



Gall Zeidler Consultants

Geotechnics | Tunnel Design | Engineering

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Dominic Reda

Senior Tunnel Engineer

Years of Experience

13

Education

M.Sc., Civil Engineering, Polytechnic Institute of New York University, 2011

B.Sc., Civil Engineering, Polytechnic Institute of New York University, 2008

Professional Associations

American Society of Civil Engineers (ASCE), Underground Construction Association (UCA) Young Members of the Society for Mining, Metallurgy & Exploration (UCA of SME)

Key Qualifications

Dominic Reda has been involved in a number of national and international tunneling projects, primarily in urban settings. His professional activities ranged from project management and design of tunnels and underground structures, independent design checks, tunnel excavation and support inspection, to waterproofing and final lining inspection. He has experience in the development of shop drawings and conceptual to final design drawings for various projects. He has also been responsible for the development of standards / specifications for small and large scale projects and is familiar with analysis of underground structures in both two and three-dimensional numerical modeling programs and in particular, surface settlements and the potential impacts on the existing infrastructure.

Mr. Reda's inspection services encompassed shotcrete inspection and testing, waterproofing inspection and testing, drainage system testing, examination and documentation of existing structural conditions, and leakage assessment of final structures. His most recent experience includes supervisory roles on the design development and design review of high profile tunneling projects.

Relevant past project experience includes:

Railroad/Transit

No. 7 Subway (Flushing) Access Improvements at Grand Central Station, New York City Transit (NYCT), New York, New York (2018-present): To relieve projected congestion and overcapacity due to increased ridership between the Lexington Avenue Line and the Flushing Line at Grand Central Station, NYCT will implement a series of packages to improve access and passenger circulation for the interchange, including widening of existing stairways and the construction of a new passageway and break in of the existing Flushing Line Station cavern arch. To limit disruption to the Flushing Line service, an innovative design solution with the implementation of a protective canopy above the eastbound track to allow for safe train operations during construction. Mr. Reda is leading the Preliminary Design for the planned SEM passageway and connection to the existing station cavern including the establishment a comprehensive

instrumentation and monitoring program, construction staging areas, procedures for much removal and delivery of materials, as well as, Bridging Documents for Design-Build Procurement.

Hudson Tunnel Project, Amtrak, Secaucus, New Jersey to New York, New York (2017-present): The Hudson Tunnel Project has been proposed to increase Amtrak's NEC service and NJ Transit's commuter rail service between New Jersey and New York Penn Station with the construction of two new TBM single-track tunnels through the Palisades and underneath the Hudson River. Upon completion of the new tunnels, the existing twin-track North River Tunnel will undergo rehabilitation. Gall Zeidler Consultants is providing Program Management Support Services for Amtrak, which includes providing input for the Environmental Impact Statement, review of the project construction schedule, construction staging and logistics, cost estimating, and contract packaging, review design drawing and specification development, developing procurement documents, as well as, evaluating construction bids for at-grade and viaduct structures, as well as, TBM and SEM tunneling in both hard rock and soft ground.

West Seattle-Ballard Link Extension, Sound Transit, Seattle, Washington (2017-present): Phase 1 (Alternatives Development) of the three project phases aims to identify the preferred tunnel alignment for the West Seattle-Ballard Extension. Phase 2 and Phase 3 covering the Draft EIS and Conceptual Engineering and Final EIS/ROD and Preliminary Engineering, respectively, will further develop the preferred alternative. As part of the Phase 1 design team, Mr. Reda will be reviewing Single Bore vs. Twin Bore alignments and designs, underground station construction schemes, side-by-side vs. stacked alignments and stations, tunneling impacts to the existing infrastructure, as well as, TBM/SEM Engineering, Cost Estimating, and Value Analysis.

BART Silicon Valley Phase II Extension Project, Santa Clara County Transportation Authority, San Jose, California (2017-present): Phase II is a 6-mile extension from the current Phase I Berryessa Station terminus through Downtown San Jose to a new station and terminus in Santa Clara. This extension includes 5.0 miles of running tunnels through San Jose; four stations, of which three are underground (Alum Rock, Downtown San Jose, and Diridon), and one at grade station (Santa Clara); two intermediate ventilation structures, and East and West tunnel portals. Mr. Reda is part of the Project Management Team for the Single-Bore, double-track tunnel. His duties include conceptual engineering development for mined SEM tunnels, evaluating ground conditions and required ground treatment measures, evaluation of ground settlements and impact on surrounding surface structures and utilities, evaluate mitigation strategies for limiting surface settlements, constructability reviews of engineering design for SEM mined structures, perform reviews of the engineering work products at various stages of development, assist in the development of a Risk Register, and Participate in independent value engineering reviews.

High Speed Two (HS2) Sector C1, High Speed Two Limited (HS2 Ltd), London, United Kingdom (2017-present): HS2 Sector C1 is located within the Central Delivery Area and is essentially rural in nature. The Sector runs from the Colne Valley Viaduct South Embankment to the Chiltern Tunnel North Portal, a distance of 13.6 miles (21.89 kilometers). The Chiltern Tunnel comprises of twin bored tunnels extending approximately 9.8 miles (15.8 kilometers) in length. There are five ventilation and intervention shafts (vent shafts) for the Chiltern Tunnel, located at Chalfont St Peter, Chalfont St Giles, Amersham, Little Missenden, and Chesham Road, respectively. Mr. Reda is part of the design team for the 90% Design and Cost Scheme (Phase 1) of all SEM structures, as well as, developing the Geotechnical Baseline Report, the Durability Report and Design Report for underground structures, TBM Tunnel Obstructions Assessment, Settlement Assessment and Mitigation Program, Potential Damage Assessment and Instrumentation and Monitoring for structures along the alignment, and supporting the design development of the TBM

Segments, TBM opening design, and Program and Construction cost and scheduling. This scope will be followed by the 100% Detailed Design (Phase 2) where all design elements are finalized.

DART D2 Extension Project, Dallas Area Rapid Transit, Dallas, Texas (2017-present): The Dallas Area Rapid Transit will extend its existing light rail system, which begins west of the Interstate 345 viaduct as a U-section and transitions underground approximately under S Harwood Street for just over a mile; it emerges north of Pacific Ave. as a U-section again before transitioning to an at-grade configuration. The proposed alignment assumes underground construction for Metro Center Station, Commerce Station and CBD East Station, mined tunnels and U-sections extending westward and eastward toward East and West Portals. Mr. Reda is providing preliminary engineering for the running tunnels and underground stations, review of the vertical and horizontal alignments, evaluating ground conditions and required ground support measures, mitigation strategies for tunneling, constructability reviews of mined structures, assist in the development of project Specifications, Design Criteria, and tunneling Risk Register, as well as, the development of a series of Technical Memorandum for implementation into the project's Constructability Assessment Report.

Baltimore and Potomac Tunnel Project, AMTRAK, Baltimore, Maryland (2017-present): The project will replace the 1.4-mile long two-track tunnel with four new tunnels to reduce travel time, accommodate existing and project travel demand, eliminate impediments to the existing and projected operations, and to provide operational reliability to the heavily used section of the NEC. The current design consists of new tunnels, ventilation caverns, open cut portals, and multiple cross passages. The tunnels will be constructed utilizing Tunnel Boring Machines (TBM), whereas the caverns and cross passages will follow controlled drill-and-blast Sequential Excavation Method (SEM) techniques. Mr. Reda is providing Preliminary Engineering review of the design submissions for the temporary and permanent support systems for the underground works.

Riyadh Metro Project (Lines 1 and 2), ArRiyadh Development Authority (ADA), Riyadh, Kingdom of Saudi Arabia (2013-2019): The Riyadh Metro Project aims to introduce an efficient and sustainable mass transportation matrix in Saudi Arabia's capital and largest city, Riyadh. The metro network will link sites of mass activities - such as the universities and the airport - and provide a clean and practical mean of transportation in the busy downtown. The project encompasses six lines split into five packages. The six new lines will consist of about 112 miles (180 kilometers) of tunnels between the proposed 90 stations. The underground running tunnels are built by a combination of EPB TBMs and Sequential Excavation Methods (SEM) techniques. Mr. Reda helped develop the specifications for the Line 1 stations and the Line 2 running tunnels, supervising the technical deliverables for the Line 1 stations.

Relief Line South Project, Toronto Transit Commission (TTC), Toronto, Canada (2018-2019): The Toronto Transit Commission has approved the Preliminary Engineering Design of the Relief Line South Project, which includes construction of twin running tunnels, five new stations and modifications to three existing stations (converted to interchange stations) in City of Toronto. Mr. Reda is leading the preliminary engineering for the Sherbourne and Sumach underground stations, evaluating ground conditions and required temporary and permanent ground support measures, waterproofing requirements, mitigation strategies for tunneling, constructability reviews of mined stations, assist in the development of project Specifications, Design Criteria, and tunneling Risk Register, as well as, assisting in the development of the project's Preliminary Engineering Design Report for the Sherbourne and Sumach Stations.

Stage-2 Light Rail Transit (LRT), Ottawa-Carleton Transportation Commission (OC Transpo), Ottawa, Canada (2018): Stage-2 Light Rail Transit (LRT) is a proposed light rail extension to the under-construction Confederation Line, which is the first stage of the new LRT system in Ottawa, Ontario, Canada. The Stage-2 project will add 39 km of railway and 23 new stations to the O-Train system from Bayshore to Place d'Orleans, and south to Bowesville at Riverside South. The proposed three extensions include Confederation Line West, Confederation Line East and Trillium Line South. Mr. Reda lead the evaluation of alternative TBM designs to the cut-and-cover approach proposed in the concept design. After providing general alignment and structural design considerations, concepts for twin bore, medium bore and large bore alternatives were proposed.

Gallery Place-Chinatown Station Passageway, Washington Metropolitan Area Transit Authority (WMATA), Washington, D.C. (2018): WMATA released a Request for Information (RFI) regarding the overall project feasibility and recommended project approach for constructing a diagonal passageway at the Gallery Place - Chinatown Station. The new passageway would allow passengers to bypass the crowded tunnel junction with the Green and Yellow Line, as well as, provide additional area to alleviate platform crowding and facilitate efficient movement through the station, especially in the critical area on the westbound Red Line platform. The passageway would require the construction under historic buildings along G Street and 7th Street NW and cutting of the station concrete vault walls at the Red Line platform and the mezzanine above the Green and Yellow Line tracks. Mr. Reda assisted in the development of preliminary design level drawings, calculations and reports for the SEM passageway, including a detailed break-in of the station vaults.

Northern Line Extension Project, London Underground Limited (LUL), London, United Kingdom (2016-2017): The Northern Line Extension extends the existing Charing Cross branch of the Northern Line from the Kennington Loop to a new terminus south of Battersea Power Station. The project includes the construction of two new stations, ventilation shafts, nine cross passages, two junction tunnels, and 3.5 miles (5.6 kilometers) of new running tunnels, which are constructed by a combination of EPB TBM and SEM. The junction has been designed to connect to the existing tunnel without minimal disruption to the operation of LUL. GZ is responsible for performing the independent design check (Category 3) for the scheme. Mr. Reda is the Project Manager for the Category 3 Design Check and is responsible for overseeing the analysis work, reviewing the design, and coordinating with the client and designers.

Vauxhall Station Upgrade Project, London Underground Limited (LUL), London, United Kingdom (2013-2017): The project consists of congestion relief and Step Free Access (SFA) works to improve passenger flow and accessibility for Vauxhall Station on London Underground's Victoria Line. A SEM shaft and tunnels provided access from ticket hall to platform levels. Ground conditions included London Clay and improved River Terrace Gravels. Mr. Reda assisted in performing a Potential Damage Assessment (PDA) to the existing LUL assets due to the construction of the new SEM structures. Additionally, he is currently acting as the SEM Shift Engineer and represents the designer (GZ) on site during construction. Mr. Reda's responsibilities include overseeing excavation works and encountered geotechnical conditions, evaluating instrumentation measurements, supervising the installation of support measures, supervising the required testing for both primary and secondary linings, and testing of the waterproofing system. Furthermore, he is part of the team that reviews and accepts all of the Contractor's proposals related to temporary and permanent SEM works.

Paddington Bakerloo Line Link, London Underground Limited (LUL), London, United Kingdom (2015-2016): Paddington BLL will enable paid passengers to interchange between the new Paddington Crossrail station and the existing LU Bakerloo Line station. This will be accomplished with a complex system of

SEM structures, squareworks structures, SGI tunnels, and pre-cast concrete shafts. The majority of the tunnels will be built in London Clay. GZ is responsible for performing the independent design check (Category 3) for the scheme. Mr. Reda is the Assistant Project Manager for the Category 3 Design Check and is responsible for overseeing the analysis work, reviewing the design, and coordinating with the client and designers.

Dulles Corridor Metrorail Project, Virginia Department of Rail and Public Transportation and Metropolitan Washington Airports Authority (MWAA), Vienna, Virginia (2007-2013): The Dulles Corridor Metrorail is a new 23 mile (37 kilometer) line extending the Metro service from the existing Orange Line at the East Falls Church Station in Fairfax County to Route 772 in Loudoun County, Virginia. Phase I of the project features twin single-track running tunnels at Tysons Corner in Fairfax County, mined with Sequential Excavation Method (SEM) techniques; each tunnel has a length of approximately 1,700 feet (520 meters). Phase I is scheduled to open in 2014 and will be called the Silver Line. Ground conditions include fill, residual soils and saprolite, claystone, and the Balls Bluff Formation (mudstones and siltstones). Mr. Reda assisted in Finite Element analysis of the initial and final tunnel linings. In addition, he aided in the development of the Operation and Maintenance Manual for these tunnels.

Bond Street Station Capacity Upgrade, London Underground Limited (LUL), London, United Kingdom (2012-2013): London Underground Ltd. is undertaking a major upgrade program to improve the capacity and safety of Bond Street Station. Numerous passenger tunnels, stair tunnels, and escalator and lift shafts will be built between and below existing underground facilities that are currently serving the station, forming main utility arteries for water, gas, power and communication. Above ground, several buildings highly sensitive to ground settlements have to be protected against any potential ground movements generated by the tunneling works. The tunneling work utilizes various methods, including Sequential Excavation Method (SEM) with shotcrete support, as well as traditional hand-mining techniques, with square works and timber headings for openings within confined space. Ground conditions include London Clay and sediments of the Lambeth Group (over-consolidated clays, sand lenses, and the potential for pressurized groundwater). The groundwater table is located above the London Clay. Mr. Reda was in charge of carrying out settlement analyses using Oasys, Ltd's XDisp software potentially resulting from the construction of the new SEM structures. Furthermore, the software was used to determine the potential damage categories for existing buildings. He also carried out interaction analyses to assess the potential effects by the construction of the new SEM tunnels on existing LUL underground assets.

East Side Access Project, New York Metropolitan Transportation Authority Capital Construction (MTACC), New York, New York (2011-2012): The project will connect the Long Island Rail Road's (LIRR's) Main and Port Washington lines in Queens to a new LIRR terminal beneath Grand Central Terminal in Manhattan. The 22 foot diameter tunnel excavation of 4.5 miles (7.2 kilometers) was carried out using Seli and Robbins TBMs for all drives in Manhattan and Herrenknecht Slurry TBMs for all drives in Queens. Mr. Reda was involved in the construction quality control process as Tunnel Inspector.

Tottenham Court Road Station Upgrade, London Underground, London, United Kingdom (2008-2011): The Tottenham Court Road Station is being upgraded to increase capacity in order to better accommodate current and future commuter needs. At the same time, the upgrade will minimize passenger journey time and improve the quality of access within the station. The upgrade will include a new concourse tunnel, escape tunnels, cross passages, an interchange tunnel, and connector stub tunnels. Ground conditions included fill, Terrace Gravels, London Clay and various materials of the Lambeth

Group (sands, silts and clays). Mr. Reda assisted in the Category 3 Independent Design Check of the Shotcrete Linings (built with SEM) for the project. The independent check included the review of design drawing and checking the structural stability of the tunnels using Finite Element Analysis.

Trans Hudson Express (THE) Tunnels, New Jersey Transit, Newark, New Jersey, to New York, New York (2010): New railway tunnel and terminus station in Manhattan and two new 1.5-mile-long tunnels under the New Jersey Palisades and the Hudson River. Highly varied geological conditions (soft glacial lake deposits, estuarine deposits, hard Jurassic diabase, sandstone, and various hard rocks including Manhattan Schist). On the Manhattan side, soft soil and mixed face conditions require frozen soil techniques for pre-stabilization and shotcrete linings for initial support of the TBM receiving tunnels and cross passages under the Hudson River. Design of the SEM tunnel segments, including a reception tunnel for the Hudson EPB TBM drive in Manhattan and the cross-passages between the main tunnel tubes beneath the Hudson River and the rock caverns for the terminal station in Manhattan. Mr. Reda aided in the development of the initial ground support design drawings and analyses of the main Station Cavern and adjoining adits and cross-passages. The initial ground support design drawings were created using Bentley MicroStation and the analyses were conducted using Rocscience Inc.'s Phase, Unwedge and Swedge software.

Green Park Station – Step-Free Access Project, London Underground, London, United Kingdom (2008-2009): The Step-Free Access (SFA) Project's main goal is to provide step-free access from street level to all operational platforms via the ticket hall, as well as between platforms for interchange purposes. This project included the construction of a 92 foot (28 meter) deep, large-diameter shaft in close proximity to an operational escalator shaft, with new connections to existing platform tunnels and a large-span tunnel to accommodate the two-story lobby lift. The new facilities were constructed using Sequential Excavation Method (SEM) techniques, with initial support consisting of reinforced shotcrete lining. Ground conditions included London Clay; the groundwater table was located approximately 9 to 12 feet (3 to 4 meters) below the ground surface. Mr. Reda was involved in the design and computer modeling analyses for a shaft and tunnel stub to be constructed using shotcrete.

Highway Tunnels

Hampton Roads Bridge-Tunnel Expansion Project, Virginia Department of Transportation (VDOT), Virginia Beach, Virginia (2019-present): The Hampton Roads Bridge-Tunnel (HRBT) expansion project consists of design and construction for improvements to the Interstate 64 (I-64) corridor between Settler's Landing in Hampton and Interstate I-564 in Norfolk to provide additional capacity throughout the corridor. Improvements include a new bridge-tunnel complex approximately 3.5 miles long (5.6 kilometers) and generally parallel to the existing Hampton Roads Bridge-Tunnel. GZ is responsible for performing the Independent Design Verification (IDV) for Mott MacDonald (Designer of Record) of the Bored Tunnel, Tunnel Approach Structures, the Circular / Multi-Cell Shafts, and the ground improvement scheme. Mr. Reda is responsible for overseeing the IDV analysis work for the segmental lining and slurry walls for shafts and approach structures, reviewing the design, and coordinating with the designers.

Istanbul Strait Road Crossing Project, Republic of Turkey Ministry of Transportation, Istanbul, Turkey (2013-2014): The Istanbul Strait Road Crossing Project, also called the Eurasia Tunnel Project, will alleviate the traffic congestion in and around the city of Istanbul. With the total length of 9.1 miles (14.6 kilometers), the project will connect the cities of Kazlıcesme and Goztepe on the European and Asian sides of Turkey, respectively. Construction will include Conventional Tunneling approach tunnels and cross passages, ventilation shafts, cut-and-cover structures, and a 3.4 mile (5.4 kilometer) Tunnel Boring Machine (TBM) tunnel beneath the Bosphorus Strait. Once complete, the TBM tunnel

will consist of a double-deck road tunnel with two lanes on each deck. Ground conditions include quartz, quartz arenite, arkose, conglomerates, sandstones, dolomites, limestones, shales and mudstones, as well as extreme water pressure. The project will be built entirely within a highly-active seismic zone. Mr. Reda was in charge of performing finite element analyses for the new SEM tunnels and cross passages as part of the independent verification as well as review the SEM package for design and constructability concerns.

Port of Miami Tunnel Project, Florida Department of Transportation, City of Miami, Miami, Florida (2012): Twin tunnels will provide a direct underground connection from the Port of Miami at Dodge Island via Watson Island to I-395 and all other highways in and around Miami. The tunnels are bored by a single 12 m diameter TBM. Gall Zeidler Consultants provides expert consulting services for the project and executes the independent assessment of the construction effects on the existing structures on the Dodge Island structure above the tunnel alignment. This assessment included independent two and three-dimensional finite element modeling of the affected structures. Additionally, GZ provided inspection services to document the existing condition of the structures prior to the EPB TBM excavation beneath Dodge Island. Mr. Reda headed the on-site inspection team to document the existing condition of the Dodge Island structures.

Zimmerman Trail Tunnel Project, City of Billings, Billings, Montana (2010-2013): Zimmerman Trail is a historic roadway that was originally constructed in the late 1800s for the purpose of expediting livestock. A tunnel with bidirectional traffic was proposed to eliminate the concern of the unstable slope adjacent the road. The 35-ft high by 61-ft wide tunnel featured a 14-ft lane with 8-ft shoulder in each direction. Proposed rock excavation utilized sequential excavation method (SEM) with controlled blasting. Tunnel ground support consisted of rock dowels and reinforced shotcrete. After excavation and support, a drained waterproofing system followed by a cast-in-place reinforced concrete final lining would be installed. Mr. Reda supported the development of all tunnel engineering aspects of the Zimmerman Trail Alternatives Analysis Feasibility Study. The scope of services included input to the alignment studies with consideration of Stopping Sight Distances for grades and horizontal curves per proposed alignment, recommendations on Fire Life Safety requirements based on domestic and international regulations, standards and guidelines, review of the geotechnical program, interpretation of the geotechnical data, developing typical cross-sections along with excavation and support measures, Unwedge analysis to verify the rock support design and recommendations for waterproofing, final tunnel lining and tunnel ventilation.

Devil's Slide Tunnels, CALTRANS, San Pedro Mountain, US Highway 1 between Half-moon Bay and Pacifica, California (2007-2012): The tunnels bypass US Highway 1 in an area prone to landslides. Tunneling was in accordance with the principles of SEM (NATM) with five different support categories along with pre-support measures including spiling and pipe arch canopies. The geological conditions included highly tectonized and weathered granites (chemically altered), fault gouges, clay/siltstone with clay interlayers. An open PVC membrane based waterproofing system is used for waterproofing. Mr. Reda developed shop drawings for the project involving excavation and support for the different support categories, shotcrete portal canopies, and turn-under sequencing and initial tunnel support measures. In addition, Mr. Reda aided in the Finite Element Analysis for the design of the initial and final tunnel linings using Rocscience, Inc.'s Phase2 software.

Tunnel Rehabilitation/Refurbishment/Repair

Tuscarora Tunnel Rehabilitation, Pennsylvania Turnpike Commission (PTC), Fannettsburg, Pennsylvania (2014-present): The historic Tuscarora Tunnels along the Pennsylvania Turnpike were originally built in 1939 and have been exhibiting water infiltration since the original construction. Various rehabilitation

contracts have attempted to control the water infiltration but were unsuccessful. PTC secured Gannett Fleming and GZ to design the most extensive rehabilitation which has ever been performed in the tunnels to remedy the water infiltration problems. Mr. Reda assisted in the development of the structural lining and waterproofing design and specifications for the project.

MetroLink Cross County Extension, St. Louis Metro, St. Louis, Missouri (2013-present): The MetroLink Extension, Facilities 2 contract included 1.3 miles (2.1 kilometers) of dual track cut-and-cover tunnels with two below-grade stations which extended the Metro's Blue Line from Kingsland Avenue to Ritz Carlton Drive. The tunnels were constructed in 2004 with cast-in-place base slabs and tunnel walls, and precast concrete roof segments. GZ is providing expert witness services to the owner's representative regarding tunnel leakage that occurred after the construction of Tunnels 3 and Big Bend Station. Mr. Reda is heading the on-site inspection team to document the leakages within Tunnel 3 and Big Bend Station and is currently overseeing the remediation design for the MetroLink structures.

Park Avenue Tunnel Rehabilitation, New York Department of Transportation (NYDOT) Division of Bridges, New York, New York (2018-2020): The Park Avenue Tunnel in New York City carries one lane of Northbound traffic from 33rd St to 40th St. The tunnel, completed in 1834 as an open cut and covered in 1852, has been in operation for over 150 years, and was previously used for various railroads. As part of the rehabilitation works, the tunnel drainage system has been replaced, including installation of catch basins, manholes, and drainpipes, both in the vertical walls and underneath the pavement. A new shotcrete lining will be installed which will have steel reinforcement with lattice girders to allow control of geometry. As part of the Resident Engineering Inspection (REI) team, Mr. Reda is providing technical support for any proposed changes by the Contractor and Designer during demolition and installation of the new waterproofing drainage system, installation permanent reinforcement and the placement of the shotcrete final lining.

Medical Center Cross-over Tunnel Waterproofing Design, Washington Metropolitan Area Transit Authority (WMATA), Washington, D.C. (2012-2014): The Medical Center Metro Station is an essential part of the Washington D.C. Metro System's Red Line, servicing the National Institute of Health and the Walter Reed National Military Center. The mined station cavern and attached crossover cavern structure have experience extensive water intrusion from the surrounding rock since their construction in the 1980s, and water infiltration continues to impact various systems in the tunnel. This project consists of the design of a new waterproofing system within the crossover cavern in order to eliminate tunnel leakage. Ground conditions include permeable bedrock (biotite-hornblende tonalite) with joints and fractures, as well as a high groundwater table. Mr. Reda was involved with the development of designed waterproofing system, waterproofing and shotcrete final lining drawings and specifications for the rehabilitation project.

Power Tunnels

London Power Tunnels, National Grid, London, United Kingdom (2012-2014): National Grid is currently undertaking a major cable replacement program in the area of London. The upgrade includes the installation of high-voltage underground cables within cable tunnels between Hackney and Willesden. The main tunnels are being constructed by TBMs. TBM launch and reception chambers and cable diversion chambers, are being built by SEM methods. The tunnels are being constructed in London Clay and sediments of the Thanet Formation. Mr. Reda is involved in the design of the primary and secondary linings for the SEM Chambers. He carried out Finite Element Analysis for the design and provided detailed design drawings.

North-South Transmission Cable Tunnel Project, Land Transport Authority (LTA), Singapore (2012-2013): The North-South Transmission Cable Tunnel will be 11.5 miles (18.5 kilometers) running from Gambas to May road, designed for storage of ten 400kV electrical cables. The tunnel consists of shafts, adits, and TBM tunnel. Contract NS1 comprises the northern contract of the North-South Transmission Cable Tunnel running from Gambas Shaft to Mandai Shaft. The works in this Contract consist of a 3.6-mile-long (5.87 kilometers) TBM tunnel with an internal diameter of 19.7 feet (6 meters) and three Shafts, namely Gambas Shaft, Sembawang Shaft and Mandai Shaft out of tunnel adits at these shaft locations. Mr. Reda supported the design the structural support of the tunnel liner and support of excavation as well as supervised the development of design drawings.

Other Facilities

Plane Train Tunnel West Extension Project, City of Atlanta Department of Aviation, Atlanta, Georgia (2019-present): The City of Atlanta Department of Aviation seeks to improve the efficiency and capacity of the Automated People Mover (APM) at the Hartsfield-Jackson Atlanta International Airport by extending the tunnel approximately 640 feet (195 meters) to the west from the train's current terminus. The project also includes structural retrofitting of the existing terminus to enable the extension and the construction of an Emergency Egress Shaft, Ventilation Shaft, cross passage tunnel, and track crossover structure. GZ is providing the Contractor with Peer Review Services for the egress and ventilation shafts and the tunnel extension, including the crossover and cross passage. As Project Manager, Mr. Reda is the Project Manager reviewing the underground design packages, raise constructability concerns, overseeing the structural analysis, and coordinating with the Contractor and Designer of Record.

Phase IIIA Combined Sewer Overflow (CSO) Program: Pawtucket Tunnel Project Tender Design, Narragansett Bay Commission (NBC), Pawtucket, Rhode Island (2020): The Pawtucket Tunnel Project is final part of three phase Combined Sewer Overflow (CSO) control program to lower CSO volumes in Upper Narragansett Bay, which was originally initiated in 1998. Phases I and II of the program were focused on the Providence area and were completed in 2008. The Pawtucket Tunnel Project includes an approximately 2.2-mile-long (3.5 kilometers), 30 foot (9.1 meter) inside diameter TBM Tunnel, 80 foot (24.4 meter) inside diameter Pump Station, 60 foot (18.3 meter) inside diameter Launch / Screening Shaft, 36 foot (11 meter) inside diameter Ventilation Shaft, and ancillary underground structures (i.e. TBM launch and reception adits, drop and ventilation shafts, and connecting adit tunnels). GZ is responsible for the permanent design of the large diameter shafts, TBM segmental lining opening the temporary and permanent design, and the temporary and permanent design for all ancillary tunnel structures. Mr. Reda is the Project Manager for the Tender Design and is responsible for overseeing the analysis work, reviewing the design, and coordinating with the Construction Joint Venture.

Technical Expert Services

Soto Norte Project, Sociedad Minera de Santander S.A.S. (Minesa), Bucaramanga, Colombia (2017-present): Minesa plans to commission the Soto Norte Project to reach a gold deposit located ~34 miles (~54 kilometers) northeast of Bucaramanga. The project aims to produce more than 9 million ounces of gold over a lifetime of approximately 26 years, with an estimated investment of \$1 Billion over the next 5 years. An approximately 4.3-mile-long (6.9 kilometers) tunnel is required to reach the gold deposit from the chosen portal area. Excavation of the tunnel will be carried out by a combination of conventional tunneling and Hard-Rock Tunnel Boring Machine (TBM) tunneling methods; throughout the alignment, several faults will be encountered where high groundwater inflow is expected. The minimum excavated diameter of the TBM tunnel is 26.9 feet (8.2 m) to meet future mining demands. Mr. Reda is leading the design team providing SEM/TBM tunneling advisement services, development of technical specifications, procurement support, and a review of the rock support design.

Evaluation of TBM Augmentation Concepts, Anglo American PLC, (2019-2020): Gall Zeidler Consultants investigated methods with which to improve the speed of tunneling projects in hard rock as well as to investigate the possibility of enhancing traditional tunnel boring machine (TBM) designs with novel excavation tools and techniques in order to improve Tunnel Boring Machine (TBM) advance rates. Mr. Reda supported the evaluation and feasibility of the various tools and techniques to improve tunneling advance rates for integration into a TBM as well as provide recommendations for increased TBM utilization and contracting methods.

Pacific-Orinoquia Connection Project, Republic of Colombia Ministry of Transportation, Florida, Colombia (2019-2020): The transportation project aims to connect the Colombian east and west coasts with 932-mile-long (1,500 kilometer) of transit infrastructure, which includes a double track 28.9 mile (40 kilometer) tunnel with a parallel evacuation gallery tunnel that will be used as emergency and maintenance through the Western mountain range. Mr. Reda supported the preparation of a Feasibility Study for the evacuation gallery tunnel utilization a TBM for excavation and support. The Feasibility Study considered the tunneling methodology and required infrastructure for TBM construction, recommendation for TBM selection, development of high-level cost and schedule estimates, conceptual design for the temporary and permanent support of the TBM Tunnel, finite element analyses at critical sections, and identification of design and construction risks,

Westside Purple Line Extension Section 2, Los Angeles County Metropolitan Transportation Authority (Metro), Los Angeles, California (2017-2019): The Westside Purple Line Extension Section 2 is part of an approximately 9-mile-long (14.5 kilometers) westerly extension of the LA Metro Purple Line. The project will extend the line from its current terminus at the Wilshire/Western Station to a new terminus at the West Los Angeles Veterans Affairs Hospital. The construction of Section 2 is planned to be accomplished utilizing Pressurized-Face Tunnel Boring Machines (TBMs) to construct two circular tunnels approximately 22 feet in diameter. GZ is supporting the Beverly Hills Unified School District (BHUSD) who has raised concerns on the tunneling impacts to the school's campus. Mr. Reda is leading the design team performing preliminary settlement and damage assessments, developing tunneling strategies for encountering both active and abandoned oil wells within the BHUSD, and addressing all design and construction aspects to the underground scheme.

Technical Papers and Publications

AN ENGINEERED TUNNELING APPROACH FOR MINE ACCESS TUNNELS, North American Tunneling Conference, Nashville, TN, June 7 – 10, 2020, (with O'Brien, T., Syrtariotis, N., Gall, V., & Wooton, K.)

URBAN TUNNELLING: THE VAUXHALL UNDERGROUND STATION UPGRADE, SEE TUNNEL – Promoting tunneling in SE European Region, ITA World Tunnel Congress, Dubrovnik, Croatia, 22-28 May, 2015 (with Bauer, A. & Beirne, C.)

SOFT GROUND TO HARD ROCK – VERSATILE TUNNELLING METHODS IN URBAN AREAS, Zagreb Underground, ITA Croatia 2014, Zagreb, Croatia, 27-28 March, 2014 (with Gall, V. & Zeidler, K.)