Our cities are evolving. The primacy of the suburb is waning, and urban living has become fashionable. Neighbourhoods that were once filled with smoke stacks and factories are now gentrifying to welcome young professionals with their burgeoning families and empty nesters who want to enjoy the benefits of their city. These urbanites do not glorify big green front lawns with their requisite hours of mowing and two-car garages, preferring instead shorter commute times, access to restaurants, museums and shopping, and freedom from the dependency on cars for transportation. At the same time, more people are leaving their rural roots for cities, in search of better economic opportunities, further contributing to population growth. This shift in population centers, the need to connect newly gentrified neighbourhoods into the transport network, and greater reliance on public transit is changing the way that cities must plan. With rising ridership, many governments and transit agencies are recognizing the urgency to expand their services in order to respond to the increased demand. New public transit options are essential. Light Rail Transit (LRT) offers key advantages that have led to its resurgence in recent decades. It offers a lower price point compared to metros, which require extensive tunnelling. Many cities are also embracing the romance of yesteryear that comes with the renaissance of tramway and streetcar systems. New LRT lines help integrate neighbourhoods, improving property values, and encouraging new construction. Their overland transport is also beneficial to local businesses situated between stops, who lose visibility when trains run underground.

WSP is proud to present this collection of our work in the domain of light rail transit.
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Adelaide Coast to Coast Line, Stage II

This is the second stage of the South Australia government’s long-term strategy to extend the light rail from the city to Semaphore. It involved a 2.8km extension of the light rail facility from North Terrace in the Adelaide Central Business District to the Adelaide Entertainment Centre via a centre-of-road alignment along two six-lane arterial roads.

The project involved refinement of a concept route alignment under the Early Contractor Involvement model, followed by development of design documentation for the construction phase of the project.

WSP formed part of the Aurecon design team and managed the geometric design, traffic engineering, pavement design, and environmental services. In addition, WSP played a key role in the innovation and safety in design workshops, to develop the concept design, detailed design, and documentation for the project.

The final design meets the project objectives and the design documentation was prepared within very tight time frames, allowing the project to be delivered by early 2010 and within budget.

Location
ADELAIDE, SOUTH AUSTRALIA, AUSTRALIA
Client
THIESS-DOWNER EDI JOINT VENTURE
Status
OPENED IN 2010

Baltimore Central Line

WSP led the general engineering consultant joint venture responsible for development of the 35km, 24 station Phase I of this LRT system, to provide service to the city’s central business district.

The project involved 22.5km of doubletrack route and 12.9km of single-track route.

The schedule for delivery of this project was ambitious because of the state’s desire to initiate service for the opening of the new Baltimore Orioles baseball stadium in the spring of 1992. The WSP team received notice-to-proceed on May 18, 1988, and revenue service began in April 1992.

In January 2002, construction began on the Double Track Project, which added a second set of tracks to eight segments of the light rail line. With both northbound and southbound trains sharing one track, delays were common and a disabled vehicle or system maintenance could shut down the line. WSP, in joint venture, provided construction management and construction engineering and inspection services.

In December 2004, the MTA completed the southern half of the project, making light rail service from downtown Baltimore to Baltimore-Washington International Airport more reliable and efficient.

On February 26, 2006, the MTA celebrated the completion of the Light Rail Double Track project by reopening the last few miles of the line to Hunt Valley.

Location
BALTIMORE, MARYLAND, UNITED STATES
Client
STATE OF MARYLAND MASS TRANSIT ADMINISTRATION (MTA) + STATE OF MARYLAND
Status
OPENED IN 2006
The West Light Rapid Transit Expansion Project consists of an 8.2km addition to the Calgary LRT system between 13th Street SW and 73rd Street SW. WSP was a key member of the Design-Build team awarded the contract to design, build, and undertake procurement for the project. WSP provided the design for the entire civil/structural infrastructure (tunnels, trenches, elevated guideway, and roadworks) for this P3 project.

Included in the scope of work were six passenger stations (an elevated, an underground, two at-grade, and two located in trenches), nine traction power substations, a major highway interchange, two park-and-ride facilities, a four-storey office building, and the associated roadworks and utilities. WSP designed two station area plans: Westbrook Station, which is Calgary’s first underground station, and 45th Street Station, a trench transition station, as well as all of the traffic signals.

Operating conditions, including rapid temperature fluctuations and snowfall accumulations, were all considered in the design. In addition, stormwater management modelling was done to review any potential rainfall events or hail/snow events that locally could impact guideway drainage performance.

Throughout the project, WSP coordinated with all external stakeholders, including the City of Calgary, the LRT Safety Committee, franchise utilities, and environmental agencies. WSP also coordinated the third-party designs and vetted the design with the LRT infrastructure being built. Strong communication and organization skills were key ingredients to successfully managing all coordination with external stakeholders.
As part of its vision to position Canberra as a sustainable and liveable city, the Australian Capital Territory government has commissioned the start of the Capital Metro light rail project. It is anticipated that an effective and reliable light rail system will attract investment and employment opportunities, bring environmental benefits, and encourage more active lifestyles for Australia’s capital city.

Key objectives for the project are: increasing the mode share of public transport, optimising the frequency and service reliability, achieving affordable capital and operational costs, growing a more diversified Canberra economy, stimulating sustainable urban redevelopment along the corridor, increasing social and economic participation, revitalising the Northbourne Avenue corridor, and reducing carbon emissions.

Capital Metro will address many of the key environmental concerns for the city, including air quality, traffic volumes and congestion, ambient noise, greenhouse gas emissions, and urban growth within Canberra. Analysis has shown that by 2031 without a transit system in place, commuters north of the city will face travel times of up to an hour during peak periods. WSP was engaged to provide planning and environmental assessment services, including preparation of a preliminary environmental assessment and the subsequent Environmental Impact Statement for Stage I of the Capital Metro, a 12km light rail line between Gungahlin and Civic.

WSP also provided a preliminary environmental assessment and a Referral under the Environmental Protection and Biodiversity Conservation Act 2001 for a 3km extension of the light rail to Russell.

Location: CANBERRA, AUSTRALIAN CAPITAL TERRITORY, AUSTRALIA
Client: CAPITAL METRO AGENCY
Status: UNDER CONSTRUCTION

**Chicago Construction Management On-Call Consultant**

WSP was chosen by the Chicago Transit Authority (CTA) to manage the design and construction phases of the design-build rehabilitation of five transit stations on CTA's Blue Line. The stations restoration project marks the third consecutive task order for construction management services to be completed as part of the CTA's program to reduce rail slow-zones and modernize the stations along this line from Chicago’s central business district to O'Hare International Airport, including several upgrades needed to make the stations compliant with the Americans with Disabilities Act. WSP has managed the rehabilitation of eight stations and over 6.4km of elevated and subway track systems since late 2017 and we are currently managing the design-build rehabilitation of an additional two stations.

WSP was also chosen to manage the design and construction phases of the Ravenswood Loop Connector Signals Restoration project on the CTA’s heavily travelled Brown Line on Chicago’s North Side. The signals renewal follows our efforts in managing the track renewal along much of the same corridor and consists of a three-year project that will completely reconstruct and upgrade nearly nine miles of rail signalling.

Location: CHICAGO, ILLINOIS, UNITED STATES
Client: CHICAGO TRANSIT AUTHORITY
Status: ONGOING
The Cincinnati Bell Connector streetcar is an electric mode of transportation operating on a 5.8km loop connecting downtown Cincinnati’s Riverfront with the Over-the-Rhine neighborhood and Findlay Market. WSP was a substantial contributor to the city’s development strategy. The Cincinnati Streetcar Feasibility Study, completed in November 2007, assessed the economic impact, cost estimate, and route analysis for Phase I of the streetcar system. WSP served as designer and project coordinator and worked with the city to manage, plan, and design the 5.8km first phase of the streetcar system that opened in September 2016. In Phase II, WSP is developing alignments and routes for connectors and additional uptown loops.

In Phase I, services included identifying and procuring vehicles, creating and executing a management and operational plan, including a projected staffing plan for system management, streetcar operations, and infrastructure maintenance (track, electrical, and control systems), establishing and implementing a security plan, transit network planning, environmental documentation, and completing final design services for all elements of the streetcar system. The maintenance facility was designed to LEED certified standards. Bio-swale is located at the majority of the station stops. The project will improve quality of life by propagating community growth and development and improving infrastructure by linking transportation systems. The project will also enhance historic and cultural resources and minimize noise vibration.

The vision remains to create a streetcar system that spurs development and is part of a larger multimodal transportation system that links areas outside the downtown core and throughout the region. Downtown is Cincinnati’s largest employment center, with approximately 70,000 people in the area every day. The system will ultimately include a downtown circulator and a connector to the uptown area that serves the region’s hospitals and the University of Cincinnati.
WSP provided fast-track design and engineering services for the development of Cleveland’s Waterfront Transit Line. As an extension of the Blue/Green Line, the Waterfront Line consists of a 3.5km, double-track light rail line with four stations. It provides continuous public transportation through an area that previously had limited bus service; convenient transfer to the existing Red Line; and stations at key points, improving access to businesses and other local attractions.

In order for the system to serve Cleveland’s Bicentennial celebration in July 1996, the WSP team fast-tracked engineering, architectural, urban, and graphic design services as well as engineering support during construction, reducing a typical 4 to 5-year project schedule to 2.5 years. To meet the ambitious schedule, the project team used various time-saving methods, including a precast segmental structure for the viaduct.

While the project’s deadline was critical, aesthetics were also given a great deal of consideration in order to promote Cleveland’s image. WSP utilized a fully integrated design team, which included artists and architects together with civil, structural, and systems engineers to provide a “cutting-edge urban design” on schedule.

Cleveland Waterfront Transit Line

**Location**: CLEVELAND, OHIO, UNITED STATES

**Client**: GREATER CLEVELAND REGIONAL TRANSIT AUTHORITY

**Status**: OPENED IN 1996

**Length of Extension**: 3.5km

**Time Saved Due to Fast Tracking**: 2.5 Years

**Stations**: 4

**Awards**
- Waterfront Center Annual Award for a Quality Waterfront Project, 1996
- The Growth Association, Downtown Marketing, and Development Council of Cleveland - Downtown Recognition Award, 1996
- Ohio Chapter of the American Society of Civil Engineers – Project of the Year Award, 1996.
The Greater Copenhagen Light Rail project is being delivered under a partnership between the Danish State, the Capital Region and eleven local municipalities. It will extend over 28km between Lyngby in the north and Ishøj in the south, passing through eight municipalities and having 28 stations. At six of the stations (Lyngby, Buddinge, Herlev, Glostrup, Vallensbæk and Ishøj), it will be possible for passengers to change to the local S-trains which serve the wider Greater Copenhagen region. It will provide a service running every five minutes in the daytime and every 10 minutes in the evenings and on weekends.

WSP has provided consultancy services for the civil works aspects of the light rail project, including early design, planning and cost estimation in conjunction with the production of the Environmental Impact Assessment and, ultimately, with the securing of Construction Act powers for the scheme. In the subsequent phases of the project, WSP has delivered strategic advice, design services (including production of the reference design for the light rail alignment, roads and structures), utility relocation protocols, project management and controls, traffic planning, tender document preparation, evaluation of tenders and support for the tender negotiations.

The project remains ongoing, and WSP is continuing to assist Hovedstadsens Letbane towards final owner’s approval and contract(s) awarded. The utility relocations phase and the main construction works will follow.
With congestion forecasted to double by 2021, Edinburgh needed to address the issue of transport capacity. The development of a new tram system provided a solution to the city’s growing public transport needs. Potential routes were assessed, and the Leith Waterfront to Edinburgh airport route was selected for development in Phase I. WSP designed the first line of the planned network, which extends from east to west across the city and connects to the airport.

A wide and complex mix of urban realm and streetscape was included in the route. Integration with existing traffic flows required significant remodelling of roadways and traffic signal controlled junctions to permit practical runtimes for the tram. WSP provided key stakeholder management, interfacing with the city planning authorities, Network Rail, and the bus operators.

WSP’s role included complete design services, specifications for overall system functionality, integration of the system with other transport modes for road use, pedestrians, traffic management and public transport issues, delivery of a design that maximizes the speed of construction, system engineering, systems assurance processes, safety and RAM procedures, and energy evaluation and reduction recommendations, including regenerative braking designs.

WSP also provided support for the client’s procurement process for trams, covering provision of specifications and technical support through to the development of the tender for tram provision and maintenance.

**EDINBURGH, SCOTLAND, UNITED KINGDOM**

**Client**
TRANSPORT INITIATIVES EDINBURGH

**Status**
OPENED IN 2011

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<tr>
<th>LENGTH OF LINE</th>
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<td>TRAM FREQUENCY</td>
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The Gold Coast light rail is one of the largest public transport projects in the country, as well as the largest transport infrastructure project ever undertaken on the Gold Coast. It is one of Australia’s fastest growing local government areas, with over 400,000 residents and an estimated 60,000+ visitors each night. Traffic is also growing rapidly, particularly along the urbanized areas of the coastline between Southport and Broadbeach. As development continues, a greater emphasis is being placed on the need to provide a sustainable transport system that caters to future growth and helps shape more sustainable land use.

TransLink first commissioned WSP to complete a comparative analysis study for a bus rapid transit (BRT) or light rail transit (LRT) operation for the Broadbeach to Parkwood corridor. The Gold Coast Light Rail Feasibility Study followed from previous studies that identified the need for a high-frequency public transport corridor on the Gold Coast. Since the light rail route is proposed to travel underground, on the surface, and over structures, appropriate geotechnical, hydrogeological, and contaminated land investigation techniques were applied for each location. The LRT will also reduce the carbon footprint by using clean electrical energy rather than fossil fuel.

The first stage of work connects 16 stations from Griffith University and Gold Coast University Hospital near Southport to the Convention Centre at Broadbeach. This section includes 13km of double track, a maintenance depot, and a stabling area. WSP provided detailed design of the overhead line system. The amount of documentation required on site was minimised, allowing significant time saving while meeting client’s strict program and cost requirements.

The award and provision of the civil and track alignment contract allowed for four months to complete design and review. To meet time constraints, WSP compressed the design process into a three-month period - from release of civil and track alignment to complete design delivery for submission to government and relevant stakeholder review. WSP’s unique, simplified drawing system contributed to managing budget and time constraints.
The Raide-Jokeri LRT will be a dual-track light rail link between the Itäkeskus district in Helsinki and Keilaniemi in Espoo. A smooth, uninterrupted service is one of the key design principles of this 25km transit corridor. With 32 stations, Raide-Jokeri will use modern trains to connect Finland’s two largest cities. The light rail will partially replace the Bussi-Jokeri, Helsinki’s busiest bus service with 30,000 daily passengers. In addition to light-rail tracks, the project plan will include stations, connections, exchange stations, the depot, as well as affected roads. These components will be carefully designed to provide robust data on costs, feasibility, and impacts to facilitate proper decision-making. The project plan will serve as the basis for the construction design process. This vital cross-region service requires a rail link with a higher capacity and a higher service level. Raide-Jokeri will also significantly influence land use in the vicinity of the track in the near future. This consideration is also a part of the scope of the project plan.
WSP provided general design consultant services to NJ TRANSIT for the development of the Hudson-Bergen Light Rail, a 33km system encompassing 24 stations and five regional park-and-ride lots.

The initial 15km segment, completed in 2002, runs from 34th Street in Bayonne and West Side Avenue in Jersey City to Hoboken Terminal; the second phase, completed in 2006, comprises a 10km segment from Hoboken Terminal to the Tonnelle Avenue Park-Ride and from 21st Street to 34th Street in Bayonne. Future extensions are planned.

NJ TRANSIT used the design-build-operate-maintain procurement method, whereby the contractor completed the design, participated in financing, purchased the vehicles, performed construction, and then operates and maintains the system.

WSP provided preliminary engineering and architectural services for all facilities and systems, final design and contract document preparation for the Weehawken Tunnel and Bergenline Avenue Station in Phase II, and advancement of design for inclusion into a design-build document.

Acting as an extension of NJ TRANSIT staff for the design-build phase, we also provided review of final design documents, technical support during construction, and construction quality and schedule monitoring.

Awards
- Concrete Industry Board - Award of Merit for the Weehawken Tunnel and Bergenline Avenue Station, 2004
- American Public Transportation Association - Innovation Award, 2000
- New York Construction News Top Projects - #1 Project, 1999
- Professional Women in Construction (PWC) - Project for the 21st Century Award, 1996
Light Rail Transit III is the third LRT system in the Greater Kuala Lumpur/Klang Valley region and will serve an estimated population of two million in the Western Corridor by 2020. It is estimated that Line III will benefit 500,000 commuters. The new line will have 26 stations, including five interchange stations, with existing and future public transport systems. Total transit time will be approximately 58 minutes.

WSP has been commissioned by Prasarana - the organization established by the Malaysian Government for delivery and management of its major rail projects - to undertake the role of line-wide system consultant for Line III. This proposed new light rail line, extending 36km from Bandar Utama to Johan Setia, will serve as a major public transport system for the southwestern areas of Kuala Lumpur. The alignment will have 25 stations including a Grand Central station near Stadium Shah Alam with an end-to-end travel time of around 51 minutes.

WSP will undertake the design of the line-wide system works, including the eight core railway systems of light rail vehicles, signalling and train control, power supply and distribution, communications, depot equipment and maintenance vehicles, track work, automatic revenue collection, and electronic access control for the entire Line III. The scope will also include interface and integration with civil works design, preparation of tender documentation, tender evaluation, construction stage support, testing and commissioning, and staff training.

Kuala Lumpur Light Rail, Line III

Location
KUALA LUMPUR, MALAYSIA

Project Owner
PRASARANA MALAYSIA BERHAD

Client
MRCB GEORGE KEN SDN BHD

Status
UNDER CONSTRUCTION

STATIONS
26

LENGTH OF LINE
36km

TOTAL TRANSIT LINE
58 Minutes
Los Angeles
Metro Gold Line

WSP performed preliminary engineering and program management services for the original 22km section of the Gold Line, from Los Angeles to Pasadena, which opened in 2003. It included at-grade, elevated, and underground sections. We also performed structural and seismic analyses of the proposed alignment, given the area's high level of seismic activity.

The 9.7km Metro Gold Line Eastside Extension, from Union Station in downtown Los Angeles to East Los Angeles, opened in 2009, offering residents of the city's Eastside easy access to destinations throughout Los Angeles. WSP, in joint venture, provided preliminary design of the at-grade system as well as detailed design and construction services for twin 2.7km tunnels under Boyle Heights. The eight stations, many of which were designed by WSP architects and their joint venture colleagues, were planned to fit the context of the neighbourhoods in which they are located.

WSP also provided preliminary engineering services for the Foothill Extension of the Gold Line. The first segment of the Foothill Extension, which extended the Gold Line 18km from Pasadena to Azusa, opened in 2016. The second phase of the Foothill Extension would extend the Gold Line 19km from Azusa to Montclair.

Location
LOS ANGELES, CALIFORNIA, UNITED STATES

Client
LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY

Status
COMPLETED IN 2013

LENGTH OF ORIGINAL LINE
22km

LENGTH OF EASTSIDE EXTENSION
9.7km

LENGTH OF FOOTHILL EXTENSION
38km
LOS ANGELES, CALIFORNIA, UNITED STATES

Client
EXPOSITION CONSTRUCTION AUTHORITY

Status
COMPLETED IN 2016

LIGHT RAIL

LIGHT RAIL

LIGHT RAIL

LIGHT RAIL

WSP was lead designer to the design-build joint venture for Phase II of the Expo Line, which extended Los Angeles Metro light rail service 10.6km to Santa Monica. Phase II of the Expo Line opened for service in May 2016, marking the first time in six decades that it was possible to travel by rail—in 46 minutes—from downtown Los Angeles to the beach at Santa Monica. Phase II included seven stations, with the terminus at 4th Street and Colorado in Santa Monica, just blocks from the Pacific Ocean.

A dual-track light rail line was constructed in place of an abandoned single track that had not operated in decades. The project included station and track design as well as 24 street crossings, in some cases using newly constructed above-grade-level bridges and in others using at-grade crossings with gates.

WSP was responsible for all design management and key design aspects of the project, including drainage and road improvements and strategies for relocating utilities. We also designed the track guidance, structures, stations, traction electrification system, overhead contact system, and the communication duct bank.

Phase I of the Expo Line, from downtown to Culver City, opened in 2012. Phase II extended the line from Culver City to Santa Monica. The Expo Line serves neighbourhoods on the city’s Westside including Exposition Park, Century City, West Los Angeles and Westwood, and offers an alternative to travel on the congested Interstate 10 freeway. Ridership on the Expo Line extension is expected to reach 18,000-20,000 weekday travellers after the first year of service.

The Expo Line was delivered by the Exposition Construction Authority, which was created by the state legislature to oversee the planning, design and construction of the Expo Line. The Expo Authority turned the completed line over to the Los Angeles County Metropolitan Transportation Authority, which owns and operates it.

Los Angeles
Expo Line, Phase II

FEWER CARS ON THE I-10 DAILY

64,000

LENGTH OF EXTENSION

10.6km

TRAVEL FROM DOWNTOWN LA TO SANTA MONICA

46 Minutes
The Macau LRT Line forms the backbone of a comprehensive city-wide public transport network, and will be delivered in two phases. Phase I consists of a 21km elevated system with 21 stations and a depot on a 12ha site. The system will serve the Macau Peninsula and Taipa, connected by the Sai Van Bridge. It will operate on a driverless rubber tyre system in both a two-car (single unit train) and a four-car (double unit train) train configuration.

WSP serves as Lead Design Consultant for both contracts, with responsibilities including civil, structural, environmental, and E&M engineering services. These services include studies, onsite survey works, conceptual to detailed design, depot planning, alignment design, architectural design of the viaduct and stations and depot, public engagement support, and preparation of complete tender documentation for all construction contracts.

The Light Rapid Transit Phase I is a major transportation project in Macau. To enhance the connectivity of the LRT network, the Transportation Infrastructure Office has implemented several public transport interchange projects at designated stations.

The Barra Station project consists of an underground parking facility with three 12,000m² basements and one 250m² sunken mezzanine, and the associated road network, which provides access to the public transport interchange. The structure is a 25m-deep basement with three floor levels, and the wall support is a permanent diaphragm wall.
Since 2007, we have worked to secure funding, develop, expand, and enhance Greater Manchester’s iconic tram system. This expansion programme will nearly triple the size of the network with some 60km of new lines being delivered in a range of urban environments as well as bringing a range of improvements to transform the wider network. This has included the construction and refurbishment of over 300 retaining structures, tunnels, viaducts, and bridges.

Operating as a fully integrated delivery team, WSP has provided a comprehensive program management service, including risk management, project controls, and contract management, as well as extensive engagement with thousands of stakeholders – ranging from members of the public to businesses, local authorities, politicians, interest groups, and statutory bodies.

Our accomplishments as part of the TfGM Metrolink Integrated Delivery include bringing 5 new lines into service in 11 phases, with 24.5km of new line opening significantly ahead of schedule. The 14.5km extension to Manchester Airport opened to passengers in November 2014, over a year ahead of schedule. Most notably, we developed an alternative rail junction control solution to bring forward the opening of the South Manchester Line. The original design for the Oldham Town Centre extension did not fit within funding parameters. We developed a solution to construct an at-grade tramway integrated with a fully remodelled highway layout, which has transformed the area to support wider regeneration plans, with significant cost savings.

Utility diversions are a key cost and program risk for Light Rail Schemes. They were a huge project in their own right, with over 500 separate contracts. Our development of specific solutions to individual problems was a major achievement. We achieved a saving of £10 million and a nine-month reduction on the overall utility diversions program on the Manchester Airport Line, an effort recognized by the Light Rail Awards.

Manchester
Metrolink

<table>
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<th>Location</th>
<th>MANCHESTER, ENGLAND, UNITED KINGDOM</th>
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<tr>
<td>Client</td>
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**CONSTRUCTION AND REFURBISHMENT OF RETAINING STRUCTURES, TUNNELS, VIADUCTS, AND BRIDGES**

| 300+ |

**OPENED 12 MONTHS AHEAD OF SCHEDULE**

**Manchester Airport Line**

**LENGTH OF EXPANSIONS**

| 60km |

**Awards**

- National Transport Awards - Special Award for “Outstanding Performance”
- Light Rail Awards, including Project of the Year for Three Consecutive Years
- Chartered Institute for Highways and Transportation - Major Projects Award
- National Rail Civil Engineering Award for the Extension to Manchester Airport
- British Precast Concrete Award for the Highest Levels of Innovation, Quality and Efficiency in its Tram Stop Platform Construction, 2012

The 5.4km extension to Manchester Airport opened to passengers in November 2014, over a year ahead of schedule. Most notably, we developed an alternative rail junction control solution to bring forward the opening of the South Manchester Line. The original design for the Oldham Town Centre extension did not fit within funding parameters. We developed a solution to construct an at-grade tramway integrated with a fully remodelled highway layout, which has transformed the area to support wider regeneration plans, with significant cost savings.

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The MTA’s Purple Line is a planned 26km, 21-station light rail line in the northern Washington D.C. suburbs, extending from Bethesda to New Carrollton in Maryland. It will provide the first circumferential rail transit line connecting to the existing metrorail system, providing light rail access to key business districts and activity centers, the University of Maryland, four branches of the Washington Metropolitan Area Transit Authority system, and Amtrak’s Northeast Corridor.

The Washington DC Metro system, like most transit systems, is a radial system designed to get passengers into and out of downtown, but as land uses have changed and more jobs are now located in the suburbs, there is now a growing market for suburb-to-suburb travel. The Purple Line will serve that market, and will also provide access to the metro system for the people who live in the ‘wedges’ between the Metro lines.

The Purple Line is expected to provide significant travel time savings. In one segment of the corridor, a bus trip that would take 40 minutes during peak traffic hours would only take an estimated 9 minutes on the Purple Line.

WSP is part of Maryland Transit Partners, a joint venture serving as the program management consultant. WSP provided numerous services and guidance during the critical procurement and financing stages to secure federal funding for the project. Construction began in August 2017.

Awards
- Federal Transit Administration - Outstanding Achievement Award, 2015
- Maryland Quality Initiative Planning Award, 2014

Maryland
Purple Line

Location
MARYLAND, UNITED STATES

Client
MARYLAND TRANSIT ADMINISTRATION (MTA)

Status
UNDER CONSTRUCTION

LENGTH OF LINE
26km

COMMUTE TIME SAVED
31 Minutes

STATIONS
21

Awards
- Federal Transit Administration - Outstanding Achievement Award, 2015
- Maryland Quality Initiative Planning Award, 2014
Streetcars have been an integral part of New Orleans' public transportation network since the first half of the 19th century. The St. Charles Avenue Streetcar, in operation since 1835, is the oldest continuously operating street railway system in the world. Over a period of three decades, WSP has contributed to the New Orleans Regional Transit Authority’s (RTA) expansion and revitalization of several of the city’s streetcar lines.

WSP served as construction manager to the RTA for the extension of the Loyola Avenue Line from Canal Street to the Union Passenger Terminal, through the city’s central business district, and for the re-establishment of the Rampart Street/St. Claude Avenue Line from Canal Street to Elysian Fields Avenue. The firm provided construction management and support staff throughout the construction and close-out phases, as well as monitoring and controlling the schedule and budget.

The 2.6km extension of the Loyola Avenue Line was completed in 2013, in time for the Super Bowl. The project included eight state-of-the-art, solar-powered transit shelters, relocation and replacement of numerous underground utilities, as well as road paving and striping and landscaping.

Work on the 2.1km Rampart Street/St. Claude Avenue Extension began in January of 2015, with completion and startup of service in 2016. WSP assisted the RTA with oversight and constructability reviews during the final design, and assistance with coordination of utility relocation agreements.

As part of a joint venture, WSP served as general architecture and engineering consultant for the revitalization of the Canal Street line, which links downtown with mid-city residential and commercial neighbourhoods, as well as important tourist destinations and the central business district. WSP provided a variety of services, including engineering oversight, transit operations analysis, environmental review, rail systems engineering and rail systems support during construction. Streetcar service returned to Canal Street in 2004, 40 years after it had been shut down.
Passenger service on the Newark Light Rail Extension began on July 17, 2006. It connects the downtown district, providing service between two of Newark’s busiest intermodal facilities—Penn Station and Broad Street Station.

The project included five new aboveground stops, and provided easier access to NJ TRANSIT’s city subway, commuter rail and bus networks, Amtrak, Greyhound, and Newark Liberty International Airport.

From Penn Station, Newark, the city’s main rail hub, light rail vehicles travel north to Broad Street Station in less than 10 minutes, stopping at Center Street near the New Jersey Performing Arts Center, Atlantic Street’s growing commercial district, and Riverfront Baseball Stadium. Then, returning southbound, the stops include Washington Park’s cultural institutions, and again Center Street. The 27.4m low-floor vehicles, the same vehicles used for the Hudson-Bergen Light Rail and the Newark City Subway, can seat up to 70 riders. They are powered by 750 volts from the overhead catenary system and operate at speeds up to 40km per hour.

WSP, in joint venture, supported NJ TRANSIT’s efforts on this project with design, engineering, and construction assistance services. WSP’s services were provided under four contracts: advance underground utility relocations; an underground tunnel structure; all at-grade components (civil, stations, and systems work); and the tunnel emergency ventilation system.
Newcastle
Light Rail System

Transport for NSW was tasked with implementing two core elements of the transport improvements: truncation of the heavy rail branch line, and introduction of a light rail system. The light rail development was split into two stages: (1) replacing the heavy rail service and (2) providing access to and connectivity within the central business district.

One of the main objectives of this initiative was to provide a less intrusive transport mode, allowing greater permeability. The light rail network will travel east from a new Wickham transport interchange and terminate at Pacific Park.

We were engaged as lead designer – performing all aspects of the feasibility and definition design. Our role included the geometric design of the light rail alignment, investigation into impacts on public utilities, assessment and appropriate response to traffic network impacts, assessment of the appropriate size of the light rail vehicle, consideration of social, environmental and heritage impacts, stakeholder consultation support, detailed cost estimates production, and road safety evaluation. We also managed sub-consultants for the operations modelling, a variety of surveys, and cost estimations, while taking into consideration community concern about the potential reduction of on-street parking.

Location
NEWCASTLE, NEW SOUTH WALES, AUSTRALIA

Client
TRANSPORT FOR NSW

Status
UNDER CONSTRUCTION

Odense
Tramway

Odense Light Rail is one of the first light rail projects in Denmark and is funded through a partnership of the national government, region, and local municipality. The project includes the construction of a new 14.3km bi-directional light rail line served by a new control and maintenance centre. The line will connect the centre of Odense and the multimodal transport hub to the new super hospital and the city’s ever-growing university campus. It supports the wider city vision of stimulating inward investment and ongoing efforts of urban densification.

WSP has been providing client consultancy services to Odense Municipality since the feasibility stage. We have also supported the project in securing EIA approval in May 2014 and, more recently, in the successful tendering and award of the key delivery contracts in June 2017. Utility diversions are largely complete, and changes to the road layouts are ongoing. The project remains on track to be completed in late 2020.

WSP’s professional services have covered a wide range of disciplines, including strategic advisory, project management, support in development of tender material for Transportation System (TS) and Rolling Stock (RS) contracts, and subsequent management of the tendering process. WSP has most recently been engaged to support the client in the delivery phase by undertaking design assurance of the TS & RS contractors’ deliveries and by continuing to offer the client further ad hoc support in all aspects of project delivery.

Location
ODENSE, DENMARK

Client
ODENSE KOMMUNE DENMARK

Status
UNDER CONSTRUCTION

42 43
Ottawa’s Light Rail Transit is the first stage in Canada’s capital city future rail network. The 12.5km electric light rail system replaces existing diesel powered buses, providing rapid transit between Blair Station in the east and Tunney’s Pasture in the west. The route includes 13 stations and a 2.5km tunnel that will alleviate congestion through the downtown core.

For Phase I, WSP was retained by the City of Ottawa to develop a business case and multiple account evaluation, provide program management services and assist in the selection of a partner for a public-private partnership (PPP) to deliver a light rail transit system to serve the city’s core north-south corridor. The team’s specific assignments included project management, analysis and recommendation of PPP delivery models, financial and economic viability and value for money analysis, advice on procurement strategies and development of procurement tools, RFI and RFP preparation and evaluation of submissions, recommendation of the preferred proponent and drafting of reports and recommendations.

For Phase II, the City of Ottawa engaged our team to develop a business case for the extension of the City’s LRT system to the south, east, and west, as well as providing a connection to the airport. This economic and financial business case was developed to quantify and evaluate the benefits of the PPP project and to provide a basis from which to pursue funding from the government. In 2015, the Ottawa City Council unanimously approved the project, and both provincial and federal governments have given funding commitments.

This project represents one of the many projects that combine our engineering and planning expertise with the economic and financial capabilities of the Global Strategic Consulting team. It represents one of our many engagements working with the City of Ottawa on the various iterations of LRT development since the early 2000s.

Ottawa Confederation Line

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Perth’s population is expected to reach 2.7 million by 2031, with public transport patronage predicted to double. A fast, efficient inner city transit system is required to ease traffic congestion and meet public transport demands. Studies have shown that light rail could carry as many passengers as currently used on the heavy rail lines – up to about 35,000 people per day.

The Department of Transport (DOT) was tasked with delivering Metro Area Express (MAX), Perth’s first light rail network. The zoned alignment extends from Mirrabooka in the north through the Perth CBD before splitting into two branches – west to the QEII Medical Centre, and east to the Causeway.

WSP was the lead designer for the concept design of the city centre portion of the project. Our role included the geometric design of the light rail alignment, including stops/stations; investigation into impacts on public utilities; assessment and appropriate response to traffic network impacts; structural assessments and design for bridges and retaining walls; consideration of social, environmental and heritage impacts; stakeholder consultation; detailed cost estimates; and road safety auditing.

We later formed an integrated services team with the DOT, in joint venture, to deliver the next stages of the project. The team was tasked with production of a business case as well as the documentation for the procurement of a design, construct, and operate contractor.

Providing a safe, fast, and reliable service while maintaining access to the existing properties along the alignment was a considerable challenge. Our design solution minimized the length of alignment where general traffic would share the trackway and limited turning movements across the alignment.

Expected passengers per day: 35,000
Length of line: 22km
Population by 2031: 2.7 Million
Valley Metro Rail is building the largest at-grade, in-street light rail system in the United States. Deciding to forego a phased approach, the mandate is to build all three segments of the city’s 91.7km LRT system at once.

WSP served as general engineering consultant for the final design and design support services during construction of the initial 32km segment, which included 28 stations, 8 park-and-ride locations, and 50 light rail vehicles. Trains replaced bus routes along the Metro alignment, freeing buses to travel expanded and new routes in the Valley. The system has the capacity to carry up to 12,000 people per hour, the equivalent of a six-lane freeway. The system opened in December of 2008 with 26,000 daily boardings in the first year.

Valley Metro Rail’s 5km Central Mesa Extension, which includes four new stations along Main Street, opened in August 2015, seven months early, bringing rail transit to the city’s downtown. The opening of the Northwest Extension followed in June 2016.

WSP continues its relationship with Valley Metro with a 3.2km extension to the Central Mesa Extension that is targeted for completion in 2018, while a second phase of the Northwest Extension has been targeted for a 2023 opening. This extension will connect the Dunlap Avenue station to points farther north along a 2.4km corridor that will lead to the Metrocenter Mall in Phoenix.

### Phoenix Valley Metro Rail

**Location**: PHOENIX, ARIZONA, UNITED STATES  
**Client**: VALLEY METRO RAIL  
**Status**: ONGOING  
**Projected Final Length**: 92km  
**Passenger Capacity Per Hour**: 12,000  
**Savings from Streamlining**: $2 Million
In the early 1980s, WSP, in joint venture, prepared an alternatives analysis and a draft environmental impact statement that examined options for light rail and expanded bus service for the Portland metropolitan area. The Tri-County Metropolitan Transportation District of Oregon (TriMet) opted to build one of the first modern light rail systems in the United States, known as MAX (Metropolitan Area Express). The first segment, known as the Banfield or Eastside line, extends from downtown Portland 24km east to Gresham and was completed in 1986. WSP, in joint venture, prepared the preliminary design for that line, now part of the MAX Blue line.

In 1992, the firm began detailed design for a 29km western extension of the MAX light rail, from downtown Portland to the western suburb of Hillsboro. Beginning in 1993, the firm also performed construction management of the line. Most of the western extension is at grade, except for a 4.8km tunnel through the region’s West Hills. The West Hills extension included one station, at Washington Park, designed by WSP and its architectural subconsultant ZUG. At 79m below ground, it is the deepest transit station in North America. The 29km Westside MAX opened, on schedule and within budget, in September 1998, offering a 51-minute ride from downtown Portland to Hillsboro. The Westside line connected with the existing Eastside line in downtown Portland, creating a 53km line now known as the MAX Blue Line.

Two years after the opening of the Westside line, WSP, as general engineering consultant to TriMet, began design of the Interstate MAX extension, now known as the Yellow Line, which runs from the Rose Garden Transit Center 10km north along Interstate Avenue to the Portland Exposition Center. Interstate Max opened four months early, in May 2004, and well under budget.

Portland
Interstate MAX

Location: PORTLAND, OREGON, UNITED STATES
Client: TRI-COUNTY METROPOLITAN TRANSPORTATION DISTRICT
Status: OPENED IN 2004

Length of West Hills Tunnel
4.8km

Deepest Transit Station in North America
Washington Park Station

Weekday Ridership
+95%

Awards
- American Consulting Engineers Council - Grand Award, 1999
- Consulting Engineers Council of Oregon - Grand Award, 1999
Phase I of the South Corridor Project extended the Sacramento Regional Transit District’s light rail system 10.1 km connecting to the existing light rail system between the 16th Street and 24th Street Stations and continuing south through the Union Pacific Railroad right-of-way to its terminus at the Meadowview Road crossing. The entire alignment is at grade and includes 15 grade crossings of existing city streets. The Phase I South Corridor extension includes eight stations spaced approximately 1.6 km apart. The three southernmost stations have park-and-ride lots.

WSP provided final design services for the South Line’s civil, track, and structures, and traction electrification system contracts.

The project required right-of-way acquisition, utility relocations, freight track relocation, design and construction of track, drainage, park-and-ride lots, stations, signalling, and traction power facilities, as well as procurement of vehicles, track materials, traction power substations, and other operating equipment.

A minimum clearance of 6.1 m was maintained between the centerlines of the LRT and Union Pacific tracks. All the grade crossings were constructed with prefabricated concrete crossing panels and were protected by standard railroad signals equipped with lights, bells, and gates. Sound walls and visual screening were provided in selected sections where the line passed near residential areas. All the stations have low platforms that allow for wheelchair access.

The Phase I extension serves a diverse cultural, ethnic, and economic population. It provides South Sacramento with a fast, efficient route to major destinations, such as Sacramento City College, Luther Burbank High School, and the Campbell Soup Company.
WSP served as program manager for all three Transit Express (TRAX) lines, acting as an extension of UTA’s staff from initial planning through final design and construction support. The Transit Express is a double-tracked light rail system and includes 23 stations, 12 park-and-ride lots, and 20 traction power substations. The system is unique because it is one of the few in the United States that has time-separated operation of light rail and freight trains on the same track.

The initial 24km North-South line was designed to relieve congestion in Salt Lake City’s heavily travelled I-15/State Street Corridor. WSP’s role included community relations, budget and schedule control, quality assurance, design management, procurement, construction oversight, and testing. The North-South line opened in December 1999, one year ahead of schedule and approximately $20 million under budget.

The four-station, 5.7km University line opened in December 2001, $4 million under budget, 11 months ahead of schedule, and in time for the 2002 Winter Olympics. WSP provided design-build engineering management services. In contrast to the North/South line, which mostly used existing railroad right-of-way, the University Line required extensive and costly street work.

The 2.4km, three-station Medical Center Extension opened in September 2003, $8 million under budget and nine months ahead of schedule. This new TRAX extension was built to provide immediate relief for the sprawling medical complex, which employs more than 14,000 workers and handles thousands more patients. The roundabout on the Medical Center Extension is cited by UTA officials as the only one in the country with trains running through it.

Location
SALT LAKE CITY, UTAH, UNITED STATES
Client
UTAH TRANSIT AUTHORITY (UTA)
Status
OPENED IN 2003

San Diego
Green Line Extension

WSP, in joint venture, provided management and design services for the Mission Valley East extension of San Diego’s light rail transit system. The extension of the San Diego Trolley’s Green Line opened in 2005 and included the Trolley’s first underground station, at San Diego State University. The extension of the Green Line Trolley was considered critical to San Diego State University’s plan to attract more students and to draw young people who may have never patronized public transit. Most importantly, the extension represented a further effort to provide mobility alternatives for San Diegans—toward using high-quality public transit to reshape the patterns of urban development for the region.

Location
SAN DIEGO, CALIFORNIA, UNITED STATES
Client
SAN DIEGO METROPOLITAN TRANSIT SYSTEM
Status
OPENED IN 2005

The four-station, 5.7km University line opened in December 2001, $4 million under budget, 11 months ahead of schedule, and in time for the 2002 Winter Olympics. WSP provided design-build engineering management services. In contrast to the North/South line, which mostly used existing railroad right-of-way, the University Line required extensive and costly street work.

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The Mid-Coast Corridor Transit Project will extend trolley service from downtown San Diego to University City, a major employment and residential center and home to the University of California, San Diego. The project includes a 17.7km double-track alignment from an existing transit center in Old Town to University City. The extension includes nine stations—four at grade and five aerial—as well as five park-and-ride facilities providing a combined 1,170 parking spaces.

WSP is the lead engineering and environmental consultant to the San Diego Association of Governments (SANDAG) and the San Diego Metropolitan Transit System on the project. The firm is also the designer of record, responsible for advancing the project from conceptual engineering through final design, including track and systems design and operations analysis, station design, traffic engineering, civil and utilities design, and structures design.

WSP was also responsible for preparing the National Environmental Policy Act and California Environmental Quality Act documents required for environmental approval of the project. This included preparation of the alternatives analysis, draft and final supplemental environmental impact statement/subsequent environmental impact report (SEIS/SEIR), and the SEIR/Supplement to the SEIR for impacts to the federally endangered San Diego fairy shrimp.

WSP also coordinated preparation of the resource agency permits and provided land-use, cost-estimating, financial and travel-forecasting services, and preparation of materials in support of the preliminary engineering and engineering applications.

For the first phase of the San Diego Trolley expansion program, WSP was retained to provide construction management services. The 5.1km Old Town segment will be the first operational link of the North Line providing regularly scheduled service from Centre City to the historic Old Town district. Construction on the Old Town project was performed in four phases to accommodate the addition of LRT service along this alignment.

During the first phase of construction, utilities along the alignment were relocated and the grade was prepared for the addition of the doubletrack LRT line adjacent to the existing doubletrack AT&SF line. Costs were reduced by completing work before performing the seismic improvements rather than waiting to perform the seismic improvements after the LRT service was operational. The seismic upgrading of these structures involved steel encasement of concrete columns, additional pilings, and the expansion of bridge footings. Signals along the alignment were upgraded to accommodate commuter rail usage. Traction power substations were installed along the line to supply electricity to the overhead catenaries that provide the power required to operate the LRT vehicles. System testing was included in the final phase of the construction contract for the Old Town project. Final acceptance and project closeout following successful completion of these tests concluded WSP’s efforts on the Old Town Extension.
In September 2009, the purchase of 57 new low-floor light rail vehicles was approved as the first step in the rehabilitation of the Blue and Orange lines. WSP was retained by the San Diego Association of Governments (SANDAG) on behalf of the Metropolitan Transit System (MTS) to assess the infrastructure of the Blue and Orange lines, prepare a phasing plan for the improvements, and validate the MTS’s finance plan.

Before the new cars could be put to use, the Blue and Orange lines required rehabilitation to raise station platforms eight inches above the top of the rail, to accommodate the bridge plate/ramp of the low-floor vehicles and meet ADA requirements. Additionally, the MTS had embarked on a major rehabilitation program for the Blue Line corridor to replace old rail and overhead electrical contact wire, and to improve grade crossings, track, switching, signalling, and freight operations.

WSP was responsible for the infrastructure conditions assessment, the phasing plan, and the validation of the MTS’s finance plan. Under a separate contract with SANDAG, we provided program management services for implementing the low-floor and the track rehabilitation program, and for ongoing operational analysis and simulation modelling.

The rehabilitation and improvement of the Blue and Orange lines are extensive and include track, signals, overhead contact systems, substations, grade crossings, and station elements. WSP used a proven computational dynamic network simulation model—the Rail Traffic Controller model—to confirm the effectiveness of both short-term (during construction) and long-term operating strategies and configurations.

San Diego Orange and Blue Lines Rehabilitation

Location
SAN DIEGO, CALIFORNIA, UNITED STATES

Owner
SAN DIEGO METROPOLITAN TRANSIT SYSTEM

Client
SAN DIEGO ASSOCIATION OF GOVERNMENTS

Status
COMPLETED IN 2015

LOW-FLOOR LIGHT RAIL VEHICLES
57

TRAINS OPERATING PER HOUR IN EACH DIRECTION
12

PEAK BLUE LINE HEADWAY
7.5 Minutes

San Diego Light Rail

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During the first half of last century, streetcars travelled up and down Three Street, shuttling riders between downtown and points along the Bayshore Corridor. Now, decades later, the Third Street Light Rail Project has re-established rail service along this corridor. The project has been structured to improve service reliability and travel times, enhance transit connections, and help generate economic opportunities and jobs for local residents and business owners.

Phase I extended the Muni Metro light rail service. In 2007, the T Third Street opened, running to the southern border of the city from the Caltrain depot station. It runs through some of San Francisco’s most economically depressed areas, and will likely bring a much needed boost to the prospects of those neighbourhoods.

Phase II will extend light rail service north. When the Central Subway opens to the public in 2019, it will vastly improve transit options for residents of one of the most densely populated neighbourhoods in the country.

After completing preliminary engineering in 2009, WSP took the lead of two other joint ventures for the final design of the tunnels and stations. The first joint venture is responsible for utilities relocation and design, as well as design support during construction of the twin tunnels, the tunnel boring machine (TBM) launch and retrieval shafts, five cross passages, settlement monitoring and instrumentation, portal construction, and mitigation measures for controlling tunnelling-related settlement. The second joint venture currently led by WSP is responsible for the final design and design support during construction of the three underground stations: the Yerba Buena/Moscone Station, the Union Square/Market Street Station, and the Chinatown Station.
WSP led the general design consultant joint venture responsible for design and construction support services for the Tasman West Light Rail Transit project and has provided services to the Santa Clara Valley Transportation Authority (VTA) since the project’s inception in 1991. The project extended the Guadalupe Corridor LRT system by 12km. The system serves the cities of San Jose, Santa Clara, Sunnyvale, and Mountain View, with 12 stations. Stations were located along the alignment so that major employers in the area, as well as retail centers and entertainment facilities, are only a short walk or shuttle bus trip from the nearest station. Convenient connections are available to bus services, commuter rail, and Amtrak service. This cooperative effort between the VTA and the cities of San Jose, Santa Clara, Sunnyvale, and Mountain View, working in partnership with the Federal Transit Administration, Metropolitan Transportation Commission, and California Department of Transportation, has provided residents with convenient light rail service and has helped to reduce demand on the valley’s congested roadways.

Despite delays caused by extremely harsh weather conditions, Tasman West opened for revenue service one year ahead of schedule and within budget.

San Jose Tasman West Light Rail

Location SANTA CLARA COUNTY, CALIFORNIA, UNITED STATES
Client SANTA CLARA VALLEY TRANSPORTATION AUTHORITY
Status OPENED IN 1999

NEW STATIONS 12
OPENED AHEAD OF SCHEDULE 1 Year
LRT EXTENSION 12km

Awards
- California Transportation Foundation—Tranny Award for Project of the Year in the State of California, 2000
- American Public Works Association—Public Works Project of the Year Award, 2000
Seattle Sound Transit Light Rail

The Central Puget Sound Regional Transit Authority (Sound Transit) was created to implement a Ten-Year Regional Transit System Plan to create three new high-capacity transit systems. Puget Sound Transit Consultants, a three-firm joint venture led by WSP, was selected by Sound Transit in 1997 as the principal civil facilities preliminary engineering designer for theplainlight rail component.

WSP’s role on the project included work on four segments: (1) the initial segment, which was planned to incorporate the existing 2.1 km downtown Seattle transit tunnel, and extends the line approximately 23 km south of downtown Seattle to an interim terminus station at South 154th Street in Tukwila; (2) the Airport Link, which extends the line 2.7 km to a terminus station at the Sea-Tac Airport; (3) the North Link, which includes the University Link subsection that extends the line 5.1 km from downtown northward to the University of Washington campus and that continues approximately 6.4 km beyond the University station to a terminus station at Northgate mall; and (4) the Tacoma Link, a separate 2.6 km line constructed in downtown Tacoma.

WSP has supported the light rail alignment alternatives selection process and the environmental impact assessment, prepared conceptual designs, and performed preliminary engineering for the civil facilities on the tunnel, aerial guideway, and at-grade alignments.

As the segment designs have been completed in stages, WSP has continued to support Sound Transit by managing section designers for the multiple final design contracts and providing design services during construction.
Stockholm’s strong growth has put pressure on its transport system. Public transit is land-efficient but must be attractive and competitive to respond to the increasing needs of passengers. To support an enhanced labour market, it is also necessary to provide commuters with an efficient trip to and from regional centers. Public transport also plays an important role as a catalyst for land development, providing homes for new residents in the region.

Tramway South improves travel possibilities to and within southern Stockholm. The tramway shortens the distance between the regional urban centers, Flemingsberg and Kungsängen in Skärholmen, and towards Fruängen and Älvsjö. The tramway has its own track system, with a complete depot for vehicle maintenance. The two-phase track route expansion involved first building a tramway between Flemingsberg and Center of Skärholmen, and then extending the track route to the Centre of Älvsjö.

WSP studied four depot locations along the planned track route and carried out cost estimation for the depot alternatives. We estimated vehicle costs in order to identify future functional and technical requirements. We also investigated the future of the tramway considering the city of Stockholm’s strategies and development.

WSP also performed passenger forecasts and economic calculations of alternative tramway stretches and altered bus services. We made a summary of how infrastructure affects growth, the structuring characteristics of traffic systems, and the social effects of transport investments.
The tram network in Stockholm is undergoing a major expansion. Tramway City is expected to carry 63,000 passengers per day by 2030 and will supply the new Royal Seaport district with efficient and environmentally friendly public transport. It will provide a climate-smart, high-capacity connection between the suburb of Lidingo, Stockholm Royal Seaport, and Stockholm city centre. The tramway will also be extended to Sergel Square/Central Station, reaching the central hub of Stockholm’s public transport. Changing between commuter train, subway, bus, and tram lines will be easy and efficient once the extension is completed.

WSP has provided preliminary and detailed design for the line. Services include permanent way, road design, landscape architecture, geotechnics, rock engineering, land development, surveying and mapping, cable ducting, acoustics, traffic, water and sewerage, environmental impact assessment, risk and safety, 3D model, cost estimates, and project management.

The Tramway City project includes three elements: the modernization of Lidingo line, the construction of a new tram depot, and the expansion of the existing line 7 in two directions. The entire Tramway City will cover 15.9 km and include 30 stops. A depot with space for 30 trams is being built in Lidingo.

One of the major challenges was to find solutions to build the new tracks in the existing environment with ongoing traffic and laying the new tracks without disturbing local retail activity. Another challenge has been communication with the public and with information services to brief local residents on construction plans. The Tramway City project has a strong focus on sustainability and will be certified by CEEQUAL, which assesses the sustainability of infrastructure projects.

We mobilized a multidisciplinary team of experienced engineers, architects, urban planners, traffic and construction planners, cost managers, and environmentalists, who established a clear strategy to reduce the risk profile and develop and clarify the delivery program. Relying on high competence, extensive resources, committed staff, and very good relations with the client, the project has been extremely fruitful.
The Central Business District and South East Light Rail Project comprises the construction and operation of a new light rail service in Sydney, including approximately 12km of new tracks, 20 stops, and the maintenance and stabling facilities. The proposal also includes the transformation of 40 percent of George Street, through the development of a pedestrian zone between Hunter and Bathurst streets.

During Stage I, WSP provided strategic planning approvals advice to Transport for NSW (TfNSW) to determine the likely approvals pathway for the project. We also provided environmental and planning input into the development of the definition design, which involved coordinating an options assessment process for various project elements.

During Stage II, WSP prepared the Supporting Documentation for the SSI Application, followed by a large and complex Environmental Impact Statement (EIS), as well as the Submissions Report, which includes a Preferred Infrastructure Report. During the process we managed a number of specialist subconsultants for heritage, visual impact, social impact, economic impact, and planted trees. Specialist assessments for traffic, transport and access, and noise and vibration and other environmental issues were also incorporated into the EIS.

WSP maintained a close and collaborative relationship with the TfNSW project team throughout the project to ensure the project deliverables were delivered within budget and on time, within a compressed program.

The NSW Government wanted to extend the light rail service from its previous terminus at Central Station north through the Central Business District. Stage I of the Sydney Light Rail Extension involved the construction and operation of a 5.6km extension of the current Sydney Light Rail, including nine new light rail stops, from the current terminus at Lilyfield along the disused freight rail corridor to Dulwich Hill Train Station. The project also includes the GreenWay – a shared walking and cycling path with bushcare sites – from Iron Cove to the Cooks River.

WSP worked in collaboration with the NSW Department of Transport to undertake the planning approvals for the project. WSP was also tasked with preparing the environmental assessment, implementing a community and stakeholder involvement plan, a constructability report to provide an indicative plan and method for the feasible construction for the project, and a commuter parking strategy.

The project team worked closely with the NSW Department of Transport to deliver the environmental assessment report within the client’s ambitious project program, with a draft report completed within eight weeks of the project’s commencement.

The comprehensive consultation process provided an opportunity for the community to give feedback during the process so that all disparate needs and views were considered to achieve the most appropriate design, and to develop ongoing management measures.
Location
SYDNEY, NEW SOUTH WALES, AUSTRALIA
Client
TRANSPORT FOR NSW
Status
UNDER CONSTRUCTION

© Image courtesy of Transport for NSW

Sydney
Parramatta
Light Rail

Length of Light Rail
20km
Growing Population
+4.5 Million
Planned Opening
2023

Parramatta is Sydney’s second Central Business District, supporting a growing population of 4.5 million and counting. Local transport in the area is a major issue, with significant congestion from private car use, as well as an existing public transport network featuring indirect routes and long travel times for commuters who currently use buses and trains.

Transport for NSW was looking for an option for a truly integrated public transport network for Western Sydney, one that could act as a catalyst for urban renewal in the region and improve the sustainable transport outcomes for the Greater Parramatta to Olympic Peninsula Growth Corridor.

Our initial focus was on transport planning to identify growth potential of corridors and centres for jobs and housing, as well as opportunities for improved access to land uses such as health, education, recreation, and social housing. We then applied an engineering overlay to the project to determine its feasibility at an early stage, including consulting light rail delivery experts at the beginning of the planning process in order to maintain a focus on end-state operational requirements.

When complete, the light rail will provide around 20km of new public transport, supporting identified growth precincts and creating a sustainable future for Western Sydney. It will also create new transport links between key centres within the Greater Parramatta region.
Toronto Agincourt Grade Separation, Sheppard East

WSP was part of the program management team responsible for delivering the Agincourt Grade Separation project, which is part of a 25-year, $50 billion plan to transform regional transportation.

As part of this team, WSP took the lead role in managing the design consultant, coordinating the permits process, utility relocation design and construction, and managing the construction contract for the Agincourt grade separation project. This project will provide a dedicated right-of-way for the future Sheppard East LRT line by grade separating Sheppard Avenue east from GO’s Uxbridge subdivision railway corridor.

WSP collaborated with the City of Toronto rights-of-way management team for the development of engineering requirements for the core system contract and viaduct/depot, and associated infrastructure works with the Department of Rapid Transit Systems, coordination with E&M, civil and core system subcontractors, coordination for design interfaces, quality assurance, change control, schedule management, and integration of the CSD/SEM drawings.

WSP also completed the design and construction of the railway bridge, including temporary shoring for bridge construction, installation of rail and road diversions, as well as reinstatement of permanent tracks, signals, and management of the railway flagging needs. Additionally, the existing GO Agincourt station platform was lengthened to meet operating criteria for 12-car operations, and the addition of parking spaces and platform shelters. This project required significant utilities relocation work. Successful implementation of risk management protocols led to better outcomes for all stakeholders, including schedule and cost savings for the contractor, and reduced risk for third-party utility owners.

Taipei Metro, Neihu Line

The Taipei Metro Neihu Line is a Phase II Brown Line extension that was opened for revenue service in 2009. The line is a medium-capacity system, where most of it is on an elevated corridor with several tunnel sections that connect directly to the Muzha Line, providing transfer to Neihu, Nangang, and Muzha.

The extension is a 14.8km, 12-station extension to the existing Muzha Line. It is a fully automated and driverless system, with one depot utilizing Fully Automatic Operation.

WSP was commissioned by the Core System Contractor – Bombardier – to provide interface and project management support. WSP’s key responsibilities included interface of engineering requirements for the core system contract with the viaduct/depot, and associated infrastructure works with the Department of Rapid Transit Systems, coordination with E&M, civil and core system subcontractors, coordination for design interfaces, quality assurance, change control, schedule management, and integration of the CSD/SEM drawings.

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Location
TORONTO, ONTARIO, CANADA
Client
TORONTO TRANSIT COMMISSION
Status
COMPLETED IN 2012

Location
TAIPEI, TAIWAN
Client
BOMBARDIER
Status
OPENED IN 2009
The Eglinton Crosstown is a 19km rapid transit line that will run through the heart of Toronto. Following along Eglinton Avenue, the transit line will run west to east, from Weston Road to Kennedy Station. A 10km section of the line will be tunnelled underground between Keele Street and Brencliff Drive.

There are 15 underground stations and 10 at-grade stops. Three of the underground stations provide transfer points to the existing TTC subway system and adjacent bus terminals. The project also involves connection and coordination with three GO Rail stations at Mount Dennis, Caledonia, and Kennedy. A maintenance and storage facility is also part of the project.

WSP, as part of a joint venture with Hatch and Parsons, is providing project management and technical advisor services, from project initiation through to project completion. The joint venture is responsible for project management activities, including: deployment and integration of project staff with current Metrolinx staff; management of scope, design and schedule; risk assessment and mitigation; quality assurance and control programs; communications and management reporting; identifying project and contract strategies; preparation of program terms and reference; coordination, monitoring and collaboration; progression of consulting and construction requirements; provision of staffing requirements; preparing program presentations agreements; project delivery strategy; and contract preparation.

WSP, with its joint venture partners, has undertaken the direction and interface management of other consultants, such as geotechnical, surveyors, and measurement instrumentation consultants.

WSP, with its joint venture partners, has also provided third-party approvals and utilities staff for the project. One of the key issues with respect to utilities has been the ability of staff to work with Toronto Hydro and secure “Offers to Connect” for high-voltage supply in advance of construction, to enable an accelerated approval process once a consortium is chosen.

WSP, with its joint venture partners, was instrumental in leading the application of new and amended road cuts, occupation permits, and approval to support construction, as well as overseeing the traffic management plans developed for the station construction.
WSP is a member of a joint venture consortium, Spadina Link Project Managers, which has been awarded the project management services contract for the Toronto-York Spadina Subway Extension (TYSSE) by the Toronto Transit Commission (TTC). The infrastructure initiative is sponsored by three levels of government: Government of Canada, Province of Ontario, the City of Toronto, and Region of York. The extension will be the first TTC subway network located outside the Toronto city limits.

The TYSSE will extend the Spadina subway line by 8.6km and add six stations, of which 2.4km and two stations will be entirely within the Region of York. One station straddles the Region of York and City of Toronto boundary, while another will serve York University, with the terminus at the Vaughan Centre. The project commenced in April 2008, and is expected to be completed in nine years. The joint venture team of approximately 200 people (including more than 30 from WSP) is headquartered at TTC’s TYSSE project office. The WSP team serves in many roles on the TYSSE project, including project engineering coordinators, planning and approval coordinators, property coordinators, transportation coordinators, communications/community relations coordinators, and subject matter experts.

### Toronto-York Spadina Subway Extension

<table>
<thead>
<tr>
<th>Location</th>
<th>TORONTO, ONTARIO, CANADA</th>
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<tbody>
<tr>
<td>Client</td>
<td>Toronto Transit Commission</td>
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<tr>
<td>Status</td>
<td>UNDER CONSTRUCTION</td>
</tr>
<tr>
<td>STATIONS</td>
<td>6</td>
</tr>
<tr>
<td>LENGTH OF EXTENSION</td>
<td>8.6km</td>
</tr>
<tr>
<td>MEMBERS OF JOINT VENTURE TEAM</td>
<td>200+</td>
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The City of Turku has had an average annual growth of 1,600 new residents over the past five years. A tramway system is a long-term and comprehensive method to further develop the urban region. The project aims to attract private and public investments along the tramway line, stimulate city growth, and change Turku’s urban look.

WSP’s mandate was to design the complete tramway system and conduct impact studies to create a general plan. Our plan was based on structural model suggestions related to tramway location and land use.

The tramway planned for Turku includes double tracks in both directions, strong transport benefits, and a more inclined geometry than a traditional tramway. The three lines have a total of 32 stops, placed further apart than those of current bus routes. The routes are as straight and short as possible, and trains will run every 7.5 minutes at rush hour. Turku seeks to make the tramway a punctual and competitive transportation alternative to private cars.

By 2035, the tramway is expected to significantly impact the development of land use and urban structure. Almost 20,000 new residents and 11,000 new jobs will relocate near the three-line tramway network. Daily commutes to Turku are projected to increase by 25 percent, from 750,000 to 940,000. However, due to the city centre’s limited traffic capacity, car traffic can grow at the same rate. Daily public transit commutes are expected to increase by 52 percent with the tramway—almost 18,000 more riders per day than current levels.
The Canada Line was one of the highest-profile infrastructure improvements in preparation for the 2010 Olympic Winter Games. Connecting downtown with the Vancouver International Airport (YVR) and the city of Richmond, the light rail rapid transit line is completely isolated from general traffic. Tracks are at grade, below grade, or elevated. The project was completed ahead of schedule, and revenue service started well before the contract requirement of November 30, 2009.

The Canada Line runs on dedicated rails north-south from the transportation hub at Waterfront Centre to the heart of Richmond’s civic precinct then via Sea Island to Vancouver International Airport. With 17 stations, new parking and bus facilities, and countless connections to destinations around the region, Canada Line is an important link in the regional transportation network.

Early in the process, the decision was made to go with a public-private partnership. This was a first PPP delivery project for Vancouver’s rapid transit construction. The challenges were many, as there were four funding partners working in two cities, and three water crossings requiring environmental permits.

For the procurement phase of the project, WSP provided a project manager and technical support personnel. During the implementation phase, our technical team was strengthened to provide construction management and monitoring, along with engineering management. The team’s main focus was managing the concession agreement. In addition, we designed and managed construction projects that fell outside the concession agreement, such as the relocation of the Canadian Pacific Railroad tracks and the downsizing of a large warehouse to make way for the tracks.

There were many positive outcomes and benefits created by everyone working cooperatively. The project went to revenue service three and a half months ahead of schedule, which allowed the operator to gain more experience before the Olympics.
The new Evergreen Line is an 11km extension to the existing SkyTrain system in Metro Vancouver, seamlessly integrating with the Millennium Line at Lougheed Town Centre Station. It provides a fast, frequent, and convenient SkyTrain service, connecting Coquitlam City Centre through Port Moody to Lougheed Town Centre in approximately 15 minutes. It connects without transfer to the current SkyTrain network at Lougheed Town Centre Station and integrates with regional bus and West Coast Express networks.

With its completion in 2016, the Vancouver SkyTrain system became the longest fully grade-separated rapid transit system in Canada.

WSP acted as a member of EGRT Construction, a consortium led by SNC Lavalin to design, build, and finance the Evergreen Line. We were responsible for providing a suite of engineering design and construction site services in support of the line. The line’s alignment requires a combination of elevated and at-grade guideways, as well as a short bored tunnel.

WSP was responsible for the design of seven elevated special guideway structures, and provided the civil and mechanical design for the expansion of the existing Lougheed Town Centre Station, the seismic design for three new stations and associated facilities, as well as landscape and restoration design for the roadway alignment and all seven stations.

WSP was also responsible for the overall traffic management plan, including maintenance of residential and commercial access along the alignment.
The Millennium Line SkyTrain Expansion was an undertaking to increase the capacity of the rapid transit system in the Greater Vancouver Area. The expansion involved the design and construction of a 12-station, 21km line connecting Vancouver with Burnaby and New Westminster to the southeast.

WSP was one of three members of the project management team under the auspices of Rapid Transit Project 2000, a company specially created by the B.C. government. We were primarily in charge of managing the fixed facilities, and provided overall project management. We coordinated work with municipalities, railways, utility companies, and other third parties, and filled key roles in the construction management of the guideways, tunnels, and stations. In addition, WSP was also responsible for producing civil and structural engineering design standards and for overseeing their application during the process of design and construction.

The major challenge faced by the project management team was to transform a 20.4km-long line on a map into revenue service in four years. The project ran through three cities, conflicted with three different railways, and crossed many fish-bearing watercourses. No agreements were in place, and all the land required for the project needed to be acquired.

One of the most critical requirements of the project was that the new line had to be constructed without disruption to traffic flows or neighbourhoods. The solution was to build it within existing corridors, mostly using elevated guideways and tunnels. Over 17km of guideway was built in 16 months using innovative truss-erected, segmental, pre-cast technology procured under a design-build contract.

The project was completed on schedule and $70 million under budget. The opening to revenue service went smoothly, and the operator, British Columbia Rapid Transit Company, is very pleased with the system.
International Agility

42,000 employees
550 offices
40 countries
6.4B 2016 revenues (CAD)

Top International Design Firm

#1
TRANSPORTATION

#1
MASS TRANSIT AND RAIL

Figures at December 31, 2017

Source: ENR Global Sourcebook 2017
Our Urban Passenger Rail Community

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Can we anticipate the unforeseeable, perceive the unexplainable, and plan something unbelievable?

What if we can?