



# Tunnels and Trenchless Technologies





# Why Pick Hatch Tunnels?



**Capability**  
Excellence in all tunnel applications  
& specialties



**Capacity**  
Over 100 dedicated tunnel specialists



**Large Tunnel & Project Experience**  
Largest rock TBM project in the world



**Leader in Innovation**  
Technical, procurement & delivery



**International Recognition**  
Dozens of awards



**National & Global Presence**  
Over 55 offices in the US & worldwide



**Proven Project Delivery**  
Thousands of kilometers of tunnels







Elm Road Generation Station Water Intake Tunnel, Oak Creek, Wisconsin

# Tunneling the future

In this fast changing world, we are all facing numerous challenges in maintaining existing infrastructure as well as building new to support development and growth. At Hatch, our tunnel experts help our clients face these challenges through total commitment, professional excellence and innovation.

Whatever our clients envision, Hatch can design and manage from concept to completion. With over six decades of business and technical experience in infrastructure, mining and energy, we know your business and understand that your challenges are changing rapidly.

As an employee-owned and client focused professional services firm, we draw upon our 9,000 staff worldwide to create positive change for our clients and the communities we serve. With over 20 offices throughout the United States and Canada and an additional 35 offices world-wide, Hatch offers a full-range of services to handle any size project—from a small inspection assignment to world-class, multi-billion-dollar transit programs. We offer clients a complete range of engineering services, including planning, design, procurement, construction and program management and operations support.

Tunnel and Trenchless Technology engineering is one of Hatch's core strength technical specialties with roots beginning on Toronto's subway system in the 1950s. Steady growth since then means that Hatch has now engineered thousands of kilometers of tunnels. Whether it is hard rock tunnel boring machine, sequential excavation method, drill and blast, micro-tunneling, horizontal directional drilling or pressurized face tunnel boring machine in soil, we identify the most appropriate technology to suit the project.

With over 100 tunnel specialists that include engineers, geologists and construction management professionals, we have the capacity, experience and understanding to meet challenges on new transportation links, highways through environmentally sensitive areas, major transit expansion programs, water conveyance and sewage facilities and pedestrian tunnels.









Minneapolis Airport LRT Tunnel, Minneapolis, Minnesota



Ottawa LRT Tunnel, Ottawa, Ontario

## Outstanding Project of 2014

Beacon Hill Station and Tunnel Project received several awards for its technical excellence including “Outstanding Project of the Year” from the International Federation of Consulting Engineers in 2014.

# Rail & Transit

Well designed and configured passenger rail & transit systems improve the quality of life in communities along with reducing greenhouse gas emissions. Transit systems in urban centers and airports require underground construction in a manner that minimizes surface disruption throughout the construction process. Building underground rail and transit facilities through urban areas presents many challenges, including variable subsurface conditions, complex rights-of-way restrictions 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 tunneling expertise required for underground projects, and to complement these services with extensive skills in the specialist areas of track design, signaling, communications, traction power, ventilation and emergency egress provisions, rail activation, and systems commissioning makes us a truly ideal partner for our clients.





Whittier Access Tunnel, Alaska

# Road Tunnels

As the demand for additional highway infrastructure expands, Hatch's capabilities in large-diameter and large-bore tunnels are finding increasing application across North America. Together with our comprehensive civil, structural and transportation engineering expertise, we bring critical knowledge and experience to the early stages of these highly visible, long-term projects.

Whether the client's project requirements are highway realignment through a rural canyon, a river crossing, or a route beneath a congested urban center, we can help by offering the appropriate construction technologies. Hatch can provide fully integrated teams that cover not only the tunnel design but also traffic and roadwork, fire-life safety, tunnel ventilation, emergency egress and illumination designs.



Central Artery Tunnels, 1-90/1-93 Interchange, Boston, Massachusetts





North West PATH Tunnel from Union Station, Toronto, Ontario

# Pedestrian Tunnels

As underground publicly occupied spaces, pedestrian tunnels require a truly integrated multi-discipline approach in order to provide a safe, accessible and pleasant user experience. By their very nature, pedestrian tunnels tend to be shallow structures, which typically generate conflicts with urban utilities, traffic and existing buildings, resulting in highly complex projects.

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. Hatch's core tunneling strengths are complemented by our in-house capabilities in architectural, mechanical, electrical and fire-life safety disciplines, allowing us to provide a fully integrated in-house service.



Billy Bishop Airport Pedestrian Tunnel, Toronto, Ontario (Image courtesy of Ports Toronto)





Niagara Power Tunnel, Niagara Falls, Ontario (Photo provided courtesy of Ontario Power Generation Inc.)

## Largest Rock TBM

The 14.44 m diameter Robbins open-gripper TBM, christened “Big Becky”, excavated 1.7 million m<sup>3</sup> of rock which was transported through the tunnel by conveyor belt and stored on Ontario Power Generation property. When it was commissioned, Big Becky was the largest hard-rock TBM in the world.



Seymour-Capilano Twin Tunnels, Vancouver, British Columbia

## Water Tunnels

North America’s water supply and distribution system is in a constant state of repair, upgrading and expansion. It is critical that these “lifeline” facilities remain operational for extended periods of time. Hatch’s replacement water conveyance systems experience ranges from small diameter pipelines using horizontal direction drilling, to some of the largest diameter machine-bored tunnels for electrical power generation. We have worked with clients on projects that have traversed the most diverse conditions — from pristine mountain areas to active fault crossings, subaqueous crossings beneath rivers, estuaries and oceans, and highly developed urban environments.





West Area Pump Stations and CSO Tunnels, Atlanta, Georgia

# Wastewater Tunnels

North America's aging wastewater infrastructure requires attention to address deterioration, lack of redundancy and insufficient capacity resulting from population growth. With ever increasing environmental considerations and sensitivity, combined and sanitary sewage overflows require complex and costly system improvements.

As hard surfacing associated with development reduces the ground's ability to absorb rainfall, storm water runoff is becoming an increasing problem. For wastewater and storm water collection and conveyance, developments in tunnel design and construction have resulted in a wide-range of successful, sustainable solutions that have been implemented by Hatch.

No matter what size pipe is required, there is a sustainable underground approach that will provide a cost-effective solution. We are able to provide our clients with the right blend of tunnel, shaft, and hydraulic system design expertise to provide well-engineered solutions for the most complex wastewater and storm water conveyance and storage needs.



Ashbridges Treatment Plant Outfall, Toronto, Ontario





Keswick WPCP Effluent Outfall Expansion, Keswick, Ontario



West End Trunk Line, Chester County, Pennsylvania

# Trenchless Technologies

Trenchless technologies consist of a family of techniques for smaller diameter underground infrastructure implementation, allowing renovation, replacement and new construction with minimal disruption of the ground surface. Whether micro tunnel boring machines, horizontal directional drilling (HDD), pipe ramming, or jack-and-bore have been used, Hatch has done it successfully.

Trenchless technologies offer tremendous advantages for the construction and rehabilitation of water, wastewater, energy, communications and industrial infrastructure by minimizing public inconvenience and traffic disruption. Often, trenchless technologies are the only practical solutions for the construction or rehabilitation of infrastructure in environmentally sensitive areas, built-up urban areas, or other areas otherwise not amenable to traditional open-cut construction techniques.

Whether Hatch is completing condition assessments, rehabilitating to extend useful life, or constructing new infrastructure, we have the qualified staff for the job. Our distinguished experts, who are recognized locally and globally, provide a wealth of trenchless knowledge. Hatch leverages that experience and knowledge to deliver customized solutions for our clients' unique needs.





# Hatch Tunnels - Areas of Expertise

## Tunnel Applications

Rail & Transit  
Road & Highway  
Water  
Hydro-Electric  
Wastewater & CSO  
Intakes & Outfalls  
Pipelines  
Pedestrian

## 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

## 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

## Deep Excavations & Shafts

Soldier Piles & Lagging  
Secant Piles  
Slurry Walls  
Liner Plate & Ribs  
Soil Nailing

## Geotechnical Characterization

Geotechnical Baseline Reports  
Geology & Hydrogeology  
Investigation & Assessment

## Numerical Modeling of Ground

Structure Interaction  
2-D & 3-D Modeling  
Dynamic  
FLAC, Phase2, Staad

## 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

## Ground Improvement

Jet Grouting  
Compensation Grouting  
Permeation Grouting  
Ground Freezing  
Dewatering

## Instrumentation & Monitoring

Conventional & Linear Survey  
MPBX, Tapex, Inclinator  
Electronic Data Collection  
LIDAR

## Settlement Prediction & Mitigation

Building & Utility Damage  
Assessment  
Monitoring Programs  
Pre-Construction Condition Surveys  
Pre- & Post-Tunneling Mitigation

## Risk Management

Risk Registers  
Qualitative Assessments  
Quantitative Assessments  
Monte Carlo Analysis

## Fire Life Safety Analyses

Code Compliance  
Exit Analyses  
Fire Modeling  
Ventilation

## Rehabilitation

Condition Surveys  
Corrosion & Design Life Assessment  
Remediation Design  
Emergency Repairs  
Systems Restoration





**Gary Kramer**

Tel: +1 905 919 3782

gary.kramer@hatch.com

**Tomas Gregor**

Tel: +1 905 403 3802

tomas.gregor@hatch.com

**Don Phelps**

Tel: +1 604 639 1004

don.phelps@hatch.com

**Jean Habimana**

Tel: +1 438 266 7888

jean.habimana@hatch.com

**Marc Gelinas**

Tel: +1 905 315 3504

marc.gelinas@hatch.com



Hatch has served clients for over 60 years and has project experience in more than 150 countries around the world. With 9,000 people in over 55 offices, Hatch has more than \$35 billion in projects currently under management.

20160401

This publication contains information in summary form, current as of the date of publication, and is intended for general guidance only. We make no guarantees, representations or warranties of any kind, expressed or implied, regarding the information including, but not limited to, warranties of content, accuracy and reliability. Any interested party should undertake their own inquiries as to the accuracy of the information. Hatch Ltd. excludes unequivocally all inferred or implied terms, conditions and warranties arising out of this document and excludes all liability for loss and damages arising therefrom. This publication is the copyrighted property of Hatch Ltd. © 2016 All rights reserved.