APPENDIX A

STANTEC EXECUTIVE SUMMARY

Executive Summary

Background

The existing Arlington Street Bridge over the CPR Yards is a 37 span, 609.3 m long bridge. It extends from Logan Avenue at the south to Dufferin Avenue at the north. It carries two vehicular traffic lanes and two sidewalks. The bridge is in poor condition and is width restricted, height restricted, load restricted and has very steep approaches. Truck traffic and buses are not allowed on the bridge.

Inspections and repairs conducted in 2010 precipitated a recommendation to conduct a North Winnipeg Transportation Study to determine the best place to cross the CPR Yards between Main Street and McPhillips Street as the rail yard at Arlington Street is at the widest point in the CPR yards. The "CPR Yards Crossing Study" Functional Design completed by Stantec Consulting Ltd. took place from August 2014 to July 2016 and determined that the best place to cross the CPR yards was at Arlington Street on an alignment immediately west of the existing bridge. The study recommended that Arlington Street from McDermot Avenue to Selkirk Avenue be reconfigured to two sidewalks, two bike lanes, and two through-traffic lanes with left turn lanes at key intersections. The bridge was to carry two sidewalks, two bike lanes, and three traffic lanes (two in the northbound direction and one in the southbound direction). The traffic lanes on the bridge would meet current and projected future traffic demands beyond 2031 and would be expandable to four lanes between Logan Avenue and Selkirk Avenue which will be needed when other CPR Yard Crossings are under reconstruction in the future. The bridge would be lengthened to improve the bridge grades to current modern standards. As a result, the CPR "L-Lead" spur line needs to be removed near the bridge requiring track improvements away from the project. The lengthened bridge would extend over Dufferin. The Class 4 project cost estimate from the functional design was $300 million and assumed a construction start date of 2020.

The Arlington Street Bridge over the CPR Yards replacement preliminary design commenced in December 2016 and was completed in May 2018. It built on the recommendations from the functional design.

Arlington Street Bridge Preliminary Design

The Preliminary Design assignment started where the Functional Design left off. The project limits for the Preliminary Design is along Arlington Street from McDermot Avenue to Selkirk Avenue. The functional design for the roadway from McDermot Avenue to Selkirk Avenue was developed further by incorporating utilities, property impacts and construction staging.

Two bridge options were completed to a Preliminary design level. The two options are;

- Base Option - Tub Girder Bridge
- Enhanced Option - Arch Bridge

The two options are the same except the enhanced option replaces two tub girder spans with a single span arch. The enhanced option eliminates one bridge pier in the CPR Yard and provides a dramatic skyline feature. Further description of the bridge options and project scope is discussed herein this summary. The Project Goals which were reaffirmed in the Preliminary Design are provided next for reference.

Project Goals

The Project Goals were developed during the Functional Design assignment and reaffirmed at the start of the Preliminary Design assignment and consist of five key themes:

- **To be Technically Sound**
- **To be Environmentally Responsible**
- **To be Cost Effective**
- **To Reflect Needs of the Local Community**
- **To be Understood and Accepted by those Affected**

Base Option – Tub Girder Bridge

The steel tub girder option consists of nine spans and has MSE wall approaches. The total bridge length is 556.3 m with a 130 m long south approach and a 97 m long north approach. There are eight steel trapezoidal girder spans and one precast prestressed concrete girder span over Dufferin Avenue. at the north end of the bridge. There are 10 substructure units, four of which are within the CPR yard. Rock Socketed Caissons are recommended for the foundations within the yard. Driven steel H-Piles are recommended for foundations outside of the yard. Cast in place pier caps are recommended for the substructure caisson caps.

Total Project Cost – Base Option $284.1 million, (financing costs not included) based on 2020 Project Commencement

The below figure illustrates the Tub Girder Option

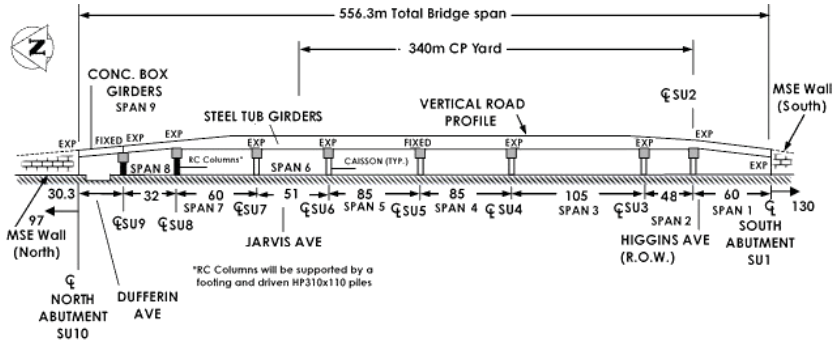


Figure E1 – Tub Girder Bridge – Base Option



Figure E2 – Steel Tub Girder Bridge Option - Rendering

The Tub Girder Bridge option was carried to a Preliminary Design level and is the least expensive option and therefore is considered the Base Bridge Option.

Enhanced Option – Network Arch Bridge

The Network Arch Bridge option consists of eight spans and has MSE wall approaches. The total bridge length is 556.3 m with a 130 m long south approach and a 97 m long north approach. There are six steel trapezoidal girder spans, one precast prestressed concrete girder span over Dufferin Avenue. at the north end of the bridge and one feature network arch span. There are 9 substructure units, three of which are within the CPR yard.

The difference between the Base Option and the Enhanced Option is Spans 2 & 3 from the Tub Girder option are replaced with a single network arch span of 153m, thereby eliminating one yard pier. The remainder of the structure is essentially identical. The construction methodology is however very different.

Total Project Cost – Enhanced Option $305.8 million, (financing costs not included) based on 2020 Project Commencement.

The below figure illustrates the Network Arch Bridge.

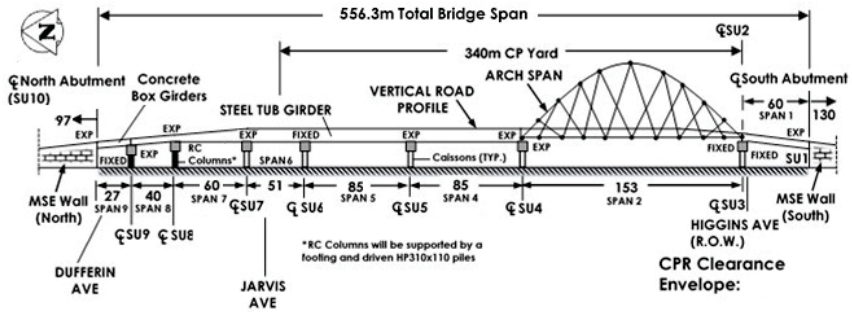


Figure E3 – Arch Bridge Option



Figure E4 – Arch Bridge Option Rendering

The Network Arch Bridge option was carried to a Preliminary Design level and is favoured by the Community and PAC. Basically, the Network Arch option has a feature Arch span and therefore is considered the Enhanced Bridge Option.

Option Differences

The Enhanced Option – Network Arch Bridge is the slightly favoured option based on a decision matrix; however, it is $21.7 (7.6%) million more expensive. The bridge option differences are as follows:

Base Option - Tub Girder Bridge

- Total Project Cost $284.1m, 2020 project commencement
- Decision Matrix Score: 89.9/100
- No feature span to restore the skyline
- Supported by the community and PAC only if additional aesthetics added
- Easier to maintain
- Girder superstructure installation is simpler
- No protective coatings issue

Enhanced Option - Network Arch Bridge

- Total Project Cost $305.8 m, 2020 project commencement
- Decision Matrix Score: 91.6/100
- Same aesthetic features as the base option except Network Arch offer additional aesthetics with skyline feature that can be viewed from a distance.
- Best meets the Project Goals
- One less pier in the CPR Yards
- Less track modifications within the yards
- Favoured by the community and PAC
- Has a higher maintenance cost due to arch coating

Evaluation of Options

The bridge options are 70% the same, based on bridge length. The 30% difference represents the 153m arch span. Applying this numeric ratio, the Aesthetics and Other factors were determined to be 70% the same for both options and therefore the remainder was used to determine the score accordingly. Aesthetics is worth 25 points overall with 70% the same, the base score is 70% of 25, which is 17.5 points. The arch option receives full score for aesthetics. Same rationale was used for the other criteria. The other criteria is only worth 5 points.

For Financial Criteria, Total Project Costs and Life Cycle Costs were used to calculate the scores. The less expensive option receives maximum score. The Enhanced option score was determined by a ratio to the base cost. Total Project Cost is worth 45 points and Life Cycle worth 5 points.

Social Criteria, which is worth 20 points, was scored based on input received from CPR through various Value Engineering Workshops. CPR provided comments on total impact on their operations during construction and thereafter. This input was used to score the options accordingly. The schedule did not differ significantly for either option and therefore both options received maximum points of 4 for Schedule.

Total maximum score is 100 points. A summary of the scoring is illustrated in the next figure.

Table E1 – Decision Matrix Summary

		Tub Option	Arch Option
Evaluation Criteria	**Points**	**Score**	**Score**
Financial			
Capital Cost (45%)	*45*	45	41.8
Life Cycle Cost (5%)	*5*	5	3.9
Social Criteria			
Impact to CPR operations (10%)	*10*	8	8.5
Schedule (4%)	*4*	4	4.0
Constructability (6%)	*6*	5.4	4.8
Aesthetics Criteria			
Aesthetic (25%)	*25*	17.5	25
Other			
Pigeons (1.25%)	1.25	1.25	0.88
Future Expandability (1.25%)	1.25	1.25	0.88
Ease of Maintenance (2.5%)	2.5	2.5	1.75
Total	**100**	**89.9**	**91.5**

As can be seen in the above table, the Enhanced Option is slightly favoured over the Base Option.

Road Design

- Roadway works include 1.765 km of reconstruction on Arlington Street and adjacent roadways from McDermot Avenue to Selkirk Avenue.
- The horizontal and vertical geometric designs were developed specific for the bridge options and their constraints. The vertical road geometry was specifically developed to ensure the vertical grades were no more than 5%
- Logan Avenue intersection will need to be raised approximately 1.1m.
- All bus stops to be unconstrained.
- The Arlington Street corridor, within this project limits, has been developed with a three-lane configuration, as well as one-way protected bike lanes and sidewalks on either side of the roadway. This configuration was preferred during the Functional Design and was confirmed as the preferred configuration during the onset of this project.
- Dufferin Avenue is to remain open with a vertical clearance of 4.3 metres.
- Bus stops are proposed to be unconfined bypass designs

Geotechnical Design

- The recommended foundation is rock socketed cast-in-place concrete caissons based on least impacts to CPR within the yard. Foundations outside of the yard were recommended to be driven piles and pile cap due an easier substructure to build and less cost.

- The approaches utilize an approximately maximum fill depth of 6m. As such, the use of cellular concrete is recommended to limit settlements and does not require the use of wick or sand drains to expedite the consolidation period.
- The use of cellular concrete is expected to result in stable slopes and should limit the porewater pressure responses in the clay material.

Environmental Factors

- The soil within the CPR yards was tested for containments and the soil is considered contaminated. During construction, excavated soil will have to be collected, contained, and properly disposed of.
- The assessment of transportation noise was completed based on inputs and assumptions which results in conservative prediction of sound levels. The acoustic transportation assessment indicated that based on the assumptions and information available at the time of the study, the new Day-Night sound level would not exceed the current Day-Night sound level by more than 5 dB. As per the City of Winnipeg's "*Motor Vehicle Noise Policies and Guidelines*" no mitigation was required to be considered.

Rail Line Modifications

- Temporary and permanent track modifications have been developed for each substructure unit, accommodating both their final geometry as well as their construction.
- L-Lead line to be removed from the CPR Yard to 30m past Pacific Avenue.
- Rail crossing on Logan and Pacific Avenue to also be removed.
- Rail crossing improvements are required on Erin Street and Clifton Street for the Great West Development rail modifications.
- A new rail crossing is proposed on Erin Street for the Great West Development Line connection.
- A construction agreement is to be finalized between the City and CPR upon Preliminary Design completion.

Utilities and Services

- The clay tile catch basin sewer leads require complete replacement in most cases.
- The decommissioning of the bridge is not anticipated to affect the existing utilities, although some hydro lines will need to be temporarily relocated during decommissioning.
- Cast iron water main under the road renewal will need to be replaced.
- As the proposed bridge is larger than the existing and runoff will not be permitted to be placed onto CPR property, the use of detention areas to the northeast and southwest of the bridge are proposed. This project will be subject to Clause 8 of Environmental EA No. 3042.
- Land drainage discharge flow rates to the combined sewer system must be limited to the pre-development flow rates.

Land Use and Aesthetics

Included as Part of this Project

- A community and green space at the north west corner of the Arlington Street - Logan Avenue intersection.
- Basketball courts on the north side of the yard and will also serve as a detention area.
- Streetscaping and green spaces have been identified as important features of the revised corridor.
- Safety is a key consideration and concern. The light levels must be developed knowingly both on and around the bridge and roadway. Maintain clear sightlines from traffic as much as possible. Engage the youth by this project and provide recreational options for them.
- Through art, storytelling, and continued engagement, the bridge can be a symbolic connection and new beginning – a part of the adjacent communities rather than an imposed divider.

Future Development Plan (not included)

- Surplus land post construction has been identified with a potential development plan.
- More convenient shopping and employment opportunities have been identified by stakeholders as being important. A shopping corridor linking Arlington Street to the commercial centre at Logan Avenue and to McPhillips Street shopping is desired as part of this project.
- The North End Community Renewal Corporation is considering building an Arts Centre in the North End that could be a landmark and central attraction within a corridor plan.
- Market gardens, playground and sports fields have been identified as good fits for this project.



Figure E5 – Community Gathering Space – North west Logan Avenue and Arlington Street

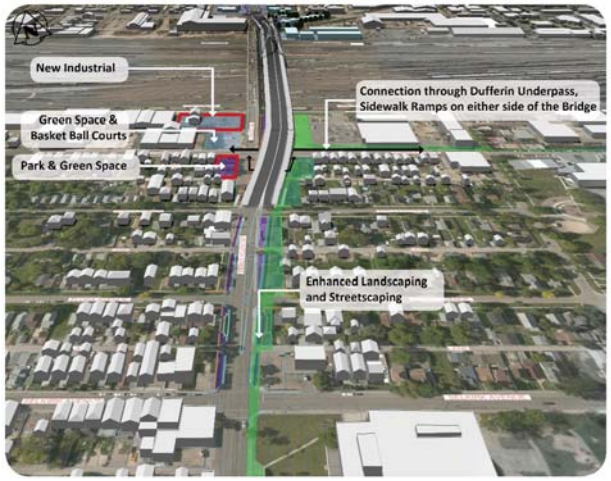


Figure E6 – Green Space and Enhanced Landscaping

Property

The impacted properties were determined based on the proposed alignment and bridge options. A total of 55 properties were noted as partial or full takes for this project.

Table E2 – Summary of Properties

Property	No. Of Properties
Full Taking	
Residential	21
Commercial	5
Industrial	5
Undeveloped Land	9
Partial Taking	
Residential	3
Commercial	4
Industrial	8
Total Property Takings	***55***

Net CPR Puts and Takes

The required and proposed property Puts and Takes will form part of the COW and CPR agreement. A summary of the properties and areas for transfer are as follows:

- L-Lead Line ROW, CPR Yard to Pacific Avenue 15,663 m² ***(Take)***
- Existing Arlington Street ROW 1,238 m² ***(Put)***
- Great West Development ROW 1,565 m² ***(Put)***
- Great West Development North Property 3,791 m² ***(Put)***

Net CPR Property Transfer ***9,069 m² (Take)***

Surplus Lands

Upon completion of the project, there will be surplus land available for redevelopment. This land would be sold to a developer through the Property Planning and Development Department. Herein this report, the identified surplus lands have been categorized as; Retail, Commercial, Industrial or Park. Due to Transport Canada regulations, none of the surplus land could be used for residential/multifamily developments.

A summary of the surplus land is as follows:

- 1599 Erin Street – Commercial 1819 m²
- 797 Jarvis Avenue – Retail 2053m²
- 936 Logan Avenue – Retail 381m²
- Arlington Street & Logan Avenue – Retail 2573m²
- 935 Henry Avenue – Industrial/Park 7516m²

Total Surplus Property ***14,342 m²***

Property Cost Summary

Some properties are vacant, and some have existing buildings. As part of our property cost evaluation, the cost to acquire the property has been determined as well as secondary costs such as:

- ***Building demolition*** – This is the cost associated with removal of the existing house/building and foundation, capping any underground utilities, and removing any overhead services.
- ***Business Relocation*** – This cost is associated with businesses that can no longer operated at their current location and a new similar property and building is needed to be acquired so that business can relocate and continue operations.
- ***Injurious Affected Businesses*** – This is the cost associated with impact to the business, however not to the point where the business needs to relocate.
- ***Property Development*** – This cost is for after the project is complete, costs for landscaping, finishing and or planned development for that property as part of this project.

The total cost for property acquisition and secondary costs is shown in Table E3.

Construction Methodology

- A potential construction methodology was developed for each component of the project including the roads, bridges, and utilities.
- Specific construction methodology for the construction of the substructure units was developed to assess the impacts to CPR. The access routes, construction area requirement, equipment and durations were

assessed and related to the proposed rail works for the project. Additionally, construction methodologies have been developed for the superstructure construction. It is anticipated the tub girders will be launched into placed and the arch span would be rolled into place using Self-Propelled Modular Transporters (SPMT).

- The means and methodologies will be chosen by the constructor, however, specific requirements for routing, durations and laydown areas within the yard are anticipated to be required by CPR.
- The existing west sidewalk is proposed to be used for worker access and construction service supply; water, hydro and a pipe for concrete pumping.

Risk

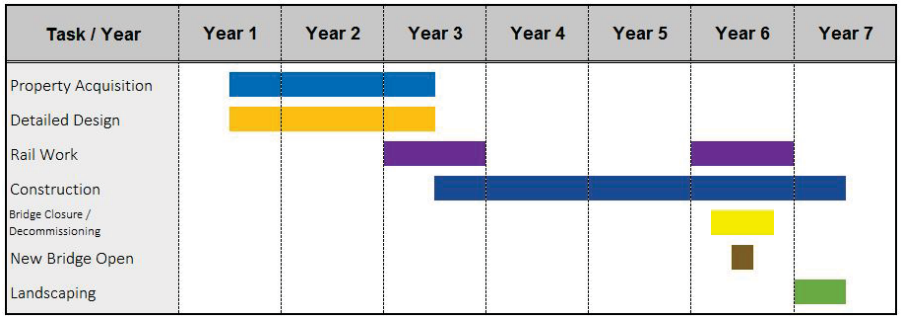
During the development of the risk register, 67 risks were identified. These risks were evaluated based on their potential impact to cost, time, reputation, and goals of the project. These risks were addressed throughout the preliminary design and are to be addressed continuously throughout the detailed design phase.

This project requires five years to complete from approval to proceed through to project completion. Based on the risk and mitigation strategy, costs associated to the risk impact have been calculated and included for both options.

Schedule

The next figure shows a summary of the project schedule over seven years. The Project Commencement is anticipated to be 2020 (Year 1), which Detailed Design and Property Acquisition can start. Construction is a five-year timeframe tentatively starting in 2022 (Year 3), finished in 2026 (Year 7). The existing bridge is scheduled to be closed spring of 2025 (Year 6) with the new bridge opening fall of 2025 (Year 6). Landscaping to be completed the following year (Year 7).

Figure E7 – Project Schedule Summary (Base on a Design-Bid-Build Method or Project Delivery)



Class 3 Cost Estimate

The cost estimates were compiled according to the recommended crossing options and phased construction. The Preliminary Design option cost is a Class 3 category cost estimate (-20% to +30%). These costs are quantity and unit cost based. The Class 3 Estimates include; utility relocations, property acquisition, rail detours and track modifications, bridge structures, retaining walls, drainage structures, etc.

- 2020 Project Commencement
- Property assessment for 2017. Adjusted for 2020 Project Commencement
- Canadian dollar at 75 cents US (±5¢), tariff free import
- CPR shipping and or operation impacts/delay costs not included, if any
- Financing costs to the City for borrowing of funds required for the project are not included and is to be addressed in the Budgeting Process.

Table E3 – Summary of Project Costs (Based on project commencement in 2020)

Arlington Street Bridge over the CPR Yards Replacement Preliminary Design		
Description	**Tub Girder Option**	**Arch Option**
Mob and Demobilization	$ 13,449,000	$ 15,166,000
Decommissioning of Existing Bridge	$ 12,953,000	$ 12,953,000
Bridge Works	$ 101,967,000	$ 118,950,000
Road Works	$ 10,325,000	$ 10,345,000
MSE Wall Works	$ 8,135,000	$ 8,327,000
Rail Works	$ 9,977,000	$ 9,618,000
Utility Works	$ 8,371,000	$ 8,371,000
Soil Remediation	$ 141,000	$ 141,000
Property Acquisition	$ 20,747,000	$ 20,747,000
Landscaping / Art	$ 2,076,000	$ 2,076,000
Enhancements	$ 3,201,000	$ 3,578,000
Sub-Total	$ 191,342,000	$ 210,272,000
Quantity & Material Contingency	$ 25,327,000	$ 27,239,000
SUB TOTAL CONSTRUCTION COSTS	**$ 216,669,000**	**$ 237,511,000**
Engineering Costs	**$ 24,101,000**	**$ 26,445,000**
Risk	**$ 30,739,000**	**$ 28,402,000**
Interest, Admin Overhead and Insurance	**$ 12,658,000**	**$ 13,492,000**
TOTAL	***$ 284,167,000***	***$ 305,850,000***

Project Delivery

After the full project delivery analysis and Value for Money assessments have been completed, further described in the report, the Design-Bid-Build option was determined to be the highest value, representing approximately a 7.5% savings over the Design-Build-Finance-Operate-Maintain (DBFOM) option, in net present value costs. This net savings may change depending on key assumptions which were made, but sensitivity analysis did not identify a scenario where DBFOM was a higher value. The unique and highly constrained nature of the work involved in the Arlington Street Bridge Replacement Project makes Design-Bid-Build the preferred option and is expected to significantly reduce the City's risk profile. CPR also preferred the Design Bid Build delivery method for this unique project.

Recommendations

The Stantec Project Team has the following recommendations.

1. It is recommended that a pre-demolition survey occur under the existing bridge to identify the potential presence of nesting birds (e.g., swallows) if construction/demolition is planned to occur during the sensitive breeding period (i.e., April 1-August 31) to evaluate the need to deter selection of the site by protected species for nesting.
2. Notice must be given to the Minister responsible of any proposed railway work (i.e., line work or crossing work) under the Railway Safety Act and for any construction or alteration of structures located above or below a line of railway by party other than a railway company under the Regulations Respecting Notice of Proposed Railway Works.
3. It is recommended that a test program of the proposed pigeon mitigation plan be implemented on the existing truss to verify or measure how well the system works, before implement for the entire life of the new structure.
4. Additional survey is required to be completed during the detailed design. The existing survey does not have sufficient information to the east and west limits of the required track work. The track location and alignments should also be reconfirmed as the survey for this project has noted conflicting locations of tracks with other existing information. It is recommended that a drone survey be completed to confirm the track alignments and locations and GPS survey be completed near the west and east limits of the track work to confirm the elevations
5. It is recommended that a minimum of one caisson, at each substructure (one test hole per substructure unit) be completed during the detailed design. This will confirm the stratigraphic conditions and provide the contractor with additional information that should reduce their risk and control costs for the project.
6. The sections of cast iron watermains along Arlington Street are recommended to be replaced.
7. It is recommended that a construction "Rule Book" be developed during detailed design for construction to be used by the General and Sub contractors as a quick guide to CPR operation rules and contacts.
8. It is recommended that Dufferin Avenue continue under Arlington Street to maintain traffic and pedestrian thoroughfare.
9. It is recommended that pedestrian exit ramps are installed at Dufferin Avenue to maintain pedestrian and cyclist connection from Arlington Street.
10. The Project Advisory Committee indicated that the Tub Girder Bridge concept would require further development to meet the desire for an iconic structure and addition to the Winnipeg skyline, as identified from public consultation (unanimously supported).
11. The Arch Bridge Option is the slightly favoured bridge option based on the evaluation matrix.