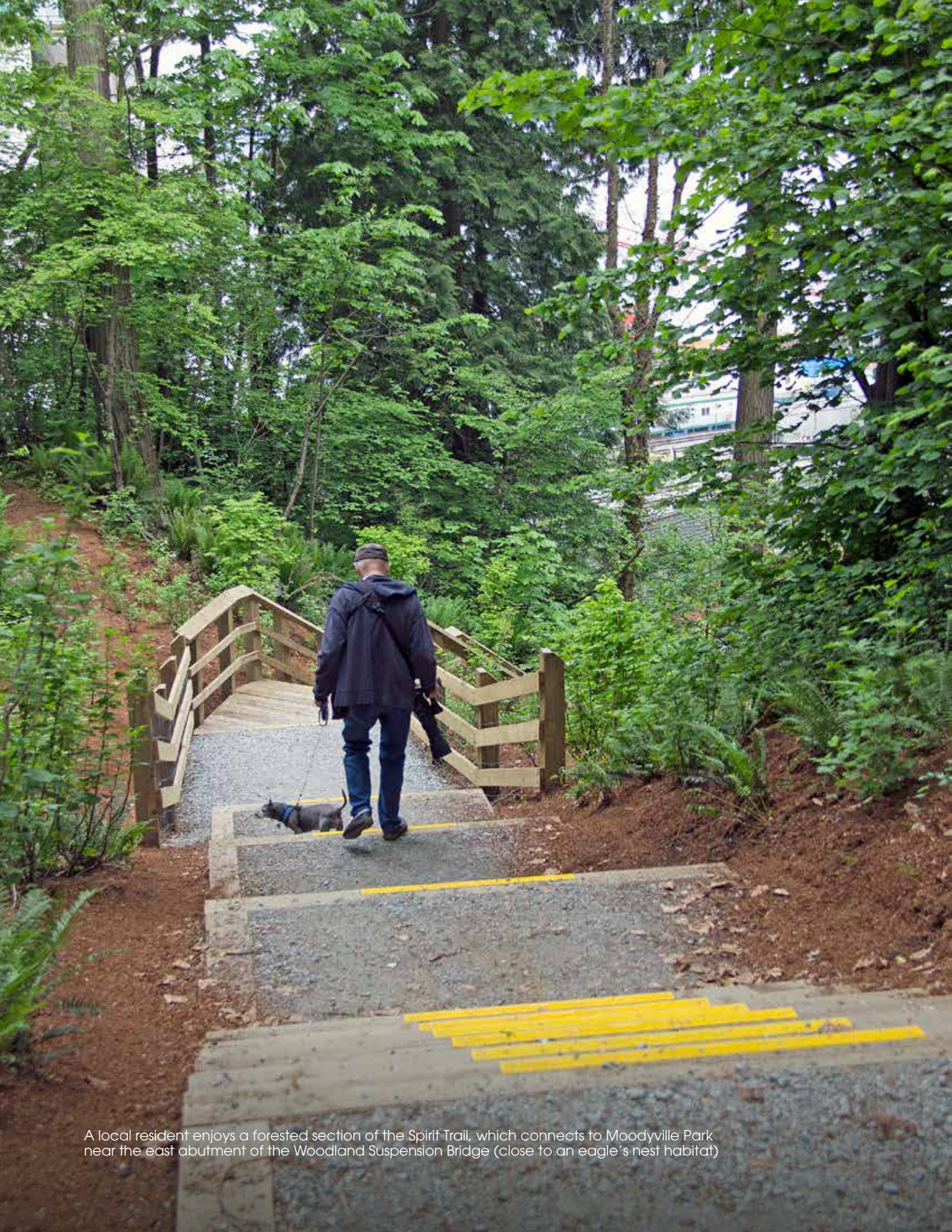


Low Level Road Project

Canadian Consulting Engineers Award
2016





A local resident enjoys a forested section of the Spirit Trail, which connects to Moodyville Park near the east abutment of the Woodland Suspension Bridge (close to an eagle's nest habitat)

What's inside

Confirmation Receipt	v
Entry Consent Form	xi
Full Project Description.....	1
75-Word Project Summary	1
<i>Project Highlights</i>	<i>3</i>
<i>Innovation.....</i>	<i>3</i>
<i>Complexity.....</i>	<i>6</i>
<i>Social/economic benefits.....</i>	<i>7</i>
<i>Environmental benefits.....</i>	<i>8</i>
<i>Meeting client's needs.....</i>	<i>9</i>

“We are really pleased to see that these finishing touches to the Spirit Trail and the Public Art will be soon up for our enjoyment. It is really great that these extra touches are part of the plan to complement the work that is being done. It all helps to enrich our lives.”

Trails BC



A multi-use section of the Spirit Trail, connecting community members to businesses at the west end of the project site

The Spirit Trail Overpass connects key segments of the Spirit Trail for pedestrians/cyclists along the North Shore





Spirit Trail rustic pathway connection between the Woodland Bridges



Retaining wall construction in progress along the Low Level Road corridor

Full Project Description

75-Word Project Summary

Port of Vancouver and City of North Vancouver's Low Level Road Project is a road/rail re-alignment and overpass project, designed by Stantec to address growing neighbourhood safety, traffic, and railway concerns. The project supports economic growth through expanded port terminals, and improves life quality through enhanced mobility, active transportation connections, and noise mitigation. As a sustainable solution for the community, it is the first transportation project in North America to achieve ISI Envision Platinum Certification.



St. Andrews intersection near the businesses at the west end of the project site



Kennard Ave intersection, which is an at-grade diverging diamond near the east end of the project site

“I’ve had a great deal of interaction with the City, the Port, and the engineers regarding this project, and I must say that everyone deserves full marks for their professionalism and dedication to the project.”

Local North Shore Resident

Project Highlights

Innovation

The Low Level Road project involved the elevation, realignment, and widening of approximately 2.5 km of roadway, improving rail infrastructure, slope stability, community connections, and safety. Construction included multiple retaining walls totaling over 30,000 m², a vehicle overpass, over 2 km of Spirit Trail, multiple noise walls, 4.4 km of cyclist lanes, street lighting, utility relocations, and three pedestrian bridges. The following are highlighted examples of how innovation was incorporated in to the detailed design for each engineering discipline involved:



Roadway/Geometrics Design

- Optimized road and pathway horizontal alignment to maintain the green buffer zone between the community, roadway, and port terminals.
- Road alignment elevation to mitigate noise, view impacts, landslides, and accommodate dedicated bicycle lanes.
- Diverging diamond, at-grade signalized intersection to accommodate lower noise, reduce emissions, and improve safety.
- Geometric design of retaining walls, which maintain railway clearances by integrating wall notches to inset vertical insulated watermain lines.



Rail Design

- Consideration of construction sequencing in all rail track relocation designs, ensuring uninterrupted CN service and eliminating the expense of temporary detour tracks.
- New grade separation design allowing maintenance access to the tracks, enhancing safety and efficiency, and replacing original tracks which ran a few feet from the roadway.
- Expansion of two CN tracks that store up to 12,000 ft of train per track.



Geotechnical Design

- Alternative retaining wall configuration, identified in value engineering, saving approximately \$14.5 million in construction costs and efficiency during installation.
- Reuse of native material and optimized soil excavation volume for MSE wall construction by using uneven soil reinforcement lengths (trapezoidal walls).



Artwork displays were incorporated into the retaining walls at two locations along the corridor to recognize the First Nations (Coast Salish) cultural significance in the area, as well as the history of Moodyville and the working Port



Aerial photograph of completed project



Spirit Trail Woodland Suspension Bridge



Spirit Trail Overpass



Neptune/Cargill Overpass



Bridge Design

- **Spirit Trail Woodland Suspension Bridge:** a context-sensitive superstructure that blends in to the surrounding vegetated environment and creates a rustic pedestrian experience.
- **Spirit Trail Overpass:** a tilted steel tied arch superstructure, selected to optimize structural depth, which minimizes approach pathway embankment costs. An aesthetically-pleasing landmark in the community, the 42 m single span crossing accommodates future road widening for additional transit facilities, and provides improved pedestrian/bicycle connectivity in the area.
- **Neptune/Cargill Overpass:** a flared, two-span steel girder vehicle bridge that features integral support design (no joints or bearings) to minimize future maintenance costs. An integrated pier wall and railway crash wall accommodate the two span configurations within the existing railyard and the south abutment allows future expansion of the terminal.



Electrical Design

- LED lighting uses a fraction of the power required for conventional lighting, allowing minimal service requirements without sacrificing lighting quality.



The Neptune Cargill overpass eliminated three at-grade crossings, significantly reducing train whistle noise in the community and improving traffic safety and efficiency.

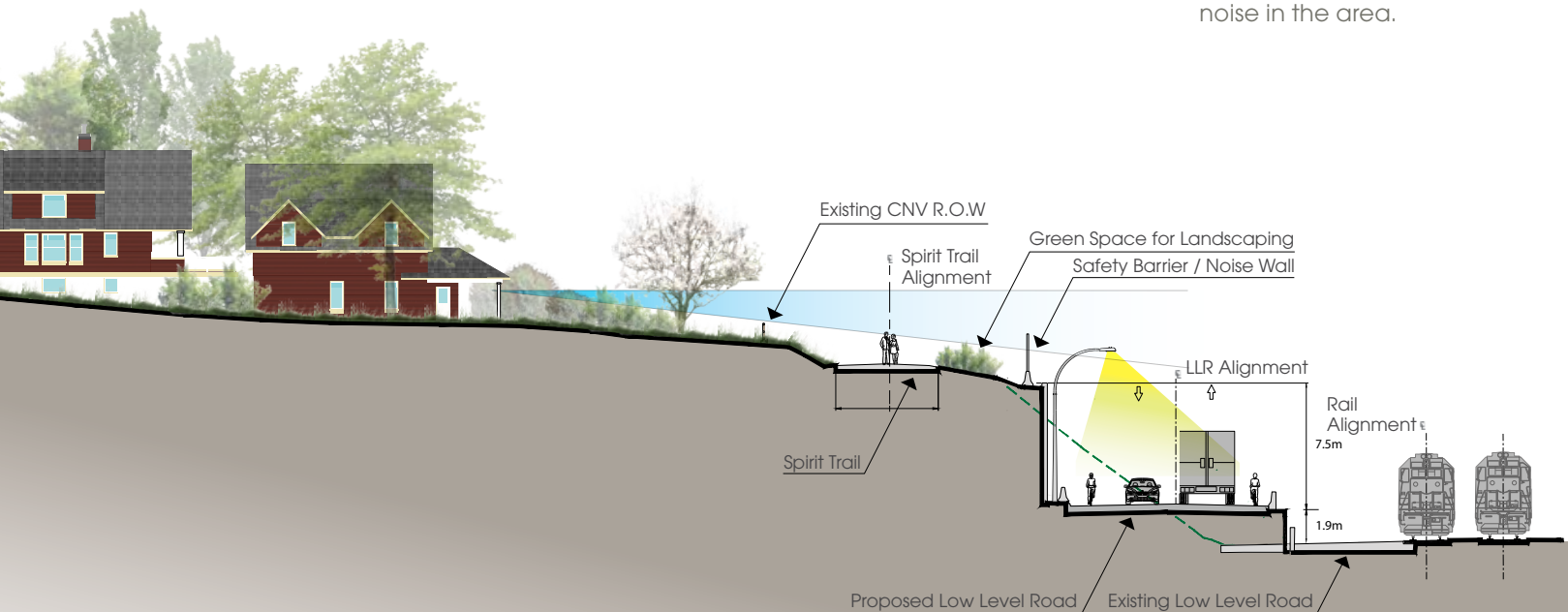
Complexity

Stantec's design team developed cost-effective and innovative solutions to the various constraints and challenges facing the design and construction of the project, including:

- Conducting a robust stakeholder engagement program to meet the needs of the community, while still achieving strategic objectives for infrastructure improvements; this required multiple design iterations under difficult timeframes to meet schedule demands.
- Elimination of three at-grade rail crossings (port access points) and installation of a new grade separated vehicular overpass, which required staged construction to avoid impacts to port operations.
- Implementation of a multi-tier, grade separated retaining wall system, with different wall types required, along existing unstable slope conditions in a climate that has an extended rainy season.
- Geometric design challenges in achieving horizontal railway clearances along the entire corridor due to limited real estate available.
- Mitigating seismic hazards for all structures supporting the traveling public, including localized areas of liquefiable and laterally spreading soil conditions.
- Protecting environmentally sensitive areas (i.e. eagle's nest tree habitat in Moodyville Park directly adjacent to the new Spirit Trail Woodland Suspension Bridge), mitigating visual, noise, and dust impacts to residents, and avoiding/minimizing impacts to two non-fish-bearing watercourses.
- Maintaining access to residential streets, driveways, emergency routes, and local businesses which required new parking facilities, within limited right of way.
- Integration of vehicular, pedestrian, and cyclist traffic to be compatible with existing and planned pathways.
- Upgrading existing intersections to address safety issues such as stopping sight distance within a constrained corridor.



Noise walls were included in the design to minimize noise in the area.



2012 Public Consultation View Impact Assessment

Social/economic benefits

The successful completion of the project relied not only on technical innovation and excellence, but it also required a full understanding of the economic and social impacts on surrounding communities.

Through the ISI Envision® infrastructure rating system, the sustainability of the project was measured based on 60 criteria across five categories according to the positive social, economic, and environmental impacts in the community. By virtue of receiving the highest possible certification level (Platinum), this project has demonstrated restorative features which will highly benefit society for many years.

With increased rail and port capacity, Low Level Road enhances safety and permits more-efficient rail operations to accommodate anticipated trade, rail and traffic growth and terminal expansion projects planned for the North Shore. The project supports 5,000 jobs and annually contributes more than \$10 million CAD in municipal taxes and \$7.9 billion CAD to British Columbia's gross domestic product.

Port of Vancouver awarded contracts with significant financial value to First Nations communities. Focused on cultural and historical preservation, thorough investigations of the site were conducted to locate potential First Nations heritage artifacts. During public consultation, a preference for public art themes including Coast Salish, history of Moodyville, and the working Port were indicated, all of which have been successfully incorporated in to the project with three custom art displays along the corridor.

Quality of life has also been improved through decreased traffic congestion, reduced noise pollution, improved multi-modal connectivity, enhanced safety, and more opportunity for active transportation rather than single-occupancy driving.

The North Shore Trade Area
is estimated to generate

\$10.5B

direct and indirect GDP

5,000

North Shore Jobs

The Low Level Road Project
will support an estimated

30-50%

growth in the North Shore
Trade Area

Neptune/Cargill Overpass (the above referenced figures are based on 2013 estimates)



7,859

shrubs planted

2,258

ferns planted
along corridor

696

trees planted

120m

transparent noise walls
custom made in Austria

Green walls along St. Andrews Ave help scatter noise more than smooth concrete walls

Environmental benefits

The Low Level Road project has made a conscious effort to design with the community and environment in mind. Using the Institute for Sustainable Infrastructure's (ISI) Envision™ Sustainable Infrastructure Framework/Rating System, the project was named the first ever transportation project in North America to achieve the ISI Envision Platinum certification. Using the Envision framework, the project clearly demonstrates its overall contribution to sustainability in five categories: community quality of life, sustainability leadership, resource allocation, natural world, and climate and risks.

Environmental Impact Assessments were conducted by Port of Vancouver to identify sensitive areas along the corridor, including protection of creek corridors and Bald Eagle habitat which required innovative construction sequencing. At the end of construction, eaglets were seen at the top of the undisturbed trees and multiple sightings of adult eagles have been reported in the vicinity. Two artificial eagle nests were also installed off site along the North Shore as habitat compensation. In addition, active elimination of invasive species on site will contribute to the environmental and social well-being of the local community.

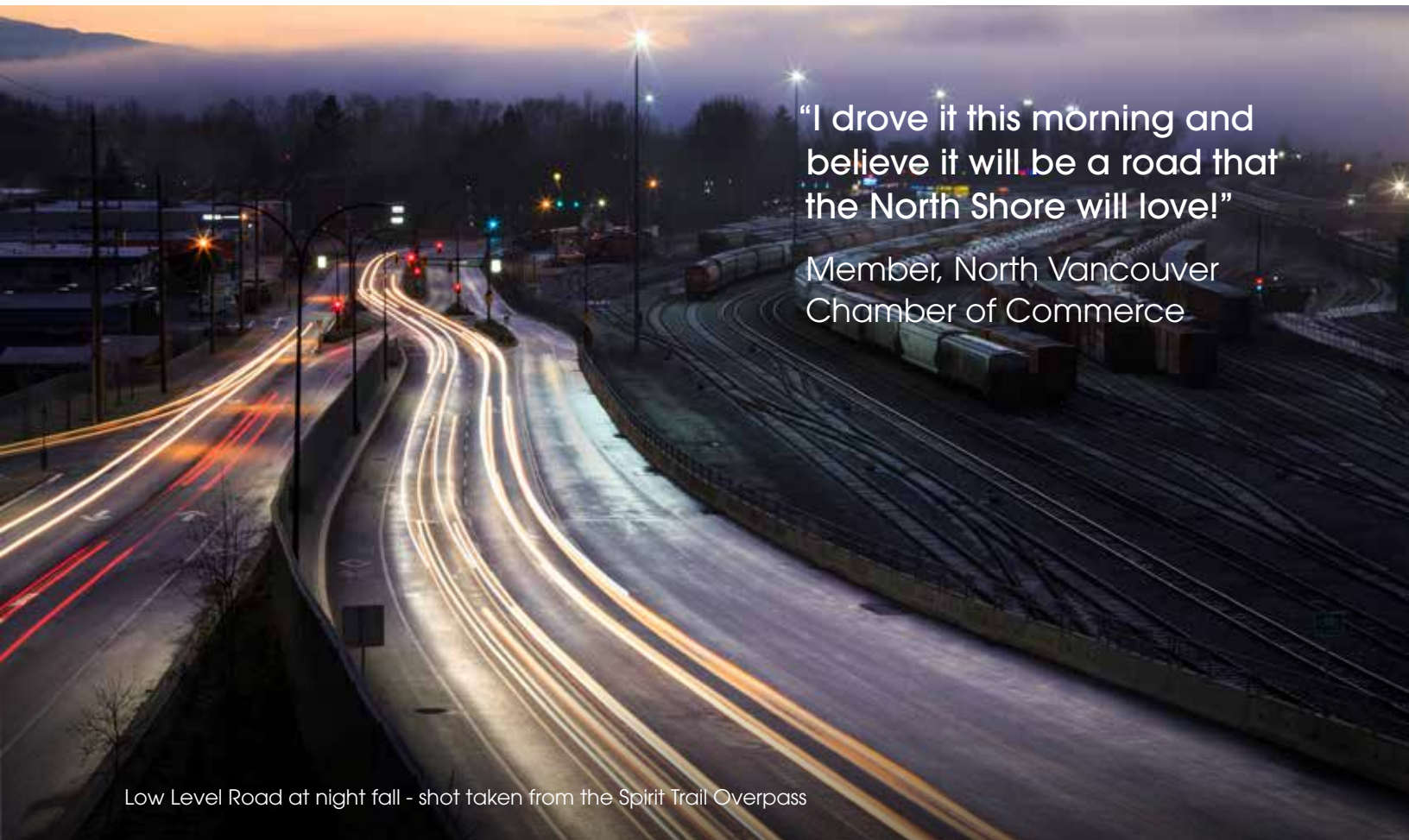
The misaligned roadway was observed to be vulnerable to rock falls, landslides, and expected impacts of seismic events (liquefiable soils, unstable slopes, etc.) and predicted sea level rise. These hazards were mitigated through slope stabilization, seismic design, and realignment of the roadway to a higher elevation (above sea level rise) to ensure the integrity of the road over a 200-year time horizon.

In total, approximately 95% of all project components are local and recyclable/reusable materials.

Meeting client's needs

The project has evolved from its initial conceptual design in 2011. Port of Vancouver and its delivery partners conducted a thorough and responsive stakeholder engagement program, incorporating requests, comments, and feedback from a variety of different stakeholders to strengthen the final design. The project design plan was refined through a public consultation process involving residents, business, and staff at the City of North Vancouver to develop a design that takes into consideration local residents and fulfills the community's best interests. Road elevation, view impacts, noise walls, aesthetics, landscaping, and integration with community development were addressed. During public consultations, a preference for public art themes including First Nations (Coast Salish), the history of

Moodyville, and the working Port were indicated; all of which have been successfully incorporated in to the project with custom-made precast concrete art panels at two key locations along the project corridor, as well as an art exhibit positioned near the business parking area at the west end of the project. With construction completion in March 2015, the finished product demonstrates the commitment of the port and its partners to sustainable infrastructure growth throughout the expanding trade areas in the Lower Mainland region. The \$101.6 million infrastructure investment was successfully delivered on time and within budget, including an accelerated detailed design phase in order to meet overall project schedule which was driven by funding deadlines.



"I drove it this morning and believe it will be a road that the North Shore will love!"

Member, North Vancouver Chamber of Commerce

Low Level Road at night fall - shot taken from the Spirit Trail Overpass