Transportation

City of Regina

Winnipeg Street Bridge Realignment Study
Value Engineering Workshop
Final Report

Prepared by:
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Project Number:

60281653.500

Date:

May 2013

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May 17, 2013

Sharla Cote, P.Eng.
Project Engineer
Infrastructure Planning Branch,
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City of Regina
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2476 Victoria Avenue
Regina SK S4P 3C8

Dear Sharla:

Project No: **60281653.500**

Regarding: **Winnipeg Street Bridge Realignment Study**
Value Engineering Workshop
Final Report

Please find enclosed five paper copies and one digital (PDF) copy of the Winnipeg Street Bridge Realignment Study Value Engineering Workshop Final Report. We enjoyed working with you and your colleagues at the City and look forward to other commissions.

If you have any questions or wish to meet to discuss the Study, please feel free to contact me directly at 306.206.1031.

Sincerely,
AECOM Canada Ltd.

Allan Duff, P.Eng.
Manager, Roadways
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AD:lk
Encl.
cc:

Distribution List

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Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	Allan Duff	January 7, 2013	Draft Report
1	Allan Duff	January 9, 2013	Final Report
2	Allan Duff	April 18, 2013	Final Report

AECOM Signatures

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Report Reviewed By:

Randy Hergenrether,
Transportation Project Manager

Executive Summary

The primary purpose of this review was to determine a method to rebuild the Winnipeg Street Bridge over Ring Road with minimal impact on road users. Studies have shown the bridge needs to be replaced. Further rehabilitation efforts are not recommended. The secondary purpose was to examine possible improvements to the interchange that would address future needs such as new development in the area, the need to add driving lanes to Ring Road and the potential for a grade separated railway crossing on Ring Road at the Canadian National Railway (CNR) Qu'Appelle Subdivision.

Rebuilding the Winnipeg Street Bridge in the existing location is the least expensive option, however, is not recommended for the following reasons:

- The Winnipeg Street Bridge would need to be closed to traffic for about a year to allow a new bridge to be built. Traffic would be redirected to other streets causing considerable hardship to many road users and businesses; and
- The existing alignment does not provide sufficient capacity for proposed future development unless significant property is acquired (Co-op Home Centre.)

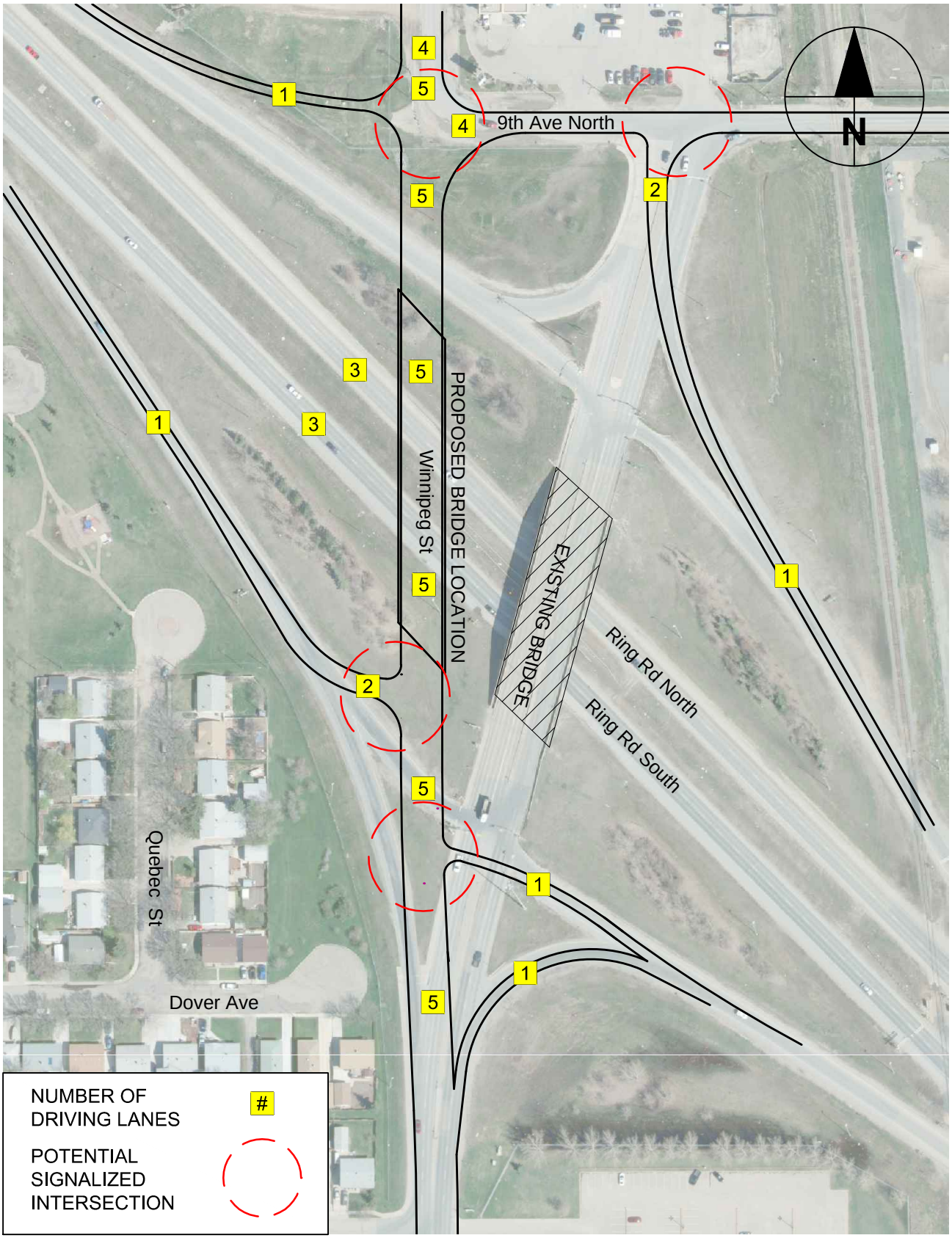
After technical review and a Value Engineering review, it was concluded that the new bridge should be rebuilt west of the existing bridge location. The west location allows the existing bridge to remain in service during construction of the new bridge and Winnipeg Street would be constructed in a north/south alignment without the existing jogs. Moving the new bridge west reduces the impacts on the existing rail crossings on Ring Road and on 9th Avenue North. A negative impact of moving the new bridge west and aligning it in a north/south alignment is that the span length of the bridge is significantly increased due to the greater skew angle between the bridge and Ring Road.

The new bridge location requires geometric modification of the interchange ramps. Various options were examined to determine the best layout that would meet all future development needs. Future needs were determined by calculating traffic volumes due to residential, industrial and commercial development north of Ring Road. Traffic generation rates were based on full development of known areas and an allowance was included for potential development areas that may occur.

Figure 9.1 illustrates the geometric layout of the preferred option. The preferred option will operate at an acceptable level of service at full development and is the least costly option. The estimated cost of the preferred option is $21.8 MM. **Table 8.1** breaks down the cost in more detail.

The preferred option salvages existing ramps as much as possible and does not require property acquisition. The critical intersection, based on potential travel delays, is the Winnipeg Street/9th Avenue North intersection. This intersection will require traffic signals to be installed immediately in conjunction with the opening of the new bridge. Traffic signals will also be required immediately at the east to northbound ramp terminal on Winnipeg Street. This intersection has a high percentage of large trucks destined to the Consumer's Co-operative Refinery Limited (CCRL) making the left turn on to Winnipeg Street. Traffic signals will address safety concerns. Other intersections may require traffic signals in the future.

The 750 mm PVC water supply main located within the centre median of Ring Road will require relocation to allow for bridge foundation work. The actual location of the water main should be accurately located prior to detailed design. Relocation work will require traffic restrictions on Ring Road during construction.



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PREFERRED OPTION - FIGURE 9.1

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1. Introduction

AECOM was commissioned by the City of Regina (the City) to recommend a bridge alignment for Winnipeg Street over the Ring Road. Winnipeg Street is a key north/south arterial roadway in Regina. The Winnipeg Street Bridge over Ring Road was built in 1975 and has had two major rehabilitations, one in 1989 and again in 2003. It was determined through a study in 2010 that replacement of the bridge is required and rehabilitation is no longer an option. The Winnipeg Street Bridge Alignment Study is a two-phase project:

- **Phase 1** - Identify opportunities and constraints that will influence the alignment decision and determine the benefits and costs associated with those factors. Critical factors include: careful consideration of all existing utilities, maintaining traffic during replacement of the bridge, development opportunities, land requirements/impacts, interchange configurations, connecting roadways, physical constraints and the CP railway crossing on 9th Avenue North, as well as the CP and CNR railway crossings on Ring Road.
- **Phase 2** - Undertake a Value Engineering (VE) Workshop, using the inputs developed in Phase 1 to make a recommendation for the bridge alignment based on both stakeholder input and a review of benefits and costs. This will include the development of qualitative and quantitative criteria to assist in the review of the benefits and costs of each scenario.

The recommendations will include, but will not be limited to the preferred bridge alignment, connecting roadways, interchange configurations and recommended traffic control for both railways and adjacent intersections. The Study will list all issues that should be considered during the detailed design phase and list the next steps.

2. Background

2.1 Background Reports

There have been a number of studies conducted that have involved the traffic operations of the study area intersections, as well as the bridge condition. Past studies include the North East (NE) Sector Road Network Study, the Consumer's Cooperative Refineries Ltd. (CCRL) Expansion Site Impact Traffic Study and the Truck Access Study. These reports included a review of 9th Avenue North and the surrounding area. As part of this study, these reports were reviewed and pertinent information was documented.

The NE Sector Road Network Study consisted of a review of the NE area of Regina which included the intersections on Winnipeg Street at 9th Avenue North and the Winnipeg Street and the Ring Road ramp intersections. The expansion of the CCRL refinery and the impact it would have on the infrastructure surrounding, was analyzed in the CCRL Expansion Site Impact Traffic Study. The Truck Access Study assessed truck traffic on 9th Avenue North between Winnipeg Street and McDonald Street, particularly at the Tank Truck Entrance. The study provided some safety improvements which were implemented by the City. The information and analysis collected in these reports was utilized during the course of this study.

The most recent report evaluating the bridge structure was prepared by Stantec Consulting Ltd. in November 2010. The Winnipeg Street Overpass at Ring Road Rehabilitation - Pre-Design Report conducted a detailed testing program and visual inspection to establish the current condition of the individual bridge elements, and analysis to identify rehabilitation work that addresses concerns related to safety, functionality, service life, utilities and aesthetics.

A subsequent memo to the previous report was prepared in December 2010 that confirmed delaying rehabilitation work at the Winnipeg Street Bridge for one (1) to two (2) years would pose no serious issues, although the City should consider not performing rehabilitation and using the money to fund a replacement structure. This recommendation was made in light of new information that several large projects and developments were expected in the area of the bridge rehabilitation that would generate additional traffic along Winnipeg Street. The City accepted the recommendation to replace the structure.

2.2 Previously Identified Area Road Network Improvements

The following key roadway infrastructure improvements near the study area have been previously recommended through the City of Regina Road Network Plan, the North East Road Network Study, as well as other relevant studies:

- Traffic signals required at the intersections of Fleet Street and McDonald Street (installed in 2010), 9th Avenue North and McDonald Street (installed in 2010), the Winnipeg Street and Ring Road ramps (installed in 2010) and the intersection of 9th Avenue North and Winnipeg Street (pending). Traffic signals were required to ease capacity concerns as a result of existing congestion and construction traffic related to the CCRL expansion.
- Ring Road (north of Dewdney Avenue) is a link that will have inadequate capacity in the future. The addition of a third eastbound lane along the Ring Road from Albert Street to McDonald Street has been recommended and is in the City's five-year capital expenditure program (2010 to 2014 General Capital Program). Grade-separation or rail relocations should be investigated as part of this project.
- For the lands northwest of Ross Industrial Park, Winnipeg Street is one of the only roadways that provide north-south access into this area. Winnipeg Street, north of Ring Road, has been identified as requiring widening and/or road upgrades to serve as a future arterial roadway.

- 9th Avenue North between Winnipeg Street and McDonald Street does not presently meet City of Regina Roadway Standards. Inadequate road width, unprotected roadside hazards, lack of provision for pedestrians and steep side slopes all contribute to safety and capacity issues for road users. A recent study has recommended that 9th Avenue North between Winnipeg Street and McDonald Street be widened to meet the minimum standard for an Industrial Collector Road (13.4 m pavement width with two-3.7 m driving lanes and two-3.0 m shoulders).
- Inland Road and Tower Road have both been identified as being part of the Northeast Bypass. These roads, presently under the jurisdiction of the Rural Municipality of Sherwood, are long term initiatives, but may be beneficial to providing an upgraded highway network to service these industrial lands.
- The City is redesigning a new access road to the bulk water station near the Mount Pleasant Sport Park located on Winnipeg Street North. A detailed design has been prepared realigning the curve at the intersection of Winnipeg Street North and 9th Avenue North, and replaces it with a 3-leg intersection. The third leg is the new entrance to the bulk water station, as well as a main access to the Mount Pleasant Sport Park. The exit to the bulk water station is a new access located approximately 80 m to the north, aligning with a driveway for the Co-Op Home Centre. The new intersection is proposed to operate as an all-way-stop controlled intersection.

3. Study Area

There are numerous constraints within the study area that must be considered when generating alignment options, such as presence of residences or businesses within the study area, buried and above ground utilities and railways and future road network modifications. These constraints are presented in more detail in this section. The constraint of most concern is existing residential or commercial structures or above-ground utilities that may require relocation. These are generally considered the highest level of constraint due to the high cost of relocation and high degree of impact on the property owner. Proposed development is also considered to be a constraint, albeit to a lesser extent than if development already exists.

3.1 Key Roadways

The overall study area is illustrated in **Figure 3.1**. The primary focus of this study will be to make a recommendation for the alignment of the Winnipeg Street Bridge, which determines how the bridge is to be replaced. The function and form of the following roadways have a significant impact on the recommended bridge alignment and should be considered as inputs into the VE criteria:

Ring Road

Ring Road is an east/west, four-lane controlled access roadway (freeway). It is an extension of the Trans-Canada Highway that bypasses the city on the north/east side. Ring Road has a speed limit of 100 km/h. It serves as a high speed connection between Regina's east and northwest suburbs and commercial districts within Regina's industrial centre. There are two at-grade railway crossings with 10 to 20 trains per day. There can be significant delays experienced at those two crossings.

Winnipeg Street

Winnipeg Street provides direct access to the Uplands Neighbourhood via 12th Avenue North, as well as the Northeast neighbourhoods (i.e. Churchill Downs, City View, etc.) directly south of the Ring Road. It also provides access via 9th Avenue North to the Mount Pleasant Sports Park, Co-op Home Centre and the CCRL Heavy Oil Upgrader and other industrial developments in the area.

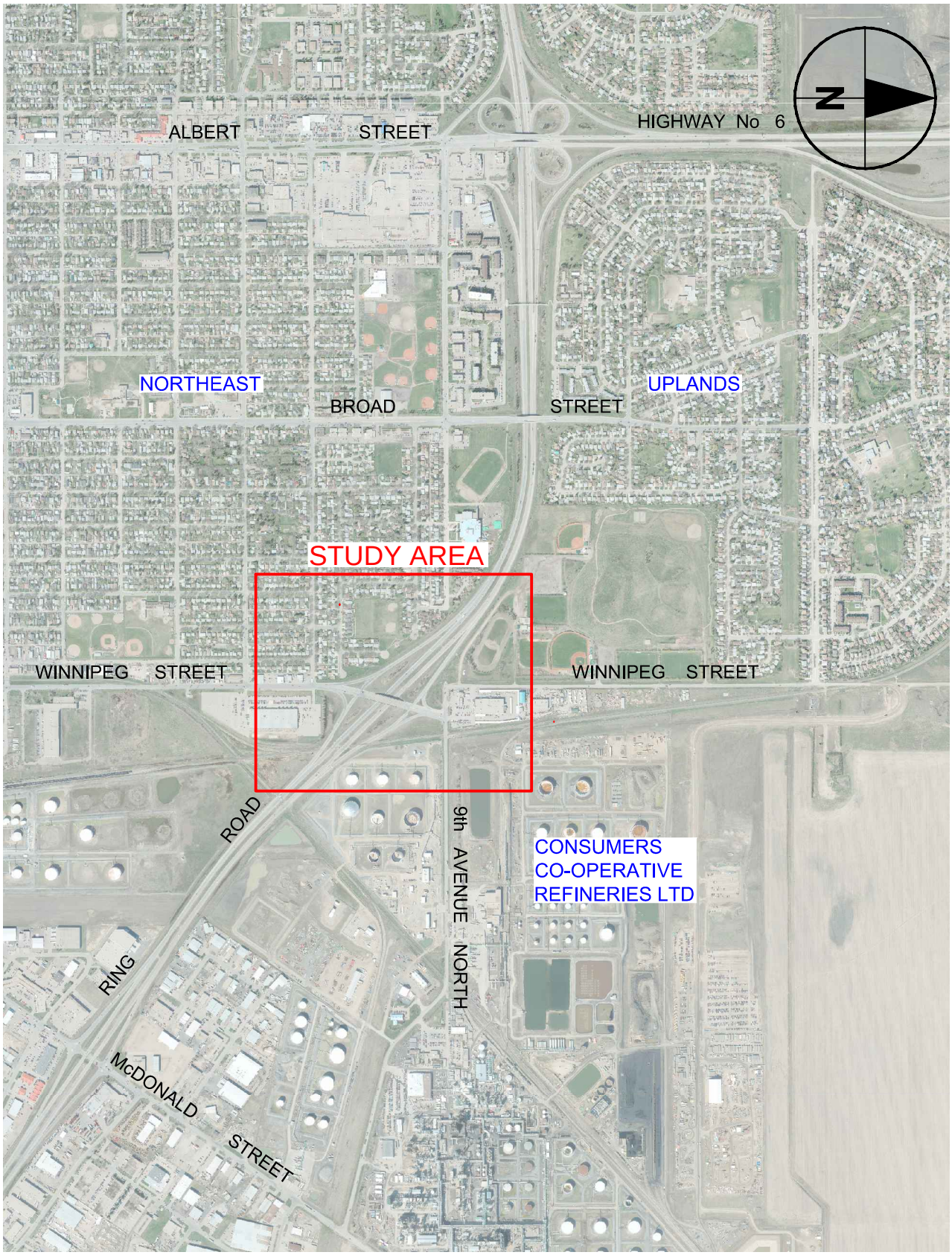
South of the Ring Road, Winnipeg Street is a north/south, four-lane undivided roadway with a speed limit of 50 km/h. Winnipeg Street north of 9th Avenue North is a two-lane arterial roadway with a 6.9 m travel width, no shoulders, steep 3:1 side slopes and no room for pedestrians or cyclists. The speed limit along this roadway section is 60 km/h. It is a substandard road. This road should be upgraded to meet the City's geometric standards.

9th Avenue North

9th Avenue North between Winnipeg Street and McDonald Street is classified as an Industrial Collector Roadway. It is primarily used to transport motorists from Winnipeg Street to McDonald Street; however, this corridor also serves a bulk fuel station for CCRL. Heavy trucks use this roadway to ship fuel from this bulk fuel station to various locations in Saskatchewan and across Canada. There has also been a significant increase in the traffic due to increased operations in CCRL over the past several years.

It is a two-lane rural cross-section roadway with gravel shoulders, narrow ditches and steep side slopes. The posted speed limit is 50 km/h. The pavement width measures 6.7 m with 0.9 m shoulders. The entire width from edge of shoulder to edge of shoulder is 8.5 m. The total right-of-way width varies, however, with the width being 24.3 m east of the CNR tracks, and 20.0 m west of the CNR tracks. There are no turning bays to accommodate turning vehicles.

Based on the City's standards, the roadway does not meet the minimum requirements of an Industrial Collector Roadway. The City of Regina standards require a minimum roadway width of 13.4 m for an Industrial Collector Roadway.



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STUDY AREA - FIGURE 3.1

3.1.1 Ring Road Widening

There has been a recommendation to widen Ring Road by adding additional lanes from Albert Street to McDonald Street. This widening project will impact the widening and lengthening of ramps, relocation of railway crossing lights, signs and utilities and reconstruction of bridge embankments at the Winnipeg Street Bridge.

This widening project should include further study prior to the detailed design and construction to determine the feasibility and extent of the widening, the widening and lengthening of ramps, relocation of railway crossing lights, signs and utilities and reconstruction of bridge embankments.

Opportunities to consider grade separations at the two rail crossings should be examined as part of this project.

3.1.2 9th Avenue North Upgrades

The need for widening this roadway from two-lanes to four-lanes is not necessarily required from a capacity perspective, based on forecast traffic volumes. However, from a safety perspective, the narrow road and steep side slopes pose structural concerns that the road may not be capable of withstanding an increase in heavy truck traffic. 9th Avenue North should be maintained as a rural cross-section, two-lane roadway. To improve safety, the roadway should be upgraded to current standards. The lane widths should be widened to 3.7 m and should include a 3.0 m shoulder on each side.

Further, the right-of-way is narrow with extensive development of both sides of 9th Avenue North. Any kind of widening will likely be expensive because it will involve utility relocation, especially on a section west of the CN Rail crossing.

To improve the operating conditions at the intersection of Winnipeg Street and 9th Avenue North, it has been recommended that the intersection be signalized, with an inter-connection with the CPR railway crossing.

3.2 Structural Condition

The Winnipeg Street Overpass at Ring Road was constructed by the City in 1975, as part of the Ring Road facility. The four (4) span structure is a mix of precast concrete girder types which include:

- Exterior Spans 1 and 4 – Interior box beam multi-spine girders with exterior FC channel girders;
- Interior Spans 2 and 3 – FC channel multi-spine girders;
- Strip seal expansion joints at each abutment and pier; and
- Supplementary supports at the piers for Span 2 and 3 FC girders.

A general elevation view of the structure is provided in **Figure 3.2**.

Figure 3.2 General Elevation of Existing Structure

Since the structure was placed into service, it has been subjected to the following repairs and rehabilitations:

- 1989 - Major rehabilitation to install a waterproofing membrane, modified expansion joint glands and installation of structural supports at the piers for girders at spans two and three to address the structural deficiencies of the FC girders and spot repairs to the surfaces of the concrete deck and barriers; and
- 2003 - Repairs to the asphalt wearing surface, longitudinal joints, barriers and medians. The purpose of this rehabilitation was to extend the life of the 1989 repairs in order to delay the major rehabilitation, which tentatively included a lateral stressing system.

Since 2001, a regular inspection and testing program has been implemented which produced two deck testing reports completed in 2001 and 2008, and detailed visual inspections in 2007, 2010 and 2012.

A predesign report prepared by Stantec Consulting Ltd. in 2010, outlined various rehabilitation strategies for the overpass, given its current condition, based on the deck testing reports from 2001, 2008 and additional testing in 2010. It is apparent from the test data that chloride-contaminated concrete exists in the bridge deck, barriers and substructure. This is evident from our 2012 visual inspection which noted delaminated and spalled areas of concrete. Representative photographs of this damage are provided in **Figure 3.3**.

Typical delamination/spalling at pier.

Typical spalling/corrosion of girder reinforcing steel at pier.

Figure 3.3 Typical Damage (2012 Inspection)

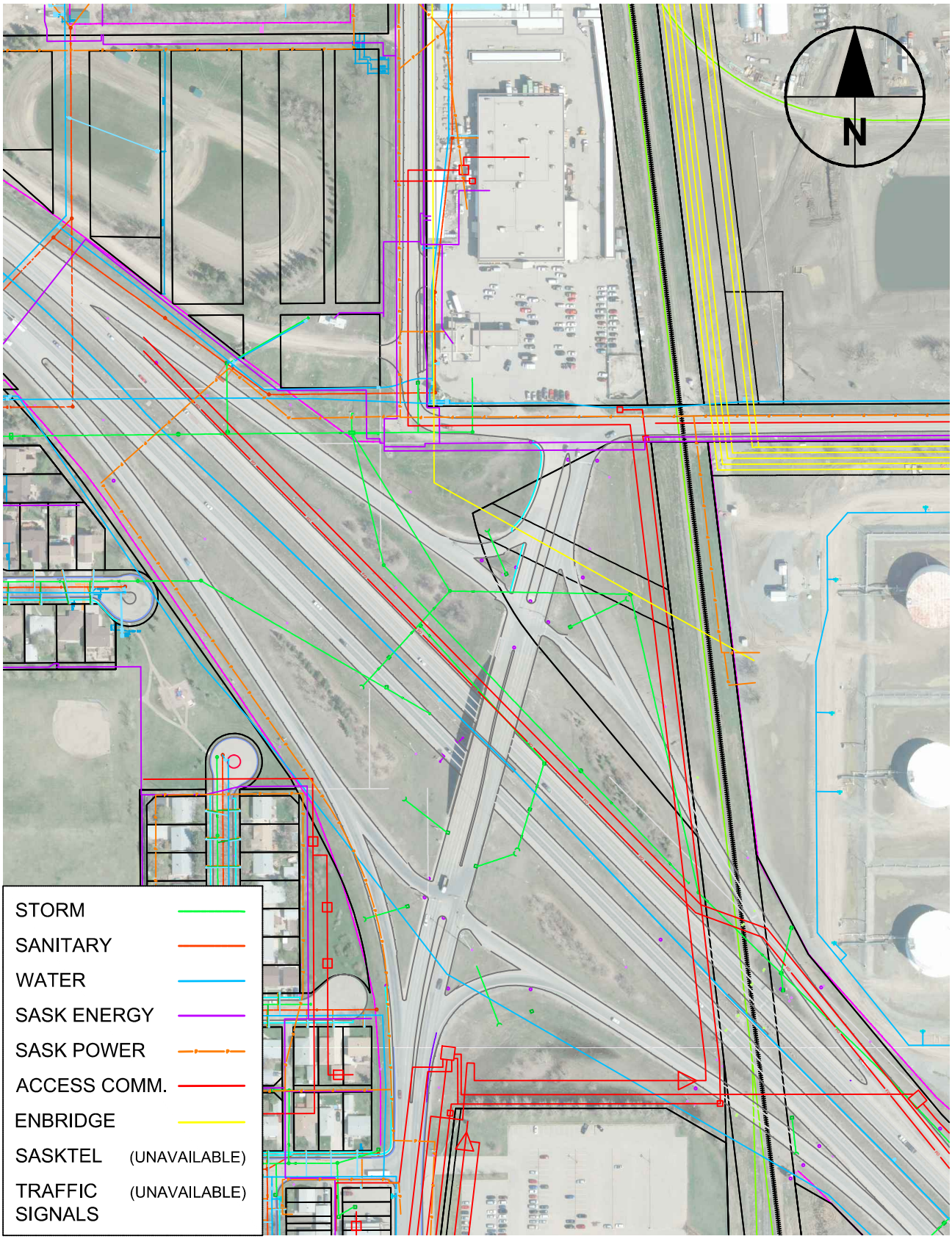
Given the current condition of the structure, the most cost effective repair strategy based on the life cycle analysis contained in the 2010 predesign report, is to allow the structure to continue to deteriorate until replacement is required in an estimated 8-10 years. Rehabilitation costs are estimated at $4.8M, which represents almost 60 percent of the cost of a new structure at this location. It may be possible to salvage certain components of the substructure. Full replacement of the bridge provides an opportunity to increase span lengths to accommodate future widening of Ring Road.

A load rating was performed as part of the 2010 predesign report. There are no current issues regarding the structural capacity of the bridge.

3.3 Utilities

There are a high number of underground and overhead utilities within the project area. The utilities include gas and oil transmission and distribution pipelines, telephone, electrical power distribution lines, water supply mains and sewage mains belonging to private companies, crown corporations and municipal government.

It is unlikely that the presence of utilities will impact the selection of bridge alignment options as impacts will be similar for each option. However, constructing a road over or under those utilities will impact the cost of the new road and are included in the project cost estimate. There are several large diameter gas pipelines and City of Regina sewer and water lines that must be considered when setting vertical grade lines. **Figure 3.4** illustrates key area utilities in the subject area. The utilities of concern are listed below the figure page:



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UTILITIES - FIGURE 3.4

Enbridge Pipelines

This company has five major pipes within the project area. Four pipes (508 mm, 864 mm, 508 mm and 610 mm) which are east of, adjacent to and parallel to, the CPR Lanigan Subdivision from just south of 12th Avenue North to/and across 9th Avenue North. The fifth 1220 mm line is located just outside the east Winnipeg Street road allowance on a 3 m easement. The pipe follows Winnipeg Street from just south of 12th Avenue North to south of 9th Avenue North and crosses diagonally southeasterly to the Enbridge complex.

Plains Midstream Pipelines

This company has one medium sized diameter pipe (406 mm) within the project area. It is located east of and parallel to the Enbridge pipes, from just south of 12th Avenue North to and across 9th Avenue North, into the Enbridge complex.

CCRL Refinery

This company has two small diameter pipes (168 mm) within the project area. They are located east of and parallel to the Plains Midstream pipe, from just south of 12th Avenue North for a distance of approximately 400 m before entering the CCRL complex.

Access Communications

This communications company has a fibre optic line running along the north side of Ring Road through the project site. Access Communications also provides service to the Sherwood Home Centre from the south (near Staples Call Centre), northward crossing Ring Road and along the west side of CPR Lanigan Subdivision to 9th Avenue North, westward to Winnipeg Street and northward to the Home Centre. It also has several buried lines along Winnipeg Street from 6th Avenue North to north of the Staples Call Centre.

SaskPower

A significant overhead line is located along the north side of 9th Avenue North from the CCRL complex, westward to Winnipeg Street. This line connects to an overhead power line along the west side of Winnipeg Street from 9th Avenue North to just south of 12th Avenue North. Two branch power lines are split off from the Winnipeg Street power line. Both splits are to the east of Winnipeg Street at 12th Avenue North and approximately 400 m south of 12th Avenue North.

SaskTel

SaskTel's facilities primarily consist of underground formations outside the immediate overpass location. It has underground formations running east-west, immediately north of 7th Avenue, along the west side of the CPR Lanigan Subdivision (from Staples to 9th Avenue North) and for a short distance along the north side of 9th Avenue North (from the CPR to the Home Centre). It also has a few underground crossings of Winnipeg Street and north of 9th Avenue North.

SaskEnergy

A 219 mm Elevated Pressure (EP) gas line is located 4 m inside the west property line of the Winnipeg Street road allowance from 9th Avenue North to 12th Avenue North. Two (168 mm and 114 mm) EP gas lines are located along the south property line of the 9th Avenue North road allowance, from Winnipeg Street eastward to the CNR Qu'Appelle Subdivision crossing of 9th Avenue North.

Several ancillary buried smaller (114 mm) gas lines are also located within the 9th Avenue North and Winnipeg Street intersection.

City of Regina

The City has numerous underground facilities within the project site, including water supply and storm water mains, which are briefly described below:

- **Water** - A 750 mm PVC water supply main constructed in 1995 is located within the centre median of Ring Road. A 500 mm steel water supply main constructed in 1976 is located along the south property line of Ring Road. A 300 mm asbestos cement water line is located along the north side of 9th Avenue North, from Winnipeg Street to the CCRL complex.
- **Storm** - A series of underground concrete pipes constructed in 1974 serves to provide storm water drainage from all quadrants of the interchange. Included are two Ring Road crossings on either side of the overpass, two crossings of Winnipeg Street (north ditch of Ring Road and north intersection of the diamond interchange), a skew crossing of each of the northeast off-ramp and northwest on-ramp. All of the above lines converge and meet in the northwest quadrant. From that point, a single 1050 mm line drains northwest and connects with a 1500 mm major storm main running along the south side of 9th Avenue North. The 1500 mm line originates in the vicinity of the Co-op Home Centre and drains westward.

3.4 Railways

There are two railways that pass through the project area; the Canadian Pacific Railway (CPR) Lanigan Subdivision and the Canadian National Railways (CNR) Qu'Appelle Subdivision.

CPR Lanigan Subdivision

This railway subdivision connects Regina to Saskatoon via a single track. This main line handles about ten train crossing movements per day. The number of mainline trains does vary with the demand for potash. The number includes a switcher which serves CCRL, EVRAZ Steel Mill and surrounding area. This switcher typically leaves the Regina yard at 2:30 p.m. and returns after switching the industries.

The road crossings of the CPR Lanigan Subdivision all have automatic crossing warning devices (flashing lights and bell) within the project site. The at-grade crossings include Ring Road, 9th Avenue North and Winnipeg Street. The 9th Avenue North crossing also has gates. Immediately south of the Winnipeg Street overpass, the CPR Lanigan Subdivision crosses the CNR Qu'Appelle Subdivision at a diamond crossing. Train traffic over the diamond crossing is controlled by a railway controlled signal system.

CNR Qu'Appelle Subdivision

This railway subdivision connects Regina to Melville, Saskatchewan via a single track. CNR operates a daily freight train to and from Melville. The train departs Regina at approximately 9:00 a.m. and returns around 6:00 p.m. During the fall, CNR may operate additional freight trains on an 'as required' basis. These freight trains usually depart late evening (approximately 10:00 p.m.) and return the following morning at about 6:00 a.m. These movements may occur two or three times per week. CNR also provides a switcher service to Enbridge and CCRL on a daily basis. Thus, in total, this main line currently handles up to about six train crossing movements per day.

A track expansion is planned for the Victoria Plains area, about 1.5 km northeast of CCRL. It is uncertain at this time if this expansion will lead to an increase in the number of train movements over the Winnipeg Street, Ring Road and 9th Avenue North crossings.

The road crossings of the CNR Qu'Appelle Subdivision all have automatic crossing warning devices within the project site. The at-grade crossings include Winnipeg Street (south of the overpass), Ring Road and 9th Avenue North. As noted above, immediately south of the Winnipeg Street overpass, the CPR Lanigan Subdivision crosses the CNR Qu'Appelle Subdivision at a diamond crossing. Train traffic over the diamond crossing is controlled by a railway controlled signal system.

3.4.1 Crossing Protection Guidelines

Transport Canada has guidelines to determine the type of traffic control at all at-grade rail crossings. The guidelines include the use of a cross product formula as a means of determining when a new crossing or an existing at-grade crossing should be considered for upgrading to a grade separated crossing (overpass or subway). The cross product is the sum of the daily vehicle traffic volumes, multiplied by the daily number of train movements.

Generally, a grade crossing must not be constructed if (a) train speeds on the line of railway exceed 80 mph; or (b) the road is a freeway, as classified in the Geometric Design Guide. In these instances, a grade separation should be provided.

Table 3.1 summarizes the cross product calculations for existing traffic conditions. Daily traffic volumes are sourced from the City's 2009 Annual Traffic Flow Map. Cross products greater than 200,000 indicate a grade separation may be required. Gates are typically provided for cross products greater than 50,000.

Table 3.1 Crossing Protection at Railway Crossings

Track	Existing Trains per Day	Crossing	Existing Daily Traffic Volumes (vpd)	Cross Product
CP Lanigan	10	9th Avenue North	6,600	66,000
	10	Ring Road	34,800	348,000
CN Qu'Appelle	6	Ring Road	34,800	208,800

3.4.2 Rail Relocation

History of City of Regina Rail Relocation Program

In the mid 1960's, the City envisaged an opportunity to relocate the main tracks and marshalling yards of the two national railways to the perimeter of the city. The vision was to rid the City of train tracks, noise, vehicular delay at grade crossings, crossing accidents and to develop the released rights-of-way into a dedicated bus way corridor and station grounds to commercial and residential use. As the concept plan was refined in the 1970's, 11 different relocation projects evolved to make up the overall rail relocation scheme.

The City of Regina, by agreement with the two railways and with funding contributions from the federal Grade Crossing Fund, completed relocating the first three projects (commonly referred to as Projects 1 to 3, inclusive) in 1975 on the east side of Regina. These projects removed railway main lines which subsequently enabled the construction of the Highway No 1 Bypass and Arcola Avenue. In 1980, the City completed a fourth project, freeing up the right of way for the Lewvan Drive roadway project.

Further to the City's application, in 1978 the Canadian Transport Commission issued a Construction Board Order for the relocation of the CNR Qu'Appelle Subdivision (Project 5) into a north/south corridor, east of the CCRL complex, through the middle of Section 4 Twp 18 Rge 19 W2M. This relocation would eliminate the at-grade crossing of this track with the Ring Road. The order was never enacted, with a very strong objection by CPR.

In the 1980's, the City applied to the Canadian Transportation Commission for a decision to relocate the CNR marshalling yard, the CNR Central Butte, Craik and Qu'Appelle Subdivisions, along with the CPR Lanigan Subdivision, to a corridor around the north side of the City. Two of the components included relocating the CPR Lanigan and CNR Qu'Appelle Subdivisions into a joint operating north/south corridor as described above.

An affirmative decision and accompanying construction orders were handed down in 1987; however, a lack of sufficient funding led the City to withdraw its pursuit of the relocations. Of noteworthy interest, both the respective federal and provincial Ministers sanctioned the Environmental Impact Assessment for the projects.

In the late 1980's and early 1990's, the City unsuccessfully tried to facilitate a compromise with the two railways to relocate the CNR Qu'Appelle Subdivision, with the addition of the CPR Lanigan Subdivision, into a joint operating corridor. The relocation of both tracks would have a significant impact on the delays and safety at the existing Ring Road at-grade crossings.

Current Opportunities

Since the early 1990's, the City has tried to maintain the corridor unencumbered so that the opportunity to negotiate a relocation of either or both the CNR Qu'Appelle and the CPR Lanigan Subdivisions, could be facilitated. The corridor is slowly being challenged with the expansion of CCRL, City of Regina Landfill and general development.

Any other corridors would involve relocating the tracks further east, around the expanded CCRL complex, at a greatly increased (capital and long-term operating) cost.

The City has reserved additional road right-of-ways at McDonald Street and Ross Avenue to accommodate future subways, in the event that rail traffic was diverted into this corridor. Furthermore, it should not be overlooked that the City, in foresight, constructed a third set of bridge abutments on the north side of the Ring Road subway (under the CPR mainline) to accommodate the potential relocation of the CPR Lanigan Subdivision. If either track should be relocated to the CPR mainline corridor, there would be a significant reduction in vehicular delays and improvement in safety on Ring Road and higher operating rail costs.

3.5 Study Area Developments

For this review, new or proposed industrial, commercial and residential developments are being identified in order to update forecast traffic volumes and identify any constraints to the alignment of the bridge. There are no identified proposed developments within the immediate area that are anticipated to affect the alignment of the bridge.

Key area developments include:

Melcor (ERIL) Lands

A total of 300 ha of new industrial and commercial development (East Regina Industrial and Business Lands (ERIL) is located east of the Ross Industrial Park and is bordered by Highway No. 46 to the north, Fleet Street to the west, Prince of Wales Drive to the east and the Glencairn neighbourhood to the south. It is assumed that these lands will fully develop within the 25 year forecast horizon for this study. This area will include Light Industrial and Business District, a Mixed Industrial and Business District, a Rail Service District and a Commercial Service District. This area has the potential to generate up to 2,800 vph in the afternoon peak hour.

Ross Avenue Industrial Park

The next phase of development for Ross Industrial Park includes approximately 57 ha of land. A concept plan for the area was previously developed in the early 1980's and the area subdivided. The area is bounded by railway lines on the west and south limits of the area, Fleet Street on the east and Turvey Road on the north. Highway No. 46 is located approximately 800 m to the north. The North Storm Drainage channel crosses the proposed development area from east to west. The SGI site was developed in 2001 south of the drainage channel. Areas west of Fleet Street are currently undeveloped.

Consumers' Co-operative Refineries Limited (CCRL)

CCRL occupies in excess 60 ha of land located east of Winnipeg Street, north of 9th Avenue North and McDonald Street and east of Fleet Street. CCRL are completing a major expansion and revamping of the Regina refinery to increase production by approximately 30 percent. Construction started in 2010 and will be complete in 2013. About 1,800 workers will be required at the peak of construction and, after the expansion and revamping is complete, it is expected that the permanent staff complement on-site will increase by approximately 150 employees.

Traffic signals were installed at the intersections of McDonald Street and Fleet Street, McDonald Street and 9th Avenue North and the two interchange ramp terminals at Winnipeg Street and Ring Road, to assist with construction related traffic.

A substantial amount of the product is shipped to consumers via truck transport. Product is shipped from two loading points. One loading point is located on the west side of McDonald Street, just south of 9th Avenue North. The other is located on the north side of 9th Avenue North between Winnipeg Street to the west and McDonald Street to the east.

CCRL has advised that approximately 4,000 trucks are loaded on a monthly basis. Assuming a typical five day week would accommodate most of the traffic from the refinery, approximately 200 trucks, with tanks, are loaded on a daily basis. Furthermore, more loadings take place during the spring and fall times of the year in support of the agricultural industry.

CCRL employees working in the truck loading area adjacent to 9th Avenue North usually start work between 7:00 and 7:30 a.m. Quitting time is 4:20 p.m. for in-scope staff and from 4:30 to 5:00 p.m. for out-of-scope staff.

City of Regina Landfill

The City has operated the Fleet Street Solid Waste Disposal and Recovery Facility since 1961. The facility is located northeast of the city in the west half of Section 3-18-19 W2M. The City has proposed expanding the existing site to the south and west of the existing footprint. Currently, the site accepts approximately 450 vehicles per day, on the average, with peak daily traffic of 1,200 vehicles per day; commercial vehicles comprising 44 percent of the vehicles; small vehicles, 48 percent; and City vehicles, 7 percent of vehicles. Traffic volumes to the landfill have increased approximately 0.3 percent per year from 2000 to 2007. Primary access to the landfill expansion will remain on Fleet Street with no new proposed connections to McDonald Street. New exit and entrance configuration onto Fleet Street, as well as traffic signals, may be required to provide for the safe control of traffic crossing Fleet Street. Long term expansion plans may require the realignment of Fleet Street.

Kensington Greens

Kensington Greens is a proposed residential development approximately 40.2 ha (99.3 acres) in size. It is bordered by the 1000 m IPSCO buffer to the north, Uplands to the south, the Canadian Pacific Railway to the east and the Highway No. 6 Service Road to the west. A total of 550 residential units are proposed and some phases of the development are currently underway.

Kensington Greens will generate an estimate of total trips of 510 vph in both directions (i.e. in and out of the subdivision) during the afternoon peak hour. Thirty percent of this traffic has been assigned to Winnipeg Street (an equivalent of 150 vph or 1500 vpd).

Somerset

Somerset is a proposed residential development approximately 56.7 ha (140 acres) in size. It is located in the north portion of the Uplands Community, adjacent to the NE side of the CP rail line. While it is intended to be primarily residential in nature, it is proposed that there will be a commercial node. The expected population is 3,630 upon build out. A total of 1,400 residential units are proposed.

Winnipeg Street is expected to be the only point of entry into the proposed development. Somerset could generate up to 1,750 vph in both directions (i.e. in and out of the subdivision) during the afternoon peak hour. A total of 65 percent of Somerset traffic would route to 9th Avenue North, or an equivalent of 1,140 vph.

The City had not formally approved this development, however; for the purpose of generating future traffic volumes, it was assumed the Somerset residential development or some other similar development will occur in this area.

3.6 Local Access

There are a number of key access points that will need to be maintained or relocated:

Bulk Water Access Road

The City is redesigning a new access road to the bulk water station near the Mount Pleasant Sport Park located on Winnipeg Street North. A detailed design has been prepared that realigns the curve at the intersection of Winnipeg Street North and 9th Avenue North, and replaces it with a 3-leg tee intersection. The third leg is the new entrance to the bulk water station, as well as a main access to the south portion of the Mount Pleasant Sport Park. The exit to the bulk water station is a new access located approximately 80 m to the north, aligning with a driveway for the Co-Op. The new intersection is proposed to operate as an all–way-stop controlled intersection.

There will be approximately 55 m between this new intersection and the 9th Avenue North and Winnipeg Street intersections. The intersection spacing is just short of meeting the minimum intersection spacing of 60 m for collector roads.

Commercial Developments

The north leg of the Winnipeg Street and 9th Avenue North intersections is the main access to the Co-op Home Centre retail store and gas bar. The design will need to consider how to provide access to this development.

3.7 Traffic Accommodations

Maintaining traffic during replacement of the bridge is a critical issue for local residents of Uplands and Churchill Downs subdivisions, as well as the adjacent businesses and the CCRL refinery. Approximately 12,000 vehicles per day drive on the Winnipeg Street Bridge. A significant percentage of the vehicles are large tanker trailer units from the CCRL refinery. Using traditional bridge replacement methods, the bridge would be out of service for at least a year.

Capacity

Closure of the Winnipeg Street Bridge will require the 12,000 vehicles that presently use the Winnipeg Street Bridge daily to choose alternate routes. The Winnipeg Street Bridge over Ring Road is one of few points of access for heavy truck traffic leaving Ross Industrial Park and is the only access to Ring Road for Upland's and Kensington Green's residents. There is limited capacity at the other Ring Road crossings (McDonald Street, Broad Street and Ross Avenue), such that fully closing the Winnipeg Street Bridge would cause significant congestion at the other bridges.

Safety

In addition to capacity concerns with Winnipeg Street traffic being detoured to other streets, safety is also a concern. Emergency access to the CCRL refinery is critical and at least two separate accesses should be available at all times. Uplands subdivision will also only have one easily accessible access during construction. Ring Road forms a barrier between the Uplands subdivision and CCRL with fire, police and ambulance.

3.8 Drainage

Adequate trunk sewers exist in the immediate area to provide drainage. Drainage will be a minor consideration when selecting the recommended bridge alignment option, as each option considered will have the same drainage impacts and concerns.

4. Traffic Conditions

4.1 Key Intersections

Winnipeg Street and 9th Avenue North is an all-way-stop controlled intersection. Traffic signals at this location are pending. All approaches are single lane approaches with no auxiliary lanes, except for the south leg of Winnipeg Street, which provides separate right and left turn lanes. The north leg provides access to a commercial development and gas bar. The west leg is wide enough to provide separate right and through lanes, although it is not signed nor painted as such. There is also a gated railway crossing approximately 35 m east of this intersection.

Winnipeg Street, Ring Road North Intersection and South Intersection form part of the Winnipeg Street and Ring Road interchange. These two intersections have been signalized since June 2010. Single auxiliary lanes have been provided for the southbound and northbound left turns.

4.2 Performance Measures

A capacity analysis was conducted on the study area using Synchro plus SimTraffic Version 8.0. Synchro is a software application for optimizing traffic signal timing and performing capacity analysis. The software optimizes splits, offsets and cycle lengths for individual intersections, an arterial or a complete network.

Performance Measures such as Average Delay, Level of Service (LOS) and Volume to Capacity Ratios (v/c) are summarized by intersection for each timeframe and peak hour analyzed.

LOS ranges in definition from LOS A, which provides the highest level of operational service to intersection users, to LOS F, which constitutes failure of the intersection or the turning movement being studied. Overall intersection LOS is based on intersection delay; the intersection delay is the average weighted delay per vehicle at the intersection. LOS D is commonly considered the limit of acceptable operation. Significant delays in traffic can occur below this level. Under certain circumstances, an LOS E is acceptable for left turn movements, only in an attempt to provide improved level of service for opposing through traffic or when the corresponding v/c ratio is less than 0.85.

Note that the LOS criteria for an unsignalized intersection are different from what is used for signalized intersections. The LOS for signalized intersections is based on average stopped delay time per vehicle. The LOS for unsignalized intersections is based on the minimum time interval between vehicles in a major traffic stream that permits side-street vehicles at a STOP-controlled approach to enter the intersection.

Table 4.1 shows LOS criteria for signalized and unsignalized intersections.

Table 4.1 LOS Criteria for Signalized and Unsignalized Intersections

Level of Service	Average Total Delay (seconds) [Signalized Intersections]	Average Total Delay (seconds) [Unsignalized Intersections]
A	10.0 or less	10.0 or less
B	10.1 to 20.0	10.1 to 15.0
C	20.1 to 35.0	15.1 to 25.0
D	35.1 to 55.0	25.1 to 35.0
E	55.1 to 80.0	35.1 to 50.0
F	Greater than 80.0	Greater than 50.0

For this analysis, the following minimum acceptable LOS was used in the evaluation: an overall intersection LOS D, LOS D for through movements and LOS E for left turn movements. The volume to capacity (v/c) ratio represents the sufficiency of an intersection to accommodate the vehicular demand for each movement. A v/c ratio less than 0.85 generally indicates that adequate capacity is available and vehicles are not expected to experience significant queues and delays. Once the demand exceeds the capacity (a v/c ratio greater than 1.0), excessive delay and queuing is expected. Under these conditions, vehicles may require more than one signal cycle to pass through the intersection. A v/c ratio of 0.85 is generally used for design and signal timing purposes.

4.3 Existing Traffic Operations

Current traffic volumes were estimated using morning and afternoon peak hour turning movement counts, conducted in 2009 by AECOM, at the three study intersections. These volumes were updated to 2012 volumes, by adding a one percent growth per year and do not include any CCRL construction related traffic. The 2012 afternoon peak hour volumes are illustrated in **Figure 4.1**. The afternoon peak hour occurs from 4:30 p.m. to 5:30 p.m.

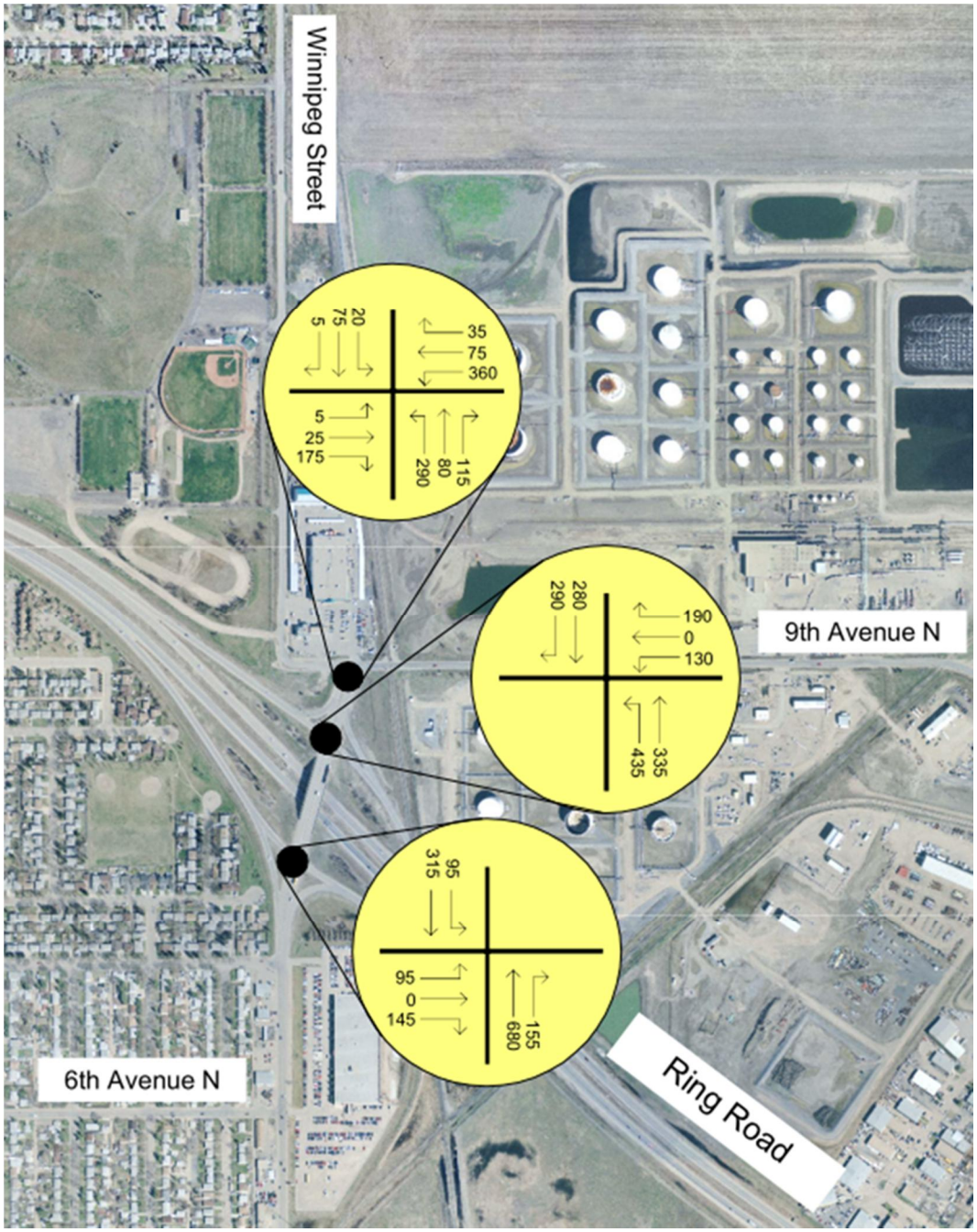


Figure 4.1 Existing Afternoon Peak Hour Traffic Volumes

Table 4.2 presents the LOS results.

Table 4.2 Existing Afternoon Peak Hour Level of Service Results

Intersections			Overall Intersection		Individual Movement		
			LOS	Delay (s)	V/C	Movement	LOS
Signalized Intersections							
Winnipeg Street		Ring Road Ramp (N)	B	15	0.74	NB LT	C
Winnipeg Street		Ring Road Ramp (S)	B	13	0.51	NB Th	B
Winnipeg Street		9th Avenue North	F	74	1.20	WB App	F
					0.98	NB LT	F

The following is a summary of key intersection operation findings:

- The network is operating with an overall total delay of 31 seconds/vehicle (s/v) or 38 hours of total delay.
- Winnipeg Street and 9th Avenue North – this unsignalized intersection currently operates at a LOS F, with several movements operating at a LOS F, including the westbound approach and the northbound approach. Both of these approaches also have v/c ratios greater than 0.85. Based on the LOS analysis, signalization would be warranted at this intersection to help alleviate the capacity concerns and help reduce v/c ratios. There are technical and safety concerns with installation of a traffic signal close to a railway signal.
- Winnipeg Street and Ring Road North and South Intersections – these intersections both operate acceptably during the afternoon peak hour, with an overall LOS B. All movements are operating at a LOS C or better, with no movements operating at v/c ratios greater than 0.74.

4.4 Forecast Baseline Traffic Operations

Forecast traffic volumes were obtained from the NE Road Network Study. An operational analysis of future traffic conditions was based on the EMME/3 model output for the 235,000 population, which is expected within the next 20 years. The EMME/3 model is a city-wide tool that incorporates land use, population and employment demographics.

The City of Regina EMME/3 model was updated in 2009 as part of a separate project that ran parallel to the NE Road Network Study. This upgrade includes the first comprehensive set of new travel surveys in 20 years and provides a chance to test for any changes to the travel behaviour incorporated in the original model.

All of the future or proposed trips generated by the developments listed in Section 3.4 are included in the forecast traffic volumes, except for those generated by the Somerset Development. For the planning purposes of this report, it was estimated that the Somerset Development would generate a total of 1750 vph and that 65 percent of this traffic would route south to 9th Avenue North. As a result, a total of 1140 vph were added to the intersection of Winnipeg Street and 9th Avenue North, primarily as a northbound left turn (+570 vph) and eastbound right turn (+370 vph). This traffic was also routed through the ramp intersections.

The forecast afternoon peak hour volumes are illustrated in **Figure 4.2**

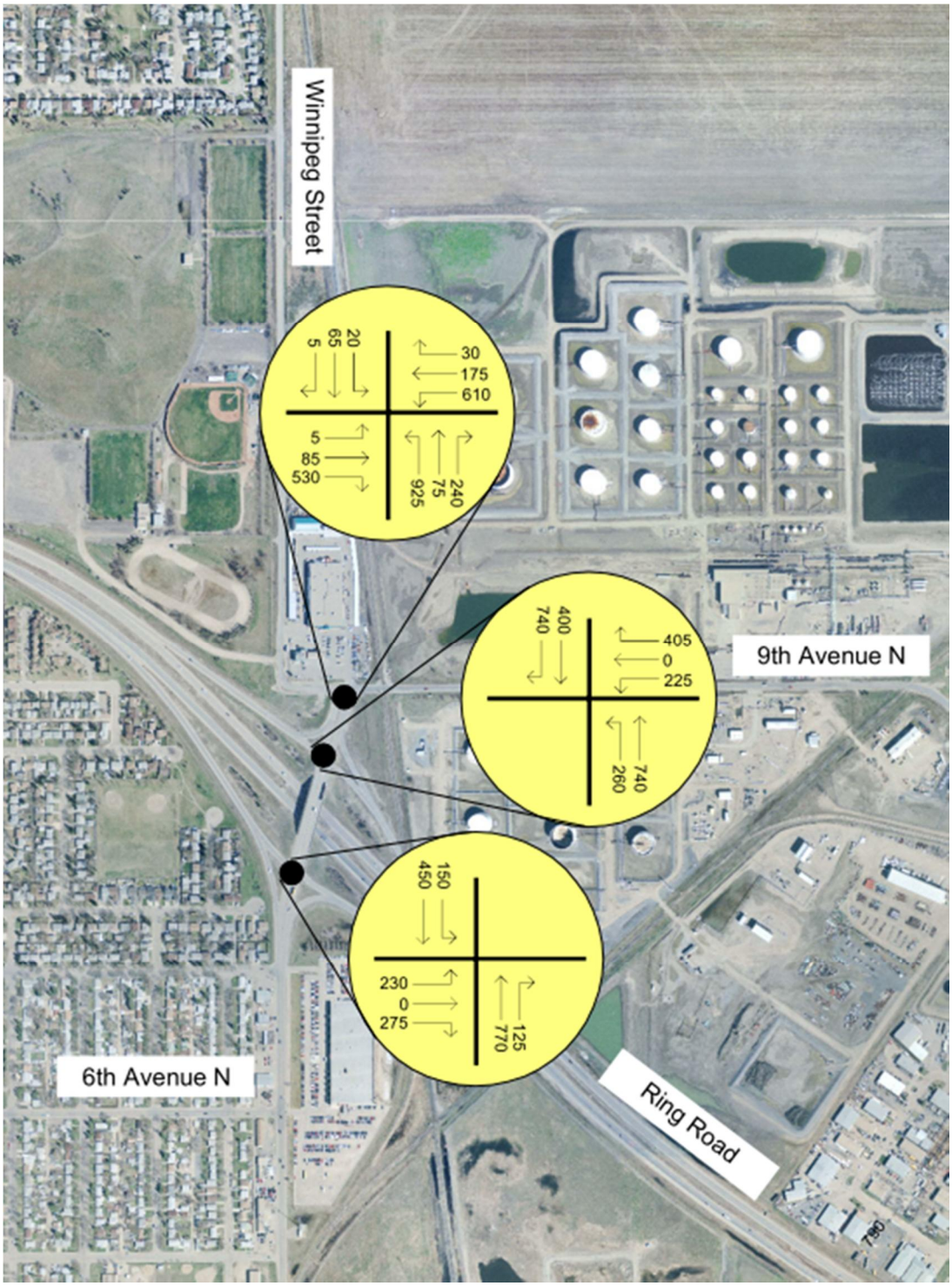


Figure 4.2 Forecast Afternoon Peak Hour Traffic Volumes

High westbound left turn volumes at Winnipeg Street and 9th Avenue North is an indication of demand, and may be a result of traffic wishing to go to Northwest Regina, by avoiding the McDonald Street interchange, which is forecast to have capacity issues. The westbound left turn may have been overestimated by the EMME model, but there may be routing assumptions that were developed that placed such a high demand for this left turn as a result of capacity constraints elsewhere in the network. It is possible that the resulting left turn will likely be in the range of 500 to 600 vehicles per hour.

Table 4.3 presents the LOS results. There have been no changes to intersection geometry or change in traffic control at any of the three study intersections.

Table 4.3 Forecast Afternoon Peak Hour Level of Service Results

Intersections		Overall Intersection		Individual Movement		
		LOS	Delay(s)	V/C	Movement	LOS
Signalized Intersections						
Winnipeg Street	Ring Road Ramp (N)	B	17	0.88	SB RT	B
Winnipeg Street	Ring Road Ramp (S)	B	18	0.70	EB LT	C
Unsignalized Intersections						
Winnipeg Street	9th Avenue North	F	+500	2.26	WB App	F
				2.87	NB LT	F
				1.33	EB RT	F

The following is a summary of key intersections operation findings:

- The overall network is operating with an overall total delay of 204 s/v or 426 hours of total delay.
- Winnipeg Street and 9th Avenue North – this unsignalized intersection will continue to operate at a LOS F, with the westbound approach and the northbound approach both operating at a LOS F. Both of these approaches also have v/c ratios greater than 0.85. Based on the LOS analysis, signalization would be warranted at this intersection to help alleviate the capacity concerns and help reduce v/c ratios. Generally, when motorists are faced with this type of delay, they will find another route, however; in this case there are few alternate routes that would reduce the motorists overall delay.
- Winnipeg Street and Ring Road North and South Intersections – these intersections will both continue to operate acceptably during the afternoon peak hour, with an overall LOS B. All movements are operating at a LOS C or better, with only one (1) movement operating at a v/c ratio greater than 0.85, which is the southbound right turn at the north intersection.

Additional analysis was undertaken using the SimTraffic model. This analysis tool identified additional concerns during the forecast afternoon peak hour regarding queuing and delay issues at all three intersections:

- Winnipeg Street and 9th Avenue North – queuing in the westbound direction reaches of average of over 200 m, while queuing in the northbound direction reaches an average of 100 m. The queuing in the northbound direction is long enough to block the westbound exit ramp from the Ring Road.

- Winnipeg Street and Ring Road North Intersection – as a result of the queuing at 9th Avenue North blocking the westbound exit ramp from Ring Road, there is queuing on the ramp for approximately 40 m back towards the Ring Road. The length of the ramp (~450 m) is sufficiently long enough to handle the maximum queues without blocking Ring Road traffic.
- Winnipeg Street and Ring Road South Intersection – as a result of the queuing at 9th Avenue North, there is also queuing in all directions at this intersection. There is queuing on the eastbound ramp for approximately 250 m back towards the Ring Road.

Signalization of the 9th Avenue North and Winnipeg Street intersection will still see significant failures (LOS F) in both the northbound and westbound approaches. Queuing will still be a concern at all intersections as a result of the failure of this intersection.

4.5 Collision History

The City provided a collision summary for the study area intersections, as well as collision summaries of the surrounding area. The summaries below include collisions reported during the last five year reporting period (2006 through to 2010, inclusive) within the study area. Overall, there were no fatalities at these intersections.

Table 4.4 presents the overall collision results for the study area locations and summarizes the top two configurations or collision pattern for each location.

Table 4.4 Collision Totals by Location

Location	Total Collisions (5-year total)	Highest Configuration	Second Highest Configuration
Winnipeg Street and 9th Avenue North	14	11 - Rear End	3 - Right Angle
Winnipeg Street and Ring Road Ramp North Intersection	13	4 - Fixed Object	4 - Rear End
Winnipeg Street and Ring Road Ramp South Intersection	9	4 - Rear End	2 - Lost Control to Ditch
Winnipeg Street Bridge (between ramps)	2	1 - Rear End	1 -Other
SW, SE, SW, NE Ramps from Ring Road to Winnipeg Street	11	4 - Lost Control to Ditch	3 - Rear End

5. Development of Scenarios

The following section provides the design considerations that were established when producing alternative bridge realignment and interchange configurations.

5.1 Design Standards

The design criteria and policies in the Transportation Association of Canada (TAC) guidelines and Saskatchewan Ministry of Highways and Infrastructure design manual, provide guidelines in the design of the Winnipeg Street Bridge realignment and interchange scenarios. The guidance allow for flexibility in applying design standards and approving design exceptions that take the context of the project location into consideration; which enables the designer to tailor the design, as appropriate, for the specific circumstances while maintaining safety. The Winnipeg Street interchange is a local interchange that provides a controlled access to the Ring Road.

The controlling criteria and selected design standards are presented in **Table 5.1**.

Table 5.1 Design Criteria

Interchange Ramps Controlling Criteria	Ramp Design Standard
Design Speed	80 km/h (50 mph)
Lane Width	3.7m (12 ft)
Left Shoulder Width	1.2m (4 ft)
Right Shoulder Width	2.4m (8 ft)
Bridge Width	As required for traffic volume, safety, pedestrian crossing, and bike lane
Curve Radius	Exceed 670 m minimum
Loop Curve Radius	Exceed 45 m minimum
Stopping Sight Distance	Exceed 130 m minimum
Super-elevation	5% maximum
Design Vehicle Name/Type	WB – 100 T/Triple Trailer CO-A
Maximum Gradient	5%
Winnipeg Street Controlling Criteria	13.4 M T.W. Industrial Classification Design Standard
Design Speed	50kph (35 mph)
Lane Width	3.7m (12 ft)
Shoulder Width	1.2m (4 ft) or wider at intersections
Curve Radius	Exceed 180 m minimum
Stopping Sight Distance	Exceed 75 m minimum
Super-elevation	5% maximum
Design Vehicle Name/Type	WB – 100 T/Triple Trailer CO-A
Maximum Gradient/Minimum Gradient	4%/0.6%

5.2 Scenario 1 – Existing Bridge Alignment

This scenario represents replacing the bridge in the same alignment as the existing bridge. **Figure 5.1** illustrates this scenario. This scenario is considered the baseline condition and all other scenarios considered will be compared to this one. The bridge spans would be increased to accommodate two additional lanes on Ring Road: one westbound and one eastbound.

The superstructure (girders, deck and expansion joints) and outside piers would be replaced. The centre pier can be salvaged. Salvaging the outside foundation may be possible. Winnipeg Street traffic will be significantly impacted. Ring Road traffic will have some speed reductions and short term restrictions during construction.

There are several construction techniques that may be used:

- Total closure – Winnipeg Street is totally closed to allow contractor full use of the site. Interchange ramps would remain open, however, certain turn movements will not be possible.
- Partial closure - Contractor must maintain traffic during construction and build the new bridge half at a time. Traffic would be restricted to one lane in each direction. Speeds would be reduced and all turn movements would be allowed. This technique takes a considerably longer time period for construction.

Advantages and disadvantages of this scenario are listed below. They were created based on the perspective of traffic safety, traffic delay and maintaining or improving economic development conditions.

Advantages:

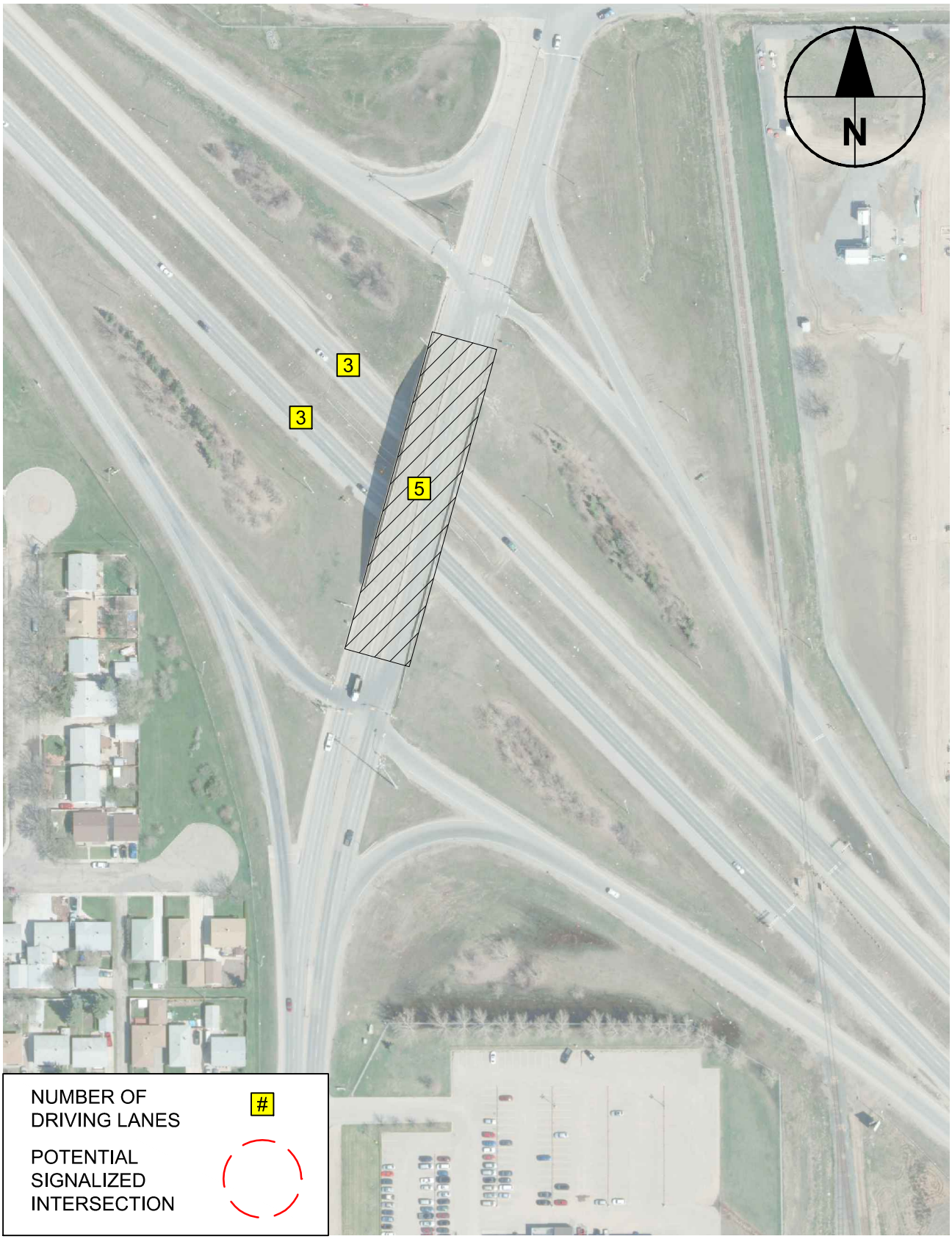
- Least cost scenario.

Disadvantages:

- Significant negative impact on Winnipeg Street traffic during bridge construction;
- Three traffic signals on Winnipeg Street in a short distance (third signal is planned at Winnipeg Street and 9th Avenue North intersections) will delay traffic; and
- Weaving concerns for traffic on westbound to northbound ramp.

Sub-Scenarios Considered

It is possible to upgrade the diamond interchange by replacing the three signalized intersections with two modern roundabouts. **Figure 5.2** illustrates this scenario. Traffic delays and collisions will be less; however, driver acceptance may be an issue as roundabouts are not common in Saskatchewan.



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City of Regina | REGINA Infinite Horizons

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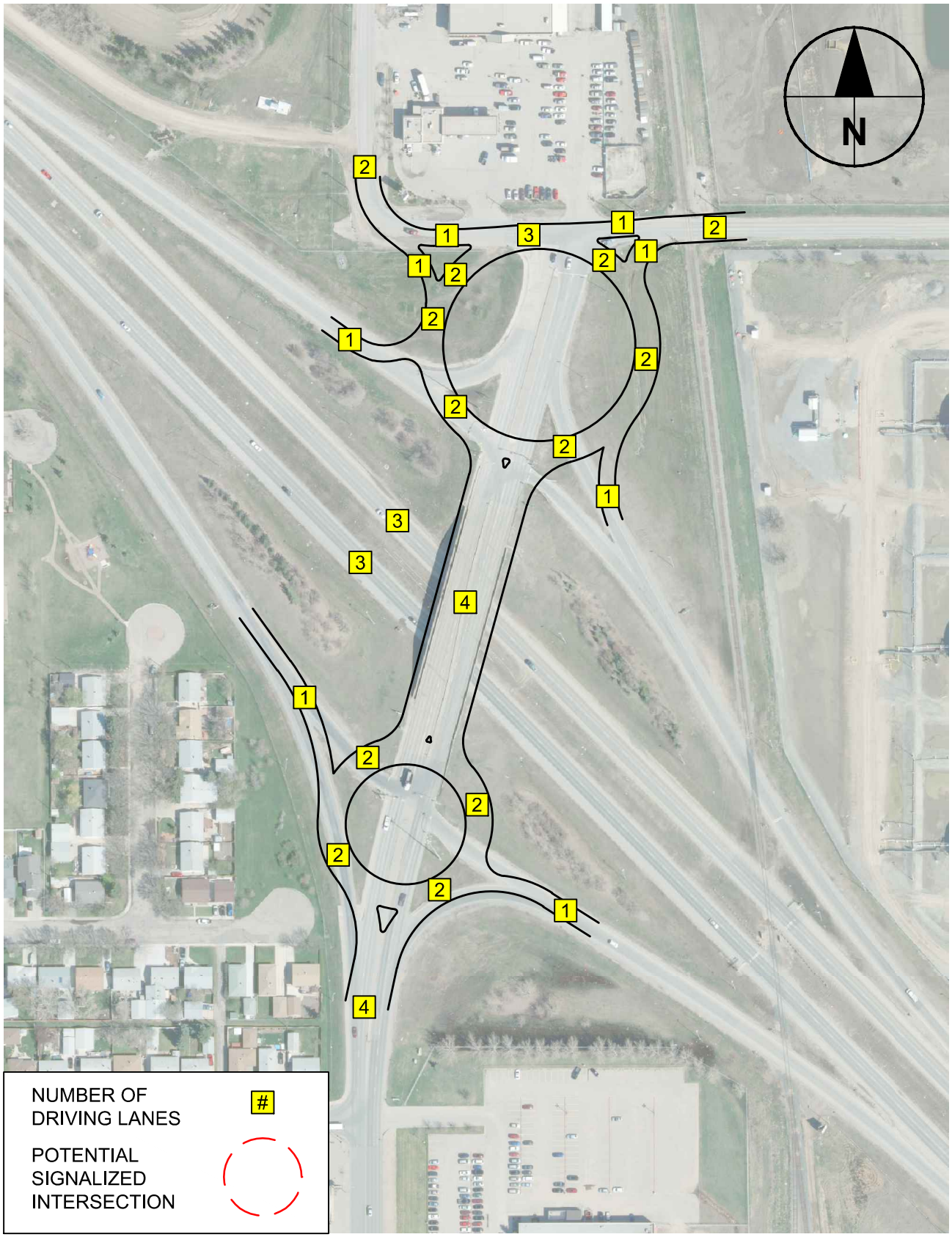
CITY OF REGINA
WINNIPEG STREET BRIDGE REALIGNMENT STUDY
VALUE ENGINEERING

EXISTING ALIGNMENT
OPTION 1-A - FIGURE 5.1



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WINNIPEG STREET BRIDGE REALIGNMENT STUDY
VALUE ENGINEERING

ROUNDABOUT

OPTION 1-B - FIGURE 5.2

5.3 Scenario 2 – New Bridge Alignment to the East with Diamond Interchange

This scenario represents construction of a separate new bridge east of the existing bridge. **Figure 5.3** illustrates this scenario. Winnipeg Street traffic can continue to use the existing bridge with little or no negative impacts during construction. Relocating the bridge requires significant vertical and horizontal adjustments to the interchange ramps to connect with the realigned Winnipeg Street.

The old bridge would be completely removed after the new bridge is open to traffic with no salvage value. A key feature of relocating the new bridge east of the existing bridge is the northward continuation of Winnipeg Street, which will require significant property purchase. As with Scenario 1, three traffic signals are required on Winnipeg Street.

Advantages and disadvantages of this scenario are listed below. They were created based on the perspective of traffic safety, traffic delay and maintaining or improving economic development conditions:

Advantages:

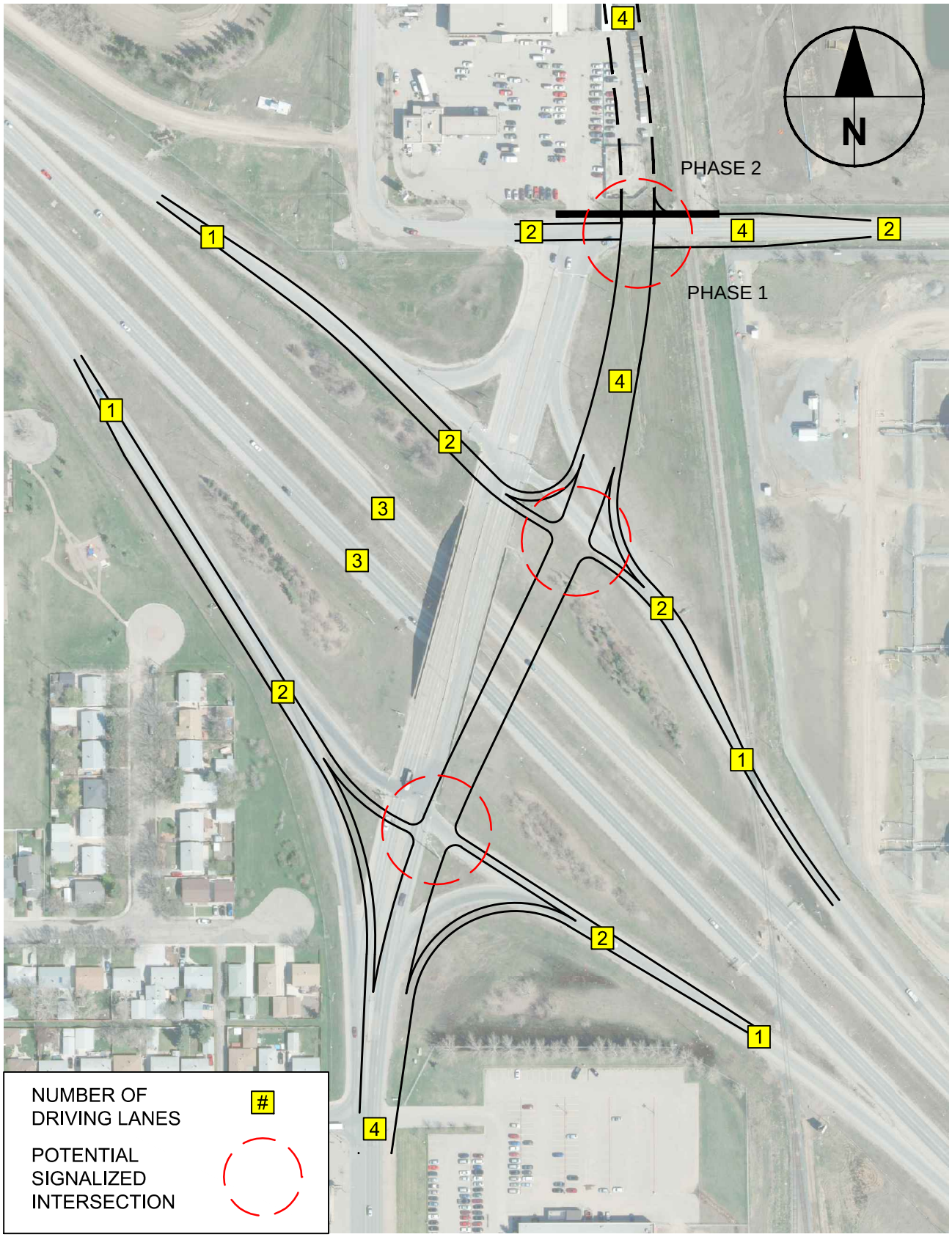
- Little or no impact on Winnipeg Street traffic during bridge construction;
- Winnipeg Street becomes a continuous north/south arterial (no jog in the road);
- Access to Mount Pleasant Sports Park and bulk water station at controlled designated intersections separate from the arterial traffic flows on Winnipeg Street (safer); and
- This scenario can be staged. Construction of Winnipeg Street north of 9th Avenue North can be delayed. In the interim, traffic would make the jog on Winnipeg Street as they do today.

Disadvantages:

- Requires three traffic signals on Winnipeg Street in a short distance (a third signal is planned at the Winnipeg Street/9th Avenue North intersection);
- Traffic signal at Winnipeg Street/9th Avenue North must be pre-empted with CPR Rail crossing signal;
- Potential for westbound vehicles to stop on CP Rail tracks (safety concern for CPR);
- The cost is four times the cost of base scenario;
- Winnipeg Street, north of 9th Avenue North has frontage on one side only. Double frontage is preferable; and
- The City will have to maintain two parallel roadways: existing Winnipeg Street as a service road to provide access to Mount Pleasant Sports Park and the new Winnipeg Street.

Sub-Scenarios Considered-

A partial cloverleaf (Parclo) is feasible. Loops can be installed in the southeast and northwest quadrants that provide free flow access to Winnipeg Street from Ring Road. This scenario is illustrated in **Figure 5.4**. Two traffic signals would be required on Winnipeg Street. This scenario provides significant improvement to level of service (less delay and collision potential). Access to Mount Pleasant Sports Park would occur via a new east/west roadway north of the Coop Home Centre. This sub-scenario cannot be staged.



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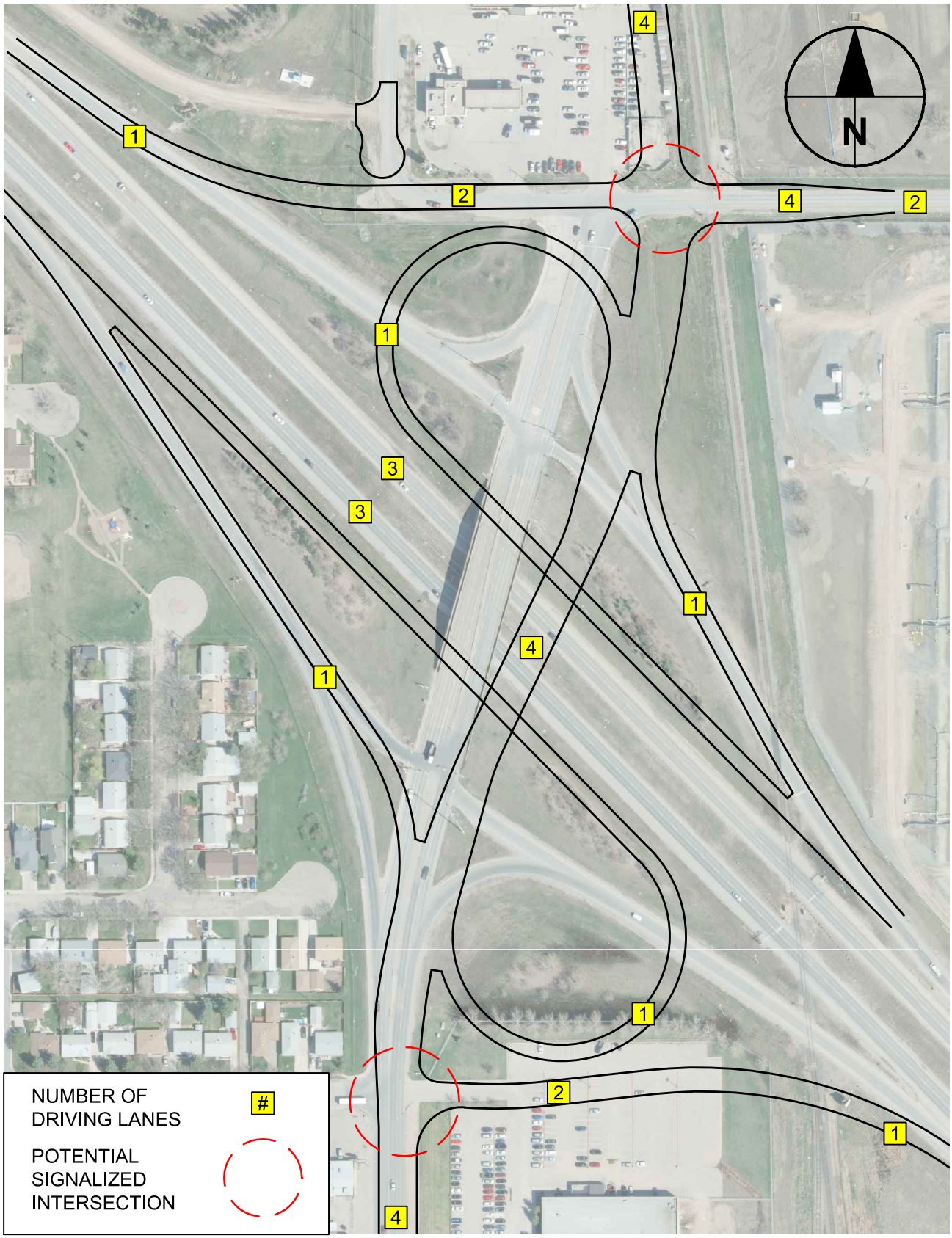
VALUE ENGINEERING

EAST DIAMOND
OPTION 2-A - FIGURE 5.3



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EAST PARCLO

OPTION 2-B - FIGURE 5.4

5.4 Scenario 3 – New Bridge Alignment to the West with Modified Diamond Interchange

This scenario represents construction of a new bridge west of the existing bridge. **Figure 5.5** illustrates this scenario. A full diamond interchange was considered, but eliminated, due to the need to purchase residential property in the south west quadrant. The chosen design is a modified diamond-type interchange to the north, and a ramp/loop combination in the south quadrant.

Relocating the bridge requires significant vertical and horizontal adjustments to the interchange ramps to connect with the realigned Winnipeg Street. The old bridge will be completely removed after the new bridge is open to traffic, with no salvage value. One traffic signal is required on Winnipeg Street and another is required on 9th Avenue North.

Advantages and disadvantages of this scenario are listed below. They were created based on the perspective of traffic safety, traffic delay and maintaining or improving economic development conditions:

Advantages:

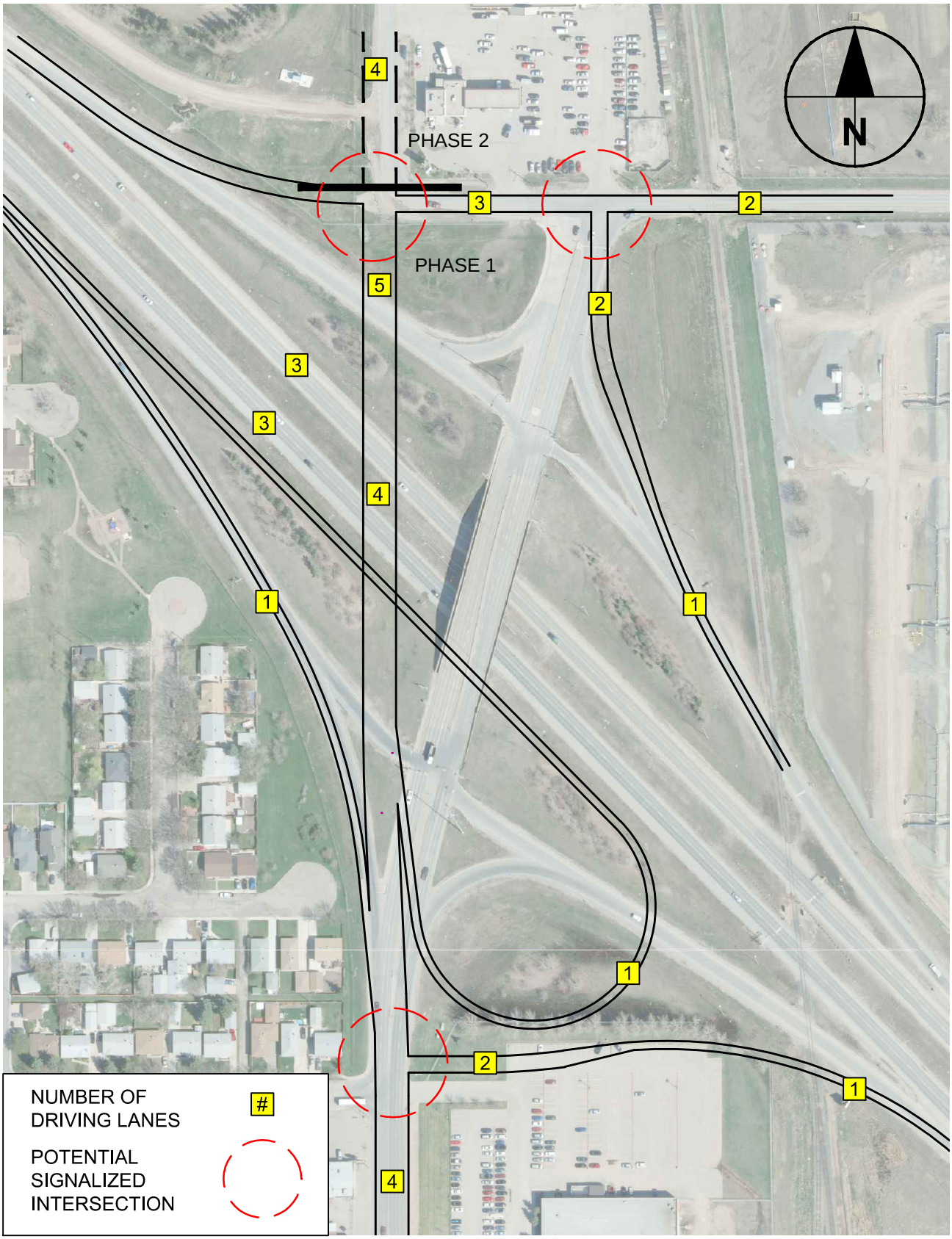
- Little or no impact on Winnipeg Street traffic during bridge construction;
- Winnipeg Street becomes a continuous north/south arterial (no jog in the road) with double frontage;
- Tanker truck access to and from the west to CCRL significantly improved;
- Requires two traffic signals on Winnipeg Street, about 500 m apart (less delay); and
- This scenario can be staged. Construction of Winnipeg Street north of 9th Avenue North can be delayed.

Disadvantages:

- Traffic signal at Winnipeg Street/9th Avenue North must be pre-empted with CPR Rail crossing signal;
- The cost is four times the cost of the base scenario; and
- The intersection at Winnipeg Street and 7th Avenue North should be closed.

Sub-Scenarios Considered

A Parclo was considered. This scenario is illustrated in **Figure 5.6**. The benefits of the Parclo are specifically to westbound motorists destined to the south. With this scenario, motorists have a free flow move rather than making two left turns at traffic signals. The disadvantages are: higher cost, speed skating oval encroachment and a more circuitous movement for CCRL tanker trucks destined to the north and west.



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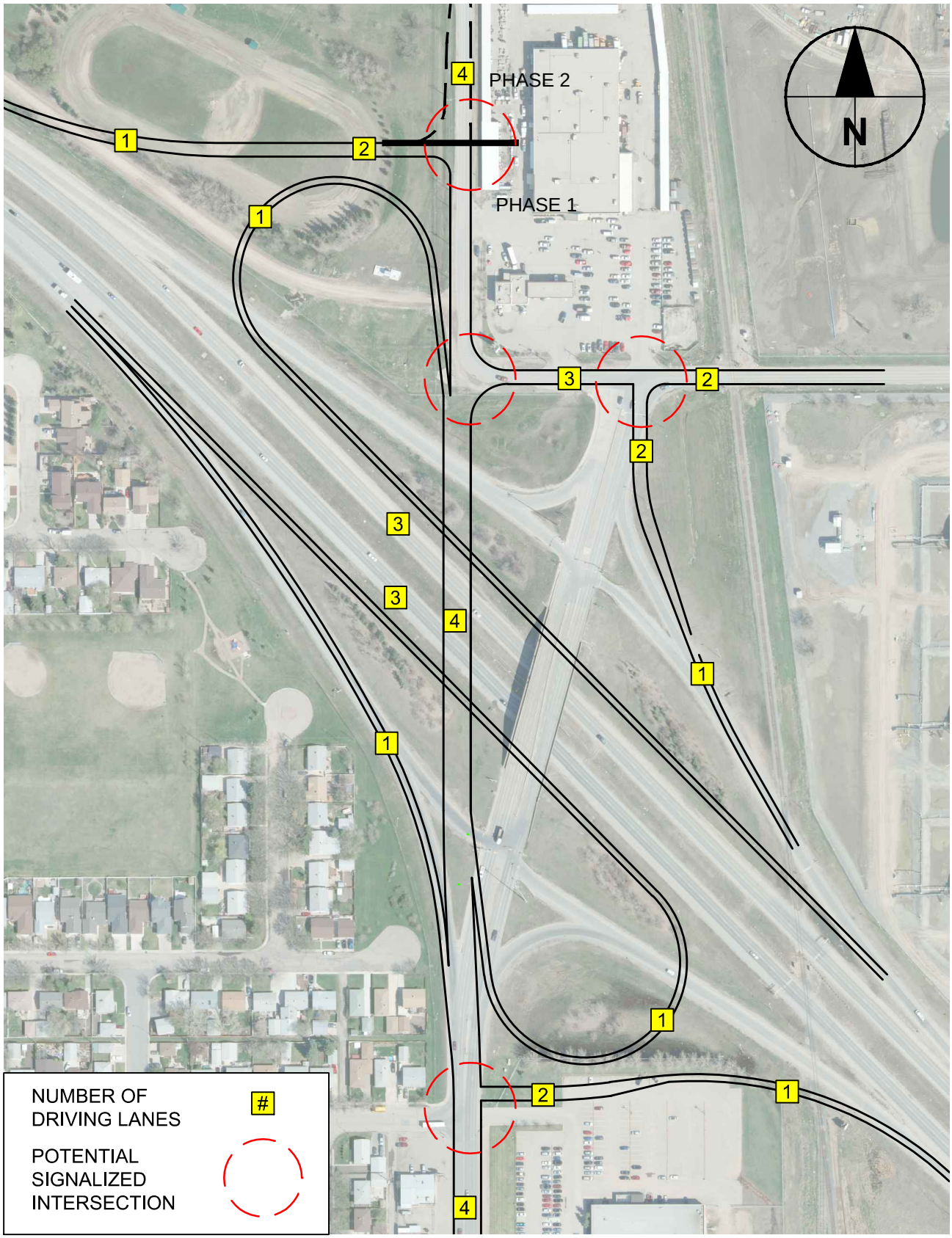
WEST PARCLO ISOLATED RAMP
OPTION 3-A - FIGURE 5.5



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WEST HALF DIAMOND AND PARCLO
OPTION 3-B - FIGURE 5.6

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5.5 Operations Review of Alternatives

Each of the six scenarios was analyzed at a high level to determine overall network delay and individual intersection operations. The capacity analysis was conducted on the scenarios using Synchro plus SimTraffic Version 8.0. Where applicable, changes to traffic control or lane arrangements in order to improve the level of service are stated. Performance Measures such as Average Delay, Level of Service and Volume to Capacity Ratios are summarized by intersection for the forecast afternoon peak hour. In each scenario, all movements are provided.

Scenario 1A – Existing Alignment

- As there are no changes to intersection geometry or interchange configuration, this scenario produces the same results as the baseline forecast traffic conditions;
- The network is forecast to operate with an overall total delay of 204 s/v or 426 hours of total delay;
- Winnipeg Street and 9th Avenue North unsignalized intersections will continue to operate at a LOS F, with the westbound approach and the northbound approach both operating at a LOS F. Both of these approaches also have v/c ratios greater than 0.85. Signalization will still result in significant failures (LOS F) in both the northbound and westbound approaches. Queuing will still be a concern at all intersections as a result of the failure of this intersection; and
- Winnipeg Street and Ring Road North and South Intersections will both continue to operate acceptably during the afternoon peak hour, with an overall LOS B.

Scenario 1B - Roundabouts

- Both roundabouts were analyzed as two-lane roundabouts with yield control at all approaches;
- The south roundabout is projected to operate at a LOS E and the north roundabout is projected to fail (LOS F); and
- Should this scenario be considered for further analysis following the VE session, additional modeling should be conducted in a software package designed to better model roundabouts.

Scenario 2A – East Diamond

- There are three main intersections with this scenario, which is very similar to the existing and baseline forecast conditions, with the exception of the reconfiguration of the Winnipeg Street and 9th Avenue North intersection;
- The network is forecast to operate with an overall total delay of 37 s/v or 78 hours of total delay;
- Winnipeg Street and 9th Avenue North intersections were signalized and a northbound right turn lane was added. It is forecast to operate at a LOS E, with several movements operating at LOS F and with v/c ratios greater than 0.85 (WB LT, NB Th, and SB Th); and
- Winnipeg Street and Ring Road North and South Intersections will both continue to operate acceptably during the afternoon peak hour, with an overall LOS B.

Scenario 2B – East Parclo

- There are two main intersections; Winnipeg Street and 9th Avenue North (of which the fourth leg is the on-ramp to Ring Road) and the south ramp intersection;
- The network is forecast to operate with an overall total delay of 8 s/v or 28 hours of total delay;
- Winnipeg Street and 9th Avenue North intersection was signalized and a northbound left turn lane and southbound right turn lane were added to service the on-ramp. It is forecast to operate at a LOS C with several movements operating with v/c ratios greater than 0.85 (WB Th, NB Th, and SB Lt); and
- Winnipeg Street and Ring Road South Intersections can operate unsignalized at a LOS A with the southbound left turn operating at a LOS B.

Scenario 3A – West Parclo Interchange with Isolated Ramp

- There are four intersections with this scenario, Winnipeg Street and 9th Avenue North, Ring Road Ramp North and South and East intersections;
- The network is forecast to operate with an overall total delay of 4 s/v or 15 hours of total delay;
- Winnipeg Street and 9th Avenue North intersection was signalized and a northbound right turn lane and southbound left turn lane was added. A channelized westbound right turn with yield control to Winnipeg Street was also added to facilitate this high movement. It is forecast to operate at a LOS A with no movements operating with v/c ratios greater than 0.85;
- The 9th Avenue North and East Ramp intersection will need to be signalized in order to prevent a LOS F for traffic exiting the ramp. If signalized, the northbound left and right turns are forecast to operate at a LOS B. Signalization will also help reduce weaving conflicts for traffic turning left from this ramp that is heading north on Winnipeg Street; and
- Winnipeg Street and Ring Road North and South Intersections can operate unsignalized at an overall LOS A. The southbound left turn at the south intersection would operate at a LOS B and the northbound left turn at the north intersection would operate at a LOS C.

Scenario 3B – West Half Diamond + Parclo Interchange

- There are three intersections with this scenario; Winnipeg Street and 9th Avenue North, Ring Road Ramp and South and East intersections;
- The network is forecast to operate with an overall total delay of 9 s/v or 24 hours of total delay;
- Winnipeg Street and 9th Avenue North intersection was signalized and a northbound left turn lane and southbound right turn lane were added to service the on-ramp. It is forecast to operate at a LOS B with several movements operating with v/c ratios greater than 0.85 (WB Lt, WB RT, NB LT);
- 9th Avenue North and East Ramp intersection will need to be signalized in order to prevent an LOS F for traffic exiting the ramp. If signalized, the northbound left and right turns are forecast to operate at a LOS B. Signalization will also help reduce weaving conflicts for traffic turning left from this ramp that is heading north on Winnipeg Street; and
- Winnipeg Street and Ring Road South Intersection can operate unsignalized at a LOS A, with the southbound left turn operating at a LOS B.

6. Value Engineering Workshop

6.1 Workshop Plan

The Value Engineering Workshop will be undertaken in accordance with the approach detailed in **Table 6.1**, which summarizes the applicable activities and goals for each phase during and following the workshop:

Table 6.1 Value Engineering Session Work Plan

Study Phase	Activity
Workshop	Conduct a three day workshop from **January 15-17, 2013,** including a site visit on the first day and a presentation of the VE study results on the final day of the workshop. The workshop will be held in Regina at AECOM's offices.
Workshop	Documentation: The team assistant will be responsible for recording workshop proceedings, including the final recommendations.
Post-Workshop	Draft Value Engineering Report: The draft report will be prepared and submitted to the City of Regina within one (1) week of the workshop.
Post-Workshop	Implementation Meeting: The Implementation Meeting will be held within three (3) weeks of the workshop to present the key VE recommendations. The draft agenda and presentation material will be submitted to the City a minimum of one (1) week prior to the meeting.
Post-Workshop	Final Value Engineering Report: The draft report will be finalized, taking into consideration any comments received from the City and the outcome of the Implementation Meeting. The report will be submitted to the City within two (2) weeks of the Implementation Meeting.
General	Minutes of meetings will be distributed no later than 10 working days following each meeting. Draft presentations and meeting agenda will be distributed one (1) week prior to the event.

The agenda for the workshop is attached in **Appendix C.**

6.2 Workshop Summary

The Workshop Team, with input from Stakeholders and after a site visit, reached several conclusions. They concluded the new bridge should not be rebuilt on the existing location for the following reasons:

- The Winnipeg Street Bridge would need to be closed to traffic for about a year to allow a new bridge to be built. Traffic would be redirected to other streets causing considerable hardship to many road users and businesses; and
- The existing alignment does not provide sufficient capacity for proposed future development unless significant property is acquired (Co-op Home Centre).

Based on the site visit, it was concluded that the new bridge should be constructed west of the existing bridge location. Building the bridge east of the existing bridge requires significant land acquisition from Co-op Home Centre to eliminate jogs in the Winnipeg Street alignment and moves the new bridge closer to the CNR Qu'Appelle Subdivision. This may impact the future design of a grade separation on Ring Road at the crossing. The 9th Avenue North rail crossing is a particular concern of CPR. They will object to any option that reduces the distance between any road intersection and their rail signals. Constructing the bridge west of the existing bridge requires a longer span bridge because of the greater skew angle, but it provides more design flexibility. It was concluded that the new bridge should be designed to be west of the existing bridge location.

The Workshop Team identified 30 different ideas for consideration. After considerable debate, the ideas were either eliminated, modified or accepted. The ideas were graphically drawn up as concepts for further review by AECOM.

Two general layout options were selected for further review and analysis. The following factors were deemed as critical needs and determined the final options that were selected for further consideration:

- Winnipeg Street at the bridge cannot be closed during construction of the new bridge;
- Eliminate jogs in the alignment of Winnipeg Street; and
- All existing railway crossings should be maintained.

A diamond type interchange was one of the options selected for further review. The existing Winnipeg Street interchange is a diamond interchange. The diamond interchange meets all of today's traffic demands, but will operate at a low level of service after proposed residential and commercial development occurs.

The other option considered is a modified diamond with a free flow loop that replaces a ramp with a traffic signal. The decision to build the new bridge west of the existing bridge creates additional space in the south east quadrant that will allow room for the loop. This design best provides for future development and will operate at an acceptable level of service at full development.

The Workshop team did not select a preferred option. They listed the two options for further review, particularly to undertake a SYNCHRO analysis to calculate level of service and delay for each of the options under consideration. They also wanted each examined in detailed to ensure the options can be designed to meet geometric standards.

7. Generation of Final Options

Based on the findings of the Value Engineering Workshop, two general layout options were selected for further review and analysis. The following factors were deemed as critical needs and determined the final options for further consideration:

- Winnipeg Street at the bridge cannot be closed during construction of the new bridge;
- The new bridge should be constructed west of the existing bridge;
- Eliminate jogs in the alignment of Winnipeg Street; and
- All existing railway crossings should be maintained.

The following describes each option in detail and provides a traffic analysis and qualitative comparison of the various final options. One common factor to all options is that the Winnipeg Street and 9th Avenue North intersection is the critical intersection with the highest delay.

7.1 Option 1- Diamond Interchange

Standard Diamond (Option 1A)

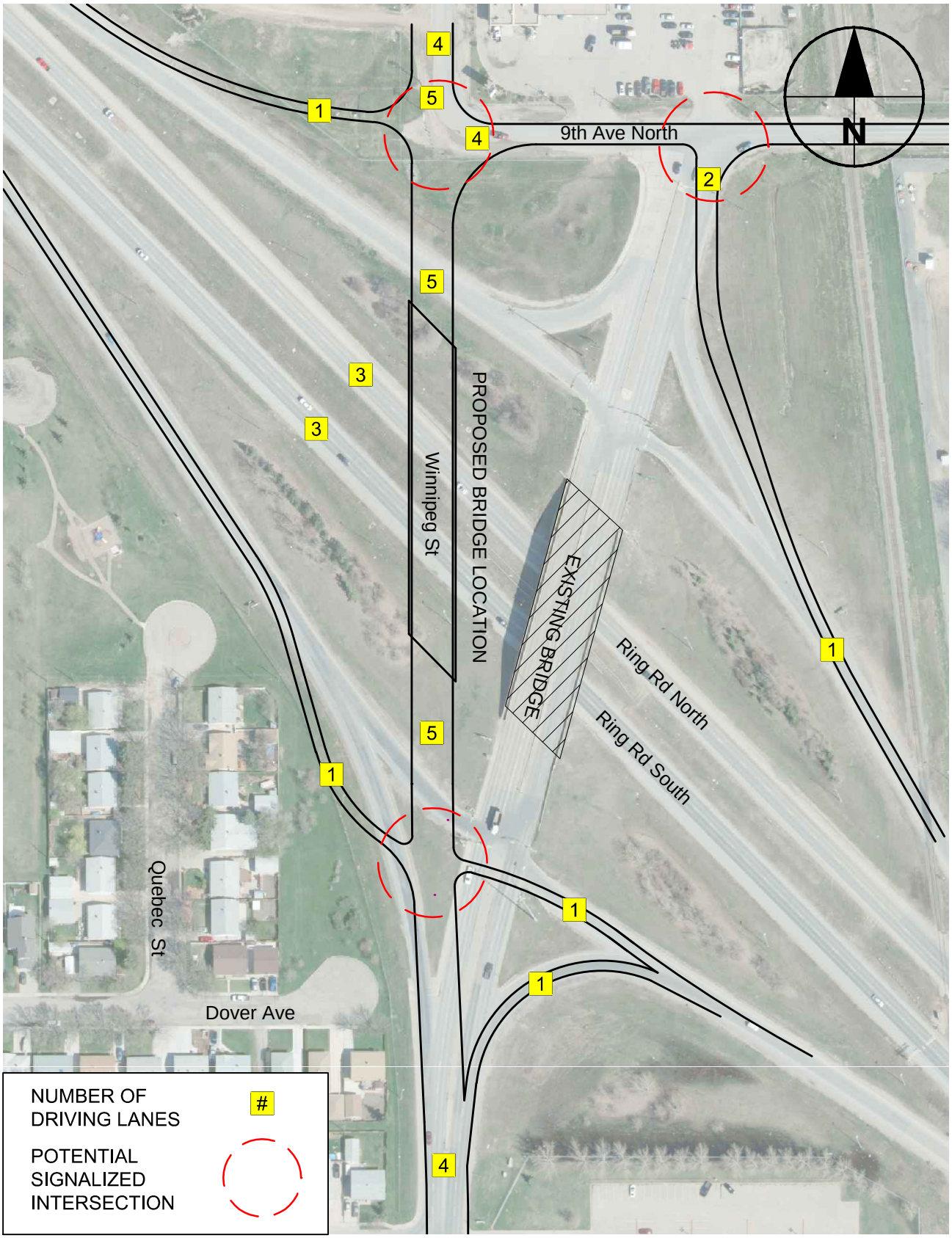
Figure 7.1 illustrates the layout of a standard diamond interchange. Traffic flow on Winnipeg Street will be relatively unimpeded. Traffic signals will be required at 9th Avenue North and at the south ramp terminals immediately. The new westbound to north/southbound ramp intersection on 9th Avenue North is not required immediately and would be installed when warranted. Care must be taken with the design of this intersection to lessen the possibility of wrong way movements. A realignment of Co-op Home Centre driveway may be required. Property purchase is required for the ramp in the southwest quadrant and it may be necessary to undertake a noise attenuation review.

Advantages of this option are:

- It maintains access to residential, commercial and industrial properties at all times during bridge replacement construction;
- Winnipeg Street alignment is direct with no jogs; and
- The eastbound to southbound ramp is designed to reduce speeding.

Disadvantages of this option are:

- The bridge span is longer (40 m longer than existing);
- The ramp in the southwest quadrant will be closer to the residential subdivision; and
- Westbound traffic destined south on Winnipeg Street has a more circuitous route with three signalized intersections.



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OPTION 1-A - FIGURE 7.1

Table 7.1 Option 1 Comparison

Screening Criteria	Option 1A – Diamond Interchange	Option 1B – Staggered Intersections
Natural Environment	• No significant differences between options.	• No significant differences between options.
Social Environment	• Impacts residential subdivision. Higher vehicle noise levels, possible encroachment of road right-of-way on private property.	• Creates commercial or industrial development potential south of Co-op Home Centre.
Cultural Environment	• No potential for impacts to cultural environment.	• No potential for heritage feature impacts.
Technical Environment	• Two traffic signals on Winnipeg Street within 300 metres. • Potential for vehicle queues across CPR tracks on 9th Avenue North. • Potential "wrong way" movement from 9th Avenue North. to WB exit ramp.	• Four traffic signals on Winnipeg Street within 300 metres. • More conflict points = higher collision potential.
Recommendation	**Not Recommended**	**Recommended**

Staggered Intersections (Option 1B)

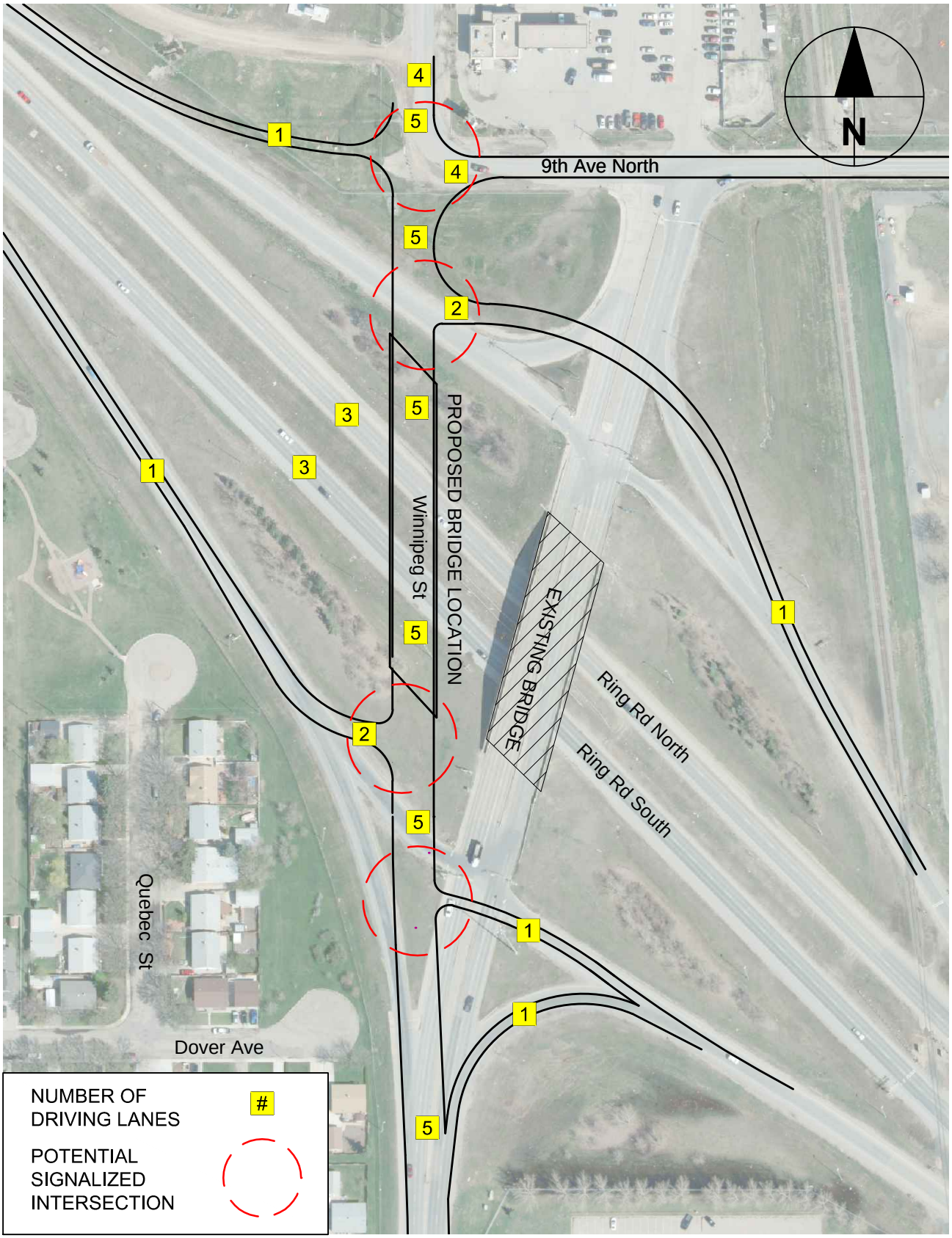
This option addresses the negative impacts of Option 1A related to property acquisition and noise concerns in the south west quadrant. While Option 1B effectively addresses those concerns, it creates other concerns related to traffic flow. **Figure 7.2** illustrates the layout of Option 1B. After the new bridge is constructed, Winnipeg Street will require two traffic signals immediately; one at 9th Avenue North and also at the eastbound to northbound ramp terminal. In the future, two additional traffic signals may be required. A detailed SYNCHRO analysis was undertaken assuming all four signals are in place and full development has occurred. The Winnipeg Street corridor will operate at lower levels of service at peak hours, but the level of service is still considered to be acceptable. This option also addresses the concern with eastbound motorists destined to Winnipeg Street south that have a circuitous route through three traffic signals. The realignment of the westbound to southbound ramp moves the ramp terminal from 9th Avenue North to Winnipeg Street. This also adds another traffic signal on Winnipeg Street, but significantly improves the level of service at the critical Winnipeg Street/9th Avenue North signalized intersection due to reduced westbound left turns.

Advantages of this option are:

- It maintains access to residential, commercial and industrial properties at all times during bridge replacement construction;
- Winnipeg Street alignment is direct with no jogs;
- The eastbound to southbound ramp is designed to reduce speeding;
- There will be improved operation of the Winnipeg Street/9th Avenue North traffic signal (less left turning vehicles); and
- It will create a parcel of land that could be sold as industrial or commercial.

Disadvantages of this option are:

- Bridge span is longer (40 metres longer than existing); and
- Four signalized intersections within 300 m on Winnipeg Street.



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OPTION 1-B - FIGURE 7.2

7.2 Option 2- Modified Diamond with Loop

Loop in Southeast Quadrant (Option 2A)

Figure 7.3 illustrates the layout of the various ramps, loop and intersections for this option. This option provides a loop in the southeast quadrant for eastbound to northbound traffic. The loop provides a free flow movement and eliminates the need for eastbound to northbound traffic to turn left at a traffic signal. Large trucks on Ring Road destined to CCRL would be the primary beneficiary. To accommodate installation of the loop, the span of the new bridge must be increased to allow an extra driving lane. There would be fewer traffic signals on Winnipeg Street, so traffic will flow better in peak periods.

Advantages of this option are:

- It maintains access to residential, commercial and industrial properties at all times during bridge replacement construction;
- Winnipeg Street alignment is direct with no jogs; and
- The eastbound to southbound ramp is designed to reduce speeding.

Disadvantages of this option are:

- The bridge span is longer (65 m longer than existing);
- The ramp in the southwest quadrant will be closer to the residential subdivision and the road elevation raised; and
- Westbound traffic destined south on Winnipeg Street has a more circuitous route with three (3) signalized intersections.

Modified Loop (Option 2B)

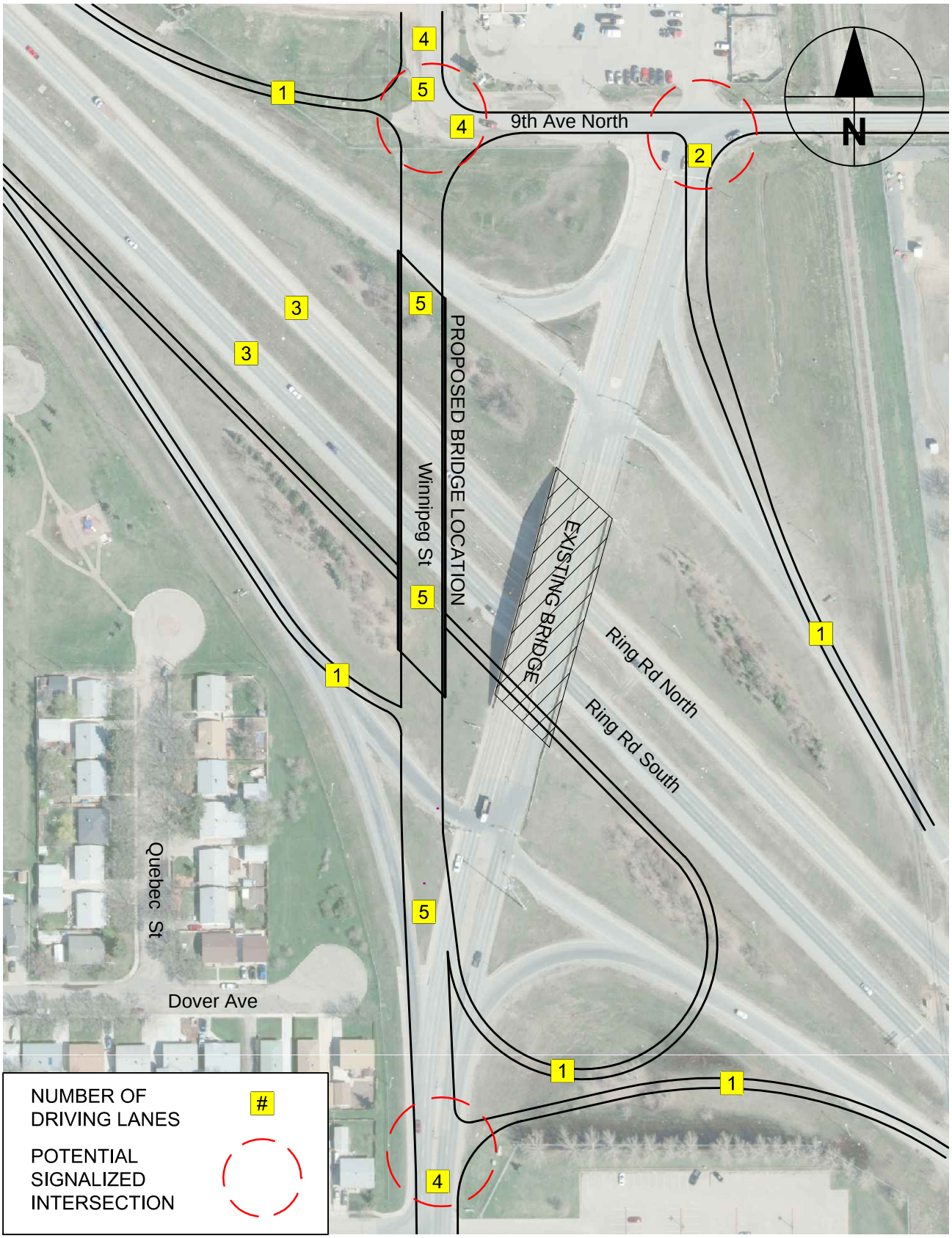
This option differs from Option 2A in that the loop will be used by westbound traffic going north or south on Winnipeg Street. Option 1A only provides for northbound traffic. **Figure 7.4** illustrates the layout of the various ramps, loop and intersections. This option addresses the concern with impacts of the relocated eastbound to southbound ramp (both vertically and horizontally) on the adjacent residences as the ramp is no longer required and can be removed. Two major signalized intersections are required on Winnipeg Street spaced 300 m apart.

Advantages of this option are:

- The same as for previous loop option, except the ramp in the southwest quadrant is removed. Less impact on residences and removes speeding issue.

Disadvantages of this option are:

- The same as for previous loop option, except eastbound traffic must turn left at traffic signal compared to a free flow right turn.



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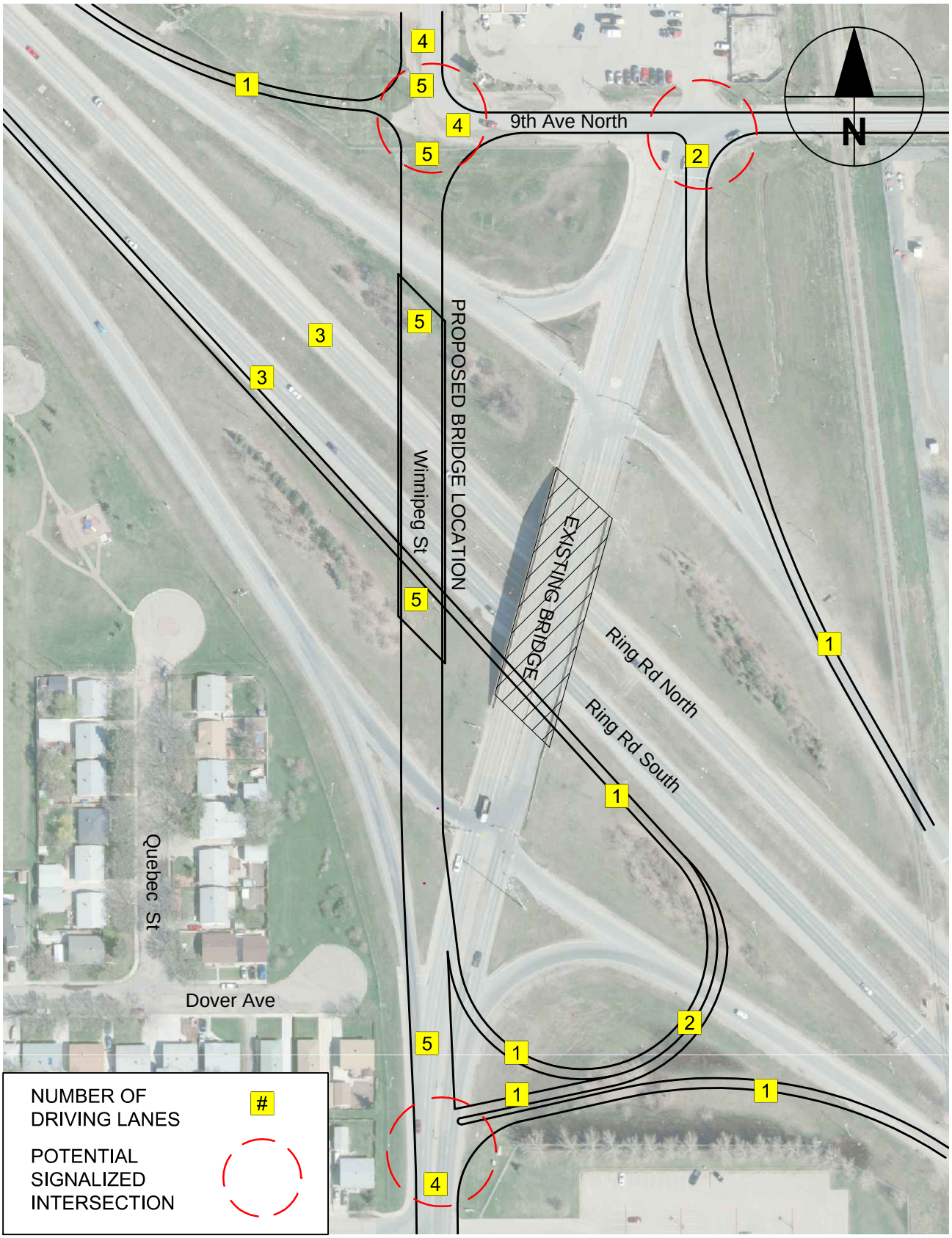
OPTION 2-A - FIGURE 7.3



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OPTION 2-B - FIGURE 7.4

Table 7.2 Option 2 Comparison

Screening Criteria	Option 2A - Modified Diamond with Loop	Option 2B – Modified Loop
Natural Environment	• No significant differences between options.	• No significant differences between options.
Social Environment	• Ramp adjacent to residents in south west quadrant will be raised. This may generate higher noise levels within the community.	• Winnipeg/7th Avenue North intersection should be closed.
Cultural Environment	• No potential for impacts to cultural environment. • No potential for heritage feature impacts.	• No potential for impacts to cultural environment. • No potential for heritage feature impacts.
Technical Environment	• Bridge span is 145 metres. • EB to SB traffic have free flow movement. • EB to SB ramp moves closer to residential area due to new bridge moving west.	• Bridge span is 125 metres. • EB to SB traffic must turn left at signal. • EB to SB ramp is moved away from residential area.
Recommendation	**Recommended**	**Not Recommended**

7.3 Traffic Analysis

An analysis was undertaken to determine which options functions the best from a traffic perspective. Using SYNCHRO, the delay, average speed of vehicles and the vehicle to capacity ratios were determined. **Table 7.3** illustrates the results of the analysis.

Table 7.3 Traffic Analysis

MOE's	Option 1(A)	Option 1(B)	Option 2(A)	Option 2(B)
No. of Intersection(s)	3	4	5	4
Signalized Intersection(s)	3	4	3	3
Stops (#)	3702	4559	3523	4006
Total Delay/Veh (S/V)	15	15	9	13
Total Delay (hr)	29	36	25	30
Average Speed (km/hr)	32	28	33	31
V/C Ratio for the Critical Intersection	0.89	0.88	0.89	0.89
	Winnipeg Street and 9th Avenue North	Winnipeg Street and 9th Avenue North	Winnipeg Street and 9th Avenue North	Winnipeg Street and 9th Avenue North

7.4 Comparison of Option 1-B with Option 2-A

Option 1B and 2A are the preferred choices. **Table 7.4** compares the two options.

Table 7.4 Comparisons of Preferred Options

Screening Criteria	Option 1B – Diamond Interchange with Staggered Intersections	Option 2A – Modified Diamond with Loop
Natural Environment	• No significant differences between options.	• No significant differences between options.
Social Environment	• No significant differences between options.	• No significant differences between options.
Cultural Environment	• No potential for impacts to cultural environment. • No potential for heritage feature impacts.	• No potential for impacts to cultural environment. • No potential for heritage feature impacts.
Technical Environment	• Four traffic signals on Winnipeg Street within 300 metres. • Bridge span is 120 metres. • EB to NB traffic turns left at traffic signal (traffic includes B-Trains destined for CCRL). • More conflict points = higher collision potential. • Potential that traffic on EB exit ramps will queue and impact traffic exiting Ring Road.	• Two traffic signals on Winnipeg Street within 350 metres. • Bridge span is 145 metres. • EB to NB traffic is free flow on loop. • Potential for vehicle queues across CPR tracks on 9th Avenue North.
Recommendation	**Not Recommended**	**Recommended**

In summary, the technical merits of Option 2A are significantly better than Option 1B. While both options will have adequate traffic capacity for full development, the primary benefit of Option 2A over 1B is that Option 1B has reduced noise levels for residents in the south west quadrant and actually has reduced noise levels from the existing condition.

8. Cost Estimates

Order of magnitude cost estimates were developed using City of Regina and Ministry of Highways and Infrastructure unit costs for each scenario considered. The cost estimates were prepared with limited site information, based on probable conditions affecting the project. The estimates represent the summation of all identifiable project component costs and are to be used for program planning to establish a more specified definition of client needs and to obtain approval in principal. The estimates include the value of land for right-of-way and roadway construction on a per-kilometre basis. An allowance has been added for lighting, signage, guardrails, landscaping, drainage, utility work or other land costs.

Table 8.1 illustrates the estimated cost of each of the scenarios considered:

Table 8.1 Table of Costs

Scenario	Roadway Construction Costs	Bridge Construction Costs	Utility Costs	Engineering and Contingencies 25%	Total Cost
Option 1 – Diamond Interchange					
1A – Standard Diamond	$2.6 MM	$11.8 MM	$3.5 MM	$4.5 MM	$22.4 MM
1B – Staggered Intersections	$2.3 MM	$11.8 MM	$3.5 MM	$4.4 MM	$22 MM
Option 2 – Modified Diamond					
2A – Loop	$3.0 MM	$14.1 MM	$3.6 MM	$5.1 MM	$25.8 MM
2B – Modified Loop	$2.8 MM	$12.1 MM	$3.5 MM	$4.6 MM	$23 MM

9. Conclusions

The primary purpose of this review was to determine a method to rebuild the Winnipeg Street Bridge over Ring Road with minimal impact on road users. The secondary purpose was to examine possible improvements to the interchange that would address future needs such as new development in the area, the need to add driving lanes to Ring Road and the potential for a grade separated railway crossing on Ring Road at the CNR Qu'Appelle Subdivision.

Rebuilding the Winnipeg Street Bridge in the existing location is the least expensive option, however, is not recommended for the following reasons:

- The Winnipeg Street Bridge would need to be closed to traffic for about a year to allow a new bridge to be built. Traffic would be redirected to other streets causing considerable hardship to many road users and businesses; and
- The existing alignment does not provide sufficient capacity for proposed future development unless significant property is acquired (Co-op Home Centre.)

The new bridge can be constructed east or west of the existing location. Building the bridge east of the existing location requires significant land acquisition from Co-op Home Centre in order to eliminate jogs in the Winnipeg Street alignment and moves the new bridge closer to the CNR Qu'Appelle Subdivision. This may impact the future design of a grade separation on Ring Road at the crossing. Constructing the bridge west of the existing bridge requires a longer span bridge because of the greater skew angle, but it provides more design flexibility. It was concluded that the new bridge should be designed to be west of the existing bridge location.

Two general layout options were selected for further review and analysis. The following factors were deemed as critical needs and determined the final options that were selected for further consideration:

- Winnipeg Street at the bridge cannot be closed during construction of the new bridge;
- Jogs must be eliminated in the alignment of Winnipeg Street; and
- All existing railway crossings should be maintained.

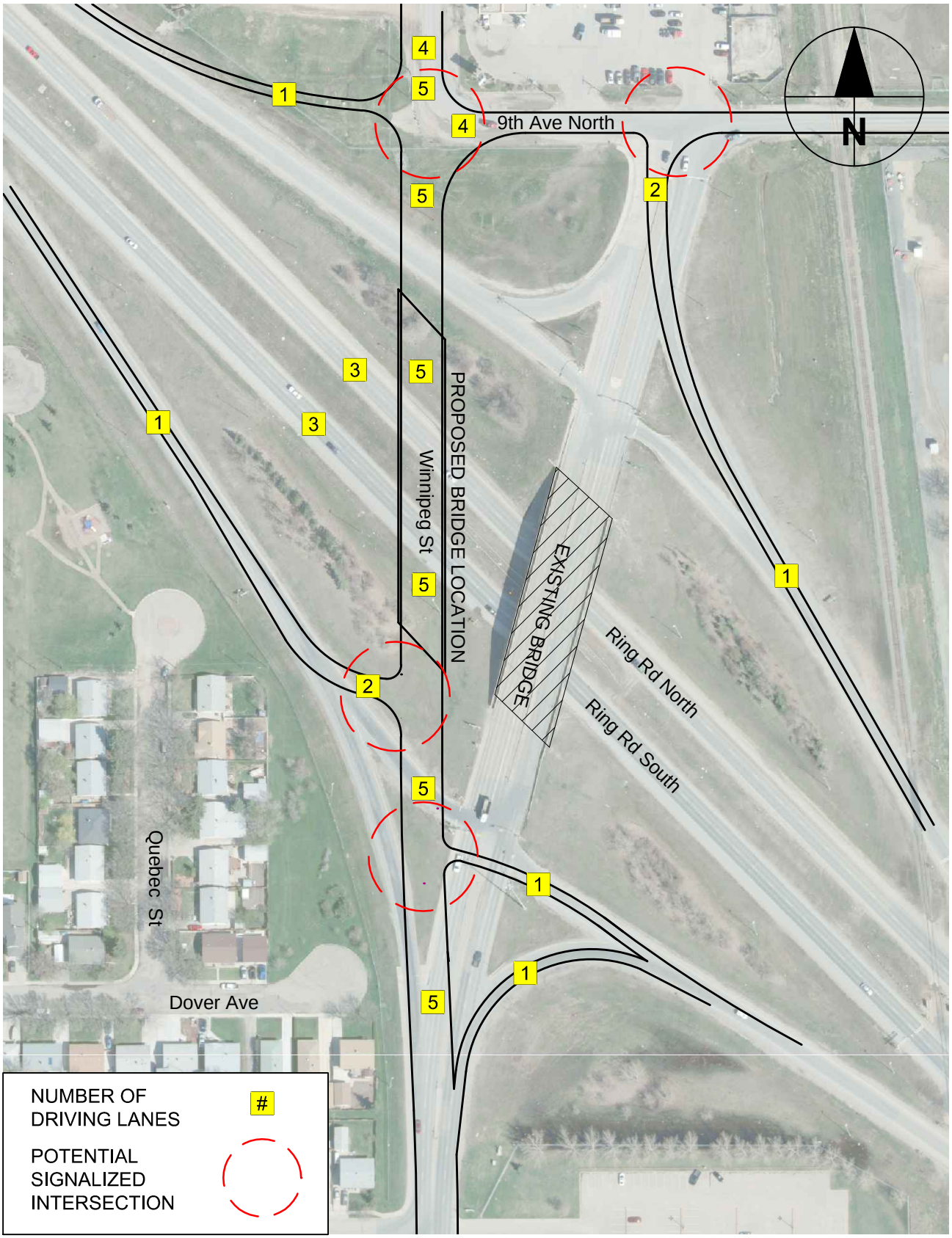
A diamond type interchange was one of the options selected for further review. The existing Winnipeg Street interchange is a diamond interchange. The diamond interchange meets all of today's traffic demands, but will operate at a low level of service after proposed residential and commercial development occurs.

The other option considered was a modified diamond with a free flow loop to replace a left turn ramp with a traffic signal. The decision to build the new bridge west of the existing bridge creates additional space in the southeast quadrant that will allow room for the loop. This design best provides for future development and will operate at an acceptable level of service at full development.

Both options will meet all of the City's traffic requirements, today and in the future. The diamond interchange option is less costly, primarily due to the cost of the bridge (span length is less), but has greater negative impacts to the residential area. The modified diamond with the loop addresses this concern and provides an improved level of service for traffic flow, however, capital costs are higher. Operational costs are slightly lower due to less road maintenance due to heavy trucks turning at a signalized intersection and less traffic signals to maintain.

Numerous meetings were held with the Steering Committee to evaluate the options based on a variety of criteria.

In conclusion, the diamond interchange with staggered intersections was selected as the preferred option. Minor changes were made to the layout to address issues raised during analysis of the various options. The preferred option is illustrated in **Figure 9.1**.



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PREFERRED OPTION - FIGURE 9.1

Figure 9.1 illustrates the geometric layout of the preferred option. The preferred option will operate at an acceptable level of service at full development and is the least costly option. The estimated cost of the preferred option is $21.8 MM.

The preferred option salvages existing ramps as much as possible and does not require property acquisition. The critical intersection, based on potential travel delays, is the Winnipeg Street/9th Avenue North intersection. This intersection will require traffic signals be installed immediately in conjunction with the opening of the new bridge. Traffic signals will also be required immediately at the east to northbound ramp terminal on Winnipeg Street. This intersection has a high percentage of large trucks destined to the Consumer's Co-operative Refinery Limited (CCRL) making the left turn on to Winnipeg Street. Traffic signals will address safety concerns. Other intersections may require traffic signals in the future.

The 750 mm PVC water supply main located within the centre median of Ring Road will require relocation to allow for bridge foundation work. The actual location of the water main should be accurately located prior to detailed design. Relocation work will require traffic restrictions on Ring Road during construction.

Appendix A

Value Engineering Session Team Members

Appendix A

VALUE ENGINEERING SESSION TEAM MEMBERS

CORE TEAM

Sharla Cote	City of Regina	
Brad Babcock	City of Regina	
Dustin McCall	City of Regina	
Ravi Seera	City of Regina	
Scott Thomas	City of Regina	
Vincent Strand	City of Regina	
Brian Ruck	AECOM	Value Engineering Lead
Brent Steranka	AECOM	Structure
Allan Duff	AECOM	Traffic Accommodations/Design
Joe Hladky	AECOM	Rail
Les Hempsey (day 1)	AECOM	Designer
Justin Demong	AECOM	Team Assistant

STAKEHOLDER GROUP

Sharron Bryce	Ward Councillor	
Wade Murray	Ward Councillor	
Kelly Wyatt	City of Regina	
Adam Homes	City of Regina	
Mark Simpson	CCRL	
Vanessa Cozine	Enbridge Pipelines	
Jim Anderson	Sherwood Co-op	
Dale Wilson	Canadian Pacific Railway	
Linda Vergata	Canadian National Railway	
Dorian Wandzura	City of Regina	Declined
Jason Carlston	City of Regina	Declined
Jerry Flegel	Ward Councillor	Declined

Appendix B

Value Engineering Summary Sheets

CREATIVE IDEA LISTING AND EVALUATION

PROJECT: Winnipeg Street Bridge Realignment Study		City of Regina
NO.	**IDEA DESCRIPTION**	**RATING**
VE 1	Construct one-way pairs – 2-lanes per direction	N
VE 2	Build a temporary diamond interchange at Broad Street to facilitate traffic management during construction at Winnipeg Street.	N
VE 3	Modify north side connections to improve access to the 9th Avenue North and Winnipeg Street North.	CF
VE 4	Use rapid bridge replacement and build bridge on existing alignment – modify cross section beneath bridge to accommodate future 6-lanes on Ring Road.	CF
VE 5	Use roundabout on south side for east bridge options.	N
VE 6	Combine CP crossing with Winnipeg Street crossing – use a parclo A/B on west side.	N
VE 7	Move CP Tracks further to the west at Winnipeg Street and tie into existing tracks south of Staples.	N
VE 8	Modify Alt "@A" to put WM on-ramp from 9th Avenue North.	N
VE 9	Modify 3A – WB off-ramp to tie to Winnipeg Street rather than 9th Avenue North.	CF
VE10	Modify 2A with a new 4-lane road to the east but keep existing Winnipeg Street Alignment over Ring Road.	N
VE 11	Roll existing Winnipeg Street Bridge superstructure to a new temporary support system and build new bridge on existing alignment (C/W VE 18)	CF
VE 12	Combine north side of 2B with south side of 2A.	N
VE 13	Modify 3A to move the new bridge closer to the existing road alignment of Winnipeg Street at the Ring Road crossing.	CF
VE 14	Modify 3A to move the bridge further to the west on a curve.	CF
VE 15	Shift Ring Road to the south through the Winnipeg Street interchange.	N
VE 16	Build single point diamond interchange (SPUI).	N
VE 17	Tighten the north side ramps; build the new bridge on the existing alignment and tie crossing directly to Winnipeg Street.	CF
VE 18	Modify Alt 1 (build bridge on existing crossing) to have WB on ramp enter directly from 9th Avenue North.	CF
VE 19	Combine north side of 3A with the south side of 2A.	CF
VE 20	Tie Winnipeg Street crossing directly to 9th Avenue North and "T" Winnipeg Street North to crossing road.	N
VE 21	Use pre-cast deck panels to expedite bridge construction.	CF
VE 22	Use NU bridge girders to expedite bridge construction.	CF
VE 23	Modify 2B – WB off directly to Winnipeg Street North	N
VE 24	Add a free flow NB right turn to 9th Avenue North in Alt 3A	CF
VE 25	Modify 3A to provide a "B" loop exit on south side.	CF
VE 26	Use a Parclo A/B for Alt 3A – all ramps on east side.	CF
VE 27	For Alts 3A and 3B; replace EB off loop ramp with direct ramp and signalized intersection.	CF
VE 28	For 3A and 3B; move EB on-ramp further north to minimize impacts to Staples.	CF
VE 29	For Alt 3 – eliminate the EB direct off-ramp; combine with B loop exit and combine in a single signalized intersection.	CF
VE 30	Modify VE29 to move the EB on-ramp further north to minimize impacts on Staples.	CF

Rating: CF = Carried Forward; N – Not Carried Forward; CW = Combined With; DS = Design Suggestion
ABD = Already being done; FDD = Failed During Development

Appendix C

Value Engineering Workshop Agenda

Appendix C Workshop Agenda

DAY 1 – Tuesday January 15, 2013

8:00 TEAM MEMBERS ARRIVE

8:05 INTRODUCTION TO WORKSHOP

- Welcome and opening remarks
- Team member Introductions
- Objectives of the workshop
- Workshop organization and agenda

8:30 STAKEHOLDER PROJECT BRIEFING/INFORMATION PHASE - Presentation by Project Team

- Project goals
- Presentation of project issues, constraints, challenges, opportunities by project team
- “Sacred cows”

10:30 BREAK

10:45 DATA REVIEW

11:30 FUNCTION ANALYSIS

- Identification of project functions
- Identify value mismatches
- Identify key areas for further study

12:00 LUNCH

- A light lunch will be provided. Please notify AECOM if you have any dietary concerns

1:00 SITE VISIT

3:00 CREATIVE PHASE

- Whole group brainstorming to identify opportunities (ideas) for value enhancement

5:00 DAY 1 - WRAP-UP

DAY 2 – Wednesday January 16, 2013

8:00 TEAM MEMBERS ARRIVE

8:15 VE TEAM LEADER STATUS REPORT

8:30 CREATIVE PHASE – Anything new to add

9:30 EVALUATION PHASE

- Select short list ideas for further analysis

10:00 DEVELOPMENT PHASE – Small Groups/Individuals

- Description of Idea
- Sketches
- Advantages – Disadvantages
- VE Proposal Summaries

12:00 LUNCH

5:00 Day 2 - WRAP-UP

DAY 3 – Thursday January 17, 2013

8:00 TEAM MEMBERS ARRIVE
8:15 VE TEAM LEADER STATUS REPORT
8:30 DEVELOPMENT PHASE – Finalize write-ups

- Description of Idea
- Sketches
- Advantages – Disadvantages
- VE Proposal Summaries

11:00 INTERNAL - VE TEAM CONFIRMATION OF VE PROPOSALS
12:00 LUNCH
3:30 STAKEHOLDER PRESENTATION OF VE PROPOSALS
4:30 WRAP-UP