

BergerWorld

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Improving
**URBAN
 MOBILITY**

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MESSAGE

From the CEO

In countries around the globe, people are moving from rural areas to cities, seeking greater access to markets, services and economic opportunity. In 1900, just 13 percent of people lived in urban areas. Today, for the first time in history, more than half of the world’s population lives in cities. The U.N. projects that two-thirds of the world’s inhabitants will reside in cities by 2050.

Cities have the potential to increase quality of life for all segments of the population. Greater population density allows governments to more easily provide basic services like electricity, clean water, healthcare and education, all of which have been linked to longer lifespans and greater overall prosperity. Well-planned and connected cities afford residents easy access to employment, products and commercial centers, generating income and economic activity.

An essential component of a successful city is an efficient transportation network. Large, decentralized areas make residents and visitors dependent on cars. Widespread automobile use can have negative impacts on the environment, causing air, water and noise pollution, and encouraging people to live farther from where they work. Smart growth and planning are essential to limiting urban sprawl.

This issue is my first as CEO of Louis Berger. It marks an evolution of the publication toward a focus on global themes and challenges facing governments, communities and society. The focus of this issue will be on urban mobility. In future issues, we will focus on other aspects of urbanization. Around the world, governments and private enterprise are undertaking innovative projects to efficiently move people and goods in, around and between major cities. Major initiatives to address urban mobility challenges are underway around the globe, including those highlighted here in India, Qatar, Saudi Arabia and the United States. In this issue of *BergerWorld*, we will discuss these challenges and initiatives, and Louis Berger’s role in helping clients implement *Solutions for a better world*.

D. James Stamatis | President and CEO



URBANIZATION *Impacting people, places and the global economy*

Our future, collectively speaking, will be an urban one. Globally, more people than ever are moving to cities, a trend that is expected to continue apace. According to the U.N. Population Division, the ranks of the world's urban dwellers will swell from 3.5 billion to 6.3 billion by 2050.

Emerging markets are ground zero for much of the rural-to-urban migration. In several Latin American nations, including Argentina, Brazil, Chile, Colombia, Cuba, Panama, Peru, Uruguay and Venezuela, more than 75 percent of people currently live in cities. And estimates suggest that Asia will cross the 50 percent urbanization threshold by 2020.

The benefits of urbanization are substantial — greater access to clean drinking water, healthcare and education,

to name a few — and result in better quality of life and more productivity. Harnessing these benefits, though, requires inventive applications of new technologies, changes in the way public services are organized and delivered, and innovations in urban planning and design.

The challenge for urban planners is to account for social, political, economic and environmental factors in the development of urban infrastructure, especially in multimodal transportation systems. Transportation infrastructure enables the movement of people and goods via roads, rail, air and water, and is integral to sustainable growth.

In many urban centers throughout North America and Europe, the “walkable city” concept, in which residents

largely travel by foot and use bike-sharing systems and ride-sharing services, has enabled many to enjoy an urban lifestyle without owning a vehicle.

Bus rapid transit (BRT) systems also are having a major impact on urban mobility, particularly from an environmental standpoint. Air quality improvements resulting from one Mexico City bus line are reducing respiratory illnesses and are on track to save the city an estimated \$4.5 million in health costs. At a global level, BRT initiatives in Mexico, Colombia, China, India and South Africa are projected to eliminate 31.4 million metric tons of carbon dioxide emissions — equal to 6.6 million cars' emissions — over a 20-year period.

The global economy is where urbanization is perhaps having the greatest impact. Cities today are responsible

for 80 percent of the world's economic output. Tokyo and New York City, the world's biggest and second biggest urban economies, respectively, together account for more than \$2.3 trillion in economic output. Both cities rank among the world's top 15 economies and boast higher economic output figures than Mexico or South Korea.

As the pace of urbanization continues unabated, the onus is on policymakers, urban planners, engineers and, ultimately, communities to leverage its benefits for the greatest number of residents. Doing so requires forward-thinking infrastructure development that accommodates today's mobility needs with future aspirations about how and where we will live, work and move within and between urban landscapes.

SAUDI Cities go multimodal



The Kingdom of Saudi Arabia (KSA), a country of 29 million people, has experienced rapid urbanization during the past 40 years. Perhaps nowhere has population growth been more robust than in Riyadh, the country's capital and largest city.

From a population of 100,000 a mere 40 years ago, Riyadh today is home to 5.7 million people, with more than 7 million in the greater metropolitan region.

But with rapid growth has come the attendant challenge of congestion, impacting residents' quality of life and creating significant pollution risks. Congestion in Riyadh is expected to become a more critical concern as the city is projected to add population at a 4 percent annual clip, reaching more than 8 million within the next decade.

To address today's urbanization challenges and equip the city to handle future growth, Riyadh's policymakers have undertaken a series of massive infrastructure investments, most notably in transportation.

In 2013, Saudi government officials awarded contracts for the development of six metro rail lines across Riyadh. Once completed, electric, driverless trains will transport passengers through 85 stations located throughout the city and over 176 kilometers of rail track. Additionally, the metro network will be supported by a 1,150-kilometer BRT network.

Still, building the infrastructure is only one part of the challenge Saudi officials face. Encouraging residents to use the infrastructure for personal mobility and to leverage it for commercial purposes presents its own challenges. At a macro level, though, officials aim to harness growing urbanization to modernize and diversify the country's economy.

As the world's top oil exporter, KSA is overwhelmingly dependent on hydrocarbons for much of its wealth. In fact, revenues from oil exports make up a disproportionate share of KSA's \$733 billion foreign asset portfolio.

That dependence leaves the country exposed to fluctuations in global energy prices. Urbanization-related infrastructure investments like the Riyadh Metro and BRT networks are one method Saudi officials are using to spur development outside of the energy sector.

In the near term, the metro system's construction will generate an estimated 15,000 skilled and non-skilled jobs. And in a country and region where native unemployment rates are worryingly high, the "Saudization" of the workforce — the process of attracting and training Saudi engineers, technicians and other skilled talent to manage and maintain infrastructure — is a priority for social stability. KSA policymakers believe a modern, efficient transportation system

will spur the development of light industrial districts, new real estate projects and other entrepreneurial initiatives along the rail lines, stimulating more economic activity and creating more jobs.

Further, better public transportation options are expected to help KSA improve how it manages its own energy use. According to estimates, roughly 2 percent of Riyadh's population currently uses public transportation, which is mostly made up of antiquated buses. But the city's — and country's — demographic trends are expected to outpace oil production, potentially forcing cuts in oil exports and making it critical to create alternative ways of moving people in the coming years. Despite anticipated challenges in transitioning residents from car dependency to public transportation reliance, officials recognize that the system can represent a significant reduction of the city's fuel usage.

The metro and BRT networks also will greatly impact quality of life for women and girls in Riyadh. The networks will offer a cost-effective means of getting around the city for women, who are prohibited by Saudi law from driving. Metro trains will feature designated family sections for female passengers.

The Arriyadh Development Authority, the Saudi government agency behind the Riyadh Metro project, selected the Louis Berger-

Hill International joint venture to provide program and construction management for three of the Riyadh Metro's six lines, 22 metro stations, 5.5 kilometers of mined tunnel and 13 kilometers of bored tunnel. In total, the joint venture is responsible for more than a third — some 67 kilometers — of the metro system's network. A separate Louis Berger-Egis joint venture also is responsible for managing procurement for the transit system's future operations and maintenance contractors.

When the first Riyadh Metro trains roll into stations, they will serve a ridership expected to number more than 1 million people daily. The metro will connect residents and visitors to all major sections and neighborhoods of the city — from King Khalid International Airport and the King Abdullah Financial District to the King Abdulaziz Historical Centre and Imam Mohamed bin Saud University — enabling greater mobility, reducing pollution and improving overall quality of life.

Visit www.riyadh-metro.com to see the system's progress or to access more information.



RIYADH on the move



MADINAH The “Enlightened City”



For a Muslim making a potentially once-in-a-lifetime pilgrimage to one of Islam’s holiest cities, navigating the highways and thoroughfares of Madinah is rarely a highlight of his trip.

Like other urban centers in the Kingdom of Saudi Arabia (KSA) and throughout the Middle East, Al Madinah Al Munawwarah (Madinah) — literally the “Enlightened City” — is undergoing rapid growth and has relatively little transit infrastructure.

The city has 1.1 million residents, and is on track to double its population in the next 25 years, according to estimates.

What sets Madinah apart from its urban peers, though, is the fact that it welcomes millions of pilgrims from across the globe each year. In fact, in parallel to growth of its resident population, Madinah is projected to welcome as many as 8.6 million Umrah visitors and 3.6 million Hajj pilgrims annually by 2040, making crowding, traffic congestion and environmental pollution caused by vehicle emissions a pressing concern.

Enabling visitors, pilgrims and residents to get around the city — and planning and investing for the arrival of millions more in coming years — is top of mind for Al Madinah Al Munawwarah Development Authority (MMDA), the Saudi governmental organization overseeing the city’s development.

MMDA has set an aggressive timeline to meet Madinah’s near- and long-term transportation challenges. In just eight years, it expects to have completed the rollout of one of the world’s most ambitious public transportation initiatives, dubbed MMPTP for Al Madinah Al Munawwarah Public Transportation Program.

Once complete, the initiative will transform Madinah, a 2,000-year-old city that is largely bereft of public transportation infrastructure, into a leading “smart” city capable of meeting the mobility needs of its growing permanent and visitor populations, while providing needed job opportunities for local workers.

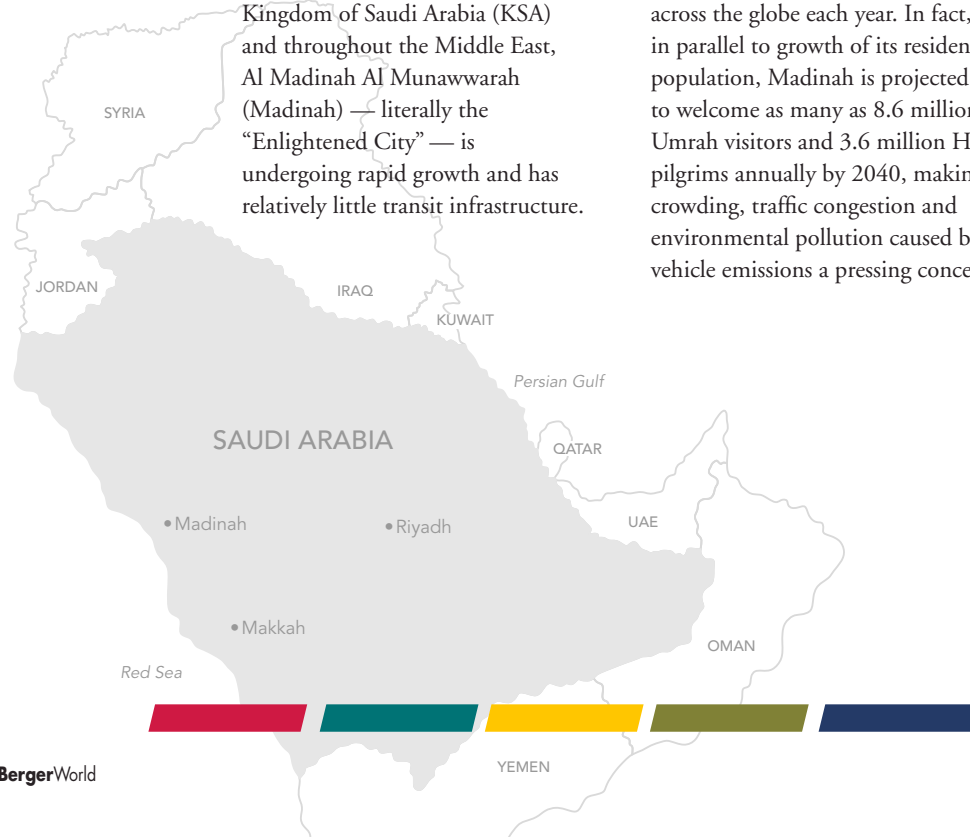
By implementing a multibillion dollar advanced, intelligent transportation system, MMPTP aims to deploy multimodal options for moving people safely and efficiently around the city. Equally important, it will expand connections to other cities in KSA, especially Makkah, Islam’s holiest city and a required pilgrimage site for every Muslim able to make the journey.

Plans for Madinah’s public transportation system include three metro lines, about 100 kilometers in length, with 71 stations; two BRT lines covering 34 kilometers and 36 stations, with four express and seven feeder bus routes; and major upgrades to, and new construction of, the primary road network, including major thoroughfares like King Abdul Aziz Road, Hijrah Road and Al Salam Road.

MMDA’s overall development plan for the city also calls for MMPTP to provide direct linkages to the new Haramain High Speed Rail project, which will whisk passengers at 200 kilometers an hour between Madinah and Makkah via King Abdullah Economic City, Rabigh, Jeddah and

King Abdulaziz International Airport. By 2023, residents and pilgrims alike will be able to travel between Madinah and Makkah in a brisk two hours by high-speed rail rather than 4.5 hours by bus or car.

During the next five years, Louis Berger will serve as program management office consultant for MMPTP, overseeing strategic planning as well as coordinating and integrating the service delivery efforts of all other consultants and advisors working on the initiative. The firm also will provide counsel on transit-oriented development around the stations and will help socialize and encourage the use of public transportation in the city.



Accelerating business in the US NORTHEAST CORRIDOR

The United States' Northeast Corridor is a 457-mile rail route stretching from Washington, D.C., to Boston, Massachusetts. The Northeast Corridor region is home to 17 percent of the U.S. population despite covering just 2 percent of its land area, making it the most densely populated area of the country. Its population density is more than 10 times greater than that of the rest of the United States.

BOSTON



NEW YORK



PHILADELPHIA



BALTIMORE



WASHINGTON, D.C.



The region also is the nation's primary economic hub, accounting for nearly 20 percent of gross domestic product annually. One-third of Fortune 100 companies are based in the area. In fact, were the Northeast Corridor region its own country, its \$3 trillion in economic activity would make it the fifth largest economy in the world, boasting a larger GDP than France's.

Due to the dense population and significant economic activity, the Northeast Corridor region represents a significant portion of the United States' transportation market. In an average day, the Northeast Corridor rail mainline supports more than 70 freight trains delivering raw materials and goods along the Eastern Seaboard. In addition, half of all Amtrak rail trips and 75 percent of the commuter rail trips in the country are made to, from or within the region. The region accounts for 30 percent of air trips nationwide and more than half of all U.S. flight delays due to congestion.

Demand for transportation in the region is projected to grow dramatically during the next 25 years. By 2040, the corridor's population is expected to increase by 7 million people, and the region will add more than 5 million jobs. The Northeast Corridor Commission estimates that by the same year, commuter rail demand will increase 87 percent, aviation demand will double and intercity rail ridership will rise by 115 percent. Given the level of congestion already present on these modes of transportation, and the region's inability to adequately handle increased road traffic, significant investments will need to be made in alternate modes of transportation and efficient urban planning.

The Northeast Corridor runs through eight states and the District of Columbia — each with its own transportation policy goals and agendas. Greater coordination between states has the potential to align transportation and urban planning objectives, reducing congestion on the region's roads, rails and runways. In 2010, Congress established the Northeast Corridor Infrastructure and Operations Advisory Commission to enhance cooperation between states, Amtrak and the U.S. Department of Transportation. The commission's mission is to develop and implement a regional investment strategy for the corridor, advance near-term infrastructure improvements, and coordinate and educate stakeholders and the public. Organizations like the commission can play a key role in shaping not only transportation, but also planning and land use in this and other multijurisdictional regions.

High-speed rail is one potential solution to easing traffic burdens on the highways and in the airspace of the Northeast U.S. Today, however, effectiveness and efficiency of high-speed rail is limited by inadequate and aging infrastructure. Many of the bridges carrying trains across the region's rivers — including New Jersey's Portal Bridge, which has been called "the Achilles' heel of the Northeast Corridor" by Amtrak — are more than a century old and unable to support the loads of high-speed trains.

Maglev uses magnetic levitation technology to move trains without them touching the ground. This technology reduces friction and resistance, allowing trains to move significantly faster than traditional rail systems. Currently maglev is being employed for a high-speed rail link between the Shanghai Metro and Pudong International Airport in China. Central Japan Railway also is developing a superconducting maglev train capable of speeds up to 311 miles per hour between Tokyo and Osaka.



The Northeast Maglev partnered with Central Japan Railway in commissioning Louis Berger to perform a feasibility study for a superconducting maglev train between Washington, D.C., and New York. The high-speed train would be the first of its kind in the United States and capable of traveling between Washington and New York in one hour. Louis Berger is providing planning, engineering, environmental and financial analysis services for the project, which would employ its own dedicated guideway.

New York City is the population and financial center of the Northeast Corridor region. With more than 8.4 million people in its five boroughs, New York is the largest city in the United States and the country's most densely populated major city. Including the metropolitan area, New York's population jumps to more than 20 million, nearly 40 percent of the Northeast Corridor.

Because of the city's significant current and historic population density, New Yorkers rely heavily on transit. Nearly half of all households in the city do not own a vehicle, a staggering number considering nearly 90 percent of commuter trips nationwide are made by car. New York is served by one of the oldest and largest subway systems in the world. Opened in 1904, the system comprises 232 miles of routes serving 421 stations across Manhattan, Brooklyn, Queens and the Bronx. In 2014, more than 1.75 billion trips were taken on New York's subway, for an average of 5.6 million trips each weekday and 5.9 million each weekend.

As part of a plan to increase service on the east side of Manhattan, the Metropolitan Transportation Authority, operator of the New York City Subway, is building a new subway line under Second Avenue. The line would cover 8.5 miles and 16 stations between Lower Manhattan and the Upper East Side. Presently, the Upper East Side is served only by the IRT Lexington Avenue Line, the most used transit line in the country, boasting more daily riders than the entire Washington, D.C., Metro system.

The focal point of New York's economy, and consequently its transit system, is Lower Manhattan. Home to the Financial District and the New York Stock Exchange — the world's largest stock exchange, with nearly \$170 billion in daily trading volume — the area is a significant contributor to economic activity and a hub for financial, professional services and government jobs. Despite the area's importance as an employment center, just 23,000 people lived in the Financial District at the time of the 2000 Census.

Lower Manhattan was devastated by the terrorist attacks of September 11, 2001. In addition to the tragic loss of thousands of lives, the attacks crippled transportation systems around the World Trade Center. Both the Port Authority Trans-Hudson (PATH) World Trade Center and New York City Subway Cortlandt Street stations were destroyed, disrupting transit to and through the Financial District. A temporary PATH station was built and opened in November 2003, allowing direct connections from New Jersey for the first time in two years.

In 2003, the Port Authority of New York and New Jersey (PANYNJ) began work on a master plan for redeveloping the World Trade Center site. The \$15–20 billion plan — by far PANYNJ's largest ever undertaking — involved construction of a memorial to the victims of the attacks, a museum documenting and analyzing the events of September 11 and their ongoing significance, and six new skyscrapers. Three of these towers, 7 World Trade Center, 4 World Trade Center and 1 World Trade Center — the tallest building in the Western Hemisphere at 1,776 feet — have already opened, bringing jobs and economic activity back to Lower Manhattan.

A key component of the World Trade Center redevelopment is the Transportation Hub. Scheduled for completion in 2015, it will be the third largest transit center by size in New York City. The completed hub will house not only the PATH World Trade Center Station, which has already opened to serve passengers from New Jersey, but also connections to 11 different subway lines and the Battery Park City Ferry Terminal. The hub also will feature 225,000 square feet of retail and restaurant space and pedestrian connections to World Trade Center towers 1, 2, 3 and 4, and the 9/11 Memorial.

The World Trade Center Transportation Hub can serve as a model for integrated transit centers in other urban areas. The completed project will be the most integrated network of underground pedestrian tunnels in New York. Such projects that can link pedestrians directly from transit to offices, retail spaces and restaurants without the use of surface roads reduce congestion and enhance pedestrian safety.

The revitalization of commerce and transportation in the area also has contributed to a significant increase in population. An estimated 43,000 people lived in the Financial District in 2014 — a nearly 100 percent increase over the area's pre-9/11 population — demonstrating the importance infrastructure improvements have on shaping where people decide to live and work.



Photos courtesy of Port Authority of New York and New Jersey

World Trade Center Redevelopment Team

In 2004, PANYNJ selected Louis Berger to serve as program manager for the World Trade Center Redevelopment Program — arguably the largest, most complex and highly scrutinized construction program in the United States. As program manager, Louis Berger is responsible for scheduling, cost management, contractual and coordination activities on behalf of PANYNJ, overseeing the work of more than 100 consultant and contractor firms.

More than 40 Louis Berger employees are involved in the daily management of the World Trade Center Redevelopment Program. From creating integrated master schedules containing tens of thousands carefully sequenced actions and managing invoicing and payment for all contractors, to communicating project progress to stakeholders and the public, and leading tours of the construction sites for government officials and dignitaries, members of the Louis Berger program management team are

PANYNJ's boots on the ground, ensuring that the \$15–20 billion redevelopment runs smoothly.

Our employees' client-focused attitude was never on display as much as during and after Superstorm Sandy, which inundated the 16-acre World Trade Center site with more than 125 million gallons of water. Before the storm hit New York, Louis Berger staff were on site setting up an operations center to assist PANYNJ in the recovery effort. In addition to identifying the areas where immediate cleanup was needed to keep to the original program schedule, our staff managed alternate sources of materials and fuel in the face of supply and delivery challenges.

As a result of the hard work of Louis Berger employees, construction was able to resume less than 10 days after the storm, significantly compressing the potential delays due to the catastrophic event.

INDIA Improving intracity transit



Louis Berger has been working in India since the 1980s.



India is one of the most populous countries on earth. Currently, more than 1.25 billion people live in India — more than 17 percent of the world's population. Due to rapid population growth, the U.N. projects that by 2028, India's population will be the largest in the world.

During the next four decades, India will be a major driver of world urbanization, as the country's urban population is projected to increase by more than 400 million. Together with China and Nigeria, India will account for 37 percent of the world's urban population growth by 2050. Already home to Delhi and Mumbai, two of the top five most populous metropolitan areas globally, India will have seven "megacities" — urban agglomerations with more than 10 million inhabitants — by 2030. These growing cities, which include Ahmedabad, Bengaluru, Chennai and Hyderabad, will need to develop infrastructure to accommodate burgeoning populations.

As India's middle class grows, so does its rate of vehicle ownership. With more middle class inhabitants in cities and more vehicles on the roads, traffic and gridlock have gripped India's urban areas. The country loses an estimated \$9.6 billion annually due to traffic congestion through wasted fuel, lost productivity and delays in shipments of goods. Given these facts, India could attain significant increases in urban quality of life by introducing operational efficiencies to its urban transport systems.

In many of India's urban centers, projects are underway to develop urban rail networks. Louis Berger has been involved in metro and monorail projects in Mumbai, Navi Mumbai and Hyderabad.

Hyderabad is an important economic center in south India. The capital of the newly formed state of Telangana,

Hyderabad also is the temporary capital for the neighboring state of Andhra Pradesh. The city is the center of the region's economy, with large industries in pharmaceuticals and information technology.

Hyderabad's population is growing rapidly. In 2014, there were more than 7 million inhabitants in the city itself and 8 million total in the metropolitan area. By 2021, the population of the city and its suburbs is projected to reach 13.6 million — an increase of nearly 70 percent. To accommodate this dramatic growth, Hyderabad will need to improve its transportation systems.

Today in Hyderabad, only 40 percent of trips taken each day are on public transportation. By comparison, more than three quarters of daily trips in Mumbai are by transit. There are more than 3 million registered personal vehicles in Hyderabad, and the city is adding an average of 200,000 each year, a number that is not expected to decrease as the city grows.

To alleviate traffic caused by population growth and encourage residents to use public transportation, Hyderabad Metro Rail Limited is constructing a 72-kilometer metro system. Covering 66 stations along three important transportation corridors in the city, the initiative is the world's largest elevated rail system constructed through a public-private partnership.

Louis Berger was selected to provide independent engineering services during the development, construction and operation phases of the project. In this role, the firm is responsible for reviewing design documents, ensuring compliance with safety measures during construction, inspecting and testing rolling stock, and monitoring construction costs.

Upon completion, the Hyderabad Metro will reduce travel times along some of the city's most traveled corridors by 50 to 75 percent. In addition to the benefits of alleviating traffic and reducing trip times, the metro consumes 80 percent less energy per passenger-kilometer than road-based transportation and reduces air and noise pollution — increasing quality of life for residents and commuters.



From left:
Neeraj Jain;
Surjit S. Madan;
A.K. Das

One of Louis Berger's key differentiators is the firm's ability to combine the international expertise of a global firm with the knowledge and skills of local experts. Today, Louis Berger employs nearly 800 experts in India on 40 active projects. Three of these experts recently received international recognition as leaders in the field of urban rail.

Neeraj Jain, deputy team leader on the Hyderabad metro project, was a guest speaker at Railways@2020,

an international conference addressing investment issues and opportunities for India's rail network that was attended by policymakers and financiers from India, France, China and Czech Republic. Neeraj discussed challenges in executing mass rapid transit projects in a public-private partnership framework. His article "Forest Land for Railway and Infrastructure Projects" also was published in Rail Business, a publication supported by the Asian Railway Association.

Surjit S. Madan, project director for the Navi Mumbai Metro Line 1, presented his paper on optimizing fleet efficiency through the use of reliability-centered maintenance at the 2015 Railways and Rolling Stock Maintenance Conference in Kuala Lumpur, Malaysia. Surjit also served as chair of the conference, which was attended by senior engineers and executives of various transit operators and business organizations from Asia and Europe.

A.K. Das, project director for the Mumbai Monorail, presented a paper on safety, security and operation of monorail systems to the International Monorail Association (IMA) in Wuppertal, Germany. Additionally, he was elected as a member of the Executive Council of IMA, which is based in Switzerland.

These and other experts providing thought leadership throughout India and the world demonstrate Louis Berger's commitment to developing and sharing international best practices.



Mumbai's metro (left) and monorail are expected to serve nearly 1 million commuters per day within three years.

The Mumbai Metropolitan Region — comprising Mumbai, Navi Mumbai, Thane, Vasai-Virar, Bhiwandi and Panvel — boasts more than 21 million inhabitants, placing it among the 10 most populous urban areas in the world. Mumbai is the commercial center of India, accounting for more than 5 percent of gross domestic product. Mumbai also represents 40 percent of all international trade and more than 70 percent of all capital transactions. It also is the center of India's immensely popular Bollywood entertainment industry.

In Mumbai, more than 11 million trips per day — 78 percent of all commuting trips in the city — are made by bus or rail. When trips made by foot are added, this number jumps to 91 percent. Despite this high rate of public transportation use, Mumbai remains gripped by gridlock on the

roads, suffering from the associated economic, environmental and quality of life losses. Unplanned growth and development within various parts of the city have meant that infrastructure investments in road projects have largely been unable to alleviate the city's traffic problems.

In response, the Mumbai Metropolitan Regional Development Agency (MMRDA) has undertaken two ambitious urban rail initiatives — Mumbai Metro and Mumbai Monorail.

Mumbai Metro is planned as a 160-kilometer system with underground and elevated tracks and stations. The first phase of the project, which is currently under development, comprises three lines. Louis Berger provided independent engineering services for the Versova–Andheri–Ghatkopar Metro Corridor, an 11.5-kilometer-long double-line standard-gauge elevated railway with

12 stations. The line also includes an at-grade depot, 25-kilovolt overhead traction and ballastless tracks. Louis Berger reviewed and approved engineering designs, implemented the quality assurance plan, monitored precommissioning trials, and reviewed training modules for operations and maintenance staff.

Since opening in June 2014, the line has seen significant ridership. In the two months after its inauguration, more than 18.5 million trips were taken on the line. The metro operator projects as many as 900,000 riders per day within three years of operation.

Mumbai's second urban rail initiative is the Mumbai Monorail. A traditional elevated metro was not feasible amidst the narrow right-of-way and significant grades in the eastern sectors of the city. As a result, MMRDA selected

an elevated monorail capable of navigating tight turns in the Mahara Chowk corridor. Louis Berger served as project manager for the Mumbai Monorail, a 39-kilometer corridor with 17 elevated stations. Each support pillar for the system's elevated tracks occupies just one square meter, minimizing the impact on surface transportation in the city's dense urban corridors. The system is the first of its kind in India and is projected to bring significant benefits to commuters between eastern and southern Mumbai.

Navi Mumbai is a planned community just east of the city of Mumbai. Established in 1971 with the formation of the City and Industrial Development Corporation (CIDCO), Navi Mumbai — literally translated as “New Mumbai” — was designed as an alternative to, rather than an expansion of, Mumbai's

urban and residential sprawl. The city was developed around the theme of a complete community — Navi Mumbai was to have its own residential, commercial and industrial centers. Since its establishment, Navi Mumbai has grown significantly. In 2001, more than 700,000 people lived in the city. By the 2011 census, the population had increased more than 59 percent.

To address this and future population growth in a sustainable manner, and to curb the growth of private automobiles on the city's roads, CIDCO has planned a five-line, 106-kilometer metro system. Given the city's polycentric nature — Navi Mumbai lacks a traditional single “downtown” or central business district — a robust urban rail network is both advantageous and easier to implement than rail projects in more centralized cities.

Louis Berger is providing planning, design review, procurement and project management services for the first phase of Line 1, linking Belapur, Kharghar, Taloja and Pendhar. The 11-kilometer elevated corridor will serve 10 stations and also contain an at-grade depot for storage of rolling stock. The completed 23-kilometer Line 1 will serve 20 stations and an extension to the new Navi Mumbai International Airport (for which Louis Berger developed a comprehensive airport master plan and preliminary designs).

The completed Navi Mumbai Metro is projected to meet the needs of the city's growing population, which is expected to double within the coming decades.





Currently, Doha is served by five primary highways, several of which are in the process of reconstruction. The Dukhan Highway, located to the west of the city, is being expanded and outfitted with several new interchanges, underpasses, overpasses and roundabouts. The Al-Shamal Road, which connects Doha with the northern region of the country, is being expanded into a modern four-lane highway with major interchanges as part of the new Doha Expressway project. The Salwa Highway, which links the south of Doha with Saudi Arabia, is being expanded and upgraded. Additionally, a sixth Doha highway, the F-Ring Road, is currently under construction. Upon completion, it will connect travelers with the newly opened Hamad International Airport.

Despite Doha's robust road network, no rail network currently exists. In response, the government proposed the construction of the Qatar Integrated Railway Project, which will encompass metro rail, light rail, and long distance passenger and freight rail.

The Louis Berger Egis Rail joint venture, in association with the Qatar Program Management Company, is providing project management consultancy services for the initiative's at-grade, above-grade and underground metro corridors and multi-modal station structures.

The first phase of the project, which is expected to open by the fourth quarter of 2019, will include the construction of four metro lines — totaling a length of 86 kilometers — and 37 stations in the city of Doha. Upon completion in 2026, the network will consist of 242 kilometers of rail lines and 107 stations, including one major interchange at Msheireb and Education City. Future long-term plans include connecting the system to the 32-kilometer Lusail Light Rail, currently under construction. Additional connections to other major Qatari cities and neighboring countries will be explored using electrified mixed-traffic lines and a causeway.

Doha also has recently made improvements to its air travel sector. In 2014, the city opened its principal aviation facility, the Hamad International Airport. The new hub was designed to accommodate the area's increasing volume of

air travel. It has an annual capacity of 29 million passengers — three times the volume of the city's former airport.

Concurrently, Doha is attempting to become a world-leading educational hub. Through its support of various programs, from basic literacy initiatives to high-end university research, the city is quickly becoming one of the foremost leaders in the area of education.

Louis Berger is helping Doha achieve this goal through the creation of Education City, a mixed-use development containing international universities, primary and secondary schools, sports facilities, a science and technology park, a convention center, and a teaching hospital.

Education City aims to be the center of academic excellence in the area, instructing students in the subject areas of critical importance to the region. It also is conceived as a forum where universities will share research results and forge relationships with businesses and institutions in the public and private sector. Louis Berger, commissioned by ASTAD Project Management, is providing construction management services for eight buildings in Education City.

Doha's commitment to education will provide its residents with increased economic opportunities, ensuring the region's continued self-sufficiency and sustainability.

The development of the transportation system and various educational institutions in the Doha region is critical to providing a sustainable urban expansion plan that benefits the Qatar public. It also supports the larger aim of Doha becoming a leading educational and sports hub on both a local and global scale. In particular, the city hopes to leverage the success of the 2019 World Championships in Athletics and 2022 FIFA World Cup in its bid to host the Summer Olympics in 2024 or 2028. The development of Doha's transportation network, in particular, will be crucial to this initiative.

QATAR Mobilizing a global sports and educational hub

Qatar, a sovereign Arab nation located in Southwest Asia, is home to just over 2 million people. Despite being among the least populated countries in the Middle East, Qatar is the world's richest nation per capita, according to Forbes magazine, given its rich oil and natural gas reserves. The country produces more than 800,000 barrels of oil daily, while its gas fields currently account for 13 percent of the global supply.

Doha is the capital and economic hub of Qatar. Several of the country's largest oil and gas companies are headquartered in the city. While Doha's economy is largely built on the revenue it generates from its oil and gas industries, the city is presently seeking to move away from its dependency on these resources.

One way that Doha is attempting to diversify the nation's economy is through increased investment in athletics. Qatar aims to become a recognized sports hub on both a local and global scale. This objective is already well under way. In 2019, Doha will host the World Championships in Athletics. In 2022, the city will host the FIFA World Cup.

To support Doha's development as a preeminent sports super city, enhance the experience of tourists during future events, attract businesses to the region and accommodate the area's rapidly expanding population, the city is in the process of upgrading its infrastructure by establishing a more reliable transportation system.





WOMEN in construction and engineering

The Middle East and North Africa (MENA) region's 175 million women and girls are better educated than ever before. In fact, according to the World Bank, a majority of young girls in MENA attend school, and more women than men are enrolled in university.

With increased skills and education, women have made rapid gains in the workplace. Still, despite this progress, they account for just 30 percent of the region's workforce. To put this into perspective, the global average for women in the labor force is about 50 percent.

The region is expected to make an estimated \$4.3 trillion in infrastructure investments over the next five years. This has the potential to reshape the region's workforce as much as its physical landscape, boosting demand for top talent in the construction and engineering fields — and helping close the gender gap in these disciplines.

One approach pioneered by Handasiyat, a virtual engineering company operating in MENA, creates flexible working conditions while taking into account the local culture, customs and religious obligations that often hinder women's progress in this field. Today, it is the region's largest hub for women engineers.

Global firms also are encouraging more women to enter these fields by helping them build and support professional networks. In February 2015, Louis Berger and AmCham Abu Dhabi's Women in Business Committee hosted a WOMEN ACHIEVE "Managing Your Career" event. The women panelists represented leaders in planning, construction management, brand management and business operations responsible for managing some of the largest programs currently underway in the region, including two Louis Berger managers on Qatar Rail's Doha Metro program — Virginia Borkoski, engineering director, and Kylie Bladen, project controls manager.

During the event, panelists shared opportunities, challenges and decisions made throughout their career as experience-based examples of how organizations can better support leadership development across gender lines. The panel also discussed the importance of mentors in career development and underlined the role men and women mentors can play in nurturing and promoting the next generation of women working on MENA construction and engineering projects.

The event was the third in a series hosted by the employee-run Women at Louis Berger committee, following similar panels in Morristown, New Jersey, and Bucharest, Romania.

Left: WOMEN ACHIEVE "Managing Your Career" event, United Arab Emirates

Right: Women at Louis Berger events in Romania, United Arab Emirates and United States



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