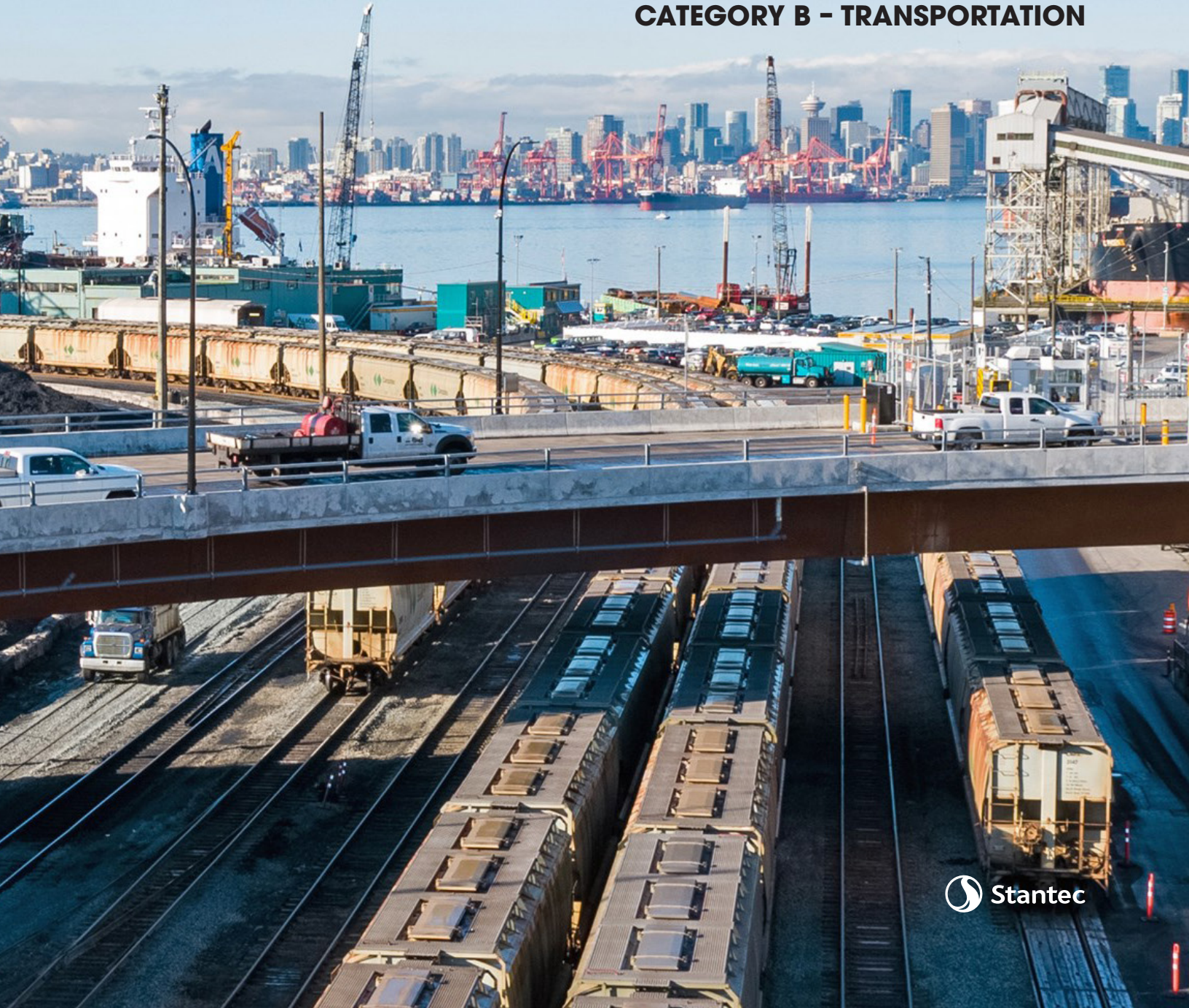
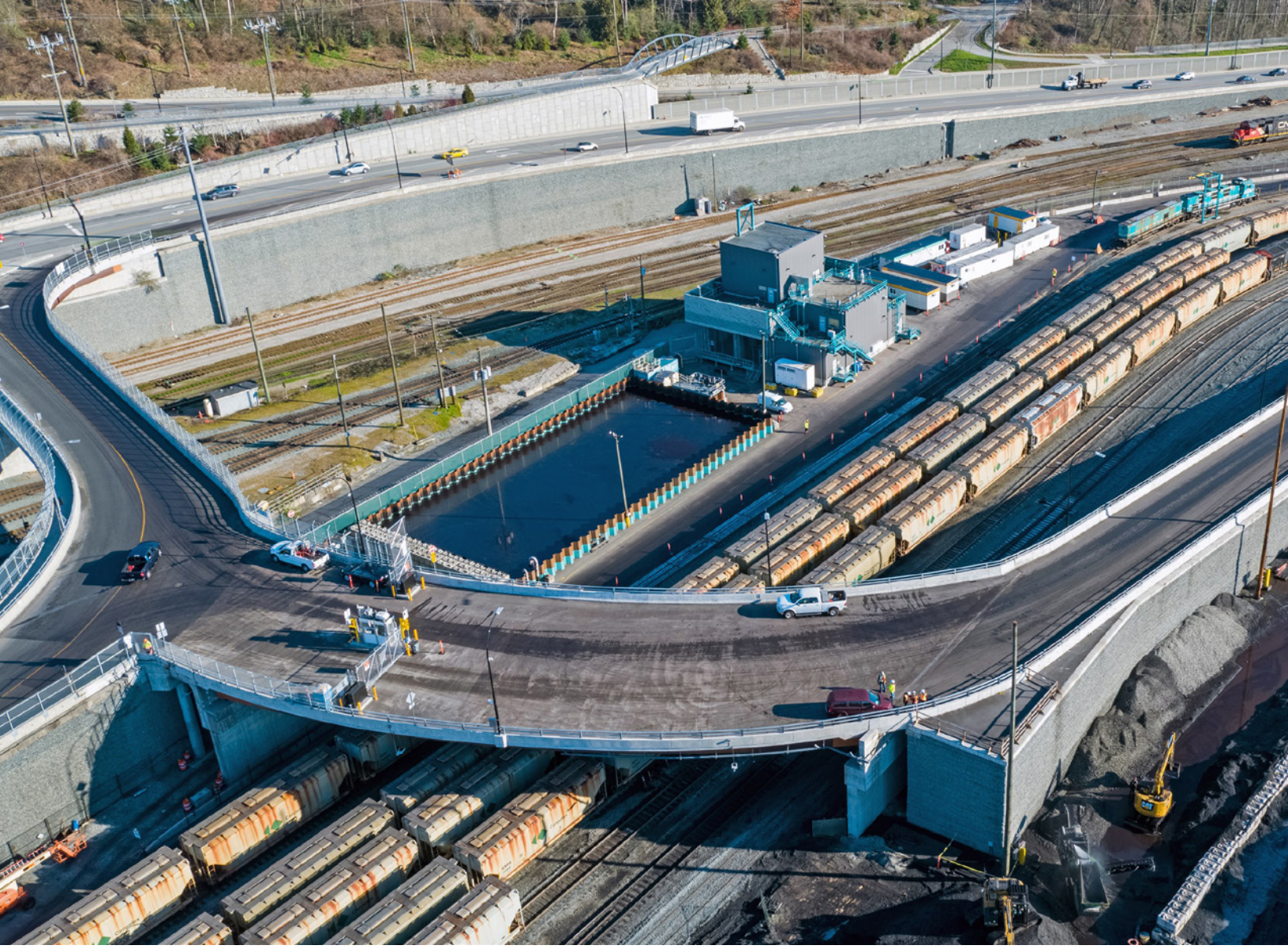
CANADIAN CONSULTING ENGINEERING AWARDS 2021

# Neptune Terminals Overpass Extension

## CATEGORY B – TRANSPORTATION



Stantec



# Project Summary

The Neptune Bulk Terminals in North Vancouver plays an integral role in connecting the Canadian economy with overseas markets by transporting 30 million tonnes of products annually. To create safer, more efficient access to the coal pit, a permanent bridge crossing needed to be built — and that's where Stantec came in.

In 2019, we were approached by Teck Resources to provide concept and detailed design, tendering, CCA and post-construction services for the overpass extension.

# Project Highlights

## **Q1** INNOVATION

The Neptune Terminals Overpass Extension consists of an overpass structure on a curved alignment and a mechanically stabilized earth (MSE) wall embankment, taking the road to grade within the terminal. In close collaboration with the port authority, contractor, terminal operators, and their stakeholders, utilizing a conventional Design-Bid-Build model, our team provided design engineering and construction support services.

Numerous configurations of bridges and approach ramps were investigated to address the complex span requirements and the available footprint within the coal stockpile area.

We proposed a two-span structure that would allow for efficient integration with the existing overpass while satisfying rail operator requirements for lateral and vertical clearances. The longer main span over the access road and rail tracks comprised curved steel box girders composite with a concrete deck, while the smaller jump span comprised a reinforced concrete slab monolithic with the supporting piers. MSE wall embankments supported the approach ramp leading to the coal stockpile area and other terminal facilities. The bridge alignment was developed on a very tight curve as the existing overpass was oriented almost 90 degrees to the proposed approach ramp. The bridge was located in a highly constrained area and had to provide adequate turning radii of industrial vehicles, custom security kiosk features on deck, all while avoiding conflicts to critical terminal infrastructure.

To achieve this, the main span used trapezoidal boxes which provide excellent versatility for varying, high skews and curved alignments. The girders spanned 56 metres with a skew of 10 degrees at the settlement pond end and 59 degrees at the MSE embankment end. Innovative construction methods were implemented to minimize port and rail disruptions: Using accelerated bridge construction techniques, the main span was successfully installed within approximately 90 minutes.

The smaller end span required our design team to address several constraints, including varied span length, complex horizontal geometrics, and tie-in with the approach embankment structure. A slab-type superstructure also provided an optimal vertical clearance required for this location.

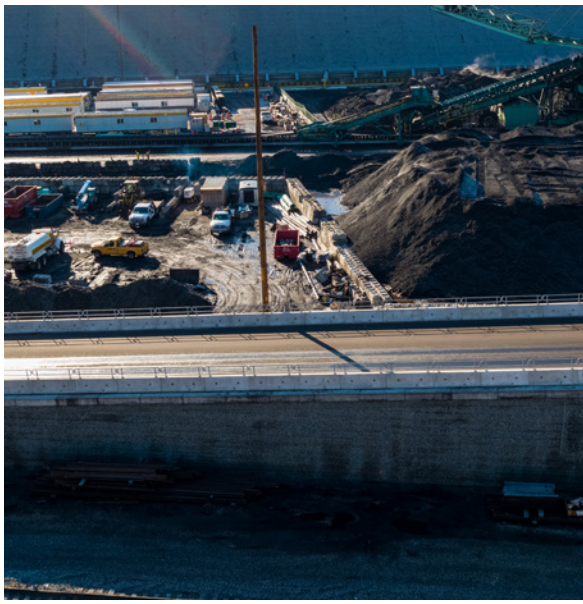
Throughout construction, port facilities were fully operational, which required exhaustive traffic control measures together with careful logistics planning and sequencing. The Stantec Engineering team developed construction staging analyses models and provided steel detailing to allow for efficient girder transportation and erection. Stantec worked closely with the Contractor to ensure stability of the skewed girders throughout the process.

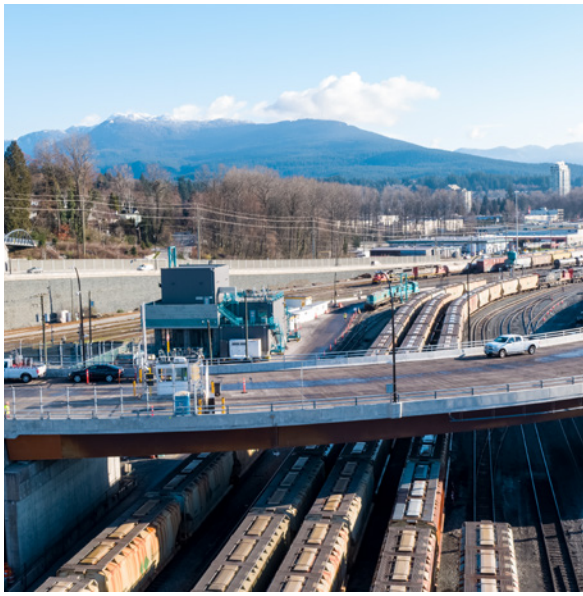
## **Q2** COMPLEXITY

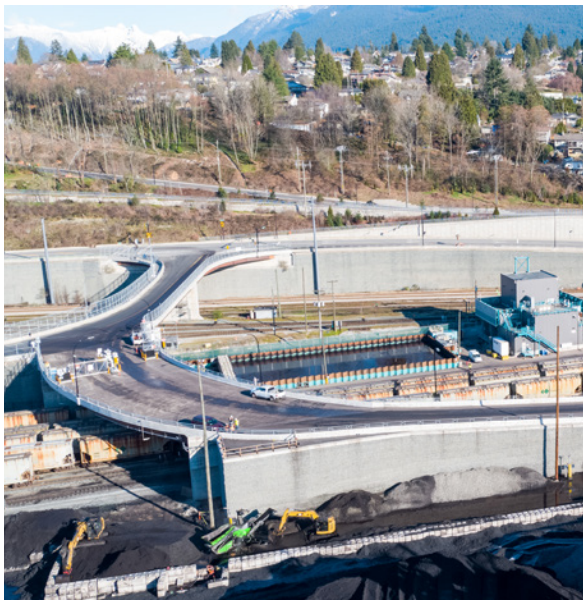
Seamless integration with the existing Neptune/Cargill Overpass was achieved through careful consideration of the site constraints and innovative use of design elements to accommodate the small curve radius and a tight alignment.

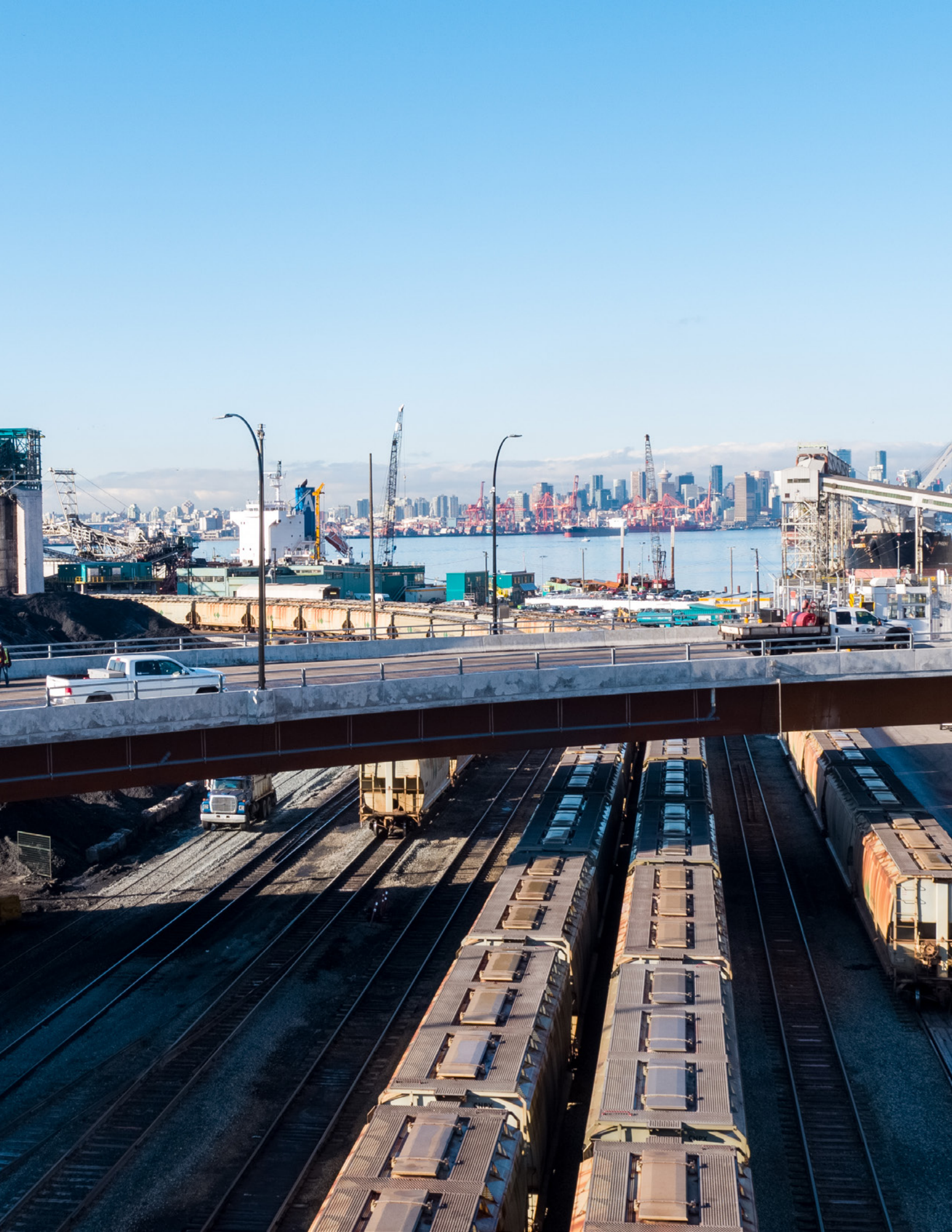
The design also required close collaboration of various engineering disciplines, particularly structural and geotechnical engineering specialists. The project design was refined through multiple iterations of engagement with the terminal operator and stakeholders to maximize efficiency of this important link in the regional supply chain. Key design and construction challenges, along with Stantec's innovative approach to mitigating these challenges, included:

- Tackling headroom limitations due to existing grades and planned future modifications using a skewed, curved alignment and structure types to accommodate complex geometry
- Tying into the existing MSE wall interface using cast-in-place construction to accommodate the curved wall geometry
- Ensuring stability of piling immediately adjacent to the existing MSE wall through wall stability assessments and pile selection
- Optimizing pier locations for an already severely congested facility
- Minimizing the footprint occupied by the MSE embankment in the coal stockpile area
- Providing a design that could be quickly erected with limited or no impact to terminal operations
- Addressing laterally spreading and liquefiable soil conditions, in one of the highest seismic risk zones in the nation, through iterative analyses methods to characterize the soil-structure interaction
- Providing customized security gates and kiosk components that are easily removed or modified to accommodate future access requirements
- Modifications to the existing settlement pond to accommodate the extension structure










## **Q3** SOCIAL AND/OR ECONOMIC BENEFITS

The new overpass extension enhances the efficiency and security of the port operations by providing safer, more direct access to the main working areas of the terminal. Its completion represents the initial phase of the Allison Project, an expansion of the existing coal export facilities at the Neptune Bulk Terminals. Terminal access provided by the new overpass is instrumental for the construction of other critical infrastructure included within the scope of the Allison Project. Once complete, these infrastructure improvements are expected to foster a sustained, economic growth planned for the local Lower Mainland region and extending across Canada. The increase to the terminal's capacity will indirectly benefit the nation's Gross Domestic Product (GDP) and spur the creation of new jobs within supporting industries.

Economic benefits were also realized during the construction of the overpass. The project engaged a local, BC-based Contractor, resulting in increased employment opportunities and resource utilization within the community. The project's overall carbon footprint also benefitted from the use of local labour by reducing commute times and transport of construction materials to the site.

A comprehensive noise study was conducted as part of the design process to quantitatively assess the impact of construction activities on noise levels within the adjacent residential neighborhoods. Baseline noise levels were established and during construction, noise levels were collected and compared with 24-hour noise sampling locations set up throughout the community.

## **Q4** ENVIRONMENTAL BENEFITS

Stantec's Environmental Services team has been involved throughout the terminal expansion, including one year of in-water work to study, assess, and monitor marine life and vegetation. We monitored marine mammals and salmon movements, evaluated marine noise, and dived to establish the marine life living underwater. The project team leveraged this experience to guide the design of a bubble curtain used during the pile driving operation to mitigate impact to fish.

A comprehensive Construction Environmental Management Plan was developed and to confirm its successful implementation, construction was monitored by a collaborative team of local First Nations and technical specialists. An archaeological team was also included during ground disturbing works in areas with archaeological potential.

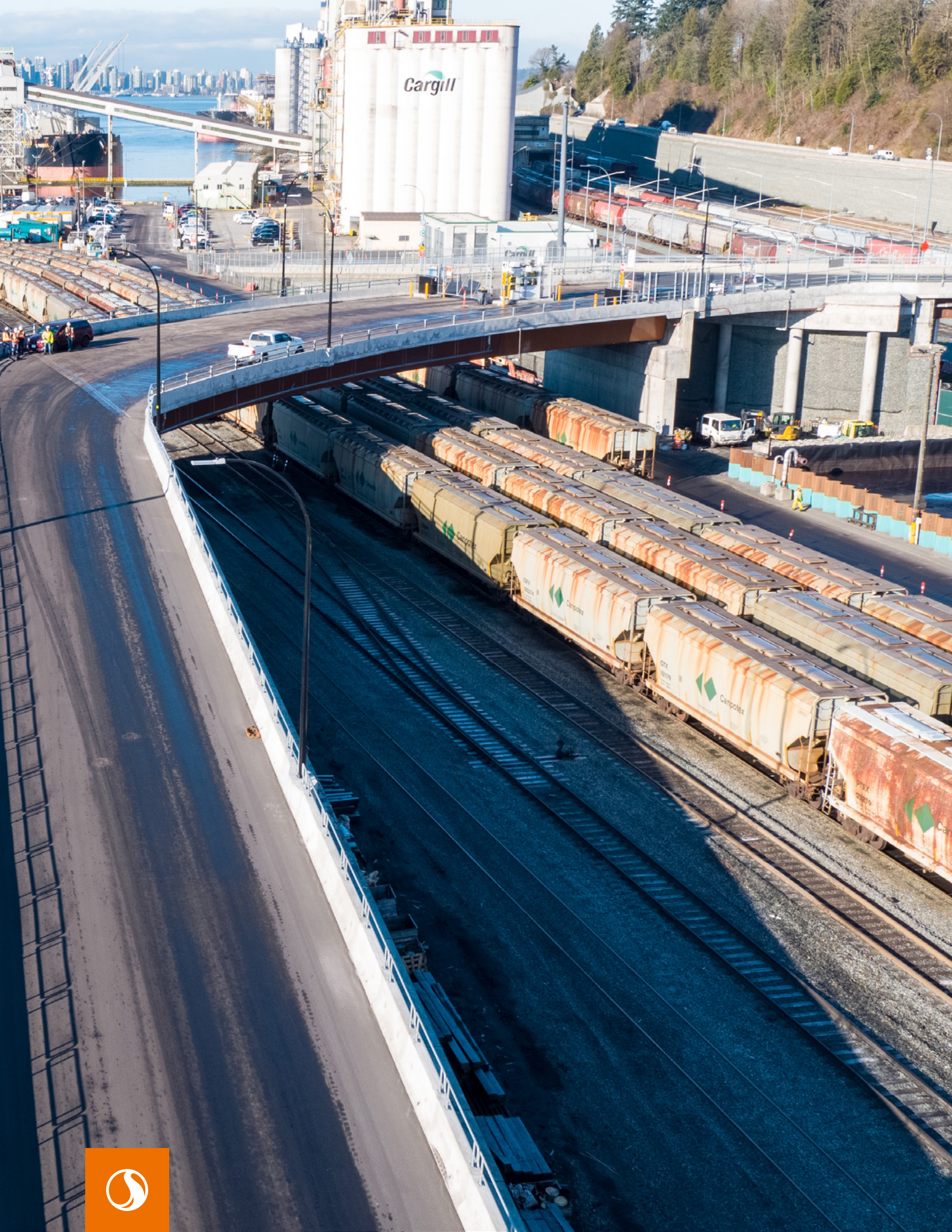
Stormwater treatment on the terminal is very complex as all surface water runoff on the overpass requires higher levels of treatment due to bulk material handling. Specific dust management protocols were deployed and monitored to ensure dust from raw materials was not being tracked offsite.

An earthworks tracking system was deployed during construction to monitor and confirm that vehicle loads being removed offsite disposed of waste material at an appropriate facility. We also utilized a non-road diesel machinery emissions program that included frequent sampling of equipment emissions to determine if the opacity was within the accepted thresholds.

## **Q5** MEETING CLIENT'S NEEDS

The Stantec Team worked collaboratively with the terminal operator and its stakeholders to establish a comprehensive and innovative bridge solution, achieving expansion targets, improving safety, and minimizing the impact of construction activities on day-to-day port operations. Identified below are the key goals of the Project and the solutions that have been developed to address them:

- Seamless integration into existing infrastructure achieved through careful conceptual design development and the use of appropriate structure configurations
- Allowances for future port expansion and modifications through modular, easily removable security components installed on deck
- Minimal impact to port operations during construction achieved through comprehensive traffic management planning, close collaboration between the contractor and engineering teams, and the use of innovative accelerated bridge construction techniques
- Minimal disturbance to sensitive or restricted areas of the site by maintaining close communication with terminal operators throughout construction and carefully staging construction staging areas
- Improved safety and accessibility at the crossing, which allows for heavy trucks to bypass congested corridors within the terminal
- Reduced maintenance requirements during the structure's life cycle achieved through the selection of weathering steel and stainless-steel components and elimination of expansion joints at the short span
- Mitigate the risks of liquefaction and meet the criteria for seismic design through innovative site preparation techniques such as Rapid Impact Compaction (RIC) and slope stability analyses
- Meet or exceed environmental protection requirements through monitoring activities and innovative measures such as protective bubble curtains, dust management and earthwork tracking


Cargill