnical Engineering for Wharf and Waterfront Structure Design*

LOCATION:

Colon, Republic of Panama

CLIENT:

Stevedoring Services of America (SSA)



Langan provided geotechnical engineering services for the Manzanillo International Terminal. The new construction required dredging of the adjacent bay to el -14 meter MSL for ship movements. In addition, a new 16-hectare container storage area was to be created within the existing bay by pumping the hydraulic fill dredge spoils into the proposed area. The subsurface materials generally consisted of very soft sensitive clayey silt deltaic deposits above the deeper siltstone rock formation, encountered near the bottom dredge depth. The new 3 to 4.5 meter thick pumped dredge fill layer was placed over the native highly compressible clayey silt deposits which were 12 to 15 meters thick. Post-construction settlements were estimated to be up to 1 to 1.5 meters.

Deep foundation support of this area was not economically feasible. Consequently, ground improvement evaluations resulted in a vertical “wick” drain system combined with fill surcharging to accelerate settlements to allow for near future construction while minimizing post-construction settlements. In addition, static and seismic slope stability analyses were performed for numerous underwater slope configurations. Ultimately, an anchored sheet pile wall placed at the top of the underwater slope in conjunction with a flattened slope seaward of the sheet pile were selected for design.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Landscape Architecture/ Site Architecture*
- *Site/Security Lighting Design*
- *Stormwater Drainage System*
- *Special Inspections*

LOCATION:

Panama City, Panama

CLIENT:

U.S. Department of State, Office of Overseas Buildings Operations (OBO)

DESIGN-BUILD TEAM:

*Einhorn Yaffee Prescott (EYP)
Caddell Construction Co., Inc.*



Langan was a key component of the design-build team for this new 15,953 GSM (about 171,717 GSF) U.S. Embassy compound. This fast-track international project posed numerous challenges for all design and engineering disciplines due to site conditions, security requirements, time constraints and the complexity of structures and uses within the compound. The project achieved LEED Silver certification, and was the first LEED-certified building in Panama and the second U.S. Embassy in the world to receive this status.

The existing terrain within the eight-hectare compound limits included steep slopes and changes in elevation of up to 60 meters, which had to be shaped to accommodate eight buildings, pedestrian and vehicular circulation routes, parking areas, gardens and recreational spaces, while complying with ADA requirements.

The stormwater drainage system was designed to handle the intense, 178-centimeter annual rainfall and alleviate adverse flooding and erosion. This included some 1,410 meters of storm piping, an above ground detention pond, stream culvert and a combination of grass and concrete lined swales.

Extensive landscape plantings were developed to buffer parking, delineate circulation and gathering spaces, and provide shade at outdoor spaces and garden areas. Langan also designed the exterior site and perimeter security lighting for the entire site, which included pedestrian walks, roadways, parking lots, recreational courts and building facades.

Langan also performed geotechnical engineering design and developed foundation recommendations from the soil boring data. Additional design support included on site-wide utility system layout, site architecture and landscape irrigation design.

ATLANTIS MEGA RESORT (PHASE III) – BAHAMAS

SERVICES:

- *Geotechnical Engineering*
- *Foundation Recommendation/ Design*
- *Full-Time Construction Inspection of Foundation Related Aspects*

LOCATION:

Paradise Island, Nassau, Bahamas

CLIENT:

Kerzner International

ARCHITECTS:

*WATG
HKS
EDSA*



At a cost of \$2.2 billion, the Atlantis Phase III development is the largest resort in the Bahamas. Developments included: two 22-story hotel towers (hotel and condominium), a water park, Mayan Temple, pools, amusement amenities and various support structures. Expansions to the existing casino and conference center are also included as part of the site's development.

Langan, as part of the design team, performed subsurface investigations, observed and monitored pile load tests, monitored production augercast piling installations, and all earthwork related activities. Retained fill heights on the order of 12 meters were required as part of the water parks system.

Unique geotechnical challenges, coastal issues and the magnitude of the resort development required implementation of high-capacity augered cast-in-place (ACIP) piles for support of the 22-story high-rise structures.

Full scale load testing of ACIP piles and footings were implemented well in advance of construction to allow economizing of foundation sizes, lengths and dimensions.

Detailed analyses and construction monitoring was utilized to ensure compatible settlements between varying height structures on similar or different foundation systems.

BAHA MAR DEVELOPMENT – BAHAMAS

SERVICES:

- *Geotechnical Engineering*
- *Foundation Recommendations/ Design*

LOCATION:

Cable Beach Area, Nassau, Bahamas

CLIENT:

Baha Mar LTD

ARCHITECT:

Hillier/RMJM



The mixed-use Baha Mar Development is a 400-hectare site consisting of the construction of five hotels including the 25-story Caesar Hotel, 12-story St. Regis, and twin W Hotels. In addition, a time share structure, convention center, podium, resort features, pedestrian and vehicular bridges are planned as part of this mega-resort expansion.

Langan performed a peer review of the geotechnical aspects of the main resort development. Langan's extensive experience with other Bahamian resorts was utilized to provide cost-effective geotechnical solutions for the proposed development.

Langan also served as the geotechnical engineer of record for the vehicular bridges and provided deep foundation recommendations for support of the bridges.

BRADFORD MARINE BAHAMAS FACILITY - BAHAMAS

SERVICES:

- *Phase I Environmental Site Assessment*
- *Phase II Environmental Site Assessment*

LOCATION:

Freeport, Grand Bahamas, Bahamas

CLIENT:

The Carlyle Investment Management



Langan completed a Phase I Environmental Site Assessment (ESA) facility which also included also a leased section at its eastern end. The Phase I ESA consisted of reviewing historical and environmental records, site reconnaissance, and interviews.

The property is located in a heavily industrialized area within the Freeport Harbor and is part of the Hawksbill Creek Agreement area which includes 150,000 acres of a tax free zone. Historical documents show part the property as wetlands. The property is used for marine operations for yacht brokerage sales and maintenance. The property is improved with seven structures totaling 20,440 SF of gross building area. The buildings were built in the late 1990's of concrete masonry and steel frame construction. Major site improvements consist of 4,202 LF of shoreline/seawall and 1,896 LF of dock facing.

The ESA revealed evidence of numerous recognized environmental conditions in connection with the current and historical shipyard uses related to boat maintenance, fueling and repair. To evaluate the recognized environmental conditions Langan conducted a Phase II ESA that consisted of a soil and groundwater investigation.

**MARINA VILLAGE EXPANSION/HARBORSIDE II/
HURRICANE HOLE MARINA – BAHAMAS**

SERVICES:

- *Geotechnical Engineering*
- *Foundation Recommendations Design*

LOCATION:

Paradise Island, Nassau, Bahamas

CLIENT:

Kerzner International

ARCHITECT:

HKS



Hurricane Hole is being extensively redeveloped, including the marina. The project plans include re-configuring the existing marina, one-story to two-story retail structures, constructing new docks within the existing marina area, constructing 10 six- to eight-story structures and various resort amenities (including: pools, landscaped areas, back-of-house areas, courtyards, etc.).

Langan, as part of the design team, has been providing geotechnical consulting services during the early design phases of this project.

Langan performed subsurface investigations and provided cost-effective foundation and marina dredging and filling recommendations.

ZOËTRY WELLNESS AND SPA RESORT AT ISLA DI ORO – ARUBA

SERVICES:

- *Impact Analysis*
- *Interagency Coordination*
- *Stakeholder Coordination*
- *Environmental Impact Assessment*

LOCATION:

Pos Chiquito, Aruba

CLIENT:

Zoëtry Wellness and Spa Resort



Langan prepared the Environmental Impact Assessment (EIA) report for the proposed Zoëtry Wellness and Spa Resort. This document was prepared using data from a number of technical experts.

The proposed project will be developed in 2018 and is projected to be the first true Eco-Resort on the island of Aruba. The project developers aspire to obtain sustainable building certifications for the inshore components of the project by following the guidelines for United States Green Building Council Leadership in Energy and Environmental Design and other certifications related to the concept of sustainability (Green Globes, The Code for a Sustainable Built Environment [BREEAM] and/or Net Zero); address concerns of local NGOs, Governmental departments, and the direct neighborhoods prior to construction; submit an EIA to the Government of Aruba.

To determine wave crest elevations needed to establish the elevation of the overwater structures and ensure a stable platform for resort facilities, the nearshore design analysis identified waves and storm surge levels associated with a 100-year return period storm.

All water services will be transported beneath the proposed pathways to the mainland to ensure no impact to the lagoon area or island.

The surrounding mangrove habitat is directly connected to other valuable habitats including coral reefs, seagrass, saltmarsh, and a gully system. The range of habitat types in proximity to each other demonstrates its uniqueness and value to the island. Significant effort will be made to enhance the environmental conditions of the surrounding environment and habitats. Furthermore, plans are proposed to mitigate the mosquito issue within the vicinity of the project and surrounding neighborhoods.

AMBER COVE CRUISE TERMINAL – DOMINICAN REPUBLIC

SERVICES:

- *Geotechnical Quality Assurance*

LOCATION:

Near Puerto Plata, Dominican Republic

CLIENT:

BergerABAM



The Amber Cove Cruise Terminal was part of Carnival's effort to expand its current ports of call in the Caribbean. Located in Maimon Bay near Puerto Plata, the terminal consists of an L-shaped pier capable of mooring two cruise ships and associated recreational facilities. The facility has a total area of approximately 30 acres.

Langan was engaged as the geotechnical subconsultant for the quality assurance of the design and construction of the pier. In this capacity, Langan was responsible for peer reviewing the foundation designs, construction methods, and quality control procedures implemented by the design-build team. As the geotechnical consultant, two of our key tasks were to oversee the foundation construction methods to ensure that they met the design requirements and to oversee the dynamic load testing for the foundations of the pier.

The key design challenges for this site are its high seismic loading combined with its hurricane susceptibility, which created several critical design conditions. Construction challenges for the site were related to its secluded location, shallow bedrock, and accelerated construction schedule. The unique combination of design and construction challenges required in many cases the review of design and construction documents on an individual element basis.

Langan's approach to geotechnical capacity evaluation based on practical experience and dynamic testing interpretation, combined with a proactive quality assurance approach, aided in creating an efficient, fluid construction schedule. At the same time, Langan's involvement and oversight helped strengthen design and construction procedures for the project.

BARBADOS NATIONAL REFERENCE LABORATORY - BARBADOS

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*

LOCATION:

Bridgetown, St. Michael, Barbados

CLIENTS:

*United States Department of State
United States Center for Disease
Control
Barbados Ministry of Health*

ARCHITECT:

Swanke Hayden Connell Architects



Langan provided site/civil and geotechnical engineering services to support the development of the proposed Barbados Ministry of Health, Barbados National Reference Laboratory located in a commercial and residential area of the island. The redevelopment site encompasses approximately 17,000 SF of a former lab area. Construction will allow the Barbadian Government to consolidate three of its four public health laboratories into a single facility. This will create more space and improve laboratory safety. The 2-story facility will house administrative offices, training functions, laboratories, and laboratory support functions and will include Biosafety Level 3 capabilities.

Langan completed a geotechnical investigation to provide recommendations for site preparation, foundation design, and other geotechnical aspects of the proposed development. Since the site was located on an island prone to sinkhole development, Langan's investigation consisted of conventional soil borings and rock coring, as well as electrical resistivity tomography surveys to assess the existence and future development of sinkholes beneath the site. The Langan investigation revealed a pinnacled rock surface under the site consistent with the karst coral limestone geology of the island.

Langan recommendations reduced the karst risk through a grouting program to mitigate potential voids and sinkholes in the subsurface. Recommendations provided also reduced the risk of future sinkhole development through proper stormwater management and grading design.

**CASTRIES TO CUL DE SAC VALLEY TUNNEL AND ROADWAY –
ST. LUCIA, WEST INDIES**

SERVICES:

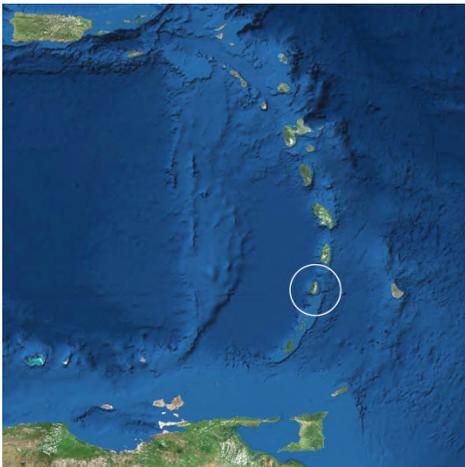
- *Geotechnical Engineering*
- *Tunnel Design*
- *Highway Design*
- *Cost Estimating*

LOCATION:

*Castries to Cul de Sac Valley, St.
Lucia, West Indies*

CLIENT:

Hess Oil Company



St. Lucia, West Indies



Langan conducted a conceptual engineering study of potential tunnel and roadway alignment alternatives connecting the Port of Castries to Cul de Sac Valley and Harbor.

The study included a field reconnaissance, review of available topographic mapping, development of four potentially feasible alignments and the preparation of cost estimates. The project would replace the steep, narrow and winding roads crossing The Morne (Morne Fortune), which presently connects the two localities.

The conceptual study also identified potential land value enhancements that could contribute to additional construction costs.

COUVA CHILDREN'S HOSPITAL WASTEWATER INFRASTRUCTURE DESIGN – TRINIDAD & TOBAGO

SERVICES:

- *Site/Civil Engineering*
- *Wastewater Master Planning*
- *Wastewater Conveyance Design*
- *Wastewater Treatment Facility Design*

LOCATION:

Couva, Trinidad & Tobago

CLIENTS:

*Shanghai Construction Group
UDeCOTT*

ARCHITECT:

HKS

STRATEGIC PARTNER:

Shanghai Construction Group



The Shanghai Construction Group, in partnership with Urban Development Corporation of Trinidad and Tobago Limited (UDeCOTT) and the Ministry of Health are developing a mixed-use, master planned community on the island of Trinidad. Langan was retained by HKS, the master planner and architect, to provide engineering planning and design.

The development will include a 230-bed, children's and adult hospital and training and teaching facility in the initial phase of development. Future phases will include a hotel, retail and residential developments.

Langan's role began with preparing master-planning civil engineering documents and a preliminary geotechnical review. Our services were later expanded to design development for the civil infrastructure including, roads, site grading and stormwater management, water and sewerage and the onsite wastewater treatment facility.

Langan's value-added services include fast-track master planning and design documents that were completed in four weeks. The wastewater treatment plans were prepared in accordance with the local Water and Sewerage Authority requirements. The 110,000 gallon per day sequencing bio reactor facility with ultraviolet disinfection included a separate laboratory and blower building.

SERVICES:

- *Infrastructure Assessment*
- *Sustainability Study*
- *Ecological Assessment*
- *Cultural Resources Assessment*

LOCATION:

Curacao, Netherlands Antilles

CLIENT:

Government of Curacao

STRATEGIC PARTNER:

Wolff Landscape Architecture



The Eastpoint Planning Study assessed 10,872 acres of undeveloped land. The land consists of five former plantations dating back to the 1800's.

Langan's services include the preparation of an infrastructure assessment for the zoning of the property to include an estimated 10,000 residential units, 3,000 hotel rooms and golf courses. Langan prepared a utility inventory and demand assessment and a traffic assessment for the future development potential.

Langan also prepared a sustainability report with recommendations that could be incorporated into the future developments and an Environmental and Ecological assessment report documenting natural and cultural features observed on the property and through historical documentation.

Our reports assisted the land planners with developing multiple potential development plans at various development densities. These plans provide the Eastpoint Planning Committee of the Government of Curacao necessary information for their use in amending the Island's Development Plan to allow development of the property.

MORGAN'S POINT RESORT AND RESIDENCES

SERVICES:

- *Geotechnical Engineering*

LOCATION:

Southampton, Bermuda

CLIENT:

Morgan's Point, LTD

STRATEGIC PARTNERS:

Southworth Development



This expansive waterfront development project encompassing over 175 acres will be home to a luxury, 84-room boutique hotel, 147 condominium units, a spa and various service and amenities buildings.

Langan provided comprehensive geotechnical engineering services, which included geophysical testing, field investigations, geotechnical/geologic evaluations and analyses, and foundation and earthwork recommendations.

The development consists of more than 40 low- to mid-rise buildings split between 2- to 3-story casita buildings, 4-story residential condominium buildings, a 7-story condo-hotel, and numerous amenities.

In light of the challenging geologic conditions at the Morgan's Point site, Langan conducted a full-scale geotechnical engineering investigation using a combination of testing methods including microgravity measurements, electrical resistivity imaging, and traditional test borings with rock coring. This multidimensional testing approach generated the data necessary to assess the unique subsurface conditions in this region, which include large subterranean solution cavities, and subsequently design appropriate, cost-effective, and stable foundation solutions.

PALMYRA RESORT AND SPA – JAMAICA

SERVICES:

- *Peer Review*
- *Constructability Consultation*

LOCATION:

Montego Bay, Jamaica

CLIENT:

Bentley International Property



The Palmyra resort consists of four 10- to 15-story beachfront buildings at Rose Hall, Montego Bay, Jamaica.

Langan provided peer review and constructability consulting services during foundation installation. Material limitations required detailed assessment and quality control of concrete used for CFA pile construction.

MONTEGO BAY LOGISTICS HUB – JAMAICA

SERVICES:

- *Geotechnical Engineering*
- *Traffic Engineering*
- *Environmental Engineering*
- *Site/Civil Engineering*

LOCATION:

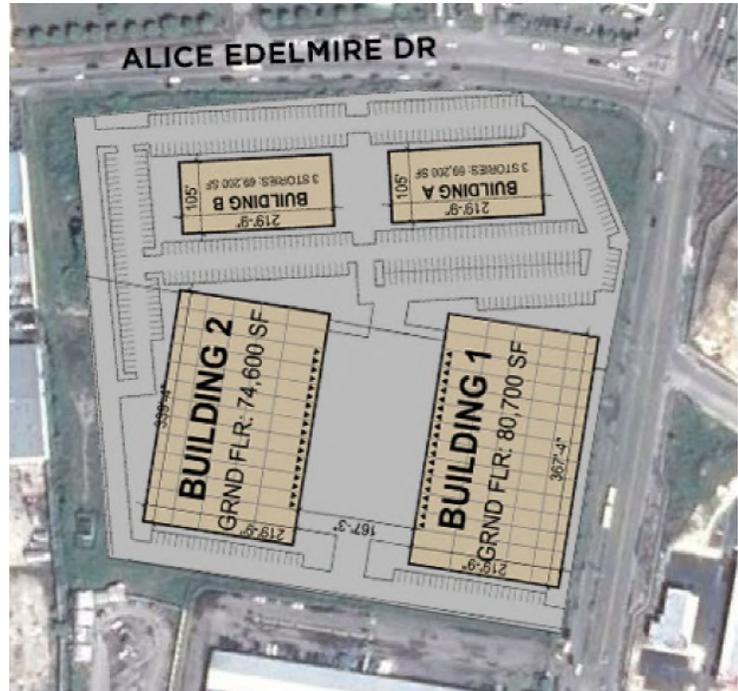
Port of Jamaica, Montego Bay, Jamaica

CLIENT:

Port Authority of Jamaica

STRATEGIC PARTNER:

Flagler Global Logistics



The proposed development will include eight spec warehouse buildings to serve the nearby Port of Montego Bay. The warehouse will range in size from approximately 2,100 square meters to 7,500 square meters.

Langan is provided a preliminary geotechnical study with preliminary foundation recommendations, ground improvements recommendations (if required), preliminary traffic impact analysis, environmental assessment, preliminary utility infrastructure analysis and recommended improvements, and site design assistance.

The site's location to existing utilities and poor subsurface conditions make the site a challenging site for development. Langan is reviewing the existing data and will provide the client with options in which the property can be developed as desired.

Langan's integrated services allow us to provide the client with a preliminary engineering study that considers all aspects of the project in a timely manner. The study and the recommendations will allow the client and the strategic partners determine the best way to develop the site.

HESS OIL FACILITY BYPASS ROADS – ST. CROIX, U.S. VIRGIN ISLANDS

SERVICES:

- *Topographic Survey*
- *Roadway Survey*
- *Utility Survey*
- *Geotechnical Engineering*
- *Traffic Engineering*
- *Drainage Analysis*
- *Highway Design*
- *Construction Plans and Specifications*

LOCATION:

St. Croix, U.S. Virgin Islands

CLIENT:

Hess Oil Virgin Islands Corporation



Langan was retained to study the required roadway improvements to accommodate the anticipated additional workers at the Hess Oil Facility in St. Croix over a three year period. The proposed roadway Improvements included:

- Construction of a new bypass road
- Construction of a new access road
- Construction of a new parking lot
- Change of a section of Hope Road to a private road

The study evaluated both the existing and future traffic and roadway systems in the vicinity of the plant. Based on the comparison of the existing and future traffic operations, the study also assessed the benefits of the proposed roadway improvements. Recommendations to mitigate any negative impact of the roadway changes were also made.

Langan also prepared plans and specifications for one and a half miles of new bypass roadways in accordance with U.S. Federal Highway Administration Specifications.

SERVICES:

- *Geotechnical Engineering*

LOCATION:

Port-Au-Prince, Haiti

CLIENT:

GB Group



This project involves infrastructure and superstructure investments to transform Port Lafito into a world-class port and maritime facility. Features at the facility will include an 82-foot-deep basin; quay wall; 1,470-foot-long dock; 1.4-million-SF cargo yard; and several support structures including an operations and maintenance building as well as a customs/security facility. Other site elements include access roads and security access gates.

Langan was responsible for conducting weekly site evaluations and observations during boring investigations. On-site investigations also included backfill material and installation, retaining wall installation, and tie-back installation.

SERVICES:

- *Phase I Environmental Site Assessment*
- *SPCC Plan*
- *UST Installation, Inspection and Permitting*

LOCATIONS:

Mercedita International Airport, Ponce
San German
El Mani Airport, Mayaguez
Rafael Hernandez Airport, Aguadilla
Luis Muñoz Marín International Airport, Carolina
Puerto Rico

CLIENTS:

Avis-Budget
Cendant



Langan was selected as the environmental consultant to provide due diligence services for four car rental facilities.

Langan completed Phase I Environmental Site Assessments at four car rental facilities. The objectives for each site included identifying recognized environmental conditions, future sampling needs, and potential environmental liabilities. A document detailing the assessment and conclusions for each site was presented to the client after desk research, interviews, and field work had been completed.

Langan was also contracted to provide tank installation oversight and permitting services at the Budget facility at Luis Muñoz Marín International Airport in Carolina, Puerto Rico. Cendant constructed a new car rental facility that includes one 10,000 gallon gasoline UST. Langan worked through a local consultant to permit the UST installation through the Commonwealth of Puerto Rico Environmental Quality Board.

GSA SAN JUAN FACILITY (MASTER PLAN, FEDERAL GARAGE AND BUILDING MODERNIZATION) – PUERTO RICO

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *3D Laser Scanning*
- *Survey Oversight*
- *Site Lighting Design*
- *Security Improvements*
- *Construction Administration*

LOCATION:

Hato Rey, San Juan, Puerto Rico

CLIENT:

U.S. General Services Administration

ARCHITECT:

*IBI Group • Gruzen Samton
Goshow Architects*



Langan provided engineering services for three projects for the GSA San Juan Facility. The projects included:

- Conceptual master planning
- New federal garage/road realignment
- High performance and green building modernization of the existing Ruiz Nazario U.S. Courthouse and Federico Degetau federal office building

We provided site/civil engineering for the preparation of a conceptual master plan for the entire campus. Langan then provided design and construction support for the new zero environmental footprint federal parking garage and its immediate perimeter. The design for the garage included the realignment of the existing on-site roadways including the ceremonial entrance drive. We also addressed site demolition, site layout, grading and drainage, stormwater management, site utilities, erosion/sediment control and construction detailing. Langan's work also included site lighting design for the phase one area and coordination with the structural engineer for the security improvements.

Geotechnical engineers performed a subsurface investigation for the new parking garage and security improvements that included soil borings within the development site, downhole seismic testing to measure the shear wave velocities of the subsurface materials, and laboratory testing to obtain additional information about the soil properties. We evaluated the potential foundation support alternatives for the proposed parking garage, developed foundation and site preparation recommendations for the proposed construction and prepared a geotechnical engineering report.

We provided 3D laser scanning and created a 3D model to support the upgrading of interior utilities and systems for the high performance and green building modernization portion of this project.

The garage was designed to a net zero energy consumption use.

**U.S. CUSTOMS HOUSE, ENVIRONMENTAL CONSULTING SERVICES –
PUERTO RICO**

SERVICES:

- *Asbestos Screening*
- *Lead-Based Paint Screening*
- *Miscellaneous/Universal
Hazardous Materials Screening*

LOCATION:

Old San Juan, Puerto Rico

CLIENT:

IBI Group



Langan conducted various screenings of the U.S. Customs House in Old San Juan, Puerto Rico. The work was conducted as part of the feasibility study for the proposed renovation of the two-story building that was constructed in 1924. The purpose of the screenings was to identify the presence of asbestos-containing material (ACM), LBP, and miscellaneous/universal hazmat in accessible areas of the facility. The room-by-room assessment of readily accessible areas for the planned renovation areas of the facility was completed in three days.

Our certified asbestos inspector identified approximately 16,000 SF and 18,000 linear feet of non-friable ACM within the planned renovation areas. An x-ray fluorescence spectrum analyzer was used by our certified lead inspector to screen the subject building for the presence of LBP. The LBP screening identified LBP on numerous components throughout the building. Miscellaneous and universal hazmat consisting of PCB containing ballasts/capacitor associated with the light fixtures, mercury containing florescent and other mixed used high intensity light bulbs, smoke detectors containing suspect radioactive materials, lead acid batteries, mercury containing thermostats, fuel tanks, chemical solvents, and electronics were identified throughout the building.

SERVICES:

- *Site/Civil Due Diligence*

LOCATION:

Caye Chapel, Belize

CLIENT:

GFA



This 281-acre private island with house an 18-hole golf course, marina, private landing strip, five miles of waterfront access, 2.2-miles of beachfront access, estate lots, branded residences, and a luxury hotel.

Langan assisted the Client during the due diligence phase. Langan's services included review and summary of available information for the island, assessment of existing infrastructure, recommending improvements to the existing infrastructure for servicing the island during the preconstruction and construction phases, estimating preliminary potable water, wastewater and electrical demands for the development of a resort and vacation homes, and assisting the Client in developing a design schedule and design scopes for studies required for the development.

CENTRO HOSPITALARIO SERENA DEL MAR – COLOMBIA

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*

LOCATION:

Cartagena, Colombia

CLIENT:

Novus Civita

ARCHITECT:

Safdie Architects

STRATEGIC PARTNERS:

*Fundación Santa Fe de Bogotá
Fundación Carlos y Sonia Haime
Designed in Collaboration with Johns
Hopkins International*



Credit: Safdie Architects
Client/Owner: Novus Civita

Langan is providing geotechnical and site/civil engineering services for the new Centro Hospitalario Serena del Mar located within Serena del Mar, a new 1,000 hectare, mixed-use community development north of Cartagena de Indias.

The hospital is a new 400 bed, 850,000 SF, general teaching and high specialty hospital. The design incorporates underground and surface parking facilities, private patient healing gardens and a public park.

The hospital will be the first developed project of Serena del Mar, the most important urban development in the Caribbean Region. Serena del Mar has been designed under the principles of collective welfare, respect for the environment, for tradition and culture. Project goals include LEED certification with many sustainable design features being planned.

Langan's civil engineering role also includes the design of a new lake bordering the hospital on the northern side. Extensive hydrologic water balance studies using 40 years of rainfall and evaporation data were performed to establish the lake design.

The existing ground conditions are compressible clay. Langan's geotechnical design specifies a surcharge program to consolidate the clays reducing the long term settlements of the surrounding roadways and hardscapes. Vertical wick drains will be utilized to speed the consolidation process from years to less than 100 days.

The hospital will be constructed in three phases. Construction is scheduled to begin in 2014 with an opening date projected to be December 2016.

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Hydrogeological Studies*
- *Traffic Study*

LOCATION:

Cartagena, Colombia

CLIENT:

Novus Civitas

ARCHITECTS:

Safdie Architects

LAND PLANNER:

EDSA



Credit: Safdie Architects

The project is located on a 1,000 hectare site along the coastal highway immediately north of the city of Cartagena, Colombia.

Langan's role began with preparing master civil engineering planning documents, geotechnical, hydrogeological and traffic studies. Our services were then expanded to design development for the civil infrastructure including roads, site grading, earthwork management, stormwater management, water and sewerage and the onsite wastewater treatment plant.

The phased development will include 10,000 residential units ranging from social housing to luxury resort homes, a US-branded community hospital, several hotels, a branded championship golf course, office and retail shopping centers, and a regional mall.

Project challenges include very poor soils resulting in the need to design ground improvement measures for all development and infrastructure areas. A 60-meter wide navigable man-made waterway is being designed to create a unique interactive community with water-based transportation and recreation opportunities.

Langan's value-added approach to the project includes multi-discipline engineering at the master plan phase to address critical infrastructure issues and costs helping to steer the master plan design. Our extensive stormwater design, earthwork management and geotechnical experience helped define a program for constructing the man-made waterways and establish earthwork requirements. Sea level rise was considered within the analysis based on historic storm events and climate change studies. The result was a 1 meter rise in elevation associated with the development pads surrounding the proposed waterways.

BARRANQUILLA CONTAINER TERMINAL – COLOMBIA

SERVICES:

- *Geotechnical Engineering*

LOCATION:

Barranquilla, Colombia

CLIENT:

BergerABAM



The Barranquilla Container Terminal is located in the city of Barranquilla along the Magdalena River. The terminal consists of a new wharf parallel to the river channel and two trestles that connect it to land. The landside project area was extended by reclamation and was filled to create container storage area.

Langan was engaged as a geotechnical subconsultant during the design phase and later re-engaged in the project during the construction phase to help the design-build team overcome foundation construction obstacles. During the design phase, Langan was responsible for designing the ground improvement for the container storage area on land and to perform geotechnical foundation design for the marine structures. During the construction phase, Langan was re-engaged to improve construction practices of the local foundation subcontractors.

The key design challenges for this site are its deep and relatively weak sedimentary formations. Construction in these formations requires practical experience to maximize the load carrying capacity achievable by deep foundation elements. In addition, the changing Magdalena river currents posed construction logistical challenges.

Langan's geotechnical evaluation and experience with cast-in-place pile construction methods resulted in a modified construction approach that allowed the derailed project to get back on track. Our modifications achieved geotechnical capacities that met the design requirements for the project, and these capacities were proven through substantial load testing. Our involvement saved millions of dollars in litigation, construction claims, and delays for the project.

SERVICES:

- *Phase I Environmental Site Assessment*
- *Asbestos Survey*
- *Lead-Based Paint Survey*

LOCATION:

Caracas, Venezuela

CLIENT:

Lehr Associates/ Hilton International



Langan conducted a Phase I Environmental Site Assessment (ESA) for the 600-unit Tamanaco Hotel. The purpose of the ESA was to identify various environmental conditions sited at the subject property resulting from on-site and/or off-site activities. The assessment areas were inspected for hazardous materials and petroleum products and included the collection of numerous bulk samples for asbestos analysis and the collection/analysis of paint samples for lead content.

A visual inspection of the subject property was conducted concurrently with the asbestos and lead-based paint surveys. The assessment areas included the subject property grounds, interior of the building, and the adjoining properties.

Langan collected a total of 42 bulk samples of suspect Asbestos Containing Materials (ACMs) observed in the building. The samples were analyzed using Polarized Light Microscopy (PLM) by a laboratory accredited by the American Industrial Hygiene Association (AIHA) and a participant in the National Voluntary Laboratory Accreditation Program (NVLAP). In most cases, multiple samples were collected for each homogeneous material.

A total of 25 painted locations were sampled and analyzed for lead content. The sampled locations included the paint on walls, ceilings, doors, door-jambes, and window frames.

U.S. EMBASSY SECURITY UPGRADE AND CHANCERY RENOVATION – BRAZIL

SERVICES:

- *Grading and Drainage Design*
- *Security Upgrades*
- *Utility Relocations*
- *Geotechnical Engineering*
- *Stormwater Management*

LOCATION:

Brasilia, Brazil

OWNER:

U.S. State Department, Office of Overseas Buildings Operations (OBO)

CLIENT:

SmithGroupJJR



The proposed physical security upgrades to the U.S. Embassy in Brazil includes new main and service compound access control (CAC) structures, as well as the construction of a new consular (pedestrian) CAC. In addition, security improvements to the existing warehouse loading dock and perimeter fuel port system were designed. The northern and eastern perimeter security walls will also be demolished and rebuilt to provide up-to-date anti-climb and anti-ram protection to the Compound.

Site constraints included steep grade changes along a portion of the northern wall, the presence of collapsible soils, and the City of Brasilia's roadway construction project located adjacent to the northern property line. Important design parameters included incorporating specific Department of State requirements and sequencing of construction to maintain site security.

Langan provided the necessary site/civil and geotechnical engineering services to prepare bridging and IFC documents for construction approval by the OBO. The documents included site design plans, grading plans, stormwater management measures, and utility relocation plans as well as a geotechnical report which provided foundation and retaining wall recommendations for construction in a collapsible soil environment.

PORT OF SAN VICENTE, WHARF NO. 1 – CHILE

SERVICES:

- *Geotechnical Engineering*
- *Marine Structure Design Interaction*
- *Cost Estimating Interaction*

LOCATION:

Port of San Vicente, Talcahuano, Chile

CLIENT:

Stevedoring Services of America



Langan performed a geotechnical engineering evaluation of a 160-meter long wharf structure constructed over weak, compressible silt strata. The wharf had previously experienced documented lateral deflection during construction and for some time afterward. The evaluation included detailed slope stability analysis for the existing and various other rehabilitated wharf and underwater slope configurations. The purpose of the project was to determine the geotechnical stability of the wharf, both statically and during seismic events.

The study evaluated varied geotechnical solutions to overcome potential instability during seismic events. Cost estimates were provided for some of the most viable geotechnical solutions.

SERVICES:

- *Design Checker Services*
- *Geotechnical Engineering*
- *Geodynamic Engineering*
- *Seismic Review*

LOCATION:

Chacao Channel, Chile

CLIENT:

Consortium of HOCHTIEF, VINCI and American Bridge

STRATEGIC PARTNER:

Ammann & Whitney



Langan served as an Independent Engineer to provide design checking on the team of Ammann & Whitney/Flint & Neill for this 2.5 km long suspension bridge Concession Project reporting to concessionaire; currently underway.

The suspended bridge was planned to link the island of Chiloé with continental Chile through the Chacao Channel. If completed, it will be the largest suspension bridge in South America.

Responsibilities include all geotechnical, geodynamic and seismic issues.

MAGELLAN GAS PROJECT – TIERRA DEL FUEGO, ARGENTINA

SERVICES:

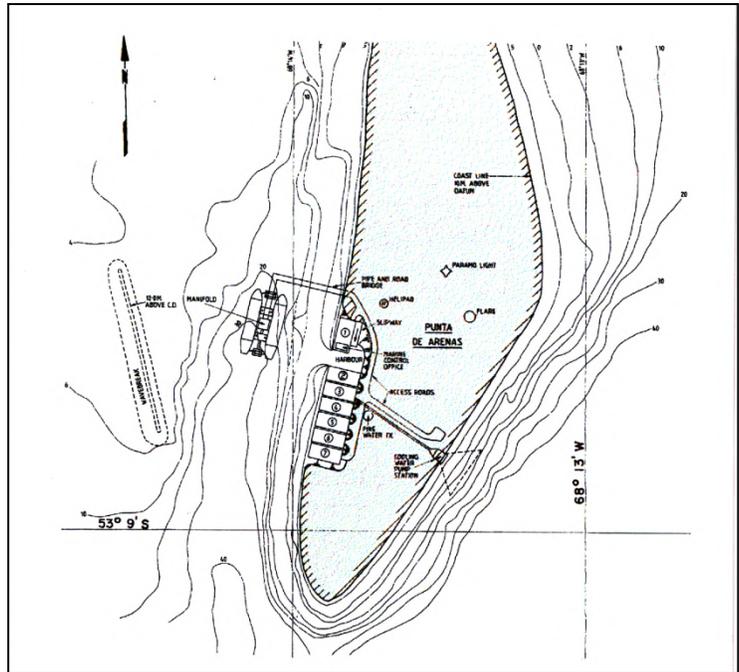
- *Geotechnical Engineering*
- *Subsurface Investigation*
- *Geophysical Investigation*
- *Hydrographic Surveys*
- *Soil Testing*

LOCATION:

San-Sebastian Bay, Tierra Del Fuego, Argentina

CLIENT:

Brown & Root Vickers, Ltd., London



The Magellan Gas project consisted of a synthetic fuel production facility on seven flat-bottomed barges. San Sebastian Bay is approximately 25 kilometers in diameter with water depths in excess of 35 meters and daily tidal fluctuations on the order of ten meters. Winds are strong and waves are typically on the order of four meters.

Langan provided geotechnical engineering services during design. Services included search and review of available geological, geophysical and hydrographic information; development of an extensive investigation program consisting of geotechnical subsurface investigations and laboratory testing using a jack-up platform; marine and hydrographic surveys, geophysical surveys, LANDSAT remote sensing images and seismological surveys.

Langan also developed preliminary foundation recommendations for the support of the reinforced concrete barges. The foundation concept included leveling of the sea bed, preparing a leveling course of sand and gravel and sinking of the barges in place.



Hudson Yards, New York, NY

Representative North America Projects

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Topographic and Boundary Surveys*
- *Transportation Engineering*
- *Site Specific Seismic Study*
- *Advanced Numerical Modeling*
- *Environmental Engineering*
 - *Phase II ESI*
 - *HazMat Inspection*

LOCATION:

New York, New York

CLIENTS:

*Hudson Yards Development Corporation
Hudson Yards, a Related Oxford venture
Extell Development Company
The Moinian Group
Jacob Javits Convention Center
The Georgetown Company
Coach Inc.
New York Jets Development
Brookfield Development
Alloy Development
Silverstein Properties
Madison Square Garden
Moynihan Station Redevelopment Corp
Hudson River Park Trust
Port Authority of NY and NJ*

AWARDS:

*2020 ULI New York Awards for Excellence
in Development (Phase One)
2019 ENR New York Best Projects,
Office/Retail/Mixed-Use (Eastern Yards)*



This major New York City rezoning and redevelopment, under the joint guidance of The City of New York, the Metropolitan Transportation Authority (MTA), Hudson Yards Development Corporation (HYDC) and State of New York initiatives, is in the process of reinventing the Hudson Yards area in Midtown Manhattan. Once complete, the site will include more than 18,000,000 SF of commercial and residential developments and 14 acres of open park space, as well as a cultural venue, 750-person public school and 200-room luxury hotel.

Langan is providing geotechnical, site/civil, transportation and environmental engineering as well as surveying consulting Special Inspection services in support of numerous developers and various agencies.

Langan's extensive knowledge and understanding of the overall Westside redevelopment plans, MTA No. 7 subway line design, and Eleventh Avenue Viaduct reconstruction has been critical to private development and agencies alike. Interaction and close coordination with agencies such as the MTA, HYDC, New York City Department of Transportation, New York City Department of Environmental Protection, and Amtrak are paramount to success of each project.

In addition to the construction of several mixed-use and commercial buildings, Langan is also providing support services for the third segment of the High Line, NYC's elevated park, which will extend through the southern portion of the redeveloped site.

Langan performed a site-specific seismic study consisting of seismic hazard analysis, soil amplification, and soil liquefaction evaluation. Langan also performed a 3D Finite Element Analysis to evaluate the potential influence of drilled-shaft foundation loads from the proposed Hudson Yards Tower E within 25 feet of the adjacent T1A-T1B tunnel of the MTA No. 7 subway extension. The model included a 3D representation of a curved tunnel and the tower's foundation. The work successfully passed a peer-review process by MTA Capital Construction.

SERVICES:

- *Surveying*
- *3D Laser Scanning*
- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Traffic Support*

LOCATION:

New York, New York

CLIENT:

SL Green Realty Corporation

ARCHITECT:

Kohn Pedersen Fox

STRATEGIC PARTNERS:

*Hines
Severud Associates
Jaros Baum & Bolles*

AWARDS:

*2018 AIA New York Design Awards:
Urban Design, Merit Award*



Credit: Kohn Pedersen Fox

Bordering the landmark Grand Central Station to the west, this supertall, 1,401-foot-tall commercial tower covers an entire city block (1,750,000 SF). Once complete, the tower will offer views of Manhattan from its indoor-outdoor observation deck, located 1,100 feet above the street. The building will also include entrances and access points for the New York City Transit (NYCT) Shuttle Train, Grand Central Station, and East Side Access for Long Island Rail Road, buses, and subways.

Langan's surveyors provided topographical surveying and 3D laser scanning of Grand Central Station, the site, and surrounding tunnels. Surveys were completed for all below-grade subway and Grand Central Terminal structures, and 3D models detailing all existing structures.

Our geotechnical engineers implemented a full site investigation and provided design services related to the location's complicated support of excavation and foundation system. Langan was on site full-time during the excavation and foundation construction phases.

Site/civil responsibilities included the redesign of a New York City combined sewer beneath East 43rd Street, as well as design and permitting of a new water main on East 42nd Street. We also designed stormwater management facilities, coordinated utility connections, provided public right-of-way improvements, and assisted with the traffic/parking design of basement-level loading docks, accessed by a truck turntable. Langan is leading the permitting and coordination efforts with NYCT and the New York City departments of Environmental Protection, Transportation, Parks and Recreation, and Department of Buildings.

The project is expected to obtain LEED Gold certification.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Environmental Engineering*

LOCATION:

New York, New York

CLIENT:

Extell Development Company

ARCHITECT:

*Adrian Smith + Gordon Gill Architecture
Adamson Associates*

STRUCTURAL ENGINEER:

WSP USA



Credit: Extell Development Company

Standing at 1,550-feet-tall, Central Park Tower will be the tallest residential building in the western hemisphere when it opens. Plans for the supertall tower include luxury condominium residences, amenity spaces, and a 300,000-SF, seven-story Nordstrom department store, which will be its flagship location.

Langan's geotechnical engineering services included a detailed subsurface investigation, foundation design, extensive preconstruction conditions documentation of several NYC landmarked buildings surrounding the site, special inspections during foundation construction, and vibration monitoring of adjacent structures.

Our site/civil engineers prepared the Builder's Pavement Plan and worked with various city agencies to facilitate permitting. Submissions included a street tree plan to the Department of Parks and Recreation, sidewalk work permit to New York City Transit, curb cut plans to the Department of Buildings, and Con Edison vault application to the Department of Transportation.

Our environmental engineers performed a soil pre-characterization study, asbestos investigation, and abatement monitoring. Langan's reports summarized the results of laboratory analytical testing and compared them with cleanup standards to provide recommendations regarding proper disposal at area facilities.

SERVICES:

- Environmental Engineering
- Geotechnical Engineering
- Site/Civil Engineering
- Surveying
- New York City Transit Authority Coordination

LOCATION:

New York, New York

CLIENT:

Hines

ARCHITECTS:

Ateliers Jean Nouvel (Design Architect)
Adamson Associates Architects
(Architect of Record)

STRATEGIC PARTNER:

WSP USA
Lendlease

AWARDS:

2020 CTBUH Award of Excellence, Best Tall Building 300-399 Meters
2019 ACEC New York Engineering Excellence: Diamond Award
2019 SARA NY Design Awards, Visionary Urban Integration Award



Credit: Ateliers Jean Nouvel/Adamson Associates Architects

53W53 is an 82-story supertall residential tower located next to the Museum of Modern Art (MoMA). The building includes 145 condominiums and 65,000 SF of gallery space for the MoMA.

Langan's geotechnical engineers completed a subsurface investigation and developed geotechnical recommendations for seismic design, mat and caisson foundation support, and lateral earth pressures for below-grade walls. We also prepared underpinning design drawings for the buildings bordering the site. We completed extensive pre-construction documentation that included video monitoring and photographic logs for buildings and New York City Landmarks adjacent to the site, as well as a New York City Transit tunnel structure beneath 53rd Street.

Our site/civil engineers provided designs for sidewalk restoration, utilities, and tree relocation. Services included Builders Pavement Plan preparation, a DEP Site Connection proposal, and interaction with the New York City Parks department. We also performed environmental waste characterization of existing site soils for off-site disposal.

Langan is also involved in construction of the tower. Our surveyors are providing weekly monitoring of adjacent building structures and our geotechnical team performed Special Inspections during foundation construction.

SERVICES:

- *Site/Civil Engineering*
- *Traffic Engineering*
- *Surveying*

LOCATION:

New York, New York

CLIENT:

Tishman Speyer

ARCHITECT:

*Bjarke Ingels Group (BIG)
Adamson Associates Architects*

STRATEGIC PARTNERS:

*Thornton Tomasetti
Cosentini Associates
MRCE
Siteworks*

A 1,041-foot-tall office tower is rising at 66 Hudson Boulevard as part of the Hudson Yards Redevelopment project. Dubbed “The Spiral,” this 66-story building contains 2.85 million SF of office and retail space, and an innovative design with cascading outdoor terraces accessible from every floor.

During the project’s initial phases, Langan performed design consultation on the loading dock capacity, layout, circulation, and operations, and prepared a Delivery Vehicle Logistics Assessment. We also helped keep the loading dock circulation space to a minimum through the use of a truck turntable and will develop design sketches and provide input on final construction documents.

Langan also prepared a topographic, boundary, and utility survey; developed a Builders Pavement Plan; designed sewer connections; and performed required inspections. We are collaborating with BIG and Adamson Associates Architects to develop a unique streetscape design featuring distinctive paving, continuous planted tree pits, and security bollards around the perimeter of the site. The security bollards require permitting through the Department of Transportation revocable consent program, and the distinctive elements through the Housing Development Corporation. The key design element is a double row of trees along the sidewalk.

The Spiral is expected to obtain LEED Silver certification.



Credit: Bjarke Ingels Group

SERVICES:

- *Site/Civil Engineering*
- *Environmental Engineering*
- *Survey*

LOCATION:

New York, New York

CLIENT:

*The Related Companies
50 HYMC Owner LLC*

ARCHITECT:

Foster + Partners

STRATEGIC PARTNER:

WSP Engineering

Langan provided multidisciplinary services for 50 Hudson Yards, a 58-story (2.9 million SF) commercial office tower. Located at the northwest corner of 33rd Street and Tenth Avenue, the development is a mixed-use tower with two cellars that provide access to the No. 7 Subway. It is New York City's fourth largest commercial office tower.

Our site/civil engineering services included the preparation of a Builders Pavement Plan for sidewalk, curb, and street improvements on all four frontages of the building (1,011-ft total length). Construction observation during utility connections to street mains and during sidewalk placement was provided.



Courtesy of Related - Oxford

Langan assisted the client in enrolling in the New York City Voluntary Cleanup Program, which is overseen by the NYC Office of Environmental Remediation (OER). Langan prepared a Phase I Environmental Site Assessment and performed a remedial investigation to evaluate the extent of these potential environmental concerns. A Remedial Action Work Plan (RAWP) was prepared and approved by OER for a Track 1 Unrestricted Use Cleanup.

The RAWP was implemented between September 2017 and April 2019, and Langan provided environmental engineering services including community air monitoring during excavation for foundation components. Langan prepared and submitted a Remedial Action Report to NYC OER to document remedial work performed at the site.

Interaction and close coordination with agencies such as the Metropolitan Transit Authority, New York City Department of Transportation, New York City Department of Environmental Protection, and New York City Department of Parks and Recreation was paramount to success of the project goals.

A preliminary topographic and boundary survey was prepared by Langan's surveyors for the site. Langan surveyors will also update the topographical and utility components of the survey following completion of the West 33rd Street reconstruction.

3 HUDSON BOULEVARD

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Finite Element Modeling*
- *Metropolitan Transportation Authority (MTA) | New York City Transit Interaction*

LOCATION:

New York, New York

CLIENT:

The Moinian Group

ARCHITECT:

FXCollaborative

STRATEGIC PARTNERS:

*WSP
Tishman Construction Corporation*

Langan provided multi-discipline services during development of this 53-story office tower. The building is anticipated to qualify for LEED Platinum Certification.

Once a brownfield redevelopment site situated along Eleventh Avenue between West 34th and West 35th Street, the 987-foot-tall tower will serve as a station entrance for the 34th Street Station of the No. 7 subway extension.

The project is unique because construction was executed in three stages using contractors for both a private developer and the MTA's selected contractor for the No. 7 project. Initially, the developer's contractor installed temporary excavation support and excavate to rock to satisfy requirements for the Brownfield Cleanup Program. The site was then turned over to the MTA for excavation of an access shaft and construction of below-grade subway structures. Finally, the developer's team reoccupied the site and began constructing tower over the below-grade subway entrance.

The distinctive nature of this project required close coordination with the MTA's design team to develop appropriate means of temporary excavation support, monitoring, and coordination of foundation schemes. In addition, extensive logistics were required with the New York City Department of Environmental Protection (NYCDEP), New York City Department of Transportation, and Amtrak.

Our geotechnical engineering services included completion of a subsurface investigation to confirm soil and bedrock conditions within the site, map bedrock discontinuities, and evaluate groundwater conditions. In addition, Langan worked closely with both the MTA and the project's structural engineer to develop design and construction recommendations for a coordinated foundation design of the overbuild tower. Finite element modeling was used to develop appropriate foundation schemes and minimize impacts to subway structures.

Site/civil engineering duties included investigations of sewer utilities within and adjacent to the location in an effort to abandon an undocumented sewer line traversing the private property. Langan worked closely with the developer and NYCDEP to determine appropriate means for abandonment of the sewer passing through the location and reconnection of several private buildings that discharge to the sewer. Our services may also include preparation of site connection proposals, Builders Pavement Plans, and agency coordination to fulfill project goals.



SERVICES:

- *Geotechnical Engineering*
- *Environmental Engineering*
- *Surveying*
- *Spill Closure Report*
- *Construction and Vibration Monitoring*

LOCATION:

New York, New York

CLIENT:

Vornado Realty Trust

ARCHITECT:

*Robert A.M. Stern Architects
SLCE Architects*

STRATEGIC PARTNER:

*DeSimone Consulting Engineers
Cosentini Associates
Lendlease
RWDI*



Credit: Vornado Realty Trust and Robert A.M. Stern Architects

Situated directly on Central Park, 220 Central Park South offers outstanding views of the park from every residence. The 950-foot-tall, 624,655 SF luxury residential building features 126 units between the 70-story tower and 18-story annex called “The Villa.” Amenities include a fitness center, spa, saltwater pool, library, and communal terrace.

The site excavation was extended to depths between 35 and 50 feet with the majority of the excavation within hard bedrock. During the excavation, Langan created a construction protection plan for six historic/landmark properties surrounding the construction site. The plan included vibration monitoring, survey control for horizontal and vertical movements, and the installation and monitoring of crack gages. Langan also provided site inspection services for permanent rock tiedown anchors and rock subgrade preparation.

Langan’s geotechnical engineering services consisted of a subsurface investigation that included a review of available historic boring data, test pit excavations, test borings with in-situ testing, soil and rock sampling, and installation of observation wells. Our engineers also compiled extensive pre-construction documentation (photographic and written reports) as part of a survey of the surrounding structures. A final geotechnical report with foundation recommendations was prepared for the client.

Langan’s environmental engineers were responsible for a spill closure report, as well as the excavation and removal of two underground storage tanks, endpoint soil sampling/analysis, and off-site disposal of petroleum-impacted soils.

SERVICES:

- *Geotechnical Engineering*
- *New York City Transit (NYCT) Coordination*
- *Excavation Support Design*

LOCATION:

New York, New York

CLIENT:

Silverstein Properties

ARCHITECTS:

*Robert A.M. Stern Architects
SLCE Architects*

STRATEGIC PARTNERS:

*WSP
Tishman Construction Corporation*

AWARDS:

2018 ULI New York Excellence in Development Awards, Hotel Development
2017 ULI Awards for Excellence in Development, Hotel Development
2017 Greater New York Construction User Council, Outstanding Projects: Residential



Credit: Archpartners, Courtesy of Silverstein Properties

Located at 30 Park Place in Manhattan's historic Tribeca neighborhood, this 82-story tower combines 151 top-end condominium apartments with a five-star, 190-room, Four Seasons Hotel, and public plaza. The four ground floors include restaurants, meeting facilities, ballrooms, spa, swimming pool and fitness center spaces.

Langan's geotechnical engineering services included an extensive subsurface investigation of a building previously located at the site. We developed foundation recommendations for foundation type, groundwater control, and monitoring requirements, lateral loading, seismic requirements, and geotechnical-related contract technical specifications. The foundation system consisted of driven H-piles and drilled caisson elements socketed into bedrock.

The site is surrounded by NYCT subways to the north and west, and landmarked buildings to the south and east. Langan designed temporary excavation support system for the two-sides of the property fronting the NYCT subway structures.

SERVICES:

- *Geotechnical Engineering*
- *Demolition of Existing Structure*
- *Environmental Engineering*

LOCATION:

New York, New York

CLIENT:

Hudson Yards, a joint venture of Related Companies and Oxford Properties Group (Hudson Yards)

ARCHITECT:

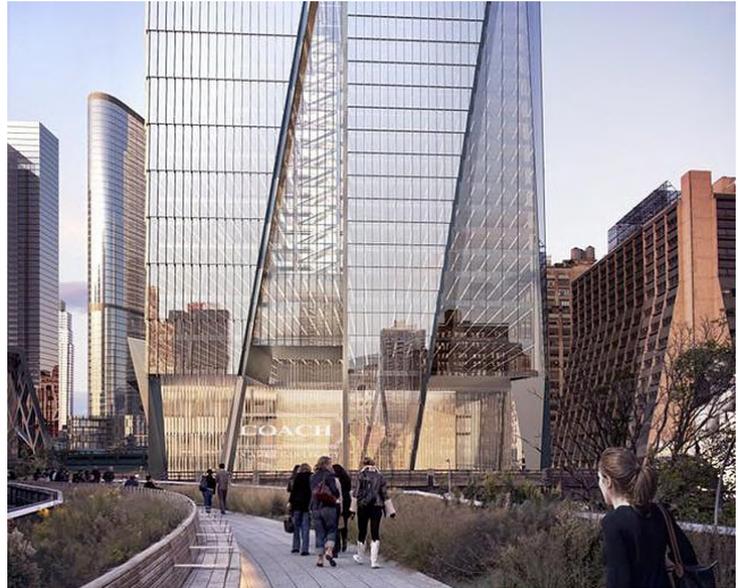
Kohn Pedersen Fox

STRATEGIC PARTNER:

*Thornton Tomasetti
Tutor Perini*

AWARDS:

*LEED Platinum Certification
2017 ULI Awards for Excellence in Development: Office Development Finalist
2016 Concrete Industry Board Awards – The Annual Award*



Credit: Kohn Pedersen Fox Associates

10 Hudson Yards is the first building to open in the Hudson Yards project. The 52-story tower includes 1.8 million SF of Class A office space. The anchor tenant is Coach, Inc., the luxury retailer. Other major tenants include Boston Consulting Group, Intersection, L'Oréal, SAP, Sidewalk Labs, and VaynerMedia.

Langan provided comprehensive geotechnical services in preparation for the design and construction of 10 Hudson Yards. The site was previously occupied by the Long Island Rail Road and a Metals Purchasing Building. Geotechnical engineers performed a subsurface investigation, which included the excavation of test pits to determine and assess the existing foundations both on and surrounding the site. Langan provided foundation design and construction recommendations for the building.

Langan was also responsible for making demolition recommendations for the existing Metals Purchasing Building. A significant challenge to demolition was the structure that was partially situated below the High Line, with the elevated rail's support columns extending throughout the building. Langan provided recommended demolition procedures.

Environmental engineers also performed an extensive environmental investigation for this e-designated site and prepared remediation workplans to address the presence of asbestos, lead-based paint, and contaminated soil at the site for the New York City Office of Environmental Remediation. An underground storage tank was also present and required proper closure and removal.

The project has achieved LEED-Platinum Certification from the U.S. Green Building Council which surpassed the original expectations of a LEED-Gold certificate.

SERVICES:

- *Geotechnical Engineering*
- *Environmental Engineering*
- *Surveying*
- *3D Laser Scanning*

LOCATION:

New York, New York

CLIENT:

Diller Scofidio + Renfro

ARCHITECT:

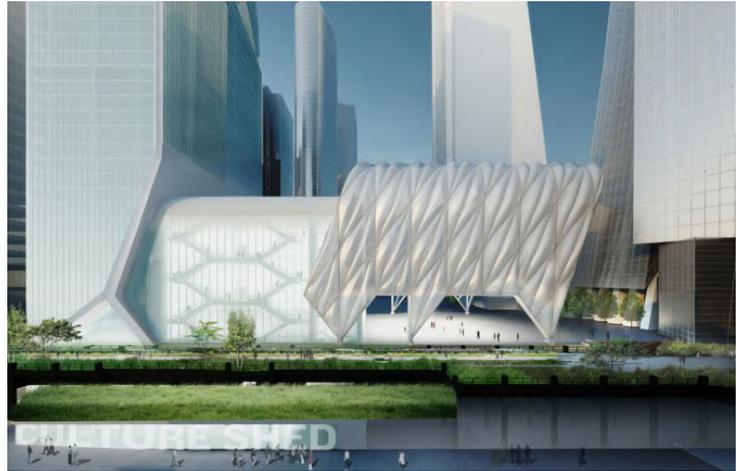
*Diller Scofidio + Renfro
Rockwell Group*

STRATEGIC PARTNER:

*Thornton Tomasetti
Jaros Baum & Bolles
Sciame Construction*

AWARDS:

*2020 AIA New York Design Awards,
Honor
2019 ENR New York Best Projects,
Cultural/Worship
2019 ENR New York Best Projects,
Project of the Year*



Credit: Rockwell Group

The Shed is a 200,000 SF multi-arts center that is host to performing arts, visual arts, and popular culture. The telescoping outer shell is a unique feature that expands and contracts when needed. The outside courtyard can be transformed into an enclosed space with the rolling shell, covered in translucent panels, that is temperature, light, and sound controlled. The theater is 17,000 SF and doubles in size when the shell is extended.

Langan's environmental services at the Shed included site-wide investigation and remediation oversight, as required by the NYC Office of Environmental Remediation pursuant to a Hazardous Materials and Noise Attenuation E-Designation. Remedial oversight included daily excavation observation, imported and exported material tracking, and air monitoring for odor, vapor, and dust. Langan also coordinated with the project team and regulatory agencies throughout the project, from preparation of work plans (in support of permit issuance) through approval of remedial closure and noise installation reports (in support of certificate of occupancy issuance).

Langan conducted a geotechnical engineering study for the site and designed the support of excavation and deep foundations. Langan also provided special inspections services during excavation and foundation construction.

Our survey team prepared an ALTA survey for financing purposes and 3D laser scanning of clearances in the parking garage and miscellaneous piping.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*

LOCATION:

New York, New York

CLIENT:

L&L Holding Company

ARCHITECT:

Foster + Partners (Design Architect)
Adamson Associates Architects
(Architect of Record)

STRATEGIC PARTNERS:

WSP
Tishman Construction
Gardiner + Theobald

AWARD:

2017 Architectural Review, MIPIM
Future Project Award



Credit: Foster + Partners

Langan provided multi-disciplinary engineering services for the renovation of this office building located in the Midtown East section of Manhattan. Services included a gut renovation and modernization/redesign of the pre-existing structure. Eight floors of the original building were retained and combined with a large vertical expansion. The resulting 47-story tower will stand nearly 900 feet.

Langan provided full geotechnical engineering services for the subsurface investigation, re-use of existing foundations determinations, and support of excavation design required for the new development. Our studies included a review of all available information, an engineering evaluation, and development of recommendations for the reuse of existing foundations. Challenging site constraints included the presence of an adjacent “cut and cover” Metropolitan Transportation Authority (MTA) tunnel, and the presence of adjacent lot line buildings.

Langan’s site/civil engineering services included permitting with the New York City Department of Buildings, MTA Metro North, and MTA New York City Transit Authority.

The building is expected to be the first New York City office tower to receive WELL-Certification.

SERVICES:

- *Phase I Environmental Site Assessments*
- *Subsurface Investigations*
- *Hazardous Materials Investigations*
- *Preparation of Demolition Specifications and Recycling/Salvaging Plans*
- *Engineering Services During Construction*
- *Air and Noise Monitoring*
- *LEED Certification and Verification Support*

LOCATION:

New York, New York

CLIENT:

Columbia University

ARCHITECT:

Davis Brody Bond LLP

STRATEGIC PARTNER:

Lend Lease



Langan was retained by Columbia University to serve as the lead environmental engineer and consulting firm for the university's Manhattanville Development expansion in the West Harlem section of New York City. The development and expansion is comprised of academic and research facilities, housing for graduate students, faculty, and other employees of Columbia University, as well as retail stores and open space areas.

Langan was responsible for all environmental requirements for pre-construction and foundation excavation of Phase 1 (block between West 129th and 130th Streets, Broadway and 12th Avenue) and pre-foundation excavation of Phase 2 (block between West 130th and 131st Streets, Broadway and 12th Avenue). This area represents an approximate footprint of nine acres.

Our services included environmental site assessments; soil, groundwater and hazmat investigations, and preparation of abatement, demolition, recycling/salvage plans, and specifications. We prepared soil and groundwater management plans and specifications, and LEED certification/verification support. Additionally, Langan negotiated investigation and remediation plans with New York City Department of Environmental Conservation for all spill issues, and the New York City Office of Environmental Remediation as the project is covered by "E" designations and Restrictive Declarations. We conducted remediation as required to remove above and underground fuel oil and gasoline storage tanks and systems. Our engineering oversight services included air (CAMP) and noise monitoring during remediation and Phase 1 foundation excavation.

Some of our accomplishments for Columbia include the successful completion of work plans and the university's environmentally sustainable design and overall project plan which earned LEED-ND (Neighborhood Development) Platinum certification; and rolling spill closure into the overall remedial program.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Environmental Engineering*

LOCATION:

New York, New York

CLIENT:

*Alexico Group
Hines*

ARCHITECTS:

*Herzog & de Meuron
Costas Kondylis and Partners
Goldstein, Hill & West Architects*

STRATEGIC PARTNERS:

*WSP
Cosentini Associates
Lend Lease
Urban Foundation Engineering*

AWARDS:

*2018 CTBUH Tall Building Awards,
Construction Award: Finalist
2018 ACEC New York Engineering
Excellence: Diamond Award
2017 ACEC Engineering Excellence:
National Recognition Award
2017 ACEC New York Engineering
Excellence: Diamond Award
2017 ENR Best of the Best Projects:
Residential/Hospitality
2017 ENR New York Best Projects:
Residential/Hospitality
2016 Concrete Industry Board Awards:
Award of Merit with Special
Recognition – Design
2011 Society of American Registered
Architects: Professional Design Award*



Rendering courtesy of Alexico Group

The site is located at the southwest corner of the intersection of Leonard Street and Church Street in the Tribeca section of Manhattan. The site, a 125- by 100-foot-deep rectangular parcel, consists of two adjoining lots previously occupied by the former New York Law School library building. The building consists of a 60-story 821-foot tall residential high-rise tower with a single cellar level.

Architects Jacques Herzog and Pierre de Meuron's condominium tower features dramatic, cantilevered terraces. It will be their first high-rise commission anywhere in the world.

Langan engineers provided site/civil, geotechnical and environmental services for this project. Geotechnical engineering services included subsurface investigation, foundation design development, supports on New York City Transit permitting process, Special Inspections on driven piles and drilled caisson installation.

Site/civil engineers were responsible for the Builders Pavement Plan, which included sidewalk grading and drainage design, and coordinating all first floor entrance elevations with the architect. Langan also assisted the design team to layout the new Con Edison transformer vaults.

Environmental services included soil investigation and management of regulated waste generated during construction.

SERVICES:

- *Site/Civil Engineering*
- *Environmental Engineering*

LOCATION:

Liberty Island, New York

CLIENT:

*The Statue of Liberty – Ellis Island Foundation, Inc.
National Park Service*

ARCHITECT:

FXCollaborative

STRATEGIC PARTNERS:

*DeSimone Consulting Engineers
Kohler Ronan Consulting Engineers
Atelier Ten
Quennell Rothschild & Partners
Phelps Construction Group*

AWARD:

*2020 ULI New York Awards for Excellence in Development
2019 ENR New York Best Projects, Cultural/Worship – Award of Merit
2019 ENR New York Best Projects, Excellence in Safety – Award of Merit
2017 International Design Awards, Architectural Design/Institutional: Silver
2017 Architectural Newspaper Best of Design Awards, Unbuilt – Landscape, Honorable Mention
2017 NYCxD Design Awards, On The Boards, Winner*



Credit: FXCollaborative; The Statue of Liberty-Ellis Island Foundation, Inc.; Statue of Liberty National Monument; and National Park Service

The Statue of Liberty Museum is a 26,000-SF freestanding museum located on Liberty Island. Once it opens in 2019, the building will triple the size of the current museum and help educate over 4.3 million annual visitors about the statue's history, influence, and importance in the world.

Design plans incorporate various sustainable features, including a landscaped roof with sweeping views of Lady Liberty and Lower Manhattan, bird-safe glass exteriors, and materials native to Liberty Island. In accordance with a FEMA Executive Order on floodplain management and resiliency, the museum will be set above 500-year flood levels and built to withstand hurricane winds.

Langan's scope of work includes site/civil engineering design, such as site grading, drainage, utility relocations, erosion control, sustainable stormwater design, floodplain consulting, and construction administration. We are also responsible for collecting and analyzing soil samples; developing technical specifications for contaminated materials; and providing waste characterization data. The contractor will use our characterization data to evaluate alternatives for reuse, recycling, and excavated soils.

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Environmental Engineering*
- *Land Use Planning*
- *Surveying*
- *Permitting*

LOCATION:

New York, New York

CLIENT:

New York University (NYU)

ARCHITECT:

*Davis Brody Bond
KieranTimberlake*



Credit: studioAMD, Davis Brody Bond & Kieran Timberlake

NYU is replacing Coles Sports Center with 181 Mercer, a 23-story, 735,000 SF mixed-use facility. The building features performance spaces, a 350-seat theatre, athletic facilities, student residences, faculty apartments, and a landscaped terrace. Designed under NYU's Climate Action Plan, 181 Mercer emphasizes sustainability with design strategies to reduce greenhouse gas emissions, water consumption, and generated waste.

Langan's services include conducting a survey of the site and adjacent subway tunnel; preparing documents for the E-designation noise and air quality requirements; and performing remedial investigation, waste characterization soil sampling, and reporting. We are also providing subsurface exploration, geotechnical consulting, support of excavation and underpinning design services, and monitoring the adjacent landmarked buildings and subway. Additionally, Langan provided site/civil and environmental services to support new Co-Generation lines from NYU's Co-Generation Plant to the 181 Mercer site. The new Co-Gen lines were required to be routed from the Plant, across two streets, and through the landmarked Silver Towers.

Langan assisted NYU during the execution and management of the ULURP process. Our work focused on a construction noise reduction, air emissions reduction, and fugitive dust control plan; construction protection plan; hazardous materials remedial investigation and remedial action plan; and stormwater best management practices plan.

Langan received approvals from the New York City Transit Authority and Department of Buildings for their support of excavation design on the project. Excavation support at the side of the site closest to the B, D, F, and M subway lines below West Houston Street incorporated a 30-foot-high below-grade foundation wall from the former building that occupied the site. The foundation wall was braced with steep-angled self-drilling hollow-bar anchors socketed into rock below the subway tunnel. Jet-grout-underpinning was designed to support the vertical loads imposed on the foundation wall and to facilitate excavation to the general subgrade. Localized excavations for proposed pits and caisson-caps extended up to about 12-feet below general subgrade and about 10-feet below the static groundwater table. Soil mixing was designed to support the localized excavations and provide a dry excavation to construct proposed pits and caisson caps.

JACOB K. JAVITS CONVENTION CENTER RENOVATION

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Environmental Engineering*
- *Phase I Environmental Site Assessment (ESA)*
- *Phase II Environmental Site Investigation (ESI)*
- *Surveying*

LOCATION:

New York, New York

CLIENTS:

*Empire State Development Corp.
NYS Convention Center Development Corp.*

ARCHITECT:

*FXCollaborative
Epstein*

STRATEGIC PARTNERS:

*Tishman
Ken Smith Workshop*

AWARD:

*2017 AIA New York State Excelsior Awards for Public Architecture, Renovation/Addition: Honor Award
2017 ULI Awards for Excellence in Development: Repositioning or Redevelopment Finalist*



Credit: Chris Cooper

The existing building, which is located in Midtown Manhattan's far west side, completed a major renovation and has achieved LEED Silver Certification. At the client's request, the design and construction management team successfully developed a plan that allowed the Javits Convention Center (JCC) to remain fully operational during its renovation and 110,000 SF expansion.

Langan's geotechnical engineering services included subsurface investigations of the expansion area and limited investigation within the existing JCC building to confirm soil conditions. A site specific seismic study was performed to develop the design response spectrum for the earthquake event. Foundation recommendations and design documents were prepared in conjunction with the structural engineer for new expansions sites; retrofitting of the existing building was completed to accommodate any major load increases. In addition, construction documents for the Lincoln Tunnel were reviewed and built into analyses for foundation and structural design.

The JCC expansion required the closure of West 39th Street and associated major utility rerouting. We provided site/civil engineering for the utility relocations including a water main, gas main, electric facilities and telecommunications. Services included permitting and close coordination with the New York City Department of Environmental Protection for sewer and water main design; the Parks Department for tree removals and plantings; the City and State Departments of Transportation for various street work; and the Port Authority for a major electric feeder relocation and to maintain continued facility accessibility.

Langan completed a comprehensive topographic and boundary survey of the JCC expansion area. Our survey included utilization of geophysical methods to locate all utilities around the site and entering the building.

We also performed a Phase I Environmental Site Assessment (ESA) and a Phase II Environmental Site Investigation (ESI). The Phase II ESI work included utility clearance, soil borings, groundwater monitoring wells, and collection/analysis of soil, groundwater, soil gas samples. Based on the Phase I ESA report, Langan prepared the Hazardous Material Section for the West Side Draft EIS. After the completion of the Phase II ESI, Langan helped prepare the Hazardous Material Section to support the West Side Final EIS.

SERVICES:

- *Geotechnical Engineering*
- *Site-Specific Seismic Study*
- *Pile and Footing Load Testing*
- *Special Inspections of Foundation Systems and Excavation Support Systems*

LOCATION:

Brooklyn, New York

CLIENT:

Forest City Ratner Companies

ARCHITECTS:

*SHoP Architects
AECOM Ellerbe Becket*

STRATEGIC PARTNERS:

*WSP
Thornton Tomasetti*

AWARDS:

*2014 ACEC NY Diamond Award
2013 ENR Best Projects – Winner
(Sports/Entertainment)
2013 ENR Best Projects – Winner
(Airports/Transit), Infrastructure
Improvements to Barclays Arena
2013 American Institute of Architects
New York Chapter Design Awards:
Honor Award
2013 Building Brooklyn Award:
Economic Development
2013 Municipal Arts Society of New
York MASTerworks Awards for
Neighborhood Catalyst*



Credit: 2013 Bruce Damonte

The Pacific Park project consists of the redevelopment of six city blocks in the Prospect Heights section of Brooklyn, NY. This massive development occupies over 22-acres, and is bordered by Atlantic Avenue and Flatbush Avenues. Active New York City Transit (NYCT) and Long Island Rail Road (LIRR) tunnels immediately abut the site.

The project entails the construction of ten high-rise structures, relocation of the LIRR rail yards, construction of a new LIRR platform and substation, a new NYCT subway station, as well as the Barclays Center, an entertainment center that will also be the new home arena of the professional NBA team the Brooklyn Nets. Six of the high-rise structures will be constructed on top of active LIRR rail yards at the Vanderbilt Yard.

Langan served as the geotechnical engineer for the arena that opened in September of 2012 and high-rise structures at the Vanderbilt Yard. The arena foundation consists of isolated spread footings bearing on the dense glacial till subsurface. The high-rise structures' foundations are a hybrid system consisting of spread footings, mat foundation, and strategically located high capacity drilled pile elements to support the superstructure, while satisfying bearing capacity requirements and minimizing settlements. Special load tests were performed to maximize footing and pile capacities.

The isolated spread footings at the arena and the combination of isolated foundation elements around the LIRR tracks was made possible by performing a site-specific seismic study that resulted in a favorable seismic designation, thus avoiding unnecessary seismic detailing and connections, and more importantly, foundation ties, saving the client millions of dollars.

SERVICES:

- Geotechnical Engineering
- Site/Civil Engineering
- Below-Grade Waterproofing Design
- Special Inspections During Construction
- Construction Administration

LOCATION:

New York, New York

CLIENT:

The Durst Organization

ARCHITECT:

Bjarke Ingels Group (BIG)

STRATEGIC PARTNERS:

Thornton Tomasetti
Hunter Roberts Construction Group

AWARDS:

2017 ArchDaily Building of the Year
2017 ULI Awards for Excellence in Development: Housing Development Finalist
2016 ENR New York Best Projects Awards: Residential Hospitality
2016 CTBUH Best Tall Building Americas
2016 Architect Magazine Residential Architect Design Award, Multifamily Housing: Award
2016 Architectural Record Top 10 Projects
2016 New York Times Best Architecture in New York
2016 SARA|NY Excellence in Residential Design Innovation Award
2015 6SQFT Building of the Year
2012 AIA NY Design Merit Award



Credit: Bruce Damonte

Regarded as a cross between Copenhagen-style residential courtyards and a New York City skyscraper, this mixed-use residential building will be separated from the Hudson River by the busy entrance ramps of Manhattan's West Side Highway and the picturesque Hudson River Park. This 38-story tower includes 709 residential units (with 25% dedicated to affordable housing) and ground floor retail space. A massive outdoor courtyard, cut into the center of the building, adds to the structure's unique shape. The development has a footprint of approximately 96,000 SF with 45,000 SF of retail space.

Langan's geotechnical engineers reviewed site geology and performed a subsurface investigation consisting of borings, test pits, groundwater monitoring and seismic cone penetrometer testing under our full-time inspection. Shallow perimeter probes were drilled along 57th Street to determine the extent of obstructions along the southern portion of the site. Our investigation also included a review of a preliminary geotechnical investigation performed by another firm.

Langan site/civil engineers developed the site grading, site water, storm drainage and sanitary sewer design for the project. In consideration to the structure's unique dimensions, we performed a 'gutter study' that reviewed capacities for the window washing tracks and gutter systems as well as forces in play by the velocity of water at the base of the structure.

SERVICES:

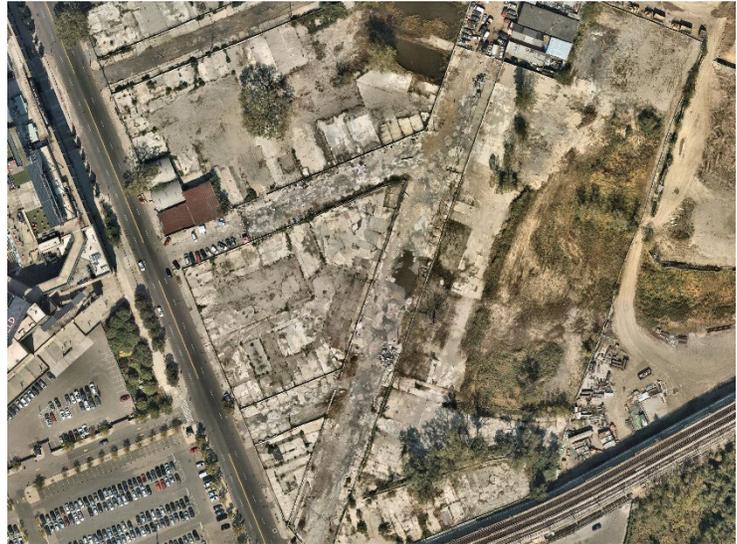
- *Geotechnical Engineering*
- *Environmental Engineering*
- *Site/Civil Engineering*
- *Surveying*

LOCATION:

Flushing, New York

CLIENT:

*The Related Companies
Sterling Equities
New York City Economic Development
Corporation*



The redevelopment of Willets Point, a 23-acre region adjacent to Citi Field, will create a new mixed-use neighborhood. Langan is providing multi-disciplinary services to develop the first 8-acre parcel, which includes 1,100 units of affordable housing, publicly accessible open space, a public elementary school and new infrastructure.

Langan's environmental team developed and implemented a waste characterization plan to determine the site's eligibility for the Brownfield Cleanup Program (BCP). As part of the BCP, we developed an Interim Remedial Measures plan to treat areas of elevated contamination. The remainder of the site will be remediated under a Remedial Action Work Plan. The team also developed a plan which proposed targeted soil remediation incorporating future building, utility, and roadway foundations into the environmental design.

To prepare the site for future development, Langan provided preliminary site/civil services for several thousand linear feet of new NYCDEP sewer and water infrastructure. Langan developed schematic design plans and bridging docs for 800 LF of 7'x5' box storm sewer, 1,000 LF of 18" dia. sanitary sewer, and 1,200 LF of 72" dia. steel water main. To date, this is the largest water main replacement work Langan has been a part of in the greater NYC area.

Langan's geotechnical group was heavily involved in the design of the linear utilities due to the site's poor soil quality and high groundwater table. A comprehensive investigation program for the proposed utilities including over 30 borings, 15 shallow test pits, and 5 deep test pits to explore the condition of DEP's existing infrastructure.

Langan's survey group performed mobile mapping services to produce high-quality topographic information quicker than through traditional methods. Topographic, boundary and utility survey were also completed for the entire 23-acre property and the surrounding roadway network.

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Traffic Engineering*
- *Surveying*
- *Planning Services*

LOCATION:

Jersey City, New Jersey

CLIENT:

Kushner Companies

ARCHITECT:

Woods Bagot



Credit: Woods Bagot

Langan is providing site/civil, geotechnical and traffic engineering, planning, and surveying services for a proposed mixed-use development in the Journal Square section of Jersey City. The development will consist of two high-rise towers measuring 46 and 69 stories over a 10-floor podium and will include 1,725 residential apartments, approximately 89,000 SF of retail, 127,000 SF of office space, and 78,000 SF of amenities space. The development is adjacent to the Journal Square PATH Station.

Project challenges include the design of the new two high-rise towers in close proximity to the Journal Square PATH Station and maintaining existing utility services to the neighboring facilities to the north of the project site. Additional challenges include the coordination of a cellar level approximately 20 feet below grade.

Langan submitted and received approval for Site Plan applications to the City of Jersey City and Hudson County indicating compliance with the City's Redevelopment Plan and land development standards. Langan will prepare and submit the NJDEP Treatment Works Approval, NJDEP Water Extension Permit and the Soil Erosion and Sediment Control permit. Technical specifications will also be prepared for all aspects of the site, geotechnical and traffic work as the project progresses.

SERVICES:

- Geotechnical Engineering
- Site/Civil Engineering
- Surveying
- Environmental Permitting
- Environmental Impact Statement
- Wetlands Mitigation
- Environmental Remediation

LOCATION:

*Meadowlands Sports Complex
East Rutherford, New Jersey*

CLIENT:

Triple Five Development

ARCHITECTS:

*Gensler
Adamson Associates Architects
(Architect of Record)*

STRATEGIC PARTNERS:

PCL Construction Services, Inc.



Langan is assisting Triple Five Development with the American Dream Meadowlands Project at the Meadowlands Sports Complex, formerly called the Meadowlands Xanadu Redevelopment Project. American Dream Meadowlands will be a unique and visually compelling 3.2 million SF entertainment and retail complex, incorporating exciting and participatory sports and entertainment venues, such as an indoor water park, indoor amusement park and indoor ski slope for the entire family.

Langan is providing site/civil engineering, geotechnical engineering, surveying, environmental engineering, and permitting services to obtain entitlements for the new indoor amusement park and water park component of the project. The parks will cover approximately 12 acres and become the entertainment centerpiece of the project. The amusement park will include a ferris wheel, for which Langan recommended a foundation system situated to bypass compressible historic fill, marsh deposits, and varved clay to the underlying shale bedrock.

Langan is the designated Licensed Site Remediation Professional (LSRP) for the parks. Langan prepared applications for all necessary State (NJDEP) and Federal (USACE) approvals, including the preparation of a Supplemental Environmental Impact Statement for a unique Consultation Process performed by the New Jersey Sports and Exposition Authority (NJSEA). Project studies included a wetland delineation, jurisdictional determination, wildlife habitat suitability assessment, preliminary assessment, site investigation, remedial action workplan and cultural resource evaluation.

SERVICES:

- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Environmental Engineering*
- *Traffic/Transportation Engineering*
- *Permitting*
- *Survey*

LOCATION:

Philadelphia, PA

CLIENT:

University of Pennsylvania Health System

ARCHITECT/CONTRACTOR:

*PennFIRST Integrated Project Delivery Team:
HDR Architecture
Foster+Partners
L.F. Driscoll
Balfour Beatty
BR+A*



Credit: Penn Medicine

In an effort to expand their rapidly growing network, Penn Medicine has assembled one of the first integrated project delivery (IPD) teams on the East Coast for the design and development of a new patient pavilion, located in Philadelphia's University City area. The new clinical facility will include approximately 500 new patient beds, 50 operating and procedure rooms, a relocated and expanded Emergency Department, 700 space substructure parking lot, and expanded healthcare delivery programs within the network.

The existing site is a 3-acre parcel where the Penn Tower and Penn Tower parking garage currently exist. The site is bound by 34th/33rd Street to the northwest, Convention Avenue to the south and east, and the Penn Museum to the northeast.

As part of the project team, known as PennFIRST, Langan is providing a multitude of services including site/civil and geotechnical engineering, environmental consulting, permitting and survey.

SERVICES:

- *Geotechnical Engineering*
- *Value Engineering*

LOCATION:

Pittsburgh, Pennsylvania

CLIENT:

PNC Financial Services Group

ARCHITECT:

Gensler

STRATEGIC PARTNERS:

Buro Happold



Credit: Connie Zhou/OTTO

The Tower at PNC Plaza 33 stories high and is considered to be the world's greenest tower. Foundation excavation was completed in 2013; building construction is expected to be completed in 2015.

Langan developed caisson design parameters for the building based on field-load test data, test-drilling results, and available site-specific geotechnical information.

Robust caissons were designed for the structure based on parameters recommended by another engineering firm. A full-scale caisson load test was then performed at the site. Langan reviewed the subsurface and load-test data and developed caisson design parameters based on the data and our experience with similar structures. Our recommended design parameters led to a less-robust foundation system and considerable cost savings and schedule reductions. Design completion included full-time Langan observation during deep foundation construction.

Compiling and reviewing data, performing the design procedure properly, and determining suitable design factors of safety took sufficient experience and engineering judgment to properly execute.

SERVICES:

- *Geotechnical Engineering*
- *Environmental Engineering*
- *Construction Observation*

LOCATION:

Arlington, Virginia

CLIENT:

Turnberry Associates

ARCHITECT:

BBGM

STRATEGIC PARTNER:

SK&A Structural Engineers



Turnberry Tower is a 25-story, 247-unit, high-end luxury condominium. The building soars nearly 400 feet above the Potomac River, and is the tallest luxury condo building in the Washington, DC metropolitan region. The 920,000 SF, \$250 million project also includes a six-level below grade parking garage.

Langan's role as the environmental and geotechnical consultant included evaluating and overseeing the asbestos abatement process during demolition of the existing hotel, assessing the potential impact of off-site environmental concerns during construction and assessing low-level contamination issues on site. Langan designed and oversaw the geotechnical aspects of the project, which included design-build excavation support systems, underpinning, removal of rock by mechanical and blasting means, construction of high-bearing pressure footings, implementation of a permanent sub-slab drainage system and monitoring of excavation support system, building and blasting movements and vibrations.

SERVICES:

- *Environmental Engineering*
- *Geotechnical Engineering*

LOCATION:

Atlanta, Georgia

CLIENT:

New Stadium Development Company

ARCHITECT:

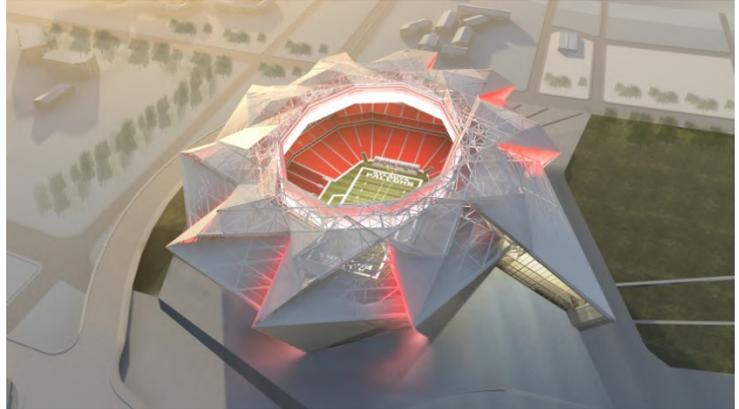
*HOK (360 Architecture)
Goode Van Slyke Architecture
Stanley Beaman & Sears
tvsdesign*

STRATEGIC PARTNER:

ICON Venue Group

AWARDS:

LEED Platinum Certified



Langan was retained as the environmental and geotechnical engineer-of-record for Mercedes-Benz Stadium, home of the Atlanta Falcons. The 1.8 million SF, 71,000-seat retractable roof stadium opened for the 2017 NFL Season; it is the world's first LEED Platinum-certified professional sports stadium.

The current site houses various parking lots, but before 1990 served as a railroad yard for the Atlanta, Birmingham & Atlantic Railroad.

Langan's scope of work included the completion of a Phase I ESA to identify any potential environmental concerns at the site; Phase II field work and full-time, on-site observation by one of Langan's environmental engineers; a geotechnical investigation consisting of 10 soil borings to obtain site-specific information regarding the characteristics of the soil and rock; investigations for roadway relocations; supplemental field and laboratory reports; and consultation during the design development and construction phases.

As the geotechnical and environmental consultant on the project, Langan continued its role throughout construction by providing asbestos abatement oversight, monitoring and testing of excavated soils to comply with the environmental soils management plan, underground storage tank closure management, storage tank closure assessments, vibration monitoring within the Marta Tunnel structure and geotechnical oversight of various foundation and ground improvement systems. Langan's geotechnical oversight role included the observation, monitoring and testing for drilled piers, augured cast in place piles, vibro piers, over excavation and replacement of unsuitable material, admixture stabilization via soil cement, shallow foundation subgrades, compacted fill and backfill as well as overall coordination.

SERVICES:

- *Geotechnical Engineering*
- *Environmental Assessment*
- *Pre-Demolition Asbestos Survey*
- *Pre-Construction Conditions Survey*
- *Vibration Monitoring*

LOCATION:

Miami, Florida

CLIENT:

1000 Biscayne Tower, LLC

ARCHITECT:

Zaha Hadid Architects

STRATEGIC PARTNER:

DeSimone Consulting Engineers

AWARDS:

2020 CTBUH Award of Excellence, Best Tall Building 200-299 Meters
2020 CTBUH Award of Excellence, Structural Engineering
2019 ENR Best of the Best, Residential/Hospitality
2018 ENR Global Best Projects, Specialty Construction – Global Best Project Award



Courtesy of 1000 Museum by Zaha Hadid Architects

One Thousand Museum will be the first high-rise building in the Western Hemisphere designed by Pritzker Award winner Zaha Hadid. This ultra-luxury residential building will rise 62-stories and ultimately stand out amongst its neighbors at 710- feet-tall. The project fronts historic U.S. Highway 1 in the heart of Downtown Miami. Former uses of the site included a gas station and a pawn shop.

At the onset of project development, Langan provided environmental services to assist with issues related to the existing gas station and pawn shop. Langan performed a pre-demolition asbestos survey of the existing structures. On behalf of the developer, Langan provided services during the tank closure and assessment accomplished by the former tenant and their consultants.

As the geotechnical engineer-of-record Langan prepared the geotechnical study and is currently overseeing the installation of high-capacity, Augered Cast-In-Place (ACIP) piles for support of the tower and podium structures. Foundation installations involved typically installing piles to 155 feet below grade with piles extending to maximum depths of 170 feet. At 170 feet, these piles are the longest ACIP piles installed in the world to date.

SERVICES:

- *Tender and Contract Phase Support*
- *Subsurface Exploration*
- *Geotechnical Engineering*
- *Geotechnical Interpretative Report*
- *Foundation Design*
- *Support during Ground Improvement Programs*
- *Monitoring During SOE Construction*
- *Geotechnical Instrumentation Monitoring during Tunneling*
- *Construction Administration*
- *Support during Differing Site Conditions claim & Dispute Resolution Board Hearings*

LOCATION:

Miami, Florida

CLIENTS:

*Florida Department of Transportation
Miami-Dade County
City of Miami
Miami Access Tunnel, LLC*

STRATEGIC PARTNERS:

*Bouygues Civil Works Florida
Jacobs Engineering Group*

AWARDS:

*American Council of Engineering Companies
Florida Engineering Society
American Society of Civil Engineers
American Road & Transportation Builders Association
Project Finance Magazine*



PortMiami Tunnel (PMT) was constructed to provide a direct link between PortMiami and the Interstate Highway network. On a daily basis, 20,500 cars, trucks and buses flow through the tunnel and away from downtown Miami's congested surface streets – supporting the increased growth at PortMiami, one of the largest cruise and cargo ports in the United States.

A 42-foot diameter tunnel-boring machine (TBM) was used to construct dual 37-foot finished diameter, 4,300-foot-long two-lane tunnels between two man-made islands and under the Biscayne Bay shipping channel. PMT was delivered as a public-private partnership with an aggressive 55-month, fast-track design and construction schedule, followed by a 35-year concession period.

This project represents the first large-diameter tunnel constructed using a TBM in Florida's challenging soft sedimentary geology. The project also required some of the largest and deepest supported excavations performed in Miami, as well as approximately 2.5 miles of roadway and access improvements including the widening of the MacArthur Causeway Bridge/I-395 over Biscayne Bay.

As a consultant to the design-build team, Langan performed the subsurface investigation and geotechnical engineering evaluation required for the design of the TBM, tunnels, entry/exit shafts, ground improvement, and associated roadway and access improvements. Langan also provided support during the tender phase, participated in the preparation of the technical proposal and contract negotiations and provided support during a Differing Site Conditions claim and ensuing dispute resolution proceedings.

Langan also provided construction administration including support and monitoring of bridge foundations, support of excavation systems for TBM entry/exit shafts, ground improvement (grouting, shallow cement-soil mixing, and cutter-soil mixing) and geotechnical instrumentation monitoring.

SERVICES:

- *Site/Civil Engineering*

LOCATION:

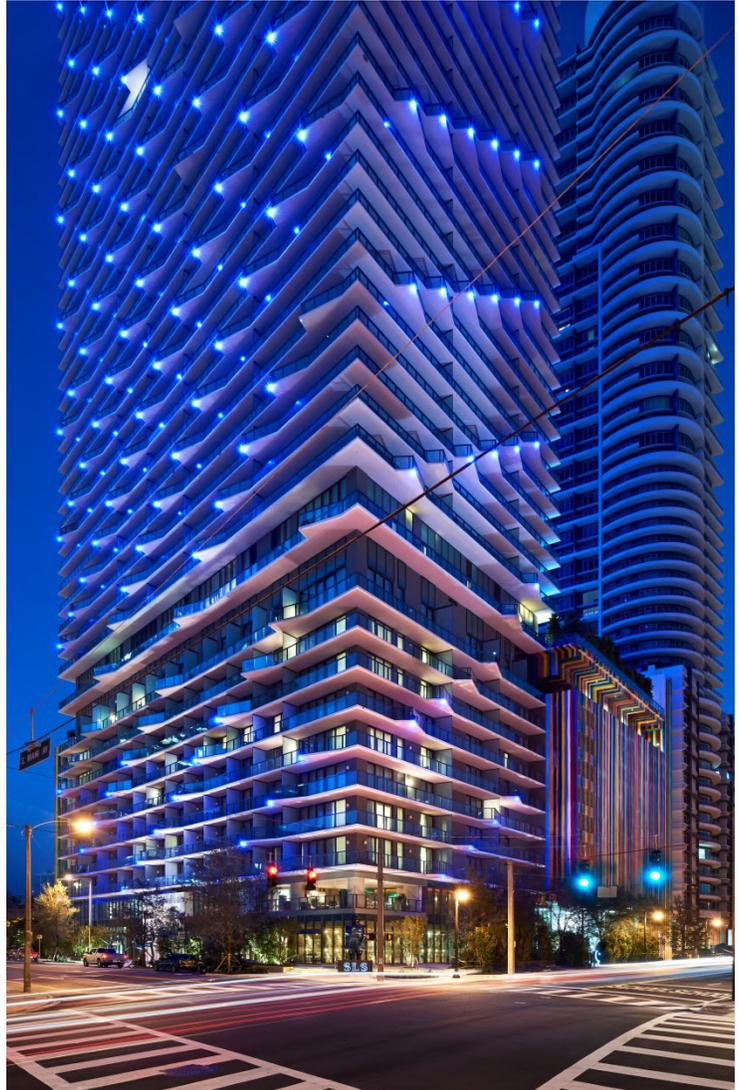
Miami, Florida

CLIENT:

Related Group of Florida

ARCHITECT:

Arquitectonica



This mixed-use tower is located in the downtown Miami area. The 465-foot-high tower includes a residential condominium and hotel tower with retail and restaurant space on the ground level.

As the site/civil engineer, Langan was instrumental in overcoming design challenges presented by the relatively large elevation change across the site and meeting drainage requirements for a Florida Department of Transportation (FDOT) right-of-way.

Langan coordinated very closely with the architect and project team to place the required water services in a compact location to maintain a large area for publicly accessible space along the project's main frontage.

Langan provided final construction documents for the project and coordinated with FDOT, City of Miami, Miami-Dade County RER, and Miami-Dade County Water and Sewer Department to obtain the required permits.

SERVICES:

- *Geotechnical Engineering*
- *Site/Civil Engineering*
- *Environmental Engineering*

LOCATION:

Miami, Florida

CLIENT:

Swire Properties

ARCHITECT:

Arquitectonica

AWARDS:

2017 Architectural Newspaper Best of Design Awards, Mixed-Use, Honorable Mention



Rendering courtesy of Arquitectonica

Langan is providing geotechnical, site/civil, and environmental engineering services for this mixed-use development located in the Brickell Financial District. The development will consist of a high-rise building with two parking levels below grade, three levels of retail beginning at street level, and 72 levels of hotel, residential and office space. The project, which is anticipated to be over 1,040 foot tall, would become the tallest tower in Miami as well as the Southeast United States.

In preparation for the design of the stormwater management system, Langan conducted specific capacity tests to estimate the capacity of deep stormwater drainage wells. The tests involved drilling by reverse air rotary to 175 feet below grade and looking for competent rock that would maintain an open hole. Langan identified zones in which the specific capacity ranged from 100 gallons per minute per foot of head (gpm/foot) to nearly 1,000 gpm/foot. Langan also prepared a Reasonable Assurance Report as part of the client's permit package for the drainage wells, which are permitted by the Florida Department of Environmental Protection.

FONTAINEBLEAU HOTEL AND CONDOMINIUM

SERVICES:

- *Geotechnical Engineering*
- *Phase I and II Environmental Site Assessments*
- *Asbestos Survey*
- *Tank Closure Assessment*
- *Coastal and Environmental Regulatory Consulting Services*

LOCATION:

Miami Beach, Florida

CLIENT:

Turnberry Associates

ARCHITECT:

*HKS
NBWW*

STRATEGIC PARTNER:

Walter P. Moore Consulting Engineers



Langan provided integrated and cost-effective environmental, geotechnical, and asbestos services for the \$1B renovation and expansion of this historic property. The 1M SF project includes a four-story convention center; 15- and 17-story towers; two, 10-story structures; three levels of the Fontainebleau Hilton Hotel Chateau; a 36-story tower with adjoining podium and garage; and a host of ground-level amenities.

Geotechnical engineering services included a study to evaluate the use of long and short augercast pile alternatives for the 36-story tower and adjoining podium and garage as well design recommendations for dewatering foundation excavations. After extensive interaction and evaluation, the short pile alternative was chosen. Additionally, a comprehensive and innovative pile load testing program led to the further shortening of piles. Together, these solutions produced substantial cost savings.

Environmental services included Phase I and II Environmental Site Assessments (ESAs) and a geophysical investigation to map out the existence of utility lines, foundations, and/or other buried structures. ESA activities prompted the discovery of an improperly abandoned underground petroleum storage tank and subsequent tank closure assessment. The closure assessment involved collecting and analyzing soil and groundwater samples in accordance with the tank closure requirements of the Florida Department of Environmental Protection (FDEP) and Miami-Dade County Department of Environmental Resources Management. Asbestos surveys of the entire property were conducted to meet permit and regulatory requirements for existing on-site structures planned for renovation and demolition.

Coastal and environmental regulatory consulting services addressed mandatory permitting requirements in accordance with FDEP. These services required close coordination with the architects, owner, and FDEP to ensure that structures and hardscapes east of the Coastal Construction Control Line (CCCL) were in compliance with FDEP coastal regulations.

SERVICES:

- *Geotechnical Engineering Study*
- *Deep Foundation Load Testing*
- *Pile Installation Observation*
- *Pre-Construction Conditions Survey*
- *Vibration Monitoring*
- *Dewatering Consultation*
- *Litigation Support*

LOCATION:

Sunny Isles Beach, Florida

CLIENT:

Regalia Beach Developers, LLC

ARCHITECT:

Arquitectonica

STRATEGIC PARTNERS:

DDA Engineers, P.A.



Credit: Regalia Beach Developers, LLC

This 44-story luxury condominium is located in the northernmost end of Sunny Isles Beach, where excessive settlements of high-rise towers have been observed and documented.

The tower is abutting the property of an existing single-family residence, and is only about four feet away from the structure and other amenities. Our geotechnical recommendations addressed any adverse impacts of the proposed construction to the adjacent residence.

Langan provided foundation-related services, including a geotechnical engineering study, deep foundation load testing and installation inspection, and a detailed building settlement analysis. Additionally, Langan provided vibration monitoring and dewatering consultation, and conducted a pre-construction conditions survey.

Langan's expertise has enabled the project to be designed on a deep foundation system to accommodate anticipated building settlement without using excessively-deep auger cast-in-place piles. Langan also provided litigation support services in frivolous lawsuits initiated by the northern neighbor prior to construction.

SERVICES:

- *Geotechnical Investigation*
- *Seismic Engineering*
- *Environmental Engineering*

LOCATION:

San Francisco, California

CLIENT:

Oceanwide Holdings

ARCHITECTS:

*Foster + Partners
Heller Manus*

GENERAL CONTRACTORS:

Swinerton | Webcor Joint Venture



Credit: Foster + Partners

Oceanwide Center will become San Francisco's second tallest development with the longest deep foundations constructed in San Francisco. The \$1.6 billion development includes two high rises, soaring 910 and 605 feet tall, with a 68-foot tall open-air plaza. The taller tower will be comprised of 1.1 million SF of office space and ultra-luxury residences while the second tower will feature San Francisco's first Waldorf Astoria Hotel and Branded Residences.

A total of 101 drilled shafts were installed to support the two towers. Due to the depth of bedrock, which ranges from 260 to 270 feet beneath street grades, and loading demands the drilled shafts were installed up to 330 feet in length. Excavations for the basements will also be among the deepest in the history of San Francisco. Excavations for the basements for the two towers will extend about 72 feet (four levels) and 65 feet (three levels) respectively, and will interconnect on the three upper levels. Langan managed a geotechnical investigation and performed engineering analyses to develop design recommendations for foundations, shoring, and construction considerations for developing in unique subsurface conditions. Our services also included a probabilistic and deterministic seismic hazard analysis to develop site-specific horizontal spectra and a soil-structure interaction analysis to integrate the response of the structure and surrounding soil to model the earthquake forces the building could experience. With the project now in construction, Langan is observing installation of the shoring and deep foundations.

Our environmental team conducted Phase I and Phase II Environmental Site Assessments in which we sampled and tested the soil and groundwater at the site to satisfy the requirements of the San Francisco Public Health Code Article 22A (Maher Ordinance). After the conclusion of the sampling and analysis, Langan prepared the required Site Mitigation Plan (SMP). In our SMP, which the San Francisco Department of Public Health (SFDPH) approved, we outlined soil handling procedures to follow and mitigate potential risks of exposure during soil excavation and grading activities. We currently provide oversight services during these activities. Upon completion, our team will prepare the required site closure report and submit it to the SFDPH for approval and to obtain a No Further Action (NFA) letter for the property.

SERVICES:

- *Environmental Engineering*
- *Landfill Gas Modeling and Mitigation Design*
- *Regulatory Compliance*
- *Site/Civil Engineering*
- *Geotechnical Engineering*
- *Methane Mitigation Design*

LOCATION:

Santa Clara, California

CLIENTS:

*Related Urban
City of Santa Clara*



The \$2 billion-plus City Place Santa Clara Landfill post-closure development is an example of how complex projects benefit from our multi-discipline collaboration to manage engineering and regulatory challenges. The process necessitates significant City and community involvement with the developer and Langan to shape the potential redevelopment, which will culminate in a Master Development Plan for the site. The 240-acre site is a former all-purpose landfill. Plans are for mixed use: office, hotel, retail, restaurant, entertainment, residential, and parking. Langan provides services for all project phases. We integrated the design and coordination process, and applied our site knowledge and understanding of site/civil, environmental, and geotechnical conditions to ensure compliance within the regulatory environment. Some of our key tasks include:

- Preparing an Engineering Feasibility Report, summarizing the results of our document review and geotechnical, environmental, and site/civil engineering analysis and assessments of the existing landfill conditions and impacts to the development.
- Conducting Phase I and II Environmental Site Assessment Investigation.
- Providing landfill gas modeling and mitigation system design services.
- Preparing a preliminary geotechnical investigation report.
- Providing site/civil services, including layout, grading, drainage, stormwater management, utilities, and Environmental Impact Report (EIR) technical support.
- Preparing an environmental regulatory roadmap for project approval by the Regional Water Quality Control Board, Local Enforcement Agency, the City of Santa Clara, CAL Recycle, and others.
- Responding to Waste Discharge Order provisions on volatile organic compound and emerging contaminants transport in leachate and groundwater and reviewing the City's groundwater monitoring reports (groundwater, surface water, landfill gas, etc.).

SERVICES:

- *Phases I and II Environmental Site Assessment*
- *Soil Management Plan*
- *Soil and Groundwater Sampling*
- *Underground Storage Tank Removal*
- *Construction Oversight*
- *Closure Reports*

LOCATION:

San Francisco, California

CLIENT:

Transbay Joint Powers Authority

ARCHITECTS:

*Adamson Associates Architects
(Architect of Record)
Pelli Clarke Pelli
(Design Architect)*

STRATEGIC PARTNER:

Webcor



Langan provided environmental consulting services from 2007 for the demolition of the former Transbay Transit Center and ramps — which spanned three city blocks — through construction of the new \$4.5 billion transit center in downtown. The new transit center centralizes the Bay Area regional transportation network. It consists of below-grade levels for trains, above-grade levels for buses, and a rooftop public park.

During demolition phase, Langan oversaw all soil removal and disposal activities, including sampling and profiling the soil and groundwater as well as abating the lead, asbestos, PCB, and universal waste. The excavation is 65 feet deep and 1,300 feet in length, involving about 510,000 cubic yards of soil. We prepared the required close out documentation at the end of the excavation. We obtained regulatory closure of the environmental aspects with no further action required.

Langan also conducted environmental monitoring during construction. Development of the new transit center involves archeological investigations, shoring wall installation, construction of a buttress for the adjoining property, timber pile removal and disposal, utility relocation, and the mass excavation for the new Transbay Transit Center.

SERVICES:

- *Subsurface Investigations*
- *Foundation Recommendations*
- *Dewatering Design/Consultation*
- *Foundation Construction Inspection and Certification*
- *Excavation & Shoring Consultation*
- *Permanent Subdrain System Recommendations*

LOCATION:

Las Vegas, Nevada

CLIENT:

Turnberry Associates

ARCHITECT:

Robert M. Swedroe Architects



The five star Turnberry Place development in the heart of the Las Vegas Strip consists of four, 40-story condominium towers and an expansive club facility. The size of the structures, the sequencing of construction, and depressed parking levels created specific geotechnical and construction challenges.

Subsurface conditions consisted of highly stratified Las Vegas Valley alluvium to the maximum depths explored of 150 feet. Specifically, the soils consisted of intermixed layers of silty sand, silty clay, clayey silt with varying fractions of fine to coarse gravel. The soils were typically dense to very dense or stiff to very stiff. Layers of “caliche” or cemented soils were found within distinct zones throughout most of the site. Groundwater was encountered at a shallow depth of about 10 feet.

The most appropriate and cost-effective foundation solution was a mat foundation alternative. The neighboring tower to the north is supported on drilled shafts, a much more conservative and costly foundation alternative. Results of tower 1 monitoring indicated maximum settlements of 1½ to 2¾ inches which was below our theoretically estimated maximum, and structurally tolerable, 3 to 4 inches.

Geotechnical recommendations were also made for construction dewatering and a permanent sub-slab drainage system for a depressed garage floor, 12-feet below the static groundwater level. Our recommendations for steeply sloped construction excavations, in lieu of a temporary shoring system, saved about \$800,000 in construction costs.