



+ Tunnel Insight

HATCH

Tunnel Insight



From legacy to an innovative future

Tunnels are increasingly being built through some of the world's most challenging terrain, cutting deep through mountains or below rivers, lakes, seas, and oceans with shallow cover—often through conditions once considered impossible or unimaginable. The presence of underground infrastructure in many cities often requires new tunnels to be built deeper and longer, introducing new challenges for design, technology, and operations.

Modern tunneling projects demand advanced expertise to develop quicker, safer, cost-effective, and environmentally responsible solutions built with minimal disruption to the public.

Hatch has been a pioneer in this space, delivering innovative and sustainable underground infrastructure development for over seven decades. Since the 1950s, Hatch has engineered more than 1,550 miles (2,500 kilometers) of tunnels across five continents, supporting critical infrastructure development worldwide.

In the past two decades, we have met evolving challenges by integrating advanced technologies and digital tools into our tunneling practice.

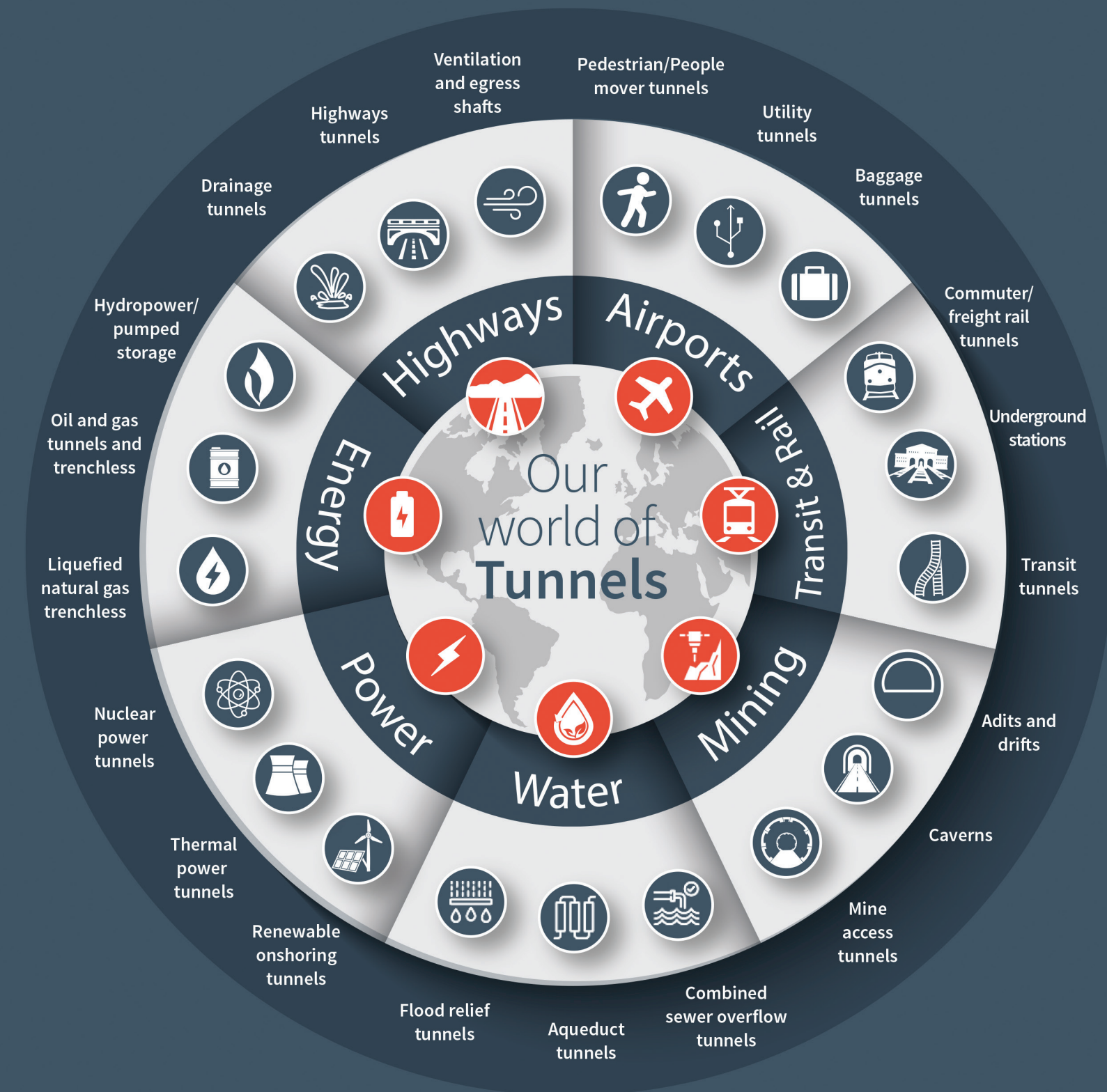
Our expertise spans the full tunnel life cycle—from planning and design through construction,

operation, maintenance, and rehabilitation—ensuring long-term performance and resilience. We've tackled all ground conditions, including rock, soil, mixed-face geology, high groundwater pressures, seismic zones, and faulted terrain.

Whether deploying the world's largest tunnel boring machines or precision trenchless techniques, Hatch selects excavation and support methods tailored to each project's unique conditions. Our approach is guided by decades of experience and a deep understanding of ground risk management.

Serving all major tunnel markets—highways, rail and transit, water, power, oil and gas, utilities, and mining—Hatch brings specialized insight into the operational and maintenance drivers that shape each sector. With a legacy of innovation, reliability, and sustainability, we continue to lead the way in delivering transformative underground infrastructure worldwide.

From the very beginning, we have led some of the world's most ambitious and groundbreaking tunnel projects. No matter the scale or complexity, we're equipped to deliver successful outcomes for our clients. At Hatch, tunneling is more than a specialty, it's a passion.



Solving the toughest challenges

Subaqueous tunnels

Conquering the deep

The applications of tunneling solutions are diverse and continue to be applied in new and emerging markets. In the past, water bodies were a major barrier to the development and expansion of infrastructure. As technology improves, subaqueous tunneling solutions have become more popular, facilitating alignments that previously would not have been possible.

Subaqueous tunnels serve a wide range of applications, including road and rail, transit, water supply, sewage systems, high-voltage power and communication cables, and oil and gas transport. These projects have increased the demands of geological exploration, often requiring drilling from barges or in areas of soft swampy ground.

Access to the tunnel face is often extremely limited or entirely unavailable from the water surface above.

Constructing subaqueous tunnels presents a range of significant challenges. These may include:

- Limited tunnel cover
- Buoyancy from hydrostatic uplift
- Potential damage from shipping and marine operations
- Difficult subsurface conditions caused by sedimentation patterns, flow regimes, marine geology, and fluctuating water levels
- Scour of the bed or channel
- Understanding fluctuations in the bathymetry
- High groundwater pressures with a persistent capacity to recharge from the overlying water body
- Risk of substantial water inflows during excavation.

Overcoming subaqueous challenges requires significant specialist expertise using up-to-date proven approaches to successfully deliver such tunnels. Backed by a proven track record in this high-risk field, Hatch confidently tackles the most demanding subaqueous challenges across the industry.



Mountain tunnels

Overcoming inaccessible terrain

Tunneling through mountainous terrain presents a unique set of engineering challenges that demand specialized expertise and innovative solutions. These environments often lack surface access, meaning construction issues must be resolved from within the tunnel—making mountain tunneling a highly technical and demanding endeavor.

Hatch has delivered mountain tunnel projects around the world. Our teams are equipped to navigate extreme geological conditions, remote locations, and limited access, ensuring safe and efficient outcomes even in the most demanding settings.

Key challenges of mountain tunneling:

- High in-situ ground stresses: squeezing ground, rock bursts, popping, and slabbing
- Fault zones, weakened rock, and high water inflow from tectonic activity
- Limited geotechnical data due to inaccessible suitable drilling sites
- Very high groundwater pressures and potential inflows
- Remote locations complicating equipment access and muck disposal
- Harsh working conditions due to weather and remote locations
- Restricted construction access due to terrain
- Seismic activity and surface instability

These conditions often converge, requiring tailored, site-specific solutions. Hatch applies innovative, customized approaches to overcome difficult conditions and deliver successful outcomes in even the most demanding mountainous environments.

Tunneling through mountains demands a high degree of skill, adaptability, and agility to respond to varying ground conditions shaped by limited data and extreme topography. Hatch draws on deep, technical knowledge to confidently make timely, informed decisions and develop solutions to overcome the unique challenges of mountainous tunneling in unpredictable geologic conditions.

Overcoming the mountain challenges in a proactive and confident approach serves to mitigate the variety of risks to project delivery and final cost.



Urban tunnels

Ever deeper with tighter challenges

As cities grow denser, the need for infrastructure that avoids surface disruption has become critical. Urban tunnels provide a way to increase service capacity while minimizing surface congestion, allowing the public, traffic, and businesses to continue their normal activities during construction.

Centuries of development have crowded shallow underground spaces, necessitating the construction of tunnels at greater depths while introducing new complexities.

Building tunnels in urban settings comes with its own unique set of challenges. These include minimizing ground movements and impacts on adjacent structures and utilities; managing traffic, construction material logistics, noise, dust, and vibration; maintaining sensitive stakeholder relationships; and dealing with undocumented structures and utilities.

Selecting the appropriate tunnel construction methods and applying ground improvement techniques are essential to preventing movement of ground and protecting adjacent structures and utilities.

Our worldwide experience in urban tunneling in various ground conditions allows us to select appropriate TBMs such as hybrid, multimode, slurry, earth pressure balance, sequential excavation method (SEM) sequence, or drill-and-blast sequence to minimize ground movement while progressing construction to meet schedule.

We have developed ground improvement techniques, including jet grouting, compensation grouting, permeation grouting, and ground freezing, that allow us to tunnel under sensitive structures and achieve zero settlement.

Some of our more technically demanding examples include tunneling under the glass-fronted Schulich Building in Toronto that achieved zero building settlement, pedestrian tunnels under critical and aging infrastructure such as a 6-foot (1.8-meter) brick-lined sewer and driving beneath existing tunnels in Los Angeles with minimal tunnel cover.

Hatch understands the evolving challenges of urban tunneling driven by the increasing demands that growing cities place on both new and existing infrastructure.

Urban tunnels routinely pushes the limits to greater depths, and with higher constraints at and near to the surface, requires high-end expertise to deliver the project successfully.



Specialist engagement in construction

The art and science of tunnels

Tunneling is widely regarded as both an art and a science. The “art” of tunneling lies in understanding construction techniques and the latest technologies to adapt to changing project demands. The “science” of tunneling requires a deep grasp of tunnel design theory. Our specialists combine both, offering significant advantages in managing the risks encountered during tunnel construction.

Tunnel construction phase services may vary significantly depending on our role in the project—whether supporting the owner, contractor, or other stakeholders. We are deeply familiar with all forms of construction engagement and are equipped to take on a wide range of roles and responsibilities. Our ability to deliver successful projects is built on a solid foundation of technical capability and knowledge.

Tunnel construction covers a broad range of techniques and technologies. We have experienced it all, from various types of TBMs, roadheaders, drill and blast, and sequential excavation to the construction of various types of shafts and support facilities.

We have managed and delivered construction projects involving running tunnels, adits, caverns, shafts, underground sumps and pumping stations, and various linings, including precast, cast-in-place, and steel.

To effectively manage or supervise tunnel construction, it’s critical to closely monitor quality, timeliness, safety, schedule, and budget to meet contract requirements. Leveraging our advanced capabilities, we provide timely decisions and proactively address potential and evolving risks. Collaboratively working with both the Owner and Contractor minimizes the potential for consequential adverse impacts, delays, and additional costs.

Using our unique skills in both the art and science of tunnels, our teams share a common mission: to provide close and continuous attention to quality, timeliness, and safety while keeping the project within budget and aligned with contract requirements.

Hatch provides the science of practical designs that are understanding the art of specialist tunnel construction and addresses the project challenges and risks.



Taking care of our underground assets

Extending the life of a tunnel

A well-known industry saying is “the existing hole in the ground is an asset.” Maintaining existing tunnels extends their operational life and provides a dependable foundation for expanding capacity.

As aging tunnels face increasing demands from growing urban populations, Hatch is dedicated to extending the life of existing infrastructure through cost-effective, innovative, sustainable, and tailored rehabilitation solutions.

Our specialists have delivered a wide range of tunnel upgrades—from remote locations like the Whittier Access Project in Alaska and the Lesotho Highlands Water Project in Lesotho and South Africa, to complex urban settings like the Mount Royal Tunnel double-arch replacement in Montreal and the Toronto Transit Commission (TTC) Subway tunnel rehabilitation program.

Extending the life of a tunnel involves more than structural repairs. We’ve repeatedly renovated and repurposed tunnels, including our work in Baltimore’s historic Howard Street Tunnel, where we increased clearance to accommodate double-stack intermodal rail services.

We combine our technical knowledge and digital expertise to deliver high-value engineering services for our clients. Digital tools such as LiDAR mapping, 3D modeling and visualization, digital twins, and automation, help us make faster field decisions, improve the accuracy in as-built data collection, and reduce downtime during tunnel construction.

We apply advanced concrete modeling and specialized fire life safety strategies to protect critical infrastructure. Our capabilities include

detailed ground-structure interaction modeling, computational fluid dynamics, and other numerical and finite element methods to simulate real-world conditions and develop optimized, cost-efficient solutions

With a strong background in tunnel investigation, design, costing, and construction inspection, Hatch helps clients maximize asset value, enhance system resilience, and reliably expand capacity as an alternative to new tunnel construction.

Decades of experience in tunnel rehabilitation positions us as a trusted partner in delivering solutions that not only restore functionality, proactively to a state of good repair, and extends the life of the tunnel. This serves to contribute to the development of more sustainable, interconnected, and future-ready urban environments.



Forging an innovative tunnel future

A legacy of continuous evolution

Drawing on decades of experience across infrastructure, energy, and mining, we have developed construction techniques that challenge traditional norms. We remain a leader in precast concrete lining design, offering optimized, cost-effective, and sustainable solutions.

One of our earliest achievements was the design and construction of the Yonge Subway tunnels in the 1950s, a first for the TTC and Hatch. That was followed by the TTC's University Subway tunnels. In both cases, we introduced innovative techniques beyond cut-and-cover methods, including tunnel shields, compressed air methods, and advanced lining systems. Hatch's one-pass precast lining system for the TTC was a North America's first, setting new industry standards for tunnel support.

Since then, we've led tunnel development for high-speed rail, highways, and hydropower across Canada, the US, Australia, the Middle East, South America, Africa, India, South Korea, and the United Kingdom. Our portfolio includes the largest pressurized-face TBM tunnel, the largest hard-rock TBM tunnel, and the longest undersea tunnel and cavern.

In the mid-1990s, we expanded our US presence to include water, combined sewer overflow, oil and gas, and power tunnels. A significant acquisition added over a century of hydropower and underground engineering knowledge, enhancing our rock tunneling capabilities. This led to a landmark project beneath Niagara Falls, where we delivered a world-record tunnel using the largest diameter rock TBM of its time.

We've applied advanced numerical modeling to solve challenging ground-structure interaction scenarios. At Seattle's Beacon Hill Station, our modeling enabled the safe design of one of North America's deepest mined transit stations.

Our work also includes tunneling beneath active transit systems, such as in Los Angeles' Regional Connector Transit Corridor, and developing tunnel lining designs for seismic and swelling ground conditions.



Our commitment to innovation is demonstrated through cutting-edge technologies and pioneering construction methods. With a legacy of excellence and a drive for continuous improvement, Hatch remains a leader in shaping the future of the tunneling.

Tunnels for all major sectors

Industry leading tunnel services

Since our founding, we've built a strong legacy in tunneling, contributing to some of the world's most significant underground projects. We've engineered thousands of miles of tunnels across five continents—beneath urban centers, residential areas, mountains, lakes, and rivers.

As tunnels grow deeper and longer, often weaving through existing underground infrastructure, we take on some of the industry's most difficult design and construction projects.

facility types. Our deep technical proficiency is embedded in our staff and has fostered the growth of a large, diverse, and reliable global network of tunneling professionals.

We continue to lead advancements in pressurized face TBMs, precast concrete tunnel lining (PCTL), NATM and SEM methods, fiber-reinforced linings, digital tools, and record-setting large diameter TBMs. Our achievements, including several industry-defining and pioneering breakthroughs, continue to push technological boundaries and help owners and contractors overcome complex project challenges.

Our extensive portfolio is backed by a strong reputation built on consistent achievements in the tunnel industry. Our success is driven by the dedication, skill, and quality of our specialist staff, a seasoned team that consistently delivers outstanding results. Through long-term deployment, continuous mentoring from senior professionals, and a culture that encourages creative problem solving and a "can do" attitude, we deliver cutting-edge solutions for the world's toughest tunneling demands.

Whatever our client's vision, Hatch tunnel specialists, supervise, design and manage it, from concept to tunnel construction 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.

Our specialists actively manage underground risks, delivering safe, efficient, and sustainable solutions.

Whether using hard rock TBMs, SEMs, drill and blast, or pressurized face TBMs in soil, rock, or mixed conditions, we select the most appropriate technology for the anticipated ground conditions.

Hatch has a long history of tunnel design and construction across a wide range of sectors and

Our global tunnels 70-year heritage



1955 - 1980

- TT Line 1 Tunnel, CAN
- TTC University Subway, CAN
- TTC Yonge Subway, CAN

1990 - 2000

- Channel Tunnel, UK/FR
- Lesotho Katse Water Tunnel, SA
- Lesotho N. and S. Water Delivery Tunnels, SA
- LA Hollywood Redline, USA
- St. Clair River Tunnel, CAN
- Detroit River Tunnel, USA

2002 - 2007

- Western Beaches CSO Tunnel, CAN
- Lesotho Mohale Water Tunnel, SA
- Lesotho Matsoku Water Tunnel, SA
- Durban Harbour Tunnel Project, SA
- Beacon Hill Tunnel, USA
- Dulles Airport APM Tunnel, USA
- Ashlu Creek Hydro Tunnel, CAN

2010 - 2014

- Seymour-Capilano Twin Water Tunnels, CAN
- Niagara Tunnel, CAN
- Edmonton Valley LRT Tunnel, CAN

2020 - 2021

- LA Metro-Regional Connector, USA
- Eglinton Crosstown LRT Twin Tunnels, CAN
- Lafontaine Tunnel, CAN
- Atwater Highway Tunnel, CAN
- Minneapolis Central City Parallel Tunnel, USA
- Annacis Outfall Tunnel, CAN



1980 - 1990

- Melbourne Loop Railway, AUS
- Buffalo LRRT, USA
- Baltimore Rapid Transit USA
- Vancouver Expo Line Tunnel, CAN

2000 - 2001

- Boston Harbor Effluent Outfall, USA
- TTC Sheppard Subway Twin Tunnels, CAN
- San Jose BART Extension, USA
- Minneapolis Hiawatha LRT Tunnel, USA

2008 - 2009

- 19th Ave Sewer Tunnel, CAN
- Canada Line, CAN
- West Area CSO Storage Tunnel & Pumping Station, USA
- North Dorchester Bay CSO Tunnel, USA

2015 - 2019

- Evergreen Line Tunnel, CAN
- Etobicoke Creek Trunk Sanitary Sewer Twinning, CAN
- Port Mann Water Supply Tunnel, CAN
- Toronto-York Spadina Subway Extension (TYSSE), CAN
- Mid Halton Effl. Outfall Tunnel, CAN
- Southeast Collector, CAN
- Euclid Creek Tunnel, USA
- NW PATH Tunnel, CAN
- Billy Bishop Airport Pedestrian Tunnel, CAN

2022 - Ongoing

- Potomac River Tunnel, USA
- ALCOSAN Ohio River Tunnel, USA
- Réseau Express Métropolitain (REM), CAN
- Calgary Green Line LRT, CAN
- Ashbridges Bay WWTP Effluent Outfall, CAN
- Burnaby Mountain Pipeline Tunnel, CAN
- Annacis Water Supply Tunnel, CAN
- Inner Harbour West WWF Tunnel, CAN
- Melbourne Metro Tunnel, AUS
- Lesotho Highlands Polihali Water Tunnel, KOL
- Sydney Metro Airport Line, AUS
- Coquitlam No.4 Water Tunnel, CAN
- Eagle Mountain Tunnel, CAN

Delivering Tunnels for all Sectors

Markets	Tunnels Services	Tunnels Expertises	Delivery Methods
<ul style="list-style-type: none"> • Water • Wastewater • Transit and Rail • Highway • Airports • Power • Energy • Mining 	<ul style="list-style-type: none"> • Planning • Design • Construction Management • Program Management • Inspection and • Rehabilitation 	<ul style="list-style-type: none"> • Contract Administration • Resident Engineering • Inspection • Quality assurance/control • Claims • Constructability review • Value engineering • Risk Management • Safety 	<ul style="list-style-type: none"> • Design-Bid-Build • Design-Build • Progressive Design Build • Early Contractor Involvement • Contractor Design • Public-Private Partnerships • Owner's P3 oversight



About Hatch

Hatch is a global engineering, project delivery, and professional services firm. Whatever our clients envision, our teams can design and build. With over seven decades of business and technical experience in the mining, energy, and infrastructure sectors, we 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 11,000 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.

At Hatch, our tunnels expertise extends across all three areas of our business. This unique, and specialist expertise has been critical to Hatch since our beginning as it engages many facets of our overall business project engagements. No matter the scale of the project, Hatch is equipped to deliver comprehensive underground and tunneling solutions.

Find out more on www.hatch.com



Scan the QR code to learn more about what we can do!

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