URBAN PASSENGER RAIL

Light Rail Transit

We are WSP

As one of the world's leading professional services firms, WSP exists to future-proof our cities and environment. We provide strategic advisory, engineering, and design services to clients in the transportation, infrastructure, environment, building, energy, water, and mining sectors. Our 66,000 trusted professionals are united by the common purpose of creating positive, long-lasting impacts on the communities we serve through a culture of innovation, integrity, and inclusion. Sustainability and science permeate our work. In 2022, WSP derived more than half of its $11.9 B (CAD) revenues from services that support the UN Sustainable Development Goals. The Corporation's shares are listed on the Toronto Stock Exchange (TSX:WSP).

Designing World-Class *Light Rail Transit Systems*

Our cities are evolving. The primacy of the suburbs 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 invigorate 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.

Table of Contents

*Also see our **Metros** and **Stations** Brochures*

Adelaide
Coast to Coast Line, Stage II

Location
ADELAIDE, SOUTH AUSTRALIA, AUSTRALIA

Client
THIESS-DOWNER EDI JOINT VENTURE

Status
OPENED IN 2010

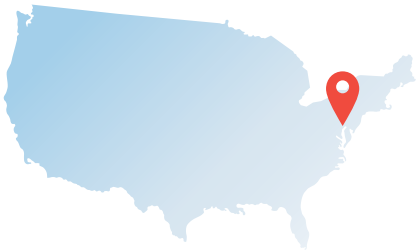
This is the second stage of the South Australia government's long-term strategy to extend the light rail from the city to Semaphore. It involved a 2.8km extension of the light rail facility from North Terrace in the Adelaide Central Business District to the Adelaide Entertainment Centre via a centre-of-road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

Baltimore
Central Line



Location
BALTIMORE, MARYLAND, UNITED STATES

Client
STATE OF MARYLAND MASS TRANSIT ADMINISTRATION (MTA) + STATE OF MARYLAND

Status
OPENED IN 2006

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.

Calgary
West Expansion

The West Light Rapid Transit Extension Project consists of an 8.2km addition to the Calgary LRT system between 11th 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.

Location
CALGARY, ALBERTA, CANADA

Client
SNC LAVALIN

Status
OPENED IN 2012

Canberra
Capital Metro

Location
CANBERRA, AUSTRALIAN CAPITAL TERRITORY, AUSTRALIA

Client
CAPITAL METRO AGENCY

Status
ONGOING

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.

Cincinnati
Bell Connector

Location
CINCINNATI, OHIO, UNITED STATES

Client
CITY OF CINCINNATI

Status
OPENED IN 2016

AVERAGE RIDERS PER DAY
3,200

LOOP STREETCAR SYSTEM
5.8 km

RAISED STATIONS
18

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 1 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 2, WSP is developing alignments and routes for connectors and additional uptown loops.

In Phase 1, 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. Additional services included identifying public and private sector financial strategies to finance the balance of the system, including Tax Increment Financing. WSP delivered final plans in November 2011 and later provided construction support services from 2013 to 2016.

WSP provided design services and managed the work of other engineering and architectural firms to complete the two-story, 12,460 square-foot maintenance and operations facility's architectural, mechanical, electrical, plumbing, and structural design. Specialty design services provided by WSP included traction power, overhead catenary system, corrosion control, and signals/communication. The maintenance facility was designed to LEED certified standards, including bioswales which are located at the majority of the station stops. The project will improve quality of life and propagate community growth and development by improving infrastructure, linking transportation systems, and connecting many of Cincinnati's cultural and recreational assets.

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.

Greater Copenhagen *Light Rail*

Location
COPENHAGEN, DENMARK

Client
HOVEDSTADENS LETBANE

Status
ONGOING

STATIONS
29

MUNICIPALITIES
8

LENGTH OF LINE
28 km

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 28 km 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. Following the award of the various (design and build) contracts for the project, WSP has supported the management of the contractors through the production of their preliminary and detailed designs, including oversight of the complex interface and safety approval processes.

The project remains ongoing, and WSP is continuing to assist Hovestadens Letbane through the utility relocations and the main construction phase.


LEDBETTER
132

Dallas
DART Blue Line

Location
DALLAS COUNTY, TEXAS, UNITED STATES

Client
DALLAS AREA RAPID TRANSIT

Status
COMPLETED IN 2012

LENGTH
7.7 km

BRIDGES
6

PARK & RIDE SPACES
+750

The Dallas-Fort Worth (DFW) region is growing at a tremendous pace, placing significant demands on the transportation system. In its report on Mobility 2025 – Metropolitan Transportation Plan, Amended April 2005, the North Central Texas Council of Governments (NCTCOG) projected population in the DFW metropolitan area to grow by approximately 75 percent between 1999 and 2025, with employment increasing during that same period by about 84 percent. A significant portion of this growth is expected to occur in northeastern Dallas County. NCTCOG anticipates that between 2000 and 2025 the city of Garland will grow to 241,283 residents a 12-percent increase while the city of Rowlett will grow by 63 percent to 72,350. In support of this growth, the Dallas Area Rapid Transit (DART) Authority broke ground on April 9, 2009 on the 7.7-km extension of the DART Blue Line from Garland to Rowlett. The extension is being procured via a design-build contract and WSP is the lead designer to the design-build contractor.

Edinburgh *Tram*

Location
EDINBURGH, SCOTLAND, UNITED KINGDOM

Client
TRANSPORT INITIATIVES EDINBURGH

Status
OPENED IN 2011

LENGTH OF LINE
14 km

STATIONS
16

TRAM FREQUENCY
7-10 Minutes

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 roadway 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. WSP were subsequently novated to the contractor consortium to provide design changes and construction support through to testing and commissioning of the finished line.


Trams
Trams

Courtesy of the City of Edmonton

Edmonton
Metro Line NW Extension

Location
EDMONTON, ALBERTA, CANADA

Client
CITY OF EDMONTON

Status
TARGETED COMPLETION OF PHASE 1 IN 2024

PROJECTED DAILY RIDERSHIP
111,000

ANNUAL REDUCTION OF EMISSIONS
1,300 tonnes

PROJECT LENGTH (PHASE 1 AND PHASE 2)
11 km

Metro Line NW Extension extends the current Metro Line that runs between Churchill and NAIT stations. Phase 1 is a 1.6km extension connecting the new Blatchford development to the City's broader LRT network. Phase 1 includes two stations and will be a key attractor for Blatchford, the City of Edmonton's premier carbon-neutral development. Phase 2 of the project will extend the Metro Line an additional 9.5 km from Blatchford to Castle Downs, then west to Campbell Road. Phase 2 includes seven stations, one transit center, and an operations and maintenance facility. The project meets heightened expectations for urban, architectural and landscape designs that support the overall sustainability and resilience of the city while achieving operational safety requirements. WSP Canada Group Limited (WSP) is a part of the Metro North Partners (MNP) team that completed the preliminary design of the Metro Line NW Expansion. Subsequently, MNP was engaged to complete the detailed design, construction administration, and closeout for Phase 1 of the project. WSP design scopes for Phase 1 included: telecommunications, signals, landscaping, utilities, and building mechanical and electrical. In addition, WSP is responsible for project testing and commissioning, systems assurance, and integration management. WSP's approach for the Metro Line NW Extension balanced the needs of key stakeholders, including the construction manager, owner, operator, maintainer, developers and the public to create a constructible design that meets long-term stakeholder needs.

As the design integration manager, WSP added value by applying systems engineering analyses to the project. The completed hazard analyses, performance simulations, reliability analyses, and requirements management provide the client assurance and confidence that the project will meet system goals.

Gold Coast
Rapid Transit

Location
GOLD COAST, QUEENSLAND, AUSTRALIA

Client
TRANSLINK

Status
OPENED IN 2014

LENGTH OF TRACK
16 km

STATIONS
18

GOLD COAST RESIDENTS
400,000+

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.


G:link
TESTING FOR
YOUR SAFETY
PASSENGER SERVICES
COMMENCING
MID 2014

© Raidejokeri Alliance

Helsinki
Raide-Jokeri Line

Location
HELSINKI TO ESPOO, UUSIMAA, FINLAND

Client
HELSINKI'S CITY PLANNING DEPARTMENT

Status
ONGOING

PASSENGERS PER WEEKDAY BY 2040
100,000

TRACK LENGTH
25 km

STATIONS
32

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 replace parts of Helsinki's busiest bus service, Bussi-Jokeri, which has 30,000 daily passengers.

WSP was responsible for the project plan, which served as the basis for the construction planning. We are currently working on the maintenance requirements. The line is estimated to start operating in early 2024.

This vital cross-region service requires a rail link with a higher capacity and more frequent service. Raide-Jokeri will also significantly influence land use in the vicinity of the track in the near future. This consideration was also a part of the scope of the project plan.

Helsinki
Kalasatama
Pasila Tramway

Location
HELSINKI, FINLAND

Client
CITY OF HELSINKI

Status
ONGOING

TRACK LENGTH
4.5 km

SUSTAINABILITY
CEEQUAL
certified project

NEW STOPS
9

Kalasatama, the former port and industrial area, is one of Helsinki's leading regional development projects. The area will be transformed into a pleasant residential and business district within 20 years. Kalasatama Pasila tramway is a major city development project. The 4.5km-long tramway complements Helsinki's sustainable rail network and supports Helsinki's vision to be the most functional city in the world.

When completed in 2024, the new tramway will provide smooth transport in just 15 minutes from Kalasatama to Pasila and link the existing tram, metro, and commuter train networks to one another. In addition to the tramway, streets, walkways, cycle lanes, green areas and municipal infrastructure will be renewed during the project.

Sustainable construction solutions, the preservation of biodiversity and building a comfortable urban environment are the guiding principles of the Kalasatama Pasila tramway project. The project recycles land masses, uses low-carbon concrete in piling, and recycles stones and street furniture. The sustainability actions will be verified with CEEQUAL certification.

The project is being executed by two alliance project groups. WSP is part of the core group, Sörkän spora, which is responsible for the major part of the project. Our experts are responsible for traffic design, environmental design and infrastructure design and project management. Our specialists are also leading the sustainability work in the project.

Helsinki
Viikki Malmi
Light rail ("Viima")

Location
HELSINKI, FINLAND

Client
CITY OF HELSINKI

Status
ONGOING

TRACK LENGTH
12 km

STATIONS
21

EXPECTED COMPLETION
2030

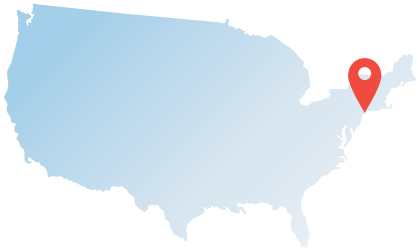
The City of Helsinki, together with WSP in Finland, drew up a general plan for the Viikki–Malmi ("Viima") tram line in 2021. The line is a new connection for public transport from the Helsinki city center to northeast Helsinki. The Viima light rail is connected to Helsinki's current tram network and will be part of the new regional light-rail network.

Our client's aim is multifold: to ensure the functioning and competitiveness of public transport in growth areas; to promote transport-emissions-reduction targets; and advance equal access to transportation as well as the wellbeing of neighbourhoods and their economical vitality.

In the general plan, WSP examined three tram lines and made related traffic calculations, such as, fleet, passenger volumes and travel times. WSP also assessed land use and environmental impacts related to ecological, cultural and recreational values. Different modes of transport were considered in the comparison.

Current plans call for construction of the tramway to begin in 2027 and be completed in the early 2030s. The length of the tramway will be approximately 12 km and have 21 stations. The Viikki-Malmi area is estimated to have an increase of 80,000–100,000 inhabitants and 25,000–40,000 jobs in 2050 compared to today.

Hudson-Bergen *Light Rail*



Location
HUDSON AND BERGEN COUNTIES, NEW JERSEY, UNITED STATES

Client
NEW JERSEY TRANSIT (NJ TRANSIT)

Status
ONGOING

REGIONAL PARK-AND-RIDE LOTS

5

STATIONS

24

OPERATE & MAINTAIN THE SYSTEM

21 Years (opened in 2000)

WSP is providing general design consultant services to NJ TRANSIT for the development of the Hudson Bergen Light Rail Transit System, a 27.4 km 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. A future extension of the West Side Avenue Branch to a new Bayfront Station and an extension of the Tonnelle Avenue Branch is planned. NJ TRANSIT used the design-build-operate maintain procurement method to hire the operator as well as construction of the system. WSP provided preliminary engineering and architectural services for all facilities and systems, including the proposed extension to Bayfront Station for advancement of design for inclusion into design-build bidding documents, and final design and construction contract document preparation for the Weehawken Tunnel and Bergenline Avenue Station in Phase II. 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. WSP is also supporting NJ TRANSIT in the procurement of a new operator, using current best practices for contracted transportation contracts.

Awards

- *Concrete Industry Board - Award of Merit for the Weehawken Tunnel and Bergen line 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*

Kuala Lumpur *Shah Alam Line (LRT3)*

Location
KUALA LUMPUR, MALAYSIA

Project Owner
PRASARANA MALAYSIA BERHAD

Client
MRCB GEORGE KEN SDN BHD

Status
ONGOING

STATIONS
26

LENGTH OF LINE
38 km

TOTAL TRANSIT TIME
52 Minutes

Kuala Lumpur's light rail transit Shah Alam Line 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. It is estimated that LRT3 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 52 minutes.

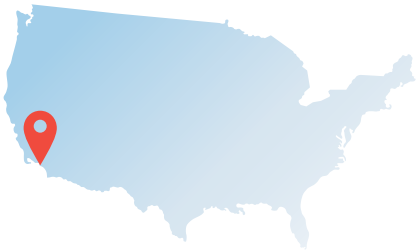
WSP has been commissioned by Prasarana—the organization established by the Malaysian Government for delivery and management of its major rail projects—to undertake the role of line-wide system consultant for LRT3.

This proposed new light rail line, extending 38 km 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 26 stations, including the Grand Central station near Stadium Shah Alam, with an end-to-end travel time of around 52 minutes.

WSP has undertaken 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 LRT3 line.

The scope also included interface and integration with civil works design, preparation of tender documentation, tender evaluation, construction stage support, testing and commissioning, and staff training.

Los Angeles *Expo Line, Phase II*



Location
LOS ANGELES, CALIFORNIA, UNITED STATES

Client
EXPOSITION CONSTRUCTION AUTHORITY

Status
COMPLETED IN 2016

FEWER CARS ON THE I-10 DAILY

64,000

LENGTH OF EXTENSION

10.6 km

TRAVEL FROM DOWNTOWN LA TO SANTA MONICA

46 Minutes

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.

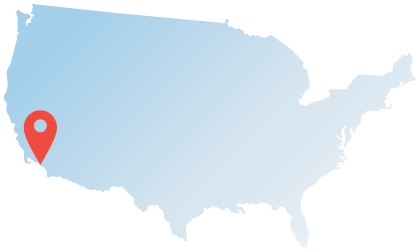
WSP was responsible for all design management and key design aspects of the project, including drainage and road improvements and strategies for relocating utilities. We also designed the track guideway, structures, stations, traction electrification system, overhead contact system, and the communication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


METRO
1023
Eastbound
to Downtown LA
Platform
1

Los Angeles *Regional Connector Transit Project*



Location
LOS ANGELES, CALIFORNIA, UNITED STATES

Client
LOS ANGELES COUNTY METROPOLITAN TRANSPORTATION AUTHORITY (METRO)

Status
ONGOING

DEPTH
30.5 m

REGIONAL CONNECTOR LENGTH
3 km

TWIN-BORE TUNNEL LENGTH
1,737 m

The Los Angeles County Metropolitan Transportation Authority's Regional Connector project is a 3km, fully underground LRT link that will allow passengers to travel through downtown Los Angeles without transferring lines.

The CAD 2.6 billion (USD 1.9 billion) project will extend from the Little Tokyo/Arts District Station to the 7th Street/Metro Center Station in downtown Los Angeles, allowing passengers one-seat rides among the A (Blue), E (Expo) and L (Gold) LRT lines and connections to the B (Red) and D (Purple) heavy rail lines. When completed, passengers will be able to travel from Azusa to Long Beach, or from East Los Angeles to Santa Monica, without transferring trains.

WSP has worked on the Regional Connector project since 2008, providing planning, environmental and engineering services, as well as on-site design support during construction. WSP currently provides technical support during systems integration and testing as the project works toward the start of revenue operations, scheduled in 2023. The project includes the construction of three new underground stations—Little Tokyo/Arts District Station at 1st Street and Central Avenue, Historic Broadway Station at 2nd Street and Broadway, and Grand Avenue Arts/Bunker Hill Station at 2nd and Hope streets. The project also includes some "firsts" for Metro. It includes Metro's first cavern excavated in soft rock by the sequential excavation method for its 17-metre-wide 10-metre-high horseshoe shaped nearly 92-metre-long rail crossover cavern adjacent to the Historic Broadway Station.

It will also be the first time for Los Angeles transit that high-speed elevators are used for passenger access instead of escalators. Located approximately 30.5 metres below the surface, the Grand Avenue Arts/Bunker Hill Station will have six high-speed elevators with the hoisting equipment below the ground surface to avoid the visual impact at the station entrance pavilion.

Lusail City
Lusail Tram

Location
LUSAIL CITY, QATAR

Client
RKH-QITARAT

Status
OPENED IN 2022

LENGTH
18 km

STATIONS
25

LINES
4

The broad goals of the Qatar Rail Development Program are to deliver a world-class, environmentally friendly, safe and reliable rail network for Qatar, and also to support the Qatar 2030 Vision for achieving the highest economic, social and environmental development standards for the Qatar community through a sustainable urban development plan.

To this end, the Government of Qatar has launched a major rail-based mobility and transportation program known as the Qatar Integrated Rail Program (QIRP), developed by the Qatar Rail Company (QRail). As part of QIRP, an 18km light rail line was delivered within the newly developed Lusail City.

WSP, in a joint venture with Egis Rail, has been awarded a contract by the client, RKH-Qitarat, to provide the first principal inspection and technical assistance for writing and updating the Civil Assets Maintenance Program for Doha Metro and Lusail Tram Civil Assets (stations, viaducts, tunnels, depots, car parks, stabling yards, pump stations, etc.). RKH-Qitarat has been awarded the maintenance contract by QRail for the Doha Metro and Lusail Light Rail Transit (LRT). The Lusail LRT system, in the new city of Lusail, which is located 15 km north of Doha, was successfully opened for public use in January 2022. The LRT was conceived to enhance transportation within the city and improve connectivity to entertainment centers such as Lusail Stadium, one of FIFA World Cup 2022 stadia.

Lusail light tram system consists of 4 main tram lines that span 18 km and 25 at-grade passenger train stations in various configurations (centre platform, side platforms and split side platforms). The project also included a viaduct to connect Lusail Tram passengers to the regional railway. In addition, the project included the Lusail Tram depot, which hosts the tram Operations Control Center and a test track.


© 2009 David Sailors

Macau
LRT, Phase I

Location
MACAU, CHINA

Client
TRANSPORTATION INFRASTRUCTURE OFFICE + MACAU SPECIAL ADMINISTRATIVE GOVERNMENT

Status
COMPLETED IN 2014

STATIONS
21

LENGTH OF LINE
21 km

DEPOT
12ha

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.

Manchester *Metrolink*

Location
MANCHESTER, ENGLAND, UNITED KINGDOM

Client
TRANSPORT FOR GREATER MANCHESTER

Status
ONGOING

CONSTRUCTION AND REFURBISHMENT OF STRUCTURES

300+

OPENED 9 MONTHS AHEAD OF SCHEDULE

Trafford Park Line

LENGTH OF EXPANSIONS

65 km

Since 2007, we have worked to secure funding, and develop, expand and enhance Greater Manchester's iconic tram system. This expansion programme will nearly triple the size of the network with 65 km of new lines being delivered in a range of urban environments, and will bring 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 partner, WSP has provided a comprehensive programme management service, including risk management, project controls, and contract management, and 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 six new lines into service in 12 phases, with 30 km of new line opening significantly ahead of schedule.

The extension to Oldham Town Centre had funding challenges. We developed a cost-effective solution to construct an at-grade tramway integrated with a fully remodeled highway layout, which has transformed the area to support wider regeneration plans, with significant cost savings.

The 14.5km extension to Manchester Airport opened to passengers in November 2014, over a year ahead of schedule. Collaborative working with the contractor enabled the 5.5km Trafford Park Line extension, Europe's largest industrial park, to open nine months ahead of schedule.

Utility diversions are a key cost and programme risk for light rail schemes. The Metrolink extension projects comprised over 600 contracts. On the Trafford Park Line, we developed an innovative way of working with multiple utility companies to efficiently design and install utilities in shared corridors.

We helped the client achieve a saving of over CAD 15.5 million (£10 million) and a six-month reduction on the utility diversions programme, which was recognised by the Global Light Rail Awards.

Awards

- *British Construction Industry Awards, Transport Project of the Year for the Trafford Park Line extension (2020)*
- *National Transport Awards - Special Award for "Outstanding Performance"*
- *North West ICE Awards, Large Project of the Year for Trafford Park Line (2021)*
- *National Rail Awards, Highly commended for Infrastructure Achievement Award and Safety Achievement Award (2020)*
- *Global Light Rail Awards, including Project of the Year for Three Consecutive Years plus many Highly Commended achievements*

© Craig Willoughby

Maryland
Purple Line

Location
SILVER SPRING, MARYLAND, UNITED STATES

Client
MARYLAND TRANSIT ADMINISTRATION (MTA)

Status
ONGOING

LENGTH OF LINE
26 km

COMMUTE TIME SAVED
<31 Minutes

STATIONS
21

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 light rail access to key business districts and activity centers, the University of Maryland, circumferential connections to the existing four branches of the Washington Metropolitan Area Transit Authority metro system, the MARC commuter train service, 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 it 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 environmental approval and planning process as well as the critical delivery method selection, procurement, and financing stages to secure federal funding for the project. WSP is currently providing project management and quality assurance oversight services during the project's construction. WSP also assisted MDOT MTA during the recent resolicitation process, working alongside the concessionaire and the State to select a new design-build team while construction was mid-way. WSP advised the State on this nearly unprecedented scenario. MDOT MTA, its advisors, and the concessionaire were able to work together so that the replacement design-build process was completed quickly, resulting in a successful new financial close in a project environment that has shown the resilience of the P3 model.

Construction began in August 2017 and the Purple Line is anticipated to open for revenue operations in 2026.

Awards

- *Deal of the Year, Rail, IJGlobal Awards for the Americas, 2017*
- *Federal Transit Administration - Outstanding Achievement Award, 2015*
- *Maryland Quality Initiative Planning Award, 2014*

New Orleans *Streetcar Expansion*

Location
NEW ORLEANS, LOUISIANA, UNITED STATES

Client
NEW ORLEANS REGIONAL TRANSIT AUTHORITY

Status
COMPLETED

HISTORY

Oldest continuously operated streetcar in the world

LINES IN OPERATION

4

SOLAR-POWERED TRANSIT SHELTERS

8

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.

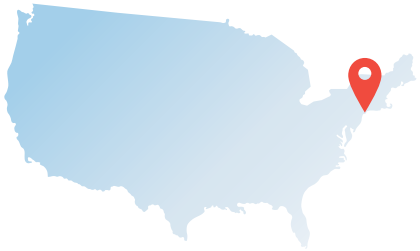
WSP served as construction manager to the RTA for the extension of the Loyola Avenue Line from Canal Street to the Union Passenger Terminal, through the city's central business district, and for the re-establishment of the Rampart Street/St. Claude Avenue Line from Canal Street to Elysian Fields Avenue. 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 2.6kmextension 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 neighborhoods, 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.

Newark
Light Rail Extension



Location
NEWARK, NEW JERSEY, UNITED STATES

Client
NEW JERSEY TRANSIT CORPORATION

Status
COMPLETED IN 2006

LENGTH
1.6 km

TRIP FROM NEWARK PENN STATION TO BROAD STREET STATION
<10 Minutes

STATIONS
5

Passenger service on the Newark Light Rail Extension (NLRE) began on July 17, 2006. The NLRE connects the downtown district, providing service between two of Newark's busiest intermodal rail stations —Newark Penn Station and Newark Broad Street Station. The project included five new aboveground stops and provided easier access to NJ TRANSIT's Newark Light Rail, commuter rail and bus networks, Amtrak, PATH, 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 40 km 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*

Newcastle Light Rail is a city-shaping project and a key part of the New South Wales (NSW) Government's AUD 650 million (CAD 587 million) program to revitalise Newcastle, providing a frequent and reliable travel option throughout the city centre and connecting key precincts in the region. It is the first entirely catenary free (wire free) light rail system in Australia. The unique approach uses an onboard power supply and provides charging at stations while passengers board and disembark through a connection to an elevated charge bar at each stop.

WSP was initially engaged in 2014 as lead designer on the project as part of a design joint venture that undertook project scoping, definition and concept design. In 2016, we moved into detailed design, managing complex design issues and volumes of changes to prepare approved-for-construction documents.

Our work included detailing all infrastructure and requirement specifications for all rail systems components, including alignment and civil works, six stops, a depot, power supply, control system and communication systems.

The design team introduced several innovations enabling the maximization of on-street parking and minimising land-sharing between general traffic and light rail vehicles. WSP worked in a joint venture to deliver the project for Downer and Transport for NSW.

The project has helped reduce city congestion while providing a frequent, reliable, comfortable, energy-efficient and sustainable travel mode through the centre of Newcastle. The light rail connects the main activity precincts and reunites the city centre with the harbour and Newcastle Beach. The team has delivered a world-class light rail system tailored to Newcastle's needs, rejuvenating the local economy and laying the foundation for future light rail networks in the region.

Location
NEWCASTLE, NEW SOUTH WALES, AUSTRALIA

Client
TRANSPORT FOR NSW

Status
COMPLETED IN 2019

Odense
Tramway

Location
ODENSE, DENMARK

Client
ODENSE LETBANE P/S

Status
OPENED IN MAY 2022

Acceptance from Odense Letbane P/S has been provided

WSP was appointed by Odense Letbane to provide consultancy and technical advisory services across the whole project lifecycle for the first phase of the tramway—from feasibility stage through to project delivery—creating a robust and reliable light rail system.

The Odense Tramway is the first new tram system to be introduced to Fyn Island, Denmark. The brand-new 14.5km bi-directional light rail line will connect the centre of Odense, the third biggest city in Denmark, and the multimodal transport hub to the new super hospital and the city's ever-growing university campus. A single light rail train will carry more than 200 passengers at a time, with approximately 35,500 passengers expected on weekdays.

WSP has been involved in the design and delivery phases of the Odense Tramway since 2015, but we also provided client consultancy services to Odense Municipality during the feasibility stage in 2011. Our 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 also been engaged to support the client in the delivery phase by undertaking design assurance of the TS and RS contractors' deliveries and by continuing to offer the client further ad hoc support in all aspects of project delivery. More specifically for the RS contract, we were involved in the design development, construction support, testing and commissioning and final acceptance of the brand-new Stadler Variobahn trams. Most recently, we have been witnessing and supporting the final testing phase of the system to allow operations to begin.

Ottawa
Confederation Line

Location
OTTAWA, ONTARIO, CANADA

Client
CITY OF OTTAWA

Status
ONGOING

STATIONS
13

TRIP DURATION PER DIRECTION
24 Minutes

LENGTH OF DOWNTOWN TUNNEL
2.5 km

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 Stage 1, WSP was retained by the City of Ottawa to develop a business case and multiple account evaluation. The team's specific assignments included project management, analysis and the recommendation of public-private partnership (PPP) delivery models, analysis of financial and economic viability, and analysis of value for money.

For Stage 2, 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 for 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 our many engagements working with the City of Ottawa on various iterations of LRT development since the early 2000s, combining our engineering and planning expertise with the economic and financial capabilities of WSP's global strategic consulting team.

Awards

- Canadian Council for Public-Private Partnerships National Awards for Innovation and Excellence, Gold Award, Transportation Innovation, 2013


BAYVIEW

©Sergio Grazia

Paris
Tramway T3 Paris

Location
PARIS, FRANCE

Client
ILE-DE-FRANCE MOBILITÉS AND VILLE DE PARIS

Status
COMPLETED IN 2018

LENGTH
4.3 km

STATIONS
8

PASSENGERS PER DAY ON THIS SECTION
90,000

Created in 2006, the T3 tramway has gradually become a real ring road linking the territories of Paris and the inner suburbs over more than 26 km in length: it is the first tramway line in France, making up to 500,000 trips every day. The southern section was inaugurated in 2006, and the eastern section in 2012.

The northern extension of the T3 tramway, from Porte de la Chapelle to Porte d'Asnières, was inaugurated in November 2018. It travels 4.3 km, running through dense urban areas on exclusive right-of-way, and includes eight new stations—serving approximately 90,000 passengers per day. The City of Paris, the Île-de-France Region and the French central government have invested 211 million euros (CAD 278 million) in the extension.

With the arrival of the tram, a completely redesigned space is offered to residents of northern Paris: 10 km of cycle paths, green area (27,000 m² of grass), 184 trees, and widened sidewalks more suitable for walking. The tram serves an area rich in urban projects—such as the ZAC Clichy-Batignolles, the new Cité Judiciaire de Paris, and the ZAC Chapelle International—and in public transport projects, such as the extension of lines 12 and 14 of the metro.

Extension of the T3 tram continues today, with a new section to the west of Paris scheduled to come into service in 2023.

WSP supported Ile-de-France Mobilités, the City of Paris and the RATP for seven years on this project for the north section, for the preliminary study and public inquiry phase, then for the study, preparation works and network rerouting, and monitoring of works until commissioning.

We brought our expertise in project management to set up organizational tools between project owners, their partners and design offices, to develop and monitor the project schedule, the risk management and the budget. We also supported project owners in monitoring regulatory procedures and setting up agreements, and in the technical supervision of the project.

Perth
Metro Area Express

Location
PERTH, WESTERN AUSTRALIA, AUSTRALIA

Client
WA DEPARTMENT OF TRANSPORT

Status
COMPLETED IN 2014

EXPECTED PASSENGERS PER DAY
35,000

SUGGESTED LENGTH OF LINE
22 km

POPULATION BY 2031
2.7 Million

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 22km 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.

Phoenix
Valley Metro Rail

Location
PHOENIX, ARIZONA, UNITED STATES

Client
VALLEY METRO RAIL

Status
ONGOING

PROJECTED FINAL LENGTH
92 km

PASSENGER CAPACITY PER HOUR
12,000

SAVINGS FROM STREAMLINING
CAD 1.37
(USD 2 million)

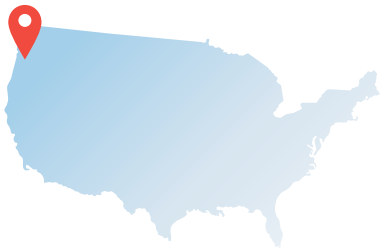
Established in October 2002, Valley Metro Rail, Inc. (METRO) was created for the purpose of planning, designing, constructing and operating a 91.7km high-capacity regional rail system for Maricopa County. The first segment of the regional rail system was the Central Phoenix/East Valley Light Rail Transit Project, a 32km light rail starter line connecting Phoenix, Mesa and Tempe.

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 continued its relationship with Valley Metro on a 3.2km extension to the Central Mesa that was opened in 2015, along with a second phase of the Northwest Extension that is 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.

Portland
Interstate MAX



Location
PORTLAND, OREGON, UNITED STATES

Client
TRI-COUNTY METROPOLITAN TRANSPORTATION DISTRICT

Status
OPENED IN 2004

LENGTH OF WEST HILLS TUNNEL

4.8 km

DEEPEST TRANSIT STATION IN NORTH AMERICA

Washington Park Station

WEEKDAY RIDERSHIP

+95%

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 Transit 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 ZGG. 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.

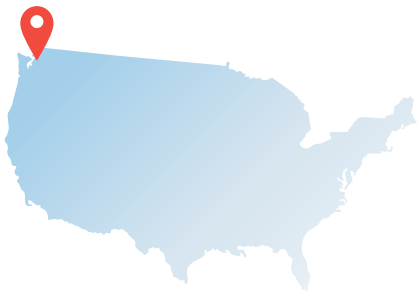
Two years after the opening of the Westside line, WSP, as general engineering consultant to TriMet, began design of the Interstate MAX extension, now known as the Yellow Line, which runs from the Rose Garden Transit Center 10km north along Interstate Avenue to the Portland Exposition Center. Interstate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

Awards

- *American Consulting Engineers Council - Grand Award, 1999*
- *Consulting Engineers Council of Oregon - Grand Award, 1999*


Next train this platform
Next train this platform
105A
Link

Redmond
Downtown Redmond Link Extension



Location
REDMOND, WASHINGTON, UNITED STATES

Client
SOUND TRANSIT

Status
ONGOING

VEHICLE PARKING GARAGE

1,400 Vehicles

LENGTH

5.5 km

TIME SAVED

72 minutes
to Sea-Tac
International Airport

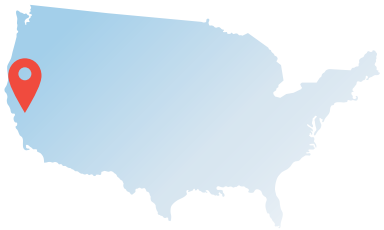
42 minutes
to downtown Seattle

In 2016, voters approved funding for the Central Puget Sound Regional Transit Authority (Sound Transit) to design and build the LINK light rail to downtown Redmond. The Downtown Redmond LINK Extension (DRLE) project includes the design and construction of a 5.8km stretch along State Route 520, which extends the Blue Line from the Redmond Technology Center Station to downtown Redmond. The project will build one at-grade station, a 1,400-vehicle parking garage, and one elevated station. Other project elements include a double-track guideway (both elevated and at-grade), civil and site work, environmental mitigation, roadways, and transit systems.

WSP's role as the design-build project management (DBPM) consultant is to provide design, environmental, quality, safety and construction oversight management per Sound Transit's policies and procedures. The DBPM team conducts submittal and design change reviews, facilitates coordination between the design-build (DB) contractor, stakeholder agencies and Sound Transit headquarters, performs quality verification of work completed, provides technical support for the operations and maintenance agreements, and oversees DB testing and commissioning activities. The DPBM consultant also performs independent quality assurance, oversees the change management process, monitors the DB safety and security certification program, and works directly with the Sound Transit Project Management to close out and transition the project to Sound Transit Operations for pre-revenue testing.

Slated to be completed in late 2024, commuters will be able to travel congestion-free from downtown Redmond to downtown Seattle in 42 minutes and to Sea-Tac International Airport in 72 minutes.

Sacramento
South Corridor



Location
SACRAMENTO, CALIFORNIA, UNITED STATES

Client
SACRAMENTO TRANSIT DEVELOPMENT AGENCY

Status
OPENED IN 2003

STATIONS
8

PASSENGERS PER DAY
15,000

PARK-AND-RIDE LOTS
3

Phase I of the South Corridor Project extended the Sacramento Regional Transit District's light rail system 10.1km connecting to the existing light rail system between the 16th Street and 23rd 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 1.6km 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 6.1m 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.

Salt Lake City *Frontlines 2015 Program*

Location
SALT LAKE CITY, UTAH, UNITED STATES

Client
UTAH TRANSIT AUTHORITY (UTA)

Status
COMPLETED IN 2015

SAVING TIME
15 Years
ahead of Schedule

LENGTH
113 km

MID-LIFE REHABILITATION
29
LRT vehicles

WSP provided program management services for 112.7 km of rail that make up the Utah Transit Authority's (UTA) FrontLines 2015 project. This major undertaking consisted of the FrontRunner commuter rail between Salt Lake City and Provo and four light rail lines—the Mid-Jordan Light Rail Line, the West Valley Light Rail Line, the Airport Light Rail Line and the Draper Light Rail Line. All projects were completed and in full operation by 2015, 15 years ahead of UTA's original schedule.

WSP supported UTA with concept planning; program management and administration; contract document preparation; project engineering; commuter rail and light rail vehicle procurement and inspection services; construction and safety oversight; communications initiatives; and overall project development in order to procure and manage designers and contractors for the various projects. WSP also supported development of several bus rapid transit (BRT) lines, assisted UTA with ongoing risk analysis, and developed an integrated project control system with a risk management component.

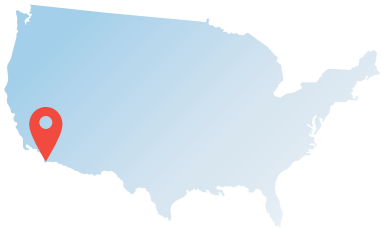
WSP also:

- Developed an integrated project controls system for project scheduling, cost, document control, budgets and scopes, and risk tracking, providing scheduling and program experts to integrate different functions into the project control tools.
- Provided New Starts experts to advise UTA on how to advance the Federal Transit Administration New Starts process.
- Provided and managing technical resources for the project.
- Organized value engineering teams and providing value engineering reviews.
- Inspected and commissioned mid-life rehabilitation for 29 LRT vehicles.

Light Rail Lines

- Airport TRAX
- Draper TRAX Line
- Mid-Jordan TRAX Line
- West Valley TRAX Line
- FrontRunner South

San Diego
Mid-Coast Extension of the University of California San Diego Blue Line Trolley



Location
SAN DIEGO, CALIFORNIA, UNITED STATES

Client
SAN DIEGO ASSOCIATION OF GOVERNMENTS (SANDAG)

Status
COMPLETED IN 2021

LENGTH
18 km

STATIONS
9

BRIDGE CROSSINGS
8

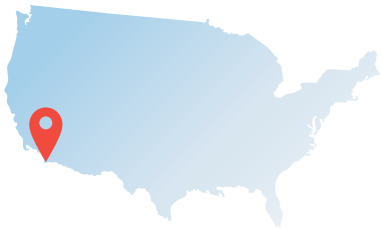
The Mid-Coast Extension of the University of California (UC) San Diego Blue Line Trolley adds an 18 km (11-mile) critical new connection for San Diego, extending the light rail line from the Old Town Transit Center north to the University Towne Centre (UTC) Transit Center in University City. The UC San Diego Blue Line now provides a one-seat connection from UTC to downtown San Diego, and south to the U.S.-Mexico border.

WSP served as the lead environmental and engineering consultant for more than a decade on behalf of the San Diego Association of Governments (SANDAG), and was responsible for environmental, planning, preliminary and final engineering; New Starts services; and environmental support and design services during construction phases of the light rail extension operated by the San Diego Metropolitan Transit System.

In addition to 18 km (11-mile) of new double tracks, the CAD 2.9 billion (USD 2.1 billion) project included the design and construction of eight bridge crossings, nearly 11 km (seven miles) of at-grade alignment in or near existing railroad right-of-way, more than 6.5 km (four miles) of aerial viaduct structures, and nine stations – five at-grade and four aerial, and 1,170 new parking spaces at five of the new stations.

As the designer of record, WSP was charged with advancing the project from environmental clearance and conceptual engineering through to construction, including track and systems design and operations analysis, station design, traffic studies and engineering, civil and utilities design, grading and drainage design, roadways and bike path design, geotechnical investigations and fault studies, and structures design. WSP also provided grant procurement services that led to a CAD 1.38 billion (USD 1 billion) Federal Transit Administration Full Funding Grant Agreement in 2016, clearing the way for construction to begin.

San Diego *Green Line Extension*



Location
SAN DIEGO, CALIFORNIA, UNITED STATES

Client
SAN DIEGO METROPOLITAN TRANSIT SYSTEM

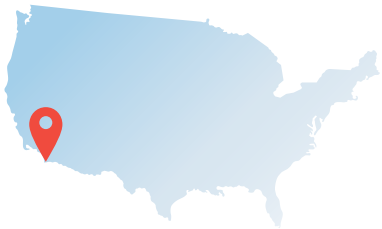
Status
OPENED IN 2005

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 9.3km extension, which began from the Mission San Diego station, connected to the existing Orange Line Trolley in the City of La Mesa, included a subway tunnel, lengthy sections on elevated viaduct, new stations, and new low-floor railcars.

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.

San Diego
Old Town Trolley Extension



Location
SAN DIEGO, CALIFORNIA, UNITED STATES

Client
METROPOLITAN TRANSIT DEVELOPMENT BOARD

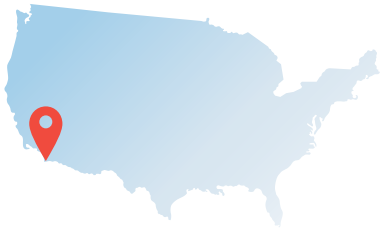
Status
OPENED IN 1996

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 LRT 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.

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

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.

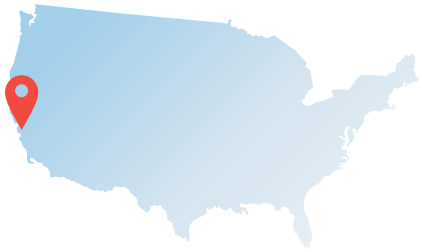
WSP was responsible for the infrastructure conditions assessment, the phasing plan, and the validation of the MTS's financing plan. Under a separate contract with SANDAG, we provided program management services for implementing the low-floor and the track rehabilitation program, and for ongoing operational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


4004
BLUE LINE
71


Montague
950
ALUM ROCK
VTA
VTA

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
12 km

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.

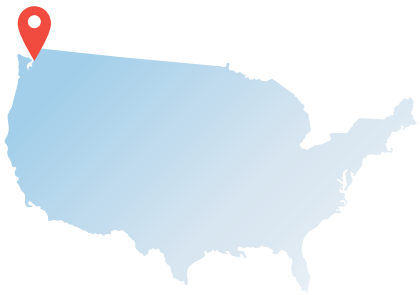
This cooperative effort between the VTA and the cities of San Jose, Santa Clara, Sunnyvale, and Mountain View, working in partnership with the Federal Transit Administration, Metropolitan Transportation Commission, and California Department of Transportation, has provided residents with convenient light 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.

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*



Location
SEATTLE, WASHINGTON, UNITED STATES

Client
CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY (SOUND TRANSIT)

Status
ONGOING

TRIP FROM AIRPORT TO DOWNTOWN
<40 Minutes

PARKING GARAGE SPACES
1,092

TWIN BORED TUNNEL LENGTH
1.6 km

Traffic and transportation are among the most important concerns of citizens in the fast-growing Puget Sound region of Washington State. In response, the Central Puget Sound Regional Transit Authority (Sound Transit) was created to implement Sound Move, the Ten-Year Regional Transit System Plan, to bring high-capacity transit facilities and services within the region's major transportation corridors, including commuter rail, light rail, and express bus systems. In 1997, Sound Transit selected Puget Sound Transit Consultants, a WSP-led three-firm joint venture, as the preliminary engineering designer for the plan's light rail component. WSP continues to work with Sound Transit to implement projects funded through their ST2 and ST3 programs.

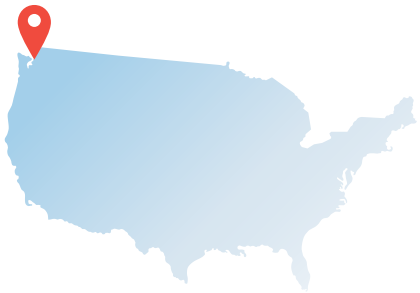
Throughout the last two decades, WSP's involvement has included work on:

- Initial Central Link light rail segment and Tacoma Link. The initial segment was planned to incorporate the existing 2.1 km Downtown Seattle Transit Tunnel and build Sound Transit's first light rail line extending approximately 23 km south of downtown Seattle to an interim terminus station at South 154th Street in Tukwila. Tacoma Link is a separate 2.6km line in downtown Tacoma.
- Angle Lake/Airport Link. This extends the Central Link segment 2.7 km to a terminus station at Sea-Tac International Airport and includes a 1,092-space parking garage.
- Northgate Link Extension. This includes University Link, which extends the line 5.1 km from downtown northward to the University of Washington campus and continues approximately 6.4 km beyond University Station to a terminus station at Northgate Mall.
- East Link Extension (ongoing). This will include six stations and the downtown tunnel in Bellevue. The final 5.5km segment will be the Redmond Extension. The East Link is under construction, will cross Lake Washington, with completion expected in 2023.
- South Link (ongoing). This 12.6km link extends from Angle Lake station to the City of Federal Way. Comprising the Kent/Des Moines, South 272nd Street, and the Federal Way Transit Center, it will extend to the Fife, Portland Avenue, and Tacoma Dome Stations.

WSP's services included supporting the light rail alignment alternatives selection process and environmental impact assessments; preparing conceptual designs; and performing preliminary engineering for civil facilities on tunnel, aerial guideway, and at-grade alignments. WSP has continued to support Sound Transit by managing section designers for the multiple final-design contracts and providing design services during construction.


INTL BLVD STATION
105A
Link
ILLEGAL
TO CROSS

Downtown Seattle *Transit Tunnel (DSTT)*



Location
SEATTLE, WASHINGTON, UNITED STATES

Client
CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY (SOUND TRANSIT)

Status
ONGOING

DSTT STATIONS
4

ELEVATORS
22

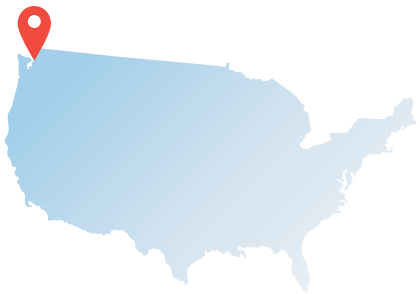
ESCALATORS
35

WSP led the program management and portfolio of projects for the Downtown Seattle Transit Tunnel (DSTT), a 2.1km-long tunnel asset built in the 1990s whose ownership is transitioning into Sound Transit's asset portfolio, including planning, developing, procuring, and overseeing a portfolio of projects that will bring the condition of the transit tunnel, currently located underneath the downtown core city street network, to Sound Transit and Federal Transit Administration (FTA) standards. The Program Management team serves as co-located, embedded staff within the agency, allowing for the trust and relationship building and collaboration across all agency departments (Executive, Design/Engineering & Construction Management, Safety & Security, and Operations) in order to deliver this work.

As part of the tunnel transfer from King County Metro (KCM) to Sound Transit (ST), Sound Transit was in need of understanding the existing conditions of the tunnel and retrofitting it to meet the growing needs of Sound Transit, including the additional three expansion light rail lines coming on-line in 2021, 2023 and 2024 that will connect to and travel through the DSTT. The project has two phases. Phase I focuses on developing the state of good repair and capital improvement program (called the portfolio of projects) needed within the DSTT. Phase 2 will deliver the program's projects on a task order by task order basis.

Integrated within the larger DSTT State of Good Repair (SOGR) Program, a program is underway to modernize all of the vertical conveyance (VC) equipment within the facility, to bring the equipment up to current agency and industry standards and to improve safety and reliability. This VC modernization program includes 22 elevators and 35 escalators within the 4 DSTT stations. A phased approach has been implemented over the course of multiple task orders, where WSP is performing assessments of the VC equipment at each station, providing recommendations on modernization alternatives, and following up with the final design of the selected alternatives. The projected contract value for WSP is CAD 13.7M (USD 10M) with an estimated construction budget of CAD 205.8M (USD 150M) to implement this modernization plan.

Seattle
Northgate Link Extension



Location
SEATTLE, WASHINGTON, UNITED STATES

Client
CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY (SOUND TRANSIT)

Status
COMPLETED IN 2021

STATIONS
3

AERIAL GUIDEWAY
671 m

UNDERGROUND TRACKS
6.9 km

The Northgate Link Extension, a new 6.9km, three-station extension of Sound Transit's light rail network that includes 4.8 km of tunnel and 671 metres of aerial guideway, opened for passenger service. As part of the North Link Transit Partners team WSP, provided final design for the CAD 2.6 billion (USD 1.9 billion) double-track light rail transit line that extends the transit system from its previous terminus at the University of Washington. The extension includes two underground stations—U District and Roosevelt—and an elevated station at Northgate. Most of the new track, except for 1.3 km, is located underground. WSP participated in extensive coordination with King County Metro and the Seattle Department of Transportation on transit, pedestrian and traffic operations, and was responsible for the aerial guideway and Northgate Station design, project integration, track design, mechanical engineering, station and tunnel ventilation, traffic and civil design for Northgate Station, and quality assurance/quality control.

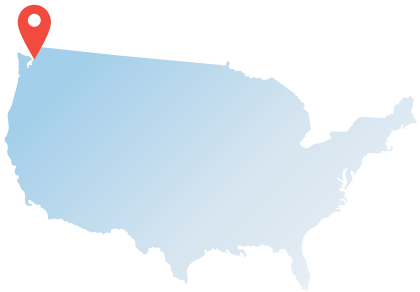
Major development over the past decade in the U District, Roosevelt and Northgate neighborhoods has added to the need for transit hubs to serve these multimodal and walkable communities. U District Station will see the highest ridership as the main transit connection to University of Washington's campus and the recently upzoned neighborhood surrounding the station. Northgate Station will be integrated with a major bus hub and will connect to the Northgate Mall site, which is being rezoned as a mixed-use development that includes the training center for Seattle's new NHL team, the Kraken, and a public skating rink facility. A new pedestrian bridge, the John Lewis Memorial Bridge, also opened and provides pedestrians with a safer connection to Northgate Station over Interstate 5 to North Seattle Community College, the University of Washington Medical Center-Northwest, and communities on the west side of the freeway.

Extended lengths of the WSP-designed underground track were designed on "floating slabs" to minimize disturbances to nearby University of Washington laboratories. Earthquake concerns and requirements were a major consideration and addressed in the project design, as Seattle is in a high seismic region and the Northgate Link is eight km from an active fault.

© David Ryder


Airport & Univ. of Wash

Seattle
South 200th Link Extension



Location
SEATTLE, WASHINGTON, UNITED STATES

Client
CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY (SOUND TRANSIT)

Status
COMPLETED IN 2016

DOUBLE-TRACK ELEVATED GUIDEWAY

2.6 km

PARKING GARAGE

1,050 stall

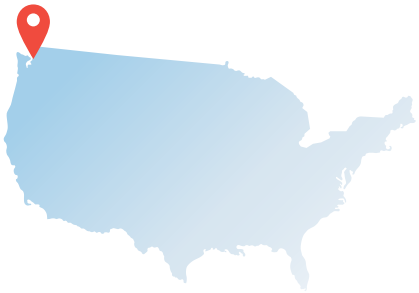
GARAGE LEVELS

7

Sound Transit's first mainline design-build project, an extension of Link light rail, travels south from the Airport Station to South 200th Street in SeaTac. As the design build project management (DBPM) consultant, WSP provided design review and construction management, and systems integration for 2.6 km of double-track elevated guideway with a new elevated station and a 1,050-stall parking garage. The seven-level garage included a pedestrian tunnel and public plaza. The team provided on-site inspections for segmental bridge construction, including gantry top-down construction of 42 spans (max span length of 43 metres) and balanced cantilever construction of three spans (max span length of 110 metres).

Design work for the structure's site civil and utilities work was completed ahead of schedule. WSP also provided construction management and design services for related local street improvements. To facilitate successful delivery using an alternative procurement method, WSP worked with Sound Transit to develop procedures and protocols for DB procurement, and provided quality control and quality assurance (QA/QC).

Seattle
East Link Segment A



Location
SEATTLE, WASHINGTON, UNITED STATES

Client
CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY (SOUND TRANSIT)

Status
COMPLETED IN 2017

LENGTH
11.1 km

STATIONS
2

CLIENT SAVINGS
Over CAD 27 million

The project includes approximately 11.1 km of retrofit/conversion of the I-90 reversible express lanes to exclusive light rail use and construction of two stations (Judkins Park Station and Mercer Island Station). Installation of light rail on the I-90 Homer M. Hadley floating bridge over Lake Washington is a world first—never before has light rail transit been carried by a floating bridge.

The WSP team introduced a new concept, the Curved Element Supported Rail (CESuRa) system, to allow light rail track to transition from the fixed to the floating span of the floating structure. The CESuRa track bridge design works through interaction of curved and rotating track supports, which automatically adjust for multidirectional movements of the supporting bridge deck. This innovative approach addressed yaw, pitch and roll movements and will provide a smooth alignment and profile under all movement combinations.

The weight of the light rail train and tracks on the floating bridge required mitigation by utilizing specially designed and tested precast lightweight concrete block track supports. The existing concrete bridge railing removal, re-ballasting, and post-tensioning of the pontoons were analyzed and designed to provide further mitigation of the light rail transit loads. Wind and wave analysis was also performed to ascertain the floating bridge's performance under high wind and wave conditions while carrying both highway and light rail traffic.

Fire and life safety retrofits were designed for the existing Mount Baker Ridge and Mercer Island Lid center roadway tunnels. Tunnel ventilation design used jet fans for the express lane tunnels and saved Sound Transit CAD 27 million (USD 20 million) in retrofit and refurbishment costs.

Project-wide structural design included seismic and gravity load analysis and retrofit design for five existing fixed bridge structures, rail/structure interaction analysis, overhead catenary system pole attachment to bridges, demolition of the westbound I-90 express lane bridge over Rainier Avenue, tunnel electrical room partitions, station platform canopy and station headhouse structures, Rainier Avenue pedestrian bridge retrofit for station access, Revit modeling and clash detection for station structures, retaining wall analysis for light rail transit loads, and sound wall design.


SvD

Stockholm
South Tramway

Location
STOCKHOLM, SWEDEN

Client
STOCKHOLM PUBLIC TRANSPORT

Status
COMPLETED IN 2015

TRACK ROUTE EXPANSION
2 Phases

DEPOT LOCATIONS STUDIED
4

POPULATION OF STOCKHOLM METRO AREA
2.2 Million

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 Kungens kurva/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.

Stockholm
Tramway City

Location
STOCKHOLM, SWEDEN

Client
STOCKHOLM PUBLIC TRANSPORT

Status
ONGOING

PASSENGERS PER DAY BY 2030
63,000

LENGTH OF EXTENSION
16 km

STATIONS
30

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 15.9km 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.


7
Interbus

Sydney
Central Business District and South East Line

Location
SYDNEY, NEW SOUTH WALES, AUSTRALIA

Client
TRANSPORT FOR NSW

Status
COMPLETED IN 2020

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.

Sydney *Light Rail Transit*

Location
SYDNEY, NEW SOUTH WALES, AUSTRALIA

Client
NSW GOVERNMENT

Status
OPENED IN 2014

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.

Sydney *Parramatta Light Rail*

Location
SYDNEY, NEW SOUTH WALES, AUSTRALIA

Client
TRANSPORT FOR NSW

Status
ONGOING

LENGTH OF LIGHT RAIL
20 km

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 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.

WSP had previously undertaken a feasibility study for local government, focused on a Western Sydney Light Rail network. This initial study generated the funding for state government to undertake further planning (the Parramatta Transport Corridor Study) in order to assess the suitability of a number of public transport modes and corridors, before a light rail network was proposed.

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.

Tainan
Advanced Rapid Transit Blue Line
(1st Phase)

Location
TAINAN, TAIWAN

Client
TAINAN CITY GOVERNMENT

Status
ONGOING

RAPID TRANSIT SYSTEM IN TAINAN

1st in Tainan

STATIONS

11

LENGTH

8.6 km

Tainan is undergoing rapid development with an increasing population as a result of the thriving semiconductor manufacturing ecosystem and ICT (information and communication technology) industry. The escalated demands of daily transportation have caused more congested road traffic during peak hours in the downtown. Existing public transportation, including bus and regional railway, can no longer suffice to quickly move people around the city. The Tainan City Government therefore engaged WSP to develop the master plan for the first advanced rapid transit (ART) line in the East District, now named "Blue Line (1st Phase)."

Based on thorough research on the relevant technologies, WSP has set six major criteria for our search of the most suitable system:

- Efficiency
- Environmental friendliness
- Interoperability
- Cost-benefit
- Technical innovation
- Technology localization

We focused on the connected autonomous vehicles-based (CAV-based) advanced rapid transit (ART) and the matured guided rapid transit (GRT) system, such as light rail and monorail, that are currently widely used in Taiwan and across Asia. The team weighs different criteria by considering the experience from the similar systems in different Taiwan cities.

Some common requirements, such as operation control centre, timetable dispatching, dedicated or mixed right-of-way and various modes of operations (including normal, degraded and emergency conditions) are considered as fundamental during the system selection process.

We proposed the CAV-based ART system to be a better option for Tainan City due to its variety of service modes, such as dynamic arrangement of the AV carriages deployed according to the real-time numbers of passengers arriving in stations during peak and off-peak hours. Current GRT cannot provide different service modes safely and quickly as the carriages in these systems are bounded by tracks.

Other advantages include high energy efficiency, less construction time and cost, the ability to adapt with mixed road traffic, better potential of technology localization and less CO_2 emissions during the construction and operation phases, as compared to GRT which usually involves larger structures and more supporting equipment.

We are working with the Tainan City Government to implement a tailored smart transportation system that is best suited for the city's needs.

Taipei
Metro Neihu Line

Location
TAIPEI, TAIWAN

Client
BOMBARDIER

Status
COMPLETED IN 2019

LENGTH OF EXTENSION
14.8 km

STATIONS
12

STRUCTURE TYPE
Elevated

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 14.8 km, 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 and 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.

WSP also completed the design and construction of an additional 101 two-car train sets, 50 percent of which were assembled in Taiwan, and the expansion/replacement of the existing signalling and the train control and power supply distribution systems, which are now compatible with both the new and existing driverless trains.


CITY MARKET

Tampere *Light Rail Tampere Area*

Location
TAMPERE, FINLAND

Client
TAMPERE TRAMWAY LTD & MUNICIPALITIES

Status
ONGOING

LENGTH
25 km

CAPACITY
264 passengers

MAXIMUM SPEED IN SERVICE
70 km/h

Tampere is the economic center of Finland's second largest metropolitan area. Tampere's location on a narrow isthmus between two lakes limits the space for bus traffic; without a tram, the local public transport would have reached its maximum capacity in the city centre.

The first stage of the Tampere tramway was implemented in 2017-2021, and the second part is to be built by 2024. WSP's mandate is to expand the Tampere tramway lines into a regional tramway system, that connects Tampere with the neighboring towns of Ylöjärvi, Pirkkala and Kangasala.

As designing a tramline is not only about the tram itself, tramway construction will impact the vitality of Tampere in several ways— developing and renewing bicycle lines, streets, and urban areas along the whole line. Approximately 70–75 percent of residential construction during 2016-2040 will take place in the tramway zone, and estimates indicate that around 90 percent of Tampere's population will live in the public transport zone by 2040. The tramway will facilitate workplace clusters and provide downtown-oriented operations outside the city centre—for example, in the Hervanta, Turtola, Kaleva and Lielahti districts. An estimated 50 percent of jobs in the city region will be located in the tramway zone by 2040.

WSP designed the master plan of the regional tramway in cooperation with Ramboll Finland Oy. The project was finished in the beginning of 2021. Currently, WSP and Ramboll together are following up the general plan with the detailed plan of the Ylöjärvi Line and the project plan of the Pirkkala Line. The regional tramway lines are going to be built in stages between 2025-2036, and the city is aiming to extend the tramlines further in 2040s and 2050s.

Toronto
Eglinton Crosstown

Location
TORONTO, ONTARIO, CANADA

Client
METROLINX

Status
ONGOING

TRANSFER POINTS TO THE EXISTING TTC SUBWAY SYSTEM

3

UNDERGROUND STATIONS + AT-GRADE STOPS

15 + 10

LENGTH OF LINE

19 km

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 Brencliffe 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 collaborative 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 also 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.

© Image Courtesy of Metrolinx

Turku
Tramway

Location
TURKU, FINLAND

Client
CITY OF TURKU

Status
COMPLETED IN 2022

WSP was commissioned to draw up a master plan for the city of Turku tramway between Satama and Varissuo. The city wants to supplement the tram plans already made, improve the implementation planning capacity and assess the impact of the tramway. The work began in May 2021 and will end in the spring of 2022. The trams are expected to operate in Turku at the turn of the decade.

A multidisciplinary project team of experts from WSP are preparing the master plan; they include experts in the areas of tramway, transport, environment, ground, bridge, municipal engineering, vibration, noise, climate and urban planning. The master plan harmonizes tram traffic as closely as possible with other traffic and mobility modes and considers a wide range of factors related to the cityscape, the competitiveness of the city, the comfort of the inhabitants, the community structure, usability, the climate objective and economic viability.

As part of the master plan, WSP will provide the City of Turku with Light Rail Design, a manual describing practical and sustainable solutions as well as a high-quality look for the tramway, including models for tram stops and lighting principles. The circular economy, the carbon footprint and the cost of the solutions have a strong influence on the recommendations. Citizens have been involved in the planning to bring out their own ideas.

The public transport solution is of great strategic importance to the city and will determine the development of the urban area for decades to come.

Vancouver
Canada Line

Location
VANCOUVER, BRITISH COLUMBIA, CANADA

Client
TRANSLINK

Status
COMPLETED IN 2009

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 new 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 new 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 P3 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.

Vancouver
Evergreen Line

Location
BURNABY, PORT MOODY, AND COQUITLAM, BRITISH COLUMBIA, CANADA

Client
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE, BRITISH COLUMBIA

Status
OPENED IN 2016

PASSENGERS PER DAY BY 2021
70,000

STATIONS
7

LENGTH OF LINE
11 km

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 2km 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.


EXIT
251
SkyTrain
BRITISH COLUMBIA
TRANSLINK
251

Vancouver
Millennium Line

Location
GREATER VANCOUVER,
BRITISH COLUMBIA, CANADA

Client
RAPID TRANSIT PROJECT 2000 LTD.

Status
OPENED IN 2002

PROJECT BUDGET SAVED
$70 Million

LENGTH OF LINE
21 km

STATIONS
12

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 water courses. 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.

Awards

- *Canadian Consulting Engineering Award of Excellence, 2003*
- *Canadian Council of Professional Engineers, 2004*
- *National Award for Engineering Achievement*
- *Project World Canada Project of the Year Award, 2004*

Vantaa *Tram*

Location
VANTAA, FINLAND

Client
CITY OF VANTAA

Status
ONGOING

LENGTH OF LINE
19.3 km

STATIONS
25

DAILY PASSENGERS (ESTIMATION FOR 2030)
82,000

The Vantaa tram is a planned high-speed light-rail line, which will connect the easternmost parts of the city to rail transport, commercial centers of the city as well as Helsinki-Vantaa Airport. The tram will increase sustainable and barrier-free mobility, enable the city's growth through smooth public transport and promote regional wellbeing and attractiveness.

Due to the scope and complexity of the work, WSP in Finland, AFRY and Finnmap Infra are jointly responsible for planning the eastern section for the City of Vantaa, and WSP is the project lead of this group. For this multidisciplinary project, we have gathered our expertise on transportation and infrastructure engineering, urban design and landscape architecture.

WSP in Finland was the chief consultant in the preparation of the general plan for the tram, which was completed in 2019. The tram simulation was carried out in collaboration with WSP's UK office.

The light-rail detailed planning is being done simultaneously with the town planning, and this phase will take about two years. Close interaction with different stakeholders is needed as the tram will be built on the existing urban structure. WSP is creating a design manual for the light rail, in which the infrastructure and surrounding requirements—landscape values, environmental structures, pavements and lighting—and the needs of the residents will be well considered.

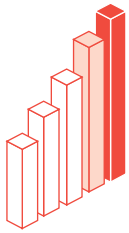
An investment decision enabling the construction of the tram will be applied for by the city council around 2023. Construction work could start in 2024 and the service could begin in 2028.

© Grant Mattice

International Agility

66,200

EMPLOYEES



8.9B

2022 NET REVENUES* (CAD)

*Non-IFRS measure

ENR
Engineering News-Record

Top International Design Firm

#1

TRANSPORTATION

#1

MASS TRANSIT AND RAIL

Source: ENR Global Sourcebook 2022

Our Guiding **Principles**

We value our people and our reputation.

We are locally dedicated with international scale.

We are future-focused and challenge the status quo.

We foster collaboration in everything we do.

We have an empowering culture and hold ourselves accountable.

Our Urban Passenger Rail *Community*

Global

Eric Peissel
+1 514 346 7336
eric.peissel@wsp.com

Australia

Sam McWilliam
+61 409 600 279
sam.mcwilliam@wsp.com

Canada

Jennifer Verellen
+1 647-531-3194
jennifer.verellen@wsp.com

Chile

Velko Zuvic A.
+ 56 9 6587 9213
velko.zuvic@wsp.com

Colombia

Javier E. Lancheros
+ 57 310 854-8159
javier.lancheros@wsp.com

Denmark

Rasmus Walter
+ 45 27643624
rasmus.walter@wsp.com

Germany

Martin Baitinger
+49 151 51029140
martin.baitinger@wsp.com

Hong Kong

Joseph Wong
+852 2579 8615
joseph.wong@wsp.com

Malaysia

David Starbuck
+60 322957816
david.starbuck@wsp.com

Middle East

Ahmed Fouda
+971 50 772 1260
ahmed.fouda@wsp.com

Nordics

Eva Helena Dahl
+46 76 8343047
evahelena.dahl@wsp.com

New Zealand

Sean Myers
+64 9 918 5166
sean.myers@wsp.com

Singapore

James Pang
+65 6395 7756
james.pang@wsp.com

South Africa

Tshepo Motsie
+27 78 310-9515
tshepo.motsie@wsp.com

United Kingdom

Darren Reed
+44 20 7337 8672
darren.reed@wsp.com

Pradeep Vasudev
+44 79 2110 6744
pradeep.vasudev@wsp.com

United States

Jannet Walker-Ford
+904 540 3504
jannet.walker-ford@wsp.com

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

What if we can?

WSP Global Inc.
1600, René-Lévesque Blvd. W.
16th Floor
Montreal, Quebec
H3H 1P9

wsp.com