# COAST MERIDIAN OVERPASS PROJECT


## SNC-LAVALIN

*with:*

**B&B CONTRACTING LTD.**
**DELCAN CORPORATION**
**EBA ENGINEERING CONSULTANTS LTD.**
**FRASER RIVER PILE & DREDGE LIMITED PARTNERSHIP**
**FREYSSINET CANADA LIMITEÉ**
**GEORGE THIRD & SONS LTD.**
**INTERNATIONAL BRIDGE TECHNOLOGIES, INC.**
**LOWER MAINLAND STEEL LIMITED PARTNERSHIP**
**MANSONVILLE PLASTICS (BC) LTD**
**SHANNON WILSON, INC.**
**STANTEC**
**TRANS-WESTERN ELECTRICAL LTD.**

SNC • LAVALIN

## PROJECT HIGHLIGHTS

Prior to the construction of the Coast Meridian Overpass, the City of Port Coquitlam in British Columbia was divided by Lougheed Highway – a major arterial in Metro Vancouver – and Canadian Pacific (CP) Rail's largest active rail yard in western Canada. The City responded to this need for improved inter-city mobility and accessibility by developing a conceptual design for the Coast Meridian Overpass. Envisioned to relieve traffic congestion, unite the two sides of the city, and connect Port Coquitlam with other major regional transportation networks, the Coast Meridian Overpass was awarded as a design-build project to SNC-Lavalin Constructors (Pacific) Inc. SNC-Lavalin Constructors (Pacific) Inc. (SLCP) submitted the lowest qualifying bid, which included a design for a 580-m, hybrid twin box-girder, cable-stayed bridge with four traffic lanes and facilities for cyclists and pedestrians.

### A Unique Design

SLCP's integrated design and construction team developed a design process that synthesized construction and fabrication methods. Limited by pre-defined pier locations, access to the rail yard, and an active seismic zone, the Coast Meridian Overpass used a single line of columns and large-diameter piles to navigate these constraints. The unique cable-stayed and steel superstructure lightened the overall structure and reduced its depth by nearly 2 m. Building on the advantages of a cable-stayed design, the team used a permanent cable to minimize deflection during the longest push-launch process successfully attempted in North America.

### An Achievement in Construction

The project's major challenge was push-launching a 580-m bridge over an active rail yard. The push-launch construction method succeeded in launching six spans over the CP rail yard and one over Lougheed Highway. A hydraulic jack pushed the span structures over the south embankment on rollers.

Cable supports were carried forward to the erection scheme, where the permanent stay cable and a temporary pair of cables supported the leading edge of the launched span. The team used multiple cable adjustments during the construction process and, to minimize additional loading, placed a sliding deviator block over top of the lead pylon for the temporary cable.

### An Integrated Design-Build Team

Managing the project's major bridge and roadway construction activities required a design-build team with a solutions-oriented approach. Together with the City, SLCP implemented comprehensive traffic management, safety, public communications, and environmental plans that minimized impacts to residents and businesses, and maintained the project's overall schedule. The Coast Meridian Overpass Design-Build Project was delivered on time and on budget to the City of Port Coquitlam in March of 2010. With the Coast Meridian Overpass in place, Port Coquitlam residents enjoy greater mobility between the two sides of the city, and access to other key transportation routes, including the Mary Hill Bypass, Trans-Canada Highway No. 1, and the future Evergreen Line extension.

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# Project Description

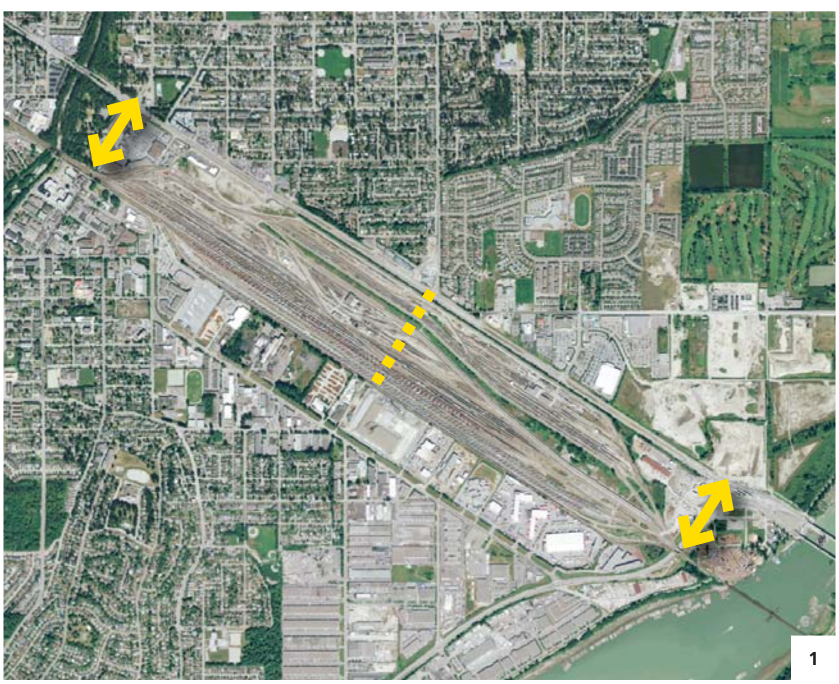
## OBJECTIVES

When the City of Port Coquitlam developed a conceptual design for a structure spanning an active Canadian Pacific (CP) Rail yard, its goals were unity and accessibility. Before the Coast Meridian Overpass, north and south Port Coquitlam was divided in two; Lougheed Highway and CP Rail's largest yard in Western Canada were sandwiched between two communities: a residential area and an industrial park. Inter-city movement was limited to two crossings to the east and west of the yard.

The concept of uniting the two sides of the city was not new. Discussions about crossing the rail yard began as early as 1913 and were re-acknowledged in regional plans in the 1980s and community and master transportation plans in the early 2000s. A third yard crossing was deemed a critical access link and necessary to improving emergency response times, promoting multi-modal transportation options, and reducing air pollution caused by idling vehicles. Nor was the City alone in realizing the benefit of an overpass. TransLink, Metro Vancouver's transportation authority, recognized that an overpass would alleviate traffic congestion on Lougheed Highway and would be a key component to the region's growing transportation network; the overpass subsequently became one of TransLink's major road priorities in its 2005-2007 plan.

To achieve these objectives, the City set an aggressive budget and schedule for the Coast Meridian Overpass, resulting in the largest civil works project the City had ever considered. Had the bids from the private sector been above the City's estimates, the project would have likely been stalled. The City also needed to negotiate an arrangement with CP Rail that would minimize impacts on their operations, despite creating only a short construction window to complete the work.

After reaching an agreement with CP Rail to facilitate construction and after finalizing a cost-sharing partnership with TransLink, the City eventually awarded the design-build contract to SNC-Lavalin Constructors (Pacific) Inc. (SLCP). As the proponent with the lowest qualifying bid, SLCP was given the complex task to design and build an overpass in and over a yard handling 3,000 to 3,500 rail cars – including the West Coast Express commuter rail – each day. As well, all major road work activities had to minimize disruption to local traffic, businesses, and residences during construction.



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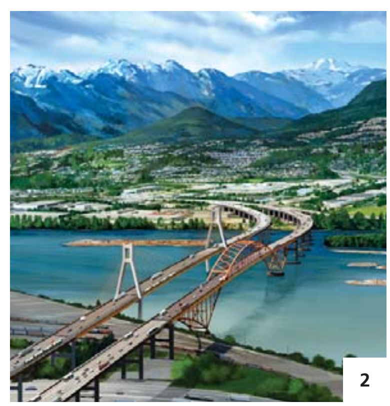

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1. *This pre-overpass aerial photo demonstrates how the rail yard divided the community, with only Shaughnessy Street and Mary Hill Bypass as access points. The dashed line indicates the location of the new overpass.*
2. *The Coast Meridian Overpass expands the road network of the city and provides another connection to the soon-to-be twinned Port Mann Bridge river crossing.*

## SOLUTIONS AND ACHIEVEMENTS

### The Challenge

The project, strong in its potential to offer lasting benefits to the City and surrounding region, came with extraordinary site, construction, and logistic challenges:

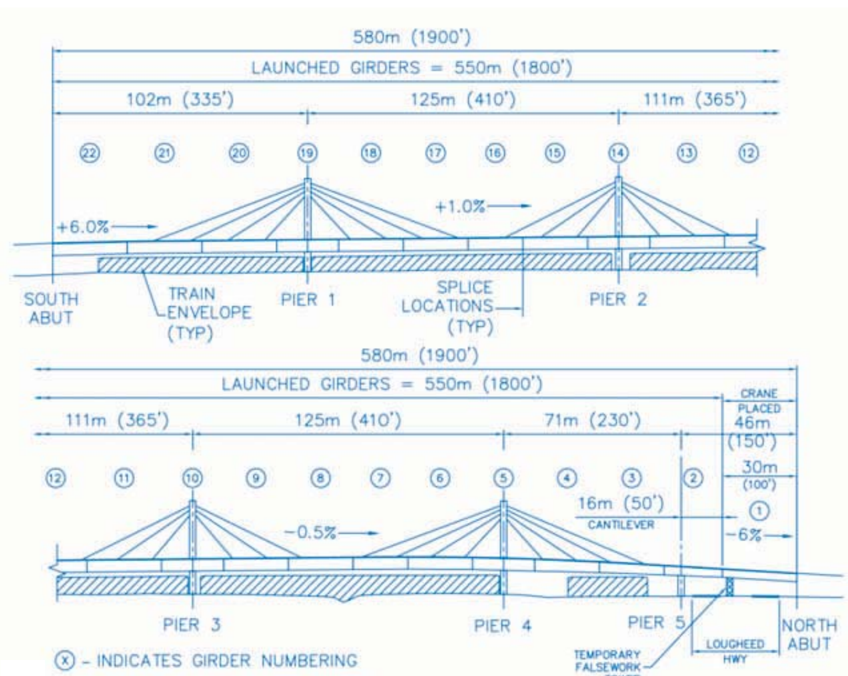
- Limited pier spacing. Because of the rail yard density and congestion with over 50 rail tracks, the locations available to place piers were limited and pre-defined. This created a long, uneven span length arrangement (approximately 102 m-125 m-110 m-125 m-72 m-46 m), which did not give the structure an optimal load distribution.
- Bending capacity. The footprint for the piers, tucked in between railcars envelopes, would only allow a single line of piers and piles, compromising the bending capacity of the bents.
- Tight vertical clearance. The project requirements stipulated a minimum vertical clearance of 7.05 m above the track top-of-rail to accommodate double stacked railcars.
- Limited site access. Due to rail yard activity, it was not possible to work from the ground or to provide temporary supports. This forced the design-build team to launch the structure. With the span layout and vertical clearance restrictions, a special structure was required.
- Soil and seismic considerations. Located in an active seismic zone, the site's soil conditions included a deep 20- to 30-metre-deep layer of soft materials with little lateral capacity.

### The Solution: A Unique, Cable-Stay Design

The bid documents included an original design concept of the Coast Meridian Overpass as a conventional, steel girder bridge with a 5-m depth, five I-girders abreast, and a composite reinforced concrete deck. But with the pre-determined pier spacing agreed upon by the City and CP Rail, the limited ground access and vertical clearance requirement, as well as the extremely limited footprint for each pier, the original design proved challenging.

During initial studies, the design-build team developed three distinct concepts. First, the base concept was refined to four I-girders instead of five. A five-girder design, under various scenarios, proved difficult to launch and required higher steel quantities. However, the team found that even four girders resulted in an impractical erection process.

Next, the design-build team considered a twin box girder concept that utilized post-tensioning on the longer spans. In order to be feasible, a launched structure requires a section with constant depth; post-tensioning would allow extra capacity over the piers, whereas a deeper section would have been present. While comparable in depth to

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*1. The fixed locations for piers created spans with different load distributions.*

the base concept from the City, this option required large structural elements and revealed logistical challenges during construction.

The third option saw a single, pre-cast, segmental, concrete box girder with extradosed cables. Constructed by an overhead truss, this bridge would eliminate the need to launch the bridge and would reduce contractor risk. This option would be shallower, with manageable structural elements during construction. However, while the overall estimated cost of this concept was competitive, the team determined that the available footprint of the pier bents could not accommodate the quantity of large diameter piles required.

These initial variations on the original design concept either resulted in difficult and complex launching methods, or fabrication, handling, and transport challenges. It was becoming clear that the final overpass design would be the longest push-launched structure in North America, and temporary stay cables would be required to minimize deflection during the eventual launch. The ultimate design needed to not only navigate in between railcar envelopes, but to also optimize construction methods.

## An Alternate Design Concept

SLCP's integrated design-build team developed a bridge design for a steel, twin box girder structure with a single plane of stay cables. The structure measured out at 580 m, with four lanes of traffic and facilities for cyclists and pedestrians. Overall, the design:

- Resulted in a shallower (by 2 m) and lighter superstructure
- Lessened steel quantities
- Lowered the bridge profile and reduced the approach lightweight fill
- Allowed the twin box girders to be launched simultaneously, thus reducing the construction schedule
- Utilized cable stays and a permanent tower to minimize deflection during the launch
- Accounted for twin level earthquakes with a 1:475 year event for the bridge to remain functional and a 1:2475 year event for collapse protection

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*1. An artist's rendering of the design solution. The Coast Meridian Overpass features bicycle and pedestrian lanes in both directions.*

This design achievement addressed the key project issues identified during the design process and lowered the overall cost. In particular, the design also exemplified how an integrated design-build team synthesized the needs of the designer, builder, and fabricator into a feasible solution.

*Superstructure*

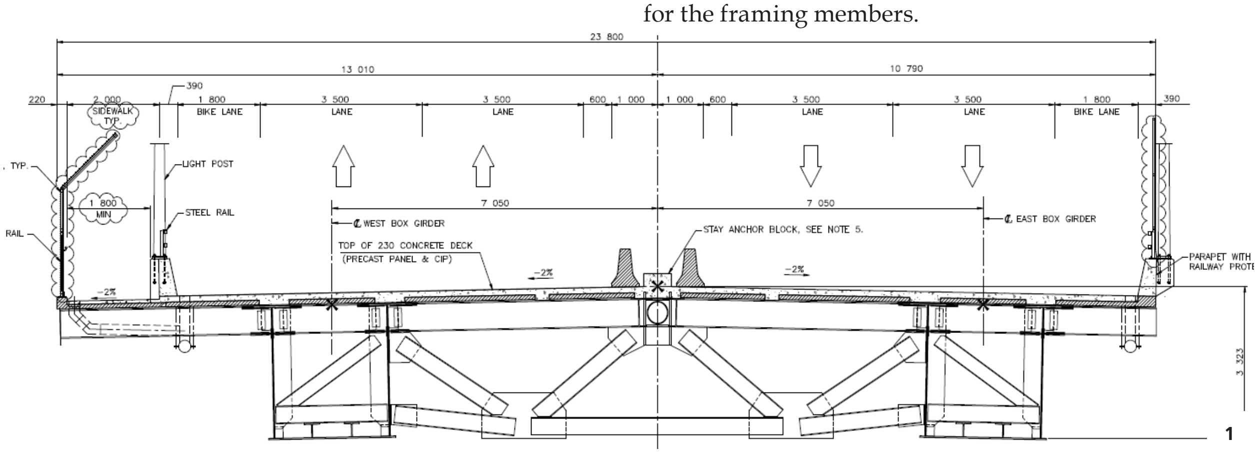
The sizing and layout of the superstructure elements were based on key governing principles. The structure would have to resist the launch loads and it would be necessary to have supplemental cable support in addition to the leading nose member. An approximately 3-m deep section was found to be optimal for the box girder.

The transverse width of the deck had three primarily lines of support: the twin box girders and the single line of stay cables. The stay cables effectively replaced a line of girders in the middle and were used to carry the load and reduce deflections. This was deemed most effective for the project, as variable depths were not considered practical for a launched structure. The stay cables helped replicate the effect of a deeper structure around the piers.

The framing system between the box girders was developed to distribute the stay forces as axial loads and avoid concentration in any one location. Diagonal bracing at each stay was designed to drag load into the box girders. The parallel twin spine beams carried most of the stay force. The remaining secondary framing members were selected to optimize the span and thickness for the concrete deck panels. This was selected as 5 m typical spacing for the transverse floor beams, with a stay support every 15 m. A stay bracing frame was developed for the stay reaction and distribution of forces to the box girders.

The design for the concrete decks utilized stay-in-place, precast, reinforced concrete panels at 110 mm thick, followed by a topping of 120-mm, reinforced, cast-in-place concrete for a total deck thickness of 230 mm. A reduced net section depth of 160 mm was used at the outer walkway.

For the vertical component of the stay force, a stay bracing frame was developed for the local stay reaction and the subsequent distribution of forces to the box girders. Double channel sections with gusset plates were used for the framing members.



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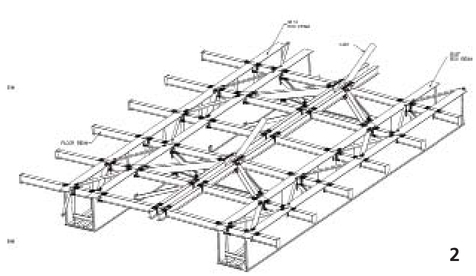
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1. *Structure cross section.*

2. *Superstructure components.*

The result of the team's governing principles and subsequent detailing was a structure capable of resisting the launch, the intermediate stressing conditions, and in-service design loads. With the basic superstructure configuration in place, the other main structural components and articulation could be finalized.

***Pylons and Stay Cables***

The pylon supporting the cables had to redirect the load of the deck into the piers and foundation. The pylons would need to be secured to the deck structure during the launch in their final design configuration.

Standard hardware components for pylon stay anchorages are usually detailed for concrete sections. However, the design team developed a detail for the stay anchorages that could accept the highly concentrated forces from the anchorages and transfer the forces to the rectangular steel box section.

The stay cables used conventional hardware and were composed of 15-mm-diameter, 7-wire strand. The number of strands per stay cable ranged from 37 for the shortest stay cable to 73 for the longest. A unique feature to the stay cable arrangement was the quantity of stay cables per pylon. Pylons 1 and 4 were given four stay cables per side, while pylons 2 and 3 featured three stay cables per side  a symmetric layout. Because the span arrangement was dictated by CP Rail, the available pier locations led to an awkward pier arrangement. To overcome this and to maintain the 15-m general stay cable spacing, an uneven layout of cables needed to be implemented.

The superstructure's pylons were made exclusively out of steel instead of concrete – an unusual option for a cable-supported bridge. Steel pylons proved more economical in light of the limited footprint at the piers and loading issues during the launch. The pylons were pre-fabricated and placed before the launch; this eliminated the need for fabrication or casting equipment in the rail yard.

***Substructure and Articulation***

Due to the single line of columns and piles for the substructure, four 2-m, octagonal, reinforced concrete piers, as well as 2-m steel piles (25-mm wall) with partial depth concrete fill, were used. The piles were approximately 30 m long. At pier 1, which had the largest tributary span width, five column/piles were used. At pier 5, which had the smallest tributary span, only two column/piles were necessary.

*1. Pylon supported cables redirected the load of the deck into the piers and the foundations.*

*2. A closer view of the pylon solution that allowed the stay cables to automatically adjust as required.*

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In addition, from a seismic perspective, twin level earthquakes were considered: a 1:475 year event for the bridge to remain functional and a 1:2475 year event for collapse protection. The 1:475 year event had a peak surface ground acceleration of 0.55 g and the 1:2475 year event had a peak surface ground acceleration of 0.68 g. Ductile detailing with high concentrations of transverse reinforcement was implemented.

The steel superstructure was a significant benefit to the substructure design for both in-service and seismic cases. Because of the lightweight structure, a reasonable arrangement of 2-m piles could be implemented. The inertial loads under the high seismic forces were also limited due to the relatively light dead loads.

The articulation of the bearings and bridge joints allowed for a continuous structure as expansion joints were only provided at the abutments. The piers in between supported the superstructure with pinned pot bearings capable of resisting the maximum seismic loads. Although the limited available space for piers was a challenge, the single-line orientation allowed for a flexible structure under thermal movements in the longitudinal direction. For this reason, sliding bearings were not required as the natural flexibility of the pile bent was utilized.

The use of box girders, with their torsional stiffness in combination with the deep framing diaphragm at the piers, only required a single bearing under each girder and pylon, greatly simplifying the detail. It also gave greater access to jacking for future replacement.

Another unique feature was the bearing underneath the pylons. A closed load path was created, as the pylon was fixed to the diaphragm and tied into the box girders via the stays. This allowed the pylon bearing to rotate at the same elevation as the box girders, and the superstructure span to behave like a continuous girder.

*Launch Detailing*

Procuring the Coast Meridian Overpass as a design-build project allowed the SLCP team to simultaneously develop design details and consider fabrication and construction issues. In order to optimize the limited pier footprints and the constricted yard access and work hours, the SLCP team developed a number of adaptations as the design progressed.

For fabrication, a number of items were identified for refinement. One feature was implementing a 2% rotation in the box girder to match the cross-fall of the deck. This maintained a constant elevation between the floor beams and the box girder top flanges, as well as simplified the connections.

Another adaptation was to maximize the number of bolted connections. Due to the amount of site assembly activities, all framing members were developed with bolted splices to eliminate shop or field welding where assembled piece would be difficult to ship due to combined size.

The launch had two major and unique features: 125-m spans that needed to be cantilevered during two of the five launches, and the superstructure profile. The superstructure had minimal slope except at either ends, where there were steep 6% transition slopes to match the relatively short approaches for the overpass. This required box girder #1 to be left off for the launches, and box girders #22 to be tapered with the 6% bridge slope on top and the 1% launch slope at the bottom.

For the launch condition, an extensive amount of effort went into combining the erection design conditions with the final design conditions of the bridge. Some examples included:

- Basing splice lengths for the box girder sections on limitations for handling weight and optimizing the construction sequence as the bridge was pushed, which resulted in 22 sections at approximately 25 m to 30 m in length.
- Increasing the size of box girder sections for lead spans. This impacted approximately one-third of the bridge length and typically resulted in the increase of a given plate thickness by 3 mm to 6 mm for the flanges. Box girder webs were only increased at the section that supported the lead (loaded) pylon.
- Adding intermediate web stiffeners to help carry the localized load of the Hillman rollers.
- Trimming splice plates on the bottom flange to avoid interference with the rollers.
- Raising diaphragm connections above the bottom flange to avoid interference with the guide restraints.
- Strengthening the diaphragm connection to the lead pylon. While supported by a bear in its final condition, the pylon was suspended during the launch, creating a flexural element. The diaphragm section was supplemented with additional plates near the mid-span connection.

A key example of integrating the erection design and final design conditions was utilizing the permanent cables to help support the structure during the launch. A total of four additional temporary cables were also used, with the same strand size as the permanent cable and 12 strands per cable. In the front span, these were splayed out to anchor at the launching nose and at a future permanent stay anchor on the back span.

As the cables were draped over the top of the pylon, a transfer mechanism was needed. The design-build team casted a deviator block, which served as a saddle and a smooth transition point for the cables. It also had a sliding capability that helped avoid transferring unequal loading into the pylon.

## Construction Over an Active Rail Yard

The project's major challenge was push-launching a 580-m bridge, as well as erecting its associated piers, over an active rail yard. Geared towards maintaining efficiency, safety, and ongoing rail yard operations, the design-build team incorporated a number of innovative approaches into its construction methodology.

### *Launch Equipment*

The superstructure of the Coast Meridian Overpass was assembled in a 220-m-long temporary assembly bed, located directly south of the south abutment. The assembly bed contained four temporary supports for each of the two box girder lines. Each support was a steel framework on an isolated concrete footing.

The steel framework was equipped with Hilman roller assemblies to support and distribute the weight of the superstructure, as well as to guide roller systems that kept the superstructure on a correct horizontal alignment during the launches. The temporary supports were spaced longitudinally at intervals of 40 m and the roller assemblies were located on the same horizontal and vertical alignment as the superstructure.

The temporary supports in the assembly bed allowed the superstructure to be erected in the "no load" condition and be immediately ready for launching. The large variability of the bridge profile required several feet of vertical adjustment available for superstructure assembly.

A number of other innovative details were implemented, including an unloading device that allowed the last girder of the launched structure to smoothly transition off of the supports to avoid a sudden drop.

Another challenge during the launch was to maintain an even support under the box girders, which are stiff and subject to concentrating loads unevenly on the roller supports. To overcome this, a support was developed with a spreader beam with a single bearing in the middle. The bearing was an elastomeric pad that allowed the spreader beam to rotate with the box girder as it deformed, keeping a nearly equal distribution between the roller supports.

Four launch cylinders (two per box girder) were each pinned at one end to the flange clamps and the other end to a frame anchored to the south abutment. After


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*1. Jacking down assembly.*

*2. Guide roller system.*

clamping against the bottom flange, the launch cylinders rams extended out 1.5 m, along with the flange clamps and superstructure.

The wedge brakes were fixed to the launch frame, and hydraulically operated with a mechanical backup. The purpose of the wedge brakes was to restrain the superstructure from motion, as the flange clamps could not be clamped to the bottom flange while the launch cylinders were retracting.

The hydraulics of the launch system operated from a self-contained unit – the launching container. The control systems, motors, and pumps within the launching container were run from a generator installed in a second container. The launch equipment was operated by a programmable logic controller (PLC) system that also continuously monitored critical systems during the launch.

The launch nose was a temporary, lightweight steel extension to the superstructure. The launch nose was custom fabricated and added to the leading end of the box girders. Designed to facilitate the superstructure's landing and transition to the upstation pier, the launch nose could also accommodate vertical and transverse loads. As the superstructure profile at the north end was at a steep 6% down-slope, a majority of the up-slope of the launch nose was to counteract the effect of the superstructure profile.

## Launch Procedure

Launching the Coast Meridian Overpass was divided into several phases. There were five alternating assembly and launching phases before the superstructure was fully assembled and launched into final position. The next phase jacked the superstructure onto the permanent bearings, and the last phase involved the crane erection of the north abutment box girders and infill steel.

***Superstructure Assembly***

The superstructure assembly activities included the installation of all components, such as box girders, pylons, floor beams, diaphragms, cross-frames, spine beams, and braces for the superstructure on the temporary supports in the assembly bed. The box girders were installed in the "no load" condition for establishing the superstructure camber during the assembly phase.

For the first assembly phase, the launch nose was installed at the leading end of the box girders, cantilevered over the CP Rail tracks. Temporary shoring towers, provided as a contingency at the request of CP Rail, were placed within the rail yard to act as temporary supports for the cantilevered launch nose.


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*1. Launching the superstructure to the each next pier required continuous monitoring of critical data.*


1. Final launching stage.

As well, the two permanent stay cables were installed at pylon 4. The four temporary stay cables were also installed overtop of pylon 4. The temporary stay cables connected ahead into the launch nose and behind into a modified permanent stay anchorage.

***Superstructure Launching***

After assembling the necessary length of superstructure needed to achieve the upstation pier, the field crews launched the superstructure upstation to the next pier. A launch was complete when the span was traversed and the launch nose was fully past the upstation pier. A cycle of the launch system normally took approximately 5 minutes with 1.5 mt advancement.

Between launch phases, the superstructure was considered as a static structure. The launch system was locked-down at the south abutment, with the wedge brakes applied to ensure that the superstructure would not move longitudinally, other than temperature-induced movement.

The rate of the launch system was about 14 m per hour. Contingency time (clearing splices past rollers, rolling off temporary supports, nose transition, crew rotation) and temporary stay cable stressing time had to be added to the launch duration, which reduced the overall launch rate.

During the launch, the superstructure was continuously monitored and tracked by survey. This information, and other pertinent data, was recorded and checked against theoretical values.

***Jacking Down the Superstructure***

After being launched into its final longitudinal position (with survey and adjustment for best fit), the superstructure was jacked down onto the permanent bearings. The bearings were then welded as per the design requirements.

The superstructure was jacked down to approximately 1.2 m at each location. A temporary sliding assembly was set between the bearings and the pier bearing plates during jack-down to allow the superstructure to freely expand or contract longitudinally while waiting for the appropriate temperature to weld the bearings to the bearing plates.

***North Abutment Superstructure Crane Installation Work***

The two box girders at the north abutment (box girder 1) were erected using a 200-ton crawler crane situated in the median of the Lougheed Highway. Heavy-duty shoring towers were preset in the median of the highway, approximately 27 m south of the north abutment. The two box girders were erected on successive nights, each sitting on the north abutment and a shoring tower. The infill steel was also placed using the crane. After the jack-down phase for the superstructure, these two box girders were jacked into correct alignment by using rams on top of the shoring towers, and then bolted splices to connect into the superstructure.

***Precast Concrete Panels Placement***

Due to limited yard access, a specially designed crane ran alongside the steel box girders on rails and placed the pre-cast panels for the concrete deck.

## Road Works, Utilities, and Traffic Management

Lougheed Highway's role as a major transportation arterial servicing both local traffic and the regional movement of people and goods needed carefully staged road works. Road works along Coast Meridian Road on the north side would unavoidably infringe upon residential yards and local businesses, and re-construction activities along Kingsway and Broadway Street on the south side would impact traffic accessing commercial areas. In total, the project reconfigured approximately 3 km of city roadway and re-constructed six intersections.

The north side road works, planned as a four-stage construction activity, reconfigured Coast Meridian Road from Lougheed Highway to St. Albert Avenue and created the new Lougheed-Meridian Connector. Coast Meridian Road included new dedicated right-turn and left-turn lanes, bike lanes, and medians. Lougheed Highway received a new eastbound left-turn lane into the Best Western hotel, and electrical and signalling infrastructure for the new Lougheed-Meridian Connector intersection.

The three-stage south side road works involved reconstructing the intersections at Broadway Street and Kingsway, and McLean Avenue and Kingsway. An additional lane and medians were added to Kingsway. SLCP also designed all the traffic signals for each intersection.

The design-build team's major utility work relocated the City's municipal watermains, the Greater Vancouver Regional District's trunk sanitary sewer and water main, BC Hydro and Telus overhead and underground facilities, BC Transmission Corporation overhead facilities, and Terasen gas pipelines.

With construction occurring right up to residential property lines and along major local and regional traffic routes, extensive traffic management plans ensured pedestrians, cyclists, transit, trucks, and motorists could pass efficiently through work zones, and that their safety, including the safety of workers and worksites, could be maintained.

During peak hours, two-way traffic was maintained on all arterial and local residential roads, and alternatives were provided where accesses were permanently or intermittently closed. The design-build team used off-peak hours to reduce traffic to one lane each way with a dedicated left-turn (in the case of Lougheed Highway) or to use single-lane alternating traffic (Bridgeman, Angelo, and Robertson Avenues). SLCP successfully maintained the existing traffic capacity for all major routes during the construction period.

## Project Management and Delivery

The Coast Meridian Overpass demanded a management team capable of quick decision making, managing numerous project stages and multidisciplinary teams, and collaborating with the City. A solutions-oriented approach allowed the team to address significant challenges, such as designing and building an overpass within and over an active rail yard and in the middle of a heavily utilized, congested roadway.

Safety for the travelling public, adjacent properties, the rail yard, and workers was a high priority for SLCP. Both freight and passenger cars passed through the CP rail yard, requiring SLCP and CP Rail to establish construction procedures that guarded against impacts to rail operations and upheld workforce safety inside the yard. These procedures were centred on transporting construction equipment and materials in and out of the yard, establishing and maintaining safe work areas, lifting and placing the more than 700 pre-cast bridge deck panels, and managing emergency situations.

Building the abutments, on-ramps, and reconfigured roads brought their own risks of negatively impacting traffic, businesses, and the residential areas located directly beside the new routes. Comprehensive traffic management plans, off-peak hour work, temporary sidewalks, and alternate transit routes were some initiatives put in place to protect the community.

This level of safety awareness for the public and for the workforces in and outside the rail yard resulted in a project completed without any lost time accidents to construction personnel, injury to the public, or incidents of falling materials.

SLCP strongly supported the City by providing timely, accurate, and transparent information, and by implementing its own communication plan alongside the City's public communications initiative. The design-build team also participated in open houses and community meetings with design boards and hand-outs. With several schools located near the project area, the team heightened awareness with school and public officials to prevent incidents during construction. This allowed the design-build team, the City, and ultimately the project, to continue to garner community-wide support.

The SLCP management structure, in combination with a quality management system certified to ISO 9001 standards, ensured that all aspects of the project were carried out methodically and to high levels of quality and safety. As such, the Coast Meridian Overpass opened to the public on time and within budget.

## Environmental, Economic and Social Sustainability, and Aesthetics

The design-build team maintained a constant sensitivity to environmental impacts, especially for a sensitive habitat along Lougheed Highway. The team expedited a trapping permit from the Ministry of Environment for the Pacific Water Shrew, a protected Species at Risk, and managed other trapping programs and vegetation and bird surveys. The team also developed key actions to protect the environment, while maintaining schedule and communication with environmental regulators.

The benefits of the Coast Meridian Overpass were always intended to be multi-faceted. Beyond extending over the rail yard and relieving a traffic problem, the overpass was envisioned as representative of environmental, economic, and social sustainability. The overpass featured bike lanes and sidewalks to encourage sustainable travel, and finally connected two sides of a city in a meaningful way. Overall mobility and emergency response times were improved, and commuters and goods were given a new option to various transportation hubs, including the Mary Hill Bypass and Trans-Canada Highway No.1.

The project not only redeveloped major roadways, but also improved the surrounding landscape. In anticipation of the increased traffic flow, acoustic fences made of attractive architectural concrete, reinforced concrete "Jersey" barriers, retaining walls, and barriers were installed to deflect vehicle noise away from residences. A neighbourhood park off Coast Meridian Road and numerous plantings were other project-related aesthetic initiatives.

Most importantly, the Coast Meridian Overpass's evolution from a weighty, standard I-girder design to an elegant and streamlined structure, presented the City of Port Coquitlam with an unexpected landmark and an aesthetically pleasing gateway between the two sides of the city.

*1. The opened overpass provides a much needed connection for the community.*

*2. Thousands of residents and business owners attended the Coast Meridian Overpass Grand Opening.*