SURREY
Serpentine Railway Bridge replacement
By Esther Lambert

Source: City of Surrey
THE SCIENCE

Increasingly severe weather poses a threat to railway infrastructure, its users, and the surrounding environment. While railway bridges, like the Serpentine Railway Bridge in Surrey, are used primarily to facilitate the movement of people and goods, they may also form part of the overall flood control infrastructure system, which includes such features as spillways and dykes. As such, their proper functioning and ability to withstand climate change is crucial in ensuring transportation safety, reduced likelihood of flooding in surrounding regions, and protection of agriculture and other ecosystem services.

THE TRIGGER

Located in Surrey’s extensive floodplain, the railway bridge would often have to be shut down whenever significant rainfall was expected to cause flooding. The risk of infrastructure failure was high due to the age of the structure and increased flood occurrences. The replacement of the Serpentine Railway Bridge with a more climate-resilient crossing was planned to ensure the safe movement of approximately $190 million of freight typically transported along the railway annually. The new crossing also completes the City’s flood control system, which protects agricultural lands, homes, utility corridors, roads, and highways.

The decision by the City of Surrey to replace the Serpentine Railway Bridge was preceded by the implementation of an ambitious program in 1997, to address lowland flooding in the floodplains of the Serpentine and Nicomekl Rivers. The goal was to control flooding within these floodplains and to support and promote agricultural activities. This flood control drive resulted in improvements of the dyking system. Since then, the City has worked with regulators and partners to implement 17 drainage pump stations, 20 km of ditches, and to replace bridge crossings.

THE APPROACH

A study identified the Serpentine Railway Bridge, owned by the Southern Railway of British Columbia Ltd., as a bottleneck that was negatively impacting the City’s efforts at the long-term management of the floodplain. It was a 58-year-old timber railway bridge prone to damage and overtopping. The City used climate models based on future scenarios for sea-level rise and increased precipitation to determine the impact on the bridge, which justified the need for a bridge replacement.

As the asset owners, Southern Railway also had a major interest in the project, having experienced significant economic losses due to the washing out of railway assets. With funding from the federal government’s Disaster Mitigation and Adaptation Fund ($750,000) and Southern Railway of British Columbia ($1 million), the City was able to start bridge replacement work in 2019. It was the first of 13 coastal
flood adaptation projects made possible through the Adaptation Fund and guided by Surrey’s Coastal Flood Adaptation Strategy.

A collaborative approach between the City of Surrey and Southern Railway was taken to address a problem that was affecting both. The design of the new crossing was based on climate modelling assuming one-meter sea-level rise by 2100, as recommended by the Province of British Columbia. Southern Railway led the development of the design, and the City consultant reviewed the design to ensure it met their standards. All this groundwork coupled with the Coastal Flood Adaptation Strategy as a guiding policy document enabled the City to develop a strong funding application. Residents were also engaged and informed of how construction activities would affect them. The new bridge was completed three months after shutting down the old bridge, resulting in a relatively short interruption of activity in the area.

One of the biggest challenges faced by the City was to get buy-in from Southern Railway in a timely fashion. Initially, the organization was also considering an alternative approach of repairing the existing bridge by replacing the damaged timber. Hence, the City needed to consider not only its interests but that of its private-sector partner, so that both their goals were being addressed.

**THE OUTCOME**

As the first completed project of 13 projects under the City’s DMAF program, this
The new design took into consideration the one-meter sea-level rise projection for 2100. Due to limits on slope angles for freight railway lines, the new crossing was built at the same elevation as the previous infrastructure, with a flood-safe design that allows it to be submerged during high water levels, while avoiding flooding of the railway itself. Concrete walls on both sides protect the track from flooding. The new design also discourages debris build up and includes a walkway to ensure the safety of workers. The redesign subsequently allowed the City to integrate and upgrade its surrounding dyking infrastructure and address the weak spot in its flood control system.

While long-term monitoring has not yet been done, debris accumulation is now non-existent, and there has been no interruptions of rail service since the construction was completed. Monitoring mechanisms have been put in place by the City to observe impacts of projected climate changes, while Southern Railway maintains the new crossing.

**A WORD FROM SURREY**

Upon reflecting on the best advice to give municipalities considering similar adaptation actions, Mr. Yonatan Yohannes, Utilities Manager, and Mr. Amir Shirazian, Project Engineer for the City of Surrey, noted the need for partners to collaborate very early in the planning process, even if all the fine details of the project have not yet been discerned. Mr. Yohannes stressed the importance of “looking at the bigger picture and involving all stakeholders in discussions about the science to support different project alternatives and the consequences of taking no action.” Ms. Tjaša Demšar, Sustainability Planner, further qualified this view by adding that municipalities ought to think outside the box about who potential partners could be, stating that, “A private company wouldn’t necessarily be the first partner a municipality would consider but, in our case, it was a great success.”

She also encouraged stakeholder engagement throughout the life of the project to ensure that residents are aware of how the project is expected to impact them. Finally, the importance of putting together a team of people passionate and determined about the project goals and qualified to get the work done was a major recommendation from Mr. Yohannes, which he believes could be one of the most crucial considerations for success.