

2019

**CANADIAN
CONSULTING
ENGINEERING
AWARDS**

**Plessis Road Twinning
and Grade Separation at
CN Redditt Subdivision**



Plessis Road Underpass - Looking North

Project Summary

Once a railway municipality, Winnipeg's Transcona suburb is a busy combination of residential, commercial and industrial areas. Designed to improve traffic flow, the \$88,000,000 Plessis Road Underpass features a grade separation between Plessis Road and the mainline CN Railway Redditt Subdivision.

The complex multidisciplinary project featured road, drainage, bridge, retaining wall, pumping station, municipal, rail, geotechnical, and hydrogeological components. Rife with challenges, AECOM overcame an aggressive schedule, major pipeline relocations and land drainage constraints.

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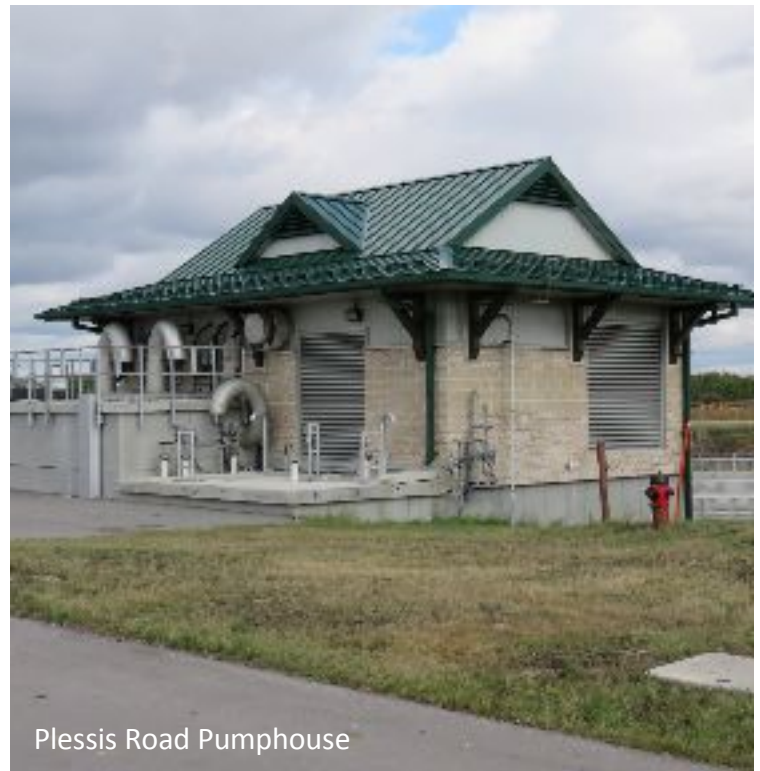
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Innovation

Drivers, cyclists and pedestrians of the City of Winnipeg's east end were frequently delayed by freight trains along the busy Plessis Road, creating congestion and increasing commute times. The solution—the Plessis Road Underpass—was created with the interests of stakeholders in mind, such as the City of Winnipeg, the federal and provincial governments, Canadian National Railway, and the numerous daily commuters.

From inception to completion, the design team (including Dillon Consulting Ltd., the roadworks and utility coordination sub-consultant) successfully applied each discipline's knowledge and expertise. The optimization of the underpass footprint avoided significant utility and drainage relocation costs in lowering the nearby Dugald Road intersection. The south road grade was increased, the rail profile raised, and a through plate girder (TPG) bridge was selected to reduce the structure below rail to maintain the minimum clearance for trucks in the underpass. Early identification of a sealed shaft (excavation) required for the pump station wet well construction avoided negative impacts to the aquifer and avoided flooding the excavation due to piezometric pressure. This was one of the most complex pump stations ever constructed in Manitoba based on capacity, depth below grade, proximity to the railway tracks, poor soils and local groundwater issues.

The constrained high profile setting and soft soils required an unconventional solution found in the steel sheetpile retaining wall. The deep sheetpile system extended below grade to intersect what would otherwise have been



Plessis Road Pumphouse

the failure plane for a deep seated failure. This was an efficient way to obtain the soil stability, factor of safety and geometry in this congested right-of-way. This system also allowed for driving the sheetpiles from existing grade with excavation at a later time to accommodate the staged construction.

Effective planning to minimize disruption to mainline train traffic, fuel pipelines, and vehicle, pedestrian and cycle traffic during the construction phase was critical to the success of the project. Oil pipelines parallel to the rail lines were relocated under the roadway structure, but above the underpass land drainage pipe due to the proximity of the bedrock and aquifer. Details were developed to allow for installation of the directionally drilled oil line to be installed through a reinforced opening in the sheetpiles, well below grade. The oil lines were also protected from traffic loading by a reinforced concrete slab. Significant effort was required to maintain the safety of the lines and the workers during construction.

Complexity

▶ **Multi-discipline Complex Project:** An integrated technical approach using collaborative and iterative design techniques combined transportation, structural, railway, geotechnical, oil and gas, municipal designs and environmental assessments, noise attenuation, and landscape design into a comprehensive design for the facility.

▶ **Challenging Designs:** The efficient and technically-compliant designs focused on minimizing land acquisition (using temporary construction easements and developing a unique upper and lower retaining wall system), staging construction to maintain rail traffic throughout construction allowing for only short disruptions for cutovers, and designing overpass foundation and superstructure types to accommodate staging and minimize excavations, disruption and risks to rail traffic.

▶ **Aggressive Timeline and Budget Constraints:** Because funding for this project was shared between the federal and provincial governments, the city and CN, an aggressive schedule and creative phased contracting had to be maintained to prevent the project from cancellation. The design optimized the grade separation footprint and overall project costs by changing road grades, optimizing retaining wall configurations, changing rail bridge structures and raising the railway track profile so as to avoid having to lower a nearby intersection and relocate a major drainage system to meet budget constraints.

▶ **Utility Coordination:** The underpass project involved planning, design and construction of a major grade separation in a highly constrained urban area. An entire suite of infrastructure owned by ten major stakeholders required relocation and staging with minimal disruption, and short shut-down periods. Multiple relocations were required to maintain service on an interim basis during construction in addition to maintaining the overall project schedule.



South Excavation



Multi Use Path Rest Area

Social and/or Economic Benefits



At Grade Road Crossing – CN Redditt Subdivision at Plessis Road



Plessis Road Underpass - Looking South

Traffic at this location was heavily restricted by trains, causing substantial traffic delays and congestion to the average 18,000 vehicles per day. By separating trains from vehicles, cyclists and pedestrians, the Plessis Underpass enhances commuter and truck traffic ease of travel—significantly reducing the travel time for people and goods. Providing access to the city’s active transportation network—with new connections between the major residential area in Transcona and the nearby active transportation corridor—vehicles, cyclists and pedestrians experience improved safety from the reduced interaction between the railway and the travelling public.

Prior to construction, an estimate of 12 to 20 trains travelled through the area in a 24-hour period. During construction, the at-grade crossing was closed to accommodate the staging of longer trains departing from the CN Transcona Shops. After construction, train traffic nearly doubled, with upwards of 30 trains passing through the area daily.

The completed structures follow a railway station architectural theme which blends the pumping station, bridge, signage and retaining walls together with the railway itself and honours the history of the Transcona neighbourhood.

Environmental Benefits



Dry Retention Pond

When traffic flows smoothly, the environment benefits. The design and construction of the twinning and grade separation at CN Reddit Subdivision minimized environmental impacts through improved transit use, reduction in greenhouse gas emissions from stopped idling vehicles multiple times each day, and improvement to the alternative transportation network.

With the presence of two existing oil and gas pipelines running through the project site, safety to the environment and human health was a top priority. Environmental investigations, completed prior to underpass construction, identified areas of potential concern and verified any impacts to soil and groundwater at the site. Impacts were mitigated during construction activities to allow for a safe work area and limit future environmental liabilities.

Major storm events had the potential to flood the surrounding drainage system and impact

road access. Emergency vehicle access and traffic safety was maintained by designing a high capacity drainage system within the underpass coupled with a large capacity pumping station and adjacent stormwater management system. The stormwater management system involved a retention basin, control structure and corresponding smaller capacity pumping station to discharge to the surrounding drainage system at predevelopment rates.

A critical local groundwater aquifer located directly beneath the site required a carefully designed approach to avoid disturbing the environment. To preserve the natural aquitard separating the directionally drilled new pipeline from the aquifer, reinforced openings in the on-site sheet piling coupled with concrete slab reinforcement were designed to allow a shallower pipeline placement and to resist traffic loading from above.

Meeting Client's Needs



First Train to Approach Bridge after North Track Cutover

The City of Winnipeg, together with federal and provincial governments, needed the existing at-grade crossing of Plessis Road at the CNR Redditt Subdivision to be replaced with an underpass grade separation structure, including earth retaining structures, to provide improvements in road safety, mobility, and sustainability.

Over 100 years, little to no previous preliminary investigations had ever been carried out for this proposed facility, leading to unexpected utility abandonments, in addition to those already known, within the rail right-of-way. Early identification and corrective action of these risks helped the city successfully navigate these surprises.

The final design optimized the grade separation footprint and overall project cost to meet

budget constraints and avoided lowering the nearby intersection with Dugald Road so that the project could proceed with the available funding. Four individual enabling contracts were created to streamline the schedule and meet financial deadlines.

The end result was the successful completion of the project using alternative solutions from numerous engineering disciplines with minimal disruption to the stakeholders involved. Road and rail traffic from the day the first two lanes opened has proven that the project was required to meet travel demand forecasts.

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