



# Transit





# Ride transit to the future

In today's world, businesses and communities are connected by intricate, multimodal networks that bring people and places closer together. The healthiest centers for livability and workability are those that plan, design, and integrate numerous modes of travel to offer a robust network of transportation options.

An important part of these networks is transit. Often considered the backbone to efficient travel, modern modes of transit have become the focus of business leaders, government officials, and community stakeholders. Transit is key to unlocking congestion, maintaining efficient movement of goods and people, and exploring opportunities for sustainable and greener system design.

Throughout North America, communities recognize the positive effect a well-designed 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, we have the experienced team that can ensure successful project delivery.

In October 2020, Hatch and LTK Engineering Services merged to become Hatch LTK, now part of Hatch's Infrastructure group with the main office in Ambler, PA and offices in 27 other cities across the US. Our strong legacy of technical excellence and corporate commitment to the rail and transit industries will create positive change for the next century. Hatch LTK will continue to provide the same high levels of staff expertise and work quality in all areas of practice formerly served by LTK, and some new ones. From the initial project phases through design, construction, and commissioning, we will continue to provide you with vital support.

Our multidisciplinary staff has worked with all kinds of passenger rail and transit infrastructure, from subways and light rail corridors to tunnels, bridges, and transit-oriented design (TOD). Drawing on a broad range of skills, we can carry out large and complex projects in-house, freeing up your staff to perform its day-to-day work.



Green Line LRT, Calgary, Alberta, Canada

## Our Capabilities

As the need for transit projects increases, so does the complexity of the project. From the initial project phases — conceptual engineering, project alternatives, right-of-way, and environmental mitigation — through design, construction, and commissioning, we provide clients with vital support. Our services cover all aspects of transit engineering, plus associated services such as value engineering, risk assessment, quality assurance and control, constructability reviews, and community relations.

The depth of knowledge and experience of our staff enables us to integrate existing systems with those that are more technologically advanced. Our knowledge of your operations and maintenance needs, and our familiarity with relevant codes and specifications, often result in reduced life-cycle costs for the equipment.

As systems integration specialists, we ensure full integration for various systems components, from the conceptual design phase through the entire development, procurement, and testing process.

## If you are considering any of the following, we can support you:

- + Intercity & High-speed Infrastructure, Rail Cars and Systems
- + Commuter Rail Infrastructure, Rail Cars and Systems
- + Light Rail & Streetcars Infrastructure, Rail Cars and Systems
- + Zero Emissions Infrastructure, Buses, Rail Cars, Locomotives, and Charging Systems
- + Rail Stations & Multimodal Terminals
- + Subway Infrastructure, Rail Cars and Systems
- + Air/Rail Connections
- + Vehicle Maintenance Facilities & Operations Centers
- + Bridges & Viaducts
- + Grade Crossings & Separations
- + Tunnels & Trenches
- + Signaling & Controls
- + Communications
- + Traction Electrification
- + Environmental Remediation
- + Stormwater Management
- + Rail Corridor Development
- + Revenue Management & Technology
- + Operations Planning & Simulation



Metro North Railroad, New York, NY

## Commuter Rail

Efficient and cost-effective commuter rail is vital to economic development in urban areas.

At Hatch LTK, we lead the industry with our support of commuter railroads. From the T in Boston to Metrolink in Los Angeles, you have counted on us to help you purchase or overhaul more than 7,500 cars, coaches and locomotives. In New York, we have worked with MNR and LIRR on the purchase of every M-series fleet since the M-3s.

For NJ TRANSIT, we have led the procurement of two generations of passenger cars: the Comets, and the Multi-Levels. We are there to help with some of your biggest challenges. When SEPTA discovered a Silverliner V car with an unusual lean to one side late on a Friday afternoon before a summer long-weekend, they called Hatch LTK for help. Follow-up inspections early the next morning by SEPTA and Hatch LTK uncovered widespread cracking of equalizer beams and together we decided to remove the Silverliner V fleet from service. We worked with the supplier, designed temporary and then permanent fixes and the cars were back in service in the fall.

For Metra in Chicago, we have upgraded systems like their fiber optic backhaul of all their communications, their signal systems and their traction power substations.

We also work in transit infrastructure. Union Station supports 250 GO Transit commuter train movements, links GO Transit to the city's subway system, and serves Canadian Pacific, Canadian National, VIA, and ON Rail operations.

As a key member of the HDI Joint Venture, Hatch was responsible for overall program management for the \$750 million Union Station Rail Corridor Infrastructure Improvement Program, including trackwork, electronic systems, fire and life safety, and a heritage train shed. According to the City of Toronto, "Union Station's revitalization will result in many benefits to commuters, including bigger, brighter transit concourses, more exits and entrances to the station, new PATH connections, repair and rehabilitation of an aging facility, and the introduction of an exciting and revitalized retail presence."

Hatch's participation helped minimize disruption to train service and inconvenience to passengers and supported the vision that the new Union Station will not only be beautiful but safe, efficient, sustainable, and highly functional.



VIVA Next Vaughn Metropolitan Centre, Toronto, Ontario, Canada



Sound Transit is a long-standing client, Seattle, WA

## Light Rail & Streetcars

In the US, we have played a leading role in virtually all new light rail and streetcar projects. For decades, cities across the US have depended on Hatch LTK for light rail expertise. Having worked for virtually every light rail service provider in North America, we've built enduring relationships with our clients, guiding them from beginning to end through the evaluation, planning, installation, testing, and maintenance stages.

From day one in Portland, Seattle, Calgary and Denver, to legacy systems like Boston's and Toronto's, Hatch LTK has led the industry in light rail and streetcar work. Currently Hatch LTK is the prime designer for LA's Regional Connector LRT project, a design-build initiative with a budget totaling almost a billion dollars. We are also providing engineering services for the Crenshaw/LAX Transit Corridor, extending the corridor approximately 8.5 miles from the existing Metro Green Line. Seattle's Sound Transit uses Hatch LTK as its lead designer for most of its build out of new lines. In Boston, we are leading the procurement of the new No. 10 LRVs, and we are doing the same in Charlotte, Los Angeles, and Toronto.

We also work with agencies to build out extensions. Calgary's West Line was the first new line to be added to the C-Train in 25 years. As Owner's Engineer, we were responsible for the preliminary design of all project elements and for developing schedules, cost estimates, contracts, proposals and proposal reviews, and constructability reviews.

In addition, we were responsible for public engagement support, risk management, construction monitoring and administration, and quality auditing. Riders can now travel from downtown Calgary to the 69th Street Station in only 18 minutes.

Streetcars are an energy-efficient and increasingly popular element of urban revitalization initiatives. We helped Dallas and Seattle implement the first off-wire streetcars in North America and have also led the vehicle and/or systems design and procurement in Detroit; Cincinnati; Washington, D.C.; Portland; Seattle; Tucson; Milwaukee; Kansas City; El Paso; Charlotte; Calgary; and Toronto.



An H Street Streetcar in Washington, D.C.



WMATA 7000 Series train, Washington, D.C.

## Heavy Rail & Subways

Almost two dozen North American cities, from New York City to Atlanta, Montreal, and San Francisco, rely on rapid transit systems to move people quickly and safely through the urban environment. Transit systems give commuters the option of moving easily around a city and its suburbs. It entices people to forgo their cars, in turn reducing emissions and traffic congestion.

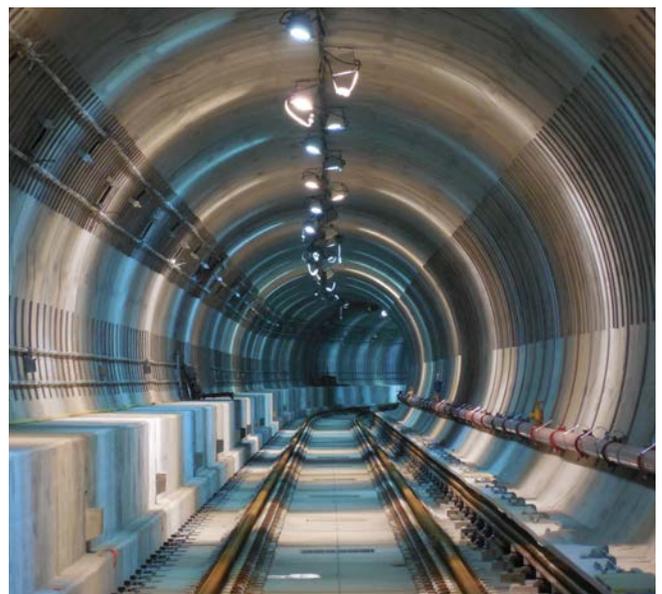
Transit doesn't just help the environment stay cleaner; it can help with economic development. Our first transit project was working as part of a team to build a heavy rail system from Camden, NJ to Philadelphia, PA in 1935. The train opened the more affluent job market in Philadelphia to residents of Camden in a way that had lasting effects on the region.

In many US cities, Hatch LTK has worked on these legacy subway systems: New York; Washington, D.C.; Boston; Philadelphia; Chicago; Atlanta; and newer systems in Los Angeles and Miami. And we have worked with them for many years: in NY, Boston, and Washington, D.C.; we have been the vehicle engineer of choice for more than 30 years. Concurrent with new procurement, we are committed to helping you keep the older trains running by troubleshooting and helping improve maintenance processes.

Most legacy heavy rail/subway systems are complete. But the extension of Toronto's Spadina subway line outside the city limits is the biggest expansion project ever undertaken by the Toronto Transit Commission. The Spadina extension includes two 18-foot-diameter tunnels, six emergency exit shafts and buildings, seven

cross-passages, two launch shafts for tunnel boring machines, and a 919-foot section of triple tunnel. Hatch, a leader in tunneling technology, designed the twin tunnels using a six-segment universal ring arrangement.

Service on the new Spadina subway extension is expected to begin the fall of 2016, using comfortable new Toronto Rocket trains. Trains will run every four to five minutes. The extended line will save 30 million car trips a year to and from the city. It will provide convenient, energy-efficient public transportation for more than 60,000 students and faculty at York University. The project is expected to generate about 20,000 jobs during the course of construction.



Spadina Subway Extension, Toronto, Ontario, Canada



Amtrak's newest trainsets for the Northeast Corridor Acela Service

## Intercity & High-Speed

High-speed rail offers potentially major benefits in traveler convenience, economic stimulation, and environmental protection.

From the first higher-speed train in the Northeast Corridor, Amtrak's Acela, to the next generation of vehicles to high-speed trainsets, Hatch LTK has partnered with Amtrak to help design and procure new trainsets.

With the 28 new trainsets, Amtrak will be able to offer half-hourly service with 25% more seats, reducing the number of trains that sell out.

We designed the trainsets with the latest crash management systems, high energy-efficiency electrical systems, and with higher track speed through innovative tilt technology. Although capable of higher speeds, the new trainsets will travel at 160 mph. The Northeast Corridor (NEC) service reduces both automobile and airline traffic in this congested corridor and is Amtrak's most profitable route.

Hatch LTK is involved with another high-speed rail project that also has significant environmental benefits. The California High-Speed Rail project is expected to reduce greenhouse gas emissions by 12 billion pounds per year — the equivalent of one million cars — and cut consumption of foreign oil by 12.7 million barrels. From 2007 to 2015, we provided project management, preliminary design, environmental engineering, permitting, and right-of-way acquisition services for three segments of the system, including Palmdale to Los Angeles, the most difficult section in the system.

This 65-mile section covers challenging terrain, including rivers, steep mountains, sensitive ecosystems, three major seismic fault lines, and densely populated cities. When the project is complete, a passenger will be able to board an express train in San Francisco and step off the train in Los Angeles 2 hours and 40 minutes later. That's three to four hours less than a driver would need to cover that distance — even without traffic.



California High-Speed Rail Train, Fresno to Orange County, USA



Sound Transit Central Link, connecting downtown Seattle to the airport

## Air/Rail Connections

Air/rail connections are among the most complex multimodal challenges faced by designers. In Greater Seattle, where hilly ground makes road development difficult and expensive, the first planned line of the city's light rail system was the Sound Transit Central Link, connecting downtown Seattle with the city's airport.

In 2000, Sound Transit retained Hatch to provide engineering services for the 5-mile Tukwila segment of the Central Link. Hatch's successful performance led to us being hired for additional work on the Central Link and the Airport Link. Hatch LTK served as the prime

contractor for all systems work for the Airport Link: traction power (medium voltage ac power distribution and substations), overhead contact system, train control, central control, SCADA, traffic signal coordination, communications, fare collection, and the O&M facility. Our value engineering saved the client approximately \$23 million and shortened the duration of construction by eight months. In addition, by using an innovative approach, our design guided runoff from the guideway to longitudinal diffusers along the low deck edge, allowing runoff to be dispersed to the natural environment.



Battery-electric buses recharging at the depot

## Zero-Emissions

Zero-emissions transit is the future of the industry. It is integral to meeting the mandated reductions in emissions of diesel and natural gas-powered vehicles. But it's not as easy as buying new buses or trains. The infrastructure, especially for buses, is much more complicated than bus-only agencies usually handle. Hatch LTK has assisted clients in the procurement, design, and maintenance of electric vehicles for decades. We appreciate the energy storage capabilities and service limitations of battery technologies, and the effects of route topology, drive cycle, on-board systems, stopping patterns, and climate on energy requirements. Hatch LTK has developed a best-in-class route model, EMITS, that predicts how batteries perform in vehicles (buses, locomotives, and D/EMUs) based on load, route topography, weather, and traffic. We also provide expert advice on practical performance expectations and operating ranges based on our clients' logistical requirements.

Our EMITS model can compare hydrogen, battery-electric, blended (diesel and battery), and diesel or natural gas-powered vehicles to help you pick the right propulsion technology for each route.

For SCRRA Metrolink, Hatch LTK performed a series of interlinked evaluations and simulations to support their efforts to select and plan for a future zero-emissions fleet of locomotives. We evaluated emerging propulsion

technologies, prepared anticipated costs, reviewed pros, cons and challenges, simulated each technology over existing and future passenger rail corridors, and ranked and summarized potential solutions, including battery, hydrogen fuel cell, natural gas, biofuel, renewable diesel, and hybrid technologies.

Also in California, Hatch LTK is developing a zero-emissions transition plan for the Redwood Coast Transit Authority (RCTA) to transition their entire fleet of buses and paratransit vehicles to zero-emissions technology by 2040.

We analyzed potential replacement models for each vehicle in their existing fleet, documenting differences in operating range, passenger capacity, and other amenities, and we developed a cost estimate for replacing the fleet and created a schedule to phase out fossil fueled vehicles. Finally, Hatch LTK completed a simulation of RCTA's operations to determine whether zero-emissions vehicles would affect their current operations. Using our EMITS model, we evaluated actual grade, speed profiles, and stopping patterns for RCTA's operation to develop accurate estimates for how actual battery-electric bus models would perform in its system. The results of the simulation indicated that the agency would need to use in-route charging to compensate for the reduced range offered by battery-electric vehicles.

# Revenue Management

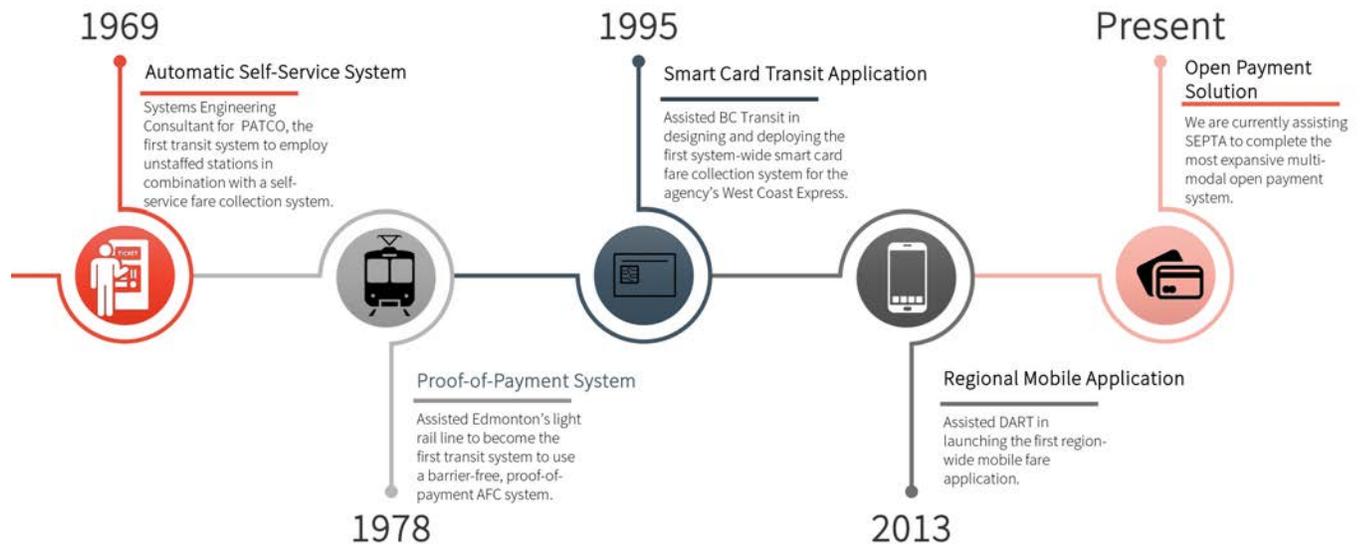
Across the industry, fare collection and IT systems are constantly getting “smarter,” seamlessly integrating the latest technologies to create new payment methods with a localized vision tailored to an agency’s budget, operating environment, and scale. While some agencies are considering going to fareless, most still need the farebox funds to help pay for daily operations.

Today, transit agencies are looking to replace their legacy equipment with new systems that provide modern solutions including open architecture and enhanced open payments that can ultimately be used to improve the overall customer experience.

Hatch LTK has always led from the front in revenue management.

From large cities like Philadelphia (SEPTA Key) and Washington, D.C. (WMATA New Fare Payment System), to smaller agencies like TARC (Louisville) and NAIPTA (Flagstaff), to regionally integrated systems in places like Tampa (PSTA/HART), we have worked closely to provide solutions that serve each agency’s needs.

## History of Firsts in North America



Hatch LTK industry "firsts"

# Operations Planning and Simulation

All rail systems have a wide number of variables that affect on-time performance and operations. The ability to model your entire system can mean the difference between customer satisfaction and the use of more autos. Our planning and simulation experts can help you plan power needs, capacity constraints, where to double track a mostly single-track system, and service design and scheduling.

For WMATA, we created planned and unplanned outage playbooks, so operations personnel had a reference source for most problems that might arise.

At Sound Transit and Denver RTD, we have modeled extensions to the systems to ensure adequate traction power capabilities, track capacity, and signal system timing.

At San Jose's Diridon Terminal, we modeled one of the most operationally complex terminals in North

America where five mainline rail operators meet to help them all plan for increased demand. As a result, the Fourth Main Track project was re-engineered to provide greater routing flexibility at the station's northern approach. The adopted design includes complex "double slip" track switches that maximize the number of parallel moves – a northbound train can leave the station while a southbound train simultaneously enters the station on an adjacent track – for the five rail operators.



The model of the Diridon Terminal tracks

# Urban Solutions

As the world's population growth continues exponentially, millions of people move to urban environments each year. Communities and cities must start to build and rebuild differently, using space more efficiently. Related infrastructure design must enable this growth and make our cities more sustainable and resilient.

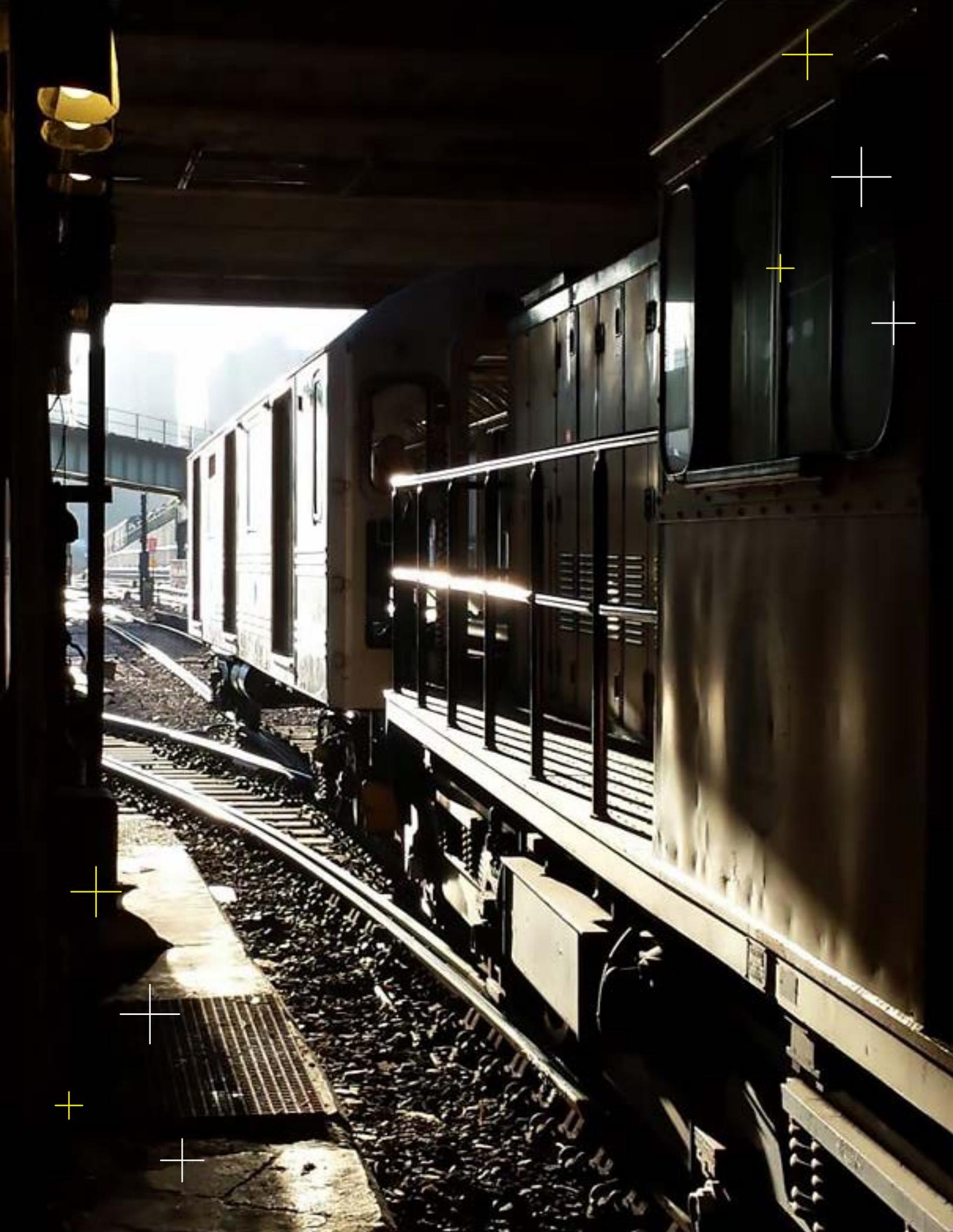
Traditionally, communities, stakeholders, and politicians have considered urban pieces individually, acting on issues independently and not approaching them with a holistic view. This has been a costly oversight. Our holistic view lets us recognize activities that might seem to be unrelated, but could be considered and executed simultaneously with significant reductions.

When San Francisco Municipal Transportation Authority (SFMTA) wanted to redesign and develop their Potrero Bus Maintenance Facility, Hatch Urban Solutions took a holistic approach that combined actionable planning,

a long-term view, smart priorities, and best practices to determine the best solution to meet SFMTA's goals. We completed a comprehensive market analysis of feasible joint uses for transit-oriented development, organized six design scenarios for the site with accompanying financial feasibility and sensitivity studies, and developed transit facility design concepts while managing stakeholder and community outreach. The result was a plan to build housing above the new facility to help ease the housing crunch in San Francisco.



The current Potrero Maintenance Facility, San Francisco, CA



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## About Hatch

Whatever our clients envision, our engineers can design and build. With over six 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 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.

[www.hatch.com](http://www.hatch.com)