HATCH

Statement of Qualifications

Transit Tunnels

Contact:

Jean Habimana
Global Director, Tunnels
T. 438.266.0788

Dominic DiBrito
Managing Director, Infrastructure –US
T. 215.641.8888

Jonathan McDonald
Global Director, Rail Systems
T. 510.390.8035

Address:
100 West Butler Avenue,
Ambler, Pennsylvania 19002

www.hatch.com


ABCON DRAGADOS

Contents

Toronto-York Spadina Subway Extension

Our Capabilities

We embrace our clients' vision as our own to help them adapt to a dynamic world. In short, your success is vital to our own! We bring our best thinking and teams to solve your toughest challenges. To help you transform the world, locale by locale!

Whatever our clients envision, our engineers can design and build. With over six decades of business and technical experience in the infrastructure, mining and energy sectors, we seek to best know your business and understand that your challenges are changing rapidly. We respond quickly with solutions that are smarter, more efficient and innovative. We draw upon our 9,000 staff with experience in over 150 countries to challenge the status quo and create positive change for our clients, our employees, and the communities we serve.

We are a full-service engineering design and project management business across all infrastructure sectors. Our particular tunneling strengths are in passenger and freight rail and aviation.

Our Transit Services

+ Large Diameter TBM Tunnels
+ SEM Tunnels & Cross Passages
+ Cut-and-Cover Tunnels
+ Drill & Blast Tunnels
+ Roadheader Bored Tunnels
+ Pedestrian Tunnels
+ Difficult Ground Conditions
+ Station & Crossover Caverns
+ Trenchless Technologies
+ Signaling & Controls
+ Heavy Rail Subways
+ Light Rail/Streetcars
+ Intercity & High-Speed Rail
+ Passenger & Commuter Rail
+ Rail Stations & Multimodal Terminals
+ Air/Rail Connections
+ Vehicle Maintenance Facilities
+ Operations Centers
+ Bridges & Viaducts
+ Electric Traction
+ Fire Life Safety
+ Tunnel Ventilation Systems
+ Rail Trackwork
+ Rail Vehicle Design
+ Tunnel Rehabilitation
+ Digital Project Delivery

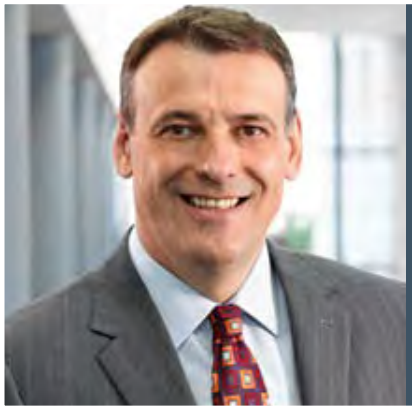
NFTA Buffalo Light Rail Rapid Transit Tunnels

Moving People to a Better Life

Throughout North America, communities recognize the positive impact a well-designed passenger transit system has on their quality of life and environment, and its strong relationship to economic success.

Whether a new-start program, an expansion, a series of extensions, or a major upgrade to an existing transit system, Hatch has the experienced team that can ensure successful project delivery.

Hatch's multidisciplinary staff has worked with all kinds of underground passenger rail and transit infrastructure, including tunnels, subways, light rail transit, heavy rail transit, commuter rail, high-speed rail, underground airport people movers and rubber-tired passenger trains, traction power systems, signaling systems, communications systems (including positive train control), and fire life safety. Drawing on a broad range of skills, Hatch can carry out large and complex projects in-house, freeing up your staff to perform its day-to-day work. With the addition of LTK Engineering Services in October 2020 to the Hatch family, Hatch LTK broadens our offerings to include vehicle engineering, zero-emissions infrastructure planning and procurement, operations planning and simulation, revenue management and a deeper bench of rail systems engineers.



"We are entrepreneurs with a technical soul. We strive for innovative solutions by leveraging our leading technical capability. We understand and are very focused on the safety and commercial outcomes of the projects we engage in."

John Bianchini, Chief Executive Officer, Hatch

Our Staff

Whatever our clients envision, our engineers, scientists, and former tunnel contractors can design and build. With over six decades of business and technical experience in the infrastructure sector, we seek to best know your business and understand that your challenges are changing rapidly. We respond quickly with solutions that are smarter, more efficient, innovative, and sustainable.

The following pages highlight our ***transit tunnel staff leadership***.

Jean Habimana, Ph.D., Eng., P.Eng., P.E.
Jean Habimana is our Global Tunnels Director. His work includes design and construction of major projects including tunnels, caverns, shafts, open-cut, and cut-and-cover excavations for both soft ground and hard rock. He has an extensive experience in static and seismic soil-structure interaction analysis and seismic design of tunnels and underground facilities. He is skilled in the coordination of different disciplines and completing projects on time and on budget.

Eric J. Cone, C.E.T., rcji, C.E.C., PMP
Eric Cone is our Global Transit Director. He has extensive experience in the design, construction and project management of government and private sector projects in the transit and transportation sectors. Having been involved in a number of rail-based transit projects, he is a Principal Specialist in commuter, regional rail and light rail transit systems. Eric has designed and managed all types of projects through various stages of the project lifecycle including preliminary and feasibility studies, new construction and rehabilitation.

Gary Kramer, P.E., P.Eng.

Gary Kramer is our Executive Tunnels Director. He has over 30 years of experience in project, design and construction management with large transit tunnel projects. He is responsible for technical leadership and quality excellence on tunnel and underground projects. Gary has been directly responsible for coordination of civil design disciplines – structural, geotechnical and end use functionality and construction management associated with tunnelling, shaft and marine works.

Hossein Bidhendi, Ph.D., P.Eng.
Hossein Bidhendi is the Regional Tunnels Director for the Province of Ontario, Canada. He is a geotechnical and structural engineering lead, project manager and design manager for tunnels, subways, and light rail transit tunnel projects. He is experienced with the integration of geotechnical and structural engineering disciplines for the design of new transit tunnels and the rehabilitation of existing facilities.

Derek Zoldy, P.Eng., MCIP, RPP
Derek Zoldy is the Regional Tunnels Director for Western Canada. He has over 30 years of experience in the areas of planning; program and project management; design; and construction management. He is experienced in public consultation, claims evaluations and expert testimony. Derek has established and developed teaming relationships with other consulting firms and has successfully identified, attracted, and recruited staff for large infrastructure projects throughout North America and globally.

Randall Divito, P.E., P.Eng.

Randall Divito is the Deputy Tunnels Director for the US. He has over 25 years of experience specializing in geotechnical and tunnel engineering for heavy civil infrastructure projects, including heavy and light rail transit. His project experience extends from planning through detailed design and construction for new construction, expansions and rehabilitation. This includes feasibility evaluations, geotechnical investigations, design and project management, resident engineering, and construction management for large-scale transit tunnel projects.

Dan Ifrim, P.Eng.

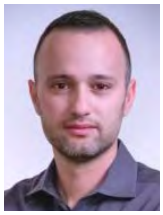
Dan is the Regional Director of Tunnel Methodologies and a Senior Project Manager with proactive approach to project management, and excellent conflict management and negotiation skills. He has strong knowledge of tunnelling methods and TBM manufacturing along with extensive experience in bored tunnels by TBM in rock and soft ground; solid knowledge of Earth Pressure Balance concept, with extensive experience in contract and project management in the tunnelling industry, across the globe. He is a qualified quality control internal auditor under ISO 9001/2008.

Matthew Geary, P.Eng., PMP

Matthew Geary is the Regional Tunnels Director for the Greater Toronto Area. He is a structural engineer and project manager with specialized expertise in tunnel and shaft design and construction for projects involving heavy and light rail transit. His experience covers all aspects of project development, from feasibility studies, conceptual design, detailed design, rehabilitation and construction management for deep excavations, shafts, and tunnels in soft ground and rock.

Saeid Rashidi, Ph.D., P.E.

Saeid Rashidi is the Regional Tunnels Director for the New York City Area. He has 28 years of experience in leading diverse design teams; successfully delivering complex infrastructure projects; and analysis and design of various types of structures including transit tunnels and associated underground structures, including precast concrete segmental tunnel liner, cast-in-place and sprayed concrete lining systems. His work experience also includes performance-based seismic engineering, blast analysis and retrofit.



Keivan Rafie P.Eng, M.Eng, PMP, ENV SP, CDT

Keivan Rafie has worked on tunnel, mining, and ground improvement projects for nearly two decades. His expertise ranges from: the design and construction of tunnel, shafts, and underground structures; design and construction of cross-passages and shotcrete operations; procurement, design, and modification of TBM and tunnelling equipment; preparation of project specifications and construction codes; TBM assembly, launch and reception procedures; and the production of precast segmental lining and relevant QA/QC process.

Tomas Gregor, Ph.D., PMP, P.Eng., P.E.

Tomas Gregor is an internationally-recognized tunnelling expert. He has extensive experience in the planning, design, design management and project management of heavy civil engineering projects, including transit tunnels. His notable project experience includes the Scarborough Subway Extension, Toronto-York Spadina Subway Extension, Eglinton Scarborough Crosstown Twin Tunnels, Eglinton LRT Line Stations Reference Design, Beacon Hill Station and Tunnels, and the Sheppard Subway.

Brian Garrod, P.Eng.

Brian Garrod is an internationally-recognized expert on tunnels and tunnel technology. He has 46 years of civil engineering experience, the last 36 years solely in tunnelling. His technical expertise covers a broad range of tunnel techniques for high and low-strength rocks and soft ground using excavation methods such as earth pressure balance tunnel boring machines (EPB TBM) and the New Austrian Tunnel Method (NATM). He also specializes in the design of one-pass precast concrete segmental tunnel linings, productivity analyses and cost estimates for transit tunnels.

Dirk Poolman, P.Eng.

Dirk Poolman is an Executive Vice President. He has over 40 years of experience in design, project and construction management on a wide variety of heavy civil projects including commuter rail transit facilities, and rehabilitation of existing transit stations and tunnels. Previous responsibilities included Global Director for Rail and Transit, and Division Manager for Canada and Central Division. Experienced in managing diverse teams and difficult projects including Joint Venture teams, resulting in positive outcomes.

Guy Chertock, P.E.

Guy Chertock has more than 25 years of experience in radio frequency and communications fields and leads the Hatch LTK Rail systems Practice. This includes experience in design and deployment of wireless networks for commercial and public safety entities. Guy has extensive experience in design, maintenance, diagnostics, and troubleshooting of complex radio networks. He has excellent knowledge of interference, RF emissions issues, and spectrum acquisition, particularly for PTC applications. Currently, Guy is involved in the development and implementation of the communications and networking components for a variety of Hatch LTK PTC-related projects including ACSES and I-ETMS PTC systems throughout the country.

Jonathan McDonald, P.E.

Jonathan McDonald is our Global Rail Systems Director. He has successfully led multi-disciplinary systems development on some of the largest and most advanced rail transit projects in the world. His project experience covers nearly all modes and configurations of transit including metro, commuter/freight rail, LRT/streetcar, and BRT in tunnel, aerial, and at-grade configurations. He also has an extensive background in estimating, scheduling, fire life safety management, construction management and site review of rail systems.

Ken Newkirk

Kenneth Newkirk has 38 years of diversified experience in the signaling industry and is our rail signals team leader. Ken's experience includes management in design, interface, test and commissioning for electrified and DMU operated transit systems throughout North America and Taiwan. Ken is a proven project manager with the ability to lead large signaling projects from design through implementation and final commissioning. Ken's experience in integration management assures that all project interfaces (EMUs, power systems, trackwork, ATS supervisory systems and communications) are coordinated and implemented per the system requirements.

Kevin Miller, P.E.

Kevin Miller has 20 years of experience in the transportation industry. This includes rail transit planning, project management, traction electrification design, track design, construction, traction electrification testing, EMI testing, and CADD. Kevin has followed project through from startup into preliminary engineering, final design and finally into construction. Kevin has worked on projects in Minneapolis, Tucson, Sacramento, Boston, Denver, New Jersey, Portland and other areas around the country. Kevin services as our OCS discipline lead, systems design and project management.

Ted Manning

Ted Manning has more than 30 years of experience and has extensive skills in electrification of rail transportation systems and leads our traction power modeling team. Ted's experience includes construction management, preliminary and final design, planning, scheduling, budgeting, and rate analysis. His work has encompassed all phases of engineering, design, specification preparation, and construction for rapid transit, light rail, streetcar, high speed rail (Amtrak NEC), and commuter rail systems. Ted has extensive experience in the application of analytical computer software for traction power load flow studies and analysis and has employed this expertise on many successful rail transit projects.

Ethan Kim, P.E.

Ethan Kim is a Principal Systems Engineer with experience managing light rail, streetcar, and electric trolley bus systems projects that include traction power substations, ac and dc distribution systems, overhead contact systems (OCS), train signaling, SCADA systems, communication systems, corrosion control systems, systemwide electrical, and vehicle maintenance facilities. Ethan is also a professional electrical engineer with expertise in traction power substation design, dc distribution systems design, control systems design, protective relaying, ground grid design, load flow modeling, design and factory testing, inspections, plan development, and specification development. He is also the Traction Power and Electrical Discipline Lead for Hatch LTK.

Lee Castellion, PMP

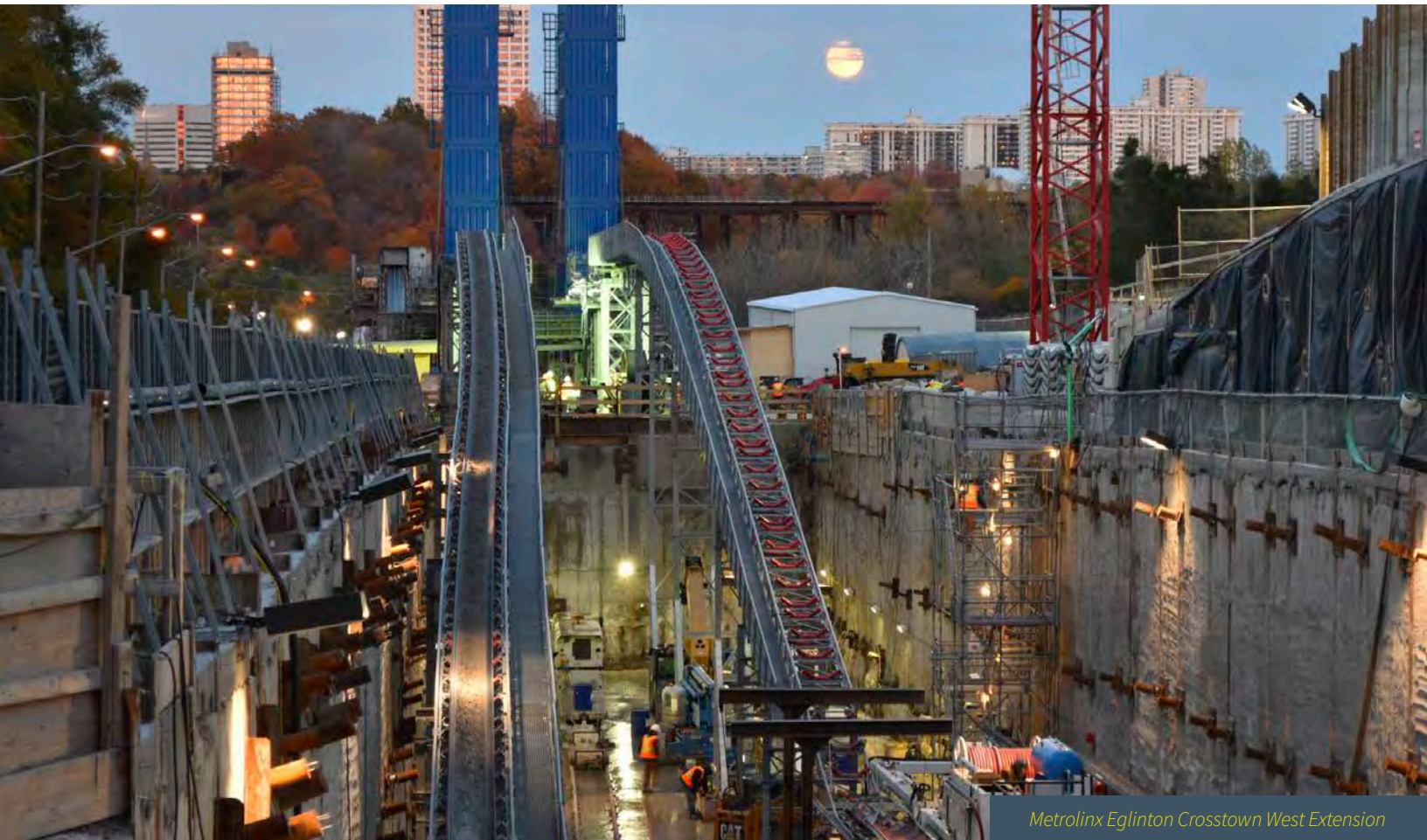
Lee Castellion has nearly 40 years of experience and is a Telecommunications Systems Design Engineer experienced in building and maintaining successful customer relationships, understanding customer needs, and both designing and delivering practical integrated telecommunications solutions on time and on budget. Lee is a PMP-certified professional with a core technical expertise covering systems integration, wireless and radio communications, train control, SCADA and transit communications in general and leads our communications and IT team.

Our Experience

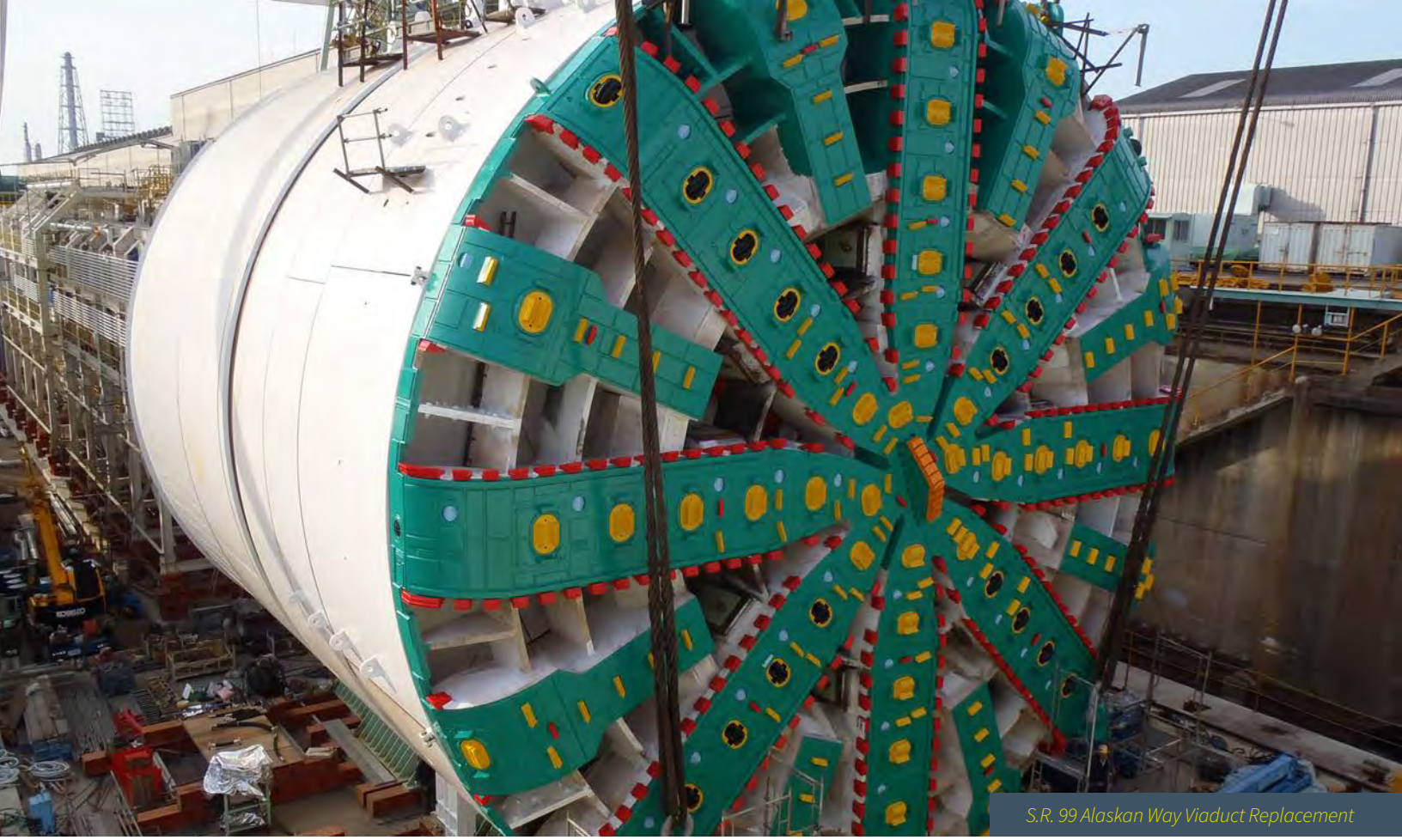
Hatch has deep roots in tunnel engineering, beginning with our work on Toronto's subway system in the 1950s. Our steady growth since then means that Hatch has now engineered thousands of miles of tunnels on five continents beneath urban centers, residential areas, mountains, lakes, and rivers. Whether it is hard rock tunnel boring machines, sequential excavation methods, drill and blast, or pressurized face tunnel boring machines in soil or mixed soil and rock conditions, we can specify the most appropriate technology to suit the anticipated ground conditions.

With over 175 dedicated tunnel specialists (engineers, geologists and construction management professionals), we have the capacity, knowledge, experience and the understanding to overcome the challenges associated with new transportation tunnel links, including through environmentally sensitive areas, major transit expansion programs, and pedestrian tunnels beneath congested urban centers.

Whatever our clients envision, Hatch specialists can design and manage it from concept to completion. With over six decades of business and technical experience in the infrastructure and mining sectors, we know your business and understand that your challenges are changing rapidly. The rate of change in the transit sector is as high as the rate of growth and Hatch is able to respond to this new normal. We advocate for integration of tested, new technologies to increase construction efficiencies and we respond quickly with innovative solutions that are smarter and more efficient. Our transit system and tunnel design process considers whole life cost optimization to provide a high value completed facility.



Metrolinx Eglinton Crosstown West Extension



S.R. 99 Alaskan Way Viaduct Replacement

Tunnel engineering is one of Hatch's core strength technical specialties. At Hatch, our tunnels practice helps our clients face the toughest challenges through total commitment, professional excellence and innovation.

Hatch has extensive experience in design and construction of subway stations and tunnels, heavy rail tunnels, and rail systems going back over 100 years. Our portfolio includes some of the world's most prominent tunnel projects, including the Los Angeles Regional Connector, Channel Tunnel in London, the Sheppard Line in Toronto, and Metro Red Line North Hollywood Extension (Segment 3). We have developed bentonite slurry tunnel boring machines and bring substantial proven experience in slurry and earth pressure balance tunnel boring machines.

Hatch has extensive experience in design and construction of transit systems across North America. The firm has earned a reputation and many awards for technical excellence and innovative solutions. Hatch provides comprehensive engineering services, including feasibility studies, planning, design, and construction management.

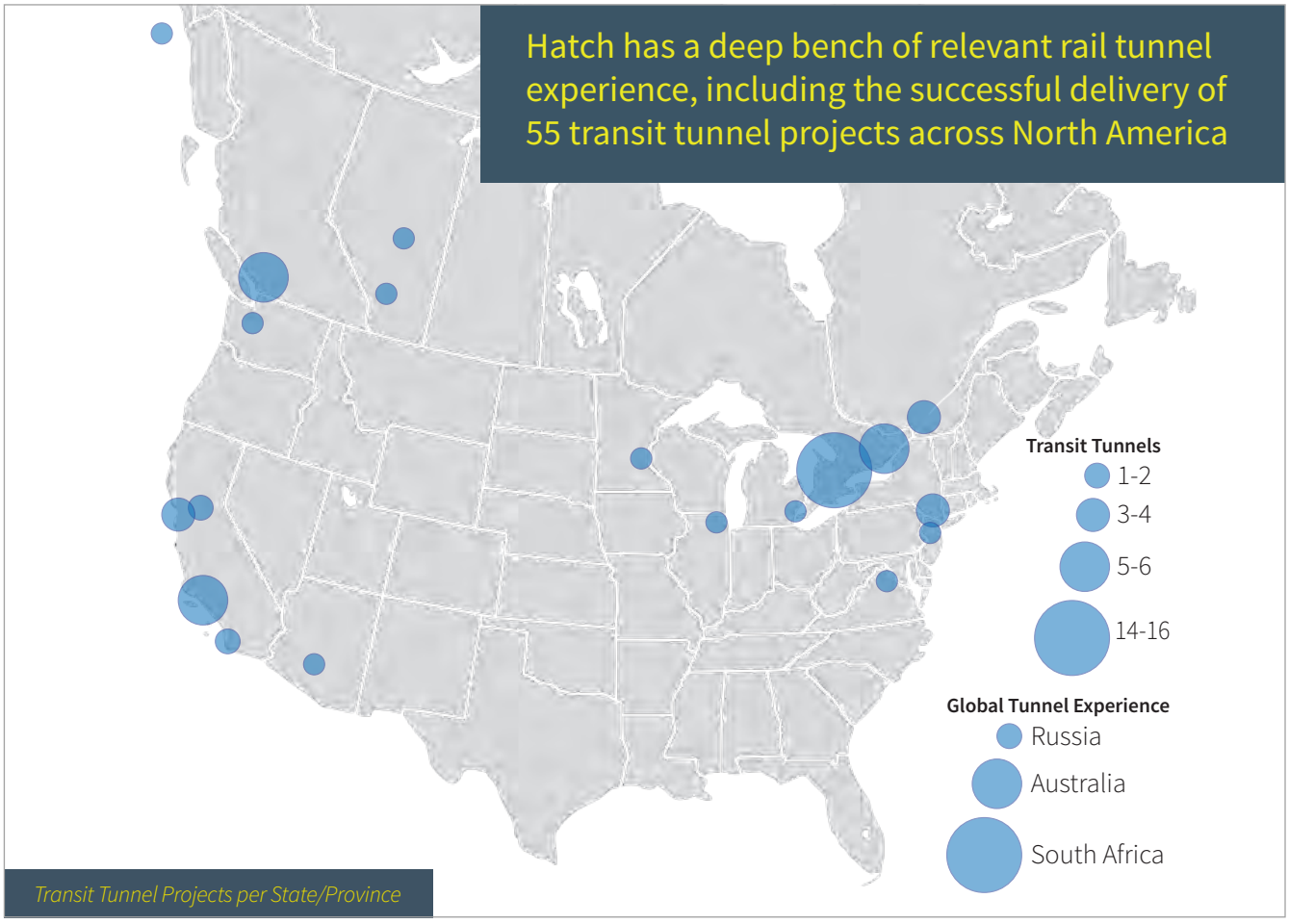
Communities depend on passenger rail systems, and recognize the positive impact of well-designed, efficiently operated systems. Governments depend on them for better connectivity, business stimulus, shaping city development and economic growth. Whether it be a new system, expansion, extension, or a major upgrade of existing systems, we have the professional multidisciplinary team to ensure effective project delivery in every facet of passenger transit tunnel engineering projects.

Tunnel engineering is one of Hatch's core strength technical specialties. At Hatch, our tunnels practice helps our clients face the toughest challenges through total commitment, professional excellence and innovation.

Throughout North America, communities increasingly recognize the positive results of a well-designed, efficiently-operated passenger rail system on quality of life, the environment, and its influence on economic success. Whether it's a new startup passenger rail program, an expansion, a series of extensions, or a major upgrade to an existing passenger rail system, Hatch has a professional and experienced team that will ensure effective project delivery.

From concept to design, and construction through implementation, Hatch helps identify the most effective engineering solutions to fit your needs. We thoroughly understand the challenges of site constraints, right-of-way issues, stakeholder and community concerns, environmental mitigation options, safe construction, and integration with an operating railroad—issues that often go beyond engineering but are critical to a project's success.

Many of our professional staff have devoted their entire careers to transit facility operations and tunnel engineering and bring experience critical to the development of innovative and sound design solutions. We are experts in rail, elevated structures, and tunnels and have received prestigious awards for our work on rail systems. Where others are satisfied to just meet client expectations, we strive to exceed them.



Project Details				Tunnels											Transit					
Project Name	Length (mi)	Diameter (ft)	Ground Type (S=Soft / R=Rock)	Cut-and-Cover	NATM / SEM	Open Shield TBM	EPB TBM	Slurry TBM	Large Dia. TBM	Twin Tunnels	Tunnel Lining	Cross Passages	Constr. Mgmt.	Rehabilitation	Rail Trackwork	Traction Power	Signaling	Communications	Fire Life Safety/TVS	High-Speed Rail
BART CBTC Design	-	-	-															●		
CA High-Speed Rail - Palmdale to Burbank	14.9	26.2	S/R			●				●	●	●			●	●			●	●
CAHSR Merced Heavy Maintenance Facility	-	-	-																	●
Calgary Green Line LRT	2.5	41.3	S/R	●	●		●		●	●	●	●			●	●	●		●	
Calgary West LRT Extension	7	45.9	S	●						●		●	●		●	●	●		●	
CDPQ Réseau Express Métropolitain (REM)	3.8	23.3	R			●					●				●	●			●	
Channel Tunnel - High Speed 1	93	7.6	S/R		●		●			●	●	●								●
CN Railway St. Clair River Rail Tunnel	1.2	27.6	S				●		●		●				●					
Cross River Rail	5.9	20.9	R	●	●	●						●			●					
Edmonton Valley LRT Tunnel	1.1	18.7	S	●	●					●			●		●	●	●			
Evergreen Line	1.4	32.8	S/R				●				●				●					
LA Metro Crenshaw/LAX	1.0	22.0	S	●			●			●	●	●			●	●	●		●	
LA Metro Purple Line Ext. Section 3 - D-B Proposal	1.0	22.0	S	●			●			●	●	●								
LA Metro Redline, North Hollywood Ext. Segment 3	12.4	22.0	R	●	●	●				●		●	●						●	
LA Metro Redline, Santa Monica Mnt. Tunnels	6.5	22.0	R	●		●				●		●	●			●			●	
LA Metro Regional Connector	2.0	19.7	S	●			●			●	●	●								
LAMCTA Purple Line Extension	-	-	-													●	●	●		
Melbourne Metro Tunnel	10.0	20.7	R	●	●			●					●							
Melbourne Underground Rail Loop	13.0	21.3	R		●	●						●								
Met Council Hiawatha Corridor	-	-	-													●	●	●		
Metrolinx Eglinton Crosstown LRT	13.7	19.0	S	●			●			●	●	●	●		●	●	●		●	
Metrolinx Eglinton Crosstown West Extension	13.7	19.0	S/R	●		●	●			●					●				●	
Metrolinx Emergent Engineering Services	-	-	-												●		●	●	●	
Metrolinx Scarborough Subway Extension	-	-	S	●			●	●	●						●	●	●			
Metrolinx Yonge Subway Extension (YSE)	7.4	18.3	S	●			●		●		●				●	●	●		●	
Minneapolis Airport Hiawatha Line LRT	2.8	18.7	S/R				●			●	●	●							●	
MTDB Mission Valley East LRT Tunnels	0.2	36.1	S	●	●	●				●	●	●	●						●	
MTQ Louis-Hyppolite-La Fontaine Tunnel Rehab.	1.1	37.7	S/R											●					●	
MWAA Dulles APM Tunnels	10.9	39.4	R	●	●	●				●	●	●			●	●	●		●	
NFTA Buffalo Light Rail Rapid Transit Tunnels	3.5	18.4	R	●	●	●				●		●	●	●	●	●	●		●	
NJ Transit ARC THE - Palisades Tunnel	1.9	24.6	S/R			●				●	●									
NYMTA LIRR East Side Access	6.8	49.2	S/R	●		●		●					●				●	●	●	
NYMTA No 7 (Flushing) Line Extension	1.5	22.0	R			●					●								●	
Ottawa LRT Confederation Line	1.6	32.8	R		●						●				●	●	●	●	●	
Phoenix Sky Harbor APM Guideway Tunnels	5.0	16.4	S	●	●	●	●	●		●									●	
SCVTA San Jose Vasona LRT Diridon Tunnels	0.2	18.7	S	●									●		●	●				
SCVTA Silicon Valley Rapid Transit (SVRT)	16.3	18.7	S	●			●			●	●	●			●	●	●		●	
SMART Larkspur Tunnel	-	-	-														●	●		
Sound Transit Beacon Hill Tunnel and Station	1.6	18.7	S		●		●			●	●	●							●	
Sound Transit East Link LRT Bellevue to Overlake	1.6	18.7	S	●	●										●	●	●		●	
Sound Transit University Link	-	-	-													●				
STM Garage Côte-Vertu - Montréal Orange Line	1.2	28.2	R		●										●	●			●	
Toronto-Windsor Corridor HSR Study	-	-	-												●					●
Tri-Met Max Blue Line Westside & Hillsboro Extension	-	-	-													●	●	●		
TTC Bored Tunnels - Original Young St. Subway	6.2	16.1	S	●		●	●			●	●	●	●		●	●	●			
TTC Sheppard Subway	8.0	17.1	S	●			●			●	●	●	●		●	●	●		●	
TTC Toronto-York Spadina Subway Extension	10.7	17.7	S	●	●		●			●	●	●	●		●	●	●		●	

Hatch Tunnels – Areas of Expertise

Tunnel Applications
Rail & Transit
Road & Highway
Water
Hydro-Electric
Wastewater & CSO
Intakes & Outfalls
Pipelines
Pedestrian
Lake Tap

Planning
Cost & Schedule Estimating
Tunnel Feasibility Studies
Economic Evaluations
Major Investment Studies
Corridor Analysis

Tunnel Design
Hard & Soft Rock
Soft Ground
Sub-aqueous
Cut-and-Cover

Project Delivery
Contract Documents
Design-Bid-Build
Design-Build
Contractor Design
Public-Private-Partnerships (P3)
Owner's P3 oversight

Construction Management
Contract Administration
Resident Engineering
Inspection
Claim Resolution
Payment Review
Safety

Program Management
Program Delivery
Project Controls
Document Management
Configuration Management
Contract Packaging

Numerical Modelling of Ground
Structure Interaction
2-D & 3-D Modelling
Dynamic Modelling
FLAC, Phase2, Staad

Tunnel Excavation Methods
Mainbeam & Shielded Rock TBMs
EPB & Slurry Soft Ground TBMs
Roadheaders
Sequential Excavation Methods
Drill & Blast
Conventional & Hand Excavation

Trenchless Technologies
Microtunnel Boring Machines
Horizontal Directional Drilling
Jack & Bore
Pipe Ramming
Open Shield Pipe Jacking

Deep Excavations & Shafts
Soldier Piles & Lagging
Secant Piles
Slurry Diaphragm Walls
Liner Plate & Ribs
Soil Nailing
Raise Boring
Shaft Drilling
Steel Ribs & Lagging
Sinking Caisson
Steel Casing
Cast-in-Place Concrete Lining
Pre-Cast Concrete Segmental Lining
Steel Shaft Liner

Geotechnical Characterization
Geotechnical Baseline Reports
Geology & Hydrogeology
Investigation & Assessment

Instrumentation & Monitoring
Conventional & Linear Survey
MPBX, Tapex, Inclinometer
Electronic Data Collection
LIDAR

Seismic
Seismic Hazard Assessment
Design Ground Motions
Fault Hazard Assessment
Fault Crossings
Liquefaction Potential

Rock Support Design
Shotcrete
Rock Bolts
Steel Mesh
Lattice Girders & Ribs
Spiles & Canopy Tubes

Tunnel Lining Design
Pre-Cast Concrete Segmental
Cast-in-Place Concrete
Shotcrete
Steel Liner Plate & Ribs
Steel Tunnel Liner

Ground Improvement
Jet Grouting
Compensation Grouting
Permeation Grouting
Ground Freezing
Dewatering
Compaction Grouting

Settlement Prediction & Mitigation
Building & Utility Damage Assessment
Monitoring Programs
Pre-Construction Condition Surveys
Pre- & Post-Tunnelling Mitigation

Risk Management
Risk Registers
Qualitative Assessments
Quantitative Assessments
Monte Carlo Analysis

Fire Life Safety Analyses
Alarm Systems
Code Compliance
Computational Fluid Dynamics (CFD)
Exit Analyses
Fire Modelling
Ventilation

Rehabilitation
3D Kinematic Scanning
Condition Surveys
Corrosion & Design Life Assessment
Remediation Design
Emergency Repairs
Systems Restoration

Dense Urban Excavation

Transit systems in urban centers and airports require construction underground in a manner that minimizes surface disruption throughout the construction process. Building underground transit facilities such as the Regional Connector in Los Angeles, Beacon Hill Station and Tunnels, Minneapolis Hiawatha LRT, Eglinton Crosstown LRT, Calgary Green Line LRT Project, the Toronto-York Spadina Subway Extension and the Evergreen Line Rapid Transit through urban areas presents many challenges, including variable subsurface conditions, complex rights-of-way and dealing with existing structures and utilities.

Of critical importance is the need to plan, design, construct, and commission these facilities so that public impacts are minimized. Hatch's ability to offer the necessary geotechnical, structural and practical tunnelling skills required of all underground projects, and to complement these skills with extensive skills in the specialist areas of track design, signaling, communications, traction power, ventilation and emergency egress, rail activation, and systems commissioning makes us a true partner for our clients.

MTDB Mission Valley East LRT Tunnels

LIRR EAST SIDE ACCESS

New York, New York

The project was to relieve present congestion problems and provide the commuter passengers of the Long Island Railroad with access to the East side of mid-town Manhattan by extending the MTA Long Island Railroad via tunnel from Queens to the historic Grand Central Terminal in Manhattan, New York City. As part of the HMM JV, Hatch was the tunnel consultant to the Program Management team, providing tunnelling expertise, specifically, managing the tunnel design and construction work, including design review and expert advice on the tunnel design and construction including tunnel lining, ventilation systems, fire/life safety issues and assessment of tunnelling methods.

LA METRO REGIONAL CONNECTOR

Los Angeles, California

Hatch, as part of the HMM JV, designed the 1.9-mile underground light-rail Metro Regional Connector Project, which will improve access to local and regional destinations, ensuring a continuous, through service between these lines and connectors to others via the 7th Street/Metro Center Station. Our design of twin tunnels and the 2nd and Broadway station includes precast concrete tunnel lining and cross passages. We assessed the structure of the tunnel lining under a major fire event and evaluating the impact assessment study and mitigation for the overhead structure the tunnel now crosses. Design and construction of the 2nd and Broadway station is adjacent to the LA Times buildings, which requires underpinning for the station-structure construction.

EGLINTON CROSSTOWN LRT TUNNELS

Toronto, Ontario

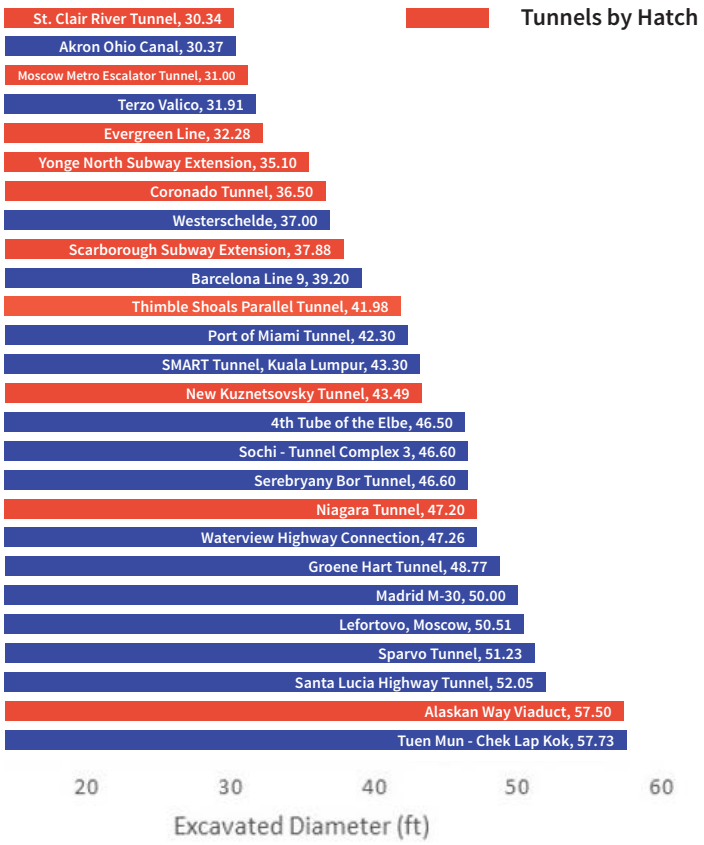
Hatch provided detailed design of the twin tunnels for the Eglinton Crosstown LRT, the largest transit expansion project ever to be undertaken in Toronto. It consists of approximately 12 miles of new LRT alignment with 20 new stations. Approximately seven miles of the alignment is underground and is mostly comprised of the two twin tunnels construction contracts. The tunnels, developed by Hatch under a separate design contract, use a six-segment universal ring arrangement. They are being mined by four EPB TBM procured by the owner to specifications provided. Hatch was engaged on the Eglinton Signal System Alterations project, which engineered a solution that ensured signal equipment in a new relay room provided for the Eglinton Crosstown Project fell within acceptable EMC/EMI limits.

S.R. 99 Alaskan Way Viaduct Replacement

Large Diameter Tunnels

Using a single, large diameter tunnel boring machine has revealed a number of unique advantages and opportunities for urban subway construction. Typical subway construction often uses cut-and-cover techniques that remove the street surface, relocate, and protect existing utilities, and excavate down from the street level. This can be very disruptive to surface traffic and has negative impacts on local businesses. This approach tries to reduce these impacts by using two smaller tunnel boring machines to excavate separate running tunnels between stations, but this method still requires cut-and-cover methods to construct the stations.The single-bore method avoids most of these in-street impacts because the tunnel, trackways and boarding platforms are all constructed below ground without disruption at the surface.

Hatch brings extensive experience in large diameter and deep shafts and can evaluate all support of excavation options. Hatch has delivered multiple large diameter tunnels, for a wide variety of purposes: transit, highway, and water conveyance. Hatch can safety deliver any tunnel project design your project requires.



S.R.99 ALASKAN WAY VIADUCT REPLACMENT

Seattle, Washington

The Alaskan Way Viaduct and Seawall Replacement is the world's largest single-tube, double-deck highway tunnel. The project uses a Mega-Earth Pressure Tunnel Boring Machine, over 57 feet in diameter, which drove the 1.7-mile highway tunnel under the streets of Seattle. Hatch was the Project Management Assistant Consultant, providing program and design management and related technical and construction management services. Hatch played a key role in alignment selection, guiding the project towards an alignment that is adjacent to the existing viaduct at the start of tunnelling at the south end of the tunnel, avoiding the original alignment through the historic Pioneer District in a narrow corridor.

NIAGARA TUNNEL PROJECT

Niagara Falls, Ontario

The project involved constructing a six mile long, 47-foot bored diameter tunnel with an intake upstream of Niagara Falls and the outlet at the head works of the generating complex downstream. This provides an average annual energy of 14% (1.6 billion kWh), promoting an environmentally-friendly source of electricity. As the owner's representative, Hatch provided technical and management oversight, managed the preparation and negotiation of a three-part geotechnical baseline report, and developed a two-pass lining system, consisting of initial rock support and a final liner made up of a double-layer, waterproofing membrane, cast-in-place concrete, and contact and pre-stress grouting.

SCARBOROUGH SUBWAY EXTENSION

Toronto, Ontario

This project is the first use of a single bore tunnel with a twin track subway line in Toronto. The existing Scarborough Rapid Transit system has been in service since 1985 and is in need of replacement. It is operating well over its design capacity levels and the solution to this issue has been to develop a subway extension from the current subway terminal at Kennedy Station to the Scarborough City Centre at McCowan and Highway 401. Hatch has been selected as the lead tunnel design consultant for this prestigious and important project to the transit infrastructure in Toronto. Hatch was responsible for the selection of the tunnel configuration, considering twin tunnels, a 38-foot diameter single bore tunnel with stations partially within the tunnel and a mid-size single bore with twin tracks tunnel.

Toronto-York Spadina Subway Extension

Cut-and-Cover Tunnels and Stations

Cut-and-cover tunnelling involves construction of near-surface tunnel structures, such as stations, in deep excavations in soil and rock followed by surface restoration upon completion. The excavation is supported with internally-braced or externally-braced shoring walls in soil and weathered rock and with rock reinforcement in competent rock. Rock reinforcement consists of rock dowels, tensioned rock bolts and post-tensioned rock anchors with reinforced shotcrete support.

While the most economical tunnel construction method, it can be highly disruptive in dense urban environments. Hatch understands how to mitigate and reduce these surface disruptions in even the most active city center. Hatch has successfully delivered cut- and-cover tunnel design and construction support services, including excavation support systems, utility relocation, and decking safety inspection prior to opening and restoring to live traffic.

DIRIDON TUNNEL

San Jose, California

A 5.5-mile light rail extension running from downtown San Jose to Campbell in shared right-of-way with the existing Union Pacific Railroad (UPRR). The line required several bridge structures (including Hamilton Bridge) over city streets, a state highway, and a creek, and under the Caltrain tracks at Santa Clara Street, and a major tunnel under the Caltrain tracks in Diridon Yard (Diridon Tunnels). A pedestrian tunnel was constructed at Diridon Station, and new retaining walls were constructed along Route 87 and Los Gatos Creek south of Bascom, which required extensive structural expertise throughout design and construction with geotechnical and environmental factors influencing the project.

SHEPPARD SUBWAY

Toronto, Ontario

The Sheppard Subway project comprised a four-mile-long underground system including five new stations with tail tracks at the terminal stations. The twin tunnels consisted of 2.4 miles of twin bored tunnels and 1,640 feet of cut and cover tunnel alignment. The tunnel included cross passages and emergency exit structures. The alignment was raised to reduce the cost of the cut and cover stations and to increase the passenger convenience. Minimum cover was 13 feet with 19-foot excavated diameter. The project was completed on budget and on schedule. The introduction of new tunnelling technology created significant cost savings and schedule acceleration.

LA METRO RED LINE NORTH HOLLYWOOD EXTENSION (SEGMENT 3)

Los Angeles, California

The 6.3-mile Metro Red Line North Hollywood Extension (Segment 3) included three new underground stations and two new line sections. 34,000-ft of 22-ft diameter tunnel constructed through faulted rock and mixed ground with advanced grouting for ground water mitigation while crossing a major fault line. Tunnels driven by two full-face TBMs through variety of rock conditions ranging from soft shales to fresh granodiorite. Cut-&-cover stations with the Hollywood/Highland Station constructed under temporary deck to minimize disruption to the prime tourist area on Hollywood Boulevard. Shafts, crossovers and track level rooms excavated by conventional means.

Toronto-York Spadina Subway Extension

SEM Tunnels

The Sequential Excavation Method (SEM) is a method of modern tunnel design and construction employing sophisticated monitoring to optimize various wall reinforcement techniques based on the type of rock encountered as tunnelling progresses.

The works built by the Sequential Excavation Method are very attractive from the economic point of view. The technique provides an economic advantage of employing inherent geological strength available in the surrounding soft ground or rock mass to stabilize the tunnel wherever possible rather than reinforcing the entire tunnel. NATM/SEM is generally thought to have helped revolutionize the modern tunnelling industry.

Many modern tunnels have used this excavation technique, and Hatch has an extensive portfolio of SEM projects throughout the years.

BEACON HILL STATION AND TUNNELS

Seattle, Washington

The project was a critical component in Sound Transit's long-term regional transportation network. Twin 4,200-ft-long tunnels, one northbound and one southbound, will be excavated using an EPB TBM and lined with one-pass precast segmental linings measuring 18-ft 10-in. internal diameter. The 380-ft-long platform tunnels plus connector tunnels, concourse adit, ventilation adits and cross-passage tunnels will be constructed using the sequential excavation method. As the lead JV partner, Hatch was responsible for overall project management and controls, as well as detailed design of all tunnels and portals, shafts, and mined station tunnels. Hatch also provided design support during construction, including the engineering oversight of the critical SEM excavation and support activities.

MISSION VALLEY EAST LRT TUNNELS

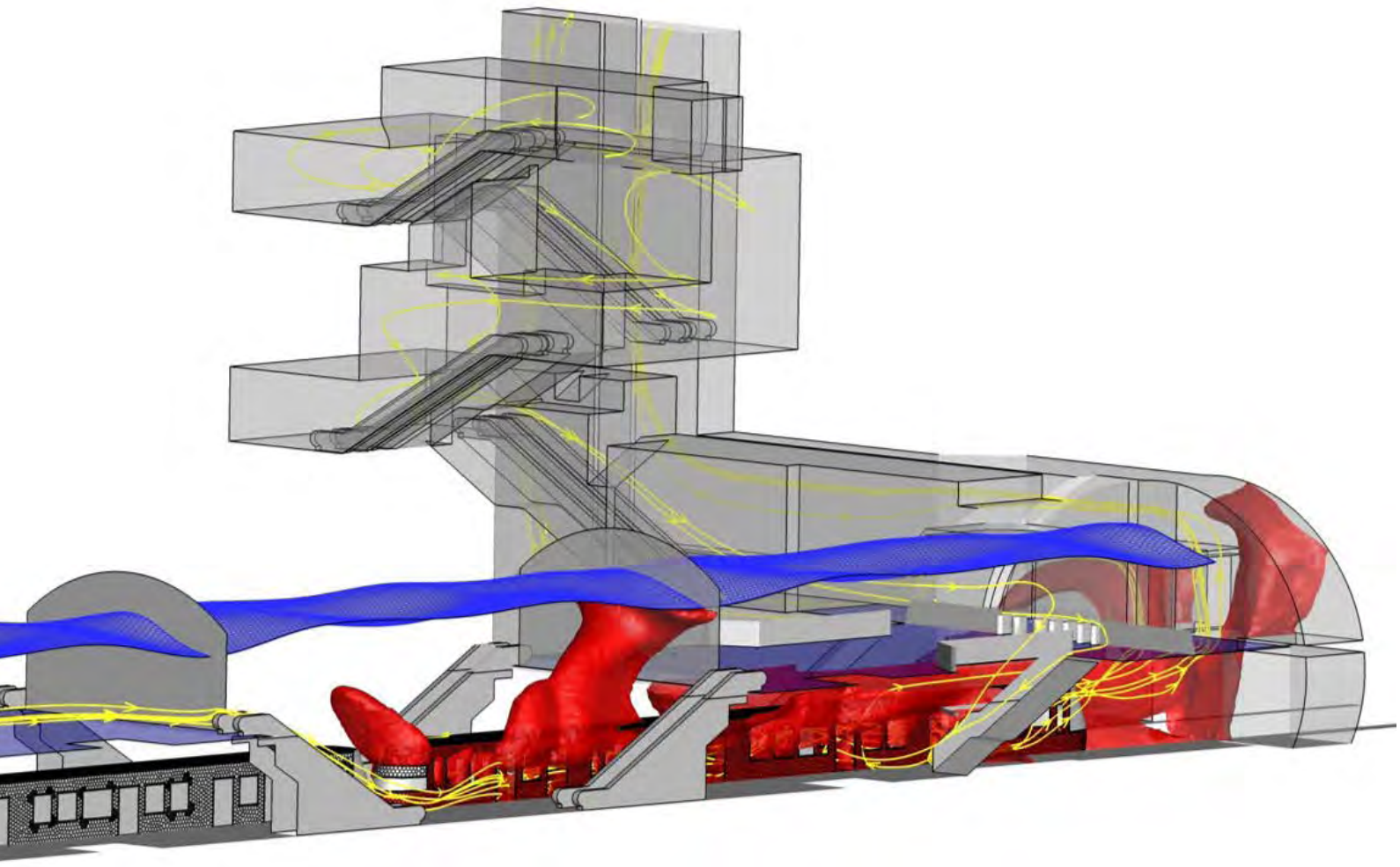
San Diego, California

The Mission Valley East Light Rail extension (Green Line) extends the San Diego Trolley from Mission San Diego to the Orange Line at Baltimore Drive. Hatch was the tunnel expert for design of the light rail tunnels and ventilation systems. During the design phase, the client altered the alignment, which changed both the length and profile of the tunnel. We responded expeditiously to changing conditions accommodating a change from conventional mined tunnels to NATM tunnels. Surface settlement was of particular concern, and settlement monitoring of historic buildings and other structures and utilities was an essential element of the excavation process.

TORONTO-YORK SPADINA SUBWAY EXTENSION

Toronto, Ontario

The project involved the first use of SEM tunnels by TTC for a mined triple-track structure. Reporting to the TTC's Project Director, the team managed the design delivery and project construction. The team prepared the preliminary design and contract specifications for all the rail system elements; e.g. track, train control, traction power supply and distribution, communications, integrated controls, and fire ventilation and supported the tender process for each contract package. Hatch also performed the following: safety system assurance, rail activation, system integration, and safety certification. Hatch also performed the detailed design of the tunnel under a separate contract as well as placed the subway system into revenue operation.



Confederation Line Project FLS Ventilation Rendering

Fire Life Safety

Safety, security and comfort of public and end users of infrastructure facilities are one of Hatch's core values. Accordingly, Fire Life Safety (FLS) and Tunnel Ventilation System (TVS) design has been one of Hatch's core services along with our long standing tunnel and infrastructure design services.

To ensure safety and comfort of people, and that facilities are maintained, especially in and around underground structures and tunnels, Hatch uses cutting- edge technologies and engineering skills. Our team of experts has been on the front lines of the design and construction of TVSs for some of the most challenging transportation tunnels (Subways and Light Rail Transit) around the world. This experience has helped Hatch to understand the challenges of engineering for such sensitive and essential tunnel systems.

Our experienced team of FLS professionals provides a full range of services. We have helped deliver different projects from preliminary studies through to installation, testing and commissioning of the TVSs.

EDMONTON VALLEY LINE LRT TUNNELS

Edmonton, Alberta

The Valley Line is an $1.8 billion 16.7-mile urban rail line crossing downtown Edmonton, separate from Edmonton's existing high-floor LRT system. Hatch was responsible for the management and coordination of all technical activities required for the development of procurement documents for this DBFOM project. As part of the Owner's Engineer team, Hatch was responsible for the design of sequentially excavated tunnel for a 990 ft., twin 19 ft. diameter tunnel extension to the existing light rail transit system. Hatch also supported tunnel systems and fire life safety design specifications. Hatch's responsibilities included supporting the City as the P3 Technical Advisor.

DULLES AUTOMATED PEOPLE MOVER

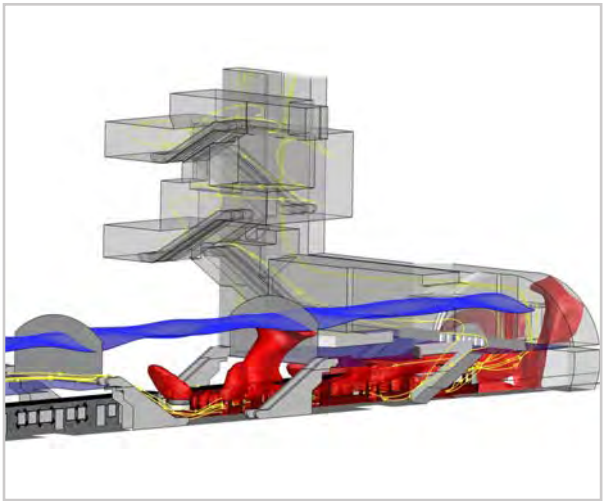
Washington, D.C.

The program includes a $450 million network of tunnels for new systems including: Underground Automated People Mover (APM) System, Pedestrian Tunnel, Baggage Conveyor Tunnel, and Utility Tunnel. The unified control of the ventilation and fire protection systems serving the Automated People Mover System required coordination between multiple design and construction contracts. Hatch not only performed the design for the APM, baggage, and tug tunnels, but also developed operational procedures in collaboration with the Authority's Fire Chief, station architects, system designers and our in-house tunnel ventilation designers.

CONFEDERATION LINE LRT

Ottawa, Ontario

One segment of the project is mainly tunneled beneath Ottawa's downtown core and includes three underground stations, two portals and approximately a 1.7 mile twin-track connecting tunnel. Hatch was responsible for preparing mechanical engineering design for tunnel fire protection, tunnel ventilation system using one-dimensional and three-dimensional analyses, reviewing tunnel fire-life-safety requirements, developing and preparing smoke dispersion analysis, planning, coordinating and preparing the TVS reports for the tunnel and three underground stations using one and three dimensional analyses (SES and CFD), evaluating and coordinating specific mechanical requirements.



Related Tunnel Applications

Road Tunnels

As the demand for additional highway infrastructure expands, Hatch's capabilities in large-diameter and large-bore tunnels and jacked tunnels are finding increasing application across North America. As seen in projects that highlight our comprehensive civil, structural and transportation engineering expertise, such as the I-90 Jacked Box Highway Tunnel, or King Road CN Grade Separation project, we bring critical knowledge and experience to the early stages of these visible, long-term projects. Whether the project involves highway realignment through a rural canyon, a river crossing, or a route beneath a congested urban center or active railway, Hatch can help by offering you the appropriate construction technologies for your needs.

King Road at CN Grade Separation

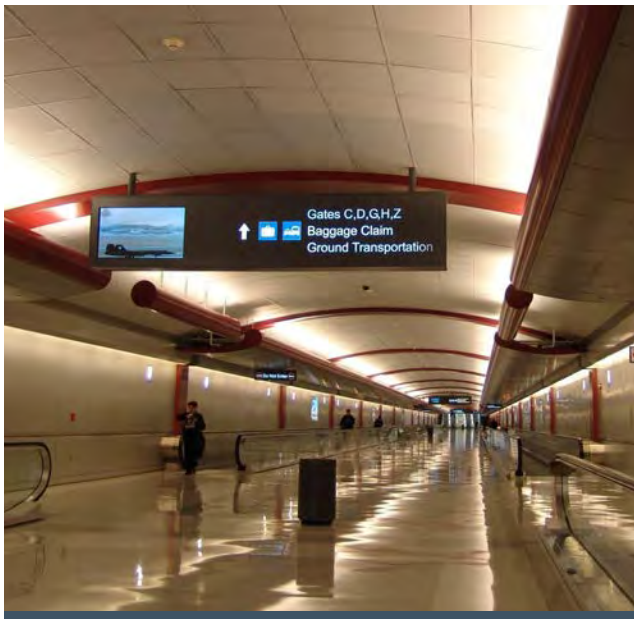
Heavy Rail Tunnels

Hatch is a full-service consulting engineering firm world renowned for its tunneling and heavy rail/ transit expertise. The firm has earned a reputation and many awards for technical excellence and innovative solutions. Hatch provides comprehensive engineering services, including feasibility studies, planning, design, and construction management. The firm provides a resource pool of 9,000 staff worldwide that allows Hatch to quickly and cost effectively respond to any project demand. Hatch has extensive experience in design and construction of heavy rail tunnels and rail systems going back nearly a century. Our portfolio includes some of the world's most prominent heavy rail tunnel projects, including the Sheppard Line in Toronto and Metro Red Line North Hollywood Extension.

Heartland Corridor - Norfolk-Southern

Pedestrian Tunnels

As underground occupied spaces, pedestrian tunnels require a truly integrated multi-discipline approach, in order to provide a safe, accessible and pleasant user experience. Pedestrian tunnels tend to be shallow structures, which typically generate conflicts with urban utilities, traffic and buildings, resulting in highly complex projects which are mitigated by Hatch's core tunneling strengths. This can be seen in successful Hatch projects, such as the Billy Bishop Airport Pedestrian Tunnel, Dulles Airport APM Tunnels, and Northwest PATH Pedestrian Tunnel (Phase 1). In urban settings, construction of these tunnels can significantly impact day-to-day operation of adjacent buildings and affect prominent stakeholder facilities, requiring effective planning and staging of the works.



MWAA Dulles Airport APM Tunnels

Tunnel Rehabilitation

Hatch has a significant history of tunnel investigation, design, costing, and construction inspection. Our experience covers tunnels of all sizes and uses, from transit, roadway, water conveyance, and utilities. Hatch has the experience and the resources to undertake tunnel rehabilitation projects across North America, ranging from the remote Whittier Access Project in Alaska to dense urban environments, such as the TTC Yonge Line tunnel rehabilitation in Toronto. Following Hurricane Sandy, Hatch mobilized inspection teams quickly to assist the Metropolitan Transport Authority Bridges and Tunnels (MTABT) to rehabilitate the Hugh L. Carey Tunnel (formerly the Brooklyn Battery Tunnel) in Manhattan, New York.

Hugh L. Carey Tunnel Rehabilitation Project

Stations and Integration

Hatch provides cutting-edge station integration design, from the construction of station boxes during underground excavation, to the integration of fire/life safety systems, railway security, surveillance, control and operation technologies. Design is critical to the success of rail and transit infrastructure. Leveraging multidisciplinary skills, digital technology and environmental management, Hatch designs efficient and integrated solutions for passenger transit and freight rail, as well as intermodal and associated facilities, including stations.

Scarborough Subway Ventilation Rendering

Signaling and Controls

Hatch is one of the pre-eminent railway train control and signal delivery firms globally with nearly 200 qualified and licensed (IRSE, P.Eng, C.Eng, PE) specialists in train control and signal design, rail operations modeling, communications, automation, system safety, and installation. More than consulting engineers, the Hatch team is made up of seasoned owner/operator engineering leads, system architects from the leading equipment supply firms, and construction leads from top contractors. Instilled with a world-class mindset, many of the Hatch Rail Systems team members have experience from the world's pre-eminent rail systems.

MTA Long Island Railroad PTC

Asset Management

Hatch provides extensive asset management experience for all aspects of a facilities lifespan from conceptual studies to decommissioning and change of use. Our staff are able to advise on strategic economic appraisal of new facilities and transit development. They have acted as technical advisor to financiers on a number of passenger rail developments, prepared master plans, and feasibility studies. Our staff are also experienced in the inspection of structures, for routine structural assessment and for repairs after accidental damage. We are able to advise on emergency and permanent repairs as well as inspecting facilities and devising inspection and planned preventative maintenance procedures.

Gautrain Management Agency Rail System Asset Audit

HATCH

For more information, please contact:

Jean Habimana
Global Director, Tunnels

T. 438.266.0788
E. jean.habimana@hatch.com

Dominic DiBrito
Managing Director, Infrastructure, USA

T. 215.641.8888
E. dominic.dibrito@hatch.com

Jonathan McDonald
Global Director, Rail Systems

T. 510.390.8035
E. jonathan.mcdonald@hatch.com

100 West Butler Avenue,
Ambler, Pennsylvania 19002

www.hatch.com