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The Saskatoon Interchange Project

2022 CCE Awards
CATEGORY SUBMISSION: TRANSPORTATION

Submitted by: CIMA Canada Inc. and Catterall & Wright

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Project Summary



Boychuk Drive and Highway 16 looking West, fully opened

CIMA Canada Inc. (CIMA+) and Catterall & Wright designed the Saskatoon Interchange Project for the City of Saskatoon from 2016 to its 2019 completion. The \$56.7 M project was a critical transportation priority for the continued growth and development of Saskatoon's east side.

As the Lead Designer for the project, CIMA+ worked alongside the Contractor, PCL Construction Management Ltd., and Catterall & Wright provided the drainage design services. The team worked together on the construction of two important interchanges that had a significant contribution to improve traffic flow, while reducing the negative congestion and safety trends at two of Saskatoon's busy intersections.

Innovation

This large-scale, multi-million-dollar investment involved the construction of two new interchanges: McOrmond Drive/College Drive and Boychuk Drive/Highway 16 for the City of Saskatoon. Through a design-build procurement model, the two interchanges were combined into one project: The Saskatoon Interchange Project. With this model in place and three teams competing to win the project, the City of Saskatoon was seeking best value delivery and the Pursuit teams refined options to provide cost-effective solutions.

PCL Construction Management Ltd. was the successful Contractor on the project, with CIMA Canada Inc. as the Lead Designer for both interchanges, and Catterall & Wright providing drainage design services. Additional sub-consultants were also engaged for geotechnical and environmental engineering services.

The objectives of this project were two-fold:

- 1) The design and construction developed for this project focused on accommodating future upgrades of College Drive and Highway 16 to include six lanes. In addition, consideration for the integration of appropriate interchange ramps, structures, drainage systems, and relocation of utilities were included in the scope of work.
- 2) The implementation of new configurations at the Boychuk site, which boasts a five-lane bridge over four lanes of highway network, while McOrmond bridge is seven-lanes wide. Changes to the eastbound and northbound loop ramps were constructed to replace the existing left turn at-grade turning lanes that were experiencing more than 1.5 km-long queues during peak hours.

Overall, this project directly impacted and contributed to significant improvements in resolving safety and traffic flow issues at these two busy Saskatoon intersections. In addition, supplementary infrastructure was built to the south, which links the city's newest developments to the freeway network, along with multi-use pathways that connect neighbourhoods in the north and south through active transportation modes – another growing need and focus across the municipality.

The design-build delivery model implemented required an engineering approach that engaged all disciplines (roadway, geotechnical, environmental, drainage, structural) to work collaboratively to meet the project's overall design objectives.

This collaboration and design development was further strengthened through direct interaction with the PCL Construction team and by providing a design that was thoroughly vetted for option analysis (including material types for bridge components, pricing and benefit/cost analysis), was efficiently constructible, and met all design requirements.

McOrmond Drive and College Drive, looking Northwest



Boychuk Drive and Highway 16, looking East



Complexity

This project had numerous challenges that were effectively addressed by the team.

Limited land area available, innovative designs required for detour roads:

- Detour designs carrying significant traffic were optimized to limit the amount of change in traffic patterns to the travelling public. Detour roadway crossings were designed so any permanent roadways would be constructed as part of the detour to minimize rework and material waste.

Limited land available for roadway geometry:

- At the McOrmond site, the team maximized on available space through modified ditch designs, additional cross drainage structures, and reworked the roadway geometry in areas with restricted space.



Complexity

Drainage restrictions into the sewer system:

- The Boychuk site had minimal allowable outflows, a significant catchment area collecting runoff, limited storm sewer outlet elevations and wetland mitigation strategies that needed to be followed. The team designed a system that maximized storage volumes within the project footprint with four primary storm water detention ponds located in each quadrant of the system. These ponds were connected with a series of pipes that allowed all ponds to achieve the same high-water level and drain out within the acceptable time limits and flow rates.
- The McOrmond interchange had a limited area to fit required storm water management systems. Significant inflow from adjacent developments required buffering prior to entering the City's storm sewer system. A series of dry and wet storm water detention ponds were designed and connected with associated piping networks that allowed the system to utilize several outfall points to meet the City's requirements.
- New storm main trunks were not permitted, and the interchange drainage systems had to tie into existing infrastructure; this was very restrictive to the storm water design approach.
- Catterall & Wright's knowledge of the City stormwater system allowed CIMA+ to leverage the information into an effective inter-connected storm water management system that also provided PCL with the excavation material for embankment construction.

McOrmond Drive construction



Girder erection



Economic and Social Benefits

This project made a significant contribution to improve traffic flow and reduced the negative congestion and safety trends at two of Saskatoon's busy intersections. It was also an important step in the creation of a more connected community.

Economic:

- Highway 16 is a major trade corridor for Western Canada with transport trucks carrying various products daily. Replacing the at-grade intersection with a free flow for highway traffic is key to ensure goods are transported safely and efficiently.
- Reduction of travel time for the public, reduces road user costs.
- Elimination of high conflict movements and long queues, with fewer and less severe collisions. This positively affects savings in insurance claims, emergency response costs, and increases societal impact.

Social Sustainability:

- Both interchanges include active mode aspects into the design, with accessible pedestrian and cyclist pathways through a 3.0 m multi-use pathway.
- Pathways were included on both sides of McOrmond Drive to link existing networks north of College Drive in the Willowgrove and Arbour Creek neighbourhoods, with the Brighton neighbourhood in the Holmwood sector on the south side of College Drive. The design balanced these active mode elements with free flow traffic requirements and the placement of pathway crossings at the locations, which have speed control design elements. Pedestrian activated traffic signals and rapid flasher pedestrian crossings were also incorporated into the design.
- The Boychuk interchange included a pathway to link the City's neighbourhoods on the north side of Highway 16 with the Greenbryer Country Club and residential community, along with Baitur Rahmat Mosque located on its south side.

MSE wall construction



McOrmond Drive drainage features



Environmental Benefits

Prior to the construction of the interchanges, both intersections experienced rapid growth in traffic volumes as the city grew. Negative upwards trends included: collisions, fuel consumption, traffic delays, and overall environment impacts.

The team was able to contribute positively to the environment with forward-thinking solutions:

- Existing wetland seedbanks were salvaged, logged, and replaced in the retained wetlands of the project.
- A very large wetland complex was located within and adjacent to the Boychuk Interchange project limits. Additional measures were taken to maintain this wetland complex outside of the project limits. This was done by delineating the areas and determining both normal and high-water levels for the complex and installing an earthen berm and rock weir to maintain these water levels without compromising the roadways or the effectiveness of the newly constructed wet pond next to the wetland. This resulted in a reduced construction footprint and minimized the impact on the existing wetland habitat.
- With the interchange projects, fuel consumption and emissions have been substantially reduced as a direct result of the free flow traffic movements in comparison to the previous intersections, which had long delays and significant vehicle idling.

McOrmond Drive



Meeting Client Needs

The design-build delivery model implemented on this project required an engineering approach that engaged all disciplines (roadway, geotechnical, environmental, drainage, structural) to work collaboratively to meet the project's overall design objectives.

These efforts were further strengthened through direct interaction with the PCL Construction team and by providing a design that was thoroughly vetted for option analysis, was constructible, and met all design requirements.

The end deliverable provided a unique design with:

- Rock columns to strengthen existing soils and reduce construction time;
- Cost-effective bridge girder systems;
- Unique drainage system design that deepened existing wetlands (providing needed earth embankment material for construction);
- Staged storage to release water into the existing city system at a more controlled rate.

Boychuk Drive and Highway 16 looking West, fully opened



Meeting Client Needs

Additionally, the design team was able to:

- Optimize design details by implementing subgrade stabilization and strengthening techniques to reduce pavement thickness and costs.
- Modify ramp geometry to facilitate the same level of service while meeting project objectives.
- Optimize the bridge structure through technical specification clarification and demonstrate value versus cost through adjustments made in some technical specifications.
- Demonstrate increased value and capacity to the storm water system by allowing slight variations in their guidelines to increase overall upstream storage.

The City of Saskatoon received tremendous value with the project delivered on schedule and at a guaranteed price. In addition, the Design team's familiarity with the municipality's processes and systems, such as their overall storm water management, ensured a design that is consistent with the City's expectations.

"This new interchange is a sign of a growing Saskatoon and it is an important step in creating a more connected community," said His Worship Charlie Clark, Mayor of the City of Saskatoon. "It is already having a significant impact for those travelling in and through the south-east part of our city by improving safety, traffic flow, and the quality of life in our community. I would like to thank our federal and provincial partners for investing in this project."

Boychuk Drive and Highway 16, looking West, temporary detour and signalized intersection in place





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