PUBLIC AGENDA
STANDING POLICY COMMITTEE
ON TRANSPORTATION

Monday, November 14, 2016, 9:00 a.m.
Council Chamber, City Hall
Committee Members:

Councillor C. Block, Councillor T. Davies, Councillor R. Donauer, Councillor D. Hill, Councillor M. Loewen, His Worship Mayor C. Clark (Ex-Officio)

Pages

1. CALL TO ORDER

2. APPOINTMENT OF CHAIR AND VICE-CHAIR

City Council, at its first meeting held on October 31, 2016, made the following appointments for November and December 2016:

Standing Policy Committee on Transportation

- Councillor C. Block
- Councillor T. Davies
- Councillor R. Donauer
- Councillor D. Hill
- Councillor M. Loewen

The Committee is now requested to appoint a Chair and Vice-Chair for the remainder of 2016.

Recommendation

That the Standing Policy Committee on Transportation appoint a Chair and Vice-Chair for the remainder of 2016.

3. CONFIRMATION OF AGENDA

Recommendation

That the agenda be confirmed as presented.

4. DECLARATION OF CONFLICT OF INTEREST

5. ADOPTION OF MINUTES

Recommendation

That the minutes of regular meeting of the Standing Policy Committee on Transportation held on September 7, 2016 be adopted.

6. UNFINISHED BUSINESS

7. COMMUNICATIONS (requiring the direction of the Committee)

7.1 Delegated Authority Matters

7.2 Matters Requiring Direction

7.2.1 Proposal to Increase Ridership on Saskatoon Transit Buses - Stan Shadick [File No. CK 7300-1] 9 - 9

Attached is an email from Mr. Stan Shadick dated October 29, 2016.

Recommendation

That the matter be referred to the Administration for a report.

7.3 Requests to Speak (new matters)

7.3.1 Drinking and Driving in Saskatchewan - Cora Janzen, Chair, Traffic Safety Committee [File No. CK 5000-1] 10 - 11

Attached is an email from Ms. Cora Janzen, Chair of the Traffic Safety Comittee dated November 8, 2016, along with the referenced letter.

Recommendation

1. That Cora Janzen be heard; and
2. That the information be received.

8. REPORTS FROM ADMINISTRATION

8.1 Delegated Authority Matters

8.1.1 Request for Encroachment Agreement – 401 21st Street East [File No. CK. 4090-2] 12 - 16

Recommendation

1. That the proposed encroachment at 401 21st Street East (Lots 21 to 23 inclusive, Block 162, Plan No. 025-2) be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

8.1.2 Request for Encroachment Agreement – 741 7th Avenue North [Files CK 4090-2 and PL 4090-2] 17 - 21

Recommendation

1. That the proposed encroachment at 741 7th Avenue North (Lot 25, Block 11, Plan No. 98SA35499) be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement, making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

8.1.3 Request for Encroachment Agreement – 240 22nd Street East – Building Facade [File No. CK 4090-2] 22 - 25

Recommendation

1. That the proposed encroachment at 240 22nd Street East (Lot 40, Block 150, Plan No. 99SA32572) be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

Recommendation

1. That the Asset Management Plan for Sidewalks be received as information; and
2. That the Administration provide a report for the 2017 Business Plan and Budget deliberations as part of the Corporate Asset Management Plan.

8.2 Matters Requiring Direction

Recommendation

That the Standing Policy Committee on Transportation recommend to City Council:

1. That the Administration be directed to eliminate the practice of using asphalt overlays on concrete sidewalks; and
2. That the funding for this service level change be from reallocation of existing funding within the roadway and sidewalk preservation program.

Recommendation

That the Standing Policy Committee on Transportation recommend to City Council:

That the eleven neighbourhoods selected for 2017 traffic reviews, as part of the Neighbourhood Traffic Management Program, include Queen Elizabeth, Exhibition, Buena Vista, Erindale, Arbor Creek, Pleasant Hill, Dundonald, North Park, Richmond Heights, Silverwood Heights, and Wildwood.

8.2.3 Temporary 8th Street Snow Storage Site – Utilization for 2016-2017 Winter [Files CK 600-29 and PW 6290-3] 135 - 139

Recommendation

That the Standing Policy Committee on Transportation recommend to City Council:

That the temporary 8th Street Snow Storage Site be reopened for the 2016-2017 winter season due to operational requirements.

8.2.4 Design & Construction Services Award for Sid Buckwold Bridge [Files CK 6050-6, x 1702-1 and TU 6050-104-01] 140 - 142

Recommendation

That the Standing Policy Committee on Transportation recommend to City Council:

1. That a budget adjustment in the amount of $360,000 be funded from the Bridge Major Repair Reserve;
2. That the engineering services proposal submitted by Stantec Consulting Ltd. for completion of the design and construction services for rehabilitation of the Sid Buckwold Bridge, at a total estimated cost, on a lump sum basis, to an upset limit of $584,656 (including P.S.T. and G.S.T.) be approved; and
3. That the City Solicitor be requested to prepare the appropriate agreement and that His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal.

8.2.5 Update on Railway Working Group [File CK 6170-1, x CK 1700-1 and TS 6170-1] 143 - 158

A powerpoint presentation will be provided.

Recommendation

That the report of the General Manager, Transportation & Utilities Department dated November 14, 2016, be forwarded to City Council for consideration during the 2017 Business Plan and Budget deliberations.

8.2.6 **Traffic Noise Sound Attenuation – Policy Framework [Files CK 375-0, x CK 375-2 and TS 375-02]** 159 - 264

Attachment 1 of this report is not being reprinted due to size. A copy is available for viewing on the City's website.

A powerpoint presentation will be provided.

Recommendation

That the Standing Policy Committee on Transportation recommend to City Council:

1. That the Administration proceed with preparing a Council Policy based on the Traffic Noise Sound Attenuation policy framework provided in this report;
2. That the recommended Traffic Noise Sound Attenuation monitoring program be included in the Council Policy; and
3. That this report be considered during the 2017 Business Plan and Budget deliberations.

9. URGENT BUSINESS

10. MOTIONS (Notice Previously Given)

11. GIVING NOTICE

12. IN CAMERA AGENDA ITEMS

13. ADJOURNMENT

7300-1

From: City Council
Sent: October 29, 2016 10:54 AM
To: City Council
Subject: Form submission from: Write a Letter to Council

Submitted on Saturday, October 29, 2016 - 10:53
Submitted by anonymous user: 128.233.5.178
Submitted values are:

Date: Saturday, October 29, 2016
To: His Worship the Mayor and Members of City Council
First Name: Stan
Last Name: Shadick
Address: 903 Temperance St.
City: Saskatoon
Province: Saskatchewan
Postal Code: S7N 0N3
Email: stan.shadick@usask.ca
Comments:
PROPOSALS TO INCREASE RIDERSHIP ON SASKATOON TRANSIT BUSES

I would hope that our new city council will act to increase use of Saskatoon buses by Saskatoon's citizens. During evenings and other non-peak times, I often observe buses driving on our streets with only a few riders aboard.

I believe that one significant contributing factor to the relatively low usage of buses in Saskatoon is the high cost of fares. Many people drive instead of taking the bus on quick errands because it seems cheaper to pay a few quarters for short-term parking or to drive to a mall with free parking rather than take a return trip by bus at a cost of $6.

I would like to make 2 suggestions to city council to increase bus ridership at non-peak times.

1) Set up a low-cost NON-PEAK TIME annual bus pass for under $90 that would be valid throughout the year at non-peak operating times. This pass would be invalid at peak operating times from 7 am – 10 am and 4 pm – 6 pm on week-days but would be valid at all other times.

2) Make bus service on Evenings after 6 pm and on all Sundays and Holidays FREE OF CHARGE. Buses seem to run mainly empty at these times.

I believe that the above suggestions would not result in a significant loss of revenue to the Saskatoon Transit System and might help get more people to use our buses.

Sincerely,

Stan Shadick

5000-1

From: City Council
Sent: November 08, 2016 9:50 AM
To: City Council
Subject: Form submission from: Write a Letter to Council

Submitted on Tuesday, November 8, 2016 - 09:50
Submitted by anonymous user: 207.195.114.48
Submitted values are:

Date: Tuesday, November 08, 2016
To: His Worship the Mayor and Members of City Council
First Name: Cora
Last Name: Janzen
Address: 95 Riel Cres
City: Saskatoon
Province: Saskatchewan
Postal Code: S7J 2W7
Email: cora.janzen@saskatoonhealthregion.ca
Comments:
On September 14th, 2016 the City of Saskatoon Traffic Safety Committee submitted a letter to the Standing Policy Committee - Transportation containing two recommendations regarding drinking and driving in Saskatchewan for the Committee's consideration at the November 2016 meeting . As the Chair of the Traffic Safety Committee, I would like to address the Transportation SPC at the November 14th meeting regarding this letter and the recommendations suggested to Committee and Council .

Thank you

The results of this submission may be viewed at:
https://www.saskatoon.ca/node/398/submission/128976

Office of the City Clerk
222 3rd Avenue North
Saskatoon SK S7K 0J5

www.saskatoon.ca
tel (306) 975.3240
fax (306) 975.2784

September 14, 2016

Secretary, Standing Policy Committee on Transportation

Dear Secretary:

Re: Traffic Safety Committee
Drinking and Driving in Saskatchewan
[File No. 225-8]

The Traffic Safety Committee, at its meeting held on September 14, 2016, discussed concerns with the key traffic safety issues facing the City of Saskatoon and Premier Wall's request for citizens to suggest improvements to the licensing of vehicles, the changes to positive reinforcement that could create safer drivers and changes to penalties to those that do not follow regulations.

The Committee also received a presentation from Cst. Les Brauner regarding the 'Preventing Alcohol and Risk Related Trauma in Youth' program. The Committee discussed concerns with respect to the severe and negative consequences of speeding, distracted driving, impaired driving (both alcohol and drug) and driving vehicles without the attention to install safety devices.

Therefore, the Committee is recommending:

That the Standing Policy Committee on Transportation recommend to City Council that:

- A letter be sent to the Government of Saskatchewan to consider stiffer criminal penalties for non-compliant drivers, higher incentives for good drivers and larger SGI penalties for infractions; and
- The Traffic Safety Committee's concerns be forwarded to the Board of Police Commissioners for information.

The Committee respectfully requests that the concerns and recommendations above be considered by the Standing Policy Committee on Transportation at its regular meeting on November 14, 2016.

Yours truly,

Cora Janzen, Chair
Traffic Safety Committee

CJ:pw

Request for Encroachment Agreement – 401 21st Street East

Recommendation

1. That the proposed encroachment at 401 21st Street East (Lots 21 to 23 inclusive, Block 162, Plan No. 025-2) be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

Topic and Purpose

The purpose of this report is to seek approval for a future encroachment for the proposed structural canopy located at 401 21st Street East.

Report Highlights

1. The proposed encroachment area is 12.09 square metres.
2. The building structural canopy will extend onto the 21st Street East sidewalk by up to 1.52 metres.

Strategic Goals

This report supports the City of Saskatoon's Strategic Goals of Sustainable Growth and Quality of Life by ensuring that designs of proposed developments are consistent with planning and development criteria and that these designs do not pose a hazard for public safety.

Background

Building Bylaw No. 7306 states, in part, that:

> "The General Manager of the Community Services Department shall not issue a permit for the erection or alteration of any building or structure the plans of which show construction of any kind on, under, or over the surface of any public place until permission for such construction has been granted by Council."

Report

The owner of the property located at 401 21st Street East has requested approval to enter into an encroachment agreement (see Attachment 1). As shown on the Site Plan (see Attachment 2) and Detailed Drawing (see Attachment 3), the proposed new building structural canopy will encroach onto the 21st Street East sidewalk to a maximum of 1.52 metres. The total area of the encroachment is approximately 12.09 square metres; therefore, it will be subject to an annual charge of $50.

Public and/or Stakeholder Involvement
There is no public or stakeholder involvement.

Other Considerations/Implications
There are no options, policy, financial, environmental, privacy, or CPTED implications or considerations; a communication plan is not required at this time.

Due Date for Follow-up and/or Project Completion
There is no follow-up report planned.

Public Notice
Public notice, pursuant to Section 3 of Public Notice Policy No. C01-021, is not required.

Attachments
1. Request for Encroachment Agreement dated September 8, 2016
2. Copy of Site Plan Detailing Proposed Encroachment
3. Copy of Elevation Plan Detailing Proposed Encroachment

Report Approval
Written by: Tanda Wunder-Buhr, Commercial Permit Supervisor, Building Standards
Reviewed by: Daisy Harington, Senior Building Code Engineer, Building Standards
Approved by: Randy Grauer, General Manager, Community Services Department

S/Reports/2016/BS/TRANS – Request for Encroachment Agreement – 401 21st Street East/lc

Request for Encroachment Agreement Dated September 8, 2016

City of Saskatoon

BUILDING STANDARDS
222-3rd AVE NORTH, SASKATOON, SK S7K 0J5

THIS IS NOT AN AGREEMENT

ENCROACHMENT AGREEMENT APPLICATION

ENA - 00006/2016.

SECTION A – PROJECT INFORMATION (to be completed for ALL ENCROACHMENT AGREEMENT APPLICATIONS)
(Please note the approval process may take up to 10 weeks dependent on the Standing Policy Committee Meeting Schedule)

TYPE OF ENCROACHMENT	New Proposed ☑	Revision ☐

PROJECT INFORMATION

Site Address	Legal Description (Lot/Block/Plan)
401 21 Street East, Saskatoon, S7K 0C5 SK	Lot 21 - 23, Block 162, Plan 025-2

APPLICANT

Contact Name	Company Name (if applicable)		
Devon Schollar	Strata Development		
Address	**City**	**Province**	**Postal Code**
1729 Ontario Avenue	Saskatoon	SK	S7K 1S9
Phone Number (incl. Area Code)	**Email Address**	**Preferred method of correspondence:**	
306-974-2896 ext. 123	devon@stratadevelopment.ca	~~MAIL~~ or EMAIL	

OWNER

Contact Name (Official Name that will appear on the Agreement)	Company Name (if applicable)		
Mike Yasinski	Hudsons Canada		
Address	**City**	**Province**	**Postal Code**
9120 37 Avenue	Edmonton	AB	T6E 5L4
Phone Number (incl. Area Code)	**Email Address**	**Preferred method of correspondence:**	
780-701-0190	mike.yasinski@hudsonscanadaspub.com	~~MAIL~~ or EMAIL	

SECTION B – SUBMISSION REQUIREMENTS (to be completed for ALL ENCROACHMENT APPLICATIONS)

	ENCROACHMENT AGREEMENT APPLICATION REQUIREMENTS		Submitted	Received (office use only)
	Application Fee	An Encroachment Application Fee of $100.00 is required to be submitted at the time of application	✓	✓
	Existing Encroachment Rcpt#2276436	Current Real Property Report/Surveyor's Certificate that clearly outlines the encroaching areas, including detailed dimensions of all areas that encroach onto City of Saskatoon Property	☐	☐
☑	**Proposed Future Encroachment**	Detailed drawings of the proposed encroaching areas including detailed dimensions of all areas that will encroach onto City of Saskatoon Property. (Once construction is complete, an updated Real Property Report/Surveyor's Certificate will be required to confirm the area of encroachment.)	✓	✓

Upon receipt of the request, the Building Standards Division of the Community Services Department will request approvals from the necessary Departments and Divisions, including Development Services, Building Standards, Transportation & Utilities and any other Department or Division as deemed necessary, depending on the type of encroachment. Upon receipt of the various approvals and that there are no objections to the request; the application will be forwarded to the next available Standing Policy Committee on Transportation meeting for their approval. Once the Standing Policy Committee on Transportation has approved, the City Clerks office will advise the applicant of the Committee's decision and will prepare the agreement. Please note that encroachment agreement requests may take up to 10 weeks to process and is dependent on the Standing Policy Committee Meeting Schedule.

Assuming the encroachment is approved, an annual fee will be applied to the tax notice. This fee is based on the area of encroachment, and is calculated at $3.25 per square meter. The current minimum fee is $50.00

DECLARATION & SIGNATURES

I DO HEREBY DECLARE:

- That the issuance of an Encroachment Agreement does not relieve the owner and authorized agents from complying with the requirements of the 2010 National Building Code of Canada, as amended and within the scope of the Uniform Building and Accessibility Standards Act.
- That the submission of this application does not give permission for encroachment of any portion of the building, and that appropriate building permits are required to be obtained prior to the construction of the encroachment.

I certify that I have read and agree to abide by the conditions above, and all information contained within this application is correct.

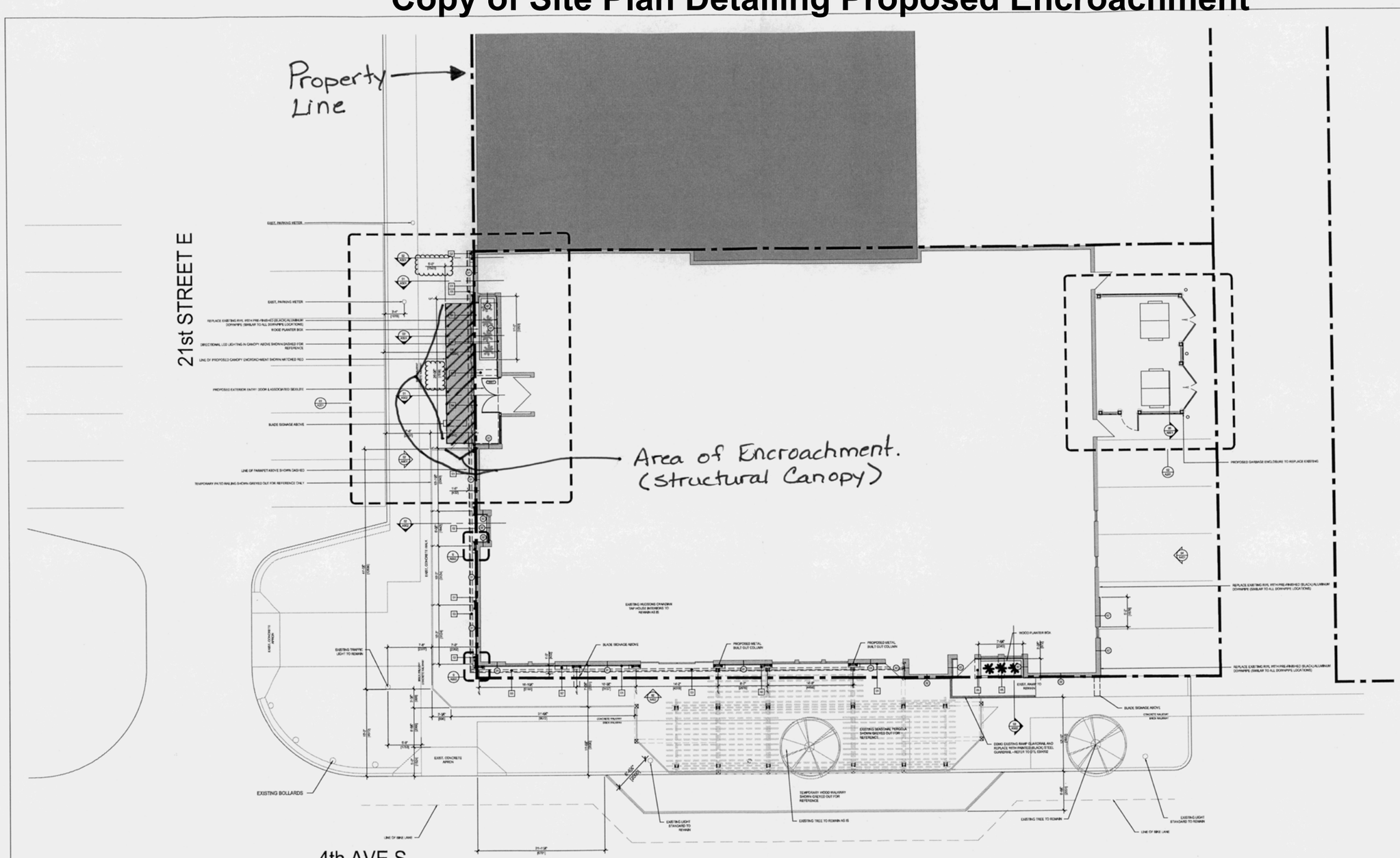
Applicant Signature	Date	Application Received By	Date Received
[signature]	Sept 8, 2016	[signature]	SEP 08 2016

RECEIVED
CITY OF SASKATOON
COMMERCIAL PERMIT OFFICER

Last updated June 2015

Copy of Site Plan Detailing Proposed Encroachment

ATTACHMENT 2



PRIME CONSULTANT

mckinley burkart

403 229 2737
550 - 110 ninth avenue sw
calgary alberta
T2P 0T1
www.mckinleyburkart.com

NOTES

DO NOT SCALE DRAWINGS. REQUEST VERIFICATION OF DIMENSIONS AS REQUIRED.

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL LEVELS, DATUMS AND DIMENSIONS AND SHALL REPORT ANY AND ALL ERRORS AND / OR OMISSIONS TO THE PRIME CONSULTANT IMMEDIATELY.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH STRUCTURAL, MECHANICAL, ELECTRICAL DRAWINGS AND ANY OTHER CONSULTANTS DRAWINGS THAT MAY BE APPLICABLE.

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNTIL SO APPROVED.

KEY PLAN

ISSUED

NO	ISSUE	DATE
A	ISSUE FOR DEVELOPMENT / BUILDING PERMIT	2016-09-07
B	ISSUE FOR ENCROACHMENT APPLICATION	2016-09-07

REVISED

NO	REVISION	DATE

SEAL

SASKATCHEWAN ASSOCIATION OF ARCHITECTS
Walker McKinley
SAA #1011 Calgary, AB
REGISTERED PROFESSIONAL ARCHITECT

CLIENT

HUDSONS CANADIAN TAP HOUSE

780 701 0180
9120- 37 avenue
edmonton, alberta, T6E 5L4

PROJECT

HUDSONS- SASKATOON

MUNICIPAL ADDRESS:
306 970 0944
401 21st street E
saskatoon saskatchewan
S7K 0C5

DRAWING TITLE

OVERALL PLAN

PROJECT

PROJECT NO	15033
STARTED	2016-08-16
SCALE	AS SHOWN
DRAWN	POR
CHECKED	POR

REVISION 00

SHEET **A101**

PLAN LEGEND

- AREA NOT IN CONTRACT
- EXISTING EXTERIOR WALLS TO REMAIN
- INDICATES EXISTING DOOR TO REMAIN
- INDICATES NEW DOOR CONSTRUCTION
- PROPERTY LINE

PLAN KEYNOTES

01 DEMO TO EXISTING EXTERIOR CLADDING TO INCLUDE DEMO OF EXISTING STUCCO / WOOD CLADDINGS AS APPLICABLE, AND REMOVAL OF EXISTING FINISH TO ENSURE THERE IS A SOLID, LEVEL, SURFACE FOR APPLICATION OF VAPOR PERMEABLE SHEATHING MEMBRANE TO EXISTING SUBSTRATE. DEMO TO EXTERIOR CLADDING TO INCLUDE ALL APPLICABLE WINDOW / DOOR TRIM ETC.

02 DEMO OF EXISTING WOOD COLUMN BUILD-OUTS. DEMO OF EXISTING COLUMNS TO BE CONTAINED BACK TO LINE OF EXISTING SUBSTRATE TO ENSURE THERE IS A LEVEL, TRUE SURFACE FOR MOUNTING OF PROPOSED EXTERIOR CLADDING AS PER EXTERIOR ELEVATIONS

03 DEMO EXISTING WOOD SIGNAGE PANELS & ASSOCIATED FRAMING / BACKING TO ENSURE THAT THERE IS A LEVEL, TRUE SURFACE FOR MOUNTING OF PROPOSED EXTERIOR CLADDING AS PER EXTERIOR ELEVATIONS

04 DEMO EXISTING WOOD ARCHWAY, ASSOCIATED CANOPY AND FRAMING. DEMO EXISTING CANOPY BACK TO LINE OF EXISTING SUBSTRATE TO ALLOW FOR PROPOSED CANOPY STRUCTURAL CONNECTIONS. REFER TO WALL SECTIONS & STRUCTURAL DRAWINGS FOR FURTHER INFORMATION

05 DEMO EXISTING ARCHITECTURAL WOOD CLAD PROJECTIONS TO LINE OF MID-BAND AS SHOWN ON EXTERIOR ELEVATIONS. DEMO TO INCLUDE REMOVAL OF ALL WOOD CLADDING TO THE BULD-OUTS AND ENSURE THERE IS A SOLID, LEVEL SURFACE FOR INSTALLATION OF PROPOSED EXTERIOR CLADDING

01 A101 OVERALL SITE PLAN
1/8" = 1'-0"

PROJECT NORTH

Copy of Elevation Plan Detailing Proposed Encroachment

ATTACHMENT 3

Calculate Area + Fee

$A = L \times W$

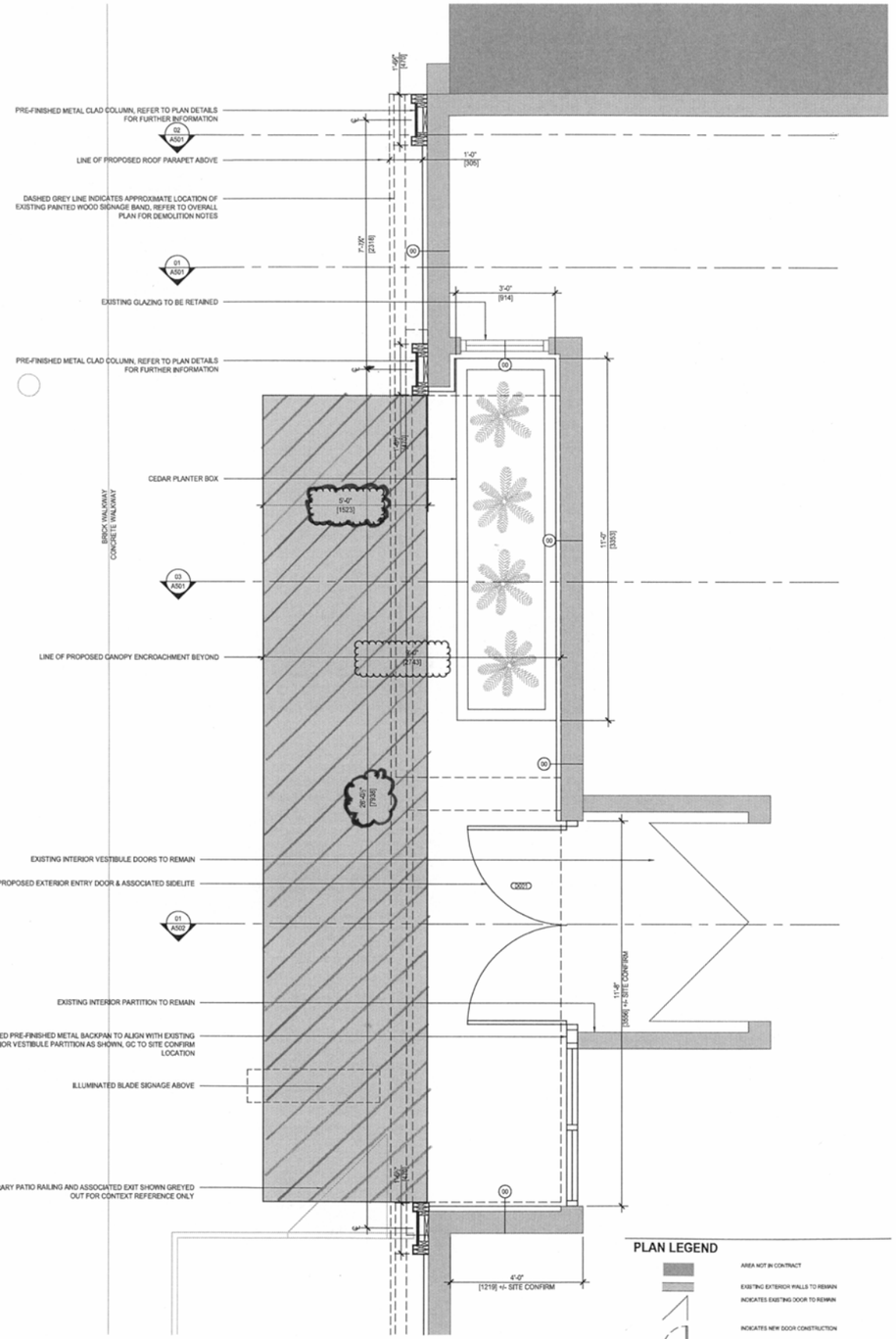
$= 7.938\ m \times 1.523\ m$

$= 12.09\ m^2$

$12.09\ m^2 \times \$3.25/m^2$

$= \$39.29$ per year

Minimum Fee = $50 per year.



01 A201 MAIN ENTRY PLAN
1/2" = 1'-0"

PLAN LEGEND

- AREA NOT IN CONTRACT
- EXISTING EXTERIOR WALLS TO REMAIN
- INDICATES EXISTING DOOR TO REMAIN
- INDICATES NEW DOOR CONSTRUCTION
- PROPERTY LINE

PROJECT NORTH

PRIME CONSULTANT

mckinley burkart

403 229 2037
550 - 110 ninth avenue sw
calgary alberta
T2P 0T1
www.mckinleyburkart.com

NOTES

DO NOT SCALE DRAWINGS, REQUEST VERIFICATION OF DIMENSIONS AS REQUIRED.

THE GENERAL CONTRACTOR SHALL CHECK AND VERIFY ALL LEVELS, DATUMS AND DIMENSIONS AND SHALL REPORT ANY AND ALL ERRORS AND / OR OMISSIONS TO THE PRIME CONSULTANT IMMEDIATELY.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH STRUCTURAL, MECHANICAL, ELECTRICAL DRAWINGS AND ANY OTHER CONSULTANT'S DRAWINGS THAT MAY BE APPLICABLE.

THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNTIL SO APPROVED.

KEY PLAN

ISSUED

NO	ISSUE	DATE
A	ISSUE FOR DEVELOPMENT / BUILDING PERMIT	2016-09-07
B	ISSUE FOR ENCROACHMENT APPLICATION	2016-09-07

REVISED

NO	REVISION	DATE

SEAL

SASKATCHEWAN ASSOCIATION OF ARCHITECTS
Walker McKinley
SAA #1011 Calgary, AB

CLIENT

HUDSONS CANADIAN TAP HOUSE

780 701 0190
9120- 37 avenue
edmonton, alberta, T6E 5L4

PROJECT

HUDSONS- SASKATOON

MUNICIPAL ADDRESS:
300 914 0944
401 21st street E
saskatoon saskatchewan
S7K 0C5

DRAWING TITLE

ENLARGED PLANS

PROJECT

PROJECT NO	15033
STARTED	2016-08-16
SCALE	AS SHOWN
DRAWN	POR
CHECKED	POR

REVISION 00

SHEET **A201**

Request for Encroachment Agreement – 741 7th Avenue North

Recommendation

1. That the proposed encroachment at 741 7th Avenue North (Lot 25, Block 11, Plan No. 98SA35499) be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement, making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

Topic and Purpose

The purpose of this report is to seek approval for a future encroachment for the portions of the proposed canopies located at 741 7th Avenue North.

Report Highlights

1. The proposed encroachment area is 15.00 square metres.
2. The building canopies will extend onto the Princess Street sidewalk by up to 0.91 metres.

Strategic Goals

This report supports the City of Saskatoon's Strategic Goals of Sustainable Growth and Quality of Life by ensuring that designs of proposed developments are consistent with planning and development criteria and that these designs do not pose a hazard for public safety.

Background

Building Bylaw No. 7306 states, in part, that:

> "The General Manager of the Community Services Department shall not issue a permit for the erection or alteration of any building or structure the plans of which show construction of any kind on, under, or over the surface of any public place until permission for such construction has been granted by Council."

Report

The owner of the property located at 741 7th Avenue North has requested approval to enter into an encroachment agreement (see Attachment 1). As shown on the Site Plan and Elevation Plan (see Attachments 2 and 3 respectively), the proposed new building canopies will encroach onto the Princess Street sidewalk to a maximum of 0.91 metres. The total area of the encroachment is approximately 15.00 square metres; therefore, will be subject to an annual charge of $50.

Public and/or Stakeholder Involvement
There is no public or stakeholder involvement.

Other Considerations/Implications
There are no options, policy, financial, environmental, privacy, or CPTED implications or considerations; a communication plan is not required at this time.

Due Date for Follow-up and/or Project Completion
There is no follow-up report planned.

Public Notice
Public notice, pursuant to Section 3 of Public Notice Policy No. C01-021, is not required.

Attachments
1. Request for Encroachment Agreement Dated September 14, 2016
2. Copy of Site Plan Detailing Proposed Encroachment
3. Copy of Elevation Plan Detailing Proposed Encroachment

Report Approval
Written by: Tanda Wunder-Buhr, Commercial Permit Supervisor, Building Standards
Reviewed by: Daisy Harington, Senior Building Code Engineer, Building Standards
Approved by: Randy Grauer, General Manager, Community Services Department

S/Reports/2016/BS/TRANSP – Request for Encroachment Agreement – 741 7th Avenue North/ks

Request for Encroachment Agreement Dated September 14, 2016

RECEIVED
SEP 14 2016
Building Standards Branch

City of Saskatoon

BUILDING STANDARDS
222-3rd AVE NORTH, SASKATOON, SK S7K 0J5

THIS IS NOT AN AGREEMENT

ENCROACHMENT AGREEMENT APPLICATION

ENA - 00009/2016.

SECTION A – PROJECT INFORMATION (to be completed for ALL ENCROACHMENT AGREEMENT APPLICATIONS)

(Please note the approval process may take up to 10 weeks dependent on the Standing Policy Committee Meeting Schedule)

TYPE OF ENCROACHMENT	New Proposed ☐	Revision ☐

PROJECT INFORMATION

Site Address: ~~743~~ 741 7th Avenue North

Legal Description (Lot/Block/Plan): 24/11/98SA35499 and 25/11/98SA35499

APPLICANT

Contact Name	Company Name (if applicable)		
RON MEDWID	101113496 Saskatchewan Ltd.		
Address	**City**	**Province**	**Postal Code**
Box 29	MARTENSVILLE	SK	S0K 2T0
Phone Number (incl. Area Code)	**Email Address**	**Preferred method of correspondence:**	
306-230-3606	rg.reno@sasktel.net	MAIL or (EMAIL)	

OWNER

Contact Name (Official Name that will appear on the Agreement)	Company Name (if applicable)		
CHRIS WALL/CORY TREMEER	102003463 Saskatchewan Ltd.		
Address	**City**	**Province**	**Postal Code**
725 9th Ave North	SASKATOON	SK	S7K 2Y8
Phone Number (incl. Area Code)	**Email Address**	**Preferred method of correspondence:**	
306-978-4377 H	wallch@sasktel.net	MAIL or (EMAIL)	

SECTION B – SUBMISSION REQUIREMENTS (to be completed for ALL ENCROACHMENT APPLICATIONS)

	ENCROACHMENT AGREEMENT APPLICATION REQUIREMENTS		Submitted	Received (office use only)
X	**Application Fee** Rcpt # 2284430	An Encroachment Application Fee of $100.00 is required to be submitted at the time of application Paid	X	X
☐	**Existing Encroachment**	Current Real Property Report/Surveyor's Certificate that clearly outlines the encroaching areas, including detailed dimensions of all areas that encroach onto City of Saskatoon Property	X	X
✓	**Proposed Future Encroachment**	Detailed drawings of the proposed encroaching areas including detailed dimensions of all areas that will encroach onto City of Saskatoon Property. (Once construction is complete, an updated Real Property Report/Surveyor's Certificate will be required to confirm the area of encroachment.)		

Upon receipt of the request, the Building Standards Division of the Community Services Department will request approvals from the necessary Departments and Divisions, including Development Services, Building Standards, Transportation & Utilities and any other Department or Division as deemed necessary, depending on the type of encroachment. Upon receipt of the various approvals and that there are no objections to the request, the application will be forwarded to the next available Standing Policy Committee on Transportation meeting for their approval. Once the Standing Policy Committee on Transportation has approved, the City Clerks office will advise the applicant of the Committee's decision and will prepare the agreement. Please note that encroachment agreement requests may take up to 10 weeks to process and is dependent on the Standing Policy Committee Meeting Schedule.

Assuming the encroachment is approved, an annual fee will be applied to the tax notice. This fee is based on the area of encroachment, and is calculated at $3.25 per square meter. The current minimum fee is $50.00

DECLARATION & SIGNATURES

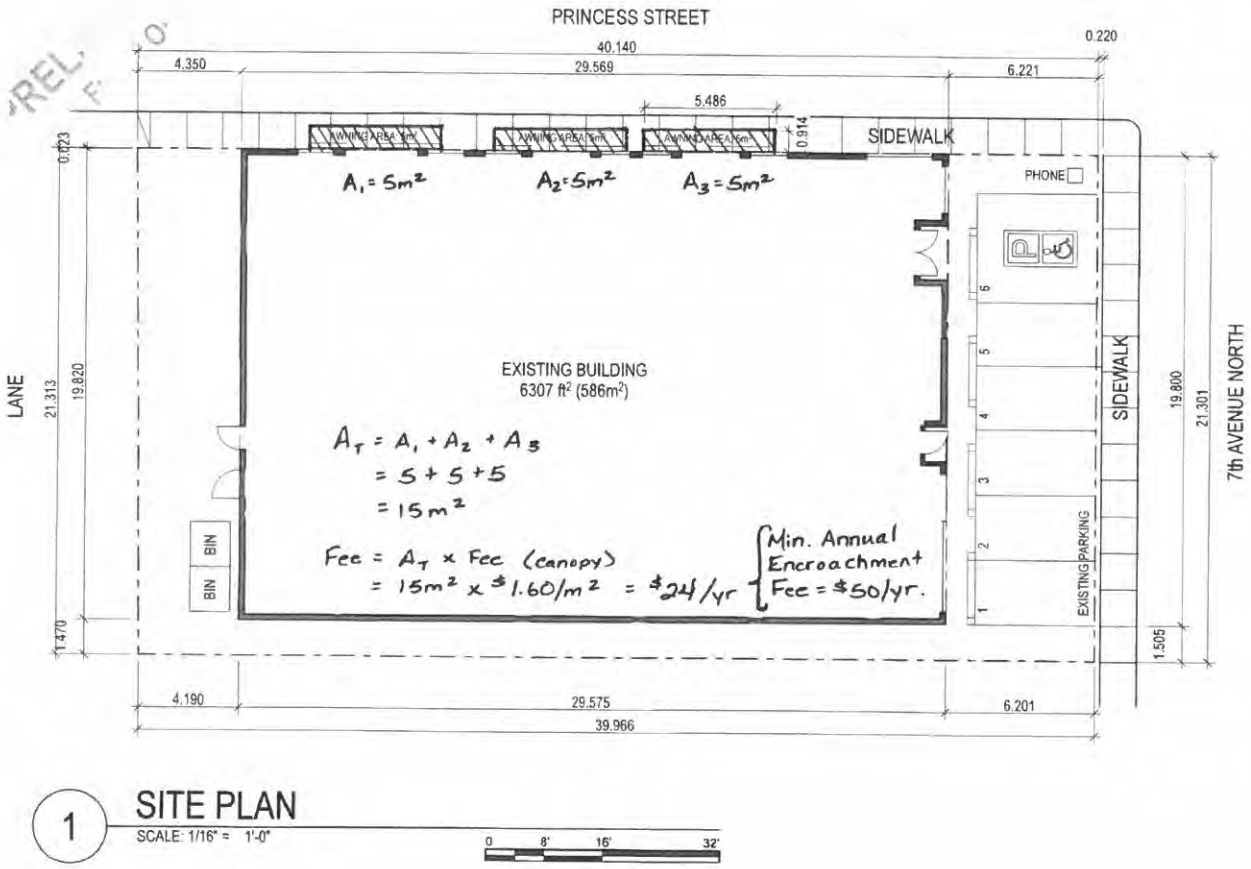
I DO HEREBY DECLARE:

- That the issuance of an Encroachment Agreement does not relieve the owner and authorized agents from complying with the requirements of the 2010 National Building Code of Canada, as amended and within the scope of the Uniform Building and Accessibility Standards Act.
- That the submission of this application does not give permission for encroachment of any portion of the building, and that appropriate building permits are required to be obtained prior to the construction of the encroachment.

I certify that I have read and agree to abide by the conditions above, and all information contained within this application is correct.

Applicant Signature	Date	Application Received By	Date Received
	Sept 8/16		Sept 14/16

Copy of Site Plan Detailing Proposed Encroachment



1 SITE PLAN
SCALE: 1/16" = 1'-0"
0 8' 16' 32'

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT THE PROPOSED STRUCTURE WILL NOT ENCROACH UPON ANY ELECTRICAL OR GAS LINES OR ANY EASEMENTS REGISTERED AGAINST THE PROPERTY IN QUESTION. THE LOCATION OF THE ELECTRICAL OR GAS LINES MAY BE LOCATED BY CONTACTING SASKPOWER OR SASKENERGY RESPECTIVELY.

SITE SECURITY MUST BE PROVIDED DURING NEW CONSTRUCTION IN ESTABLISHED AREAS AND AS REQUIRED BY THE BUILDING INSPECTOR. THE SITE SECURITY SHALL BE A 6FT CONSTRUCTION FENCE AND WILL BE REQUIRED UNTIL ALL OPENINGS UP TO 6FT FROM GRADE ARE SEALED.

ZONING REVIEW
BASED ON BYLAW #8770

ZONING:	B2: DISTRICT COMMERCIAL	
	REQUIRED	PROVIDED
SITE WIDTH:	7.5m	12.3m
SITE AREA:		855.5m²
FRONT YARD:	0m	6.2m
REAR YARD:	7.5m	4.19m
SIDE YARD:	0m/1.5m	0m/1.5m
BLDG HEIGHT	7.5m	5m
PARKING:	12 1 SPACE PER 50m2	26

PROJECT INFORMATION:

CIVIC ADDRESS:
741 7th AVENUE NORTH
SASKATOON, SASKATCHEWAN

LEGAL DESCRIPTION:
LOT 25
BLOCK 11
PLAN 98SA35199

AREAS:
BASEMENT: 586 m²
MAIN FLOOR: 586 m²
MEZZANINE: 41.6 m²

BLDG STUDIO INC
#201-226 20th St West
Saskatoon, Saskatchewan
S7M 0W9
t: 306.241.6543
www.bldgstudio.ca

SEAL

PROJECT
741/743 7th Avenue N

CLIENT
CHRIS WALL & CORY TREMEER

DRAWN BY: CMB
PROJECT NO.: 1655
DATE: OCTOBER 14, 2016
SCALE: AS SHOWN/LAYOUT
ISSUED: REVIEW

SHEET TITLE
SITE PLAN

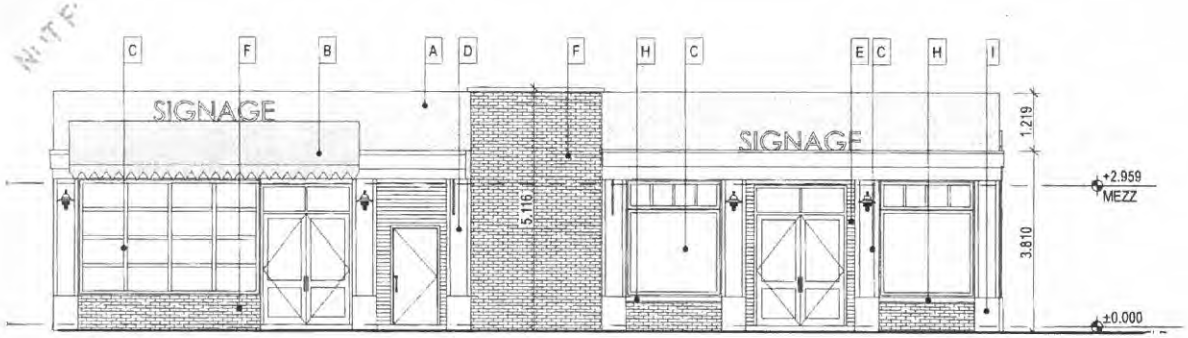
A1.0

Copy of Elevation Plans Detailing Proposed Encroachment

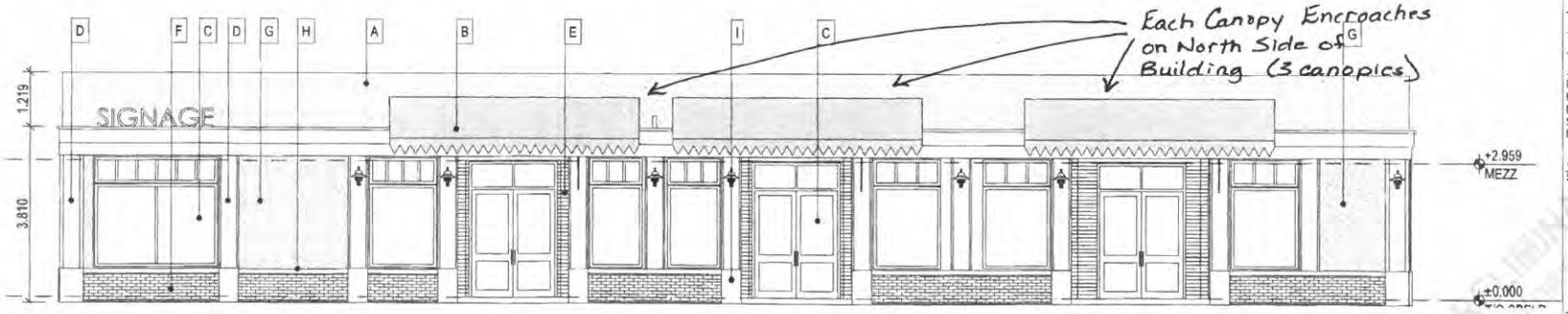
MATERIALS LEGEND

A	FLAT ACRYLIC STUCCO OFF-WHITE
B	CANVAS AWNING - BLACK
C	BLACK ALUMINUM STOREFRONT GLAZING
D	5/4 & 4/4 SMOOTH HARDIETRIM BOARD, GLOSS PAINTED BLACK
E	RECLAIMED FIR SIDING
F	TIMBERSTONE VENEER
G	FLAT ACRYLIC STUCCO BLACK
H	TIMBERSTONE DRIP LEDGE
I	LIMESTONE COLUMN BASE

1. CONTRACTOR TO ENSURE STUCCO IS INSTALLED AS PER NBC 9.28
2. CONTRACTOR TO ENSURE BRICK/STONE VENEER TO BE INSTALLED AS PER MANUFACTURER'S INSTRUCTION AND/OR NBC 9.20.
3. GUARDRAILS MUST BE A MINIMUM HEIGHT OF 900mm FOR DECKS MORE THAN 600mm ABOVE GRADE AND 1070mm FOR DECKS MORE THAN 1.8m ABOVE GRADE. MAXIMUM OPENINGS 100mm.
4. IS IT THE RESPONSIBILITY OF THE OWNER AND THE CONTRACTOR TO ENSURE ADEQUATE LATERAL SUPPORT FOR DECKS WHERE THE UNDERSIDE OF THE FLOOR JOISTS ARE 600mm ABOVE GRADE.
5. PROVIDE SAMPLES OF ALL COLOURS AND FINISHES TO BE VERIFIED BY DESIGNER BEFORE INSTALLATION.



1 **EAST ELEVATION**
SCALE: 1/8" = 1'-0"
0 4' 8' 16'



2 **NORTH ELEVATION**
SCALE: 1/8" = 1'-0"
0 4' 8' 16'

BLDG STUDIO INC
#201-226 20th St West
Saskatoon, Saskatchewan
S7M 0W9
t: 306.241.6643
www.bldgstudio.ca

SEAL

PROJECT
741/743 7th Avenue N

CLIENT
CHRIS WALL & CORY TREMEER

DRAWN BY: CMB
PROJECT NO.: 1655
DATE: OCTOBER 14, 2016
SCALE: AS SHOWN/11x17 LAYOUT
ISSUED: REVIEW

SHEET TITLE
ELEVATIONS

A3.1

Request for Encroachment Agreement – 240 22nd Street East – Building Façade

Recommendation

1. That the proposed encroachment at 240 22nd Street East (Lot 40, Block 150, Plan No. 99SA32572) be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

Topic and Purpose

The purpose of this report is to seek approval for the existing encroachments for the portions of the building façade located at 240 22nd Street East.

Report Highlights

1. The existing encroachment area is 17.39 square metres.
2. The building façade extends onto the 22nd Street East sidewalk by up to 0.44 metres and onto the 3rd Avenue North sidewalk by up to 0.42 metres.

Strategic Goals

This report supports the City of Saskatoon's Strategic Goals of Sustainable Growth and Quality of Life by ensuring that designs of proposed developments are consistent with planning and development criteria and that these designs do not pose a hazard for public safety.

Background

Building Bylaw No. 7306 states, in part, that:

> "The General Manager of the Community Services Department shall not issue a permit for the erection or alteration of any building or structure the plans of which show construction of any kind on, under, or over the surface of any public place until permission for such construction has been granted by Council."

Report

The owner of the property located at 240 22nd Street East has requested approval to enter into an encroachment agreement (see Attachment 1). As shown on the Real Property Report (see Attachment 2), the existing building façade does encroach onto the 22nd Street East sidewalk by up to a maximum of 0.44 metres and onto the 3rd Avenue North sidewalk by up to 0.42 metres. The total area of the encroachment is

approximately 17.39 square metres; therefore, will be subject to an annual charge of $56.52.

Public and/or Stakeholder Involvement
There is no public or stakeholder involvement.

Other Considerations/Implications
There are no options, policy, financial, environmental, privacy, or CPTED implications or considerations; a communication plan is not required at this time.

Due Date for Follow-up and/or Project Completion
There is no follow-up report planned.

Public Notice
Public notice, pursuant to Section 3 of Public Notice Policy No. C01-021, is not required.

Attachments
1. Request for Encroachment Agreement dated September 13, 2016
2. Copy of the Real Property Report Detailing Existing Encroachment

Report Approval
Written by: Tanda Wunder-Buhr, Commercial Permit Supervisor, Building Standards
Reviewed by: Daisy Harington, Senior Building Code Engineer, Building Standards
Approved by: Randy Grauer, General Manager, Community Services Department

S/Reports/2016/BS/TRANS – Request for Encroachment Agreement – 240 22nd Street East – Building Façade/lc

Request for Encroachment Agreement dated September 13, 2016

City of Saskatoon

BUILDING STANDARDS
222-3rd AVE NORTH, SASKATOON, SK S7K 0J5

THIS IS NOT AN AGREEMENT

ENCROACHMENT AGREEMENT APPLICATION

7+8

SECTION A – PROJECT INFORMATION (to be completed for ALL ENCROACHMENT AGREEMENT APPLICATIONS)

(Please note the approval process may take up to 10 weeks dependent on the Standing Policy Committee Meeting Schedule)

TYPE OF ENCROACHMENT	New Proposed ☐	Revision ☒

PROJECT INFORMATION

Site Address	Legal Description (Lot/Block/Plan)
NW corner of 22nd Street and 3rd Ave. 240-22nd Street East (on BPA)	O/H.

APPLICANT

Contact Name	Company Name (if applicable)		
Brady Plett	Con-Tech General Contractors		
Address	**City**	**Province**	**Postal Code**
324 Packham Ave	Saskatoon	SK	S7N 2T1
Phone Number (incl. Area Code)	**Email Address**	**Preferred method of correspondence:**	
306-381-7730	bplett@contechgc.ca	MAIL or EMAIL	

OWNER

Contact Name (Official Name that will appear on the Agreement)	Company Name (if applicable)		
Carol Morgan	Canadiana Developments		
Address	**City**	**Province**	**Postal Code**
1730 Quebec Ave	Saskatoon	SK	S7K 1V9
Phone Number (incl. Area Code)	**Email Address**	**Preferred method of correspondence:**	
306-281-4540	annette.bce@sasktel.net	MAIL or EMAIL	

SECTION B – SUBMISSION REQUIREMENTS (to be completed for ALL ENCROACHMENT APPLICATIONS)

	ENCROACHMENT AGREEMENT APPLICATION REQUIREMENTS		Submitted	Received (office use only)
☒	**Application Fee**	An Encroachment Application Fee of $100.00 is required to be submitted at the time of application	☒	☒
☑	**Existing Encroachment**	Current Real Property Report/Surveyor's Certificate that clearly outlines the encroaching areas, including detailed dimensions of all areas that encroach onto City of Saskatoon Property	☐	☐
☐	**Proposed Future Encroachment**	Detailed drawings of the proposed encroaching areas including detailed dimensions of all areas that will encroach onto City of Saskatoon Property. (Once construction is complete, an updated Real Property Report/Surveyor's Certificate will be required to confirm the area of encroachment.)	☐	☐

Upon receipt of the request, the Building Standards Division of the Community Services Department will request approvals from the necessary Departments and Divisions, including Development Services, Building Standards, Transportation & Utilities and any other Department or Division as deemed necessary, depending on the type of encroachment. Upon receipt of the various approvals and that there are no objections to the request, the application will be forwarded to the next available Standing Policy Committee on Transportation meeting for their approval. Once the Standing Policy Committee on Transportation has approved, the City Clerks office will advise the applicant of the Committee's decision and will prepare the agreement. Please note that encroachment agreement requests may take up to 10 weeks to process and is dependent on the Standing Policy Committee Meeting Schedule.

RECEIVED (SEP 13 2016) BUILDING STANDARDS

Assuming the encroachment is approved, an annual fee will be applied to the tax notice. This fee is based on the area of encroachment, and is calculated at $3.25 per square meter. The current minimum fee is $50.00

DECLARATION & SIGNATURES

I DO HEREBY DECLARE:

- That the issuance of an Encroachment Agreement does not relieve the owner and authorized agents from complying with the requirements of the 2010 National Building Code of Canada, as amended and within the scope of the Uniform Building and Accessibility Standards Act.
- That the submission of this application does not give permission for encroachment of any portion of the building, and that appropriate building permits are required to be obtained prior to the construction of the encroachment.

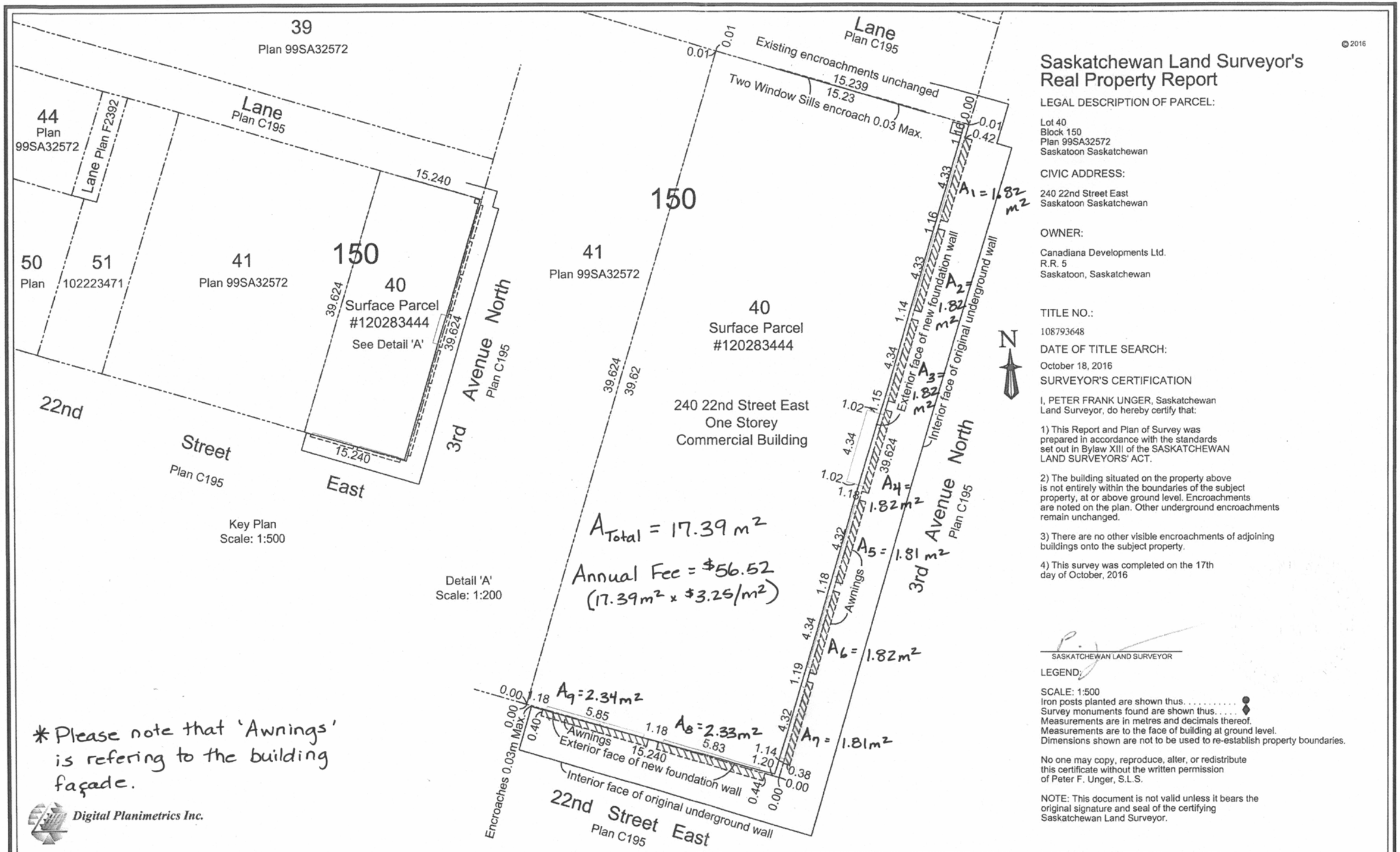
I certify that I have read and agree to abide by the conditions above, and all information contained within this application is correct.

Applicant Signature	Date	Application Received By	Date Received
[signature]	9/13/2016	[signature]	Sept 13/16

Paid Rcpt # 2283514.

Last updated June 2015

Copy of the Real Property Report Detailing Existing Encroachment



* Please note that 'Awnings' is refering to the building façade.

Digital Planimetrics Inc.

© 2016

Saskatchewan Land Surveyor's Real Property Report

LEGAL DESCRIPTION OF PARCEL:

Lot 40
Block 150
Plan 99SA32572
Saskatoon Saskatchewan

CIVIC ADDRESS:

240 22nd Street East
Saskatoon Saskatchewan

OWNER:

Canadiana Developments Ltd.
R.R. 5
Saskatoon, Saskatchewan

TITLE NO.:

108793648

DATE OF TITLE SEARCH:

October 18, 2016

SURVEYOR'S CERTIFICATION

I, PETER FRANK UNGER, Saskatchewan Land Surveyor, do hereby certify that:

1) This Report and Plan of Survey was prepared in accordance with the standards set out in Bylaw XIII of the SASKATCHEWAN LAND SURVEYORS' ACT.

2) The building situated on the property above is not entirely within the boundaries of the subject property, at or above ground level. Encroachments are noted on the plan. Other underground encroachments remain unchanged.

3) There are no other visible encroachments of adjoining buildings onto the subject property.

4) This survey was completed on the 17th day of October, 2016

SASKATCHEWAN LAND SURVEYOR

LEGEND:

SCALE: 1:500
Iron posts planted are shown thus.....
Survey monuments found are shown thus.....
Measurements are in metres and decimals thereof.
Measurements are to the face of building at ground level.
Dimensions shown are not to be used to re-establish property boundaries.

NOTE: This document is not valid unless it bears the original signature and seal of the certifying Saskatchewan Land Surveyor.

Request for Encroachment Agreement – 240 22nd Street East – Building Underground Structure

Recommendation

1. That the proposed encroachment at 240 22nd Street East (Lot 40, Block 150, Plan No. 99SA32572) be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement, making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

Topic and Purpose

The purpose of this report is to seek approval for the existing encroachments for the portions of the building underground structure located at 240 22nd Street East.

Report Highlights

1. The existing encroachment area is 33.91 square metres.
2. The building underground structure extends into the north adjacent lane by up to 2.23 metres.

Strategic Goals

This report supports the City of Saskatoon's Strategic Goals of Sustainable Growth and Quality of Life by ensuring that designs of proposed developments are consistent with planning and development criteria and that these designs do not pose a hazard for public safety.

Background

Building Bylaw No. 7306 states, in part, that:

> "The General Manager of the Community Services Department shall not issue a permit for the erection or alteration of any building or structure the plans of which show construction of any kind on, under, or over the surface of any public place until permission for such construction has been granted by Council."

Report

The owner of the property located at 240 22nd Street East has requested approval to enter into an encroachment agreement (see Attachment 1). As shown on the Real Property Report (see Attachment 2), the existing building underground structure extends into the north adjacent lane by up to 2.23 metres. The total area of the

encroachment is approximately 33.91 square metres; therefore, will be subject to an annual charge of $110.21.

Public and/or Stakeholder Involvement

There is no public or stakeholder involvement.

Other Considerations/Implications

There are no options, policy, financial, environmental, privacy, or CPTED implications or considerations; a communication plan is not required at this time.

Due Date for Follow-up and/or Project Completion

There is no follow-up report planned.

Public Notice

Public notice, pursuant to Section 3 of Public Notice Policy No. C01-021, is not required.

Attachments

1. Request for Encroachment Agreement Dated September 13, 2016
2. Copy of the Real Property Report Detailing Existing Encroachment

Report Approval

Written by: Tanda Wunder-Buhr, Commercial Permit Supervisor, Building Standards
Reviewed by: Daisy Harington, Senior Building Code Engineer, Building Standards
Approved by: Randy Grauer, General Manager, Community Services Department

S/Reports/2016/BS/TRANSP – Request for Encroachment Agreement – 240 22nd Street East – Building Underground Structure/ks

Request for Encroachment Agreement Dated September 13, 2016

City of Saskatoon

BUILDING STANDARDS
222-3rd AVE NORTH, SASKATOON, SK S7K 0J5

THIS IS NOT AN AGREEMENT

ENCROACHMENT AGREEMENT APPLICATION

#1 & 8

SECTION A – PROJECT INFORMATION (to be completed for ALL ENCROACHMENT AGREEMENT APPLICATIONS)

(Please note the approval process may take up to 10 weeks dependent on the Standing Policy Committee Meeting Schedule)

TYPE OF ENCROACHMENT	New Proposed ☐	Revision ☒

PROJECT INFORMATION

Site Address	
NW corner of 22nd Street and 3rd Ave. 240-22nd Street East (on BPA)	
Legal Description (Lot/Block/Plan)	U/G.

APPLICANT

Contact Name	Company Name (if applicable)		
Brady Plett	Con-Tech General Contractors		
Address	City	Province	Postal Code
324 Packham Ave	Saskatoon	SK	S7N 2T1
Phone Number (incl. Area Code)	Email Address	Preferred method of correspondence:	
306-381-7730	bplett@contechgc.ca	MAIL or EMAIL	

OWNER

Contact Name (Official Name that will appear on the Agreement)	Company Name (if applicable)		
Carol Morgan	Canadiana Developments		
Address	City	Province	Postal Code
1730 Quebec Ave	Saskatoon	SK	S7K 1V9
Phone Number (incl. Area Code)	Email Address	Preferred method of correspondence:	
306-281-4540	annette.bce@sasktel.net	MAIL or EMAIL	

SECTION B – SUBMISSION REQUIREMENTS (to be completed for ALL ENCROACHMENT APPLICATIONS)

	ENCROACHMENT AGREEMENT APPLICATION REQUIREMENTS		Submitted	Received (office use only)
☒	**Application Fee**	An Encroachment Application Fee of $100.00 is required to be submitted at the time of application	☒	☒
☑	**Existing Encroachment**	Current Real Property Report/Surveyor's Certificate that clearly outlines the encroaching areas, including detailed dimensions of all areas that encroach onto City of Saskatoon Property	☐	☐
☐	**Proposed Future Encroachment**	Detailed drawings of the proposed encroaching areas including detailed dimensions of all areas that will encroach onto City of Saskatoon Property. (Once construction is complete, an updated Real Property Report/Surveyor's Certificate will be required to confirm the area of encroachment.)	☐	☐

Upon receipt of the request, the Building Standards Division of the Community Services Department will request approvals from the necessary Departments and Divisions, including Development Services, Building Standards, Transportation & Utilities and any other Department or Division as deemed necessary, depending on the type of encroachment. Upon receipt of the various approvals and that there are no objections to the request; the application will be forwarded to the next available Standing Policy Committee on Transportation meeting for their approval. Once the Standing Policy Committee on Transportation has approved, the City Clerks office will advise the applicant of the Committee's decision and will prepare the agreement. Please note that encroachment agreement requests may take up to 10 weeks to process and is dependent on the Standing Policy Committee Meeting Schedule.

RECEIVED

Assuming the encroachment is approved, an annual fee will be applied to the tax notice. This fee is based on the area of encroachment, and is calculated at $3.25 per square meter. The current minimum fee is $50.00

DECALRATION & SIGNATURES

I DO HEREBY DECLARE:

- That the issuance of an Encroachment Agreement does not relieve the owner and authorized agents from complying with the requirements of the 2010 National Building Code of Canada, as amended and within the scope of the Uniform Building and Accessibility Standards Act.
- That the submission of this application does not give permission for encroachment of any portion of the building, and that appropriate building permits are required to be obtained prior to the construction of the encroachment.

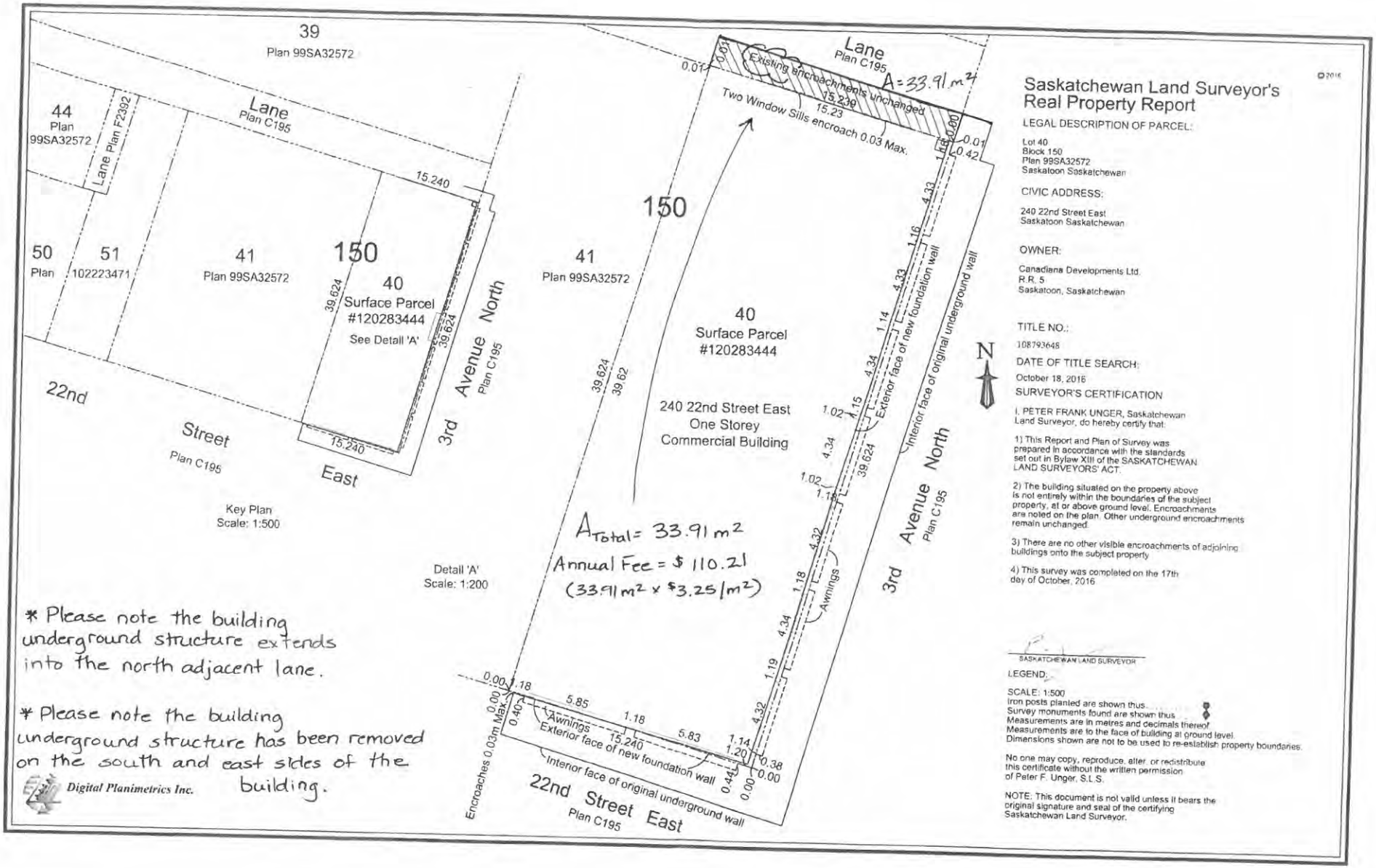
I certify that I have read and agree to abide by the conditions above, and all information contained within this application is correct.

Applicant Signature	Date	Application Received By	Date Received
	9/13/2016		Sept 13/16

Paid Rcpt # 2283514

Last updated June 2015

Copy of the Real Property Report Detailing Existing Encroachment



Request for Encroachment Agreement – 650 Broadway Avenue - Balconies

Recommendation

1. That the proposed encroachment at 650 Broadway Avenue [Lots 1 and 2, Block A3, Plan No. (Q24) A955] be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

Topic and Purpose

The purpose of this report is to seek approval for a future encroachment for the portions of the proposed building balconies located 650 Broadway Avenue.

Report Highlights

1. The proposed encroachment area is 60.16 square metres.
2. The building balconies will extend onto the 11th Street East sidewalk by up to 1.80 metres and onto the Broadway Avenue sidewalk by up to 0.35 metres.

Strategic Goals

This report supports the City of Saskatoon's Strategic Goals of Sustainable Growth and Quality of Life by ensuring that designs of proposed developments are consistent with planning and development criteria and that these designs do not pose a hazard for public safety.

Background

Building Bylaw No. 7306 states, in part, that:

> "The General Manager of the Community Services Department shall not issue a permit for the erection or alteration of any building or structure the plans of which show construction of any kind on, under, or over the surface of any public place until permission for such construction has been granted by Council."

Report

The owner of the property located at 650 Broadway Avenue has requested approval to enter into an encroachment agreement (see Attachment 1). As shown on the Site Plan (see Attachment 2) and Elevation Plan (see Attachment 3), the proposed new building balconies will encroach onto the 11th Street East sidewalk to a maximum of 1.80 metres and onto the Broadway Avenue sidewalk to a maximum of 0.35 metres. The total area

of the encroachment is approximately 60.16 square metres; therefore, it will be subject to an annual charge of $195.52.

Public and/or Stakeholder Involvement
There is no public or stakeholder involvement.

Other Considerations/Implications
There are no options, policy, financial, environmental, privacy, or CPTED implications or considerations; a communication plan is not required at this time.

Due Date for Follow-up and/or Project Completion
There is no follow-up report planned.

Public Notice
Public notice, pursuant to Section 3 of Public Notice Policy No. C01-021, is not required.

Attachments
1. Request for Encroachment Agreement dated September 23, 2016
2. Copy of Site Plan Detailing Proposed Encroachment
3. Copy of Elevation Plan Detailing Proposed Encroachment

Report Approval
Written by: Tanda Wunder-Buhr, Commercial Permit Supervisor, Building Standards
Reviewed by: Daisy Harington, Senior Building Code Engineer, Building Standards
Approved by: Randy Grauer, General Manager, Community Services Department

S/Reports/2016/BS/TRANS – Request for Encroachment Agreement – 650 Broadway Avenue – Balconies/lc

Request for Encroachment Agreement Dated September 23, 2016

City of Saskatoon

BUILDING STANDARDS
222-3rd AVE NORTH, SASKATOON, SK S7K 0J5

THIS IS NOT AN AGREEMENT

ENCROACHMENT AGREEMENT APPLICATION

RECEIVED
SEP 23 2016
Building Standards

SECTION A – PROJECT INFORMATION (to be completed for ALL ENCROACHMENT AGREEMENT APPLICATIONS)

(Please note the approval process may take up to 10 weeks dependent on the Standing Policy Committee Meeting Schedule)

TYPE OF ENCROACHMENT	New Proposed ☒	Revision ☐

PROJECT INFORMATION

Site Address: 650 BROADWAY AVENUE

Legal Description (Lot/Block/Plan): LOTS 1 AND 2; BLOCK A3 · PLAN No. (Q24) A955

APPLICANT

Contact Name	Company Name (if applicable)		
JIM ZIMMER	JAMES D. ZIMMER ARCHITECT		
Address	**City**	**Province**	**Postal Code**
1249 8TH STREET E	SASKATOON	SK	S7H 0S5
Phone Number (incl. Area Code)	**Email Address**	**Preferred method of correspondence:**	
306-931-6622	jimzimmer@sasktel.net	MAIL or (EMAIL)	

OWNER

Contact Name (Official Name that will appear on the Agreement)	Company Name (if applicable)		
ROGER KIVA DEAN POTAPINSKI	10164826 SASKATCHEWAN LTD.		
Address	**City**	**Province**	**Postal Code**
#20 207 FAIRMONT DR.	SASKATOON	SK	S7M 5B8
Phone Number (incl. Area Code)	**Email Address**	**Preferred method of correspondence:**	
306-229-2998	KIVACHIRO@SASKTEL.NET DEAN.CONFEDCHIRO@SASKTEL.NET	(MAIL) or EMAIL	

SECTION B – SUBMISSION REQUIREMENTS (to be completed for ALL ENCROACHMENT APPLICATIONS)

	ENCROACHMENT AGREEMENT APPLICATION REQUIREMENTS		Submitted	Received (office use only)
☒	**Application Fee**	An Encroachment Application Fee of $100.00 is required to be submitted at the time of application	☒	☐
☐	**Existing Encroachment**	Current Real Property Report/Surveyor's Certificate that clearly outlines the encroaching areas, including detailed dimensions of all areas that encroach onto City of Saskatoon Property	☐	☐
☒	**Proposed Future Encroachment**	Detailed drawings of the proposed encroaching areas including detailed dimensions of all areas that will encroach onto City of Saskatoon Property. (Once construction is complete, an updated Real Property Report/Surveyor's Certificate will be required to confirm the area of encroachment.)	☒	☐

Upon receipt of the request, the Building Standards Division of the Community Services Department will request approvals from the necessary Departments and Divisions, including Development Services, Building Standards, Transportation & Utilities and any other Department or Division as deemed necessary, depending on the type of encroachment. Upon receipt of the various approvals and that there are no objections to the request; the application will be forwarded to the next available Standing Policy Committee on Transportation meeting for their approval. Once the Standing Policy Committee on Transportation has approved, the City Clerks office will advise the applicant of the Committee's decision and will prepare the agreement. Please note that encroachment agreement requests may take up to 10 weeks to process and is dependent on the Standing Policy Committee Meeting Schedule.

Assuming the encroachment is approved, an annual fee will be applied to the tax notice. This fee is based on the area of encroachment, and is calculated at $3.25 per square meter. The current minimum fee is $50.00

DECLARATION & SIGNATURES

I DO HEREBY DECLARE:

- That the issuance of an Encroachment Agreement does not relieve the owner and authorized agents from complying with the requirements of the 2010 National Building Code of Canada, as amended and within the scope of the Uniform Building and Accessibility Standards Act.
- That the submission of this application does not give permission for encroachment of any portion of the building, and that appropriate building permits are required to be obtained prior to the construction of the encroachment.

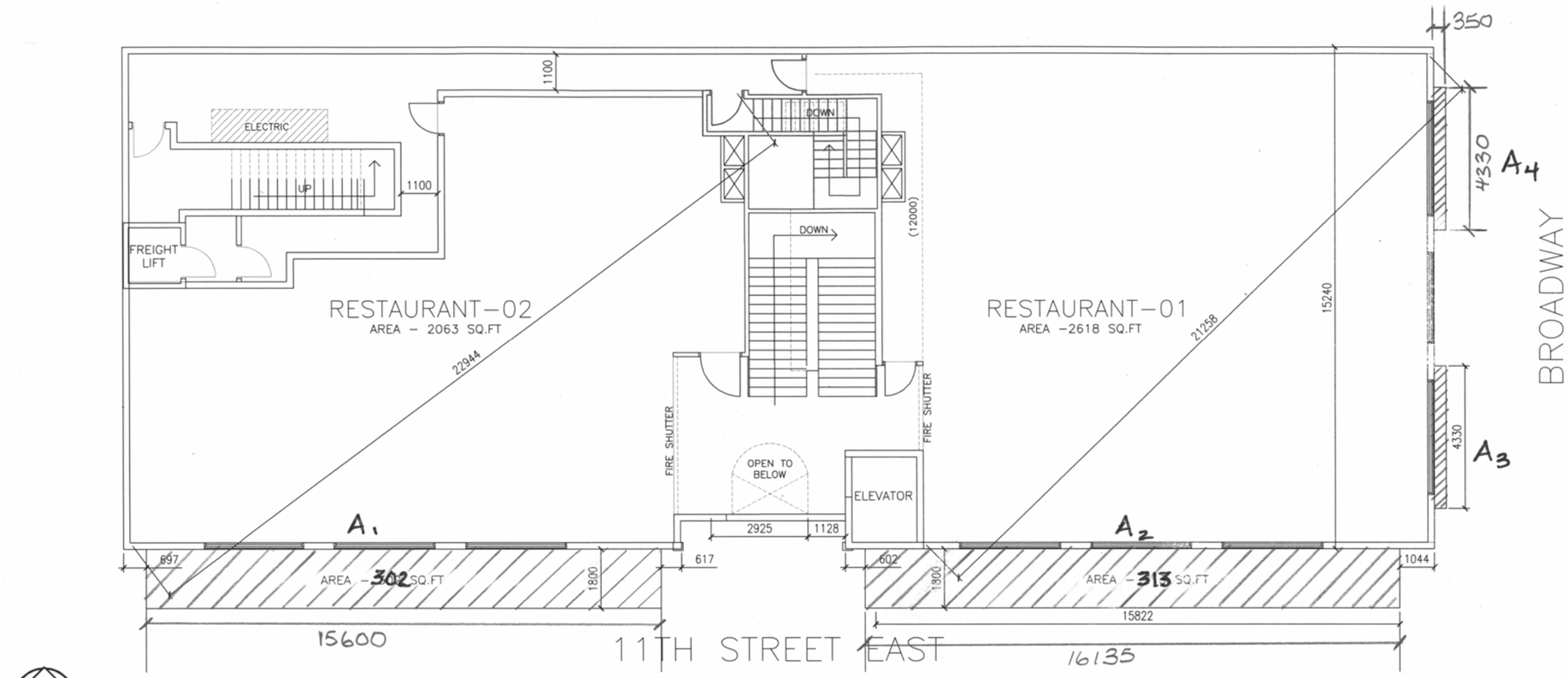
I certify that I have read and agree to abide by the conditions above, and all information contained within this application is correct.

Applicant Signature	Date	Application Received By
	SEPT. 23/2016	

RECEIVED
SEP 23 2016
Date Received
CITY OF SASKATOON
COMMERCIAL PERMIT OFFICER

Last updated June 2015

Copy of Site Plan Detailing Proposed Encroachment



NORTH

1 SECOND FLOOR PLAN

SCALE 1:150

$A_3 = A_4 = 0.35m \times 4.33m$
$= 1.52 m^2$
$= 16.3 ft^2$
(each)

$A_1 = 1.8m \times 15.6m$
$= 28.08 m^2$
$= 302 ft^2$

$A_2 = 1.8m \times 16.135m$
$= 29.04 m^2$
$= 313 ft^2$

Calculate Area + Fee

$A_T = A_1 + A_2 + A_3 + A_4$
$= 60.16 m^2$

Fee $= A_T \times \$3.25/m^2$
$= \$195.52$ per year.

No.	Revision/Issue	Date

JAMES ZIMMER ARCHITECT

1249 - 8TH STREET EAST
SASKATOON, SASKATCHEWAN
(306) 931-6622

PROGRESS / REVIEW DRAWING NOT FOR CONSTRUCTION

FINESTRA

650 BROADWAY
SASKATOON, SASK.

SECOND FLOOR PLAN

SCALE - 1:150

DRAWN: IH
DATE: OCT,2016
JOB NO.:2015-02

SHEET
P-21.3

Copy of Elevation Plan Detailing Proposed Encroachment

1 IITH ST ELEVATION
SCALE 1:150

2 FRONT ELEVATION
SCALE 1:150

No.	Revision/Issue	Date

JAMES ZIMMER
ARCHITECT
1249 - 8TH STREET EAST
SASKATOON, SASKATCHEWAN
(306) 931-6622

PROGRESS / REVIEW DRAWING NOT FOR CONSTRUCTION

FARNAM BLOCK

650 BROADWAY
SASKATOON, SASK.

FINESTRA

SCALE - 1:150

DRAWN: IH
DATE: SEP 20, 2016
JOB NO:: 2015-02

SHEET
P-19.4

Request for Encroachment Agreement – 130 4th Avenue North

Recommendation

1. That the proposed encroachment at 130 4th Avenue North (Lot 43, Block 159, Plan No. 99SA32572) be recognized;
2. That the City Solicitor be requested to prepare the appropriate encroachment agreement, making provision to collect the applicable fees; and
3. That His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal and in a form that is satisfactory to the City Solicitor.

Topic and Purpose

The purpose of this report is to seek approval for the existing encroachment for the portions of the building façade located at 130 4th Avenue North.

Report Highlights

1. The existing encroachment area is 0.42 square metres.
2. The building façade does extend onto the 4th Avenue North sidewalk by up to 0.03 metres.

Strategic Goals

This report supports the City of Saskatoon's Strategic Goals of Sustainable Growth and Quality of Life by ensuring that designs of proposed developments are consistent with planning and development criteria and that these designs do not pose a hazard for public safety.

Background

Building Bylaw No. 7306 states, in part, that:

> "The General Manager of the Community Services Department shall not issue a permit for the erection or alteration of any building or structure the plans of which show construction of any kind on, under, or over the surface of any public place until permission for such construction has been granted by Council."

Report

The owner of the property located at 130 4th Avenue North has requested approval to enter into an encroachment agreement (see Attachment 1). As shown on the Real Property Report (see Attachment 2), the existing building façade does encroach onto the 4th Avenue North sidewalk to a maximum of 0.03 metres. The total area of the encroachment is approximately 0.42 square metres; therefore, will be subject to an annual charge of $50.

Public and/or Stakeholder Involvement
There is no public or stakeholder involvement.

Other Considerations/Implications
There are no options, policy, financial, environmental, privacy, or CPTED implications or considerations; a communication plan is not required at this time.

Due Date for Follow-up and/or Project Completion
There is no follow-up report planned.

Public Notice
Public notice, pursuant to Section 3 of Public Notice Policy No. C01-021, is not required.

Attachments
1. Request for Encroachment Agreement Dated August 18, 2016
2. Copy of the Real Property Report Detailing Existing Encroachment

Report Approval
Written by: Tanda Wunder-Buhr, Commercial Permit Supervisor, Building Standards
Reviewed by: Daisy Harington, Senior Building Code Engineer, Building Standards
Approved by: Randy Grauer, General Manager, Community Services Department

S/Reports/2016/BS/TRANSP – Request for Encroachment Agreement – 130 4th Avenue North/ks

City of Saskatoon

BUILDING STANDARDS
222-3rd AVE NORTH, SASKATOON, SK S7K 0J5

THIS IS NOT AN AGREEMENT

RECEIVED
SEP 14 2016
Building Standards Branch

ENCROACHMENT AGREEMENT APPLICATION

SECTION A – PROJECT INFORMATION (to be completed for ALL ENCROACHMENT AGREEMENT APPLICATIONS)

(Please note the approval process may take up to 10 weeks dependent on the Standing Policy Committee Meeting Schedule)

TYPE OF ENCROACHMENT	New Proposed ☑	Revision ☐

PROJECT INFORMATION

Site Address: 130 4th Ave N

Legal Description (Lot/Block/Plan): ISC Parcel No. 164249668 Plan Lot 43 Blk 159, Plan 99SA3272 Ext 1

APPLICANT

Contact Name	Company Name (if applicable)		
Scott McCaig	City of Saskatoon		
Address	City: Saskatoon	Province: SK	Postal Code
Phone Number (incl. Area Code): 306 975-3208	Email Address: Scott.McCaig@Saskatoon.ca	Preferred method of correspondence: MAIL or (EMAIL)	

OWNER

Contact Name (Official Name that will appear on the Agreement)	Company Name (if applicable)		
City of Saskatoon			
Address	City	Province	Postal Code
Phone Number (incl. Area Code)	Email Address	Preferred method of correspondence: MAIL or EMAIL	

SECTION B – SUBMISSION REQUIREMENTS (to be completed for ALL ENCROACHMENT APPLICATIONS)

	ENCROACHMENT AGREEMENT APPLICATION REQUIREMENTS		Submitted	Received (office use only)
✓	**Application Fee** Pd. I.D.	An Encroachment Application Fee of $100.00 is required to be submitted at the time of application	✓	✓
☑	**Existing Encroachment**	Current Real Property Report/Surveyor's Certificate that clearly outlines the encroaching areas, including detailed dimensions of all areas that encroach onto City of Saskatoon Property	✓	✓
☐	**Proposed Future Encroachment**	Detailed drawings of the proposed encroaching areas including detailed dimensions of all areas that will encroach onto City of Saskatoon Property. (Once construction is complete, an updated Real Property Report/Surveyor's Certificate will be required to confirm the area of encroachment.)	☐	☐

Upon receipt of the request, the Building Standards Division of the Community Services Department will request approvals from the necessary Departments and Divisions, including Development Services, Building Standards, Transportation & Utilities and any other Department or Division as deemed necessary, depending on the type of encroachment. Upon receipt of the various approvals and that there are no objections to the request; the application will be forwarded to the next available Standing Policy Committee on Transportation meeting for their approval. Once the Standing Policy Committee on Transportation has approved, the City Clerks office will advise the applicant of the Committee's decision and will prepare the agreement. Please note that encroachment agreement requests may take up to 10 weeks to process and is dependent on the Standing Policy Committee Meeting Schedule.

Assuming the encroachment is approved, an annual fee will be applied to the tax notice. This fee is based on the area of encroachment, and is calculated at $3.25 per square meter. The current minimum fee is $50.00

DECALRATION & SIGNATURES

I DO HEREBY DECLARE:

- That the issuance of an Encroachment Agreement does not relieve the owner and authorized agents from complying with the requirements of the 2010 National Building Code of Canada, as amended and within the scope of the Uniform Building and Accessibility Standards Act.
- That the submission of this application does not give permission for encroachment of any portion of the building, and that appropriate building permits are required to be obtained prior to the construction of the encroachment.

I certify that I have read and agree to abide by the conditions above, and all information contained within this application is correct.

Applicant Signature	Date	Application Received By	Date Received
[signature]	Aug 18/16	[signature]	Aug 18/16

Last updated June 2015

Copy of the Real Property Report Detailing Existing Encroachment

Altus Geomatics

Toll Free: 1-800-465-6233
www.altusgeomatics.com

226 Cardinal Crescent
Saskatoon, SK, S7L 6H8
Phone 306-343-8187
Fax 306-343-3325

SASKATCHEWAN LAND SURVEYOR'S REAL PROPERTY REPORT

To: City of Saskatoon - Real Estate Service
201 - 3rd Avenue North
Saskatoon, Saskatchewan
S7K 2H7

Attention: Scott McCaig

RE: 130-4th Avenue North
Saskatoon, Saskatchewan

Date of Title Search: 04-May-2015

Registered Owner: City of Saskatoon
Active Surface Title # 136671105

Legal Description: Surface Parcel # 164249668
(Lot 43, Block 159, Plan 99SA32572 Extension 1)

Easements: Interest #145270098 CNV Easement

Interest #145270100 CNV Easement
Saskatchewan Power Corporation

Interest #145270087 CNV Common Law Easement

Interest #145329509 Public Utility Easement
City of Saskatoon
Saskatchewan Telecommunications
Shaw Cablesystems Limited

I, Daniel Llewilliam Codling, Saskatchewan Land Surveyor, have made a survey of the above-described property on the 5th day of May, 2015, and hereby certify that:

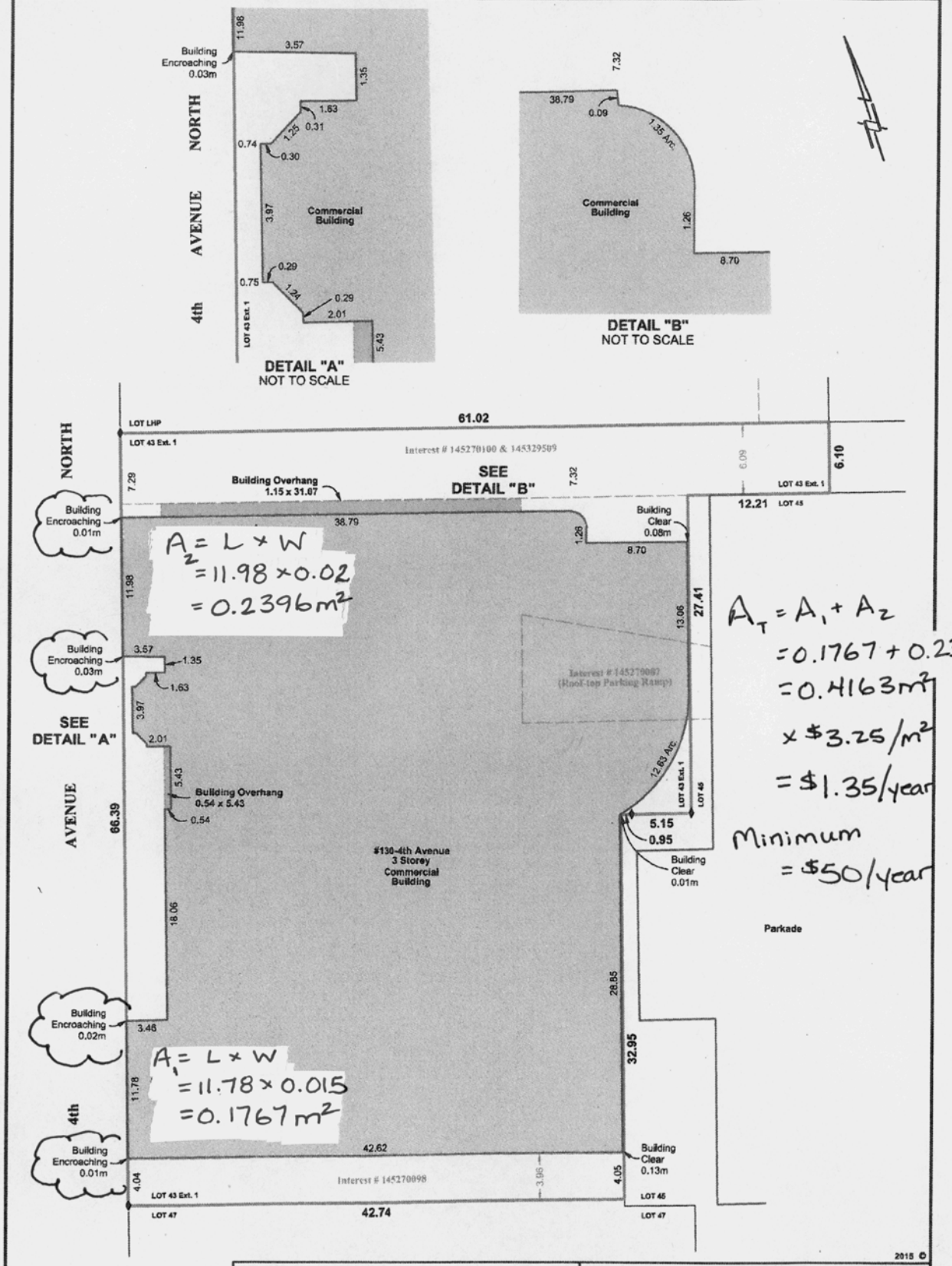
1. This plan forms a Real Property Report prepared in accordance with Article No.XIII of the bylaws of The Saskatchewan Land Surveyors Association.
2. The permanent building(s) now situated on the above-described property is(are) located as shown on this plan.
3. There are no encroachments above ground unless shown.
4. Measurements shown are to foundations at ground level unless noted.
5. This document provides data for mortgage purposes and for the use of the Municipal Building Department and should not be used for any other purpose.
6. Subsurface structures are not shown.

Dated at Saskatoon in the
Province of Saskatchewan
This 8th day of May, 2015

2015 © Daniel Llewilliam Codling, S.L.S.

Acad File: 185813RPR-A	Job No. : 185813	Page 1 of 2

SASKATCHEWAN LAND SURVEYOR'S REAL PROPERTY REPORT



2015 ©

Encroachments:

1. The building presently situated on Lot 43 encroaches onto 4th Avenue by 0.01, 0.02 & 0.03m as shown.

NOTE :

Unless otherwise specified, the dimensions shown relate to distances from property boundaries to foundation walls.
This document may not be reproduced without the written consent of the certifying Land Surveyor; further, it represents the conditions shown on the date of certification only.
All measurements are in metres.

Survey monuments found or planted are shown thus : _ _ _ _ _ ♦
Property Boundaries of Parcel Affected shown thus : _ _ _ _ _ _
Foundation shown thus : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

This Real Property Report is void if Page 1 does not bear an original signature and embossed seal, or if Page 1 is detached from Page 2.

Altus Geomatics

Toll Free: 1-800-465-6233
www.altusgeomatics.com

Scale - 1: 300	Initials: CB - CJ - DC	Field Book: Notes
Acad File: 185813RPR-A	Job No. : 185813	Page 2 of 2

19th Street Corridor

Recommendation
That the report of the General Manager, Transportation & Utilities Department dated November 14, 2016, be received as information.

Topic and Purpose
This report provides an update on the 19th Street Corridor from 1st Avenue South to Avenue H South, and specifically comments on parking, traffic safety and active transportation.

Report Highlights
1. On-street parking will be installed on the south side of 19th Street between Avenue A South and Avenue H South.
2. Paid parking stations will be installed on the south side of 19th Street between Avenue A South and Avenue C South.
3. An evaluation of two options for dedicated cycling facilities either on 19th Street or 20th Street will be completed in 2017.

Strategic Goal
This report supports the Strategic Goal of Moving Around by improving the safety of all road users (pedestrians, cyclists, and drivers), and helps provide a great place to live, work, and raise a family.

This report also supports the Strategic Goal of Economic Diversity and Prosperity, and Continuous Improvement, as the Administration is working collaboratively with economic development authorities and local businesses to promote Saskatoon as a great place to live, work, and raise a family.

Background
At the Regular Business Meeting of City Council held October 27, 2014, City Council approved an expansion of parking meters in various areas of the City. Although the Parking Committee supported the installation of the parking stations along 19th Street at that time, the scope of the initial installation of Flex Parking meters did not include 19th Street.

In 2015, parking meters were upgraded throughout the city. On June 27, 2016, City Council approved the Active Transportation Plan (ATP) in principle with next steps identified as developing a five-year implementation plan (2017 to 2021) that includes detailed capital and operating costs. The ATP identified both 19th Street and 20th Street as priorities for the potential for expansion of the bicycle network.

Discussions have also occurred with the Riversdale Business Improvement District (BID) and various area residents regarding the option of reducing the number of travel lanes from four lanes to two lanes along 19th Street between Avenue A and Avenue H. Reducing the number of lanes provides traffic calming and added on-street parking opportunities in the area.

Report

Traffic Analysis

The study (Attachment 1) illustrates the impact of reducing travel lanes on 19th Street.

The results of the study yield the following recommendations and conclusions:

- Reducing the travel lanes on 19th Street from four lanes to two lanes can adequately accommodate the traffic demands.
- The reduction of travel lanes will have a positive impact on safety by narrowing the roadway and reducing speed, and also reducing the distance for pedestrians to cross.

Action Plan

In order to address the traffic and parking concerns along 19th Street while a detailed plan for active transportation is developed, the Administration met with the Riversdale BID and identified the following action plan:

1. Install paid parking on the south side of 19th Street between Avenue A and Avenue C.
2. Install free, timed parking on the south side of 19th Street between Avenue C and Avenue H.
3. Evaluate and compare the following options to improve active transportation in early 2017:
    a. 19th Street between Avenue A South and Avenue H South:
        - One lane of parking on the south side
        - Two travel lanes
        - A bi-directional protected bike lane on the north side
    b. 20th Street between Idylwyld Drive and Avenue H South:
        - Two parking lanes
        - Two travel lanes
        - Two directional protected bike lanes

Public and/or Stakeholder Involvement

Significant public engagement was completed in the development of the ATP. Over the past several years there have been numerous discussions with the Riversdale BID regarding parking on 19th Street. Once the options for 19th Street and 20th Street are evaluated, a public engagement event will be held in 2017 to discuss the options.

Other Considerations/Implications

There are no options, communication, policy, financial, environmental, privacy, or CPTED considerations or implications.

Due Date for Follow-up and/or Project Completion

The Administration will submit a further report in the later part of 2017.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Report Approval

Written by:	Jay Magus, Engineering Manager, Transportation
Reviewed by:	Angela Gardiner, Director of Transportation
Approved by:	Jeff Jorgenson, General Manager, Transportation & Utilities Department

TRANS JM – 19th Street Corridor.docx

Capital Project #2407 – North Commuter Parkway and Traffic Bridge – Construction Update

Recommendation
That the report of the General Manager, Transportation & Utilities Department dated November 14, 2016, be received as information.

Topic and Purpose
This report is to provide the Standing Policy Committee on Transportation with an update of the North Commuter Parkway and Traffic Bridge project construction progress.

Report Highlights
1. The project continues to be on time and on budget.
2. At the Traffic Bridge, Graham Commuter Partners (GCP) has completed Pier 3 as well as the north and south bridge abutments. Span 4, the southernmost span of the bridge, has also been completed.
3. Demolition of the last original Traffic Bridge span is expected in mid-November 2016.
4. At the North Commuter Parkway bridge, construction of Pier 1, the west in-river pier, has been completed. Construction of Pier 2, the centre in-river pier, is underway with the pier foundation, diaphragm, and columns already complete, and construction of the pier cap currently underway.
5. Earthworks for the new roadways subgrades is underway. Storm sewer installation for the new roadways is ongoing until the end of November.

Strategic Goal
Construction of the North Commuter Parkway and Traffic Bridge supports the Strategic Goal of Moving Around as it will optimize the flow of people and goods in and around the city.

Background
At a special meeting held on September 8, 2015, City Council awarded the RFP for the North Commuter Parkway and Traffic Bridge, naming GCP the Preferred Proponent. At its meeting on November 23, 2015, City Council received information regarding the financial details of the Project Agreement (PA) with GCP.

A construction update was last provided to the Standing Policy Committee on Transportation on August 16, 2016.

Report

Project Status

At this time, completed designs for most of the new infrastructure have been reviewed by the project team. Full completion of all remaining design work is anticipated by late November 2016.

The overall project continues to be progressing within budget and is expected to be completed on schedule in October 2018.

Traffic Bridge Construction Status

Pier 3, the south in-river pier, as well as the north and south bridge abutments has been completed. Span 4, the southernmost span of the bridge, has also been completed.

Construction of the north in-river berm to access the two north spans, Spans 1 and 2, began October 17 and is expected to be complete the week of November 7. Demolition of the last original bridge span is expected in mid-November 2016. Once the last span is removed, work on Pier 1 and 2 (the two north piers) will commence.

North Commuter Parkway Construction Status

Construction of Pier 1, the west in-river pier, has been completed. Construction of Pier 2, the centre in-river pier, is underway with the pier foundation, diaphragm, and columns already complete, and construction of the pier cap currently underway. Piling for the east abutment is complete and aboveground construction continues.

Earthworks for the new roadways subgrades is underway. Storm sewer installation for the new roadways is ongoing until the end of November. Improvements to the intersection of Attridge Drive and Central Avenue, and the realignment of the eastbound off-ramp from Circle Drive East to Attridge Drive, commenced in May and were fully completed by the end of October.

Please see Attachment 1 for photos of the North Commuter Parkway and Traffic Bridge Construction Update.

Public and/or Stakeholder Involvement

Stakeholder involvement will be required at various stages of the project. Three public open house events have been completed since December 2015. Community events will be planned in order to engage and educate the citizens. The Administration will coordinate these activities with applicable stakeholders as necessary.

Communication Plan

Various communication requirements are to be completed by GCP during the construction phase and operating periods of the project. In addition, a communications agency has been retained through the Technical Advisor for the project, and a phased-in communications plan has been developed for the life of the project. The City's Communications division maintains an overall communications plan and has made all Bridging to Tomorrow project updates, including detailed monthly summaries, links to

live cameras at each bridge site, and quarterly video updates, available online at saskatoon.ca/bridging. The City's Communications division also provides regular project updates to the media and the general public through newsletters, news releases, and news conferences. Anyone can watch Traffic Bridge progress at the River Landing viewing area and signage has been placed near the North Commuter Parkway construction site to direct the public to the viewing area along the Meewasin Trail (just east of the cul de sac at the north end of Kinnear Avenue - north of Silverwood Golf Course).

Financial Implications

Capital Project #2407 has been approved for funding in the amount of $238.8M.

Other Considerations/Implications

There are no policy, environmental, privacy, or CPTED implications or considerations.

Due Date for Follow-up and/or Project Completion

The North Commuter Parkway and Traffic Bridge project is scheduled for substantial completion in October 2018.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Report Approval

Written &
Reviewed by: Dan Willems, Director of Major Projects
Approved by: Jeff Jorgenson, General Manager, Transportation & Utilities Department

Attachment

1. Photos of the North Commuter Parkway and Traffic Bridge Construction Update

TRANS DW – CP2407 – NCP and TB – Construction Update – November 14, 2016

NCP Pier 1 & 2 (Early September 2016)

TB Span 4 (New) Looking North Towards Span 2 (Old)

TB MSE Wall Construction

NCP Bridge – Pier 2 Cap Underway

Storm Sewer Construction

Circle Dr Offramp Bottom Lift Paving

South West Roadway Network Improvements

Recommendation
That the report of the General Manager, Transportation & Utilities Department dated November 14, 2016, be received as information.

Topic and Purpose
The purpose of this report is to provide an update on the traffic analysis on the impacts of closing the intersection of 11th Street and Avenue H and to provide information for the upcoming community engagement.

Report Highlights
1. A technical analysis has been completed and indicates that the closure will have minimal traffic impacts on the surrounding roadways. Mitigation measures are available to further minimize impacts.
2. Development of the detailed roadway network plan is underway.

Strategic Goal
This report supports the Strategic Goal of Asset and Financial Sustainability by providing for the safety of a strategic asset.

This report supports the Strategic Goal of Moving Around by providing a plan to guide the installation of traffic calming devices to improve the safety of pedestrians, motorists, and cyclists.

This report supports the Strategic Goal of Quality of Life by ensuring the quality of water.

Background
The intersection of Avenue H and 11th Street was closed for over two and half years during the completion of the Avenue H Reservoir Expansion project, and the temporary restriction was removed in November of 2014.

On March 8, 2016, the Administration provided a report to the Standing Policy Committee on Transportation titled 'South West Roadway Network Improvements'. The report included the following information:

> "Improvement to Water Treatment Plant Security and Operations
> The Water Treatment Plant is critical infrastructure for the City of Saskatoon (City) as it is vital to public health and the economy of the entire city.

> Operations have been upgraded and expanded over the last 10 years to encompass all three corners of the Avenue H and 11th Street intersection.
>
> When considering the significant infrastructure under Avenue H that links the infrastructure west of Avenue H, including reservoirs, high lift pumps, and ultraviolet disinfection, with the infrastructure on the east side of Avenue H, including intakes, clarifiers, chemical feed, and filters, it is clear that the best description of the site is that a public roadway runs through the City's Water Treatment Plant.
>
> In order to fully enclose the Water Treatment Plant, the intersection of Avenue H and 11th Street, and portions of the adjacent roadway, will need to be permanently closed to public.
>
> A combined site security plan and traffic impact study will be completed in 2017 to evaluate and mitigate the impacts of the modifications."

At the March 8, 2016 meeting, the Standing Policy Committee on Transportation verbally requested that the Administration review the traffic impacts to this area prior to 2017 to determine if permanently closing the intersection of Avenue H and 11th Street and portions of the adjacent roadway is feasible prior to 17th Street being extended.

West Industrial Concept Plan

The West Industrial Concept Plan was approved by City Council on May 20, 2008. The concept plan outlines long-term plans for modifications to the transportation network, including an extension of 17th Street from Avenue P, extending west to 11th Street. This connection would reduce short cutting along 11th Street and Avenue H by providing a more direct, higher capacity roadway. The extension of 17th Street would be an arterial roadway constructed on abandoned Canadian National Railway right-of-way that the City purchased in 2002. Facilities for active transportation would also be incorporated into the new roadway.

Report

Technical Analysis

The technical report summarizing the traffic impacts is included as Attachment 1.

The report provides the following comments:

1. No immediate improvements would be required (based on existing conditions) to support the closure of 11th Street and Avenue H.
2. No significant intersection improvements would be required if the road closures are instituted.
3. The current infrastructure can accommodate the change in traffic patterns that will result with the road closures.
4. Traffic will increase slightly on segments of 12th Street and Avenue I immediately adjacent to the Water Treatment Plant. However, there are mitigation measures available to reduce the impact.

The report identifies the following measures to further mitigate impacts on adjacent roadways:

1. Installation of a guide sign on the southbound approach to the intersection of 17th Street and Avenue H indicating to turn right to access 'Circle Drive South'.
2. Installation of traffic calming devices, such as a curb extension, at the intersection of 16th Street and Avenue H, and a centre median at the intersection of 15th Street and Avenue H.
3. Revise the traffic signals at the intersection of 11th Street and Avenue P to promote the eastbound left-turn movements from 11th Street onto Avenue P. This can be achieved through the addition of a dedicated left-turn arrow for the eastbound approach. Adding a dedicated left-turn arrow will require geometric modifications to the intersection on the eastern leg to physically restrict the eastbound through movement in the middle lane.

Roadway Network Plan

Development of the detailed roadway network plan in the south west portion of the city, including improvements along 11th Street West, is ongoing. Stakeholder consultations are underway and a further report is planned for March 2017.

Public and/or Stakeholder Involvement

Stakeholder consultations are underway with the Rural Municipality of Corman Park, SaskPower, and internal civic departments to obtain input into the development of the road network plans in the south west portion of the city. Discussions are also underway with property owners directly impacted by the proposed 17th Street Extension. A public meeting to discuss modifications to the transportation network in the area is scheduled for November 22, 2016.

Communication Plan

Notice of the upcoming public meeting to discuss the modifications will be provided to stakeholders and adjacent residents along 11th Street. Message boards along 11th Street West will also be used to notify users of the transportation network in the area.

Other Considerations/Implications

There are no options, environmental, privacy, CPTED, financial, policy considerations or implications.

Due Date for Follow-up and/or Project Completion

The Administration will report back in March 2017 with recommendations, including a summary of the community engagement.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required for this report.

Attachment

1. Saskatoon Water Treatment Plant Road Closures – Traffic Impact Assessment, August 12, 2016

Report Approval

Written by: Jay Magus, Engineering Manager, Transportation
Reviewed by: Angela Gardiner, Director of Transportation
Approved by: Jeff Jorgenson, General Manager, Transportation & Utilities Department

TRANS JM – South West Roadway Network Improvements

ATTACHMENT 1

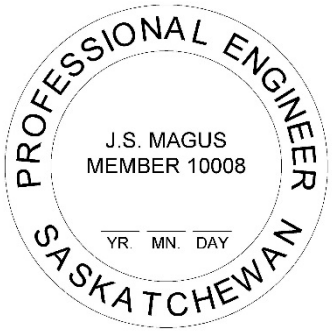
Saskatoon Water Treatment Plant Road Closures - Traffic Impact Assessment

August 12, 2016

City of Saskatoon

Authorization

Prepared By:



Jay Magus, P. Eng.

Engineering Manager, Transportation

EXECUTIVE SUMMARY

1. Background

The intersection of Avenue H and 11th Street was closed as part of the Avenue H Reservoir Expansion project for over two and half years as the project was completed, and was removed in November or 2014.

On March 8, 2016, the Administration provided a report to the Standing Policy Committee on Transportation titled 'South West Roadway Network Improvements'. The report section of this report included the following:

"Improvement to Water Treatment Plant Security and Operations
The Water Treatment Plant is critical infrastructure for the City of Saskatoon as it is vital to public health and the economy of the entire City. Operations have been upgraded and expanded over the last 10 years to encompass all three corners of the Avenue H and 11th Street intersection. When considering the significant infrastructure under Avenue H that links the infrastructure west of Avenue H, including reservoirs, high lift pumps, and ultraviolet disinfection, with the infrastructure on the east side of Avenue H, including intakes, clarifiers, chemical feed, and filters, it is clear that the best description of the site is that a public roadway runs through the City's Water Treatment Plant.
In order to fully enclose the Water Treatment Plant, the intersection of Avenue H and 11th Street, and portions of the adjacent roadway, will need to be permanently closed to public.
A combined site security plan and traffic impact study will be completed in 2017 to evaluate and mitigate the impacts of the modifications.

West Industrial Concept Plan
The West Industrial Concept Plan was approved by City Council on May 20, 2008. The concept plan outlines long-term plans for modifications to the transportation network including an extension of 17th Street from Avenue P extending west to 11th Street. This connection would reduce short cutting traffic along 11th Street and Avenue H by providing a more direct, higher capacity roadway. The extension of 17th Street would be an arterial roadway constructed on abandoned Canadian National Railway right-of-way that the City purchased in 2002. Facilities for active transportation would also be incorporated into the new roadway."

At this meeting the Committee verbally requested the Administration review the traffic impacts earlier than 2017. This review is to determine if permanently closing the intersection of Avenue H and 11th Street and portions of the adjacent roadway is feasible prior to 17th Street being extended.

2. Conclusions

Based on the analysis the following conclusions can be drawn:

1. No immediate intersection improvements are required.
2. No intersection improvements will be required when the road closures are instituted.
3. The current infrastructure can satisfactorily accommodate the change in traffic patterns that will result with the road closures.
4. Traffic will increase on segments of 12th Street and Avenue I immediately adjacent to the Water Treatment Plant. However, there are mitigation measures available to reduce the impact.

3. Recommendations

Based on the analysis the following recommendations are provided:

1. The road closures proceeds prior to the 17th Street Extension being completed.
2. Install the following mitigation measures to reduce cut-through traffic and calm traffic:
    a) Installation of a guide sign on the southbound approach to the intersection of 17th Street and Avenue H indicating to turn right to access 'Circle Drive South'.
    b) Installation of traffic calming devices such as a curb extension at the intersection of 16th Street and Avenue H, and a centre median at the intersection of 15th Street and Avenue H.
    c) Revise the traffic signals at the intersection of 11th Street and Avenue P to promote the eastbound left-turn movement from 11th Street onto Avenue P. This can be achieved through the addition of a dedicated left-turn arrow for the eastbound approach. Adding a dedicated left-turn arrow will require geometric modifications to the intersection on the eastern leg to physically restrict the eastbound through movement.

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LIST OF EXHIBITS

1 INTRODUCTION

1.1 Background

The intersection of Avenue H and 11th Street was closed as part of the Avenue H Reservoir Expansion project recently completed by the City of Saskatoon. A temporary road closure plan was developed to detour traffic as illustrated in **Exhibit 1-1**. Closures were at 11th Street east of Avenue I and Avenue H south of 12th Street. Also, as part of the closure plan two temporary all-way stops were installed in March, 2012, at the following intersections:

- Avenue P and 17th Street
- Avenue H and 17th Street

The road closure in place for over two and half years as the Avenue H Reservoir Expansion project was completed, was removed in November of 2014. Shortly thereafter in January 2015, as planned, the two temporary all-way stops were removed. However, both all-way stops were reinstated pending review.

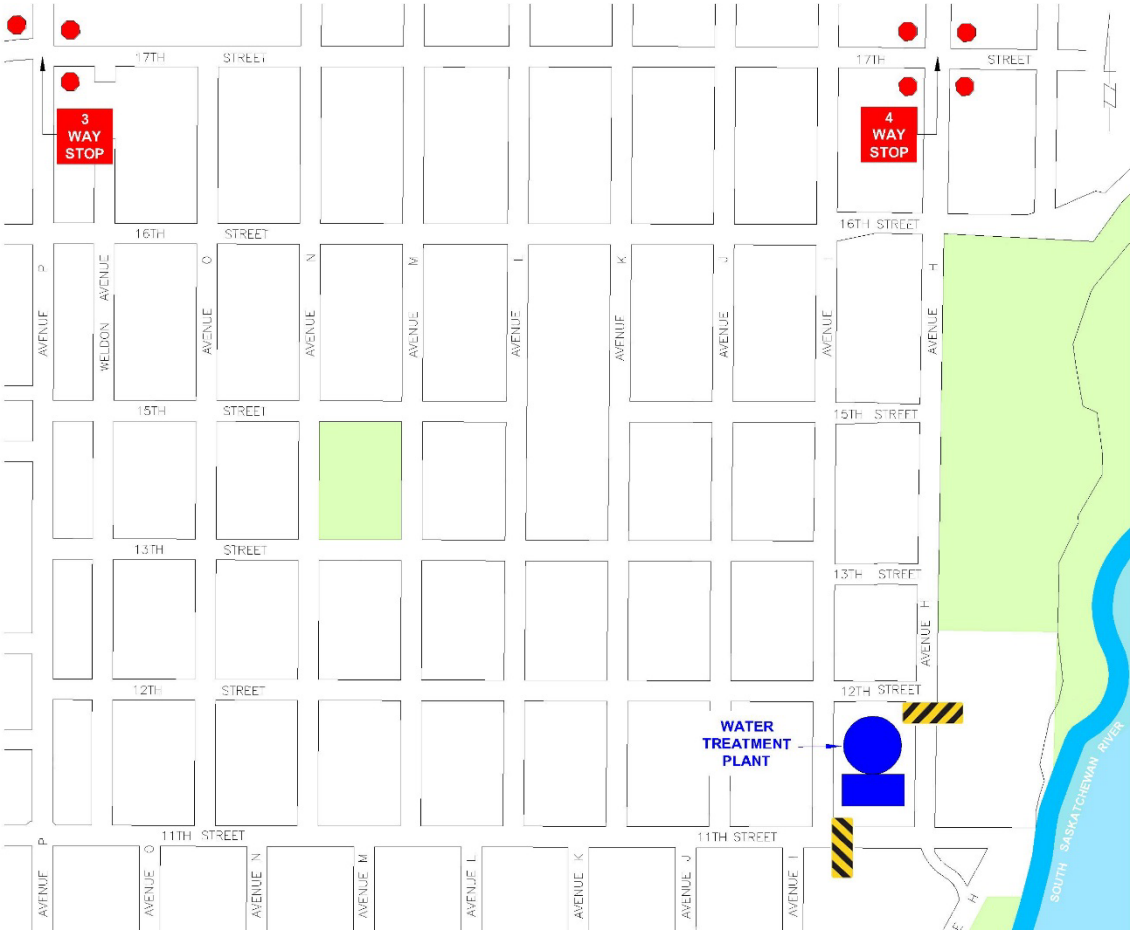


Exhibit 1-1: Previous Road Closure Plan

On March 8, 2016, the Administration provided a report to The Standing Policy Committee on Transportation titled 'South West Roadway Network Improvements'. The report section of this report included the following:

"Improvement to Water Treatment Plant Security and Operations
The Water Treatment Plant is critical infrastructure for the City of Saskatoon as it is vital to public health and the economy of the entire City. Operations have been upgraded and expanded over the last 10 years to encompass all three corners of the Avenue H and 11th Street intersection. When considering the significant infrastructure under Avenue H that links the infrastructure west of Avenue H, including reservoirs, high lift pumps, and ultraviolet disinfection, with the infrastructure on the east side of Avenue H, including intakes, clarifiers, chemical feed, and filters, it is clear that the best description of the site is that a public roadway runs through the City's Water Treatment Plant.

In order to fully enclose the Water Treatment Plant, the intersection of Avenue H and 11th Street, and portions of the adjacent roadway, will need to be permanently closed to public.

A combined site security plan and traffic impact study will be completed in 2017 to evaluate and mitigate the impacts of the modifications.

West Industrial Concept Plan
The West Industrial Concept Plan was approved by City Council on May 20, 2008. The concept plan outlines long-term plans for modifications to the transportation network including an extension of 17th Street from Avenue P extending west to 11th Street. This connection would reduce short cutting traffic along 11th Street and Avenue H by providing a more direct, higher capacity roadway. The extension of 17th Street would be an arterial roadway constructed on abandoned Canadian National Railway right-of-way that the City purchased in 2002. Facilities for active transportation would also be incorporated into the new roadway."

At this meeting the Committee verbally requested the Administration review the traffic impacts earlier than 2017. This review is to determine if permanently closing the intersection of Avenue H and 11th Street and portions of the adjacent roadway is feasible prior to 17th Street being extended.

This report is provided in response to that request of Committee.

1.2 Study Scope

The primary purpose for completing the study was to analyze intersection operating conditions for the following scenarios:

- Existing – using current traffic counts at the analyzed intersections.
- Post closure – the projected traffic volumes after the road closures.

The weekday AM and PM peak hour operating conditions for the above scenarios were analyzed for the following intersections:

- 17th Street and Avenue H
- 17th Street and Avenue P
- 12th Street and Avenue I
- 11th Street and Avenue P

1.3 Study Methodology

The Traffic Impact Assessment was completed using the following methodology:

- Gather existing traffic counts at the five intersections identified for analysis.
- Analyze existing intersection capacity and identify any infrastructure deficits, if any.
- Review traffic counts that were collected during the previous road closures and determine their appropriateness.
- Analyze the post closure intersection capacity and identify the road and infrastructure requirements, including method of traffic control, to accommodate the post closure traffic volumes.
- Determine the appropriate traffic calming, if required, to mitigate cut through traffic.

This report presents the study methodology, analysis, conclusions, and recommendations.

1.4 Traffic Analysis Methodology

Traffic analysis for the weekday AM and PM peak hours operating conditions at the identified intersections was carried out using the Synchro/SimTraffic software package. Synchro/SimTraffic software is based upon the methodology outlined in the Highway Capacity Manual (HCM).

In the HCM methodology, Level-Of-Service (LOS) is the primary evaluation criteria for operating conditions. For unsignalized intersections, the LOS is based on the computed delays. LOS 'A' represents minimal delays to traffic movements for minor street motorists, and LOS 'F' represents a scenario with an insufficient number of gaps on the major street for minor street motorists to complete their movements without significant delays.

For signalized intersections the methodology considers the intersection geometry, traffic volumes and composition, the traffic signal/timing plan, and pedestrian volumes. The average delay for each lane group is calculated, as well as the average delay for the overall intersection.

Also for signalized intersections, the 'volume-to-capacity' (v/c) ratio is used as an indicator of the extent to which a particular movement's capacity is being utilized.

The HCM intersection capacity evaluation criteria for both unsignalized and signalized intersections are summarized in **Table 1-1**.

Table 1-1: Recommended Pedestrian Safety Improvements

Level of Service (LOS)	Average Delay for UNSIGNALIZED Intersection Movements	Average Delay for SIGNALIZED Intersection Movements
A	0 – 10 sec. per vehicle	0 – 10 sec. per vehicle
B	> 10 – 15 sec. per vehicle	> 10 – 15 sec. per vehicle
C	> 15 – 25 sec. per vehicle	> 15 – 25 sec. per vehicle
D	> 25 – 35 sec. per vehicle	> 25 – 35 sec. per vehicle
E	> 35 – 50 sec. per vehicle	> 35 – 50 sec. per vehicle
F	> 50 sec. per vehicle	> 50 sec. per vehicle

Typically an individual intersection movement of LOS E or worse is an indication that intersection improvements such as traffic signals, additional lanes, etc. may be required.

2 EXISTING CONDITIONS

2.1 Existing Road Network

The existing road network is described as follows:

- Avenue P – Is aligned north-south with a cross-section that includes one driving lane and one parking lane in each direction.
- Avenue H – Is aligned north-south with a cross-section that includes one driving lane and one parking lane in each direction.
- Avenue I – Is aligned north-south with a cross-section that includes one driving lane and one parking lane in each direction.
- 17th Street – Is aligned east-west with a cross-section that includes one driving lane and one parking lane in each direction.
- 11th Street – Is aligned east-west with a cross-section includes one driving lane and one parking lane in each direction.

The existing road network is illustrated in **Exhibit 2-1**.

Exhibit 2-1: **Existing Road Network**

2.2 Existing Intersection Geometry

The existing intersection geometry, lane arrangements, and traffic control is described below:

- 17th Street and Avenue H:
  - Four-way stop controlled
  - Eastbound shared left-turn and through lane
  - Eastbound right-turn lane with ten metres storage
  - Northbound shared left-turn, through lane and right-turn lane
  - Westbound shared left-turn and through lane
  - Westbound right-turn lane with ten metres storage
  - Southbound shared left-turn and through lane
  - Southbound right-turn lane with ten metres storage

- 17th Street and Avenue P:
  - Three-way stop controlled
  - Eastbound shared left-turn, through lane and right-turn lane (from adjacent business)
  - Northbound shared left-turn and through lane
  - Northbound right-turn lane with ten metres storage
  - Westbound shared left-turn and through lane
  - Westbound right-turn lane with ten metres storage
  - Southbound shared left-turn and through lane
  - Southbound right-turn lane with ten metres storage

- 12th Street and Avenue I
  - Two-way stop controlled (northbound and southbound approaches)
  - Eastbound shared left-turn, through lane and right-turn lane
  - Northbound shared left-turn, through lane and right-turn lane
  - Westbound shared left-turn, through lane and right-turn lane
  - Southbound shared left-turn, through lane and right-turn lane

- 11th Street and Avenue P
  - Traffic signal controlled
  - Eastbound shared left-turn and through lane
  - Eastbound shared through and right-turn lane
  - Northbound shared left-turn and through lane
  - Northbound shared through and right-turn lane
  - Westbound shared left-turn and through lane
  - Westbound shared through and right-turn lane
  - Southbound shared left-turn and through lane
  - Southbound shared through and right-turn lane

2.3 Existing Traffic Volumes

Traffic counts at the studied intersections were conducted in 2016 during the periods of 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM. The resulting traffic count information is summarized in **Table 2-1**.

Table 2-1: Existing Traffic Count Information

Intersection	AM Peak Hour	PM Peak Hour
17th Street and Avenue H	7:30 AM to 8:30 AM (July 15, 2016)	4:30 PM to 5:30 PM (July 13, 2016)
17th Street and Avenue P	7:30 AM to 8:30 AM (July 14, 2016)	4:15 PM to 5:15 PM (July 13, 2016)
11th Street and Avenue H	7:30 AM to 8:30 AM (January 28, 2016)	4:30 PM to 5:30 PM (January 27, 2016)
12th Street and Avenue I	7:30 AM to 8:30 AM (July 14, 2016)	3:45 PM to 4:45 PM (July 13, 2016)
11th Street and Avenue P	7:45 AM to 8:45 AM (July 15, 2016)	4:30 PM to 5:30 PM (July 14, 2016)

The existing weekday AM and PM peak hour traffic volumes are illustrated in **Exhibit 2-2**.

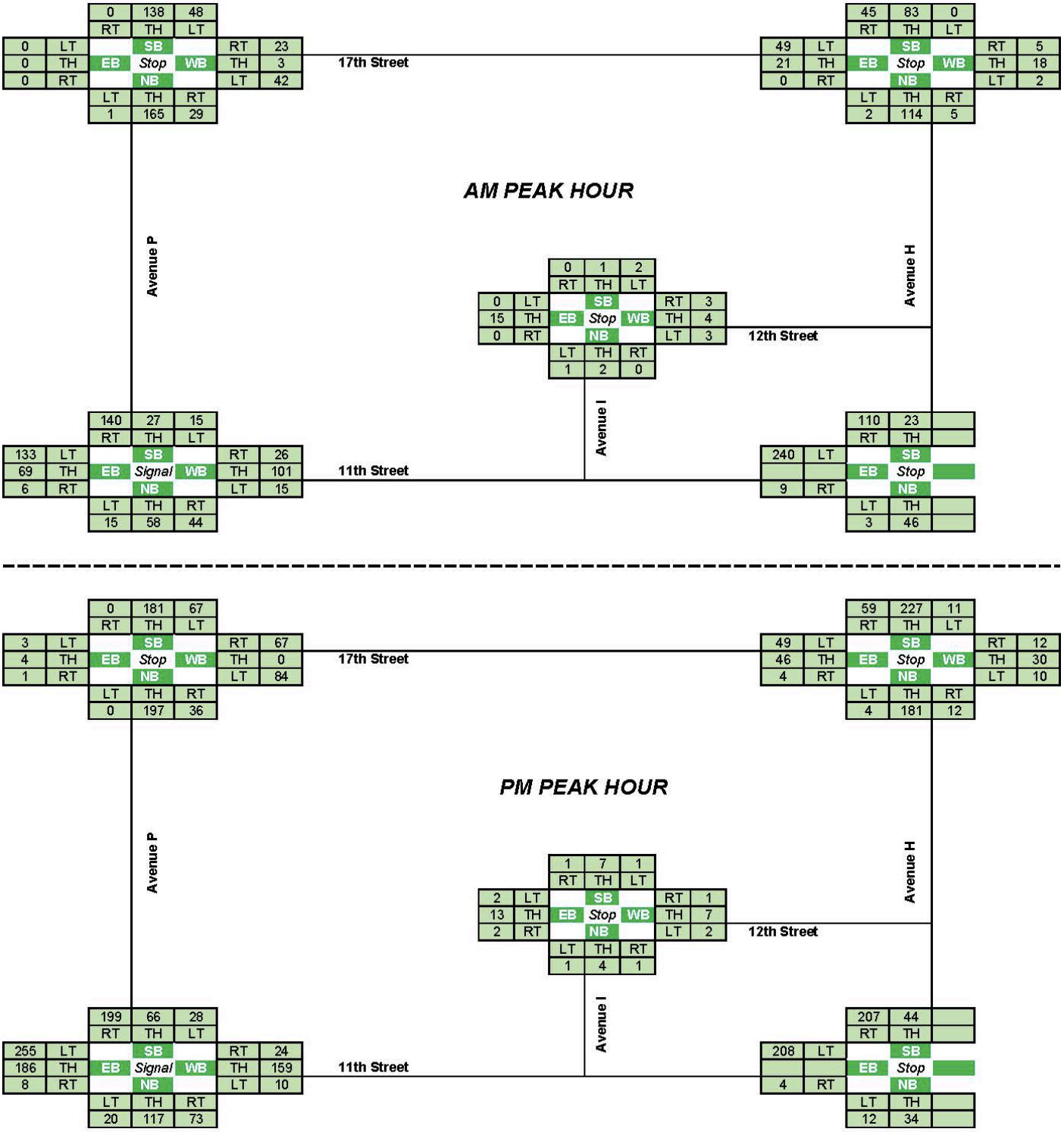


Exhibit 2-2: Existing Peak Hour Traffic Volumes

2.4 Existing Operating Conditions

Operating conditions at the studied intersections were assessed based on the existing traffic volumes shown previously in **Exhibit 2-2**. The analysis initially reflected the road network, lane configurations, and traffic controls discussed in **Section 2.2**. The analysis results are shown in **Table 2-2**.

Table 2-2: Existing Operating Conditions

Intersection/Movement			Measures of Effectiveness							
			AM Peak Hour				PM Peak Hour			
			v/c ratio	Delay (s)	LOS	Queue (m)	v/c ratio	Delay (s)	LOS	Queue (m)
Avenue H/ 17th Street	EB	LT/Thru	0.11	7.9	A		0.16	9.0	A	
		RT	0.00	6.9	A		0.01	6.9	A	
	WB	LT/Thru	0.03	7.2	A		0.07	8.2	A	
		RT	0.01	6.3	A		0.02	7.0	A	
	NB	LT/Thru	0.16	7.6	A		0.27	9.0	A	
		RT	0.01	6.0	A		0.02	6.4	A	
	SB	LT/Thru	0.11	7.3	A		0.34	9.7	A	
		RT	0.05	6.2	A		0.07	6.6	A	
	Intersection Summary		**0.16 (max)**	**7.4**	**A**	-	**0.34 (max)**	**8.9**	**A**	-
Avenue P/ 17th Street	EB	LT/Thru/RT	0.00	8.5	A		0.01	9.1	A	
	WB	LT/Thru	0.07	8.2	A		0.15	9.1	A	
		RT	0.03	6.7	A		0.09	7.4	A	
	NB	LT/Thru	0.23	8.1	A		0.29	9.1	A	
		RT	0.03	6.1	A		0.05	6.6	A	
	SB	LT/Thru	0.26	8.6	A		0.37	10.2	B	
		RT	0.00	6.7	A		0.00	7.0	B	
	Intersection Summary		**0.26 (max)**	**8.1**	**A**	-	**0.37 (max)**	**9.2**	**A**	-

Table 2-2 Continued

Intersection/Movement			Measures of Effectiveness							
			AM Peak Hour				PM Peak Hour			
			v/c ratio	Delay (s)	LOS	Queue (m)	v/c ratio	Delay (s)	LOS	Queue (m)
Avenue P/ 11th Street	EB	LT/Thru	0.46	15.9	B	13.0	0.62	14.9	B	26.8
		Thru/RT								
	WB	LT/Thru	0.23	14.8	B	8.5	0.19	11.7	B	10.6
		Thru/RT								
	NB	LT/Thru	0.07	4.0	A	7.0	0.17	7.1	A	16.4
		RT	0.03	3.8	A	3.2	0.05	6.3	A	5.5
	SB	LT/Thru	0.04	3.8	A	4.6	0.12	6.8	A	12.1
		RT	0.09	4.1	A	5.6	0.13	6.9	A	9.0
	Intersection Summary		**0.46 (max)**	**10.2**	**B**	-	**0.62 (max)**	**10.8**	**B**	-
Avenue I/ 12th Street	EB	LT/Thru/RT	0.00	0.0	A		0.00	0.9	A	
	WB	LT/Thru/RT	0.00	2.2	A		0.00	1.5	A	
	NB	LT/Thru/RT	0.00	9.0	A		0.01	9.0	A	
	SB	LT/Thru/RT	0.00	8.9	A		0.01	9.1	A	
	Intersection Summary		**0.00 (max)**	**2.4**	**A**	-	**0.01 (max)**	**3.9**	**A**	-

As illustrated in **Table 2-2**, all intersection movements are operating at an overall LOS of B or better and with a v/c ratio of 0.62 or less during the AM and PM peak hours.

It is concluded no immediate intersection improvements are required.

3 FUTURE CONDITIONS

3.1 Future Road Network

The recent report to council discussed closing the southern leg at the intersection of Avenue H and 12th Street, and the eastern leg at the intersection of Avenue I and 11th Street. This eliminates the ability for a vehicle to drive past the Water Treatment Plant on Avenue H between 11th street and 12th Street, and on 11th Street between Avenue H and Avenue I. These road closures will create an alternate route for vehicles to potentially short-cut through the neighbourhoods of King George and Holiday Park.

As previously mentioned, the intersection of Avenue H and 11th Street was closed from March 2012 to November 2014. It is anticipated that the future permanent closure will be consistent with the previous closure. Accordingly the future road network is illustrated in **Exhibit 1-1**.

3.2 Future Intersection Geometry

The future intersection geometry will be consistent with the existing intersections geometry previously described in **Section 2.2**.

3.3 Future Traffic Volumes

As the future permanent closure will be consistent with the March 2012 to November 2014 closure, the previous traffic counts collected in February and March of 2014 are indicative of the future traffic volumes. These previous traffic counts from 2014 are summarized in **Table 3-1**.

Table 3-1: 2014 Traffic Count Information (Future Traffic Volumes)

Intersection	AM Peak Hour	PM Peak Hour
17th Street and Avenue H	7:30 AM to 8:30 AM (March 4, 2014)	4:30 PM to 5:30 PM (March 4, 2014)
17th Street and Avenue P	7:45 AM to 8:45 AM (March 4, 2014)	4:00 PM to 5:00 PM (March 4, 2014)
11th Street and Avenue H	n/a	n/a
12th Street and Avenue I	7:30 AM to 8:30 AM (February 25, 2014)	4:15 PM to 5:15 PM (February 25, 2014)
11th Street and Avenue P	7:45 to 8:45 AM (February 11, 2014)	4:30 PM to 5:30 PM (February 11, 2014)

The future weekday AM and PM peak hour traffic volumes are illustrated in **Exhibit 3-1**.

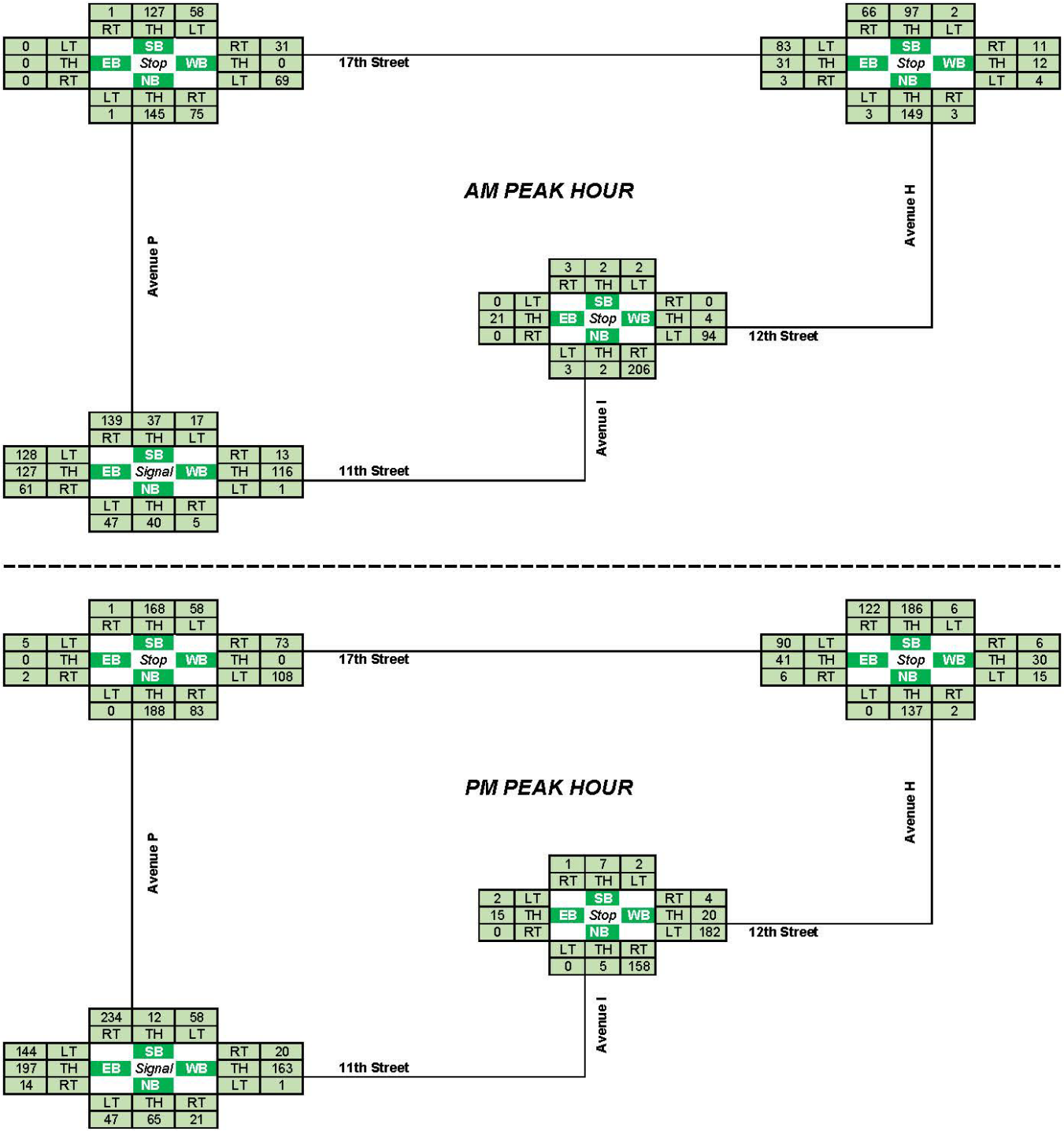


Exhibit 3-1: Future Peak Hour Traffic Volumes

3.4 Future Operating Conditions

Operating conditions at the studied intersections were assessed based on the existing traffic volumes shown previously in **Exhibit 3-1**. The analysis initially reflected the road network, lane configurations, and traffic controls discussed in **Section 3.2**. The analysis results are shown in **Table 3-2**.

Table 3-2: Future Operating Conditions

Intersection/Movement			Measures of Effectiveness							
			AM Peak Hour				PM Peak Hour			
			v/c ratio	Delay (s)	LOS	Queue (m)	v/c ratio	Delay (s)	LOS	Queue (m)
Avenue H/ 17th Street	EB	LT/Thru	0.18	8.7	A		0.22	9.5	A	
		RT	0.00	6.4	A		0.01	6.8	A	
	WB	LT/Thru	0.02	7.5	A		0.07	8.2	A	
		RT	0.01	6.6	A		0.01	6.9	A	
	NB	LT/Thru	0.21	8.3	A		0.20	8.6	A	
		RT	0.00	6.2	A		0.00	6.5	A	
	SB	LT/Thru	0.14	7.7	A		0.28	9.1	A	
		RT	0.08	6.6	A		0.15	7.1	A	
	Intersection Summary		**0.21 (max)**	**7.9**	**A**		**0.28 (max)**	**8.6**	**A**	
Avenue P/ 17th Street	EB	LT/Thru/RT	0.00	8.6	A		0.01	9.1	A	
	WB	LT/Thru	0.11	8.5	A		0.19	9.5	A	
		RT	0.04	6.8	A		0.10	7.4	A	
	NB	LT/Thru	0.20	8.1	A		0.28	9.1	A	
		RT	0.09	6.5	A		0.11	7.0	A	
	SB	LT/Thru	0.27	8.8	A		0.34	10.1	B	
		RT	0.00	6.1	A		0.00	6.5	A	
	Intersection Summary		**0.27 (max)**	**8.1**	**A**		**0.34 (max)**	**9.1**	**A**	

Table 3-2 Continued

Intersection/Movement			Measures of Effectiveness							
			AM Peak Hour				PM Peak Hour			
			v/c ratio	Delay (s)	LOS	Queue (m)	v/c ratio	Delay (s)	LOS	Queue (m)
Avenue P/ 11th Street	EB	LT/Thru	0.46	14.5	B	16.4	0.52	14.1	B	20.7
		Thru/RT								
	WB	LT/Thru	0.17	13.1	B	8.2	0.21	12.4	B	10.5
		Thru/RT								
	NB	LT/Thru	0.11	5.0	A	8.7	0.14	5.9	A	11.8
		RT	0.00	4.5	A	0.0	0.01	5.2	A	1.5
	SB	LT/Thru	0.06	4.8	A	6.1	0.10	5.7	A	8.3
		RT	0.09	5.0	A	6.0	0.16	6.0	A	8.4
	Intersection Summary		**0.46 (max)**	**10.5**	**B**	-	**0.52 (max)**	**10.1**	**B**	-
Avenue I/ 12th Street	EB	LT/Thru/RT	0.00	0.0	A		0.00	0.8	A	
	WB	LT/Thru/RT	0.06	7.1	A		0.11	6.7	A	
	NB	LT/Thru/RT	0.20	9.3	A		0.16	9.3	A	
	SB	LT/Thru/RT	0.01	10.6	B		0.02	13.4	B	
	Intersection Summary		**0.20 (max)**	**8.1**	**A**	-	**0.16 (max)**	**7.7**	**A**	-

As illustrated in **Table 3-2**, all intersection movements are operating at an overall LOS of B or better and with a v/c ratio of 0.52 or less during the AM and PM peak hours.

A review of the analysis results yields the following conclusions:

- No intersection improvements will be required when the road closures are placed.
- The current infrastructure can satisfactorily accommodate the change in traffic patterns that will result with the road closures.

4 CUT THROUGH TRAFFIC MITIGATION

Comparing the existing traffic volumes with the expected traffic volumes, once the roads are closed adjacent to the Water Treatment Plant, it is evident that an impact will be increased traffic on the segments of 12th Street and Avenue I immediately adjacent to the Water Treatment Plant.

It is expected that the road closures themselves will provide an overall benefit to the neighbourhoods of King George and Holiday Park by reducing through traffic. The intersection of 17th Street and Avenue H review of traffic counts (two sets) is summarized in **Table 4-1**.

Table 4-1: Traffic Count Review

Direction		Movement	AM Peak Hour		PM Peak Hour	
			Existing	Future	Existing	Future
Represents traffic from the west	EB	LT	70%	71%	49%	66%
		Thru	30%	26%	46%	30%
		RT	0%	3%	5%	4%
Represents traffic from the north	SB	LT	0%	1%	4%	1%
		Thru	65%	59%	76%	59%
		RT	35%	40%	20%	39%

A review of the information in the above table yields the following information:

- The traffic in the AM peak hour is not affected by the road closures.
- In the PM peak hour the eastbound left-turn increases from 49% to 66% indicating that the road closure will re-assign traffic to 17th Street and away from 11th Street through the King George and Holiday Park neighbourhoods.
- In the AM peak hour the southbound through movements decreases from 76% to 59%, and the southbound right-turn increases from 20% to 39%. This indicates that the road closure will re-assign traffic to 17th Street and away from Avenue H.

There are three other traffic calming measures recommended to further entice drivers to use 17th Street and Avenue P, instead of 11th Street and Avenue H through the residential areas:

1. Installation of a guide sign on the southbound approach to the intersection of 17th Street and Avenue H indicating to turn right to access 'Circle Drive South'.
2. Installation a traffic calming devices such as a curb extension at the intersection of 16th Street and Avenue H, and a centre median at the intersection of 15th Street and Avenue H.
3. Revision of the traffic signals at the intersection of 11th Street and Avenue P to promote the eastbound left-turn movement from 11th Street onto Avenue P. This can be achieved through the addition of a dedicated left-turn arrow for the eastbound approach. Adding a dedicated left-turn arrow will require geometric modifications to the intersection on the eastern leg to physically restrict the eastbound through movement.

The recommended geometric changes are illustrated in **Exhibit 4-1**.

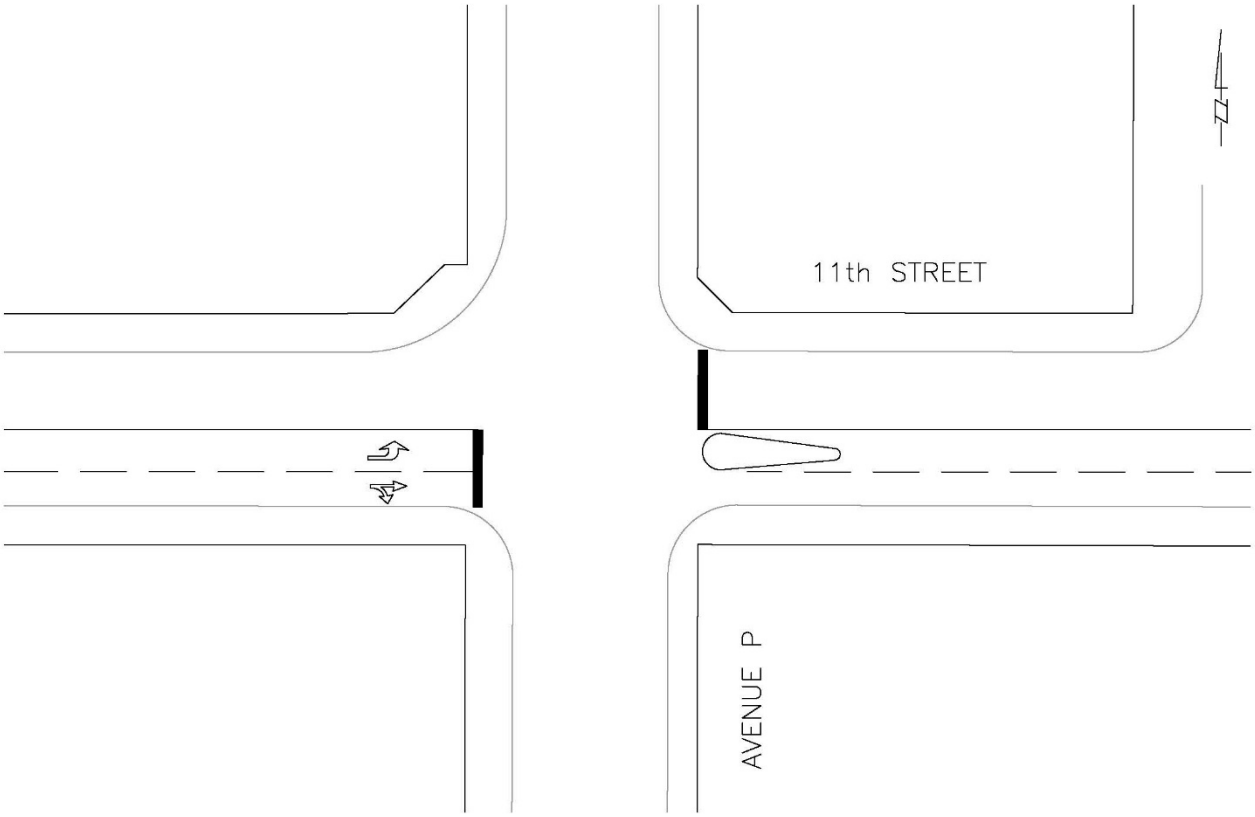


Exhibit 4-1: 11th Street / Avenue P Intersection – Suggested Changes

5 CONCLUSIONS

The following conclusions can be drawn:

1. No immediate intersection improvements are required.
2. No intersection improvements will be required when the road closures are instituted.
3. The current infrastructure can satisfactorily accommodate the change in traffic patterns that will result with the road closures.
4. Traffic will increase on segments of 12th Street and Avenue I immediately adjacent to the Water Treatment Plant. However, there are mitigation measures available to reduce the impact.

6 RECOMMENDATIONS

The following recommendations are provided:

1. The road closures proceeds prior to the 17th Street Extension being completed.
2. Install the following mitigation measures to reduce cut through traffic and calm traffic:
    a) Installation of a guide sign on the southbound approach to the intersection of 17th Street and Avenue H indicating to turn right to access 'Circle Drive South'.
    b) Installation a traffic calming devices such as a curb extension at the intersection of 16th Street and Avenue H, and a centre median at the intersection of 15th Street and Avenue H.
    c) Revise the traffic signals at the intersection of 11th Street and Avenue P to promote the eastbound left-turn movement from 11th Street onto Avenue P. This can be achieved through the addition of a dedicated left-turn arrow for the eastbound approach. Adding a dedicated left-turn arrow will require geometric modifications to the intersection on the eastern leg to physically restrict the eastbound through movement.

Building Better Bridges: An Asset Management Plan for Bridges and Structures

Recommendation:

1. That the Asset Management Plan for Bridges and Structures be received as information; and
2. That the Administration provide a report for the 2017 Business Plan and Budget deliberations as part of the Corporate Asset Management Plan.

Topic and Purpose

The purpose of this report is to provide information on assets primarily belonging to the Major Projects division such as bridges, overpasses, pedestrian crossings, sound attenuation walls and chain link fencing inventory. Specific information on value, condition, asset management initiatives, and a potential funding plan are included.

Report Highlights

1. The report shows the physical condition of bridges and structures. Currently, 29% of bridges, 58% of overpasses and 76% of pedestrian crossings are in good to very good condition.
2. A potential funding plan is illustrated with the goal of bridging the funding gap to enable the assets to reach the desired condition over time.

Strategic Goal

Under the Strategic Goal of Asset and Financial Sustainability, this report supports the four-year priority of adopting and implementing an asset-management philosophy for bridges and structures.

Background

At its meeting held on December 4 and 5, 2012, City Council resolved, in part:

> "1. That the bridges and structures preservation service level be established as "Service Level 'B'", with a targeted annual investment level of $5 million per year (2013 dollars), and additional one-time contributions totalling approximately $48 million (2013 dollars), over the next 10 years."

The City has made significant progress in addressing this gap by increasing the annual base contribution to the BMRR from $720,000 in 2012 to $3.134 million in 2016 and has allocated a total of $5.23 million in one-time funding from 2013-2016.

Report

Bridges, Overpasses and Pedestrian Crossings

As shown in Attachment 1, the estimated replacement value of the City's bridges, overpasses, and pedestrian crossings are as follows:

- Bridges $485 million;
- Overpasses $371 million; and
- Pedestrian Crossing $48 million.

There are currently a number of rehabilitation projects totalling $105.6 million anticipated to be required over the next 10 years to maintain bridges and structures in good condition while currently available funding is estimated at $60.57 million creating a funding gap of $45.0 million over the next 10 years.

Table 5 of the attachment outlines a funding scenario that would provide the BMRR with a total of $85.19 million in funding over the next 10 years. Although short of the $105.57 million gap, this funding would be sufficient to make significant progress in reaching the expenditure goal of improving structure conditions slowly over time.

Sound Attenuation Walls

The estimated replacement value of the City's sound attenuation walls is $41 million. No major rehabilitation activities are anticipated to be required within the next 20 years.

Chain Link Fencing

The replacement values of the City's Chain link fencing is $3 million. There has not been a condition assessment completed for the chain-link fencing. This assessment and a preservation program will be established over the next couple of years.

Financial Implications

Attachment 1 summarizes the current expenditure level, identifies funding gaps, existing funding from the BMRR, and a potential phased-in property tax increase to address the funding gap.

Communications Plan

The Asset Management Plan for Bridges and Structures will be communicated with the City's overarching Corporate Asset Management Plan. Communications support will create awareness of the plan through information uploaded within the Finance section of the City's website saskatoon.ca.

Other Considerations/Implications

There are no options, public and/or stakeholder involvement, policy, environmental, privacy, or CPTED implications or considerations.

Due Date for Follow-up and/or Project Completion

The Administration will submit a report to the City Council meeting to deliberate the 2017 Business Plan and Budget on the Corporate Asset Management Plan. As future

maintenance schedules and timing can change, an annual update will be provided to make any adjustments as required.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Attachment

1. Building Better Bridges: An Asset Management Plan for Bridges and Structures

Report Approval

Written by: Angie Larson, Finance Support Manager
Reviewed by: Rob Frank, Engineering Manager of Asset Preservation
Reviewed by: Todd Grabowski, Asset Preservation Manager - Bridges
Reviewed by: Dan Willems, Director of Major Projects
Reviewed by: Clae Hack, Director of Finance
Reviewed by: Kerry Tarasoff, CFO, Asset and Financial Management Dept.
Approved by: Jeff Jorgenson, General Manager, Transportation and Utilities Dept.

TRANS AL – Building Better Bridges – An Asset Management Plan for Bridges and Structures

ATTACHMENT 1

Building Better Bridges:
An Asset Management Plan for Bridges & Structures

City of Saskatoon

OCTOBER 2016

Bridges & Structures

INTRODUCTION

The City of Saskatoon's (City) bridges and structures inventory is composed of bridges, overpasses, pedestrian crossings, sound walls, retaining walls and chain-link fencing.

Preservation of the City's bridges and structures is funded from the Bridge Major Repair Reserve (BMRR). It was identified at its special meeting on December 4 and 5, 2012 through the 2012 – State of the Bridges Administrative report that the BMRR was underfunded. City Council resolved:

> "That the bridges and structures preservation service level be established as Service Level "B", with a targeted annual investment level of $5 million per year (2013 dollars), and additional one time contributions totalling approximately $48 million (2013 dollars), over the next 10 years."

In 2016 dollars, the targeted contribution per the resolution of City Council in 2012 is $5.33 million per year in base funding and $52.3 million in one-time contributions.

The City has made significant progress in addressing this gap by increasing the annual base contribution to the BMRR from $720,000 in 2012 to $3.134 million in 2016 and has allocated a total of $5.23 million in one-time funding from 2013-2016.

Although significant progress has been made to address the funding gap and resolution made by City Council in 2012, it has not been sufficient to meet ongoing long-term maintenance requirements.

CURRENT INVENTORY

The current inventory of the bridges and structures is $948 million as detailed in Table 1 below.

Table 1: Bridges and Structures Inventory and Replacement Value

Asset	Inventory	Replacement Cost
Bridges	6 ea.*	$485,000,000
Overpasses	49 ea.	$371,000,000
Pedestrian Crossing	24 ea.	$48,000,000
Sound Attenuation Walls	20 km	$41,000,000
Chain Link Fencing	48 km	$3,000,000
Total		$948,000,000

**The six bridges include: Circle Drive North/42nd Street (considered two structures), University, Broadway, Idylwyld and Circle Drive South.*

Bridges

For the purpose of this report, a bridge is a traffic crossing structure over a body of water.

Overpasses

An overpass is a traffic crossing structure over or under roadways and railways.

Pedestrian Crossing

A pedestrian crossing is a structure that allows pedestrians, cyclists and other walkway or trail users to cross over or under a major roadway, railway, body of water or other obstacle. Pedestrian crossings that are attached to a bridge or overpass adjacent to the road surfaces are not considered separately from the larger structure.

Sound Attenuation Walls

A sound attenuation wall is a barrier built alongside a railway, freeway or other high capacity roadway that reduces the impact of noise pollution to neighbouring properties.

Chain Link Fencing

Chain-link fencing included in this report is along road right-of-ways and prevent pedestrians from crossing onto the roadway. Chain-link fencing in parks and other areas are not considered in this report.

PHYSICAL CONDITION OF BRIDGES

Pedestrian Overpass from 23rd Street to 21st Street over 22nd Street

Campus Drive to Stadium

Circle Drive Cloverleaf

Condition ratings for bridges are on a five-point scale from "A" to "F", with a rating of "F" indicating a failed condition or severe deterioration and a rating of "A" signifying the structure is in Very Good condition or in a like new state. Table 2 outlines the structural condition rating which provides a general guide to the type of activities suggested by each rating. This particular rating system has been internally developed by the City.

Tables 2 and 3 outline the following two decisions to be made in order to proceed with an asset management plan.

1. What is the desired condition level?
2. How fast would City Council like to reach the desired condition level (expenditure level)?

Table 2: Structural Condition Rating

Rating	Physical Condition	Action
A	Very Good	No structural problems evident. Only monitoring and maintenance required.
B	Good	Minor deficiencies noted, monitoring and maintenance required.
C	Fair	Structures showing signs of deterioration. Corrosion is actively occurring in components of the structure.
D	Poor	Structure showing advanced deterioration.
F	Failed	Structure no longer capable of safely supporting design traffic loadings.

It is difficult to illustrate the differences between very good, good and fair since not all structural defects are visible, as the overall conditions rating is based on the deck testing reports and the following testing: copper sulfate electrode equipotential survey, delamination testing, chloride testing (and reinforcing bar depth testing), and inspections.

All structures in the City's inventory are safe for public use regardless of physical condition rating and the City works diligently to ensure all structures remain serviceable with the preservation program. Each structure in the City's inventory is inspected annually by civic staff to identify critical defects that may require investigation and to determine if there are any safety concerns.

The preservation program rates the condition of each structure. A "Poor" Condition rating can still have the structure rated as safe for users, however, it describes a structure that all inspection, testing and maintenance activities indicate that the structure has advanced deterioration and a rehabilitation is required, typically within 2-5 years.

An example of a "Poor" condition structure was Idylwyld Drive over Ruth Street Overpass illustrated in the pictures below. While monitored, the overpass was still safe to the general public, however, advanced deterioration was identified and to ensure the structure could remain in service a rehabilitation was required. Defects were discovered through deck testing and were not visible until rehabilitation occurs. The program allowed the City to plan and rehabilitate the structure in 2016 and ensured the overpass will remain safe and serviceable into the future.

An example of a "failed" condition structure was the Traffic Bridge, which was closed to traffic in August 2010 following determination of advanced structural deterioration resulting in inability to certify the bridge as safe to remain open.

Severe corrosion on the reinforcing steel.

Disintegrated concrete and delaminations that became apparent once asphalt was removed.

EXPENDITURE LEVELS

The Administration evaluates the condition of the City's assets in order to develop annual programs to maintain the assets at a minimum cost. Condition assessments or evaluations are conducted and used to establish condition levels as well as develop annual capital improvement plans.

The level of service for each type of asset is defined; however, as the level of service increases for the asset, so does the cost of maintaining the asset. In order to be able to compare the level of investment for all assets corporate-wide, five levels of expenditures are identified below. It should be noted that expenditure levels are not condition assessments but lead to a change in the asset condition over time. "A" represents the highest level of expenditure and "F" represents no expenditure.

Table 3: Expenditure Levels

Expenditure Level	Asset Condition	Description
A	Getting Better Quickly	Sufficient expenditures to keep asset in the condition specified by City Council and to increase asset condition/value quickly over time.
B	Getting Better	Sufficient expenditures to keep asset in the condition specified by City Council and to increase asset condition/value slowly over time.
C	Maintain Assets in Current Condition	Sufficient expenditures to keep asset in constant condition over time.
D	Getting Worse	Insufficient expenditures to maintain asset condition. Over time asset condition will deteriorate.
F	Getting Worse Quickly	No expenditures. Asset condition/value decreased rapidly.

Bridges & Structures

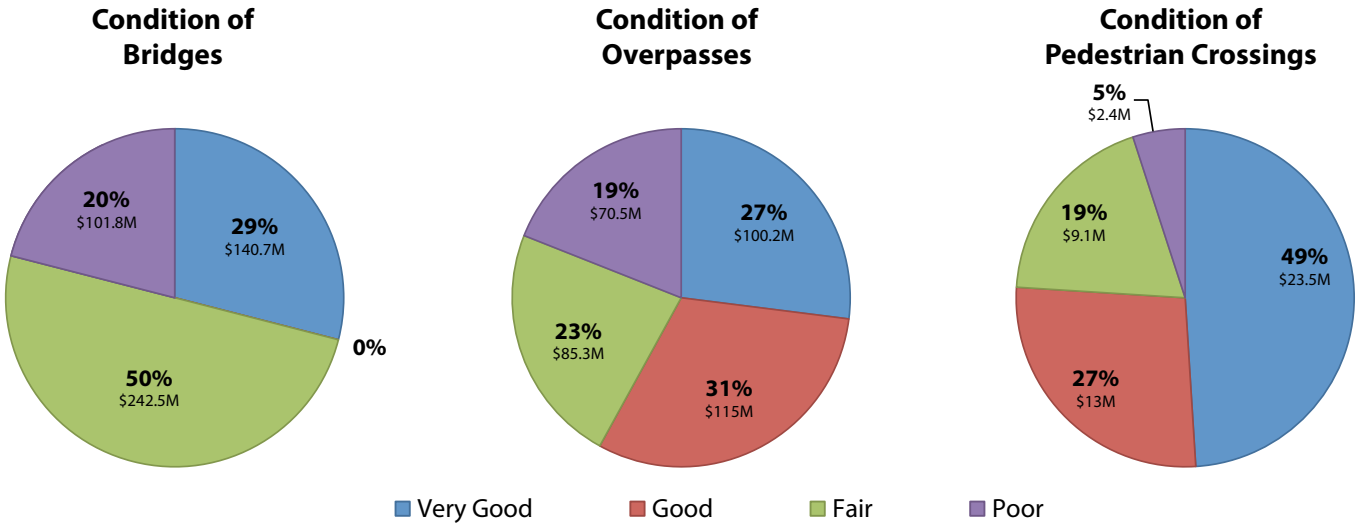
Table 4 aligns the desired condition and expenditure level. The table also shows the required 10 year funding to meet a Level "B" expenditure level and associated funding gap.

Table 4: Current Structural Condition and Desired Condition and Expenditure Level (in millions of $)

Asset	Physical Condition Actual	Physical Condition Desired	Desired Expenditure Level	Required 10 year funding *(to meet Expenditure Level)*	10 year Budgeted Funding	10 year Funding Gap *(to meet Expenditure Level)*
Bridges	*Remaining:* • 29% Very Good • 50% Fair • 20% Poor	Good	Level B	64.93	35.20	29.73
Overpasses	• 27% Very Good • 31% Good • 23% Fair • 19% Poor	Good	Level B	40.29	25.37	14.92
Pedestrian Crossing	• 48% Very Good • 27% Good • 19% Fair • 5% Poor	Good	Level B	0.35	0.00	0.35
Total				105.57	60.57	45.00

In order to reach a physical condition of "Good" over the next 10 years, the BMRR would require an additional $45 million.

The following charts show the current physical condition of the bridge and structure inventory by replacement value.



PRESERVATION PROGRAMS

The City works to ensure all bridges and structures remain safe and structurally sound. The program activities include:

- Washing and Sealing
- Safety Inspections
- Bridge Inspections & Deck Testing
- Minor Maintenance
- Major Rehabilitations
- Load Rating Program

The programs are funded through the Bridges Operating Budget and the BMRR. All bridges and structure programs have a critical part in maintaining the City's Bridges and Structures. The operating budget for annual maintenance is sufficiently funded.

Washing and Sealing

During the winter bridges are exposed to gravel, sand, and anti-icing chemicals that are spread on icy roads. The debris can cause wear on the surface of the bridge and salt can initiate chloride induced corrosion of the reinforcing steel in the bridge. The Bridge Washing and Sealing Program prolongs the life of the structures.

Safety Inspections

Each structure in the City's inventory is inspected annually by civic staff. The key goals of the safety inspections is to determine if there are any safety concerns with each structure, develop the minor maintenance programs, and identify critical defects that may require additional investigation.

Bridge Inspections & Deck Testing Program

The bridge inspection and deck testing program consists of completing industry standard inspections every 3 years and deck testing on a 6 year cycle for all bridges and overpasses that are over 10 years old in the City inventory. The deck testing covers the deck, barrier and curb components (if applicable), piers and abutments (if applicable), and expansion joints (if applicable) for each structure.

The deck testing information determines the approximate point at which each element is within its service life and produce corresponding remaining service life estimates. Once the remaining service life has been identified, rehabilitation strategies are developed and compared to help determine the optimal timing for rehabilitation.

Minor Maintenance

The minor maintenance program is completed on an annual basis under the Bridges Operating and Capital Budget. The program deals with repairs and maintenance for each structure as determined by the internal and external inspections. The minor repairs include items such as paving, route and crack sealing, concrete patching, repairing settling issues, erosion control at bridges, bridge drainage, impact damages, hand railing maintenance, and minor joint repairs.

Major Rehabilitations

The City uses deck testing data rehabilitation strategies to select rehabilitations and optimal timing for each structure.

The rehabilitation strategies for each structure have a critical period of time for each strategy, based on the level of chlorides (salts) to induce corrosion in each structure. Once the critical period is missed, the repair strategy changes and the rehabilitation costs increase.

The projects are typically selected for rehabilitation at the optimum date and confirmed through testing prior to rehabilitation. There is variability in the critical timeframe for rehabilitation, as it is unknown exactly when corrosion will be induced in the structure. However, typically once the protective membranes have failed and corrosion is occurring the deterioration rate substantially increases.

Load Rating Program

The City develops and maintains load rating analysis for several bridge/overpass structures located throughout Saskatoon. The City has had consultants prepare load capacity charts to confirm bridge capacity for truck traffic. The information is used within the City to develop the long haul vehicle routes, pickup and delivery maps and assist with the permitting process to ensure vehicle loads are within safe loading parameters for the bridges and structures.

Ten-Year Rehabilitation Plan

The projects are part of the major rehabilitation program and are selected on preservation strategies focused on reducing the cost of owning and maintaining the structures, as determined by the City's testing and assessment program.

The 10 year projects that have been selected have a critical time period for each strategy, based on the level of chlorides (salts) to induce corrosion in each structure. Once a critical time period is missed, the optimal strategy changes and the rehabilitation costs increase. There is variability in the critical timeframe for rehabilitation, as it is unknown exactly when corrosion will be induced in the structure, which is why a range is provided. Projects are typically selected for rehabilitation at the mid-date and confirmed through testing prior to rehabilitation.

POTENTIAL PLAN TO ADDRESS FUNDING GAP

Bridges, Overpasses and Pedestrian Crossings

As per the 2015 State of Bridges and Structures Report, the BMRR has been underfunded. There are currently a number of rehabilitation projects ($105.6 million) anticipated to be required over the next 10 years. This outstanding bridge/overpass rehabilitation work includes three large projects totalling $64.0 million: 2021 – University Bridge, 2024/2025 – Broadway Bridge, and 2024 – Idylwyld Ramp.

If all structures were in new condition, annual contribution to maintain bridges, overpasses and pedestrian crossings in good condition is estimated at $5.33 million. However, since structures are not in new condition, more funding is required to address the backlog. The potential plan in Table 5 considers the following two sources of funding:

1. Increase the annual contribution to the reserve from $3.18 million to $4.22 million in 2018, $5.26 million in 2019, $6.30 million in 2020 and up to $7.33 million in 2021 (0.51% mill rate impact each year).
2. Included in the Major Transportation Infrastructure Funding Plan are $23.75 million of one time payments from 2016 to 2023.

If the potential plan were to be selected at budget deliberations, this would provide the BMRR with a total of $87.28 million in funding over the next 10 years. Although short of the $105.57 million gap identified in Table 4; this funding would be sufficient to make significant progress in reaching the expenditure goal of improving structure conditions slowly over time. As future maintenance schedules and timing can change, an annual update will be provided to make any adjustments as required.

Table 5: Funding Option to Improve Funding Gap: Bridge Major Repair Reserve – Increase Annual Contribution (In millions of $)

Funding	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Annual Contribution	3.18	4.22	5.26	6.30	7.33	7.33	7.33	7.33	7.33	7.33
Mill Rate Impact	-	0.51%	0.51%	0.51%	0.51%	-	-	-	-	-
One Time Funding	7.25	-	-	-	5.00	5.00	5.00	-	-	-

All figures presented in 2016 dollars.

Sound Attenuation Walls

Most of the sound attenuation walls have been constructed after 2003. The design life for a sound attenuation wall is 50 years; therefore, no major rehabilitation activities are anticipated to be required within the next 20 years. Starting in the 2017 budget cycle, $100,000 has been allocated to cover ongoing minor maintenance requirements for this item.

Chain Link Fencing

There has not been a condition assessment completed for the chain link fencing but this assessment and a preservation program will be established over the next several years.

CLIMATE ADAPTATION STRATEGY

All of the City's bridges and structures are designed to resist the effects of weathering due to rain, ice, wind, and snow. Due to the nature of the construction materials used for these assets (i.e. concrete and steel), they are by nature resistance to many of the effects of climate change.

During periods of extreme weather such as a major rain event or high river levels due to flooding from other regions, Major Projects has established a protocol to complete underwater inspections of critical bridge elements for undermining to ensure structural components have not been compromised.

City of Saskatoon

Building Better Roadways: An Asset Management Plan for Roadways

Recommendation:

1. That the Asset Management Plan for Roadways be received as information; and
2. That the Administration provide a report for the 2017 Business Plan and Budget deliberations as part of the Corporate Asset Management Plan.

Topic and Purpose

The purpose of this report is to provide information on Saskatoon roadways. Specific information on value, condition, asset management initiatives, and two potential funding plans are included.

Report Highlights

1. The City's roadway replacement value is estimated at $2.82 billion. In order to maintain these roadways in satisfactory to good condition, an annual investment of $26.2 million is required. This funding level will be reached in 2017 as the final year of a four year dedicated levy is completed.

Strategic Goal

Under the Strategic Goal of Asset and Financial Sustainability, this report supports the four-year priority of adopting and implementing an asset-management philosophy for roadways.

Background

In 2013, City Council adopted the funding requirements to attain a Level of Service "B" based on "The Neighbourhood and Primary Roadway and Sidewalk Preservation" and "2013 Investing in the Roads to Continued Prosperity" reports. This Level of Service is intended to improve the condition of our roadways and decrease the backlog of preservation work slowly over time. Prior to 2013, funding received amounted in a resulting Service Level "E" where City's roads were deteriorating and resulting in a backlog as outlined in the October 25, 2013 report presented to the Administration and Finance Committee.

Capital funding spent on preserving roadways has increased significantly from $4.38 million in 2011 to a projected $25.1 million for 2016.

A three-year dedicated tax levy starting in 2014 was adopted to increase base funding levels to the required amounts by 2016. This plan was adjusted to a four-year phase-in during 2015 Budget and Business Plan deliberations, which resulted in 2017 being the final year of the roadway dedicated levy phase in.

Report

Building Better Roadways

As shown in Attachment 1, the City's roadway inventory consists of four classifications of roadways:

- Local – 51% of roadway
- Collector – 20% of roadway
- Arterial - 18% of roadway
- Expressway – 11% of roadway

The replacement value of all roadways is estimated at $2.82 billion.

To continue towards the desired level of service of satisfactory to good condition, the capital funding requirement is estimated at $26.2 million per year for the roadways preservation program. This expenditure level will be reached in 2017 as the final year of the four-year phase in the Building Better Roads program as previously directed by City Council is implemented. Through the Building Better Roads program, the average roadway treatment cycle has improved from once every 83 years in 2011 to once every 18 years in 2015.

As shown in the attachment, the investment in roadway preservation has effectively stopped the overall network condition decline, and network condition has shown a very slight improvement since implementation of the program. This comparison is based on predictive modelling of network condition. A city-wide physical condition assessment will be completed in 2018, using the same methodology used in 2014.

Financial Implications

Attachment 1 summarizes the current expenditure level, identifies funding gaps, existing funding from the paved roadways infrastructure reserve, and a potential phased-in property tax increase to address the funding gap.

Communications Plan

The Asset Management Plan for Roadways will be communicated with the City's overarching Corporate Asset Management Plan. Communications support will create awareness for this plan through information uploaded into a new display within the Finance pages of the City's website saskatoon.ca.

Other Considerations/Implications

There are no options, public and/or stakeholder involvement, policy, environmental, privacy, or CPTED implications or considerations.

Due Date for Follow-up and/or Project Completion

The Administration will report back during deliberation of the 2017 Business Plan and Budget on options to address the funding gap. As future maintenance schedules and timing can change, an annual update will be provided to make any adjustments as required.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Attachment

1. Building Better Roadways: An Asset Management Plan for Roadways

Report Approval

Written by: Angie Larson, Finance Support Manager
Reviewed by: Rob Frank, Engineering Manager of Asset Preservation
Reviewed by: Mitchell Parker, Roadways Preservation Manager
Reviewed by: Dan Willems, Director of Major Projects
Reviewed by: Clae Hack, Director of Finance
Reviewed by: Kerry Tarasoff, CFO, Asset and Financial Management Dept.
Approved by: Jeff Jorgenson, General Manager, Transportation and Utilities Dept.

TRANS AL – Building Better Roadways – An Asset Management Plan for Roadways

ATTACHMENT 1

Building Better Roadways:
An Asset Management Plan for Roadways

City of Saskatoon

OCTOBER 2016

Roadways

INTRODUCTION

Preservation of the City of Saskatoon (City) roadways are funded through the Paved Roadways Infrastructure Reserve. Prior to 2013, this reserve was underfunded and, over time, roadways were deteriorating resulting in a backlog of preservation and maintenance projects.

In 2013, City Council adopted a funding strategy intended to improve the condition of City roadways and, slowly overtime, decrease the backlog of preservation work. A three-year dedicated tax levy starting in 2014 was adopted to increase base funding levels to the required amounts by 2016. This plan was adjusted to a four-year phase-in during 2015 business plan and budget deliberations, which resulted in 2017 being the final year of the roadway dedicated levy phase in.

CURRENT INVENTORY

The City's roadway assets are estimated to have a replacement value of $2.82 Billion. This value includes the cost of replacing the road by physical excavation and with new approved materials.

Table 1: Current Inventory (in billions of dollars)

Asset	Inventory Ln-Km	Replacement Cost	% of Roadway
Local Roads	2,045	$1.36	51%
Collector Roads	788	$0.55	20%
Arterial Roads	734	$0.54	18%
Expressways	447	$0.37	11%
Total	4,014	$2.82	

Roadway Network:
The two types of networks are neighbourhood networks and primary networks.

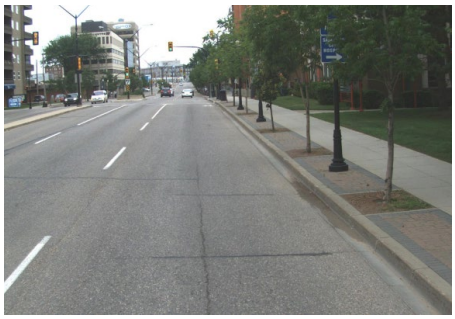
Neighbourhood Network:
Roadways that are classified as Local roads belong to the Neighbourhood Network.

- *Local Roads:* These roadways provide land access and are not intended to carry large volumes of traffic.

Primary Network:
Roadways that are classified as Collector, Arterial, and Expressway Roads belong to the Primary Network.

- *Collector Roads:* These roadways provide both traffic movement and land access. They are typically a connection between Local Roads and Arterials.

- *Arterial Roads:* These roadways provide high traffic movement between major traffic generators such as residential, commercial, and industrial neighbourhoods.

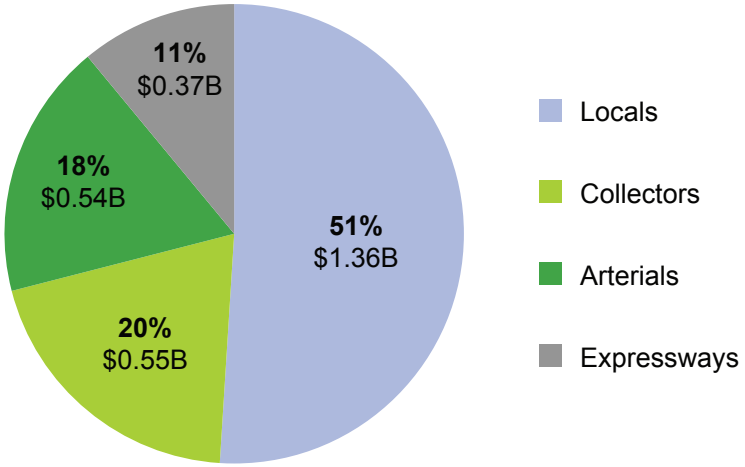


- *Expressway Roads:* These roadways accommodate high-traffic volume at high speeds and move traffic from one sector of the city to another.

Roadways

In order to provide a high-level overview of the state of the roadways, the following graph depicts the percentage of roadways in each classification and its associated values.

Figure 1: 2015 Roadway Inventory by Percent with Replacement Value (Billions)
Total Lane-Kms = 4,014



PHYSICAL CONDITION OF ROADWAYS

In 2014, the City commissioned a full condition assessment of the paved roadway network based on industry standard methodologies. This assessment was used to establish a baseline condition of the network for reporting purposes and to aid in setting future roadway preservation programs. The process of assessing the paved roadways took into account surface pavement condition, ride and roughness, and structural adequacy.

The pavement surface condition was assessed and given a Pavement Condition Index (PCI). The PCI only rates the surface condition of the pavement. Distresses in the surface condition, however, may be symptoms of underlying structural issues and/or cause of poor ride and roughness. The PCI is used as the primary condition categorization of the Roadway Network.

Ride and roughness, which is expressed as the International Roughness Index (IRI), was assessed for all segments, excluding Residential Local Roads. The IRI is an internationally recognized assessment of the quality of ride that will be reported on. The results of the IRI are beneficial for prioritization and treatment selection.

Table 2, 4, and 6 outline the two decisions to be made in order to proceed with an asset management plan.

1. What is the desired condition level?
2. How fast would City Council like to reach the desired condition level (expenditure level)?

Pavement Condition Index (PCI): The pavement surface condition state is represented by a pavement condition index which is based on the American Society for Testing and Materials (ASTM) D 6433 international standard used for roadway condition assessment.

As illustrated in Table 2, a numerical rating is assigned based on the 100 point scale from failed to good.

Table 2: PCI Numerical Rating PCI Pavement Index Range

Condition Description	PCI Pavement Index Range	Example
Good	85 < PCI ≤ 100	Little to no light defects.
Satisfactory	70 < PCI ≤ 85	Up to a few light defects.
Fair	55 < PCI ≤ 70	Multiple light defects, or a few medium defects.
Poor	40 < PCI ≤ 55	Multiple defects, light and medium.
Very Poor	25 < PCI ≤ 10	Many light defects, or a few medium defects, or a combination of a few light and medium defects, or one high defect.
Serious	10 < PCI ≤ 25	Multiple light defects, or multiple medium defects, or a couple high severity defects, or a combination of any defects.
Failed	0 < PCI ≤ 10	Lots of light defects, or multiple medium defects, high defects, or a combination of any defects.

A failed roadway typically exhibits multiple surface condition defects and structural deficiencies as per the photo below. The PCI condition state is calculated based on distinct deduct values for each defect present.

Table 3 indicates that in 2014 the City's roadway network as a whole was considered in satisfactory condition with an average PCI of 74.3 where 83% of the roadway network is in a fair to satisfactory category. The assessment does show the City's investment to roadways is improving slowly as per the approved expenditure level B. The City's Building Better Roads strategy has allowed for the preservation of a good mix of all classifications of roadways. However, due to past levels of underfunding, it is difficult to address the largest portion of the network, local roadways, backlog of work in a quick manner. It is projected that the local road network will begin to improve in PCI over the next few years.

The City's lowest PCI portion of the network in 2016 is the Collector Network. Projecting into 2018, the City's trend shows a continued improvement to PCI since some locations were pulled forward due to favorable contract pricing.

The current target is an average PCI of 80 to 85; which will indicate the City's roads will be

in a satisfactory/good condition. It is not common to have a municipality's inventory in the 90 to 100 PCI range as best practice is to allow roadways to go through a certain life cycle before treatment is applied.

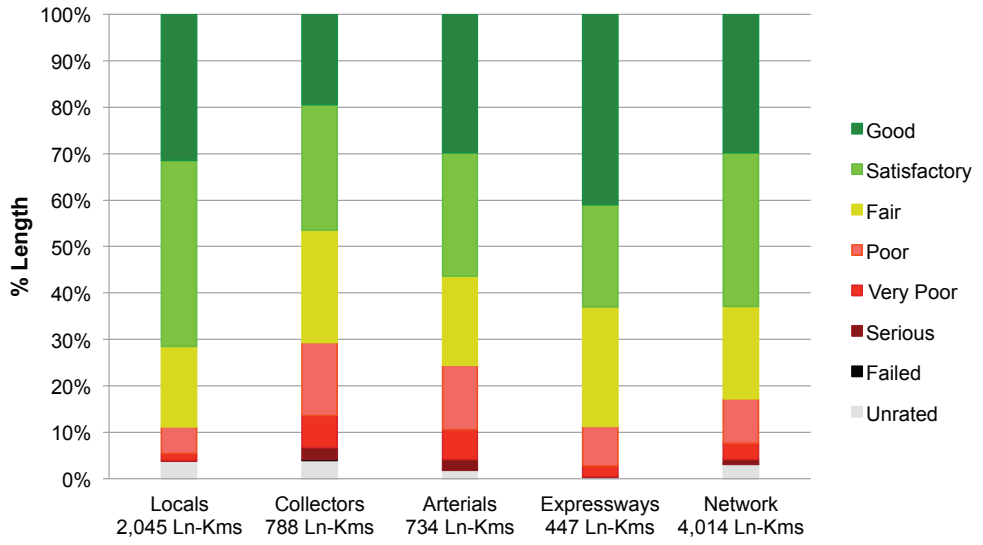
In 2016, the assessment shows the PCI is improving slowly as per the City's approved expenditure level. Future projections show a continued improvement to PCI with the goal of reaching an average PCI of 80 to 85 over time dependent on road classification.

Table 3: Rated Roadway Network Average PCI

Road	Average PCI 2014	Estimated Average PCI 2016*	Condition Description
Locals	77.4	76.2	Satisfactory
Collectors	67.4	69.8	Fair
Arterials	71.1	72.6	Satisfactory
Expressways	77.7	79.0	Satisfactory
Rated Network Avg	74.3	74.6	Satisfactory

**2016 PCI values are projected based on the 2014 condition assessment and completed surface treatments and estimated network deterioration rates. Actual PCI ranges and network improvements will be confirmed during the next City wide roadway condition assessment in 2018. Figure 2 illustrates the PCI as a percentage of length for each road class. This chart also includes the percentage of un-rated roadways.*

Figure 2: PCI by Percent Length per Road Class



International Roughness Index (IRI):

The pavement ride and roughness is represented by an international roughness index, which is a measure of irregularities of the surface that affect the ride quality. The process of IRI was developed in 1986 and is the most commonly used methodology worldwide for evaluating quality of ride.

Index ranges for condition descriptions are shown in Table 4. A higher IRI results in a higher roughness in the ride.

Table 4: IRI Pavement Index Range

Condition Description	IRI Pavement Index Range	Example
Very Low	0 ≤ IRI ≤ 1.8	Brand new road or newly resurfaced road with great ride quality.
Low	1.8 ≤ IRI ≤ 2.5	Pavement with very few undulations and generally a smooth ride.
Moderate	2.5 ≤ IRI ≤ 3.5	Roadway that may have few distresses, but has a significant portion of utility settlements causing an unsmooth ride.
High	3.5 ≤ IRI ≤ 6.5	Roadway with many distresses, patching, and utility settlements creating a bumpy ride.
Very High	IRI > 6.5	Roadways usually pothole ridden with many undulations causing a rough ride.

A roadway with a very high IRI score typically exhibits surface defects that provide a rough or bumpy ride. The photo below is an example of a road with IRI > 9.4.

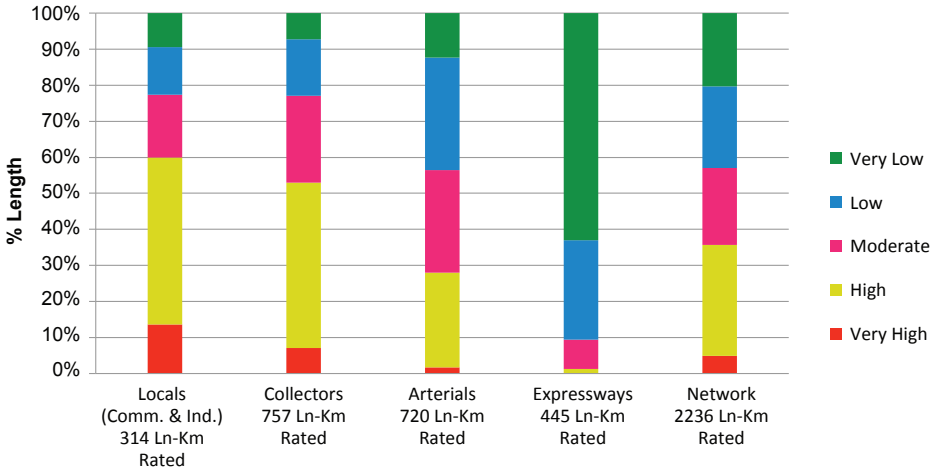
The City's roadway network is considered in a moderate roughness state as indicated in Table 5 with a weighted average IRI of 3.2mm/m where 64% of the Network rated is in a Moderate to Very Low category.

Table 5: Roadway Network Weighted Average IRI (based on In-km rated for each road class)

Road	Average IRI (mm/m)	Condition Description
Locals	4.2	High
Collectors	3.9	High
Arterials	3.1	Moderate
Expressways	1.8	Very Low
Rated Network Avg	**3.3**	**Moderate**

Figure 3 illustrates the IRI as a percent of length for each road class. This chart does not include the percentage of un-rated roadways.

Figure 3: IRI as a Percent of Length of Rated Roads



The photo below is an example of Very Low IRI.

EXPENDITURE LEVELS

The Administration evaluates the condition of the City's assets in order to develop annual programs to maintain the assets at a minimum cost. Condition assessments or evaluations are conducted and used to establish condition levels as well as develop annual capital improvement plans.

The level of service for each type of asset is defined; however, as the level of service increases for the asset, so does the cost of maintaining the asset. In order to be able to compare the level of investment for all assets corporate-wide, five levels of expenditures are identified below. It should be noted that expenditure levels are not condition assessments, but lead to a change in the asset condition over time. "A" represents the highest level of expenditure and "F" represents no expenditure.

Table 6: Expenditure Levels

Expenditure Level	Asset Condition	Description
A	Getting Better Quickly	Sufficient expenditures to keep asset in the desired condition and to increase asset condition/value quickly over time.
B	Getting Better	Sufficient expenditures to keep asset in the desired condition and to increase asset condition/value slowly over time.
C	Maintain Assets in Current Condition	Sufficient expenditures to keep asset in constant condition over time.
D	Getting Worse	Insufficient expenditures to maintain asset condition. Over time asset condition will deteriorate.
F	Getting Worse Quickly	No expenditures. Asset condition/value decreased rapidly.

Table 7 aligns the desired condition and expenditure level. The current PCI is at 74.3 and the physical condition desired is an average PCI of 80 to 85. This desired level is at the top range of the satisfactory PCI range. The table also shows the required funding to meet a level "B" expenditure level and associated funding gap.

Table 7: Funding Gap (in Millions of $)

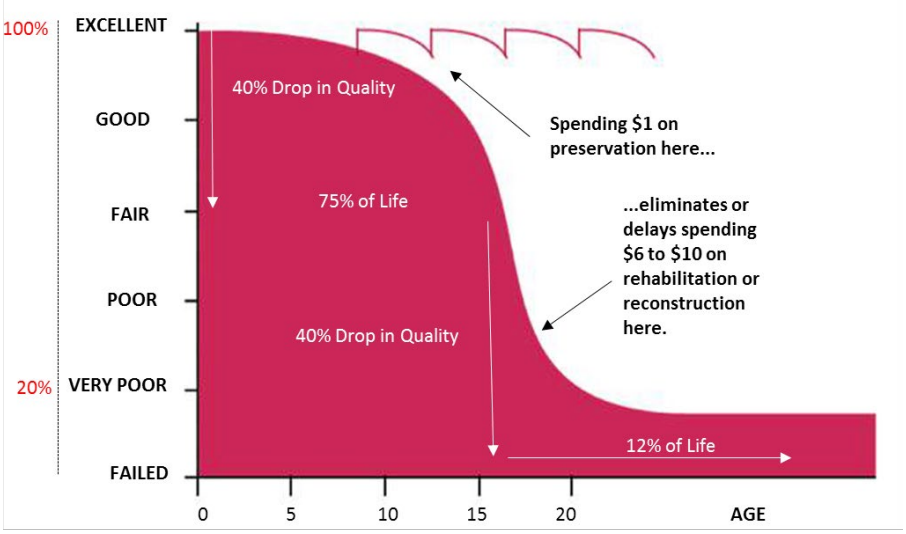
Asset	Physical Condition Actual	Physical Condition Desired	Desired Expenditure Level	Required Annual Funding (to meet Expenditure Level)	2016 Budgeted Annual Funding*	Annual Funding Gap (to meet Expenditure Level)
Roadways	PCI rating - 74.3	PCI target rating - 80.0 to 85.0	Level B	$26.20	$25.10	$1.10

**2016 budgeted funding of $25.1 million includes approximately $2.0 million of one time funding. The final phase in of the Building Better Roads Program to achieve the desired level of service is $3.1 million in 2017.*

As shown in Table 7, the amount of annual budgeted funding is not sufficient to achieve the desired "B" expenditure level. The final year of the building better roads initiative will address the outstanding funding gap of $1.1 million in 2017. If approved by City Council, the desired expenditure level will be reached.

Information from the Canadian Infrastructure Report Card 2016 demonstrates that increasing reinvestment rates will save money in the long-term. Without an increase in current reinvestment rates, the condition of City roadways will gradually decline, costing more money and risking service disruption. For example, Figure 4 demonstrates that when roads are allowed to deteriorate below a Fair condition rating, the rate of deterioration and reinvestment costs both increase substantially. Investing in preventive maintenance and regular repair will prolong the asset service life, avoiding premature and costly reconstruction and long-term service disruptions that are associated with the larger scope of work.

Figure 4: Example of Asset Deterioration Curve for Roadways



PRESERVATION PROGRAMS

The most effective way to achieve an improved roadway network condition is to use a mix of preservation, restoration, and rehabilitation treatments. Preservation treatments are less expensive than the restoration and rehabilitation treatments. Utilizing the preservation treatments are important to preserve the City's fair to good roads so they do not drop into a lower category based on the PCI.

Major Projects develops three year roadway preservation plans that cover full roadway treatments within the Preservation, Restoration, and Rehabilitation Treatment Strategies. Specific details of these treatments may vary year-to-year, depending on requirements or possible cost saving innovations. The specifics of each treatment are provided in yearly terms of reference documentation.

The photos below are examples of Microsurface and Resurfacing before and after photo.

Before microsurface

After microsurface

Before resurface

After resurface

A POTENTIAL PLAN TO ADDRESS THE FUNDING GAP

In 2013, City Council adopted the funding requirements to attain a Level of Service "B" based on "The Neighbourhood and Primary Roadway and Sidewalk Preservation" and "2013 Investing in the Roads to Continued Prosperity" reports. This level of service is intended to improve the condition of our roadways and slowly over time decrease the backlog of preservation work. Prior to 2013, funding received amounted in a resulting Service Level "E" where City's roads were deteriorating and resulting in a backlog as outlined in the October 25, 2013 report presented to the Administration and Finance Committee.

Capital funding spent on preserving roadways has increased significantly from $4.38 million in 2011 to a projected $25.1 million for 2016.

Table 8 illustrates a potential funding plan that could be implemented to meet the desired condition for roadway preservation.

Table 8: Potential Funding Plan Required for Good Condition Level (In Millions of $)

Paved Roadway and Sidewalk Preservation	2017	2018	2019	2020	2021
Arterial Roads	5.90	5.60	5.60	5.60	5.60
Collector Roads	5.90	5.80	5.80	5.80	5.80
Local Roads	3.90	3.90	3.90	3.90	3.90
Expressways	10.50	10.90	10.90	10.90	10.90
Mill Rate Impact	1.54%	0.00	0.00	0.00	0.00

**Increase has been included in the 2017 preliminary budget as part of the Building Better Roads funding strategy.*

The current strategy for preserving City roadways is to take into account where the road is in its lifecycle in relation to the typical design life of that road type. The typical design life of a road is 15 to 20 years before requiring a major restoration such as a resurfacing or structural improvement. Having a treatment cycle between 15 to 20 years is the goal for maintaining the current roadway network, although a treatment cycle closer to 15 years would help to maintain and improve the roadway network by reducing the backlog of roadways in the poor to failed condition. The treatment cycle does not mean that every road will necessarily

be treated in that 20 year period, but that the overall roadway network will have an average 20 year cycle. The condition, road type, the treatment required, and prioritization are all factors for selection of roads to be preserved, restored, or reconstructed.

As illustrated in Table 9 and based on the 2011 funding levels, the average roadway treatment cycle would be once every 83 years. In 2015 and estimated out to 2017, the funding levels and treatment selection strategy improved the average roadway treatment cycle to approximately once every 18 to 20 years, which is still a significant improvement from 5 years ago. This increase shows that the current funding strategy is in line with the typical surface treatments.

Table 9: Capital Funding and Treated Network

Treatment Year	Capital funding Dedicated to Roads ($M)	Ln-km Treated	Network Ln-km	Percent of Network Treated	Average Treatment Cycle
2011	4.38	45.1	3,690	1.2%	83 years
2012	6.96	51.4	3,758	1.4%	71 years
2013	13.33	76.6	3,906	2.0%	50 years
2014	23.40	200	3,958	5.1%	20 years
2015	21.16	220	4,014	5.5%	18 years
2016	25.10	230*	4,075	5.6%	18 years
2017	26.20	202*	4,135	5.0%	20 years

**Projected Lane kilometers*

CLIMATE ADAPTION STRATEGY

The Administration understands that road work is weather dependent. During periods of extreme weather, such as a major rain event or early winter, some projects are unable to be completed or started until favourable conditions return. If current year funding for roads are planned but cannot be completed or started due to unfavourable weather conditions or seasonal changes, work on those roads will be carried over to the next construction season.

In addition, recent changes to the roadway design standards have been implemented to require mandatory edge drainage systems to new roadway structures. This implementation will ensure that the road structure can be drained and protected during extreme weather events and high water tables caused by adverse weather conditions.


19th Street
4th Avenue

City of
Saskatoon

Building Better Sidewalks: An Asset Management Plan for Sidewalks

Recommendation:

1. That the Asset Management Plan for Sidewalks be received as information; and
2. That the Administration provide a report for the 2017 Business Plan and Budget deliberations as part of the Corporate Asset Management Plan.

Topic and Purpose

The purpose of this report is to provide information on sidewalks primarily belonging to the Major Projects division. Specific information on value, condition, asset management initiatives, and two potential funding plans are included.

Report Highlights

1. The report illustrates various methods to determine sidewalk condition. The condition of sidewalks in Saskatoon range from 'failed' to 'good' condition depending on location. At a network level, the current overall, or system average, physical condition of sidewalks is considered to be satisfactory.
2. Two potential funding plans are illustrated with the goals of bridging the funding gap to enable the assets to reach the desired condition of good over time and to show the cost of using asphalt overlays in comparison to not using asphalt overlays as a preservation strategy.

Strategic Goal

Under the Strategic Goal of Asset and Financial Sustainability, this report supports the four-year priority of adopting and implementing an asset-management philosophy for sidewalks.

Background

In 2013, City Council adopted the funding requirements to attain a Level of Service "B" based on "The Neighbourhood and Primary Roadway and Sidewalk Preservation" and "2013 Investing in the Roads to Continued Prosperity" reports. This Level of Service is intended to improve the condition of the City's sidewalks and decrease the backlog of preservation work slowly over time.

The City has made significant progress in addressing this gap by increasing the capital funding from $0.03 million in 2011 to $3.90 million in 2016.

At City Council meeting of May 24, 2016, the Sidewalk Condition and Plan report identified that more funding was required to reach the desired condition level.

During consideration of the Sidewalk Condition and Plan report on May 24, 2016, City Council resolved, in part:

> "2. That the Administration report to the 2017 budget deliberations with options for maintaining the current rate of sidewalk repair and replacement while phasing out the asphalt overlay repair program."

Report

Sidewalk Inventory

As shown in Attachment 1, sidewalk inventory consists of two networks, a neighbourhood network and a primary network. The estimated replacement value of sidewalks is as follows:

- Neighbourhood Network $502 million.
- Primary Network $220 million.

To continue towards the desired level of service of good condition, the capital funding requirement is estimated at $4.7 million for the sidewalk preservation programs and $1.03 million for sidewalk maintenance in 2017. This expenditure level will be reached in 2017 as the final year of the four-year phase in of the Building Better Roads program as previously directed by City Council.

Table 7 and 8 included in the attachment outlines a potential funding strategy that will reduce the backlog and bring the sidewalk network to good condition over time. The difference between the two tables is that Table 7 includes the use of asphalt overlays at an annual funding requirement of $4.7 million. With a funding level of $4.7 million per year, asphalt overlays that are in fair to good condition remain in place over the useful life of the sidewalk. Table 8 is a preservation strategy that eliminates asphalt overlays over time with an annual funding requirement of $6.9 million per year.

Financial Implications

Attachment 1 summarizes the current expenditure level, identifies funding gaps, existing funding from the paved roadways infrastructure reserve, and a potential phased-in property tax increase to address the funding gap.

Communications Plan

The Asset Management Plan for Sidewalks will be communicated with the City's overarching Corporate Asset Management Plan. Communications support will create awareness for this plan through information uploaded into a new display within the Finance pages of the City's website saskatoon.ca.

Other Considerations/Implications

There are no options, public and/or stakeholder involvement, policy, environmental, privacy, or CPTED implications or considerations.

Due Date for Follow-up and/or Project Completion

The Administration will report on the Corporate Asset Management Plan at the 2017 Business Plan and Budget deliberations that will include the Sidewalks Asset Management plan. As future maintenance schedules and timing can change, an annual update will be provided to make any adjustments as required.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Attachment

1. Building Better Sidewalks: An Asset Management Plan for Sidewalks

Report Approval

Written by: Angie Larson, Finance Support Manager
Reviewed by: Rob Frank, Engineering Manager of Asset Preservation
Reviewed by: Mitchell Parker, Roadways Preservation Manager
Reviewed by: Dan Willems, Director of Major Projects
Reviewed by: Clae Hack, Director of Finance
Reviewed by: Kerry Tarasoff, CFO, Asset and Financial Management Dept.
Approved by: Jeff Jorgenson, General Manager, Transportation and Utilities Dept.

TRANS AL – Building Better Sidewalks – An Asset Management Plan for Sidewalks

ATTACHMENT 1

Building Better Sidewalks:
An Asset Management Plan for Sidewalks

City of Saskatoon

OCTOBER 2016

Sidewalks

INTRODUCTION

The City of Saskatoon's (City) sidewalk networks consists of a combination of curb and sidewalk, separate sidewalks and walkways.

The two types of maintenance programs performed on these assets are either regular sidewalk maintenance or the preservation of sidewalks.

- The regular maintenance of sidewalks includes activities that extend the life of the sidewalks, reducing the costs of rehabilitation, and more importantly removal of safety hazards for pedestrians and other sidewalk network users. Examples: large cracks in sidewalks or broken concrete that creates tripping hazards.
  - The maintenance program is sufficiently funded through the operating budget. This program received $1.03 million in 2016.
- The City Sidewalk Preservation program focuses on repairing sidewalks adjacent to roadways when they are resurfaced. Therefore; the annually programmed work areas for the Sidewalk Preservation Program are aligned to the three-year road plan.
  - Preservation of sidewalks is funded from the paved roadways infrastructure reserve. In a report to City Council, on October 23, 2012, it was identified that in order to improve the paved roadway and sidewalk network and reduce the backlog slowly over time, $2.81 million should be dedicated to sidewalks. Since this report was written, a more clearly defined comprehensive condition evaluation has been completed. Considering the new evaluation and increased costs, the required funding has been identified at $4.7 million. The current annual contribution for sidewalk preservation in 2016 is $3.9 million leaving an annual shortfall of $800,000.

CURRENT INVENTORY

The sidewalk network inventory consists of two networks, a neighbourhood network and a primary network. The neighbourhood network is comprised of curb and sidewalks alongside local roads which for the most part serve residents, or business within residential, commercial and industrial neighbourhoods. The primary network consists of curb and sidewalks alongside roads classified as collector, arterial, and expressway roads. These roadways serve a broader range of users.

The two networks consist of the following equivalent lineal kilometers and valuation:

Table 1: Sidewalk Inventory and Replacement Value (in Millions of $)

Network	Eq. Lin. Km	Valuation (M)
Neighbourhood	1,012	$502
Primary	512	$220
Total	1,524	$722

The City of Saskatoon's (City) sidewalk inventory is comprised of 1,524 km of sidewalk at a replacement value of $722 million.

PHYSICAL CONDITION OF SIDEWALKS

Tables 2 and 5 outline the following two decisions to be made in order to proceed with an asset management plan:

1. What is the desired condition level?
2. How fast would City Council like to reach the desired condition level (expenditure level)?

In 2013, City Council adopted the funding requirements to attain a level of service "B" based on the following two reports: 1) Neighbourhood and Primary Roadway and Sidewalk Preservation, and 2) Investing in the Roads to Continued Prosperity. This Level of Service is intended to improve the condition of the City's sidewalks and decrease the backlog of preservation work slowly over time.

In 2014, the preservation strategy changed from replacing stretches of severely deteriorated sidewalks to rejuvenating the roadway corridor as a whole and address sidewalks adjacent to the roadway preservation program. This surgical approach ranges from repairing panels where appropriate, replacing individual panels, or replacing full segments. This approach improves more sidewalk segments as a whole, thereby reaching the needs of more citizens. Matching the treatment cycle of roadways, an average 20 year return cycle is the goal for maintaining and replacing current sidewalk defects. It should be noted that the treatment cycle does not mean that every sidewalk will be replaced; it means each sidewalk will be preserved or replaced depending on the sidewalk's current condition.

City Administration has criteria to determine the action taken depending on the severity of the condition. Below is an example of one of the set of criteria and the solution required based on specifics around the condition of the sidewalk:

A trip hazard is when the sidewalk lifts or depresses causing a ledge of 20mm or more. Most trip hazards occur at the control joints but can also occur along a crack.

- Up to 40mm and < 2m of trip length per panel - Grinding or Saw Cutting
- More than 40mm and > 2m per panel - Mud Jacking or Replacement

Repair - Grinding or Saw Cut

Mud Jack or Replacement

A sidewalk condition index (SCI) was developed in-house in 2014. The condition index is based on a similar model to the American Society for Testing and Materials (ASTM) D6433 international standard used for roadway condition assessment. The sidewalk condition is evaluated by collection of extents and severity of individual surface distresses on an

individual panel inspection. Each defect collected has a distinct deduct value based on severity and extent and is subtracted from 100 to produce the SCI score. The SCI Rating Scale, is a numerical rating, from 0, being the worst possible condition, to 100, being the best possible condition, as shown in Table 2.

Table 2: Categorized SCI Ratings

Condition Description	SCI Pavement Index Range	Example
Good	85 < SCI < 100	Little to no light defects.
Satisfactory	70 < SCI < 85	Up to a couple light defects.
Fair	55 < SCI < 70	Few light defects or one medium defect.
Poor	40 < SCI < 55	Multiple light defects, or a couple medium defects.
Very Poor	25 < SCI < 40	Many light defects, or a few medium defects, or a combination of a couple light and medium defects, or one high defect.
Serious	10 < SCI < 25	Lots of light defects, or multiple medium defects, or a couple high severity defects, or a combination of any defects.
Failed	0 < SCI < 10	Lots of light defects, or multiple medium defects, or a couple high defects, or a combination of any defects.

Table 3 shows that overall, the average sidewalk condition index for the entire city sidewalk network is 84.6 out of 100, which is classed a "satisfactory" condition state.

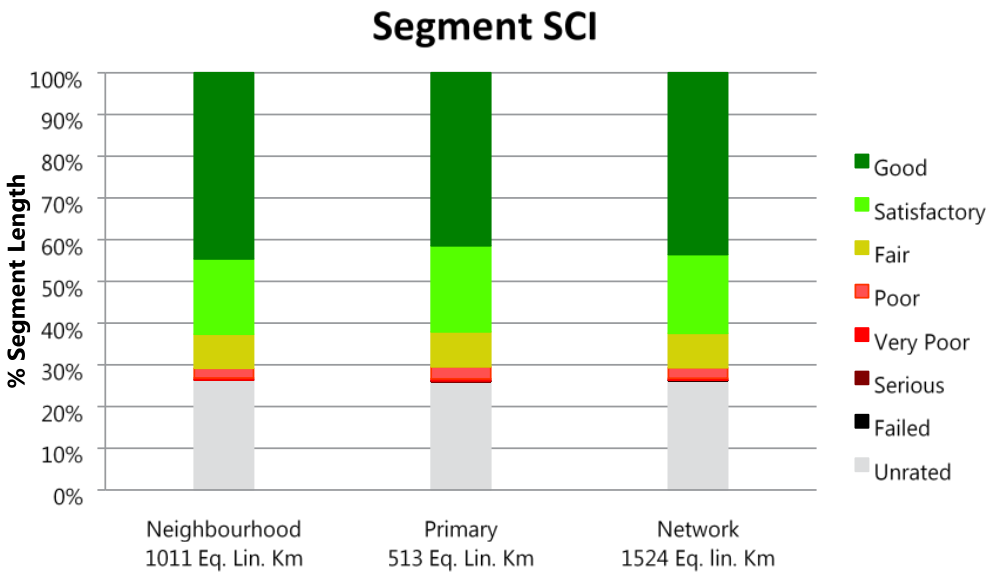
Table 3: Rated Side Walk Network Average SCI

Network	Average SCI	Condition Description
Neighbourhood	84.8	Satisfactory
Primary	84.1	Satisfactory
Total	**84.6**	**Satisfactory**

Sidewalk inspection data shows that sidewalks are generally in satisfactory condition and that failed locations tend to be localized, with individual sidewalk panels requiring treatment rather than longer sidewalk lengths. The maintenance and replacement associated with sidewalks currently in "Fair" to "Failed" condition is estimated at $80 million.

Table 4 illustrates the SCI condition of length for each network by segment and also includes the percentage of unrated sidewalk segments broken down by neighbourhood, primary sidewalks and the full network.

Table 4: SCI by Percent Segment Length per Network



The City's sidewalk network, as a whole, is considered in a satisfactory condition state with an average SCI of 84.6, with 70.8% of segments of the sidewalk network in a fair to good condition; whereas, 3.0% of segments of the sidewalk network are in a poor to failed condition. Currently 26.2% of the segments are unrated and are typically new sidewalks in new neighbourhoods and assumed to be in a good and satisfactory condition.

EXPENDITURE LEVELS

The Administration evaluates the condition of the City's assets in order to develop annual programs to maintain the assets at a minimum cost. Condition assessments or evaluations are conducted and used to establish condition levels, as well as, to develop annual capital improvement plans.

The level of service for each type of asset is defined but as the level of service increases for the asset, so does the cost of maintaining the asset. In order to be able to compare the level of investment for all assets corporate wide, five levels of expenditures are identified below. It should be noted that expenditure levels are not condition assessments but lead to a change in the asset condition over time. "A" represents the highest level of expenditure and "F" represents no expenditure.

Sidewalks

Table 5: Expenditure Levels

Expenditure Level	Asset Condition	Description
A	Getting Better Quickly	Sufficient expenditures to keep asset in the desired condition and to increase asset condition/value quickly over time.
B	Getting Better	Sufficient expenditures to keep asset in the desired condition and to increase asset condition/value slowly over time.
C	Maintain Assets in Current Condition	Sufficient expenditures to keep asset in constant condition over time.
D	Getting Worse	Insufficient expenditures to maintain asset condition. Over time asset condition will deteriorate.
F	Getting Worse Quickly	No expenditures. Asset condition/value decreased rapidly.

Using the above criteria and the physical condition desired, the Administration has identified the following expenditure levels for sidewalks:

Table 6: Funding Gap (in Millions of Dollars)

Asset	Physical Condition Actual	Physical Condition Desired	Desired Expenditure Level	Required Annual Funding (to meet Expenditure Level)	2016 Budgeted Annual Funding*	Annual Funding Gap (to meet Expenditure Level)
Sidewalk Primary Program	Satisfactory	Good	Level B	1.87	1.38	0.46
Sidewalk Construction Neighbourhood Program	Satisfactory	Good	Level B	2.83	2.52	0.34
Total				**4.70**	**3.90**	**0.80**

As illustrated in Table 6 above, the annual funding is not sufficient to achieve the desired "B" expenditure level.

In order to reach the funding level required for the desired level of service, sidewalks capital funding has increased significantly from .03M in 2011 to $3.90M in 2016.

To maintain the desired level of service for 2017, the capital funding requirement is estimated at $4.7 million for the sidewalk preservation programs and $1.03 million for sidewalk maintenance.

The current annual contribution for sidewalks preservation in 2016 is $3.9 million leaving an annual shortfall of $800,000. The maintenance program is adequately funded ($1.03 million) through the operating budget.

PRESERVATION PROGRAM

The City sidewalk preservation and maintenance programs are planned and managed by the Transportation & Utilities Department. The preservation program is planned by the Major Projects Division and construction is delivered by the Construction and Design Division. The maintenance program is managed by the Public Works Division. The two programs are integrated in a collaborative manner by utilizing the same condition data and through a high level of direct communication between all groups involved.

Sidewalk Preservation Program

This program focuses on repairing sidewalks adjacent to roadways when they are surface treated, which is the most cost-effective way to deliver this work. Therefore, the annual programmed work areas for the Sidewalk Preservation Program are aligned to the three-year road plan. Since the road program covers approximately 5% of the road network per year, equating to each road receiving preservation treatments on average once every 20 years, this allows the Sidewalk Preservation Program to have the same average cycle for return treatments. The current sidewalk preservation plan as per funding plan in Table 7 includes using asphalt overlays as a maintenance strategy and leaving existing asphalt overlays that are in fair to good condition in place to achieve their full lifecycle. Larger segments of severely deteriorated sidewalk that are in high pedestrian potential areas and outside of the roadway surface treatment program are also reviewed and collaborated between divisions to implement the best solution for repair or maintenance.

Table 8 illustrates a potential funding strategy for an alternative option that would include eliminating the use of asphalt overlays. All Sidewalk asphalt overlays would be removed regardless of their condition when the adjacent roadways are surface treated. If this funding strategy is adopted, it is estimated asphalt overlays and the sidewalk backlog will be eliminated in approximately 15 years.

Good Condition

Fair Condition

Maintenance Practices and Prioritization

Maintenance of sidewalks include activities that extend the life of the sidewalks, reducing the costs of rehabilitation, and more importantly removal of safety hazards for pedestrians and other sidewalk network users. In order to optimize efficiency, maintenance activities on sidewalks are conducted before replacements.

The planned maintenance program allows Saskatoon's sidewalks to be prioritized and maintained for safety until such time as the preservation program can be implemented in all areas. This includes sidewalks that are required to be replaced due to underground utility work, and those that are identified and confirmed as below acceptable condition through the Customer Service Centre. Public Works will not address sidewalk panels that are on the three-year Road Preservation Program, except to address serious safety concerns.

The current maintenance strategy includes using asphalt overlays to address sidewalk safety hazards throughout the City. In 2015, approximately 2.3 km of sidewalks were addressed for safety concerns at an estimated cost of $54,000. In order to discontinue asphalt overlays and address the same quantity, an additional $1.5M of annual funding per year would be required. This additional funding is included in the funding strategy on Table 8.

The photos below are examples of two different conditions of sidewalk asphalt overlay.

POTENTIAL PLAN TO ADDRESS THE FUNDING GAP

The maintenance program and sidewalk preservation program are funded from two different sources.

The maintenance program is funded through the Utilities Transportation - Road and Maintenance Operating Budget. The 2016 budget of $1.03 million is sufficient to continue the planned maintenance program.

The sidewalk preservation program is funded through the Paved Roadways Infrastructure Reserve. It was identified in the May 24, 2016 report on Sidewalk Conditions and Plan, that more funding was required to reach the desired condition level. The report stated that:

> *"An estimated $4.9 million per year is required to allow for an average sidewalk intervention treatment cycle of 20 years using the current treatment approach".*

The funding requirement has been adjusted to $4.7 million.

The current contribution is reported at $3.9 million in 2016. The shortfall to get to the desired Condition "B" target is $800,000 per year.

As illustrated in Table 3, the City's Sidewalk network as a whole is currently considered in a satisfactory condition state with an average SCI of 84.6 which will ensure the sidewalks adjacent to the roadway preservation program are addressed for maintenance or replacement as required to ensure safe conditions for pedestrians. This increase will also improve the SCI and slowly reduce the backlog of panels needing maintenance or replacements over time.

The 2017 budget request is to consolidate a number of roadway projects including the Sidewalk Preservation Project with the Paved Roads Preservation Project. Connecting these projects would allow flexibility in the strategic allocation of funding between the different roadway classifications and sidewalks required to improve the network. Table 7 and 8 illustrate potential funding plans that could be implemented to meet the desired condition for sidewalk preservation. The plan in Table 7 includes the continued use of asphalt overlays, whereas the funding in Table 8 eliminates asphalt overlays over time.

Table 7: Funding Required for Good Condition Level (Including Asphalt Overlay) (in Millions of $)

Sidewalk Preservation - Including Asphalt Overlay	2017	2018	2019	2020	2021
Planned Expenditures - Construction Neighbourhood Program	$2.83	$2.83	$2.83	$2.83	$2.83
Planned Expenditures - Primary Program	$1.87	$1.87	$1.87	$1.87	$1.87
Total	**$4.70**	**$4.70**	**$4.70**	**$4.70**	**$4.70**
Mill Rate Impact	0.39%	0.00%	0.00%	0.00%	0.00%

**Increase has been included in the 2017 preliminary budget as part of the Building Better Roads funding strategy*

Table 8: Funding Required for Good Condition Level (Eliminating Asphalt Overlay) (in Millions of $)

Sidewalk Preservation -Eliminating Asphalt Overlay	2017	2018	2019	2020	2021
Planned Expenditures - Construction Neighbourhood Program	$4.15	$4.15	$4.15	$4.15	$4.15
Planned Expenditures - Primary Program	$2.75	$2.75	$2.75	$2.75	$2.75
Total	**$6.90**	**$6.90**	**$6.90**	**$6.90**	**$6.90**
Mill Rate Impact	1.48%	0.00%	0.00%	0.00%	0.00%

CLIMATE ADAPTATION STRATEGY

Due to the nature of the construction materials used for these assets (i.e. concrete and asphalt), they are resistant to many of the effects of climate change. In new construction, edge drains adjacent to the sidewalk within the road structure have been included that will assist in reducing damage due to high water tables caused by climate change. Crack filling sidewalks has also been added as an additional maintenance practices to reduce water infiltration to the underlying soils and thus reduce damage caused by increased precipitation caused by climate change.

With respect to construction, road and sidewalk work is weather dependent. During periods of extreme weather such as a major rain event or early winter, some projects are unable to be completed or started until favourable conditions return. If current year funding for roads or sidewalks are planned but cannot be completed or started due to unfavourable weather conditions or seasonal changes, those roads or sidewalks work will be carried over to the next construction season.

City of
Saskatoon

Building Better Sidewalks – Sidewalk Programs Overview

Recommendation

1. That the Administration be directed to eliminate the practice of using asphalt overlays on concrete sidewalks; and
2. That the funding for this service level change be from reallocation of existing funding within the roadway and sidewalk preservation program.

Topic and Purpose

This report is to provide the Standing Policy Committee on Transportation with an overview of the various different programs and initiatives pertaining to sidewalks, including the Sidewalk Preservation Program, Corporate Accessibility Program, Sidewalk Retrofit Program, and Sidewalk Maintenance & Safety Program.

Report Highlights

1. Capital Project #0948 – New Sidewalks and Pathways is a retrofit program to construct sidewalks and pathways at locations where they do not currently exist.
2. Capital Project #1963 – Corporate Accessibility Implementation addresses the identified priorities of the Accessibility Service Level Guidelines, and a portion of this capital project includes accessibility ramp installations to address accessibility issues throughout Saskatoon.
3. Capital Project #2270 – Neighbourhood Network and Primary Network Preservation Programs is administered by Major Projects and is a program to restore and maintain sidewalks in a safe condition for users, which involves repairing or replacing panels of sidewalks having trip hazards or missing sections.
4. The Sidewalk Maintenance and Safety program is administered by Public Works and is a program to address spot repairs of sidewalk panels to address immediate safety concerns.
5. Eliminating asphalt overlays from the treatments available for use, yet maintaining the same treatment coverage, would require an increase in funding of $2.2 million annually. This can be achieved with either a funding increase to the program or a re-distribution of funding allocations within the existing program.

Strategic Goal

Sidewalk maintenance and preservation programs support the Strategic Goal of Asset and Financial Sustainability as these programs are designed with a goal to optimize life cycle costs for sidewalk assets. All of the sidewalk programs described in this report support the Strategic Goal of Moving Around as they improve accessibility, mobility and provide for the repair and maintenance of the City's sidewalk network.

Background

At its budget deliberations in December 2015, the 2016 budget allocations were confirmed by Council for the sidewalk programs discussed in this report. Budget allocations for 2017 are subject to Council review and approval at its deliberations in November 2016.

Report

The City's sidewalk network is managed through several different programs. All of these programs are within the Road Maintenance and Transportation Services Service Line of the Transportation Business Line. In addition, the Corporate Accessibility Program is incorporated into the Community Development Service Line of the Community Support Business Line. The following table summarizes the programs and associated business lines, service lines, and funding:

Program	Administrating Division	2016 Budget	Potential 2017 Budget
#0948 – New Sidewalks and Pathways	Transportation	$391,000	$1,300,000
#1963 – Corporate Accessibility Implementation #2548 – Major Disability Ramp Repairs	Transportation	$0.00 $180,000	$500,000
#2270 – Paved Roads and Sidewalk Preservation – Neighbourhood Network Sidewalk Preservation	Major Projects	$2,530,000	*$2,830,000/$4,150,000
#2270 – Paved Roads and Sidewalk Preservation – Primary Network Sidewalk Preservation	Major Projects	$1,380,000	*$1,870,000/$2,750,000
Sidewalk Maintenance and Safety Program	Public Works	$1,000,000	$1,010,000
Totals	n/a	$5,481,000	*$7,510,000/$9,710,000

(* utilizing asphalt overlays as a maintenance procedure/utilizing panel replacements rather than asphalt overlays)

Each program is further described in the following sections.

Capital Project #0948 – New Sidewalks and Pathways

This program is a retrofit program to construct sidewalks and pathways at locations where they do not currently exist. The Active Transportation Plan identified the missing links of sidewalks on major roadways, for a total of 90 km at a cost of $30 million. This does not include missing sidewalks on local residential roadways, estimated at an additional $31 million. Priority for construction is given to locations adjacent to schools and parks, locations with no sidewalks on either side of the roadway, and locations identified by the Neighbourhood Traffic Review and Corridor Study processes. Further details on the program can be found in Attachment 1.

For 2017, funding has been approved through the federal Public Transit Infrastructure Fund (PTIF) to improve access to transit. Accordingly, the 2017 program will focus on sidewalk construction to improve access to or along transit corridors and be consistent with the Active Transportation Plan. A further report will be presented in early 2017 outlining locations to be constructed as part of this program.

Capital Project #1963 – Corporate Accessibility Implementation

This capital project, in conjunction with Capital Project #2548 – Intersection Upgrades for Major Disability Ramps, addresses the identified priorities of the Accessibility Service Level Guidelines approved in principle by City Council on September 2, 2008, and supported by the recommendations presented in the Accessibility Implementation Action Plan. A portion of this capital project includes accessibility ramp installations to address accessibility issues throughout Saskatoon. Further details on the program can be found in Attachment 2.

For 2017, funding has been approved through PTIF to improve access to transit. Accordingly, the 2017 program will focus on construction of accessibility ramps near or adjacent to transit corridors.

Capital Project #2270 – Neighbourhood Network and Primary Network Preservation Programs

The goal of the Neighbourhood Network and Primary Network Preservation Program is to restore sidewalks in a 'safe' and functional condition for users. This involves repairing or replacing in whole or in part that are severely deteriorated, and maintaining panels of sidewalks having trip hazards, cracks, surface scaling or severe deterioration. Single or multi-panel replacements are completed on severely deteriorated panels, trip ledge cutting is performed on functional panels that have identified trip hazards, surface overlays are performed on scaled panels and crack filling is performed on functional panels that are cracked.

The preservation programs are divided between neighbourhood assets and primary assets. Neighbourhood network sidewalks primarily serve the residents of that neighbourhood. Primary network sidewalks serve a broader range and higher volume of people.

Annual sidewalk preservation programs are developed on a priority basis. Sidewalks adjacent to the annual roadway preservation program are currently given top priority for the sidewalk preservation program in order to rejuvenate streets as a whole. A budget of $4.7 million is being allocated adjacent to the roadway program each year which addresses approximately 5% of the sidewalk network. The sidewalk condition data shows that our network has an approximate $80 million backlog of work that meets preservation treatment triggers. Outside of areas adjacent to the roadway preservation program, sidewalk preservation treatments are prioritized and coordinated in locations where parking meters exist, and in areas near schools, hospitals and care homes. The remaining approximate 95% of the sidewalk network is addressed for safety through the Sidewalk Maintenance and Safety program; this program is discussed further in the following section of this report.

There are currently 47 km of asphalt overlays installed over sidewalks. The current practice is to leave the overlays in place if in fair condition and only replace poor condition overlays with new sidewalk when resurfacing the adjacent street. For comparison purposes, the unit cost of an asphalt overlay is approximately $10/m^2,

whereas the cost for concrete removal and replacement is approximately $300/m^2. The downside of asphalt overlays is that adjacent residents are typically disappointed that the panels were not replaced with concrete.

The combined roadway/sidewalk preservation approach is appropriate, although not having any replacement funding to replace high-priority sidewalks where the streets are not receiving treatment is a gap that needs to be addressed. The following options have been identified to eliminate this gap:

- In order to eliminate the use of asphalt overlays adjacent to properties, the annual allocation to sidewalk preservation would need to increase from the planned $4.7 million to $6.9 million. This could be accomplished by reducing the funding allocated to roadway treatments by $2.2 million and using this funding to repair high-priority sidewalks not adjacent to the roadway program. This would be done by allocating $1.5 million to the priority locations outside the roadway program and $0.7 million to remove asphalt overlays within the road program limits. This option would result in no new overlays being constructed, and existing asphalt overlays being eliminated slowly over time.
- Alternatively, $2.2 million could be added to the sidewalk program. This would eliminate all existing asphalt overlays in a 15-year period while maintaining roadway funding at its current level.

Considering all factors, the Administration is recommending that asphalt overlays be eliminated from use, and that the roadway program funding be re-distributed in order to accomplish this. Although this does reduce the amount of roadways that can be resurfaced each year by approximately 8.4%, favorable tender pricing has allowed the City to achieve an average return period of 18 years for roadway surface treatment. Our target return period is an average of 20-year cycle, therefore this reallocation of roadway funding appears adequate at this time to offset the additional sidewalk work. The Administration will continue to report annually on the effectiveness of the roadway and sidewalk preservation programs.

The recommendation to eliminate asphalt overlays is not related to cost effectiveness of the treatment. Asphalt overlays are a cost-effective treatment to eliminate safety hazards but do not meet the expectations of adjacent residents.

Further details on program funding can be found in the Building Better Sidewalks: An Asset Management Plan for Sidewalks report.

<u>Sidewalk Maintenance & Safety Program</u>

Over time, sidewalks will wear, and potentially be damaged by vehicles, equipment or tree roots. These factors result in the sidewalk cracking, becoming uneven, crumbling or chipping which can create dips and trip hazards. In cases where a sidewalk is not showing severe distresses, the most economical solution to address the hazard may be to repair rather than replace the sidewalk panel.

For trip hazards and dips, repair methods include grinding, saw cutting, or mud jacking to remove the trip ledge. For light to moderate cracking, repairs include crack filling. Where a panel is experiencing significant deterioration but the panel is not prioritized for timely repair under the associated preservation program, asphalt or MG-Krete patches have been used as temporary treatments until the panel can be replaced under the preservation program, however the Building Better Sidewalks: An Asset Management Plan for Sidewalks report outlines a potential funding plan to largely discontinue the use of these types of temporary patches in favour of concrete panel replacement. Further details on the program can be found in Attachment 3.

Public and/or Stakeholder Involvement

Stakeholders are engaged on these annual programs as they are developed each year. The Administration will continue to coordinate with applicable stakeholders as necessary.

Communication Plan

An explanation on how the City selects sidewalks for repair, the criteria considered when determining the type of sidewalk repair required for a particular section, as well as various other FAQs and phone numbers for residents to report faulty sidewalks, is available at Saskatoon.ca/sidewalks. The webpage also contains a printable PDF about sidewalk repair/replacement criteria, and indicates when the City is assessing and marking sidewalks to address locations for future preservation work.

Other Considerations/Implications

There are no policy, financial, environmental, privacy, or CPTED implications or considerations.

Due Date for Follow-up and/or Project Completion

Funding for these programs in 2017 is subject to City Council approval as part of its budget deliberations, scheduled for November 30, 2016 and December 1, 2016. A further report will be provided in early 2017 outlining the locations where sidewalks will be constructed under Capital Project #0948.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Attachments

1. Sidewalk Retrofit Program
2. Corporate Accessibility Implementation
3. Sidewalk Maintenance & Safety Program

Report Approval

Written &	Dan Willems, Director of Major Projects
Reviewed by	Angela Gardiner, Director of Transportation
	Brandon Harris, Director of Roadways & Operations
Approved by:	Jeff Jorgenson, General Manager, Transportation & Utilities Department

SIDEWALK RETROFIT PROGRAM
Capital Project #948 – New Sidewalks and Pathways

Background
Current standards for placement of sidewalks include sidewalks and/or multi-use pathways on both sides of local, collector and arterial streets.

This program is to construct sidewalks along roadways where they currently do not exist. There are 391 locations where sidewalks have not been installed on local and collector roadways, at an estimated cost of $31M. The recently approved Active Transportation Plan identified a cost of an additional $30M to construct missing sidewalks on arterials roadways.

The Active Transportation Plan also recommended that the standard width for sidewalks on local and collector roadways be increased from 1.5 metres to 1.8 metres and to 2.5 metres on arterial roadways. The incremental cost for the change in standard has been reflected in the cost estimates for new sidewalks.

Prioritization Criteria
Sidewalk retrofit construction is prioritized as follows:

- Priority 1: Locations primarily include outstanding resident requests, recommendations from neighbourhood reviews, and locations where no sidewalks exist on either side of the roadway.
- Priority 2: Locations around high pedestrian areas such as parks, schools, and public facilities.
- Priority 3: Locations that have sidewalk along one side of the roadway, but do not lead to a park, school, senior's complex, or public facility.

Funding Source
Active Transportation Reserve (ATR) - funded by a 0.1% mill rate contribution, to a maximum of $500,000 per year.

Previous Funding Levels:

2006 – $250,000
2007 - $100,000
2008 to 2014 - $0
2015 - $23,000
2016 - $391,000 (partially funded from Traffic Safety Reserve)

For 2017, a total of $1,300,000 will be allocated to this program with funding secured through the federal Public Transit Infrastructure Fund (PTIF) to improve access to transit. Accordingly, the 2017 program will focus on sidewalk construction to improve access to or along transit corridors and be consistent with the Active Transportation Plan. The City's 50% matching contribution of $650,000 will be from a reallocation of utility dividend from Building Canada funded utility projects.

CORPORATE ACCESSIBILITY IMPLEMENTATION
Accessibility Ramp Program

Background
Capital Project #1963 – Corporate Accessibility Policy addresses the identified priorities of the Accessibility Service Level Guidelines approved in principle by City Council on September 2, 2008, and supported by the recommendations presented in the Accessibility Implementation Action Plan. The installation of accessibility ramps is included as a component in this project.

In 2011, an inventory was completed to identify locations where accessibility ramps should be constructed. The inventory identified the need for 3460 ramps at an estimated cost of $10M.

Prioritization Criteria
Installation of accessibility ramps is prioritized as follows:

- Priority 1: Locations primarily identified through resident requests.
- Priority 2: Locations consistent with criteria from 2008 Implementation of Accessibility Action Plan which includes locations near seniors' residences and Access Transit customer locations.
- Priority 3: Remaining locations.

Funding Source
Reserve for Capital Expenditure (RCE) – funding for this program has previously been allocated from RCE which is intended to finance the cost of capital expenditures at Council's discretion. RCE is funded by an annual authorized provision in the City's Operating Budget.

Previous funding levels:

2012 – $518,000
2013 – $190,000
2014 – $150,000
2015 - $0
*2016 - $0

*Note: in 2016, funding in the amount of $150,000 was approved from Transportation Infrastructure Expansion Reserve for Capital Project #2548 - Intersection Upgrades for Major Disability Ramp Repairs to fund accessibility ramps in conjunction with intersection upgrades. In addition, a further $30,000 was approved as a budget adjustment in 2016 from the Traffic Safety Reserve.

For 2017, a total of $500,000 will be allocated to this program with funding secured through the federal Public Transit Infrastructure Fund (PTIF) to improve access to transit. Accordingly, the 2017 program will focus on accessibility ramps in locations to improve access to or along transit corridors and be consistent with the Active Transportation Plan. The City's 50% matching contribution of $250,000 will be from a reallocation of utility dividend from Building Canada funded utility projects.

SIDEWALK MAINTENANCE AND SAFETY PROGRAM

Background

The City of Saskatoon operates over 1500 km of sidewalks and walkways. The Sidewalk Maintenance and Safety Program is responsible for postponing expensive rehabilitations and replacements, reducing public safety risks such as tripping hazards, and ensuring normal sidewalk and walkway function.

Prioritization

Sidewalk maintenance treatments are prioritized on a risk basis. Typically, the most severe distresses in the busiest areas are treated first. However, there are other factors that affect the priority of a sidewalk repair including proximity to care homes for the elderly; schools, parks, and other public areas; and locations where sidewalks exist on only one side of a roadway.

Public complaints or inquiries by special interest groups provide input for work scheduling as well. All requests are reviewed and treatment options, prioritization and scheduling is determined based on the risk factors listed above.

Treatments

Sidewalk maintenance treatments include the following:

- Grinding or saw cutting to remove elevated trip hazards;
- Asphalt patching of severe surface failures, at low spots to prevent ponding, and to match adjacent sidewalk panels;
- Filling of light to moderate cracks;
- MG-Krete, a cement and epoxy surface treatment, to treat worn or scaled surfaces; and
- Full replacement of high priority isolated panel failures.

Funding

Sidewalk maintenance received $1.03M in funding for 2016 through the operating budget.

2017 Neighbourhood Traffic Management Reviews

Recommendation
That the Standing Policy Committee on Transportation recommend to City Council:

That the eleven neighbourhoods selected for 2017 traffic reviews, as part of the Neighbourhood Traffic Management Program, include Queen Elizabeth, Exhibition, Buena Vista, Erindale, Arbor Creek, Pleasant Hill, Dundonald, North Park, Richmond Heights, Silverwood Heights, and Wildwood.

Topic and Purpose

This report identifies the eleven neighbourhoods selected for traffic reviews in 2017. The traffic reviews are intended to address local traffic concerns such as speeding, shortcutting, pedestrian accommodation, and parking.

Report Highlights

The eleven neighbourhoods selected for traffic reviews include Queen Elizabeth, Exhibition, Buena Vista, Erindale, Arbor Creek, Pleasant Hill, Dundonald, North Park, Richmond Heights, Silverwood Heights, and Wildwood based on Councillor input, collision history, number of concerns received, and number of existing temporary traffic calming devices.

Strategic Goal

This report supports the Strategic Goal of Moving Around as it improves the safety of all road users (pedestrians, cyclists, and drivers), and helps provide a great place to live, work, and raise a family.

Background

City Council, at its meeting held on August 14, 2013, approved a new process within the Neighbourhood Traffic Management Program. This process includes a strategy to review concerns on a neighbourhood-wide basis by engaging the community and stakeholders in first identifying specific traffic issues, and secondly, developing joint recommendations that address the issues.

In 2014, Neighbourhood Traffic Plans were developed for the following eleven neighbourhoods: Varsity View, Westmount, Brevoort Park, Holliston, Haultain, Hudson Bay Park, Caswell Hill, City Park, Kelsey-Woodlawn, Mayfair, and Nutana.

In 2015, Neighbourhood Traffic Plans were developed for the following eight neighbourhoods: Mount Royal, Adelaide-Churchill, Lakeview, Meadowgreen, Montgomery Place, Confederation Park, Avalon, and Greystone Heights.

In 2016, Neighbourhood Traffic Plans are being developed for the following eight neighbourhoods: Stonebridge, Willowgrove, Hampton Village, Silverspring, Grosvenor Park, Lakeridge, Sutherland, and Parkridge.

Report

Neighbourhoods were prioritized based on the following criteria:

- Councillor priorities (3 points per selection);
- Collisions (0 points for low, 1 point for medium, 2 points for high);
- Number of outstanding concerns (1 point per concern); and
- Number of temporary traffic calming devices in place (1 point per device).

In three instances, adjacent neighbourhoods were grouped together in order to maximize efficiencies and to accommodate more people and neighbourhoods, resulting in eight separate traffic reviews.

This process results in the following neighbourhoods selected for 2017 traffic reviews:

- Queen Elizabeth and Exhibition (Ward 7);
- Buena Vista (Ward 6);
- Erindale and Arbor Creek (Ward 10);
- Pleasant Hill (Ward 2);
- Dundonald (Ward 4);
- North Park and Richmond Heights (Ward 1);
- Silverwood Heights (Ward 5); and
- Wildwood (Ward 9).

Speeding concerns in other neighbourhoods will continue to be addressed on a case-by-case basis.

The prioritization of the neighbourhoods are illustrated in Attachment 1.

The neighbourhoods reviewed since this process began, and distribution city wide, is shown in Attachment 2.

Public and/or Stakeholder Involvement

Public meetings will be held for each of the eight reviews, including an initial meeting with residents and stakeholders, to identify specific traffic concerns and potential improvements, and a second meeting to present a neighbourhood draft traffic plan for discussion. A third meeting may be required if significant changes of the traffic plan are requested. The neighbourhoods grouped together will attend a combined meeting.

Residents and business owners who cannot attend the meetings will be able to provide feedback via the City of Saskatoon's (City) online neighbourhood traffic concerns form, Shaping Saskatoon.ca website, or by phone, email, or mail.

Initial meetings will be held in spring 2017, while the second meetings will be held in fall 2017.

The City's internal departments will have an opportunity to provide input on the plan pertaining to the impact on their operations.

Communication Plan

Residents and stakeholders in each neighbourhood will be invited to attend both meetings. The meeting invitations will be provided as follows:

- A flyer delivered to each residence in the neighbourhood;
- Through the Shaping Saskatoon.ca website;
- Through requesting the neighbourhood community associations to post the information on their website or Facebook page; and
- By notifying the appropriate Councillor.

The collection of issues and potential improvements will be completed through the following:

- The Shaping Saskatoon.ca website;
- Written submissions at the meetings;
- Written notes taken by the Administration at the meetings; and
- Written, verbal, and e-mail submission to the Administration.

Financial Implications

The resources required to undertake the neighbourhood traffic reviews outlined in this report are estimated at $350,000, and will be submitted for approval as part of the 2017 Business Plan and Detailed Budget under Capital Project #1512 – Neighbourhood Traffic Management funded from the Traffic Safety Reserve.

Improvements identified in the traffic plans are funded through the Traffic Safety Reserve. The purpose of the Traffic Safety Reserve is to provide funding for vehicular traffic, pedestrian, and safety related projects, including traffic calming. It is funded from the City's share of the fine revenue generated from red light cameras and Automated Speed Enforcement.

Environmental Implications

Neighbourhood traffic reviews are expected to have positive greenhouse gas emissions implications, as the tendency is to reduce total vehicle mileage in an area by reducing speeds and improving conditions for walking, cycling, and transit use.

Other Considerations/Implications

There are no other options, policy, privacy, or CPTED considerations or implications.

Due Date for Follow-up and/or Project Completion

A report presenting the traffic plan will be prepared for each neighbourhood, and an annual report outlining the following years' selections will be presented to City Council.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Attachments

1. Neighbourhood Prioritization List
2. Neighbourhood Selections

Report Approval

Written by:	Justine Marcoux, Transportation Engineer, Transportation
Reviewed by:	Jay Magus, Engineering Manager, Transportation Angela Gardiner, Director of Transportation
Approved by:	Jeff Jorgenson, General Manager, Transportation & Utilities Department

TRANS JM – 2017 Neighbourhood Traffic Management Reviews.docx

Neighbourhood	# of Concerns	Temporary Traffic Calming Devices	Collisions	Councillor Selection	TOTAL SCORE	Year of Review	Ward
Queen Elizabeth / Exhibition	24	1	1		26		7
Buena Vista	17		-	3	20		6
Erindale / Arbor Creek	12	2	-	3	17		10
Pleasant Hill	10	-	2	3	15		2
Dundonald	8	1	-	3	12		4
North Park / Richmond Heights	7	1	-	3	11		1
Silverwood Heights	6	1	1	3	11		5
Wildwood	6		2	3	11		9
College Park / College Park East	6		1	3	10		8
Eastview	6	1	-	3	10		7
Pacific Heights	10		-		10		3
Evergreen	7		1		8		10
Riversdale	1	5	2		8		2
Fairhaven	3		1	3	7		3
Massey Place	6	1	-		7		4
Westview	6	1	-		7		4
Holiday Park / King George	5	1	-		6		2
Briarwood	4		1		5		8
River Heights	4		1		5		5
Lakewood SC	3		1		4		9
Rosewood	4		-		4		9
Forest Grove	3		-		3		1
Lawson Heights	2		-		2		5
Nutana SC	-		2		2		7
Nutana Park	-		-		-		7
The Willows	-		-		-		7
Brevoort Park						2014	8
Caswell Hill						2014	2
City Park						2014	2
Haultain						2014	1
Holliston						2014	6
Hudson Bay Park						2014	6
Kelsey-Woodlawn						2014	1
Mayfair						2014	1
Nutana						2014	6
Varsity View						2014	6
Westmount						2014	4
Confederation Park						2015	3
Montgomery Place						2015	2
Greystone Heights						2015	8
Avalon						2015	7
Lakeview						2015	9
Meadowgreen						2015	2
Mount Royal						2015	4
Adelaide-Churchill						2015	7
Stonebridge						2016	7

Neighbourhood	# of Concerns	Temporary Traffic Calming Devices	Collisions	Councillor Selection	TOTAL SCORE	Year of Review	Ward
Willowgrove						2016	10
Hampton Village						2016	4
Sutherland						2016	1
Silverspring						2016	10
Grosvenor Park						2016	6
Lakeridge						2016	9
Parkridge						2016	3

Ward	2014	2015	2016	2017	TOTAL
1	4	-	1	2	7
2	2	2	-	1	5
3	-	1	1	-	2
4	1	1	1	1	4
5	-	-	-	1	1
6	3	-	1	1	5
7	-	2	1	2	5
8	1	1	-	-	2
9	-	1	1	1	3
10	-	-	2	2	4
Total	11	8	8	11	38

Temporary 8th Street Snow Storage Site – Utilization for 2016-2017 Winter

Recommendation

That the Standing Policy Committee on Transportation recommend to City Council:

That the temporary 8th Street Snow Storage Site be reopened for the 2016-2017 winter season due to operational requirements.

Topic and Purpose

The purpose of this report is to obtain approval for the temporary 8th Street Snow Storage Site to be utilized for the 2016-2017 winter season due to operational requirements.

Report Highlights

1. The temporary 8th Street Snow Storage Site is required to accommodate private snow haulers during the commissioning and first season of the new Snow Management Facility at the Civic Operations Centre.
2. To minimize the impact to residents in the area, the snow will be pushed into a berm along the west side of the site. The temporary site will have reduced hours and restrict tailgate slamming.

Strategic Goal

This report supports the 4-year and 10-year priorities for the Strategic Goal of Moving Around by providing temporary snow storage sites to achieve levels of service and ensure that roads, streets, sidewalks and bridges are in working order and in a good state of repair during the winter season.

Background

Administration is developing a long-term snow management plan to support a city-wide snow removal program with permanent snow management facilities in each quadrant. The first permanent snow management facility will open in January 2017 at the Civic Operations Centre, replacing the temporary Valley Road Snow Storage Site. Temporary snow storage sites will again be available on Wanuskewin Road and Central Avenue for this season.

The temporary 8th Street Snow Storage Site was developed in 2014 while a permanent southeast site was procured. The intent and the communication to adjacent neighbourhoods was to only require the site for two winter seasons (2014/2015 and 2015/2016). The site was accessed significantly less than the other three sites and very few residents contacted the City with complaints about noise or other issues.

Report

Extension of the temporary 8th Street Snow Storage Site

The new Civic Operation Centre (COC) Snow Management Facility, which is expected to open January 1, 2017, has capacity to accommodate the southeast users until a permanent Snow Management Facility is in place. It is recommended that the temporary 8th Street site be reopened for one more winter season to accommodate snow storage in November and December, and provide an alternative site to decrease pressures during the first four operating months of the COC Snow Management Facility.

Reduced Hours and Restrictions

To reduce impact on residents, tailgate slamming and site access after 10:00 p.m. will not be permitted at the 8th Street site. The gates will be locked overnight and site signage will advise of restrictions in place. All initial snow will be placed along the west border of the site to minimize truck noise and headlights. This has proven successful in previous years at this site and other temporary sites.

Options to the Recommendation

The Standing Policy Committee on Transportation may recommend that City Council direct the Administration to close the temporary 8th Street Snow Storage Site and rely on the two north temporary snow storage sites located on Central Avenue, and Wanuskewin Road until the Civic Operation Centre Snow Management Facility opens, January 1, 2017. The risk of this approach is major congestion at the north sites if there is significant snow in November and December 2016, and if there is a delay in opening the new Snow Management Facility. Preparing a temporary site requires dry ground conditions and takes several weeks to complete each season, and is best managed in the fall.

Communication Plan

Adjacent residents will be updated through their community associations and in a flyer mailed to Briarwood and Lakeview addresses. Snow haulers may subscribe to the City's e-mail list for timely snow storage site updates at saskatoon.ca/snow. Site signage will be in place to notify snow haulers of all site restrictions.

Financial Implications

The cost for Administration to operate the temporary 8th Street Snow Storage Site is estimated to be between $50,000 to $100,000 per winter, depending on snow volume and usage.

Other Considerations/Implications

There are no policy, public and/or stakeholder engagement, environmental, privacy, or CPTED implications or considerations.

Due Date for Follow-up and/or Project Completion

Administration will continue to provide updates on the long-term plan for snow storage.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Attachment

1. Temporary 8th Street Snow Storage Site Frequently Asked Questions

Report Approval

Written by: Eric Quail, Roadways Manager
Reviewed by: Brandon Harris, Director of Roadways & Operations
Approved by: Jeff Jorgenson, General Manager of Transportation and Utilities

TRANS EQ – Temporary 8th Street Snow Storage Site – Utilization for 2016-2017 Winter.docx

City of Saskatoon

Temporary 8th Street Snow Storage Site
Frequently Asked Questions

Why is the temporary snow storage site on 8th Street open again?

The new Snow Management Facility at the Civic Operations Centre on Valley Road is scheduled to open in January 2017. This facility has capacity to accommodate the southeast site users as long as necessary. The recommendation is to keep the temporary 8th Street snow storage site open for one more winter season to decrease pressure and provide an alternative site for the first operational season of the new facility.

Why do you have to have a southeast site this year? Can't it wait until you have permanent land?

We have heard loud and clear that snow removal is critical for many commercial and multi-unit residential properties with no space to store snow. The southeast quadrant has many of these types of properties that want to keep trucking costs down with a nearby site. In 2014, residents were told the site would only be used for two years while land was procured. The City continues the process for securing land for a permanent Snow Management Facility in each quadrant to accommodate a city-wide snow removal program.

The water table in this area is already high in our neighbourhood. Will we have to worry about more water in the spring causing flooding in our homes?

The site is graded to manage the snow melt in a way that has not increased the problem in the past two years while in operation.

Are there any safety concerns for nearby residents?

Dangers that exist are contained within the site where large trucks will be backing up, dumping and turning around. The rules of the site will be posted at the entrance to include use of full Personal Protective Equipment, a maximum speed of 20 km/h and a reminder for passengers to remain in the vehicle at all times.

Will the site be fenced off?

There will be locking gates at the entrance and exit which will be closed outside of the hours of operation. Snow fence will be installed to control the litter. Anyone entering the site without authorization may be charged with trespassing.

Is the site open on the weekend?

The site will be open 7 days a week from 7:00 a.m. to 10:00 p.m.

How many trucks will there be?

At peak times in the week following a snow event, there could be dozens of trucks per hour.

Will it be loud?

The site is designed to minimize noise disturbances for neighbours by reducing operating hours, and building a snow berm along the west boundary of the site for sound attenuation. In addition, tailgate slamming, which is slamming the tailgate against the box of the truck by hard breaking of the truck, is not allowed on this site because it can be very loud and disruptive. Registered snow haulers have been notified in advance of no tailgate slamming.

The back-up alarm on the trucks and equipment are an important safety requirement and cannot be disabled.

Will there be an odour?

When the ground is frozen, there will be no odour from the snow, but there may be some odour from the truck exhaust, which dissipates.

Who can I contact if I have a concern?

Please report concerns to the 24-hour customer service centre at 306-975-2476 or snow@saskatoon.ca. In an emergency, please call 9-1-1.

Design & Construction Services Award for Sid Buckwold Bridge

Recommendation

That the Standing Policy Committee on Transportation recommend to City Council:

1. That a budget adjustment in the amount of $360,000 be funded from the Bridge Major Repair Reserve;
2. That the engineering services proposal submitted by Stantec Consulting Ltd. for completion of the design and construction services for rehabilitation of the Sid Buckwold Bridge, at a total estimated cost, on a lump sum basis, to an upset limit of $584,656 (including P.S.T. and G.S.T.) be approved; and
3. That the City Solicitor be requested to prepare the appropriate agreement and that His Worship the Mayor and the City Clerk be authorized to execute the agreement under the Corporate Seal.

Topic and Purpose

This report is to obtain City Council approval to allocate funding for design and construction engineering services for the Sid Buckwold Bridge rehabilitation and Idylwyld Drive over 19th Street ramps, and to award the proposal submitted by Stantec Consulting Ltd. for this work.

Report Highlights

1. The Administration is requesting approval for a budget adjustment of $360,000 funded from the Bridge Major Repair Reserve to be allocated equally between Capital Project #2396 - Idylwyld Drive Northbound/Southbound over 19th Street Overpass and Capital Project #2268 - Idylwyld Drive and 19th Street to 1st Avenue Northbound Overpass.
2. The City issued a Request for Proposal (RFP) to provide engineering services for the design and construction of this rehabilitation work. The City received six proposals for the engineering services. Upon review and evaluation, the proposal submitted by Stantec Consulting Ltd was determined to be the preferred proposal.

Strategic Goal

This report supports the Strategic Goal of Asset and Financial Sustainability as measures are being taken to ensure that City bridge assets are well-managed and well-maintained.

Background

The Sid Buckwold Bridge is a post-tensioned concrete girder bridge originally constructed in 1965. Rehabilitation of the structure is planned for 2018 based on findings and recommendations from the City inspection and deck testing program.

The Idylwyld Drive over 19th Street ramps are also recommended for rehabilitation within the next four to six years. Due to the proximity in timing, the City included the scope of completing the ramp rehabilitation with the Sid Buckwold Bridge rehabilitation dependent on the proponents review, testing and recommendation which will consider both cost and impact.

Report

Capital Budget Adjustment

The requested budget adjustment of $360,000 will provide the funding to allow for the engineering design and construction services to begin in order to prepare for the bridge and possible ramp rehabilitation.

Design and Construction Services

The City's preservation plan, with the results of the Deck Testing Program, identified the need for the rehabilitation of the Sid Buckwold Bridge and the Idylwyld Drive over 19th Street ramps to optimize the service life of the structure and diminish the overall capital lifecycle costs.

The City issued an RFP for design and construction engineering services for Sid Buckwold Bridge rehabilitation with additional design and construction engineering services for the ramps. The RFP closed on October 18, 2016, and six proposals were received. After a comprehensive review, the proposal from Stantec Consulting Ltd. was determined to be the preferred proposal, at a total estimated cost, to an upset limit of $584,656 (including taxes).

Options to the Recommendation

This commission is required in order to support the City's asset management system for bridges and structures. However, an option would be to not approve the additional funding required for the project and reject the proposal of Stantec Consulting Ltd. to perform the Engineering Services. This option is not recommended.

Communication Plan

Project information and traffic restrictions impacting drivers and residents may be communicated through multiple channels including the news media, social media, construction letters, service alerts and the City's website. If necessary, advertising in the City Pages may be used.

Financial Implications

The Administration is recommending the approval of an additional $360,000 from the Bridge Major Repair Reserve allocated equally to Capital Project #2268 – Idylwyld Drive and 19th Street to 1st Avenue Northbound Overpass and Capital Project #2396 - Idylwyld Drive Northbound/Southbound over 19th Street Overpass. There is sufficient funding in the Bridge Major Repair Reserve.

The estimated net cost to the City for the engineering services as submitted by Stantec Consulting Ltd. follows:

Base bid for project	$556,815
GST (5%)	27,841
Total Bid	$584,656
GST Rebate (100%)	(27,841)
Net Cost to the City	$556,815

With the approval of the additional funding in the amount of $360,000, there will be sufficient funding available within Capital Project #2268 – Idylwyld Drive and 19th Street to 1st Avenue Northbound Overpass and Capital Project #2396 - Idylwyld Drive Northbound/Southbound over 19th Street Overpass to complete this work.

Environmental Implications
The recommendations will result in consumption of resources and associated generation of greenhouse gas emissions, once construction proceeds. The overall impact on greenhouse gas emissions is not known at this time.

Other Considerations/Implications
There are no public and/or stakeholder involvement, policy, privacy, or CPTED implications or considerations.

Due Date for Follow-up and/or Project Completion
A follow-up report is not required.

Public Notice
Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Report Approval

Written by:	Todd Grabowski, Manager, Asset Preservation for Bridges
Reviewed by:	Rob Frank, Engineering Manager, Asset Preservation
Reviewed by:	Dan Willems, Director of Major Projects
Approved by:	Jeff Jorgenson, General Manager, Transportation & Utilities Department

TRANS TG – Design & Construction Services Award for Sid Buckwold Bridge

Update on Railway Working Group

Recommendation
That the report of the General Manager, Transportation & Utilities Department dated November 14, 2016, be forwarded to City Council for consideration during the 2017 Business Plan and Budget deliberations.

Topic and Purpose
The purpose of this report is to provide an update on the progress of the Railway Working Group and to outline the scope of the upcoming work to minimize delays at rail crossings throughout the city.

Report Highlights
1. Modifications were made to Canadian National Railway's (CN) operations in the south west portion of the city to reduce traffic delays in the area.
2. Saskatoon Regional Economic Development Authority (SREDA) has completed a preliminary analysis of the economic impact of rail delays at key rail crossings throughout the city.
3. The scope of the first phase of the grade separation and rail relocation feasibility study has been developed to compare both options.
4. The second phase involves more detailed analysis on the chosen option.

Strategic Goals
This report supports the Strategic Goals of Moving Around and Quality of Life by ensuring that traffic continues to flow and supports the corporate priority of life safety initiatives within the city.

Background
The Standing Policy Committee on Transportation, at its meeting held on March 8, 2016, received a report from the General Manager of the Transportation & Utilities Department. The Committee resolved:

> "1. That the report of the General Manager, Transportation and Utilities Department dated March 8, 2016, be received as information;
> 2. That the Administration look into the cost of a feasibility study of rail line relocations, to include the current report, and report back to the 2017 Business Plan and Budget deliberations for consideration and action;
> 3. That the Administration continue the course of action with the Railway Working Group; and
> 4. That a presentation from CN and CP on rail safety, proximity guidelines, and the rail mobile app be provided to the Standing Policy Committee on Transportation at a future meeting."

Report

South West Operational Concerns

The Administration met with CN and Transport Canada in February 2016 to discuss the ongoing operational concerns in the south west portion of the city near the Viterra grain terminal on 11th Street West. Modifications were made to CN's operations for spotting cars to Viterra, resulting in a reduction in delays along 11th Street West. The Administration is continuing to monitor the impacts of CN's operations in the area.

Preliminary Economic Analysis

Saskatoon Regional Economic Development Authority has completed a preliminary analysis of the economic impact of rail delays and lost labour productivity to businesses in the Saskatoon Region. The analysis was based on nine priority rail crossing locations throughout the city:

- 22nd Street at Avenue F
- Idylwyld Drive at 25th Street
- Marquis Drive
- Preston Avenue near Innovation Place
- 11th Street at Dundonald Avenue
- Central Avenue at Gray Avenue
- 33rd Street at Edmonton Avenue
- 51st Street near Wanuskewin
- 33rd Street at 3rd Avenue/Warman Road

The results of the analysis estimated that businesses in the Saskatoon Region lose 209 hours of production per working day, or 52,668 hours per year. This translates into $2.5 Million of lost Growth Domestic Product to the Saskatoon Region economy per year (Attachment 1).

Traffic delays due to trains within the city also result in a number of indirect costs. These indirect costs have not been factored into the estimate above. Some additional factors to be considered include:

- Impact of train delays on public transit users;
- Lost time on weekends, which was not included in the above estimate;
- Increased environmental costs due to the time vehicles spend idling;
- Increased vehicle operating costs due to the time vehicles spend idling; and
- Potential for increased accident rates due to traffic congestion around train crossing intersections.

Phase One - Scope of Feasibility Study

The Administration has reached out to independent consultants and other municipalities that have explored the feasibility of relocating rail infrastructure to minimize delays on the transportation network. In order for Saskatoon to realize a significant benefit in the reduction of delays at existing rail crossings, a main priority would be to relocate the entire CP mainline, and possibly the CP yard operations.

The Administration's intent is to evaluate the feasibility of relocating CP as an initial phase of the feasibility study. The impact of CP on the city's road network is significantly greater than that of CN, due to the number of at-grade crossings along the mainline. If the relocation of CP is determined to be financially feasible, the study may further explore the relocation of CN.

Two options will be considered as part of the feasibility study for grade separations and the relocation of rail infrastructure. To determine the relative benefits and costs, each of the two options will be compared to the current state of at-grade rail crossings (i.e. "do nothing").

1. Construct grade separations at priority rail crossing locations; and
2. Relocate CP rail infrastructure, including CP Sutherland Yards.

The analysis to evaluate the feasibility of constructing grade separations will include:

- High level screening to identify the needs of each corridor, considering all users and adjacent land use;
- Identification of constraints, including underground services and utilities;
- Identification of impacts to adjacent properties including access and property acquisitions;
- Develop an order of magnitude cost estimate for each grade separation; and
- Cost/benefit analysis for the construction of grade separated rail crossings.

The feasibility study for rail relocation will include the following components:

- Internal stakeholder consultation including civic departments and emergency services;
- Cost/benefit analysis of rail relocation including, at a minimum:
    - Evaluation of existing rail infrastructure, including inventory of assets, condition, and replacement values;
    - Environmental impacts;
    - Economic impacts of rail delays throughout the city;
    - Impact on emergency response and goods movement; and
    - Identification and quantification of the impact of relocation to rail operations.

The feasibility study will provide the ability to compare both options to determine which to pursue further.

<u>Phase Two - Detailed Analysis</u>

The second phase of the work will involve a more detailed analysis of the chosen option to undertake extensive stakeholder consultation, and the development of a business case to approach senior levels of government for construction funding.

Should relocation be chosen as the preferred option, the relocation of rail infrastructure can occur with or without the approval of a rail company. The *Railway Relocation and Crossing Act* outlines the process for obtaining an order from the Canadian Transportation Agency to relocate rail operations away from urban areas in order to promote urban development, provided the municipality pays and relocation does not

harm the viability and finances of the railway. Key requirements under the Act, which would be undertaken in the second phase should relocation be chosen, include:

- An Urban Development Plan
- A Transportation Plan
- A Financial Plan
- Environmental Studies

Public and/or Stakeholder Involvement

Both CN and CP are members on the Railway Working Group. The Combined Business Group and the Saskatoon Regional Economic Development Authority are also represented in the Railway Working group.

Internal stakeholders will be involved in the first phase of the feasibility study. Discussions with external stakeholders will be undertaken as part of the second phase.

Communication Plan

Media briefings may be considered as the committee's work progresses.

Environmental Impacts

Delays at rail crossings increase fuel use, greenhouse gas emissions, and air pollution associated with vehicle idling. The environmental impacts of the delays, given the current traffic and train volumes, will be quantified as part of the business case.

Financial Impacts

Federal funding has been secured through the Public Transit Infrastructure Fund (PTIF) to undertake the first phase of the feasibility study at a cost of $300,000. An additional $350,000 is available to initiate the second phase of the feasibility study, for a total of $650,000. The City is responsible for 50 percent of the costs. The City's portion of funds ($325,000) will be from reallocation of a utility dividend from Building Canada funded utility projects.

Other Considerations/Implications

There are no options, policy, privacy or CPTED considerations or implications.

Due Date for Follow-up and/or Project Completion

The first phase of the feasibility study will be completed in 2017 and presented to the Standing Policy Committee on Transportation in early 2018.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Attachment

1. SITTING IDLE - An Estimate of the Lost Labour Productivity Costs to Businesses in the Saskatoon Region Due to Train Traffic Delays (SREDA August 2016)

Report Approval

Written by: Angela Gardiner, Director of Transportation
Approved by: Jeff Jorgenson, General Manager, Transportation & Utilities Department

SITTING IDLE

An Estimate of the Lost Labour Productivity Costs to Businesses in the Saskatoon Region Due to Train Traffic Delays

SASKATOON REGIONAL ECONOMIC DEVELOPMENT AUTHORITY
AUGUST 2016

Saskatoon Regional Economic Development Authority (SREDA)

SREDA is an independent non-profit economic development organization whose mandate is to help grow the local economy by providing economic information and analysis to aid in business planning, attracting new businesses, helping local companies grow, supporting entrepreneurs, coordinating regional economic development planning and marketing the Saskatoon Region.

SREDA is funded by the City of Saskatoon, regional municipalities and over 100 private sector investors. With their support, SREDA helps grow the local economy and create jobs and prosperity for the Saskatoon Region. This is done by providing programs and services focused around six pillars:

1. Business and Investment Attraction
2. Business Retentions and Expansion
3. Entrepreneurship
4. Economic Forecasting and Analysis
5. Marketing the Region
6. Regional Planning

SREDA Economic Impact Studies

As SREDA's second pillar relates to the retention and expansion of existing Saskatoon Region businesses, it falls within SREDA's mandate to assist local organizations with economic impact analysis.

SREDA's criteria for providing economic impact analysis estimates include:

- Organization is a member of SREDA
- Organization operates within the Region
- Scale of study is within the capability of SREDA staff

Disclaimer

This Economic Impact Estimate was prepared by SREDA at the request of the RWG (Railway Working Group). The figures set out in this report are estimates based on the information provided by the RWG and information provided by Statistics Canada (2010 Input-Output tables for Saskatchewan). SREDA may at some point carry out a more detailed analysis (Economic Impact Study) which may or may not lead to an adjustment of these estimates.

Table of Contents

Executive Summary

This report provides an estimate of lost labour productivity to businesses within the Saskatoon Region as a result of traffic delays at nine rail crossings within the city of Saskatoon. Results of the data analyzed estimates businesses in the Saskatoon Region lose 209 hours of production per working day, or 52,668 hours per year. This translates into a production loss of $10,068 per working day or $2.5 million lost in GDP to the Saskatoon Region economy per year.
In addition to the direct labour productivity loss incurred, motorists delayed by trains also lose 42,084 hours per year of personal time during the work week.

Train delays within the city also result in a number of indirect costs. These indirect costs have not been factored into the estimated above. Some additional factors to be considered include:

- impact of train delays on public transit users
- lost time on weekends - which was not included in the above estimate
- increased environmental costs due to time vehicles spend idling
- increased vehicle operating costs due to time vehicles spend idling
- potential for increased accident rates due to traffic congestion around train crossing intersections

As the Saskatoon Region continues to grow we would expect the magnitude of both the direct and indirect costs to increase along with increases in local economic activity and population growth.

Introduction

There are two major rail lines along with associated spur lines running through the City of Saskatoon, Canadian Pacific (CP) and Canadian National (CN) (Appendix A). These rail lines cross major road intersections at a number of points throughout the city. Each time a train crosses one of these road-railway intersections they hold up traffic, resulting in an opportunity cost due to lost productivity. SREDA has been engaged by the RWG (Railway Working Group) to provide an estimate of these traffic delays on the Saskatoon Region's economy. RWG is a group made up of participants from both the Class 1 railways (CN and CP Rail), The Greater Saskatoon Business Community, Saskatoon Fire Department and managers from both the Transportation and Planning departments of the City of Saskatoon. The group's goal is to see rail and road work positively and safely into the future of this municipality.

This report estimates the train crossings at nine rail-vehicle intersections. The estimates are in the form of lost productivity ultimately leading to lost GDP as well as lost personal time for motorists.

Data

The following vehicle and train data is used in the report:

- The number of vehicles crossing each intersection per day (collected from May 12th to 14th, 2015, with the exception of Idylwyld drive which was collected November 4th, 2014 (Appendix B)
- The number and length of trains crossing each intersection (provided by the City of Saskatoon Transportation Branch).
- The vehicle occupancy rate (obtained from Canadian Vehicles Survey (2009) by Natural Resource Canada)

FIGURE 1: VEHICLE AND TRAIN DATA

INTERSECTIONS	VEHICLE INFO		TRAIN INFO			
	Vehicles/ Minute	Occupancy Rate	Length (km)	Speed (km/hr)	Time (minutes)	Frequency
2nd/3rd Ave @ 33rd St.	19	1.65	2.55	48.30	3.17	12
Preston near Innovation Place	15	1.65	2.55	48.30	3.17	12
Idylwyld Drive @ 25th St.	21	1.65	2.55	24.15	6.34	12
Central Avenue	9	1.65	2.55	48.30	3.17	12
11th St. West of Circle Dr.	7	1.65	2.55	40.25	3.80	5
22nd St. @ Ave F	22	1.65	2.55	24.15	6.34	5
33rd St. @ Edmonton Ave.	16	1.65	1.78	40.25	2.65	6
51st St. West of Warman	22	1.65	1.78	40.25	2.65	6
Marquis Drive	15	1.65	1.78	40.25	2.65	6

(Data continued)

In order to translate the train and vehicle data into a GDP and dollar impact, this report uses data on Saskatoon's employment rate, number of employees and GDP.

FIGURE 2: SASKATOON REGIONAL ECONOMIC DATA 2015

Number of employees[1] (000)	171.5
Employment as a fraction of population	0.56
GDP[1] (000,000)	$17,193.5
Labour Productivity[2] (output/hour)	$48.20

1. Conference Board of Canada (2015Q4) *2. GDP/total work hours*

Methodology

Combining the data on the quantity and duration of train crossings with vehicle counts and vehicle occupancy allows for the estimation of person-hours of time lost due to trains crossing roadways within Saskatoon. This quantity of time can then be multiplied by the employment rate and estimated labor productivity to estimate lost GDP due to train delays.

The estimated total loss in GDP will vary depending on the time of the day a train is crossing an intersection (a train crossing at 5:00 p.m. blocks more vehicles than a train crossing at 5:00 a.m.). However due to unavailability of information on specific train crossing times, the average daily number of vehicles crossing each intersection per minute is used.

Total Time Loss

The estimated total daily time loss across intersections was calculated by using the rate of vehicles crossing each intersection per minute using the following formula:

$$\mathbf{TL} = \sum_{i=1}^{n}(ri * O)\ \frac{t_i(2a+(t_i-1)d)}{120} fi, \qquad (1)$$

Where:

TL = Total Time Loss in hours
r_i = rate of vehicles crossing i-th intersection per minute
O = vehicle occupancy rate
t_i= the time it takes for a train to cross i-th intersection
a = 1, d = 1
fi = number of times a train crosses i-th intersection per day
i = 1, 2... 9. (Number of intersections)

Lost GDP

To calculate the potential lost GDP, equation (1) is multiplied by the Saskatoon employment as percentage of population and labour productivity:

$$\mathbf{GDP\ Loss} = \sum_{i=1}^{n}(ri * o)\ \frac{t_i(2a+(t_i-1)d)}{120} fi\ (e)\ (p) \qquad (2)$$

Where:

e = Saskatoon employment as a fraction of population (2015) = 0.56
p = Labour Productivity in Saskatoon = $48.20

Results

The estimated time loss due to train delays on weekdays is calculated to be 376 hours per day. Of this, 209 hours is lost by working individuals while 167 hours is lost by non-working individuals (Figure 3).

FIGURE 3: ESTIMATED DAILY TIME LOSS

INTERSECTIONS	VEHICLES/ MINUTE	TRAIN DELAY TIME (MINUTES)	TRAINS PER DAY	PERSON-HOURS OF DELAY PER DAY BUSINESS IMPACT	PERSON-HOURS OF DELAY PER DAY PERSONAL IMPACT	TOTAL
2nd/3rd Ave @ 33rd St.	19	3.17	12	23	19	42
Preston near Innovation Place	15	3.17	12	18	14	32
Idylwyld Drive @ 25th St.	21	6.34	12	89	71	160
Central Avenue	9	3.17	12	11	9	20
11th St. West of Circle Dr.	7	3.80	5	5	4	9
22nd St. @ Ave F	22	6.34	5	39	31	70
33rd St. @ Edmonton Ave.	16	2.65	6	7	6	13
51st St. West of Warman	22	2.65	6	10	8	18
Marquis Drive	15	2.65	6	7	5	12
Total				209	167	376

Based on a 252 day working year, the daily time loss can be converted to an annual time loss. For working individuals, this amounts to 52,668 lost hours per year while for non-working individuals the time loss is 42,084 hours per year (Figure 4).

FIGURE 4: ESTIMATED ANNUAL TIME LOSS

SEGMENT OF POPULATION	ANNUAL HOURS LOST
Employed and on work time (business impact)	52,668
Not employed	42,084
Total	94,752

In order to calculate a GDP value of this delay, the total time delay apportioned to working individuals can be viewed as lost production to local businesses. Multiplying the daily lost hours by the average Saskatoon labour productivity of $48.2 per hour results in a daily GDP loss of $10,073 for the Saskatoon economy. This translates to an annual loss of $2.5 million (Figure 5). Because it is difficult to place dollar value on time for individuals not formally employed, this report only estimates the time loss and not the GDP impact of train delays for this segment of the population.

(Results continued)

FIGURE 5: ESTIMATED GDP LOSS

INTERSECTIONS	PERSON-HOURS OF DELAY PER DAY	LOST BUSINESS PRODUCTIVITY ($/DAY)	LOST BUSINESS PRODUCTIVITY ($/YEAR)
2nd/3rd Ave @ 33rd St.	23	1,123	282,902
Preston near Innovation Place	18	861	217,055
Idylwyld Drive @ 25th St.	89	4,308	1,085,617
Central Avenue	11	540	136,087
11th St. West of Circle Dr.	5	239	60,309
22nd St. @ Ave F	39	1,862	469,333
33rd St. @ Edmonton Ave.	7	338	85,085
51st St. West of Warman	10	469	118,171
Marquis Drive	7	328	82,603
Total	209	$10,073	$2,537,163

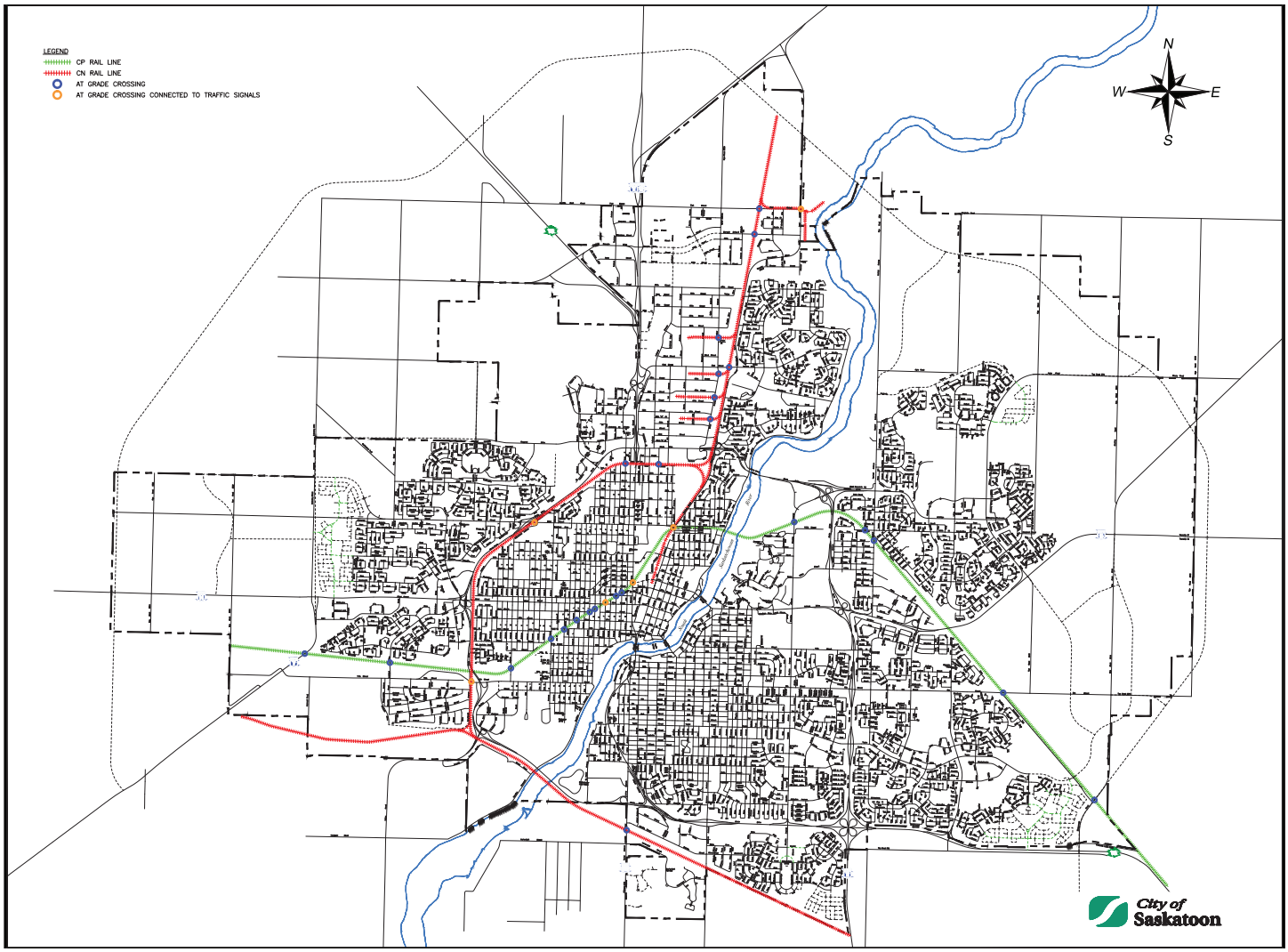
In addition to the direct costs outlined above to businesses and residents in the Saskatoon Region, train delays in the city result in a number of indirect costs. These costs have not been factored into the costs estimated above, hence the overall cost of train delays would be much greater than estimated above. Additional factors to be considered include:

- impact of train delays on public transit users
- lost time on weekends - which was not included in the above estimate
- increased vehicle operating costs due to time vehicles spent idling
- increased environmental costs due to time vehicles spent idling
- potential for increased accident rates due to traffic congestion around train crossing intersections

In the future, there is likely to be more cars on Saskatoon roads, as well as increased train traffic. This implies that the magnitude of both the direct and indirect costs outlined in this report are expected to increase along with increases in local economic activity and population growth.

Appendices

Appendix A: Rail Crossings Map



Appendix B: Traffic Data

	Number of Vehicles at Intersections per 15 minutes								
	2nd/3rd @ 3rd Street	Preston near Innovation Place	Idylwyld Drive @ 25th Street	Central Avenue	11St. West of Circle Drive	22nd Street @ Ave. F	33rd Street @ Edmonton Ave.	51st Street West of Warman	Marquis Drive
6:00 AM	96	47			120	131	92	129	
6:15 AM	154	97			118	175	141	171	
6:30 AM	218	149			136	249	219	306	
6:45 AM	284	198			120	281	265	420	
7:00 AM	344	268	387		111	308	259	346	
7:15 AM	429	316	494		138	369	297	468	
7:30 AM	558	413	688		194	309	399	594	
7:45 AM	500	496	658		206	705	412	647	
8:00 AM	523	400	637		166	456	353	548	
8:15 AM	436	407	610		172	528	384	533	
8:30 AM	461	375	551		180	485	451	489	
8:45 AM	525	368	520		165	540	389	454	
9:00 AM	391	267			126	481	271	404	
9:15 AM	377	304			125	457	246	449	
9:30 AM	371	286			106	458	238	420	
9:45 AM	413	272			133	457	265	473	
10:00 AM	411	279			105	365	201	423	
10:15 AM	422	276			115	382	236	402	
10:30 AM	413	313			117	393	269	442	
10:45 AM	444	306			103	424	248	405	
11:00 AM	438	309			110	404	212	470	
11:15 AM	512	308			121	427	241	530	
11:30 AM	265	336	522		125	464	269	607	
11:45 AM	366	359	520		123	521	305	669	
12:00 PM	343	377	553		141	542	314	616	
12:15 PM	357	352	545		143	445	318	568	
12:30 PM	546	372	536		160	532	353	618	
12:45 PM	496	377	543		161	601	360	680	
1:00 PM	543	355	576		142	547	322	559	
1:15 PM	424	338	570		141	517	282	526	
1:30 PM	474	323			148	453	282	542	
1:45 PM	490	310			114	523	288	547	
2:00 PM	486	339			108	460	299	497	
2:15 PM	456	323			145	481	298	481	
2:30 PM	483	338			140	511	341	481	
2:45 PM	528	350			160	353	367	488	
3:00 PM	408	364			183	612	395	547	
3:15 PM	599	384			181	588	481	605	
3:30 PM	594	440			221	660	504	659	
3:45 PM	591	443			236	600	484	648	
4:00 PM	712	501	665		210	687	525	668	
4:15 PM	684	526	715		236	672	522	633	

Appendix B: Traffic Data (continued)

	Number of Vehicles at Intersections per 15 minutes								
	2nd/3rd @ 3rd Street	Preston near Innovation Place	Idylwyld Drive @ 25th Street	Central Avenue	11St. West of Circle Drive	22nd Street @ Ave. F	33rd Street @ Edmonton Ave.	51st Street West of Warman	Marquis Drive
4:30 PM	720	621	761		249	747	517	822	
4:45 PM	551	529	748		284	630	576	730	
5:00 PM	729	497	736		245	669	525	874	
5:15 PM	613	414	680		274	647	521	713	
5:30 PM	532	368	582		256	581	497	572	
5:45 PM	445	345	591		215	547	486	576	
6:00 PM	396	314			181	498	416	479	
6:15 PM	350	314			144	463	378	403	

Source: City of Saskatoon, Transportation Branch

Traffic Noise Sound Attenuation – Policy Framework

Recommendation
That the Standing Policy Committee on Transportation recommend to City Council:
1. That the Administration proceed with preparing a Council Policy based on the Traffic Noise Sound Attenuation policy framework provided in this report;
2. That the recommended Traffic Noise Sound Attenuation monitoring program be included in the Council Policy; and
3. That this report be considered during the 2017 Business Plan and Budget deliberations.

Topic and Purpose
This report provides an update on the Traffic Noise Sound Attenuation (TNSA) program, including a policy framework for the program and updated sound measurements.

Report Highlights
1. A TNSA Policy Review and Development document was prepared.
2. Traffic Noise Attenuation policies of twelve jurisdictions were reviewed.
3. A review of the best practices for noise mitigation and technologies employed in other municipalities is provided.
4. Several key components that are requirements in a traffic noise policy and the recommendations for each component are provided.
5. A recommended TNSA monitoring program is provided.

Strategic Goal
This report supports the Strategic Goal of Moving Around and Quality of Life by providing TNSA to help maintain the quality of the outdoor amenity space in residential areas located adjacent to high volume roadways.

Background
In 2013, a report was submitted to City Council during the 2014 Budget Deliberations and approved the construction of nine sound attenuation projects in Capital Project #1522 – Traffic Noise Sound Attenuation. The funds were to be borrowed and repaid over a 10-year period to complete these projects. City Council also requested a revised policy before additional locations on the priority list are funded and that the priority list be updated based on this policy.

During consideration of the Capital Project #1522 – Traffic Noise Sound Attenuation report, the Standing Policy Committee on Transportation, at its meeting held on July 19, 2016, resolved:

> "That the matter be referred to the Administration to provide an update report regarding policy and standards prior to a report being submitted to the 2017 Business Plan and Budget deliberations."

Report

Scope of Policy Review

In 2016, the City of Saskatoon retained aci Acoustical Consultants Inc., a firm that specializes in acoustical engineering, to assist in the development of a Traffic Noise Attenuation Policy as follows:

- Conduct a peer review of traffic noise policies within other Canadian Jurisdictions.
- Summarize the current best practices in the field of noise attenuation engineering, including types of construction (i.e. types of materials used in walls).
- Summarize and highlight consistencies and inconsistencies, emerging technologies, and trends in policies and bylaws. This information is needed in order to determine how many other jurisdictions are facing similar sound attenuation demands and the approaches they are using in terms of policy, bylaws, and technology.
- Provide a framework and technical information pertaining to a City Policy for Traffic Noise Attenuation, along with options and potential implications related to the allowable maximum sound levels.

The complete Traffic Noise Attenuation Policy Review and Development document prepared by aci Acoustical Consultants Inc. is included as Attachment 1.

Other Cities' Policies and Practices

The following 12 policies were reviewed: City of Saskatoon (historical); City of Regina; City of Edmonton; City of Calgary; City of St. Albert; Strathcona County; City of Leduc; Fort McMurray; City of Red Deer; Alberta Transportation; BC Ministry of Transportation and Infrastructure; and Ontario Ministry of the Environment and Climate Change. A summary of the reviewed traffic noise sound attenuation policies is provided in Attachment 2.

Review of Currently Practiced Noise Mitigation

Highlights from the best practices for noise mitigation and technologies used in other municipalities are provided below:

1. Appropriate Neighbourhood Planning:
   Provide commercial development directly abutting the major transportation corridor and residential land use further into the neighbourhood; use natural buffers such as storm water management facilities, parks, and natural areas; designate heavy truck routes and bus routes away from residential developments.
2. Enforcement and Education:
   An education and enforcement program of local bylaws is critical to reducing traffic noise as standard noise barriers will not reduce the annoyance of excessively loud vehicles.
3. Barriers (Earth Berm/Noise Walls) can be used in combination:
   a. Earth Berms are equivalent to noise walls in noise mitigation but require more land than walls, maintenance of vegetation and may introduce drainage issues.

b. Noise Walls have factors for wall design to be considered: geometry, mass, reflection, gaps, access, and security.

4. Pavement/Tires:
   Largest contributor to traffic noise is vehicle tires interacting with the road at speeds above 40 to 50 kph. Low environment noise tires are not known to be commercially available, and a municipality may not have jurisdiction over the use of vehicle tires.
5. Vegetation:
   Largest level of public misconception is vegetation, as in reality vegetation typically provides an insignificant level of sound attenuation.

Traffic Noise Policy Framework

Several key components are requirements in a traffic noise policy. The recommendations for each component are as follows:

Component	Item	Details
Assessment Criteria	Decibel Scale and Weighting	dBA (A-weighted decibel sound level.)
	Threshold (Timeframe and Value)	Ldn 65 dBA (logarithmic average conducted over an entire 24-hour period with a 10 dBA penalty to the monitored or modeled noise during the night-time period.)
	Measurement Location	Receptor in defined outdoor rear amenity space, 5 m from the adjacent property line, 1.5 m elevation, 3 m from any obstructions (i.e. a shed). Applicable to single family residential land use, and townhouse type (maximum of two storeys) multi-family land use.
	Maximum Allowable Sound Level	The maximum overall sound threshold is Ldn 65 dBA
	Applicability	Residential areas only are considered for traffic noise mitigation.
	Mitigation Responsibility	Developers are responsible for traffic noise mitigation in new developments. The City is responsible for new and upgraded transportation areas, as well as, retrofit areas that are technically, economically, and administratively feasible.
Noise Impact Assessments	Applicability	Required for new developments adjacent to existing transportation corridors; new/upgraded transportation corridors adjacent to existing developments and retrofit projects for existing transportation corridors.
	Methods and Software	Use the 400,000 population horizon as the future planning horizon. See details in Attachment 1.
	Report Information	See details in Attachment 1.
Noise Monitoring	Measurement Rationale	Pre-project noise monitoring is recommended for upgraded transportation corridors as well as new development. Post-project noise monitoring may be conducted on a case-by-case basis.
	Measurement Location	See details in Attachment 1.
	Measurement Equipment	See details in Attachment 1.
Measurement Conditions	Duration and settings, weather conditions, traffic conditions, isolation conditions, noise monitoring report information – See details in Attachment 1	
Noise Barriers	Maintenance for barriers (walls and/or earth berms) on private property should be the responsibility of the property owner while maintenance for barriers on public property should be the City's responsibility. Minimum recommended noise attenuation should be a goal of 5 dBA where possible but the performance for noise barriers for new/upgraded/retrofit projects should be assessed on a case-by-case basis. The absolute minimum attenuation for retrofit projects should be 3 dBA.	

TNSA Program

Currently the Administration conducts noise measurements for residents on a first come, first served basis. In 2014, 17 noise measurements were completed and in 2015 30 were completed. The estimated cost for testing averages $20,000 per year, and of the noise measurements conducted, 90% measured under 65 dBA as the property did not back a transportation corridor. This method of addressing noise concerns has not identified any new potential TNSA projects outside of the current monitoring list.

The Administration recommends a revised approach to monitoring the potential TNSA locations that will yield useful and timely information and be more cost effective.

The Administration has developed a list of potential future sound wall projects by removing projects that are either constructed, currently being constructed, planned on being constructed with approved funding, or locations where TNSA is not feasible. Only locations adjacent to arterial roads or freeways/expressways, with average daily traffic levels greater than 20,000 vehicles per day, are included as traffic noise results from higher traffic volumes. The Administration will add potential TNSA locations for consideration by monitoring when traffic volumes over 20,000 vehicles per day are measured. The resultant recommended TNSA monitoring list is in Attachment 3.

Noise measurements will be completed every three years beginning in 2019 to quantify changes in traffic patterns as traffic volumes will shift once the North Commuter Parkway opens in the fall of 2018. The results will be submitted through a report to City Council. Large capital projects, such as interchanges, would include a review of requirements for traffic noise attenuation on a case-by-case basis, and would be outside the three-year cycle.

Other Considerations/Implications

There are no options, public and/or stakeholder involvement, communication, policy, financial, environmental, privacy, or CPTED considerations or implications.

Due Date for Follow-up and/or Project Completion

The Administration will prepare a Council Policy based on the framework outlined in this report for presentation to the SPC on Transportation in early 2017.

Public Notice

Public Notice pursuant to Section 3 of Policy No. C01-021, Public Notice Policy, is not required.

Attachments

1. Traffic Noise Attenuation Policy Review and Development, aci Acoustical Consultants Inc., November 1, 2016
2. Table 2.1 Summary of Reviewed Traffic Noise Attenuation Policies
3. Recommended Traffic Noise Sound Attenuation Monitoring List

Report Approval

Written by:	Jay Magus, Engineering Section Manager, Transportation
Reviewed by:	Angela Gardiner, Director of Transportation
Approved by:	Jeff Jorgenson, General Manager, Transportation & Utilities Department

TRANS JM – Traffic Noise Sound Attenuation – Policy Framework.docx

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Traffic Noise Attenuation Policy

Review and Development

Prepared for:

City of Saskatoon

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aci Project #: 16-073
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1.0 Introduction

aci Acoustical Consultants Inc., of Edmonton AB, was retained by the City of Saskatoon to assist in the development of a Traffic Noise Attenuation Policy (The Policy). The purpose of the work was as follows:

- Conduct a peer review of the traffic noise policies within other Canadian Jurisdictions.
- Summarize the current best practices in the field of noise attenuation engineering, including types of construction (i.e. types of materials used in walls).
- Summarize and highlight consistencies and inconsistencies, emerging technologies, and trends in policies and bylaws in order to determine the extent to which other jurisdictions are facing similar sound attenuation demands and the approaches they are using in terms of policy, bylaws, and technology.
- Provide a framework and technical information pertaining to a City Policy for Traffic Noise Attenuation, along with options and potential implications related to the allowable maximum sound levels. Recent noise modeling studies within the City of Saskatoon, conducted by aci, allowed for direct determination of noise attenuation to meet various criteria in various locations.

To that end, the information provided in the document is as follows:

- **Section 2.0**: Review of traffic noise attenuation policies within 12 jurisdictions in Canada (11 active policies and the historical policy within the City of Saskatoon. Each policy is reviewed in detail and comparisons are provided between the various policies to highlight consistencies and inconsistencies.
- **Section 3.0**: Review of the current Best Practices for transportation noise mitigation including planning, enforcement, education, barriers, pavement, and vegetation.
- **Section 4.0**: Traffic noise policy framework. This provides a detailed list of the information required and recommended for a traffic noise attenuation policy including the assessment criteria, conducting noise impact assessments, conducting noise monitoring, noise barrier specifications, and a glossary of terms.
- **Section 5.0**: Assessment of various noise attenuation criteria within the City of Saskatoon to determine the noise mitigation required to achieve each criteria target. The purpose for this was to provide a sense of sense of the scale required in order to meet the various assessment criteria which will help in the process of determining the specific assessment criteria.
- **Appendices**: Acoustic primer and list of various noise levels.

2.0 Other Jurisdictions Policy Review and Summary

2.1. General Discussion

As part of the process for developing a Traffic Noise Attenuation Policy, it is important to review the policies of other similar jurisdictions within Canada. Thus, a search was conducted for traffic noise policies within cities and municipalities across Canada. A total of 12 policies were reviewed (11 currently applicable polices and the historical policy within the City of Saskatoon). Table 2.1 provides an overall summary of all reviewed policies while Sections 2.2 to 2.13 provide a detailed summary for each policy. It is important to note that traffic noise polices were not found for some of the largest cities within Canada (including Vancouver, Winnipeg, Montreal). In general, it is at the discretion of each city or Municipality to determine if a traffic noise policy is required. One exception, however, is in Ontario in which there is a traffic noise policy that applies throughout the entire province. Also, traffic noise policies tend to be separate documents relative to noise bylaws which are intended for general noise nuisance issues such as noisy residential neighbours, or commercial/industrial development adjacent to residential areas. A review of noise bylaws was not conducted. Finally, although not formally reviewed as part of this assessment, it is worth noting the Alberta Energy Regulator (AER) Directive 038 on Noise Control (2007). The AER Directive 038 is specific to the energy industry within Alberta and not applicable to traffic noise. However, the AER Directive 038 has useful information pertaining to environmental noise measurement equipment and methods as well as a glossary of terms and a brief acoustic primer. Information contained within the AER Directive 038 was used in Section 4.0 of this report. For more information, refer to the following website: http://www.aer.ca/rules-and-regulations/directives/directive-038

2.1.1. Sound Level Criteria Comparison

Throughout the reviewed policies, the maximum allowable sound levels ranged from as low as 50 dBA (L_{eq}Night) to as high as 65 dBA $L_{eq}24$[1] [2] and various levels in between, with 65 dBA $L_{eq}24$ being the most common (used in 5 of the reviewed policies). All of the reviewed policies assess the noise at the exterior of the residential structure (even if that value is ultimately used to estimate an interior noise level). Refer to Appendix I for a description of the acoustical terms used and to Appendix II for a list of common noise sources.

The outdoor assessment location ranged from 2 m inside the property line to 3 m from the residential dwelling façade with 5 of the policies not specifically defining the location. The assessment height ranged from 1.2 m to 1.5 m (1.5 m being the most common with 5 policies) with 5 of the policies not specifically defining the height. Finally, the planning horizon for determining the need for noise attenuation ranged from 10-years to 20-years (10-years being the most common with 5 policies) with 2 policies not specifically defining the planning horizon and 1 policy specifying that the design capacity for the road be used for predictions.

None of the reviewed policies have criteria that are applicable to the second story of the residential structure and none have criteria that are applicable to multi-storey residential buildings (i.e. apartments and condominiums). Although not often stated within noise policies, traffic noise mitigation for second storey elevations is difficult and expensive to achieve and would typically require noise barrier heights that would be undesirable by the residents. Traffic noise mitigation for the higher elevations of multi-storey residential buildings is generally not possible through conventional means (i.e. noise berms and/or barriers) because of the inability to block the line-of-sight from the residential suite to the roadway and would need to be dealt with through the construction of the building itself.

In addition, none of the reviewed policies have assessment criteria for interior noise levels within the residential structure. Some of the reviewed policies make reference to desired interior noise levels with an assumed noise attenuation associated with the structure, but none have specific interior noise criteria

[1] The British Columbia Ministry of Transportation and Infrastructure Policy uses a sliding scale that depends on the noise level prior to the Project with no specific definable maximum allowable noise level, however, for areas with no new/upgraded roads a value of 65 dBA L_{dn} is considered to have a moderate impact which would trigger a noise mitigation assessment.

[2] Some jurisdictions use a maximum allowable noise level of 65 dBA L_{dn}, which is more restrictive than a level of 60 dBA $L_{eq}24$. The amount by which the two metrics differ is dependent on the difference between the day-time and night-time traffic noise levels.

that must be achieved. This is typical throughout environmental noise policies for transportation noise as well as industrial noise. The level of noise attenuation from exterior to interior will differ from structure to structure depending on the orientation relative to the noise source, the design and construction of the structure exterior, the geometries and design associated with the layout of the structure, and the sound absorptive materials (i.e. furniture, draperies, carpet) used within the structure. Plus, there are often noise sources within residential structures that can produce higher noise levels than typical interior criteria and yet the residents tend to not object to (i.e. furnace, refrigerator). Thus, it is common practice to assess noise levels at the exterior of the residential structure with an assumption of the typical structural noise attenuation (with all doors and windows closed). The most prevalent issue with this type of assessment is for residents who sleep with bedroom windows open. The exterior criteria in all of the reviewed policies (even in Ontario with the most stringent criteria of 50 dBA L_{eq}Night at the plane of the bedroom window) would generally result in nighttime noise levels above the published desired interior noise levels in residential bedrooms if the windows are open.

Finally, note that none of the reviewed polices have traffic noise criteria that are applicable to commercial or industrial development. Most of the time, this is not a significant concern since noise levels associated with industrial facilities and many commercial facilities are often at or above those associated with adjacent traffic noise and people are not living (i.e. sleeping) at these locations. The are some areas, however, where this can be a concern. For example, at commercial buildings that are located very near major roadways with large windows that face onto the roadway. It is common practice for any noise mitigation efforts associated with reducing interior noise levels to be assumed by the owner/operator of the commercial business. Other areas where this can cause concern are Hotels and other similar temporary lodgings where people are indeed sleeping. Again, a Hotel is considered a commercial business and it is common practice for any noise mitigation efforts associated with reducing interior noise levels to be assumed by the owner/operator of the commercial business.

2.1.2. Noise Monitoring Specifications Comparison

None of the reviewed policies have information pertaining to when noise measurements should be conducted (i.e. time of year, minimum duration, etc.) or the minimum noise measurement equipment requirements. With regards to the minimum equipment requirements and practices surrounding conducting a noise monitoring, this allows for the potential for vastly different noise monitoring results

with little consistency or ability to conduct meaningful comparisons in the data. Similarly, none of the reviewed policies have information pertaining to what events or actions would trigger a noise measurement to be conducted for an existing roadway.

2.1.3. Funding Comparison

For all of the reviewed policies that specifically mention new residential development adjacent to existing transportation infrastructure, the cost associated with noise mitigation is the responsibility of the developer. Some of the reviewed policies do not specify this, however, the common practice is to assume that the developer would be responsible for the cost of achieving traffic noise levels within the criteria of the specific jurisdiction.

For all of the reviewed policies that specifically mention new/upgraded roadways, bus lanes, and LRT projects, the cost associated with noise mitigation is the responsibility of the City/Municipality. Typically, the cost for noise mitigation is included in the capital cost for the project. Some of the reviewed policies, however, have no information pertaining to new/upgraded transportation infrastructure and would then assess the need for and cost of noise mitigation on a case-by-case basis.

For all of the reviewed policies that specifically mention retrofit projects (i.e. building noise barriers in existing areas with known high traffic noise levels), the cost associated with noise mitigation is the responsibility of the City/Municipality and is assessed on a case-by-case basis. The City of Calgary has a ranked list (publicly available on the City website) with the locations, estimated noise barrier dimensions, and estimated cost. The actual construction of the barriers from year to year is contingent on funding within the City budget. The City of Edmonton has a similar process by which there are internally known areas that are likely candidates for noise mitigation retrofits, pending funding.

One important component with regards to the funding of noise barriers is the criteria that have been set (i.e. maximum allowable noise levels). Some of the reviewed policies have the same criteria for new residential development and for upgrade/retrofit projects. Others, however, have two different sets of criteria. As an example, Strathcona County (Alberta) has a criterion of 55 dBA $L_{eq}24$ for new residential development and 65 dBA $L_{eq}24$ for upgrade/retrofit locations. In terms of the required quantity and cost of noise mitigation, there is a significant difference between 55 dBA $L_{eq}24$ and 65 dBA $L_{eq}24$. In recent

years, this has been a cause for concern with developers of new areas (55 dBA $L_{eq}24$ is often a difficult target to achieve) and residents in existing areas (65 dBA $L_{eq}24$ is seen by some as "too loud"). Similarly, in the City of Leduc, new residential development has a criterion of 55 dBA $L_{eq}24$ while there is no specific criterion for upgrade/retrofit projects. One reason for the lack of criteria for upgrade/retrofit projects is the high cost associated with achieving a maximum noise level of 55 dBA $L_{eq}24$. In recent years, a common practice in the City of Leduc is to provide the noise mitigation requirements to achieve a range of noise levels (55, 60, 65 dBA $L_{eq}24$) and then the City determines the actual mitigation that will be implemented based on need/benefit/cost. The result of this is criteria that can change from project to project, resulting in inconsistencies.

It is also important to note that some of the reviewed policies make reference to having a minimum 5 dBA reduction in sound level associated with implementing noise mitigation in order for the project to be considered "worth the cost". This concept of a minimum 5 dBA reduction is common for environmental noise assessments within transportation and industrial applications.

2.1.4. Policy Information Availability Comparison

Of the 11 currently applicable traffic noise policies reviewed, 4 are imbedded within municipal "engineering standards" or "development standards" documents, one was only available by phoning the City and requesting the document (after finding reference to it in a development standards document), and one was not available online at all (obtained through previous work involving the document). This often makes it difficult for the general public to locate through web-based searches unless they know specifically where to look.

2.1.5. Emerging Technologies and Trends in Policies

None of the reviewed policies make any reference to the use of emerging technologies. Specific noise mitigation measures are assessed on a project-by-project basis with noise berms and barriers being the primary method for noise mitigation. Many of the reviewed policies are several years old, and have not been recently updated. In terms of trends, there are no identifiable trends for the newer policies relative to the older policies.

Table 2.1 Summary of Reviewed Traffic Noise Attenuation Policies

City / Municipality	Policy Document	Source	Noise Level Criteria	Funding	Assessment Location	Assessment Height	Future Assessment Timeline
City of Saskatoon (Historical)	Historical information previously posted on the City of Saskatoon Website	Historical information previously posted on the City of Saskatoon Website	65 dBA Ldn (Historically)	No information for New Development City to pay for Retrofit Barriers based on need and budget	Not Defined	Not Defined	Not Defined
City of Regina	Regina Traffic Division Procedure Manual Section 6.0	Received via e-mail after calling City. Otherwise not available online.	65 dBA Ldn	Developers to pay for New Development City to pay for Retrofit Barriers based on need and budget City to pay for barriers as part of Capital Cost for new/upgraded roads where required	3 m from dwelling facade in direction of noise source	1.5 m above grade	20 year planning horizon
City of Edmonton	Urban Traffic Noise Policy (UTNP) C506A	City of Edmonton Website (easily found through Google Search)	65 dBA Leq24	Developers to pay for New Development City to pay for Retrofit Barriers based on need and budget City to pay for barriers as part of Capital Cost for new/upgraded roads where required	Private Backyards	1.5 m above grade.	20 year planning horizon
City of Calgary	Surface Transportation Noise Policy TP003	City of Calgary Website (easily found through Google Search)	60 dBA Leq24	Developers pay for New Development (up to 10-years planning for new roadways) City pay based on need and budget through specific Noise Barrier Retrofit Program City pay as part of Capital Cost for new/upgraded roads where required	Outdoor Leisure Area	Not Defined	10 year planning horizon
City of St. Albert	Municipal Engineering Standards, Section 3.9	City of St. Albert Municipal Engineering Standards Document available at City website	65 dBA Leq24	Developers to pay for New Development City to pay for Retrofit Barriers based on need and budget City to pay for barriers as part of Capital Cost for new/upgraded roads where required	Not Defined	Not Defined	Not Defined
Strathcona County	SER-009-027	Strathcona County Website (easily found through Google Search)	55 dBA Leq24 New Residential 65 dBA Leq24 Existing Residential	Developers to pay for New Development City to pay for Retrofit Barriers based on need and budget City to pay for barriers as part of Capital Cost for new/upgraded roads where required	5 m from dwelling facade in direction of noise source	1.5 m above grade	Future volumes based on design capacity of road
City of Leduc	Engineering Standards Section 1.15	City of Leduc Engineering Design Standards Document available at City website	55 dBA Leq24 New Residential No Criteria for Existing Residential	Developers to Pay for New Development No information/precedent regarding retrofits or new/updgraded road construction	5 m from dwelling facade in direction of noise source	Not Defined	Not Defined
Fort McMurray	Engineering Servicing Standards and Development Procedures, Section 4.9	RMWB Engineering Services Standards and Development Procedures document available at RMWB website	65 dBA Leq24 New Residential No Criteria for Existing Residential	Developers to Pay for New Development No information/precedent regarding retrofits	2 m inside residential property line, in direction of noise source	1.2 m above grade	10 year planning horizon
City of Red Deer	Engineering Services Design Guidelines, 2016 Edition. Section 13	City of Red Deer Engineering Services Design Guidlines Document available at City website	60 dBA Leq24 New Residential No Criteria for Existing Residential	Developers to Pay for New Development No information regarding retrofits	3 m from dwelling facade in direction of noise source. 4.5 m from Property Line if building unknown	1.5 m above grade	20 year planning horizon
Alberta Transportation	Noise Attenuation Guidelines for Provincial Highways Under Provincial Jurisdiction Within Cities and Urban Areas	Website that is not directly accessable by the public	65 dBA Leq24	Developers to pay for New Development Alberta Transportation to pay for Retrofit Barriers based on need and budget Alberta Transportation to pay for barriers as part of Capital Cost for new/upgraded roads where required	2 m inside residential property line, in direction of noise source	1.2 m above grade	10 year planning horizon
British Columbia Ministry of Transportation and Infrastructure	Policy for Assessing and Mitigating Noise Impacts From New and Upgraded Numbered Highways	BC Ministry of Transportation and Infrastructure Website	Range based on comparison to the "pre-project" noise levels with maximum allowable noise limit	Applicable for retrofits/upgrades and paid for by the Province of BC. No specific information regarding new Development	Not Defined	Not Defined	10 year planning horizon
Ontario Ministry of the Environment	Publication NPC-300. Environmental Noise Guideline, Stationary and Transportation Sources - Approval and Planning	Ontario Ministry of the Environment Website (easily found through Google search)	55 dBA LeqDay for Outdoor Living Area 50 dBA LeqNight at Window for Bedrooms	Developers to Pay for New Development No information/precedent regarding retrofits	3m from dwelling façade for outdoor living area. Plane of window for indoor.	1.5 m above grade	10 year planning horizon

2.2. City of Saskatoon

In the past, the criteria used to evaluate the road noise and barrier design within the City of Saskatoon has been as follows[1]:

> *"Only existing residential sites with a rear or side lot abutting high traffic roadways would be considered for a sound attenuation barrier. In general, the outdoor area must experience a noise level standard of 65 dBA L_{dn} or higher without a sound attenuation wall to be considered for future installation.*
>
> *Sound attenuation walls will be constructed of City-approved composite materials with due consideration to streetscape and future maintenance requirements. A public meeting with property owners may be conducted prior to deciding on the type of wall to be constructed, however, the final decision regarding the type of wall to be constructed will be at the discretion of the City of Saskatoon. Sound attenuation barriers will be constructed on the City right-of-way only. Installation of the private side yard fencing is the sole responsibility of the property owner."*

For more current traffic noise information, refer to the following website:
https://www.saskatoon.ca/moving-around/driving-roadways/managing-traffic/traffic-noise

[1] Obtained from the previous City of Saskatoon Website discussion of noise barriers. Information is no longer available on the City of Saskatoon Website.

2.3. City of Regina

The City of Regina has a traffic noise attenuation policy imbedded within Section 6.0 of the Regina Traffic Division Procedure Manual for which there is no information available online and which was obtained by calling the City and requesting the document. The Regina policy specifies a maximum allowable noise level of 65 dBA L_{dn} (day-night average level), assessed within the outdoor living space at a height of 1.5 m and 3 m from the building façade. For future assessments, the following procedure and noise level standards are to be used, as taken directly from the Regina policy:

6.0 ***Noise Level Projection Procedure***

6.1 In the case of new residential development or in the evaluation of barriers, the twenty year projection of future traffic volumes will be used in noise studies.

6.2 Traffic volume projections will be provided by the Engineering & Works Department.

6.3 Vehicle speed shall be the proposed or posted speed.

6.4 Truck volumes shall be assumed to comprise 6% of the total projected traffic flow unless known by actual traffic count or by trip generation rates and land use.

6.5 Noise levels shall be calculated using traffic noise prediction methods approved by the City of Regina Engineering & Works Department Traffic Division. These methods include: The Alberta Surface Transportation Noise Attenuation Study Manual for the Prediction of Surface Transportation Noise, the Canada Mortgage and Housing Corporation method, the Federal Highway Administration method Stamina 2.0/Optima. Other technically accurate methods of noise prediction shall be subject to Engineering & Works Department approval. When appropriate, actual measurements with noise monitoring equipment shall be employed.

6.6 Noise levels shall be calculated as the A-weighted 24-hour day-night sound level Ldn (24) expressed in decibels (dBA).

7.0 ***Noise Level Standards***

7.1 The noise level standards of this policy shall apply to all existing or proposed transportation corridors with roadway classification "Freeway", "Expressway", or "Major Arterial".

7.2 For existing or proposed transportation corridors abutting residential land, a noise level standard of 65 dBA Ldn shall apply subject to a maximum barrier height of 5.0 m, a minimum barrier height of 2.0 m, and a reduction of 5 dBA Ldn by the installation of a noise barrier.

7.3 For future or existing transportation corridors where abutting lands are to be zoned industrial or commercial, with good expectation that commercial buildings will occupy these lands and with enforcement of such zoning: no noise barrier standard shall apply.

7.4 The requirement for barriers for other land uses or zoning classifications shall be at the discretion of the City of Regina Engineering & Works Department.

7.5 Where residential developments are being planned adjacent to existing or proposed transportation corridors, the developer shall be responsible for ensuring that noise levels in the ground level outdoor living space area do not exceed 65dBA Ldn based on 20 year traffic projections.

7.6 For residential development where the incident sound level at the façade of any dwelling unit is projected to exceed 55 dBA Leq (24), the City shall require as a condition of approval that the building construction standard shall be in accordance with Canada Mortgage and Housing Corporation recommendation for "adequate sound insulation".

The Regina policy also provides detailed minimum requirements for the construction of earth berms and noise barriers (materials, geometries, locations).

For new residential development, the assessment, design and construction cost for noise attenuation is the responsibility of the developer. For existing development, the following procedure is to be used, as taken directly from the Regina policy:

8.0 ***Prioritization of Candidate Sites – Existing Development***

8.1 Candidate sites for noise attenuation shall be those with noise sensitive land use where noise level exposure in the ground level outdoor living space area nearest the roadway noise source is greater than 65 dBA Ldn.

8.2 Areas where barrier installations would not be technically or economically feasible will not be candidate sites. Such sites will include, but will not necessarily be limited to those sites where barrier heights required to meet the noise level standard would exceed 5m or where property access requirements would prevent construction of an effective barrier.

8.3 Where noise level reduction due to a barrier is expected to be less than 5 decibels, a barrier is not considered to be cost effective. Such sites will not be candidate sites.

8.4 Where roadways are rescheduled to be upgraded within the next five years; noise attenuation will be addressed at the time of roadway construction.

8.5 Feasibility of barrier placement will respect future twenty year road right-of-way requirements.

8.6 Candidate sites will be prioritized using the Barrier Priority Index which is a relative measure of the noise attenuation cost benefit ratio for each site. The Barrier Priority Index is defined as:

$$BP1 = \frac{(ENL - DNL)N}{C} \quad \textit{where}$$

BP1 = Barrier Priority Index
ENL = Estimated Noise Level in dBA Ldn based on current or projected traffic counts or actual noise measurement.
DNL = Design Noise Level in dBA Ldn or the minimum noise level for consideration in prioritization (65 dBA Ldn)
N = Number of first row ground level dwelling units which would be protected by barrier attenuation.
C = Barrier construction cost in thousands of dollars including all associated costs such as utility modifications.

The value of the index increases with the traffic noise level and number of residences protected, and decreases with the cost. The larger the value of the index the higher the relative priority of the site.

8.7 Implementation of attenuation of candidate sites will be dependent upon budget allocations, priority ranking and cost/benefit analysis.

In summary, the Regina Traffic Division Procedure Manual requires a maximum sound level of **65 dBA L_{dn}** for all residential outdoor living spaces, nearest to the roadways. For new residential development, the noise mitigation is the responsibility of the developer. For retrofit or new/upgraded road construction, the noise mitigation is the responsibility of the City, subject to economic and technical feasibility, which includes a minimum requirement of achieving a 5 dBA reduction and a maximum sound wall height of 5 m.

2.4. City of Edmonton

The City of Edmonton currently has the Urban Traffic Noise Policy (UTNP), C506A (February, 2013) which is available on the City of Edmonton website. The UTNP is applicable to residential land use adjacent to major transportation facilities such as arterial roadways, light rail transit and future high speed transit facilities. The UTNP accounts for "background" transportation noise only and does not deal with non-typical events such as loud mufflers, stereos, etc. These are dealt with under the City of Edmonton Community Standards Bylaw C14600. The following is taken directly from the UTNP:

Policy Statement:
Mitigating the impact of traffic noise in the urban environment is governed by the following:

The City of Edmonton will seek to ensure that no new residential development less than three storeys will be allowed adjacent to transportation facilities (arterial roadways, light rail transit) unless the developer proves to the satisfaction of the City that the projected noise level in the private back yards of residences abutting the transportation facility will not exceed 65 dBA Leq24. Construction of any noise attenuation measures necessary to achieve this threshold will be funded and undertaken by the developer of the adjacent property, unless specific site characteristics, such as topography or existing land uses, necessitate the consideration of relief from the requirement. Under these circumstances, the attenuated noise level in the abutting private back yards should be the lowest level technically and economically practicable.

The City of Edmonton will seek to achieve a projected attenuated noise level below 65 dBA Leq24 or as low as technically, administratively, and economically practicable, where any urban transportation facility (arterial roadways, light rail transit) is proposed to be built or upgraded through or adjacent to a developed residential area where private back yards will abut the transportation facility. Funding for noise attenuation, where appropriate, and subject to availability, is considered in the cost of the project.

Existing residential sites backing onto a transportation facility (arterial roadways, light rail transit) with measured noise levels exceeding 65 dBA Leq24 in the private back yard will be considered for noise attenuation by the City of Edmonton, where technically administratively, and economically practicable, and subject to the availability of funds and the endorsement of adjacent property owners.

The City of Edmonton will seek to minimize the impact of operational noise associated with the Light Rail Transit (LRT) system on adjacent noise-sensitive land uses while balancing the need for safety and security of road users and patrons at stations, including pedestrians at intersecting roadways.

The purpose of this policy is to:

1. *Seek to ensure that the negative impacts associated with the ongoing exposure to excessive traffic noise is mitigated in the City of Edmonton.*
2. *Assign the responsibility for traffic noise mitigation to the developers of new residential land uses as appropriate.*
3. *Assign the responsibility for traffic noise mitigation to the City of Edmonton where major transportation facilities are proposed or upgraded, subject to funding availability.*
4. *Govern the application of the City of Edmonton's "retrofit noise attenuation program", subject to funding availability.*

In addition to the 1-page UTNP C506A document, the City of Edmonton is currently working on a companion document detailing the noise measurement and modeling methodology including where measurements need to be conducted, etc. All of the details are not currently known, however, it is known that the UTNP C506A uses a 20-year planning horizon for traffic volume projections (AAWDT volumes) to predict future noise levels adjacent to new developments and new or upgraded transportation facilities. In addition, the previous version of C506A utilized a measurement and modeling height of 1.5 m above grade which will likely remain.

In summary, the UTNP requires a maximum sound level of **65 dBA L_{eq}24** for all private back yard locations adjacent to the transportation facility. For new residential development, the noise mitigation is the responsibility of the developer. For retrofit or new/upgraded road construction, the noise mitigation is the responsibility of the City, subject to economic and technical feasibility.

for more information, refer to the following website:
http://www.edmonton.ca/transportation/on_your_streets/traffic-noise.aspx

2.5. City of Calgary

The City of Calgary current has the Surface Transportation Noise Policy (STNP) TP003 (April 1988) which is available on the City of Calgary website. The following is taken directly from the STNP:

BACKGROUND

Many people are exposed to sounds which become annoying. Transportation noise, especially from vehicles, is part of our daily lifestyle. Cars and especially trucks are major sources of noise.

The City of Calgary is committed to reducing the impact of such noise sources in existing and future residential areas. As part of the planning process in Calgary, residential areas are examined to determine whether there is an existing or potential problem in outdoor rear leisure areas around the home.

The City of Calgary's Surface Transportation Noise Policy prescribes the conditions under which noise barriers are constructed adjacent to residential properties using guidelines established by the Federal Government.

PURPOSE

The intent of the Surface Transportation Noise Policy is to provide the design noise levels and descriptors, design criteria, and the responsibility for providing noise attenuation.

POLICY

DESIGN NOISE LEVEL GUIDELINES

The Design Noise Level (DNL) in residential areas for outdoor leisure areas is 60 dBA Leq 24.

In order to achieve acceptable noise levels in residential areas in a consistent and objective manner, it is necessary to utilize a guideline or target noise level. The descriptor dBA Leq 24 is defined as the daily unit of noise which condenses a full 24 hours worth of sound energy into a single number "A-Weighted" to correlate closely with human hearing. Generally, it has been found that a single number representing a 24 hour time period is a good measure of annoyance. The descriptor Leq24 has been used for a number of years and based on empirical research, has proven to be acceptable. The decibel level of 60 dBA for 24 hours has also proven to be acceptable from a benefit/cost point of view.

In residential areas it is specifically the outdoor leisure area in which target levels are to be achieved. This would include ground level areas such as yards and patios or common areas allocated outside multi-dwelling complexes. For buildings two stories or higher, where balconies are considered as the outdoor leisure area, protection should be provided on an individual basis through the use of architectural treatments.

With the achievement of the exterior DNL of 60 dBA Leq24, it is expected that the interior DNL of 45 dBA Leq24 should result with the use of standard construction materials. This level is acceptable, on an average, for most rooms inside dwellings.

In all cases, in order to maximize benefit/cost, noise attenuation should be constructed to achieve a minimum 5 decibel reduction, with a desirable target of 10 decibels. There may be instances where these criteria are not achievable and, therefore, the design noise level cannot be applied in all cases. The achievement of design noise levels must be technically, economically and administratively feasible. Therefore, feasibility is determined when the Administration reviews the details of the noise attenuation design and all alternative measures have been evaluated.

PROCEDURE

IMPLEMENTATION OF DESIGN NOISE LEVELS

In the process of implementing design noise level objectives, the roles of all participants involved in the planning, design and construction of residential subdivisions and adjacent roadways and associated noise attenuation, must be clearly defined. The general practice is that the provision of noise attenuation is dependent on the timing of the residential development and/or the transportation facility. The earlier in the planning process that noise is considered, the greater the flexibility that will be available in providing acceptable acoustical environments in residential areas.

POTENTIAL NOISE IMPACT

A Potential Noise Impact area consists of residential development proposed adjacent to major roads, expressways, freeways, light rail transit corridors, and other rail tires.

Residential development adjacent to a transportation corridor/facility may or may not experience traffic noise problems resulting from proximity to the corridor/facility. Based on field measurements and/or computer calculations, facilities are identified as having a potential noise problem and a noise impact analysis is required. In cases where residential development is proposed adjacent to existing or future transportation corridors/facilities, the developer is responsible for providing a noise impact analysis. This requirement and the analysis methodology is reviewed and approved by the Transportation Department.

RESPONSIBILITY FOR IMPLEMENTATION

The City's responsibility for achieving desirable noise levels is an ongoing process. As a general principle, the timing for providing noise attenuation is the most critical factor in determining responsibility for funding its implementation. When a developer constructs a residential development adjacent to a roadway which has a potential noise impact, if the expected noise levels exceed the City's Design Noise Level, the developer is responsible for providing noise attenuation at his expense. The choice of attenuation measure is left to the developer, subject to City approval. When the method chosen is the installation of a noise barrier, the City reimburses the cost of a 1.8 metre high chain link fence (which would have been required as a minimum) for the length of the noise barrier required.

There are four typical cases in which this responsibility can be categorized.

Case I: Residential development or redevelopment adjacent to an existing or imminent (within 10-years) transportation noise source.

The developer, at his cost, is responsible for providing noise attenuation necessary to achieve sound levels less than or equal to 60 dBA Leq24 where technically and economically feasible.

The method of attenuation should be initiated by the developer, and determined in consultation with the City in order to meet City specifications. Given the developer has maximized opportunities to provide an acceptable acoustical environment, the City will continue to accept the responsibility to further the achievement of the desired noise levels as part of the roadway design.

Example: Where there are existing transportation corridors/facilities, the future noise level is calculated based on the design year traffic volumes (10 years hence), and noise attenuation must be constructed by the developer at the time of development.

Case II: Residential development or redevelopment adjacent to a future (beyond 10-years) transportation noise source.

The developer is responsible for designing and constructing the residential area in such a way as to facilitate the necessary attenuation at the time of construction of the roadway. The City of Calgary would then be responsible for completing the required noise attenuation.

Example: Where there is a future transportation corridor, the future noise level is calculated, based on the design year (beyond 10 years). The developer shall design and construct the residential area in such a way as to accommodate the construction of noise attenuation by the City.

Case III: Upgrading of a roadway adjacent to existing residential developments:

The City is responsible for providing noise attenuation necessary to achieve the Design Noise Level where technically and economically feasible.

Example: When any upgrading takes place, such as reconstruction or new construction of roadways adjacent to an existing residential development, the City installs noise attenuation, as feasible.

Case IV: Present residential development, adjacent to an existing transportation noise source.

Problem locations are identified, and placed as a candidate on the Noise Barrier Retrofit Program for review by City Council.

Example: In situations where a noise problem has been identified, but where a roadway is not scheduled for upgrading within the foreseeable future, the City installs noise attenuation, as feasible. The process

involves a feasibility review of candidate locations, and ranking based on a benefit/cost analysis. Project priority and funding level is determined by City Council.

In summary, the City of Calgary allows for a maximum sound level of **L_{eq}24 of 60 dBA** measured within the outdoor leisure area and uses a 10-year planning horizon for noise modeling. The responsibility of noise wall costs are as follows:

- For residential development adjacent to existing or imminent transportation noise (within 10 years), the developer is responsible. The city, however, reimburses the equivalent cost of a 1.8m chain-link fence (the minimum required fencing).
- For residential development adjacent to future transportation noise (beyond 10 years), the responsibility is the cities, but the developer has to ensure there is room for the barrier in the development.
- For upgrades to existing roadways adjacent to existing residential development, the city is responsible.
- For present residential development adjacent to existing roadways, the city will consider noise wall construction in accordance with the City Noise Barrier Retrofit Program. The City has a brochure detailing the Retrofit Program along with a list of the top 10 locations which qualify for the Program, pending funding availability by the City.

For more details, refer to the website:

http://www.calgary.ca/Transportation/TP/Pages/Environment/Noise-Barrier-Program.aspx

2.6. City of St. Albert

The City of St. Albert currently has the Municipal Engineering Standards, Section 3.9 on Noise Attenuation (2013) which is available on the City of St. Albert website. The following is taken directly from the document:

"*A Noise Impact Assessment, signed and sealed by a professional engineer, must be provided in cases where a major arterial roadway and/or railway runs through or adjacent to a proposed residential development. The assessment must list the current noise levels, estimate future noise levels, and identify and implement noise attenuation measures required to achieve a* ***maximum noise level of 65 dBA Leq over a 24-hour period****, and in accordance with the City's Noise Bylaw, Bylaw 31/2006.*"

There is no information pertaining to the specific noise assessment location (distance or height). There is also no specific information pertaining to the criteria for retrofit or new/upgraded road construction, although anecdotal information indicates that the City of St. Albert will consider noise mitigation to meet 65 dBA $L_{eq}24$ for retrofit areas on a case-by-case basis (pending funding) and will consider noise mitigation to meet 65 dBA $L_{eq}24$ for new/upgraded roads as part of the capital construction cost.

For more information, refer to the following website:
http://www.stalbert.ca/business/engineering/engineering-standards/

2.7. Strathcona County (Alberta)

Strathcona County currently has the Traffic Noise Policy SER-009-027 (June 12, 2007) which is available on the Strathcona County website. SER-009-027 is applicable to all existing or new residential neighborhoods. This policy serves as a guideline to assess and, as necessary, to attenuate forecasted or actual traffic noise in these residential neighborhoods. The sound level descriptor used in all assessments is an A-weighted $L_{eq}24$. The following is taken directly from SER-009-027:

Policy Statement

A consistent framework is necessary for the assessment and, as necessary, the attenuation of forecasted or actual traffic noise in residential neighborhoods.

Definitions

A. *Outdoor Criterion Sound Level for new residential development - 55 dBA.*
B. *Outdoor Trigger Criterion Sound Level for existing residential development - 65 dBA*
C. *Receiver location - 5 metres from the rear facade of the dwelling and 1.5 metres above the ground elevation at that point*
D. *Road Design Capacity – For the purpose of this Policy, projected traffic volumes to be used for the calculation of projected noise levels on arterial roads are:*
    - *4 lane arterial road - 27,000 vehicles per day*
    - *6 lane arterial road - 40,000 vehicles per day*
E. *Sound Level Descriptor - The sound level descriptor to be used in all assessments will be the 24 Hour Energy Equivalent Sound Level or Leq (24 Hour) expressed in A-weighted decibels or dBA. All sound levels in this policy are Leq (24 Hour).*
F. *Vicinity - the depth of 2 residential lots and will be the nearest residential lots to the roadway regardless of commercial, light industrial or green space screening*
G. *Residential Urban Village - compact, walkable, mixed-use neighbourhoods, as designated in the Area Concept Plans and Area Structure Plans.*

Guidelines

A. *Attenuation of Traffic Noise for Proposed New Residential Development*
    1) *A Noise Impact Assessment, satisfactory to the Manager of Engineering and Environmental Planning, is required for all residential development to be constructed within the vicinity of existing and proposed major roadways.*

2) *The assessment must address background noise levels, the impact of current traffic levels and the impact of traffic at projected road design capacity. The assessment will identify the attenuation measures necessary to meet the Outdoor Criterion Sound Level.*

B. *Attenuation of Traffic Noise for Existing Residential Areas*

1) *No measures will be undertaken for residential neighbourhoods until the measured noise levels 5 metres from the rear facade of the dwelling and 1.5 metres above the ground elevation at that point, exceed 65 dBA.*
2) *No protection will be provided for second or subsequent storeys of houses unless such protection can be achieved by a maximum of a 2.5 metre wall on the existing grades at the road right-of-way limit.*

C. *Attenuation of Traffic Noise for Residential Urban Villages*

1) *A Noise Impact Assessment, satisfactory to the Manager of Engineering and Environmental Planning, is required for all residential development to be constructed within the vicinity of existing and proposed major roadways.*
2) *Noise attenuation will be provided through building orientation and privacy walls and fences.*

Procedures

A. *Attenuation of Traffic Noise for Proposed New Residential Development*

1) *Developers will be required to provide a design for a 55 dBA maximum noise level. The Manager of Engineering and Environmental Planning, at his sole discretion, may relax the design in the interests of practicality, however, under no circumstances shall the attenuation measures as designed permit greater than 60 dBA at design road capacity 5 metres from the facade of the nearest dwellings and 1.5 metres above the ground elevation at that point.*
2) *Traffic noise levels will be estimated using the Strathcona County Traffic Noise Prediction Model. When traffic noise predictions are made, print-outs from the model containing the input data and predicted sound levels will be attached to the Noise Impact Statement for consideration and acceptance by the County. Electronic "reports" will also be acceptable if compatible with County equipment and systems.*
3) *The traffic volumes used for the noise prediction will be the Road Design Capacity traffic volumes. Percentages of medium and heavy trucks for use in the model will be based on existing traffic counts.*
4) *The Developer shall construct or provide funds for the construction of the attenuation measures to meet the road design capacity.*
5) *Where the predicted noise levels are below the 55 dBA level without the provision of a attenuation facility, the minimum requirement acceptable is a 1.8 metre high double board wood fence. At the sole discretion of the Manager of Engineering and Environmental*

Planning this may be relaxed in circumstances where the vicinity of the house is screened from the roadway by sufficient vegetation to provide a design noise level no greater than 55 dBA, 5 metres from the nearest dwelling's facade and 1.5 metres above the ground elevation at that point. The screening property must be municipal reserve, environmental reserve, public utility lot or other such designation or use that would not reasonably be expected to change during the design life of the dwellings.

6) *Wherever possible absorptive materials will be preferred over reflective noise attenuation measures. Developers are encouraged to explore the availability of alternative construction material for the construction noise attenuation facilities and use vegetation in the development for screening of the arterial from the residence.*
7) *Achievement of C.M.H.C. recommended noise levels inside buildings is not controllable by the County. Home owners concerned about these noise levels are expected to take their own mitigative measures and should refer to Part 11 of the Alberta Building Code that specifies the use of sound insulation for the interior living areas. If requested, the Manager of Engineering and Environmental Planning may authorize home interior testing for the determination of the building attenuation measures required.*
8) *The developers of any multi-storey residences planned for "the vicinity" of a major roadway must use sound insulation for the interior living areas that conform to Part II of the Alberta Building Code.*

B. *Attenuation of Traffic Noise for Existing Residential Areas*

1) *In areas where the Outdoor Trigger Sound Level Criterion of 65 dBA noise level is exceeded, Council will consider, on a priority and availability of funds basis, the construction of such noise attenuation measures that are determined by Administration to have the desired attenuating effect.*
2) *Where residents would prefer a more expensive attenuation measure than that proposed by the County, they may petition on a local improvement charge basis to pay the difference in cost for the enhanced facility.*
3) *Where residents would prefer a noise attenuation facility in advance of the County's ability to provide it, in accordance with the Municipal Government Act, RCA 2000, M-26, they may petition for the construction of such noise attenuation measures at any time on a 100% local improvement charge basis.*
4) *The residents will be assisted by Engineering and Environmental Planning staff in the determination of the design and estimated cost of such noise attenuation measures. In conjunction with the petition process, all residents adjacent to the property line on which the facility will be constructed must sign a working easement agreement prior to implementation of the project.*

C. *Attenuation of Traffic Noise for Residential Urban Villages*

1) *Developers will be required to provide a design for a 55 dBA maximum noise level to the outdoor amenity area and deck areas.*

2) *Traffic noise levels will be estimated using the Strathcona County Traffic Noise Prediction Model. When traffic noise predictions are made, print-outs from the model containing the input data and predicted sound levels will be attached to the Noise Impact Statement for consideration and acceptance by the County. Electronic "reports" will also be acceptable if compatible with County equipment and systems.*
3) *The traffic volumes used for the noise prediction will be the Road Design Capacity traffic volumes. Percentages of medium and heavy trucks for use in the model will be based on existing traffic counts.*
4) *Developers must use sound insulation for the interior living areas that conform to Part 11 of the Alberta Building Code.*

In summary, as described in SER-009-027, the Outdoor Criterion Sound Level for new residential development is **55 dBA L_{eq}24** which may be relaxed at the sole discretion of the Manager of Engineering and Environmental Planning. Under no circumstances shall the attenuation measures as designed permit **greater than 60 dBA L_{eq}24** at design road capacity 5 meters from the facade of the nearest dwellings and 1.5 meters above the ground elevation at that point. The Outdoor Criterion Sound Level for existing residential development is **65 dBA L_{eq}24**.

for more information, refer to the following website:

http://www.strathcona.ca/departments/transportation-and-agriculture-services/traffic-management/traffic-noise/

2.8. City of Leduc

The City of Leduc currently has the Engineering Standards – Section 1.15 Noise Abatement (2006) which is available at the City of Leduc website. The following section, which is most applicable to this study, is taken directly from the Criteria:

1.15 NOISE ABATEMENT

1. *Where an arterial roadway, Secondary Highway or Primary Highway abuts or passes through a development area, the Developer shall engage an independent consultant to conduct a noise study to forecast noise levels that would be experienced within the development area from the rail and/or roadway.*

2. *Where the noise study predicts a 24 hour L_{eq} of 55 dBA or less measured or calculated at a distance of 5.0 metres from the nearest dwelling facade adjacent to the rail and/or the roadway within the subdivision area, no further action by the Developer shall be required.*

3. *Where the noise study predicts a 24 hour L_{eq} in excess of 55 dBA, the Developer shall provide noise attenuation in a form that will reduce the noise level to 55 dBA or below. Under extenuating circumstances and at the discretion of the City Engineer, the design noise level may be relaxed.*

In summary, the City of Leduc allows for a maximum sound level of **L_{eq}24 of 55 dBA** measured at approximately 5m from the nearest dwelling in the direction of the noise source. There is no mention of the height of the receptor. There is no policy regarding noise level criteria for new/modified road construction or retrofit programs.

for more information, refer to the following website:
http://www.leduc.ca/City_Government/Departments/Engineering/Engineering_Design_Standards.htm

2.9. Regional Municipality of Wood Buffalo – Fort McMurray

The Regional Municipality of Wood Buffalo (RMWB) - Fort McMurray has the Engineering Servicing Standards and Development Procedures, Section 4.9 on Sound Abatement (2013) which is available at the RMWB website. The criteria are applicable to new developments that include and/or are adjacent to arterial roadways, highways and railways, or any other land use identified to generate noise. The following is taken directly from Section 4.9:

At the direction of the Municipality, a noise impact assessment may be required for all new developments that include and/or are adjacent to arterial roadways, highways, and railways, or any other land use identified to generate noise. The threshold requiring noise mitigation measures shall be an A-weighted 24 hour equivalent sound level of 65 dB[1], measured 1.2 meters above ground level and 2 m inside of the property line (i.e. outside of the road right-of-way), adjusted for the 10 year planning horizon of the traffic loads on the adjacent arterial roadway.

The mitigation of noise can include berms or elevated contoured embankments along arterial roadways, highways and/or railways. Sound barrier fences or equivalent means of noise abatement may also be accepted by the Municipality upon approval of design submittal.

The side slopes of the embankment shall have a maximum gradient of 4H:1V. Pedestrian connectivity via a PUL shall work with the grades, by reducing the gradient and placing retaining walls where required along the adjacent property lines on the subdivision side, and cutting a walkway diagonally along the embankment at a maximum 8% grade on the roadway side. The right-of-way may require widening to suit.

In summary, the criteria sets a threshold of **65 dBA L_{eq}24** measured 1.2 m above ground level and 2 meters inside the property line. There is also no specific information pertaining to the criteria for retrofit or new/upgraded road construction.

For additional information, refer to the following website:
http://www.woodbuffalo.ab.ca/living/Services-and-Utilities/Engineering-Servicing-Standards.htm

[1] Also typically written as 65 dBA L_{eq}24.

2.10. City of Red Deer

The City of Red Deer currently has the Engineering Services Design Guidelines, Section 13.13 Noise Study (2016) which is available at the City of Red Deer website. The following is taken directly from the document:

> *The City's Traffic Noise Attenuation (Council) Policy establishes the maximum design noise level at 60 dBA Leq (24) for new development areas adjacent to expressways and arterial roadways.*
>
> *When a Noise Study is required, typically at Area Structure Planning (Section 4) or Servicing Study (Section 5), to support a project or development the following criteria shall be used:*
>
> 1. *The maximum noise level of 60 dBA Leq (24) relates to the outdoor leisure area. The receiver is located 1.5 m above the ground and 3 m from the face of the building. If the location of the building is not known, the receiver should be located 4.5 m from the property line.*
>
> 2. *Noise levels are to be predicted for the 20-year traffic volume as forecast in the current City of Red Deer Transportation Study. Predicted traffic volumes for highways (i.e. Hwy. 2, Hwy. 2A, Hwy. 11 and Hwy. 11A) should be obtained from Alberta Transportation.*
>
> 3. *The Noise Study is to contain a report of the findings and scaled drawing(s) of the site including the following:*
>   a. *building location(s),*
>   b. *receiver location(s),*
>   c. *road alignment,*
>   d. *proposed noise barrier(s),*
>   e. *coordinate grid (for FHWA method),*
>   f. *scaled cross-section at each receiver location showing roadway, receiver, and ground elevation as required,*
>   g. *traffic volumes and percentage of heavy vehicles,*
>   h. *detailed calculations used to determine noise levels and barrier heights, and*
>   i. *table showing receiver noise levels with and without a barrier.*
>
> *The package of information provided shall include the construction specifications for the sound attenuation barrier, if the Study's results warrant one.*

In summary, the City of Red Deer allows for a maximum sound level of **L_{eq}24 of 60 dBA** measured at 3 m from the face of the dwelling in the direction of the noise source at a height of 1.5 m. For areas where the locations of the proposed dwellings are not yet known, the assessment location is 4.5 m from the property line. There is also no specific information pertaining to the criteria for retrofit or new/upgraded road construction. For more information, refer to the following website:

http://www.reddeer.ca/media/reddeerca/city-services/engineering/publications/Design-Guidelines-Full-Version.pdf

2.11. Alberta Transportation

Alberta Transportation has a document entitled *Noise Attenuation Guidelines for Provincial Highways Under Provincial Jurisdiction Within Cities and Urban Areas (2002)*, which is difficult for the public to find since it is not on a published website or a website that is navigable through conventional means. Although this document does not apply to any specific Municipality, it does apply to some of the major highways operated by Alberta Transportation within major urban centers and provides a useful comparison. The following is taken directly from the document:

Definition:

Noise is defined as the sounds generated by vehicles operating on the highway. It includes but is not limited to engine/exhaust sounds and road contact sounds.

Guidelines:

- *For construction or improvements of highways through cities and other urban areas, Alberta Transportation will adopt a noise level of 65 dBA Leq24 measured 1.2 metres above ground the level and 2 metres inside the property line (outside the highway right-of-way). The measurements should be adjusted to the 10 year planning horizon value, as a threshold to consider noise mitigation measures.*
- *The mitigation of noise issues could include constructing noise walls and/or berms. The decision to implement noise mitigation must consider whether mitigation is cost-effective, technically practical, broadly supported by the affected residents, and fits into overall provincial priorities.*
- *Any accepted noise mitigation measures consistent with this guideline will be the responsibility of Alberta Transportation. Where established local noise mitigation policies are more stringent than this guideline, the local policy may be considered on a shared responsibility basis.*
- *Alberta Transportation will be responsible for noise attenuation, in accordance with this guideline, in areas where Alberta Transportation is undertaking widening (by at least one lane width) or major realignment of an existing road or constructing a new road adjacent to an existing residential development.*
- *In areas where a residential subdivision is constructed adjacent to an existing roadway, the development proponent will be responsible for noise attenuation consistent with these guidelines.*
- *In areas where a residential subdivision is constructed adjacent to a designated highway that has not been constructed, Alberta Transportation will request that the development proponent and approving authority address future noise concerns consistent with these guidelines.*

In summary, the criteria sets a threshold of **65 dBA L_{eq}24** measured 1.2 m above ground level and 2 meters inside the property line.

For additional information, refer to the following website:
http://www.transportation.alberta.ca/Content/docType490/Production/NoiseGuidelines.pdf

2.12. British Columbia Ministry of Transportation and Infrastructure

The British Columbia Ministry of Transportation and Infrastructure has the *Policy for Assessing and Mitigating Noise Impacts From New and Upgraded Numbered Highways,* April, 2014 (the BC Policy) which is available on the BC Ministry website. The BC Policy is applicable to new and existing numbered highways and freeways within the entire province, but is not specifically applicable to any other major arterial or collector roadways within the various cities and municipalities.

The BC Policy uses the day-night average sound level (L_{dn}) and, as stated in the Policy:

> *The Policy takes a "dual-threshold" approach to identifying noise impacts that warrant mitigation consideration so as to better address the range of possible impacts associated with highway projects and to provide greater flexibility in selecting mitigation measures consistent with the project degree of impact. These thresholds are shown in two forms in Figures 1 and 2. In Figure 1, baseline, or pre-project, noise levels (L_{dn}s) are plotted on the horizontal axis while total, post-project (10 years after project completion) noise levels are plotted on the vertical axis. Mitigation consideration shall be warranted for noise impact situations falling within the Moderate and Severe impact zones. Note that mitigation will only be carried out where total post-project noise levels are clearly dominated by highway traffic. In Figure 2, pre-project noise levels are shown on the horizontal axis while the project-related increases in total noise exposure required to warrant mitigation consideration are plotted on the vertical axis. The Moderate and Severe noise impact threshold values are presented in tabular form in Table 1.*

Figures 1 and 2 and Table 1 from the BC Policy, have been copied below.

Figure 1; Project-Related Traffic Noise Impact Thresholds

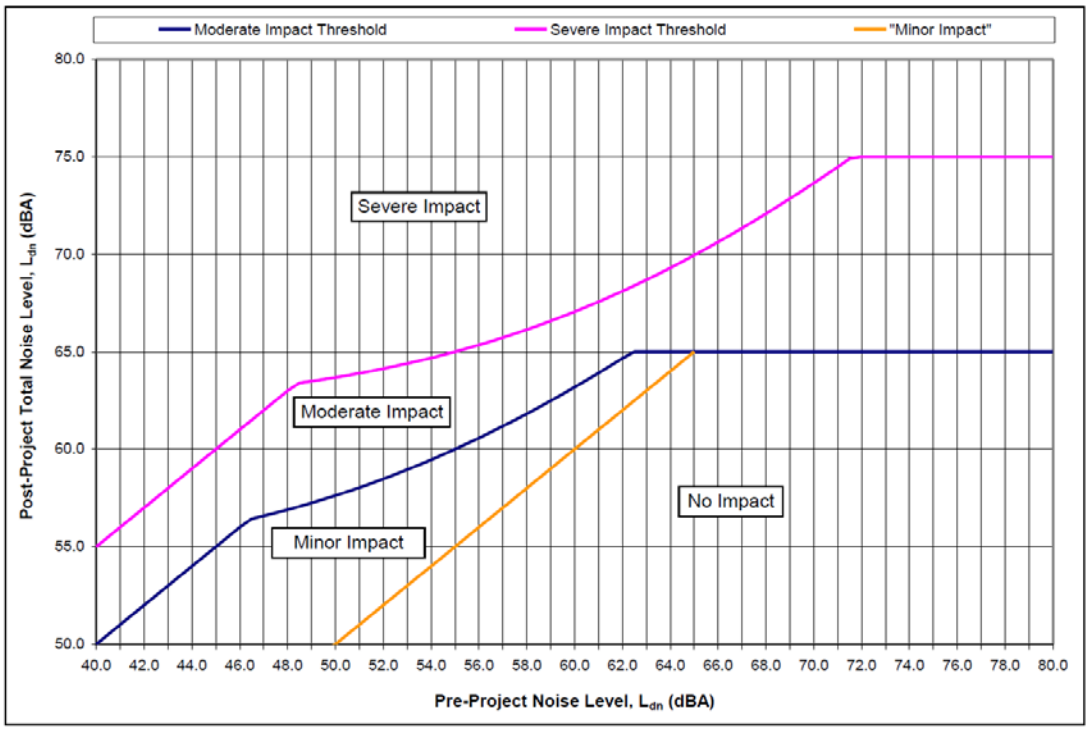

Figure 2; Increases in Total Noise Levels Permitted by Impact Thresholds of Figure 1.

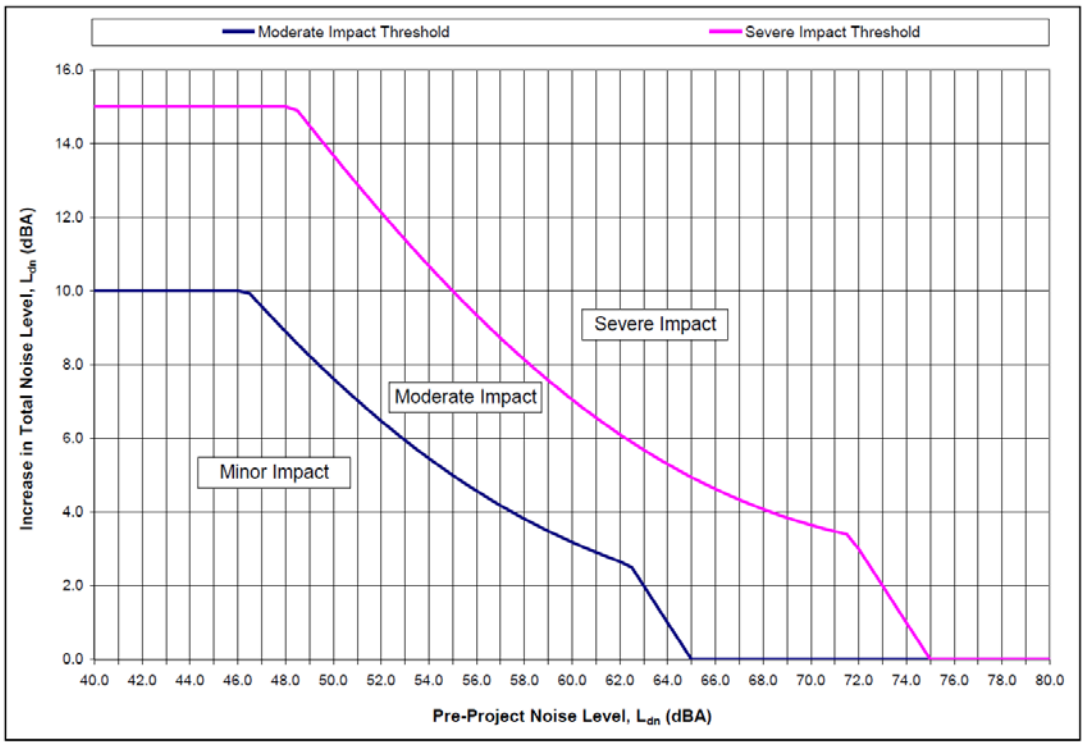

Table 1; Post-Project Total L_{dn} Values and Increases in Total L_{dn} Corresponding to Noise Impact Thresholds of Figures 1 and 2 Respectively.

Pre-Project L_{dn} (dBA)	Post-Project Total L_{dn} (dBA) (Figure 1)			Increase in Total L_{dn} (dBA) (Figure 2)		
	Minor Impact	Moderate Impact	Severe Impact	Minor Impact	Moderate Impact	Severe Impact
40.0	40.0	50.0	55.0	0.0	10.0	15.0
41.0	41.0	51.0	56.0	0.0	10.0	15.0
42.0	42.0	52.0	57.0	0.0	10.0	15.0
43.0	43.0	53.0	58.0	0.0	10.0	15.0
44.0	44.0	54.0	59.0	0.0	10.0	15.0
45.0	45.0	55.0	60.0	0.0	10.0	15.0
46.0	46.0	56.0	61.0	0.0	10.0	15.0
47.0	47.0	56.6	62.0	0.0	9.6	15.0
48.0	48.0	56.9	63.0	0.0	8.9	15.0
49.0	49.0	57.2	63.5	0.0	8.2	14.5
50.0	50.0	57.6	63.7	0.0	7.6	13.7
51.0	51.0	58.0	63.9	0.0	7.0	12.9
52.0	52.0	58.5	64.1	0.0	6.5	12.1
53.0	53.0	59.0	64.4	0.0	6.0	11.4
54.0	54.0	59.5	64.7	0.0	5.5	10.7
55.0	55.0	60.0	65.0	0.0	5.0	10.0
56.0	56.0	60.6	65.3	0.0	4.6	9.3
57.0	57.0	61.2	65.7	0.0	4.2	8.7
58.0	58.0	61.8	66.1	0.0	3.8	8.1
59.0	59.0	62.5	66.6	0.0	3.5	7.6
60.0	60.0	63.2	67.1	0.0	3.2	7.1
61.0	61.0	63.9	67.6	0.0	2.9	6.6
62.0	62.0	64.7	68.1	0.0	2.7	6.1
63.0	63.0	65.0	68.7	0.0	2.0	5.7
64.0	64.0	65.0	69.3	0.0	1.0	5.3
65.0	64.0	65.0	69.9	0.0	0.0	4.9
66.0	64.0	65.0	70.6	0.0	0.0	4.6
67.0	64.0	65.0	71.3	0.0	0.0	4.3
68.0	64.0	65.0	72.1	0.0	0.0	4.1
69.0	64.0	65.0	72.8	0.0	0.0	3.8
70.0	64.0	65.0	73.6	0.0	0.0	3.6
71.0	64.0	65.0	74.5	0.0	0.0	3.5
72.0	64.0	65.0	75.0	0.0	0.0	3.0
73.0	64.0	65.0	75.0	0.0	0.0	2.0
74.0	64.0	65.0	75.0	0.0	0.0	1.0
75.0	64.0	65.0	75.0	0.0	0.0	0.0
76.0	64.0	65.0	75.0	0.0	0.0	0.0
77.0	64.0	65.0	75.0	0.0	0.0	0.0
78.0	64.0	65.0	75.0	0.0	0.0	0.0
79.0	64.0	65.0	75.0	0.0	0.0	0.0
80.0	64.0	65.0	75.0	0.0	0.0	0.0

In summary, unlike all of the other traffic noise policies reviewed, the BC Policy uses a scaled approach with a range of allowable increases in noise levels (relative to the pre-project noise levels) as well as a maximum allowable noise limit. The document does not specify how the allowable increases or maximum limits were determined and does not provide any references for the information.

The BC Policy is applicable to residences as well as Hospitals (on a case-by-case basis). There is also discussion of noise mitigation for educational facilities, libraries, churches, and museums, however unlike the rest of the document, the criteria used for these specific spaces is a L_{eq}(max-hour) of 40 dBA inside the structure and assumes a 20 dBA reduction through the building façade, resulting in an L_{eq}(max-hour) of 60 dBA at the exterior building façade. No other reviewed policy uses the metric of L_{eq}(max-hour).

It is important to note that the specific receptor locations (location and height) are not defined in the document. Also, unlike all of the other traffic noise policies reviewed, the BC Policy is intended to apply to new highway or retrofit highway construction in which the province of BC will pay for the noise attenuation. There is no specific discussion regarding the applicability of the noise criteria for new residential development adjacent to existing highways.

For additional information, refer to the following website:
http://www.th.gov.bc.ca/publications/eng_publications/environment/references/moti_noise_policy_april_23_2014.pdf

2.13. Ontario Ministry of the Environment

The Ontario Ministry of the Environment (MOE) has Publication NPC-300, Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning (2013) which is available on the MOE website. NPC-300 covers various noise sources such as stationary (mechanical equipment) and transportation including road, rail, and aircraft. Specific to road noise, NPC-300 is used as a framework throughout Ontario in place of road noise policies in each Municipality.

As discussed in NPC-300:

> *Section C3.2.1 Method*
> *The assessment of road traffic noise impact, if required by the land use planning authority, is evaluated by prediction using statistically averaged road traffic information, based on the higher of the AADT (Annual Average Daily Traffic) or SADT (Summer Average Daily Traffic). The commonly used prediction method for road traffic noise, as recommended by MOE, is a method entitled ORNAMENT, Ontario Road Noise Analysis Method for Environment and Transportation, published in 1989 by MOE, as amended from time to time. The descriptors are the 16-hour daytime L_{eq} (16) (07:00 – 23:00) and the 8-hour nighttime (23:00 – 07:00) equivalent sound levels.*
>
> *For complete description on assessing road traffic impacts, refer to ORNAMENT. Other traffic noise prediction models have been and are being developed by various authorities and may be adopted from time to time for use in Ontario by the MOE.*
>
> *In order to be consistent with MOE guidelines, the sound level should be assessed in an Outdoor Living Area (OLA), such as a rear yard or a patio, and in indoor living areas, such as bedrooms and living rooms. Where the noise impact exceeds the applicable sound level limits, mitigation measures such as site planning, architectural design, noise barriers, building envelope elements (windows, exterior walls, doors) with upgraded sound isolation performance and/or central air conditioning may be required. Noise control measures are not required if the sound level estimated in the OLA is 55 dBA or less during the daytime and 50 dBA or less in the plane of bedroom windows during either daytime or nighttime.*

For planning purposes, a 10-year planning horizon is used. Further, the Outdoor Living Area is defined in more detail as follows:

> *"Outdoor living area (OLA)" (applies to impact assessments of transportation sources) means that part of a noise sensitive land use that is:*
> - *intended and designed for the quiet enjoyment of the outdoor environment; and*
> - *readily accessible from the building.*
>
> *The OLA includes:*
> - *backyards, front yards, gardens, terraces or patios;*
> - *balconies and elevated terraces (e.g., rooftops), with a minimum depth of 4 metres, that are not enclosed, provided they are the only outdoor living area (OLA) for the occupant; or*

- *common outdoor living areas (OLAs) associated with high-rise multi-unit buildings.*

The following considerations apply to OLAs:

1. *For the purposes of noise impact assessment in an OLA at grade, the point of assessment is typically:*
   a. *3 metres from the building façade;*
   b. *1.5 metres above grade or floor level; and*
   c. *aligned with the midpoint of the subject façade.*
2. *For elevated OLAs or those at grade that are less than 6 metres in depth, the point of assessment is in the middle of the OLA at 1.5 metres above grade or floor level.*
3. *For the purposes of the noise impact assessment in an OLA at grade, the minimum areas that require protection/consideration are 56 m^2 for single family dwellings, 46 m^2 for semi-detached dwellings and 37 m^2 per unit for row housing (dwellings). If the total area of the OLA is smaller than the areas noted above, then the entire OLA, excluding the footprint of the dwelling needs to be protected.*
4. *The noise impact assessment at an OLA excludes the effect of sound reflection from the façade. In general, the point of assessment in the OLA is a point used for prediction (including extrapolation), rather than measurement, of sound levels.*

The Plane of Window is defined as follows:

> *A point in space corresponding with the location of the center of a window of a noise sensitive space. The noise impact assessment excludes the effect of sound reflection from the plane of the window on which it is located. In general, the plane of a window is a point used for prediction (including extrapolation), rather than measurement, of sound levels. The plane of door has the same meaning as the plane of window for the purposes of this guideline.*

The NPC-300 provides for a maximum *indoor* sound level of 45 dBA L_{eq} during the day-time or night-time in residential structures (other than bedrooms) as well as hospitals, nursing homes, schools, and daycare centers. Within residential bedrooms, the maximum indoor sound levels are 45 dBA L_{eq}Day (07:00 – 23:00) and 40 dBA L_{eq}Night (23:00 – 07:00). In most jurisdictions, it is commonly assumed that the building façade (with windows closed) will attenuate traffic noise by at least 15 dBA, if it has been built to meet the Building Codes. This would represent an *exterior* noise level at the plane of window of 60 dBA during the day-time and 55 dBA during the night-time, which exceeds the criteria previously listed. Based on the criteria within the NPC-300, it can be surmised that the document assumes only a 10 dBA reduction associated with the building façade with windows closed. This is a conservative assumption.

In terms of road noise mitigation, as discussed in Section C7.1:

C7.1.1 Outdoor Living Areas

If the 16-Hour Equivalent Sound Level, L_{eq} (16) in the OLA is greater than 55 dBA and less than or equal to 60 dBA, noise control measures may be applied to reduce the sound level to 55 dBA. If measures are not provided, prospective purchasers or tenants should be informed of potential noise problems by a warning clause Type A. If the 16-Hour Equivalent Sound Level, L_{eq} (16) in the OLA is greater than 60 dBA, noise control measures should be implemented to reduce the level to 55 dBA. Only in cases where the required noise control measures are not feasible for technical, economic or administrative reasons would an excess above the limit (55 dBA) be acceptable with a warning clause Type B. In the above situations, any excess above the limit will not be acceptable if it exceeds 5 dBA.

C7.1.2 Plane of a Window – Ventilation Requirements

C7.1.2.1 Daytime Period, 07:00 – 23:00 Hours
Noise control measures may not be required if the L_{eq} (16) daytime sound level in the plane of a bedroom or living/dining room window is less than or equal to 55 dBA. If the sound level in the plane of a bedroom or living/dining room window is greater than 55 dBA and less than or equal to 65 dBA, the dwelling should be designed with a provision for the installation of central air conditioning in the future, at the occupant's discretion. Warning clause Type C is also recommended.

If the daytime sound level in the plane of a bedroom or living/dining room window is greater than 65 dBA, installation of central air conditioning should be implemented with a warning clause Type D. In addition, building components including windows, walls and doors, where applicable, should be designed so that the indoor sound levels comply with the sound level limits (previously listed). The location and installation of the outdoor air conditioning device should comply with sound level limits of Publication NPC-216, and guidelines contained in Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, or should comply with other criteria specified by the Municipality.

C7.1.2.2 Nighttime Period, 23:00 – 07:00 Hours
Noise control measures may not be required if the L_{eq} (8) nighttime sound level in the plane of a bedroom or living/dining room window is less than or equal to 50 dBA. If the sound level in the plane of a bedroom or living/dining room window is greater than 50 dBA and less than or equal to 60 dBA, the dwelling should be designed with a provision for the installation of central air conditioning in the future, at the occupant's discretion. Warning clause Type C is also recommended.

If the nighttime sound level in the plane of a bedroom or living/dining room window is greater than 60 dBA, installation of central air conditioning should be implemented, with a warning clause Type D. In addition, building components including windows, walls and doors, where applicable, should be designed so that the indoor sound levels comply with the sound level limits (previously listed). The location and installation of the outdoor air conditioning device should comply with sound level limits of Publication NPC-216, and guidelines contained in

Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, or should comply with other criteria specified by the Municipality.

C7.1.3 Indoor Living Areas – Building Components

If the nighttime sound level outside the bedroom or living/dining room windows exceeds 60 dBA or the daytime sound level outside the bedroom or living/dining area windows exceeds 65 dBA, building components including windows, walls and doors, where applicable, should be designed so that the indoor sound levels comply with the sound level limits (previously listed). The acoustical performance of the building components (windows, doors and walls) should be specified.

Warning Clause Type C

"This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."

In summary, NPC-300 allows for a maximum *exterior* sound level in the outdoor living area (1.5 m elevation and 3m from the building façade) of 55 dBA during the day-time (07:00 – 23:00) and a maximum *exterior* sound level of 50 dBA at the plane of window for residential bedrooms and 55 dBA at the plane of window for all other residential rooms during the night-time (23:00 – 07:00). This assumes a 10 dBA reduction of sound across the building façade which will result in *interior* noise levels of 40 dBA for bedrooms and 45 dBA for all other residential spaces. A 10-year planning horizon is used. There is also no specific information pertaining to the criteria for retrofit or new/upgraded road construction.

For more information, refer to the following website:

https://www.ontario.ca/page/environmental-noise-guideline-stationary-and-transportation-sources-approval-and-planning

3.0 Current Best Practices

Another component in developing a Traffic Noise Attenuation Policy is to review the current noise mitigation practices and technologies employed in other cities and municipalities. In general, these practices and technologies tend to not be written into noise policies and the information provided below is based largely on the anecdotal experience of the author, having conducted numerous traffic noise studies across Western Canada.

3.1. Planning

The first best method for reducing traffic noise for residential areas is through appropriate neighbourhood planning. Where possible, residential areas should be separated from major transportation corridors by large distances with other development in between. For example, it is recommended to have commercial development that directly abuts the major transportation corridors and then have the residential development further-in, on the other side of the commercial development. This will provide greater distance between the major transportation corridor and the residential development and will also provide barriers in the form of the commercial buildings. Similarly, the use of natural buffers like storm water management facilities (SWMFs), parks, natural areas, and other public spaces can help to provide a "distance barrier" which will lower the traffic noise levels at the residential development.

Having specific designated heavy truck routes and bus routes that are separated from the residential developments can also help to reduce the overall traffic noise impact since these vehicles contribute the largest to the overall traffic noise level.

3.2. Enforcement and Education

One significant source of traffic noise annoyance for adjacent residents is associated with excessively loud vehicles on the roadway. In many situations, the excessive noise is caused by an illegal activity such as use of engine retarder brakes within City limits, street racing or other potentially subjectively annoying activities such as excessively loud stereos, vehicles with excessively loud exhaust noise, etc. Standard engineering mitigation methods such as noise barriers or earth berms do very little to reduce the noise from these types of events. In addition, excessive noise from such events are typically under the

jurisdiction of local noise bylaws and are not covered by traffic noise attenuation policies. Thus, the solution for mitigating these types of noise sources is a program of enforcement of local bylaws and educating the public regarding the impacts of these noise sources.

3.3. Barriers

For areas where commercial and natural buffers are not feasible or for existing areas where the configuration of the road and adjacent residential locations are fixed, the next noise mitigation strategy is the use of noise barriers. Noise barriers generally come in the form of earth berms or noise walls or a combination of the two. It is common practice in many municipalities to stipulate that the noise barrier used for retrofit projects or new/upgraded roadways provide a minimum of 5 dBA of attenuation before the subjective noise reduction benefit is considered worth the cost of the installation. A traffic noise barrier that can provide 10 dBA of reduction is considered a good barrier and a 15 dBA reduction is nearing the practical limit for any traffic noise barrier.

3.3.1. Earth Berms

Earth berms can be an effective means for noise mitigation. In terms of a "barrier" effect, earth berms are similar to noise walls for any given height and location of the earth berm centerline. For example, an earth berm that is 1.83 m tall will act as a similar noise barrier to a 1.83 m noise wall if the wall was located at the same line as the centerline of the earth berm. Earth berms provide the required mass and continuity (i.e. no gaps or openings) to act as an appropriate noise barrier. In addition, relative to noise walls, earth berms naturally incorporate sound absorption through the dirt and the vegetation (typically grass and possibly bushes/shrubs). And earth berms tend to be subjectively more visually appealing than noise walls.

However, relative to noise walls, earth berms require a significant amount of land. Typical berms require slopes ranging from 3:1 to 4:1, depending on the specific municipal requirements. This means that, for a 3:1 slope, for every 1 m of height, 6 m of total width is required (3m on each side) plus the width of the top plateau. Thus, a berm that is 5 m tall would typically require at least 31 m total width (with a 1 m wide plateau) and even wider if it is desired to have a plateau that can be driven on with a vehicle for maintenance purposes. Plus, the vegetation on the berm requires maintenance (i.e. mowing grass, tending to shrubs and bushes) during the summer months which carries an associated cost. Finally, earth berms can present issues associated with water runoff and drainage.

In some municipalities, there are instances in which retrofit noise attenuation has been achieved through the use of an earth berm (or a larger earth berm than was previously there). The rear residential property line is shifted closer to the roadway (giving the resident more land), and the centerline of the earth berm is located at the new property line. This provides additional noise attenuation and gives the resident a larger lot, at the cost of having part of the lot encompass one half of an earth berm. The maintenance of that half of the earth berm is then the responsibility of the resident. Further, in some instances, the residents take it upon themselves to cut-in to the earth berm and install an appropriate retaining wall to give them more flat usable yard area.

3.3.2. Noise Walls

Noise walls are the most common form of traffic noise mitigation. Noise walls can be comprised of various materials including wood, masonry, metal, and even vegetative/living barrier walls. There are several important components required for a good noise wall, including:

- **Geometry:** The geometry associated with the noise wall is the single largest factor in determining the performance of the noise wall. The location of the noise wall (relative to the roadway and the receptors) and the height are what determine the amount of sound that will propagate over top of noise wall to the other side. In general, assuming relatively flat ground, it is better to locate the noise wall as close to the roadway or the receptors as possible with the least effective place being midway between the roadway and the receptors. The exception to this is if there is already an earth berm located in between the roadway and the receptors, in which case, it is typically best to locate the noise wall on top of the earth berm. Further, it is generally better to locate noise walls as close to roadways as possible so that all residential receptors on the "shadow" side receive similar noise reduction benefits (as opposed to locating the noise wall at the nearest rear residential property line which would largely benefit the nearest residents and then have a much lesser benefit for all other residents further-in). Also, as one would intuitively expect, a taller noise wall will attenuation the noise better than a shorter noise wall. Finally, the noise wall must be sufficiently long that it either extends well past the desired noise attenuation property OR wraps around to provide the necessary attenuation. Note that the geometry rules apply equally to noise walls and earth berms and combinations of the two.

- **Mass:** As sound propagates from the road towards the residential area with a noise wall in between, some of the sound will impact the noise wall and transmit directly through it, while some of the sound will propagate over the wall and diffract back down to the other side. It is important that the sound that transmits through the noise wall be sufficiently less than the sound that transmits over top of the noise wall. This can be accomplished by using building materials that have enough mass. For traffic noise barriers, the generally accepted minimum value is a noise wall with a surface density of at least 20 kg/m^2. This is readily achieved with a double board wood fence (if using wood materials) or any thickness of masonry materials that would commonly be used for noise wall construction.

- **Reflections:** The location of and the materials used for a noise wall can result in significant sound reflections off the wall towards the opposite direction which will increase the overall noise levels in that direction. Depending on what is located on the opposing side, these reflections and increased sound levels may be a concern. This is further compounded for situations where there are noise walls on each side of the roadway, resulting in multiple reflections and an overall increase in noise levels that limits the effectiveness of the noise walls. There are sound absorptive materials available for noise walls that can limit the amount of reflected sound. Further, it may be possible to adjust the location of the noise wall to reduce the reflected sound.

- **Gaps:** The noise wall needs to have no gaps throughout or along the bottom. Even very small gaps in the composition of the noise wall (i.e. small gaps with abutting single fence boards) will significantly compromise the performance of the noise wall, allowing too much of the sound energy to transmit directly through. This has significant implications when it comes to pedestrian pathways through the noise wall. For pedestrian pathways, it is important to install overlapping sections of wall such that there is no direct line-of-sight through the opening. Figure 3.1 provides a sample schematic of typical overlap methods. Note that these will vary for each situation and need to be reviewed by an experienced acoustical engineer.

- **Access:** For larger noise walls (typically taller than 2.44 m), access is often required to both sides of the noise wall so that the Municipality can maintain both sides. This affects the location of the noise wall as well as any vegetation that may be located nearby on either side. As mentioned previously, it is generally best to locate noise walls as close to the roadways as possible. In terms of noise attenuation, this would put the noise barrier right at the curb. However, there are traffic

safety, visibility, snow build-up, drainage, and accessibility issues that prevent having the noise wall this close. In general, the recommendation is to locate the noise wall as close as feasible to the roadway, keeping in mind all of the various other restrictions.

- **Security:** Noise walls can provide security concerns. Long spans of tall walls can provide places for criminals to hide and little means of escape for potential victims of crime. Depending on the location, the available security lighting, and the access issues, security can be a significant concern and needs to be considered when implementing noise wall design.

When using wood materials for noise wall construction, the fence boards need to be doubled and overlapped with staggered joints to minimize the gaps. Figure 3.2 provides a sample schematic of a solid screen wood fence that will provide the required composition. Typically, the main issue associated with wood is that, in order for any barrier to provide appropriate noise attenuation, it must be in direct contact with the ground with no gap underneath. This provides a long-term maintenance issue with wood rotting. Note also that most municipalities will only allow a wood fence to be built with a maximum height of 2.44 m (8 ft) due to the structural integrity and maintenance issues.

When using masonry materials, the same rules and recommendations apply, particularly with regards to the gaps in between the masonry blocks. There are various materials available that provide interlocking or overlapping joints which, when combined with the mortar, eliminate or significantly reduce the gaps. These materials can come in the form of standard sized masonry blocks that are assembled in a staggered pattern in between masonry posts or in much larger pre-cast panels that fit in between large posts and need to be maneuvered with the use of a crane. Masonry walls can be built much taller than wood fences and are the most common material used for noise walls taller than 2.44 m.

Metal materials can also be used, subject to the same rules and recommendations as with the wood and masonry materials.

Plastics and other composite materials can be used, provided that they provide the minimum level of noise reduction such that the sound transmitting through the barrier is sufficiently less than the sound that propagates over the barrier. Typically, the use of such materials is assessed on a case-by-case basis, with the vendors providing laboratory tested results for the sound transmission loss of the barrier and the values reviewed and approved by an experienced acoustical engineer.

It is important to note the use of buildings as noise barriers. Given the significant mass and continuity (i.e. no gaps) associated with typical building construction, buildings will provide the same noise barrier performance as a noise wall with the same height and length. This is why long spans of commercial buildings (for example in strip malls or big box stores) can provide significant levels of noise attenuation.

Finally, one of the most recent materials/technologies available for wall barrier design is to use a so called "living wall". There are various versions that incorporate structural support, earth, and vegetative material to provide a barrier that looks more like a hedge row than a noise wall. One method that has been used in some Canadian municipalities incorporates a central core that is made up of approximately 0.5 m thick of earth, contained within a woven cloth-like container and a wooden structure. This provides the "barrier" required for noise attenuation. On the outside of the structure (on both sides) living plant material grows and provides sound absorption and visual appeal. Given that there is living plant material, this wall would require regular maintenance.

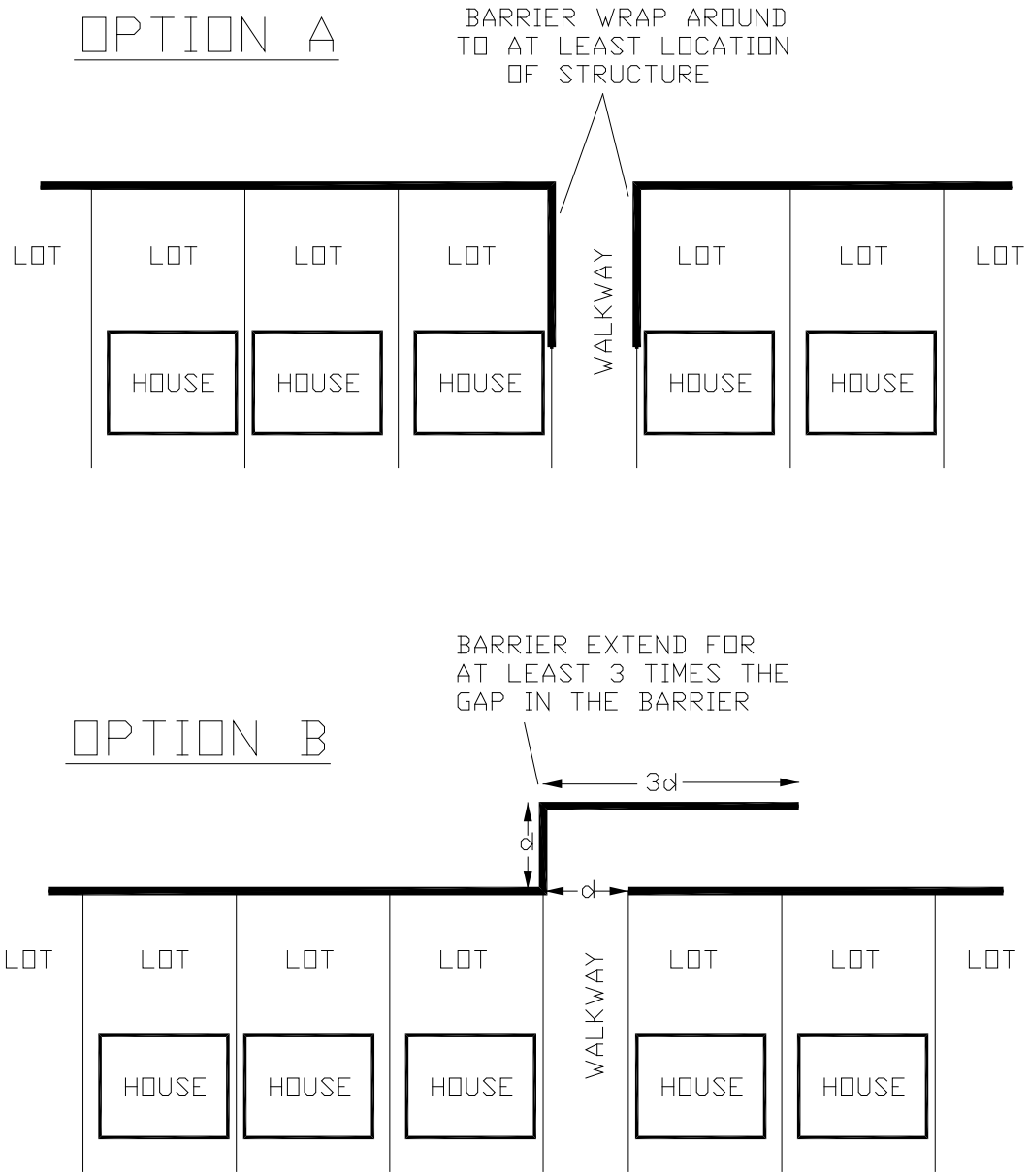

Figure 3.1. Sample Schematic of Noise Wall Walkway Overlap

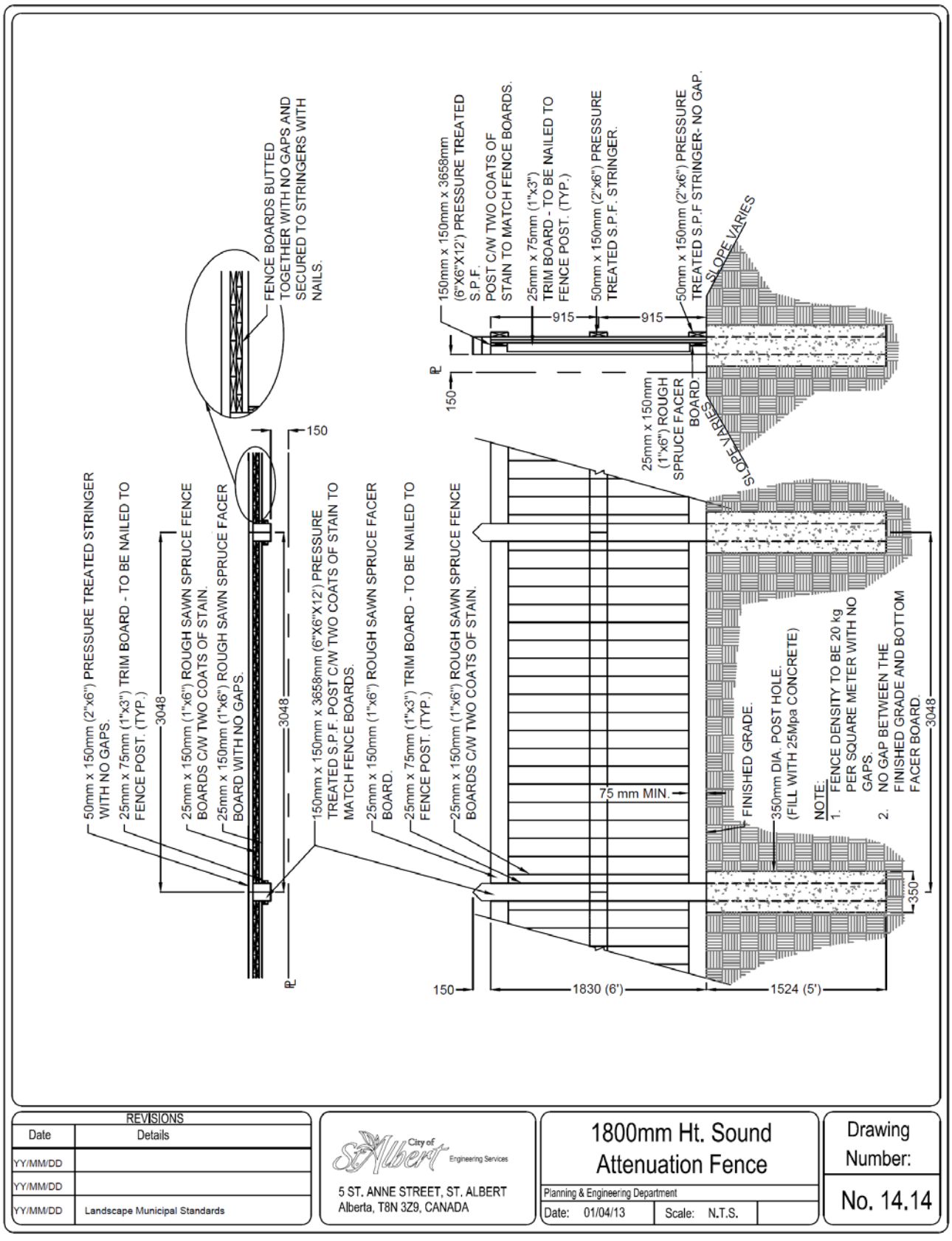

Figure 3.2. Sample Schematic of Solid Screen Wood Fence

Source: City of St. Albert, Engineering Services

3.4. Pavement / Tires

The largest contributor to traffic noise is the noise associated with the vehicle tires interacting with the road, in particular at speeds above approximately 40 – 50 km/hr. The factors that determine the level of tire noise are the composition of the tires themselves and the composition of the road. Tire manufacturers are always conducting research regarding tire noise, however, factors such as traction and durability are of prime importance relative to noise. Unfortunately, these are often at odds and noise ends up becoming a secondary or tertiary factor. Low environmental noise tires are not known to even be commercially available. Further, a municipality would likely have no jurisdiction over the use of vehicle tires.

With regards to the road surface, newer asphalt pavements tend to result in lower noise levels than older, rougher pavements. Similarly, rough surfaces such as chip-seal coatings tend to result in higher noise levels. Thus, road surface maintenance and updated paving materials can help to reduce noise levels. Further, there are various asphalt mixture options (including those which use crushed/recycled rubber tires) which can reduce the noise levels by providing a more "compliant" road surface that is not as hard and is slightly more sound absorptive than conventional asphalt. Long term tests conducted in Alberta (areas with similar road conditions and climate to Saskatoon) indicate that the noise reduction benefits associated with these materials are typically only present for the first year or two and then start to deteriorate (along with the road surface itself) through the winter/summer freeze/thaw cycle such that the noise levels are back to original after just a few years.

3.5. Vegetation

In terms of traffic noise mitigation, the factor which has the largest level of public misconception is related to vegetation. The myth is that planting a few rows of trees and bushes will result in notable noise reduction. The reality is that vegetation typically provides an insignificant level of sound attenuation. Only in situations with very large gaps between the roadway and the adjacent residential receptors (larger than 20 – 30 m) full of thick, dense vegetation, will the level of vegetative sound attenuation even start to become noticeable and still well below that of typical noise barriers. Installing such vegetation in areas where there is currently no vegetation would also be as expensive or more expensive than a noise wall with much less acoustic benefit. Further, if the vegetation is comprised of leafy trees and bushes, then for approximately half of the year, there is absolutely no noise attenuation because there are no leaves. In general, vegetation tends to provide a placebo (out of sight, out of mind) effect. The overarching recommendation is that if there is existing vegetation and it can be kept, then allow it to remain. But do not bother to install new vegetation in hopes of providing appropriate noise attenuation.

4.0 Traffic Noise Policy Framework

The information provided in this Section is intended to be used by the City of Saskatoon in developing the technical and detailed components required for a traffic noise attenuation policy. The information is based on components contained within the reviewed traffic noise policies as well as anecdotal experience of the author. The Section is divided into the following subsections:

- Assessment criteria
- Conducting noise impact assessments
- Conducting noise monitoring
- Noise barrier requirements
- Glossary of terms.

Each of the subsections is further divided in to various specific components. For some of the specific components the information and recommendations are provided without options and are based on the rationale provided. However, some of the components contain various options that would need to be reviewed and decided upon for implementation into the traffic noise attenuation policy. At the end of some of the components the various options are listed in bold, along with the recommended course of action (where applicable).

4.1. Assessment Criteria

The single most important component to a traffic noise attenuation policy is the assessment criteria (metric and value). The requirement for noise mitigation based on either noise monitoring or noise modeling depends on the assessment criteria. In addition, the noise monitoring and noise modeling methods and techniques need to be conducted in accordance with the assessment criteria.

4.1.1. Metrics

4.1.1.1. Decibel Scale and Weightings

The noise assessment criteria should use the metric of the A-weighted decibel sound level (dBA). This matches every other reviewed jurisdiction within Canada and is the most common metric world wide. Sound level measurements for road, rail, and industrial noise sources all use this metric. It is also worth noting that, for some industrial noise assessment policies/guidelines, the C-weighted (dBC) sound level is used as well. However, this is more applicable to situations where there is a sufficiently high likelihood of significant low frequency noise, such as that which may be associated with industrial applications. For typical vehicle traffic noise, however, low frequency noise does not tend to be a specific problem and none of the reviewed traffic noise policies use the dBC metric. In addition, some policies/guidelines make use of the frequency content of the noise in 1/1-Octave or 1/3-Octave bands. Although of interest and sometimes useful information to obtain when conducting a noise monitoring, use of the frequency content in setting criteria for a traffic noise policy is generally considered too onerous and is not typically done. Again, none of the reviewed traffic noise policies make use of the frequency content.

Options: dBA, dBC, frequency content

Recommendations: Use dBA only

City of Saskatoon Recommendations: Adopt dBA as the metric.

4.1.1.2. Timeframe and Value

The next component of the assessment metric is to determine the timeframe over which the assessment is to be conducted. As indicated in the review of other traffic noise policies within Canada, the most common timeframe is the $L_{eq}24$ followed by the L_{dn}. All but one jurisdiction uses one of these two timeframes. The only jurisdiction that does not is in Ontario, where the assessment timeframe is separated into day-time (07:00 – 23:00) and night-time (23:00 – 07:00). Given that traffic patterns are generally very

repeatable and predictable, must jurisdictions elect to have a single criterion to cover the entire 24-hour period (i.e. $L_{eq}24$ or L_{dn}) instead of having a separate criterion for each of the day-time and night-time, respectively.

As its name implies, the $L_{eq}24$ is a logarithmic average conducted over an entire 24-hour period. Due to the nature of the logarithmic average and typical traffic patterns, the time periods which largely dictate the $L_{eq}24$ value are the morning and afternoon peak traffic times. The reduced traffic during the night-time does significantly impact the $L_{eq}24$.

The L_{dn} is very similar to the $L_{eq}24$, with one significant difference. The L_{dn} adds a 10 dBA penalty to the monitored or modeled noise during the night-time period (the specific night-time period needs to be defined as part of setting the assessment metric). Thus, the L_{dn} will always be higher than the $L_{eq}24$. The amount by which the two differ depends on the differences between the day-time and night-time traffic noise levels and the definition of the night-time period. Most jurisdictions define the night-time as the time period from 22:00 – 07:00 (9-hours). Typically, with night-time from 22:00 – 07:00, traffic noise within urban environments tends to result in the L_{dn} being 2 – 3 dBA higher than the $L_{eq}24$.

As part of the traffic noise policy review and development process a study was conducted to determine the relative noise barrier impact associated with various criterion levels of the $L_{eq}24$ (65, 60, 55 dBA) and the L_{dn} (65, 60, 55 dBA) at various locations within Saskatoon for the future (400k population) timeline. The specific assessment locations and the detailed results are provided in Section 5.0. A summary of the results is as follows:

- 65 dBA $L_{eq}24$ – Essentially no noise mitigation is required to achieve 65 dBA $L_{eq}24$
- 60 dBA $L_{eq}24$ – Barrier heights ranged from 0.0 m to 4 m with most barriers 1.83 m or 2.44 m
- 55 dBA $L_{eq}24$ – Barrier heights ranged from 1.83 m to 8.5 m with most barriers between 4.0 m to 6.0 m

- 65 dBA L_{dn} – Barrier heights ranged from 0.0 m to 2.44 m with most areas either requiring no barrier or just a 1.83 m solid screen wood fence.
- 60 dBA L_{dn} – Barrier heights ranged from 1.83 m to 6.5 m with most barriers between 3.0 m to 6.0 m
- 55 dBA L_{dn} – Barrier heights ranged from 3.0 m to 12 m with most barriers between 5.0 m to 8.0 m

Ultimately, the selection of the specific assessment timeframe and criteria value is a trade-off between having lower overall community noise levels (benefit to residents) and the costs associated with the noise mitigation required to achieve the desired values.

Options: L_{eq}24 (65, 60, 55 dBA), L_{dn} (65, 60, 55 dBA), L_{eq}Day/L_{eq}Night

City of Saskatoon Recommendations: Adopt L_{dn} 65dBA as the threshold.

4.1.1.3. Location

The next component of the assessment metric is to determine the location at which the noise level is to be measured or modeled. Firstly, none of the reviewed noise policies use an indoor receptor location. Some of the reviewed policies make reference to desired interior noise levels with an assumed noise attenuation associated with the structure, but none have specific interior criteria that must be achieved. This is typical throughout environmental noise policies for transportation noise as well as industrial noise. The level of noise attenuation from exterior to interior will differ from structure to structure depending on the orientation relative to the noise source, the design and construction of the structure exterior, the geometries and design associated with the layout of the structure, and the sound absorptive materials (i.e. furniture, draperies, carpet) used within the structure. Plus, there are often noise sources within residential structures that can produce higher noise levels than typical interior criteria and yet the residents tend to not object to (i.e. furnace, refrigerator). Thus, it is common practice to assess noise levels at the exterior of the residential structure with an assumption of the typical structural noise attenuation (with all doors and windows closed).

The next factor is to determine where the outdoor noise level should be assessed. Some of the reviewed policies specify a location that is 3 m from the residential structure while others specify 5 m from the residential structure. Yet, others specify a location that is 2 m within the residential property line. With regards to specifying an assessment location that is 3 m or 5m from the structure, the biggest issue is with the acoustic reflections off the structure. Placing a noise monitor so close to a large reflecting surface can result in increased noise levels (as much as +3 dBA). In addition, for noise modeling assessments of new developments, the location of the structure is often not known. Thus, it is not recommended to specify a location that is so close to the structure. With regards to the location 2 m inside the residential property line, this can also have issues and significant variances from property to property. If there is already a

good noise reducing fence at the rear property line, then a measurement location so close to the fence can result in excessive acoustic shielding from the fence at the measurement/modeling location. Thus, it is recommended to specify a location that is approximately mid-yard to minimize both the structure reflection issues and the fence acoustical shielding issues. For most newer residential lots, a distance of 5 m from the property line that is adjacent to the road noise source is generally approximately mid-yard. In addition, most policies make reference to the backyard or the outdoor amenity or outdoor living space for the assessment. Most policies do not consider the front-yard of a residence to be an outdoor amenity or outdoor living space. Part of the issue with using the front-yard as the assessment location is that noise mitigation is generally not possible or desired because most residents are not amenable to installing a noise barrier in their front yard. Thus, even if the residential property "fronts" or "sides" onto the adjacent major roadway, the noise assessment is almost always conducted with the receptor in the backyard.

Adding to the discussion about the outdoor amenity space assessment locations is a discussion regarding multi-family buildings such as apartments or condominiums without a defined outdoor amenity space. None of the reviewed policies specifically discuss such situations and typically all upper floors (from 2nd floor and up) are not included in traffic noise policies because noise mitigation is generally not feasible for these locations due to the inability of noise barriers to block the line-of-sight between the residence and the adjacent roadway. Anecdotally, within most municipalities, if there are ground-floor apartments or condominium units, each with a defined (i.e. fenced-in) outdoor amenity space, then these would be considered for noise mitigation in the same manner as a single family detached residential structure.

The final factor for the assessment location is the height. Most of the reviewed policies have a height of 1.5 m above ground. Some use a value of 1.2 m above ground. Typically, the rationale for using an assessment height of 1.5 m above ground is that it is close to the average ear-level of a person standing within the yard. If using a height of 1.2 m, there could be some additional acoustical shielding associated with the fence that would not be as prevalent at a height of 1.5 m. Also, none of the reviewed policies assess the noise levels at a height of the 2nd story for 2-storey houses. This means that the noise levels are typically not assessed at the height of any 2nd storey bedroom windows. Although noise modeling calculations can be performed at this height, it is difficult to conduct a noise monitoring at this height. Further, if the idea is to assess the noise level within the outdoor amenity space, then the assessment height should match the typical use of that outdoor space. Thus, an assessment height of 1.5 m is recommended.

Two variants to the use of 1.5 m above ground within the outdoor amenity space include issues associated with decks and with walkout lots (and combinations of the two). Sometimes there are situations in which the rear deck is used by the homeowners exclusively as their "outdoor amenity space". Concurrently, there are situations in which the rear deck is elevated above grade by a sufficient amount that it can significantly impact the line-of-sight to the adjacent roadway (i.e. sitting on the rear deck and can see overtop of the fence with direct line-of-sight to the adjacent roadway and elevated noise levels compared to 1.5 m above ground). A similar but even more exageraged scenario can occur with rear walk-out lots in which the rear property line is significantly lower in elevation than the rear of the house. If such a house has a deck off the main floor, then this deck will almost certainly be elevated well above the fence and will allow for direct line-of-sight to the adjacent roadway. If the rear yard itself slopes down enough, even an assessment location mid-yard (or 5 m from the property line) can also result in direct line-of-sight to the adjacent roadway. For all of these situations, the result would be higher noise barriers than those which would be required with a flat backyard and an assessment height of 1.5 m above ground.

Options: Indoor vs. Outdoor, specific location within outdoor space, height of receptor, issues with rear decks and walk-out lots

Recommendations: Receptor in defined outdoor rear amenity space, 5 m from the adjacent property line, 1.5 m elevation. Applicable to ground floor apartments and condominiums if an outdoor amenity space is clearly defined (i.e. fenced-in)

City of Saskatoon Recommendations: Receptor in defined outdoor rear amenity space, 5 m from the adjacent property line, 1.5 m elevation, 3 m from any obstructions (i.e. a shed). Applicable to single family residential land use, and townhouse type (maximum of two storeys) multi-family land use.

4.1.1.4. Maximum Allowable Sound Level vs Relative Increase

Most of the reviewed policies provide for a maximum overall sound level and do not account for any increases in sound levels associated with new/upgraded roads relative to the sound levels that were present prior to the new/upgraded road. This is common for traffic noise attenuation policies as well as most industrial environmental noise policies. The only reviewed policy that included an assessment of the relative increase in sound level was in British Columbia for numbered highways. In addition, it is important to note that, within the United States, all major road projects that fall under the jurisdiction of

the Federal Highways Administration (FHWA) have both the maximum allowable increase in sound levels (relative to the pre-construction sound levels) as well as an overall maximum value. The allowable increases and the maximum value are determined separately by each State, within the FHWA guidelines.

The intent with including both sets of criteria (maximum overall value and maximum allowable increase relative to pre-construction) is to minimize impacts associated with new/upgraded roads, in particular in areas where the new/upgraded roads will result in a potential significant increase in noise levels. A typical example of this is if a new highway or freeway is built in an area with nearby houses where there was previously only green space. Even though the overall noise levels associated with the highway may be below the maximum allowable limit used elsewhere in the City, the relative increase in noise levels could easily be in the range of 20 to 30 dBA[1], which would very likely be subjectively unacceptable to most of the adjacent residents and be received with strong opposition. Such has been the case with both the City of Edmonton and City of Calgary ring roads as well as sections of Circle Drive in Saskatoon.

Thus, it would seem reasonable to include both a maximum overall value and a maximum allowable increase within the assessment criteria. The difficulty with having both criteria is that, if the pre-construction noise levels are low enough, then the target criteria would be different for each new or upgraded road project. This will create different "acceptable" noise levels throughout the City which will constantly be evolving for each project and can change for any given area when the next project occurs. Further, in addition to the typical future noise modeling impact assessment that would typically be required for new/upgraded road projects, this method would also require detailed pre-project noise monitoring and pre-project noise modeling which adds cost and time.

Options: Either maximum overall sound level only OR maximum overall sound level plus maximum allowable increased sound level relative to pre-project sound level.

City of Saskatoon Recommendation: The maximum overall sound threshold is L_{dn} 65dBA.

[1] Most jurisdictions that include a maximum allowable increase use a range of 5 – 15 dBA.

4.1.2. Applicability

In all reviewed policies, the assessment criteria are applicable to residential areas and not intended for commercial or industrial developments. In general, traffic noise levels tend to be less of a concern for commercial and industrial areas since there are typically no people living/sleeping in these areas and there tend to be fewer outdoor amenity spaces where traffic noise is a nuisance.

The are some areas, however, where this can be a concern. For example, at commercial buildings that are located very near major roadways with large windows that face onto the roadway. It is common practice for any noise mitigation efforts associated with reducing interior noise levels to be assumed by the owner/operator of the commercial business. Another area where this can cause concern are Hotels and other similar temporary lodgings where people are indeed sleeping. Again, a Hotel is typically considered a commercial business and it is common practice for any noise mitigation efforts associated with reducing interior noise levels to be assumed by the owner/operator of the commercial business.

Other areas that may warrant consideration for noise mitigation include schools, hospitals, museums, libraries, churches, and park areas. For all of the structures included in this list, reducing the noise within the interior is achievable through appropriate design of the building envelope. However, some of these spaces (schools, hospitals, park areas) also tend to have outdoor spaces used for educational purposes or healing/relaxation that may warrant reduced traffic noise levels.

Options: Residential areas only or also include commercial, industrial, schools, hospitals, museums, libraries, churches, and park areas?

City of Saskatoon Recommendation: Residential areas only are available for traffic noise mitigation.

4.1.3. Mitigation Responsibility

In terms of designing and building noise mitigation (i.e. noise barriers) it is important to stipulate who is financially responsible. In essentially all of the reviewed policies, the responsibility is as follows:

- For new developments adjacent to existing or approved (but not yet built) transportation corridors (roads, bus lanes, LRT), determining the need for and then the implementation of required noise mitigation is the responsibility of the developer, pending review and approval by the City.

- For new or upgraded transportation corridors (roads, bus lanes, LRT) adjacent to existing developments, determining the need for and then the implementation of required noise mitigation is the responsibility of the City and is paid for as part of the capital cost of the associated transportation corridor project. Noise mitigation is included for locations where it is technically, economically, and administratively feasible.
- For retrofit areas with existing transportation corridors (roads, bus lanes, LRT) adjacent to existing developments, determining the need for and then the implementation of required noise mitigation is the responsibility of the City, for locations where it is technically, economically, and administratively feasible.

Some jurisdictions also include the possibility that residents pay themselves for noise mitigation for retrofit areas (pending City review and approval) where the City has deemed mitigation to be technically, economically, or administratively not feasible. The idea is that if residents are willing to pay for the mitigation themselves, then there is at least an opportunity for them to investigate and pursue that option.

Finally, for retrofit projects, some of the reviewed policies include the use of a cost vs. benefit calculation to quantify the rationale for the noise mitigation and to compare/rank various locations in which retrofit noise mitigation is being reviewed. The simplest form of this calculation is to divide the cost of the project by the number of impacted residential dwellings (i.e. $/dwelling) with a lower number better than higher. Another example is used by the City of Regina (below) in which the cost and the number of impacted residential dwellings are included along with the relative reduction in noise level associated with the proposed mitigation. This method not only determines the $/dwelling but also factors in the performance of the noise mitigation. Thus, if there are two similar projects costing the same and with the same number of impacted residents, the one with the better performing noise mitigation would rank higher than the other.

City of Regina Cost Benefit Calculation Method

$$BP1 = \frac{(ENL - DNL)N}{C}$$

Where:

BP1 = Barrier Priority Index
ENL = Estimated Noise Level in dBA Ldn based on current or projected traffic counts or actual noise measurement.
DNL = Design Noise Level in dBA Ldn or the minimum noise level for consideration in prioritization (65 dBA Ldn)
N = Number of first row ground level dwelling units which would be protected by barrier attenuation.
C = Barrier construction cost in thousands of dollars including all associated costs such as utility modifications.

Options: Developer responsible for new development, City responsible for new and upgraded transportation corridors as well as retrofit areas? Technically, economically, and administratively feasible? Allow residents to pay for mitigation themselves? Include a cost vs. benefit calculation?

City of Saskatoon Recommendation: Developers are responsible for traffic noise mitigation in new developments. The City is responsible for new and upgraded transportation areas as well as retrofit areas that are technically, economically, and administratively feasible.

4.2. Noise Impact Assessments

A significant component for a traffic noise attenuation policy is to provide the methods and reporting requirements for a noise impact assessment to allow for increased accuracy and more consistency in the assessments carried out by acoustical engineering consultants and the City.

4.2.1. Applicability

A traffic noise impact assessment will be required for the following:

- New developments adjacent to existing transportation corridors.
- New/Upgraded transportation corridors adjacent to existing developments
- Retrofit projects for existing transportation corridors and existing development where a study is being conducted to determine if noise mitigation is feasible and to what extent noise mitigation may be applied.

4.2.2. Methods and Software

- A traffic noise impact assessment must be carried out by a qualified and experienced Acoustical Engineer.
- The assessment calculations and modeling need to be conducted using any of the following acceptable software:
    - CADNA/A
    - SoundPlan
    - B&K Predictor
    - Traffic Noise Model (TNM)
    - Other software upon approval of the City
- The noise modeling software needs to account for the following conditions throughout the entire study area:
    - Topography of the study area (i.e. elevation contours) with a minimum 1 m vertical elevation resolution. Most elevation contour information is available from the City of Saskatoon.
    - Roadway alignment with lane dimensions or roadway width. Modeled roads should span well beyond the study limits of the model since road noise outside of the study limits still contributes to the overall area noise levels.
    - Property lines (residential, commercial, industrial)
    - Existing and proposed noise barriers.

  - Existing and proposed buildings, where appropriate and applicable.
  - Vegetation, where appropriate and applicable.
- It is recommended that the noise modeling software have the ability to make use of aerial imagery for increased accuracy of various topographical, vegetative, building, and barrier features.
- With regards to the traffic noise source data, the model needs to be able to account for the following minimum information for each road:
  - Traffic volumes (i.e. vehicles per hour) during the day-time and night-time.
  - Percentage of heavy vehicles during the day-time and night-time. Heavy vehicles essentially includes everything that is not a passenger vehicle.
  - Posted speed limits.
- The noise modeling for all projects needs to be conducted with a future planning horizon for traffic volumes. Does the City want to specify a minimum number of years (i.e. 10-years, 20-years), or a future City population (i.e. 400k population)?
- The noise levels need to be assessed at representative receptor locations (i.e. matching those associated with the assessment criteria) as well as using a calculation grid over the entire study area for generation of noise contour mapping. The height of the calculation grid needs to match the height associated with the assessment criteria.
- The noise modeling results need to be determined for the following scenarios:
  - Baseline conditions (if applicable)
  - Future conditions with all proposed area roadways and development and projected planning horizon traffic volumes and *without* any additional noise mitigation.
  - Future conditions with all proposed area roadways and development and projected planning horizon traffic volumes and *with* additional noise mitigation required to achieve the assessment criteria.

Options: Future planning horizon (10-years, 20-years, 400k population),

Recommendations: In terms of the planning horizon, it seems that the current standard and available traffic projections are for the 400k population, so it is reasonable to continue using that standard until it needs to be revised (i.e. as the population nears the 400k mark).

City of Saskatoon Recommendation: Use the 400k population horizon as the future planning horizon.

Additional questions that need to be addressed include:

- Is a baseline noise monitoring required for an existing transportation corridor that will be modified? It is recommended to conduct baseline noise monitoring for this scenario. The noise monitoring data can be used as a calibration/verification method for a baseline case noise model to ensure that the noise model is providing an accurate representation of the study area. Then, the noise model can be augmented with the modified roadway design and topography and the future projected traffic volumes and the results can be determined with a higher degree of certainty than if there was no baseline noise monitoring/modeling conducted. In addition, if the selected assessment criteria utilize a maximum overall sound level plus a maximum allowable increase in sound level (relative to baseline), conducting a baseline noise monitoring and using that information to calibrate/verify the noise model will increase the accuracy of the pre-project and post-project noise level comparison.

- Is a baseline noise monitoring required for a new transportation corridor? It is recommended that baseline noise monitoring *not* be conducted for this scenario, unless the selected assessment criteria utilize a maximum overall sound level plus a maximum allowable increase in sound level (relative to baseline). Otherwise, there is no advantage to obtaining the baseline noise levels and it is likely that a baseline case noise model will not be generated.

- Is a baseline noise monitoring required for a new development that is being built adjacent to an existing transportation corridor? It is recommended to conduct baseline noise monitoring for this scenario. The noise monitoring data can be used as a calibration/verification method for a baseline case noise model to ensure that the noise model is providing an accurate representation of the study area. Then, the noise model can be augmented with the addition of the development, any proposed development related transportation corridors, and the future projected traffic volumes. The results can be determined with a higher degree of certainty than if there was no baseline noise monitoring/modeling conducted.

4.2.3. Report Information

In order to allow for consistent review of noise impact assessment reports and to allow for data to be used in subsequent noise studies, the following information must be included in all noise impact assessment reports:

- Detailed description of the study area with all area topography, vegetation, roads, receptors, commercial and industrial areas identified along with any other information pertinent to the noise study.
- Maps and (where applicable) imagery of the study area indicating all area roads, receptors, commercial and industrial areas, property lines, and any other information pertinent to the noise study.
- Description of the noise modeling software and/or calculation standards used along with the various input parameters.
- Description of noise modeling receptor locations.
- Detailed traffic volumes used for the study including:
    - Roadway name
    - Day-time and night-time traffic volumes
    - Day-time and night-time percentage of heavy vehicles
    - Posted speed limits
- Table of noise receptors and modeled sound levels for the various assessment cases and comparison to the assessment criteria.
- If applicable, description of the noise mitigation required to achieve the assessment criteria. Noise mitigation information must include (at minimum):
    - Description of the location of noise barriers
    - Graphical representation of the location of the noise barriers (i.e. location of noise barriers drawn on a map)
    - Geometry of noise barriers (height and length)
    - Minimum noise barrier construction recommendations

4.3. Noise Monitoring

There are minimum requirements that should be established for conducting noise monitoring. This will allow for increased accuracy, better continuity for data collected by various acoustical engineering consultants and the City, and the ability to compare data obtained at the same locations at different time periods (i.e. comparing data from one year to the next, etc.).

4.3.1. Measurement Rationale

None of the reviewed policies have information pertaining to the process that triggers the need for a noise monitoring. It is recommended to have some guidelines in this regard. The main questions to ask are as follows:

- **What triggers the need for a noise monitoring adjacent to an existing roadway?**
  - This could be based on residential complaints.
  - This could be based on historical information (i.e. the area is known to have relatively high traffic noise levels based on previous noise monitoring).
  - This could be based on a City wide pro-active program for obtaining traffic noise levels in areas that are likely to have high traffic noise levels, even if residents have not complained.

- **How often is noise monitoring to be conducted adjacent to existing roadways?** For example, if the area is known to have high noise levels (but lower than the noise mitigation criteria), is there a specific interval (perhaps annually or every 2 years) at which the noise monitoring is to be conducted to track the noise levels?

- **Should all new/upgraded transportation projects and new developments include a pre-project (baseline) noise monitoring program?**
  - One benefit of such a program is to obtain the pre-project noise levels for use in comparing to any potential post-project noise monitoring.
  - Another benefit of such a program is that the baseline noise level data can be useful in calibration / verification of any computer noise modeling for the upgraded Project.
  - New transportation corridors (where none had existed before) will likely not benefit from conducting a baseline noise monitoring unless the selected assessment criteria includes a maximum overall sound level plus a maximum increase in sound level, relative to the baseline conditions.

- **Should all new/upgraded transportation projects include a post-project noise monitoring program to ensure that noise levels are within the assessment criteria?**
    - Most jurisdictions do not require post-project noise monitoring.
    - If the noise impact assessment results indicated that the noise levels would be well below the assessment criteria (at least 5 dBA lower), then a post-project noise monitoring program is likely not warranted.
    - If the noise impact assessment results indicated that the noise level would be near the assessment criteria (within a few dBA, to be determined by the City), then a post-project noise monitoring program may be warranted.

Options: **What triggers the need for noise monitoring adjacent to an existing roadway?**
How often should a noise monitoring be conducted adjacent to an existing roadway?
Should pre-project (baseline) noise monitoring be conducted?
Should post-project noise monitoring be conducted?

Recommendations: Pre-project noise monitoring is recommended for upgraded transportation corridors as well as new development and is recommended for new transportation corridors only if the assessment criteria allow for a maximum allowable increase in sound level relative to the baseline condition. Post-project noise monitoring should be conducted if the noise impact assessment results indicate that the noise levels would be near the assessment criteria (within a few dBA, to be determined by the City).

City of Saskatoon Recommendations: Pre-project noise monitoring is recommended for upgraded transportation corridors as well as new development. Post-project noise monitoring may be conducted on a case by case basis.

4.3.2. Measurement Location

The noise monitoring measurement location should match the requirements defined in the assessment criteria. This includes the location within the yard and the height. In addition, there are some important factors to consider for the noise monitor location, including:

- **Adjacent Structures:** The noise monitor should be located at least 5 m from any structure. This includes the house and any garage or shed or fence or similar broad-surfaced structures that are located within the yard. Locating the noise monitor near a structure will allow for acoustic reflections (reflecting off the structure) to influence the noise monitoring data and can result in higher than normal noise levels. Further, whenever possible, the noise monitor should be placed at an angle relative to any nearby structures such that, if there are any sound reflections, the angle of the reflection will not significantly impact the noise monitoring results.

- **Non-Transportation Noise Sources:** The noise monitor should be placed in a location where the dominant noise sources are those associated with the adjacent transportation corridors. If there are other non-transportation noise sources nearby, they may impact the noise monitoring data and result in noise levels that are higher than those associated with the transportation corridor. When determining a noise monitoring location, the potential site must be reviewed for non-transportation noise sources. If other noise sources are audible, then it is recommended to not conduct the noise monitoring at that location. If other potential noise sources are not audible at the time of setup, but may be turned on during the noise monitoring period, then the location should be avoided. Examples of common non-transportation noise sources include (but are not limited to):
    - Air conditioner condensers
    - Outdoor hot tubs
    - Building ventilation fans
    - Furnace intake/exhaust
    - Hot water heater intake/exhaust
    - Industrial or commercial facilities located very near the residential property
    - Electrical transformers from adjacent electrical substations
    - Power lines and power poles
    - Transformer "hum" from large yard lights
    - Pets or other animals nearby. Typically, this would include dogs that tend to bark

In general, there will be situations in which the prescribed noise monitoring location (i.e. the location defined in the assessment criteria) will not be feasible. In those cases, the acoustical practitioner should have the discretion to place the noise monitor in an "acoustically logical" location that will provide results indicative of the noise levels associated with the adjacent transportation corridor and that will minimize external influences.

4.3.3. Measurement Equipment

The Instrumentation used to conduct the noise monitoring must be able to measure the A-weighted (dBA) continuous energy equivalent sound level (L_{eq}) of steady, intermittent, and fluctuating sounds. It must be able to accumulate the data and calculate the L_{eq} values with a sample interval of no longer than 1-minute and run continuously for at least 24-hours. The instrumentation must meet the minimum technical specifications in the IEC 61672-2 Ed.01.0 2003 (or latest version), for Type/Class 2 (or Type/Class 1) sound level meters. Use of sound level meters less than Type/Class 2 is not allowed and Type/Class 1 is recommended for increased accuracy.

Noise monitors must be field calibrated immediately prior to the measurement using a sound calibrator meeting the requirements of EN/IEC 60942 (2003) Class LS, and ANSI S1.40-2006 (latest revision) for Class 1 calibrators. Noise monitors must have their calibration checked immediately after the measurement using the same calibrator and a record of the pre- and post-measurement calibration results must be included in the report.

Noise monitors must be calibrated by the instrument manufacturer, an authorized instrument calibration facility, or another agency acceptable to the City within a three-year period immediately preceding the measurements. Records of calibration must be maintained and the calibration certificates must be provided with the noise monitoring report. Noise monitors which fail a pre-use or post-use calibration test (e.g. the noise monitor does not read within ±1 dBA) must not be used until re-calibrated for accuracy, applicability and the cause of deviation has been removed. Data collected from noise meters that fail a pre-use or post-use field calibration test (e.g., the noise monitor does read within ±1 dBA) must not be used.

Field calibrators must be recertified in accordance with ANSI publication SI.40-1984 (or latest revision), which requires that a calibrator be recalibrated at least once a year. The calibrator may be used for a one-

year period dated from the manufacturer certificate prior to requiring recalibration. Records of calibration must be maintained and the calibration certificates must be provided with the noise monitoring report.

The noise monitor must incorporate an appropriate outdoor measurement windscreen to minimize wind noise. The microphone must be a "direct-incidence" or "direct-field" type and be oriented in the vertical position.

The noise monitoring instrumentation must be capable of conducting a digital audio recording for the entire duration of the noise monitoring period. This can be accomplished either with recording capability directly on the noise monitor or with a separate recording device connected to the noise monitor with time-stamp capability. The digital audio recording is to be used during the post-processing data assessment for identification and isolation (i.e. removal) of abnormal or non-transportation corridor related noise events.

4.3.4. Measurement Conditions

4.3.4.1. Duration and Settings

The noise monitoring must be conducted for a minimum duration of 24-hours. Longer durations are recommended to allow for more flexibility in using a 24-hour window with appropriate weather conditions. The noise monitoring must be conducted with a maximum 1-minute L_{eq} sample period, with shorter sample periods recommended for less overall data time removal during the post-processing isolation analysis.

4.3.4.2. Weather Conditions

One of the most important factors in determining when a noise monitoring can be conducted is the weather conditions. The various acceptable weather conditions are as follows:

- **Wind:** Ideally, the noise monitoring should be conducted with a light wind (5 – 15 km/hr) in the direction from the adjacent transportation corridor towards the noise monitor location. Alternatively, calm wind conditions are acceptable as are light cross-wind conditions. The noise monitoring must not be conducted with upwind conditions (i.e. wind in the direction from the noise monitor towards the transportation corridor). The maximum allowable sustained wind speed is

15 km/hr (regardless of the direction) since any higher wind speeds will result in wind generated noise at the microphone or excessive leaf rustling on nearby vegetation. An even lower wind speed may be necessary if there are large leafy trees near the noise monitor which could result in a significant leaf-rustling noise level in even moderate wind speeds. If there are brief periods of excessive wind or wind from the wrong direction, then that data may be isolated (removed) from the overall data set provided that sufficient data remain for an appropriate analysis. In all cases, an appropriate outdoor windscreen must be used for the noise monitoring.

- **Precipitation:** There cannot be precipitation during the noise monitoring. Wet or snow covered road surfaces result in different noise levels and frequency content compared to dry road surfaces. In addition, significant rainfall can produce noise that will add to the noise from the transportation corridor. Finally, freshly fallen snow on the ground in between the transportation corridor and the noise monitor can change the ground level sound absorption significantly in a short period of time which will impact the noise monitoring results. If there are brief periods of precipitation, then that data may be isolated (removed) from the overall data set provided that sufficient data remain for an appropriate analysis. However, if snow falls and persists on the ground, then the noise monitoring data may not be useable.

- **Season:** It is recommended that noise monitoring adjacent to transportation corridors be conducted in the summer months when there is foliage and no snow covering the ground. This generally precludes winter-time noise monitoring. Early Spring and late Fall are also not recommended, unless specific circumstances warrant these time periods. The reason for the summer-time noise monitoring is that, typically, most residents have greater concerns for traffic noise in the summer months when residential windows are being left open overnight and when people tend to make more use of their outdoor amenity spaces. In addition, the ground and vegetative sound absorption and barrier conditions in the summer months tend to be consistent from day-to-day, introducing minimal variability with these parameters. In the winter, however, there can be large changes in the ground cover within just a few hours due to fresh snow fall (acoustically absorptive) versus hard-packed snow conditions (acoustically reflective). Finally, frozen pavement and cold tires (with a significant number of winter tires) produce different noise levels and frequency characteristics than during warm summer conditions with summer tires.

Local weather data for the duration of the noise monitoring must be obtained and provided within the noise monitoring report. At a minimum, hourly weather data is available for the Saskatoon Airport from the Environment Canada or Weather Network websites. However, it is recommended that even more localized weather data be obtained through the use of a portable weather station in the vicinity of the noise monitor. A portable weather station will be capable of collecting data in intervals much finer than 1-hour and will give a more accurate representation of the conditions local to the noise monitor. If using a portable weather station, some key elements include:

- Measurement of wind direction and wind speed with average and peak wind speed values.
- Measurement of air temperature
- Measurement of relative humidity
- Measurement of barometric pressure
- Measurement of precipitation
- Weather sensor height between 5 m to 10 m above the ground
- Weather monitor located in open area that is generally unobstructed from the wind for increased accuracy for the wind speed and wind direction measurements.

4.3.4.3. Traffic Conditions

It is important that the traffic conditions on the adjacent transportation corridor be appropriate for the intended noise monitoring period. Typically, this means that the noise monitoring needs to be conducted during a weekday (Monday-Tuesday, Tuesday-Wednesday, Wednesday-Thursday, Thursday-Friday) and not on a weekend or a holiday. In addition, there cannot be any road construction or other such occurrences on the adjacent transportation corridors that will hinder the flow of traffic in any way (i.e. lane closures, etc.). Finally, there cannot be any significant unplanned traffic disruption from traffic accidents or other similar occurrences. Depending on the severity of such a disruption in traffic, the noise monitoring results may be invalidated. The intent is to conduct a noise monitoring during normal daily traffic flow.

4.3.5. Isolation Analysis

Within a duration of 24-hours, it is highly likely that there will be non-transportation related or abnormal noise events within the vicinity of the noise monitor that will result in adversely affected monitored noise levels. Such non-transportation corridor related noise events include (but are not limited to):

- Noise from animals such as dogs barking, birds chirping (common in the morning), frogs and crickets.
- Noise from human activity nearby such as people talking, mowing lawns, etc.
- Noise from construction activity nearby.
- Noise from emergency vehicle sirens.
- Noise from abnormally loud vehicles such as loud motorcycles near the noise monitor, engine retarder brakes from heavy trucks, street racing or excessive speeding.
- Excessive wind-noise during periods of high wind speeds.
- Periods of precipitation that either result in precipitation noise or vehicle tire noise that has changed in amplitude and frequency content.
- Aircraft flyovers.

These non-transportation related or otherwise abnormal noise events should be identified and isolated (removed) from the noise monitoring data such that the remaining data more accurately reflect the noise levels associated with the adjacent transportation corridors. In order to appropriately isolate the noise monitoring data, a simultaneous digital recording must be conducted along with the noise monitoring. The audio needs to be time synchronized with the noise monitoring data for use in the post-processing analysis. Within the noise monitoring report, the isolated noise data needs to be identified, including the start/stop times for the data removal, the time duration of the removed data, and the reason for the data removal. The time duration for the remaining useful data also needs to be identified. The time duration for the remaining data needs to be sufficient such that the overall 24-hour assessment value is still considered valid and applicable.

4.3.6. Noise Monitoring Report Information

In order to allow for increased accuracy, better continuity for data collected by acoustical engineering consultants and the City, and the ability to compare data obtained at the same locations at different time periods (i.e. comparing data from one year to the next, etc.), the following information must be included in all noise monitoring reports:

- Detailed description of noise monitoring location with measured distances from reference locations (i.e. property lines and buildings), an aerial view schematic and photos of the equipment within the measurement location. This information is necessary for use in computer noise modeling exercises as well as for conducting follow-up noise monitoring at a subsequent time period.
- Description of the area surrounding the noise monitor including structures, noise sources, vegetation.
- Start/stop times/dates for the noise monitoring equipment and the defined time period used for the data assessment.
- Quantitative and (if available) subjective weather data for the noise monitoring period and the source of the quantitative weather data (i.e. website data or portable weather monitor).
- Discussion of results and comparison to the assessment criteria.
- Graphical form of the noise monitoring data with monitored dBA L_{eq} sound level vs. time for the entire assessment period.
- Detailed list of isolated (removed) noise data with the start/stop times, the duration of the data removed, the reason for the data removal, and the quantity of remaining data used for the data assessment.
- Calibration certificates for the noise monitoring equipment and field calibrators.

4.4. Noise Barriers

With regards to the design and construction of noise barriers, there are a number of items that need to be addressed or specified within the traffic noise attenuation policy, including:

- The general construction of noise barriers should be as follows:
    - The construction of any noise barriers (walls and/or earth berms) needs to adhere to all specific City requirements (is there a specific City document for noise barrier or noise fence construction?).
    - The design and construction of noise barriers need to consider appropriate surface water runoff drainage and maintenance access.
    - Barriers must be constructed with no visible gaps throughout the span of the barrier or at the bottom of the barrier. If the barrier is in the form of a solid screen wood fence, the fence must extend all the way to the ground wherever possible.
    - Barriers must be constructed of material that has enough mass to sufficiently reduce the sound transmitting through the barrier, relative to the sound transmitting over the barrier. For typical traffic noise sources, the minimum barrier surface density is 20 kg/m^2.
    - Any openings within barriers (for pedestrian access) must be designed to minimize sound transmission through the opening by using overlaps or other similar methods.

- For the situation where a noise barrier is installed at the residential or commercial or industrial property line, the maintenance responsibility needs to be clearly defined in the traffic noise policy. For locations where the noise barrier is installed solely on public land, it is typically the responsibility of the City to maintain both sides of the barrier. When the barrier is installed at the shared property line, however, access for maintenance on the private property side of the barrier is difficult and there are numerous potential issues associated with maintenance. It may be appropriate to specify that the resident is responsible for maintenance of the barrier on their side of the property. This applies to both noise walls and earth berms.

- For new/upgraded transportation corridor projects or for retrofit projects, it is recommended to install a clause within the traffic noise policy stating that the City will only build noise mitigation when it is shown to be technically, economically, and administratively feasible, as determined by the Engineering or Transportation Department Manager. There may be situations where achieving noise levels below the assessment criteria requires noise mitigation that is considered too expensive

or has other factors which may preclude it from being built such as minimal public approval. Thus, it is recommended to review noise mitigation implementation on a case-by-case basis for new/upgraded/retrofit projects and assess based on more than just the noise levels.

- With regards to the performance of noise barriers, it is common to specify a minimum sound level reduction of target of 5 dBA. A noise barrier than cannot achieve a sound level reduction of at least 5 dBA is generally considered to not be worth the associated cost since the subjective reduction in noise levels will be only minimally subjectively noticeable. Indeed, this should be a good minimum design target, but this level of attenuation may not always be attainable (depending on the geometry) and should not prevent noise mitigation from being installed. The level of noise mitigation attained should be reviewed and compared to the cost of the mitigation on a case-by-case basis. For retrofit areas, the absolute minimum should be at least a 3 dBA reduction. Any less will not even be subjectively noticeable to the residents and the associated cost of the mitigation will be essentially wasted.

- For new developments adjacent to existing transportation corridors, there should not be a minimum noise barrier performance target. The barrier should be designed to meet the assessment criteria, regardless of the noise level reduction that would have been attained without the noise barrier in place.

Options:

- **Who is responsible for maintaining noise barriers after construction?**
- **What is the minimum level of noise mitigation?**

Recommendations:

- **Maintenance for barriers (walls and/or earth berms) on private property should be the responsibility of the property owner while maintenance for barriers on public property should be the responsibility of the City.**
- **Minimum recommended noise attenuation should be 5 dBA where possible but the performance for noise barriers for new/upgraded/retrofit projects should be assessed on a case-by-case basis. The absolute minimum attenuation for retrofit projects should be 3 dBA.**

City of Saskatoon Recommendations:

- **Maintenance for barriers (walls and/or earth berms) on private property should be the responsibility of the property owner while maintenance for barriers on public property should be the responsibility of the City.**
- **Minimum recommended noise attenuation should be a goal of 5 dBA where possible but the performance for noise barriers for new/upgraded/retrofit projects should be assessed on a case-by-case basis. The absolute minimum attenuation for retrofit projects should be 3dBA.**

4.5. Glossary of Terms

It is recommended to include a glossary of terms within the traffic noise attenuation policy. Those terms that specifically pertain to noise are as follows:

A-Weighted Sound Level – A-weighted sound level is measured on a sound level meter, using a setting that emphasizes the middle frequency components similar to response of the human ear. The A-weighted sound level is found to correlate well with subjective assessments of the annoying or disturbing effect of sounds.

Abnormal Noise Events – Noises that are sufficiently infrequent as to be uncharacteristic of an area or that occur so close to the microphone as to dominate the measurements in an unrealistic manner. Consideration must be given to deleting occurrences of abnormal noise from the measurements to obtain a reasonably accurate representation of the sound environment. Examples of abnormal noises include a dog barking close to the microphone, people talking in the vicinity of the microphone in a quiet environment, or a passing road grader.

Absorption – Absorption is a property of materials that reduces the amount of sound energy reflected. Thus, the introduction of an "absorbent" onto the surfaces of a noise barrier will reduce the reflected sound pressure level. The amount of sound absorption is denoted by the sound absorption coefficient which is a unit less number between 0 and 1 with 0 being completely reflective and 1 being completely absorptive.

Attenuation – A reduction in sound level in travelling from a source to a receiving point.

Barrier – A solid physical obstruction between the roadway and the observer, which interrupts the line of sight between them. Barriers can take the form of walls, berms, or buildings.

Barrier Attenuation – The reduction in level of sound travelling over hard ground resulting from a barrier being inserted between the noise source and the receiving point.

Berm (Earth Berm)– A mound of earth that interrupts the line of sight between the noise source and the receiving point, thus acting as a barrier.

Calibration – The procedure used for the adjustment of a sound level meter using a reference source of a known sound pressure level and frequency. Field calibration takes place before and after the sound level measurements.

Day-Night Average Sound Level (L_{dn}) – Day-night sound level in dBA is derived by performing a logarithmic average of the time varying sound energy equivalent over the daytime (L_{eq}Day) with the time varying sound energy equivalent over the night time (L_{eq}Night) and adding a 10 decibel "penalty" to the L_{eq}Night.

Day-Time – Defined as the hours from 07:00 to 22:00.

dBA – The decibel (dB) sound pressure level filtered through the A-weighting filtering network to approximate human hearing response at low intensities. Also see *dB* and *A-weighted sound level*.

Decibel (dB) – One tenth of a Bel. Sound is measured in decibels. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Decibels are not linear units, rather they are expressed using a base-10 logarithmic scale. An increase of 10 decibels represents 10-times the acoustical energy. An increase of 20 decibels represents 100-times the acoustical energy.

Energy Equivalent Level (L_{eq}) – The L_{eq} is the logarithmic average sound level over a specified period of time. It is a single-number representation of the cumulative acoustical energy measured over a time interval, T. The time interval must be specified in order for the L_{eq} to be valid. If a sound level is constant over the measurement period, the L_{eq} will equal the constant sound level.

L_{eq}24 – The energy equivalent sound level (L_{eq}) assessed for a 24-hour time period.

Night-Time – Defined as the hours from 22:00 to 07:00.

Noise Monitor – A self contained sound level meter installed in a weather protective case that can measure environmental noise levels for extended periods of time. Typically, the sound level meter is installed in a case while the microphone is mounted to a tripod and incorporates an outdoor windscreen and rain protection hood.

Propagation – The passage of sound energy from a noise source to a receiver.

Sound Insulation – The use of structures and materials designed to reduce the transmission of sound from one room or area to another or from the exterior to the interior of a building.

Sound Level Meter – An instrument designed and calibrated to respond to sound and to give objective, reproducible measurements of sound pressure level. It normally has several features that would enable its frequency response and averaging times to be changed to make it suitable to simulate the response of the human ear.

Sound Pressure Level (SPL) – The decibel equivalent of the pressure of sound waves at a specific location, which is measured with a microphone. Because human reaction and material behaviors vary with frequency, the sound pressure level may be measured using frequency bands or with an overall weighting scale such as the A-weighting system. The sound pressure level depends on the noise sources, as well as on the location and environment of the measurement path. *See also dB (decibel)*

Windscreen – A specialized piece of porous sponge or foam that fits over the microphone in order to reduce the noise generated by the wind blowing around the microphone. Useful in moderately low wind speeds. Generally, outdoor measurements are not recommended when wind speeds exceed 15 km/hr, as the wind-induced noise on the microphone becomes of the same magnitude as the levels of noise being measured.

5.0 Assessment of Various Noise Level Criteria

The singular most important component to any traffic noise attenuation policy is the selection of the specific assessment criteria that will determine the need for and the quantity of noise mitigation. In an effort to provide assistance with the selection of the specific assessment criteria, various assessment criteria have been evaluated for various roadways within the City of Saskatoon. Five completely separate areas within Saskatoon were evaluated, each with different roadway configurations and future traffic volumes, different distances between the roadways and adjacent residential receptors, and different topography. For each study area, a noise model (previously generated as part of a noise barrier study project within Saskatoon) was used to determine the required noise barrier heights and lengths to meet various assessment criteria including 65, 60, 55 dBA $L_{eq}24$ and 65, 60, 55 dBA L_{dn} at the adjacent residential receptor outdoor amenity spaces for the future conditions (400K population). The intent is to provide a sense of the scale required in order to meet the various assessment criteria. For more information regarding the specific study areas with detailed description of the geometries and topography as well as the traffic volumes, refer to the reports entitled:

- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for College Drive Between Central Avenue to CPR Bridge & McKercher Drive Between Boychuk Drive and College Drive*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.
- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for Boychuk Drive Between Taylor Street and Heritage Crescent*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.
- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for Circle Drive Between Highway 16 and Taylor Street*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.
- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for 22 Street Between Michener Crescent and Haviland Crescent*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.
- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for Circle Drive Between Milton Street and 33 Street West*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.

5.1. College Drive Between Central Avenue and McKercher Drive

This specific study area spans the south side of College Drive from the intersection at Central Avenue to the interchange with McKercher Drive and then follows McKercher Drive south to Boychuk Drive. The residential receptors are all comprised of single family detached houses which back onto Central Avenue and McKercher Drive.

- 65 dBA $L_{eq}24$ – No noise mitigation required to achieve 65 dBA $L_{eq}24$
- 60 dBA $L_{eq}24$ – Barrier height from 3.0 m to 3.5 m tall (approximately 1,100 m length)
- 55 dBA $L_{eq}24$ – Barrier height from 5.0 m to 6.0 m tall (approximately 1,100 m length)

- 65 dBA L_{dn} – Barrier height 2.44 m tall (approximately 1,100 m length)
- 60 dBA L_{dn} – Barrier height 4.5 m tall (approximately 1,100 m length)
- 55 dBA L_{dn} – Barrier height from 7.5 m to 8.5 m tall (approximately 1,100 m length)

5.2. Boychuk Drive Between Taylor Street and Heritage Crescent

This specific study area spans the west side of Boychuk Drive from the intersection at Taylor Street to the intersection at Heritage Crescent. The residential receptors are all comprised of single family semi-detached houses which back onto Boychuk Drive. The following noise barriers are required to meet the various assessment criteria:

- 65 dBA $L_{eq}24$ – No noise mitigation required to achieve 65 dBA $L_{eq}24$
- 60 dBA $L_{eq}24$ – No noise mitigation required to achieve 60 dBA $L_{eq}24$
- 55 dBA $L_{eq}24$ – Barrier height from 1.83 m to 2.44 m tall (approximately 280 m length)

- 65 dBA L_{dn} – No noise mitigation required to achieve 65 dBA L_{dn}
- 60 dBA L_{dn} – Barrier height 1.83 m tall (approximately 280 m length)
- 55 dBA L_{dn} – Barrier height 3.0 m tall (approximately 280 m length)

5.3. Circle Drive Between Highway 16 and Taylor Street

This specific study area spans the east and west sides of Circle Drive from the interchange at Highway 16 to the interchange with Taylor Street. The residential receptors are all comprised of single family detached houses which back onto Circle Drive. There are also multi-family residential structures to the south of Taylor Street on the west side of Circle Drive which have not been included in the noise mitigation assessment. It should be noted that Circle Drive within this area is flanked on both sides by an earth berm approximately 3 m tall with the houses on the other side of the berm. The following noise barriers are required to meet the various assessment criteria:

- 65 dBA $L_{eq}24$ – Most of study area requires no noise mitigation to achieve 65 dBA $L_{eq}24$, just a short span (approximately 130 m) with a 1.83 m tall barrier to the northwest of the intersection between Circle Drive and Highway 16.
- 60 dBA $L_{eq}24$ – Barrier height from 1.83 m to 3 m tall (approximately 2,600 m length)
- 55 dBA $L_{eq}24$ – Barrier height from 3.5 m to 7.0 m tall (approximately 2,600 m length)

- 65 dBA L_{dn} – Barrier height from 0 m to 2.44 m tall (approximately 2,600 m length)
- 60 dBA L_{dn} – Barrier height from 1.83 m to 4.5m tall (approximately 2,600 m length)
- 55 dBA L_{dn} – Barrier height from 7 m to 10+ m tall (approximately 2,600 m length)

5.4. 22 Street Between Michener Crescent and Haviland Crescent

This specific study area spans the north side of 22 Street from approximately Michener Crescent to approximately Haviland Crescent. The residential receptors are all comprised of single family detached houses which back onto 22 Street. The following noise barriers are required to meet the various assessment criteria:

- 65 dBA $L_{eq}24$ – No noise mitigation required to achieve 65 dBA $L_{eq}24$
- 60 dBA $L_{eq}24$ – Barrier height 1.83 m tall (approximately 650 m length)
- 55 dBA $L_{eq}24$ – Barrier height from 4.0 m to 4.5 m tall (approximately 1,700 m length)

- 65 dBA L_{dn} – No noise mitigation required to achieve 65 dBA L_{dn}
- 60 dBA L_{dn} – Barrier height 3.0 m tall (approximately 1,700 m length)
- 55 dBA L_{dn} – Barrier height from 3.5 m to 7.0 m tall (approximately 1,700 m length)

5.5. Circle Drive Between Milton Street and 33 Street West

This specific study area spans the north and south sides of Circle Drive from approximately Milton Street to the interchange with 33 Street West. The residential receptors are all comprised of single family detached houses which back onto Circle Drive. It should be noted that Circle Drive within this area is flanked on the north side by an earth berm approximately 2 m tall with the houses on the other side of the berm. The following noise barriers are required to meet the various assessment criteria:

- 65 dBA $L_{eq}24$ – No noise mitigation required to achieve 65 dBA $L_{eq}24$
- 60 dBA $L_{eq}24$ – Barrier height from 1.83 m to 4 m tall (approximately 1,800 m length)
- 55 dBA $L_{eq}24$ – Barrier height from 4.5 m to 8.5 m tall (approximately 1,800 m length)

- 65 dBA L_{dn} – Barrier height from 1.83 m tall (approximately 350 m length)
- 60 dBA L_{dn} – Barrier height from 1.83 m to 6.5 m tall (approximately 1,800 m length)
- 55 dBA L_{dn} – Barrier height from 7.5 m to 12 m tall (approximately 1,800 m length)

6.0 References

- City of Regina *Traffic Division Procedure Manual, Section 6.0*
- City of Edmonton *Urban Traffic Noise Policy (C506A)*, 2013
- City of Calgary *Surface Transportation Noise Policy (TP003)*
- City of St. Albert *Municipal Engineering Standards, Section 3.9*
- Strathcona County *SER-009-027 (Traffic Noise)*
- City of Leduc *Engineering Standards Section 1.15*
- Regional Municipality of Wood Buffalo *Engineering Services Standards and Development Procedures, Section 4.9*
- City of Red Deer *Engineering Services Design Guidelines, Section 13*
- Alberta Transportation *Noise Attenuation Guidelines for Provincial Highways under Provincial Jurisdiction Within Cities and Urban Areas.*
- British Columbia Ministry of Transportation and Infrastructure *Policy for Assessing and Mitigating Noise Impacts From New and Upgraded Numbered Highways*
- Ontario Ministry of the Environment *Publication NPC-300, Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning*
- Alberta Energy Regulator (AER), *Directive 038 on Noise Control, 2007*, Calgary, Alberta
- Canadian Mortgage and Housing Corporation (CMHC), *Road and Rail Noise: Effects on Housing*, 1981
- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for College Drive Between Central Avenue to CPR Bridge & McKercher Drive Between Boychuk Drive and College Drive*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.

- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for Boychuk Drive Between Taylor Street and Heritage Crescent*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.

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- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for 22 Street Between Michener Crescent and Haviland Crescent*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.

- *Environmental Traffic Noise Modeling and Traffic Noise Barrier Recommendations for Circle Drive Between Milton Street and 33 Street West*, Prepared for the City of Saskatoon, by aci Acoustical Consultants Inc., November, 2015.

- International Organization for Standardization (ISO), *Standard 1996-1, Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment procedures, 2003*, Geneva Switzerland.

- International Organization for Standardization (ISO), *Standard 9613-1, Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of absorption of sound by the atmosphere, 1993*, Geneva Switzerland.

- International Organization for Standardization (ISO), *Standard 9613-2, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation, 1996*, Geneva Switzerland.

Appendix I THE ASSESSMENT OF ENVIRONMENTAL NOISE (GENERAL)

Sound Pressure Level

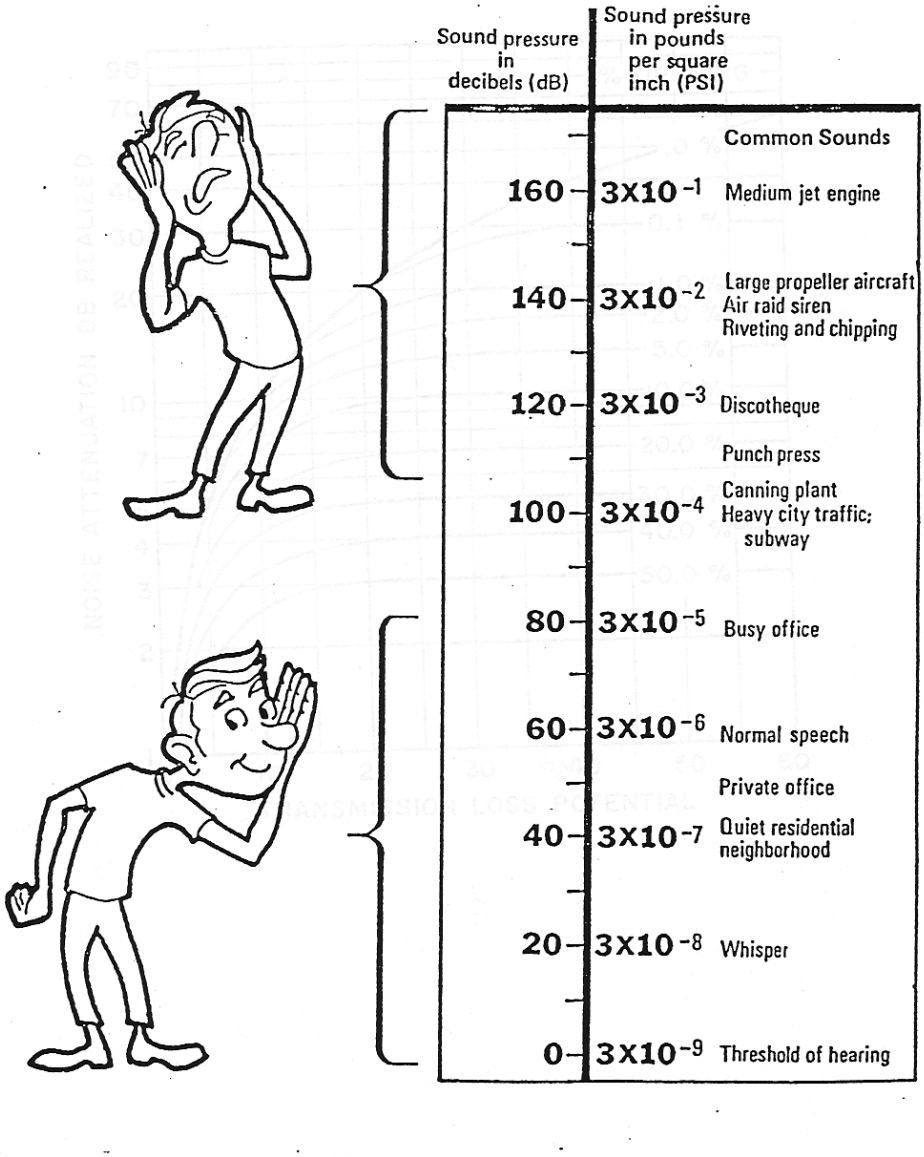
Sound pressure is initially measured in Pascal's (Pa). Humans can hear several orders of magnitude in sound pressure levels, so a more convenient scale is used. This scale is known as the decibel (dB) scale, named after Alexander Graham Bell (telephone guy). It is a base 10 logarithmic scale. When we measure pressure we typically measure the RMS sound pressure.

$$SPL = 10\log_{10}\left[\frac{P_{RMS}^{2}}{P_{ref}^{2}}\right] = 20\log_{10}\left[\frac{P_{RMS}}{P_{ref}}\right]$$

Where: SPL = Sound Pressure Level in dB
P_{RMS} = Root Mean Square measured pressure (Pa)
P_{ref} = Reference sound pressure level ($P_{ref} = 2\text{x}10^{-5}$ Pa = 20 μPa)

This reference sound pressure level is an internationally agreed upon value. It represents the threshold of human hearing for "typical" people based on numerous testing. It is possible to have a threshold which is lower than 20 μPa which will result in negative dB levels. As such, zero dB does not mean there is no sound!

In general, a difference of 1 – 2 dB is the threshold for humans to notice that there has been a change in sound level. A difference of 3 dB (factor of 2 in acoustical energy) is perceptible and a change of 5 dB is strongly perceptible. A change of 10 dB is typically considered a factor of 2. This is quite remarkable when considering that 10 dB is 10-times the acoustical energy!


Sound pressure in decibels (dB)
Sound pressure in pounds per square inch (PSI)
Common Sounds
160
3X10 -1
Medium jet engine
140
3X10 -2
Large propeller aircraft
Air raid siren
Riveting and chipping
120
3X10 -3
Discotheque
Punch press
100
3X10 -4
Canning plant
Heavy city traffic; subway
80
3X10 -5
Busy office
60
3X10 -6
Normal speech
Private office
40
3X10 -7
Quiet residential neighborhood
20
3X10 -8
Whisper
0
3X10 -9
Threshold of hearing

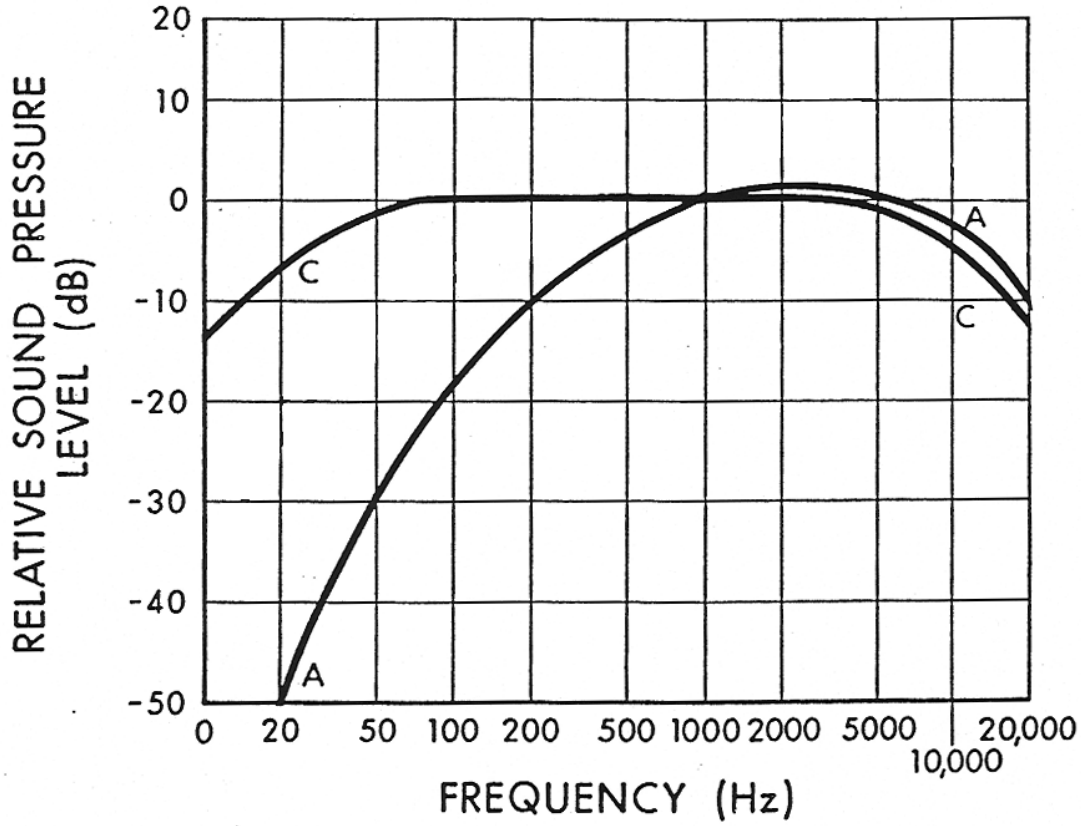
Frequency

The range of frequencies audible to the human ear ranges from approximately 20 Hz to 20 kHz. Within this range, the human ear does not hear equally at all frequencies. It is not very sensitive to low frequency sounds, is very sensitive to mid frequency sounds and is slightly less sensitive to high frequency sounds. Due to the large frequency range of human hearing, the entire spectrum is often divided into 31 bands, each known as a 1/3 octave band.

The internationally agreed upon center frequencies and upper and lower band limits for the 1/1 (whole octave) and 1/3 octave bands are as follows:

Whole Octave			1/3 Octave		
Lower Band Limit	Center Frequency	Upper Band Limit	Lower Band Limit	Center Frequency	Upper Band Limit
11	**16**	22	14.1	**16**	17.8
			17.8	**20**	22.4
22	**31.5**	44	22.4	**25**	28.2
			28.2	**31.5**	35.5
			35.5	**40**	44.7
44	**63**	88	44.7	**50**	56.2
			56.2	**63**	70.8
			70.8	**80**	89.1
88	**125**	177	89.1	**100**	112
			112	**125**	141
			141	**160**	178
177	**250**	355	178	**200**	224
			224	**250**	282
			282	**315**	355
355	**500**	710	355	**400**	447
			447	**500**	562
			562	**630**	708
710	**1000**	1420	708	**800**	891
			891	**1000**	1122
			1122	**1250**	1413
1420	**2000**	2840	1413	**1600**	1778
			1778	**2000**	2239
			2239	**2500**	2818
2840	**4000**	5680	2818	**3150**	3548
			3548	**4000**	4467
			4467	**5000**	5623
5680	**8000**	11360	5623	**6300**	7079
			7079	**8000**	8913
			8913	**10000**	11220
11360	**16000**	22720	11220	**12500**	14130
			14130	**16000**	17780
			17780	**20000**	22390

Human hearing is most sensitive at approximately 3500 Hz which corresponds to the ¼ wavelength of the ear canal (approximately 2.5 cm). Because of this range of sensitivity to various frequencies, we typically apply various weighting networks to the broadband measured sound to more appropriately account for the way humans hear. By default, the most common weighting network used is the so-called "A-weighting". It can be seen in the figure that the low frequency sounds are reduced significantly with the A-weighting.



Combination of Sounds

When combining multiple sound sources the general equation is:

$$\Sigma SPL_n = 10\log_{10}\left[\sum_{i=1}^{n} 10^{\frac{SPL_i}{10}}\right]$$

Examples:

- Two sources of 50 dB each add together to result in 53 dB.
- Three sources of 50 dB each add together to result in 55 dB.
- Ten sources of 50 dB each add together to result in 60 dB.
- One source of 50 dB added to another source of 40 dB results in 50.4 dB

It can be seen that, if multiple similar sources exist, removing or reducing only one source will have little effect.

Sound Level Measurements

Over the years a number of methods for measuring and describing environmental noise have been developed. The most widely used and accepted is the concept of the Energy Equivalent Sound Level (L_{eq}) which was developed in the US (1970's) to characterize noise levels near US Air-force bases. This is the level of a steady state sound which, for a given period of time, would contain the same energy as the time varying sound. The concept is that the same amount of annoyance occurs from a sound having a high level for a short period of time as from a sound at a lower level for a longer period of time.
The L_{eq} is defined as:

$$L_{eq} = 10\log_{10}\left[\frac{1}{T}\int_0^T 10^{\frac{dB}{10}}\,dT\right] = 10\log_{10}\left[\frac{1}{T}\int_0^T \frac{P^2}{P_{ref}^2}\,dT\right]$$

We must specify the time period over which to measure the sound. i.e. 1-second, 10-seconds, 15-seconds, 1-minute, 1-day, etc**. An L_{eq} is meaningless if there is no time period associated**.

In general there a few very common L_{eq} sample durations which are used in describing environmental noise measurements. These include:

- $L_{eq}24$ - Measured over a 24-hour period
- L_{eq}Night - Measured over the night-time (typically 22:00 – 07:00)
- L_{eq}Day - Measured over the day-time (typically 07:00 – 22:00)
- L_{dn} - Same as $L_{eq}24$ with a 10 dB penalty added to the night-time

Statistical Descriptor

Another method of conveying long term noise levels utilizes statistical descriptors. These are calculated from a cumulative distribution of the sound levels over the entire measurement duration and then determining the sound level at xx % of the time.

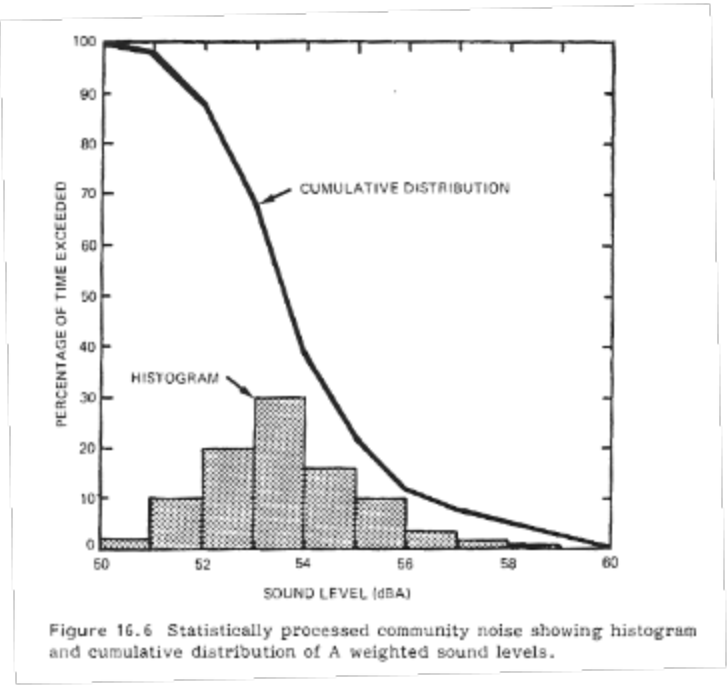


Figure 16.6 Statistically processed community noise showing histogram and cumulative distribution of A weighted sound levels.

Industrial Noise Control, Lewis Bell, Marcel Dekker, Inc. 1994

The most common statistical descriptors are:

L_{min} - minimum sound level measured
L_{01} - sound level that was exceeded only 1% of the time
L_{10} - sound level that was exceeded only 10% of the time.
- Good measure of intermittent or intrusive noise
- Good measure of Traffic Noise

L_{50} - sound level that was exceeded 50% of the time (arithmetic average)
- Good to compare to L_{eq} to determine steadiness of noise

L_{90} - sound level that was exceeded 90% of the time
- Good indicator of typical "ambient" noise levels

L_{99} - sound level that was exceeded 99% of the time
L_{max} - maximum sound level measured

These descriptors can be used to provide a more detailed analysis of the varying noise climate:

- If there is a large difference between the L_{eq} and the L_{50} (L_{eq} can never be any lower than the L_{50}) then it can be surmised that one or more short duration, high level sound(s) occurred during the time period.
- If the gap between the L_{10} and L_{90} is relatively small (less than 15 – 20 dBA) then it can be surmised that the noise climate was relatively steady.

Sound Propagation

In order to understand sound propagation, the nature of the source must first be discussed. In general, there are three types of sources. These are known as 'point', 'line', and 'area'. This discussion will concentrate on point and line sources since area sources are much more complex and can usually be approximated by point sources at large distances.

Point Source

As sound radiates from a point source, it dissipates through geometric spreading. The basic relationship between the sound levels at two distances from a point source is:

$$\therefore SPL_1 - SPL_2 = 20\log_{10}\left(\frac{r_2}{r_1}\right)$$

Where: SPL_1 = sound pressure level at location 1, SPL_2 = sound pressure level at location 2
r_1 = distance from source to location 1, r_2 = distance from source to location 2

Thus, the reduction in sound pressure level for a point source radiating in a free field is **6 dB per doubling of distance**. This relationship is independent of reflectivity factors provided they are always present. Note that this only considers geometric spreading and does not take into account atmospheric effects. Point sources still have some physical dimension associated with them, and typically do not radiate sound equally in all directions in all frequencies. The directionality of a source is also highly dependent on frequency. As frequency increases, directionality increases.

Examples (note no atmospheric absorption):

- A point source measuring 50 dB at 100m will be 44 dB at 200m.
- A point source measuring 50 dB at 100m will be 40.5 dB at 300m.
- A point source measuring 50 dB at 100m will be 38 dB at 400m.
- A point source measuring 50 dB at 100m will be 30 dB at 1000m.

Line Source

A line source is similar to a point source in that it dissipates through geometric spreading. The difference is that a line source is equivalent to a long line of many point sources. The basic relationship between the sound levels at two distances from a line source is:

$$SPL_1 - SPL_2 = 10\log_{10}\left(\frac{r_2}{r_1}\right)$$

The difference from the point source is that the '20' term in front of the 'log' is now only 10. Thus, the reduction in sound pressure level for a line source radiating in a free field is **3 dB per doubling of distance**.

Examples (note no atmospheric absorption):

- A line source measuring 50 dB at 100m will be 47 dB at 200m.
- A line source measuring 50 dB at 100m will be 45 dB at 300m.
- A line source measuring 50 dB at 100m will be 44 dB at 400m.
- A line source measuring 50 dB at 100m will be 40 dB at 1000m.

Atmospheric Absorption

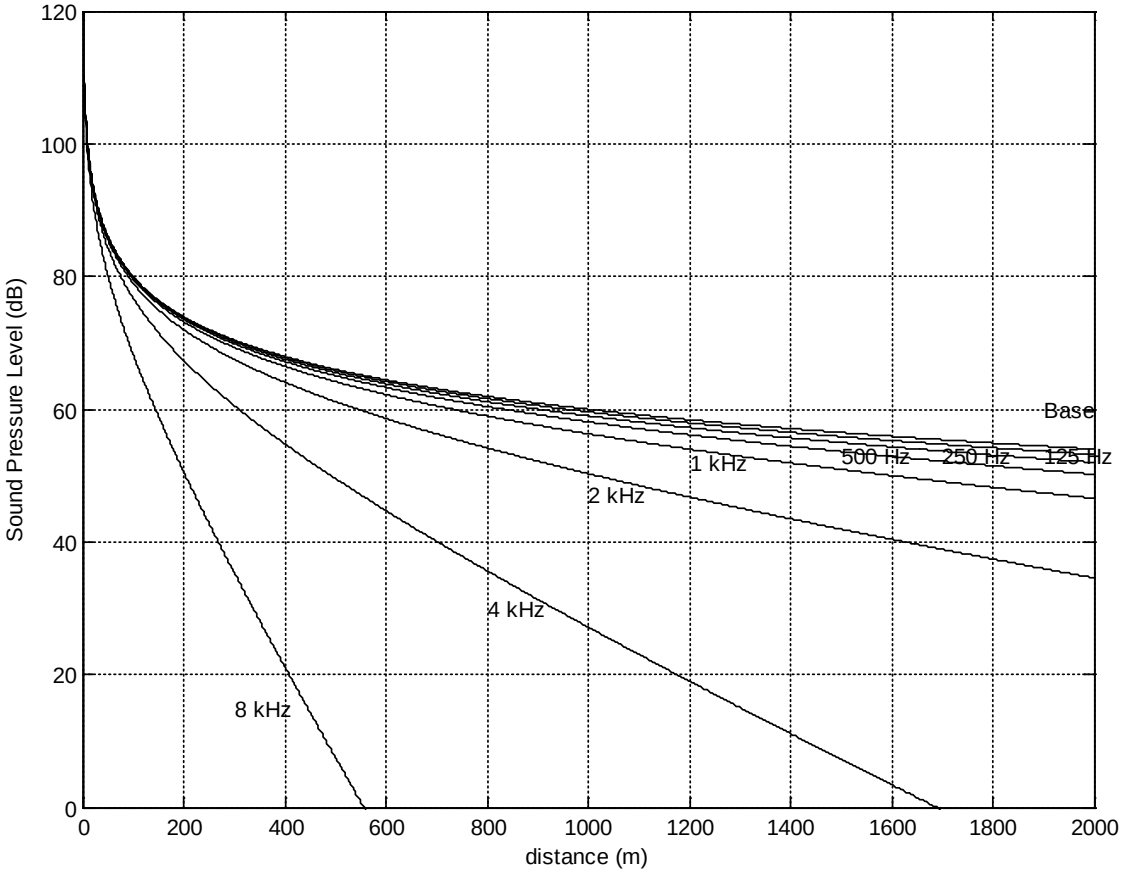
As sound transmits through a medium, there is an attenuation (or dissipation of acoustic energy) which can be attributed to three mechanisms:

1) **Viscous Effects** - Dissipation of acoustic energy due to fluid friction which results in thermodynamically irreversible propagation of sound.
2) **Heat Conduction Effects** - Heat transfer between high and low temperature regions in the wave which result in non-adiabatic propagation of the sound.
3) **Inter Molecular Energy Interchanges** - Molecular energy relaxation effects which result in a time lag between changes in translational kinetic energy and the energy associated with rotation and vibration of the molecules.

The following table illustrates the attenuation coefficient of sound at standard pressure (101.325 kPa) in units of dB/100m.

Temperature	Relative Humidity	Frequency (Hz)					
°C	(%)	125	250	500	1000	2000	4000
30	20	0.06	0.18	0.37	0.64	1.40	4.40
	50	0.03	0.10	0.33	0.75	1.30	2.50
	90	0.02	0.06	0.24	0.70	1.50	2.60
20	20	0.07	0.15	0.27	0.62	1.90	6.70
	50	0.04	0.12	0.28	0.50	1.00	2.80
	90	0.02	0.08	0.26	0.56	0.99	2.10
10	20	0.06	0.11	0.29	0.94	3.20	9.00
	50	0.04	0.11	0.20	0.41	1.20	4.20
	90	0.03	0.10	0.21	0.38	0.81	2.50
0	20	0.05	0.15	0.50	1.60	3.70	5.70
	50	0.04	0.08	0.19	0.60	2.10	6.70
	90	0.03	0.08	0.15	0.36	1.10	4.10

- As frequency increases, absorption tends to increase
- As Relative Humidity increases, absorption tends to decrease
- There is no direct relationship between absorption and temperature
- **The net result of atmospheric absorption is to modify the sound propagation of a point source from 6 dB/doubling-of-distance to approximately 7 – 8 dB/doubling-of-distance (based on anecdotal experience)**



Atmospheric Absorption at 10°C and 70% RH

Meteorological Effects

There are many meteorological factors which can affect how sound propagates over large distances. These various phenomena must be considered when trying to determine the relative impact of a noise source either after installation or during the design stage.

Wind

- Can greatly alter the noise climate away from a source depending on direction
- Sound levels downwind from a source can be increased due to refraction of sound back down towards the surface. This is due to the generally higher velocities as altitude increases.
- Sound levels upwind from a source can be decreased due to a "bending" of the sound away from the earth's surface.
- Sound level differences of ±10dB are possible depending on severity of wind and distance from source.
- Sound levels crosswind are generally not disturbed by an appreciable amount
- Wind tends to generate its own noise, however, and can provide a high degree of masking relative to a noise source of particular interest.

Temperature

- Temperature effects can be similar to wind effects
- Typically, the temperature is warmer at ground level than it is at higher elevations.
- If there is a very large difference between the ground temperature (very warm) and the air aloft (only a few hundred meters) then the transmitted sound refracts upward due to the changing speed of sound.
- If the air aloft is warmer than the ground temperature (known as an *inversion*) the resulting higher speed of sound aloft tends to refract the transmitted sound back down towards the ground. This essentially works on Snell's law of reflection and refraction.
- Temperature inversions typically happen early in the morning and are most common over large bodies of water or across river valleys.
- Sound level differences of ±10dB are possible depending on gradient of temperature and distance from source.

Rain

- Rain does not affect sound propagation by an appreciable amount unless it is very heavy
- The larger concern is the noise generated by the rain itself. A heavy rain striking the ground can cause a significant amount of highly broadband noise. The amount of noise generated is difficult to predict.
- Rain can also affect the output of various noise sources such as vehicle traffic.

Summary

- In general, these wind and temperature effects are difficult to predict
- Empirical models (based on measured data) have been generated to attempt to account for these effects.
- Environmental noise measurements must be conducted with these effects in mind. Sometimes it is desired to have completely calm conditions, other times a "worst case" of downwind noise levels are desired.

Topographical Effects

Similar to the various atmospheric effects outlined in the previous section, the effect of various geographical and vegetative factors must also be considered when examining the propagation of noise over large distances.

Topography

- One of the most important factors in sound propagation.
- Can provide a natural barrier between source and receiver (i.e. if berm or hill in between).
- Can provide a natural amplifier between source and receiver (i.e. large valley in between or hard reflective surface in between).
- Must look at location of topographical features relative to source and receiver to determine importance (i.e. small berm 1km away from source and 1km away from receiver will make negligible impact).

Grass

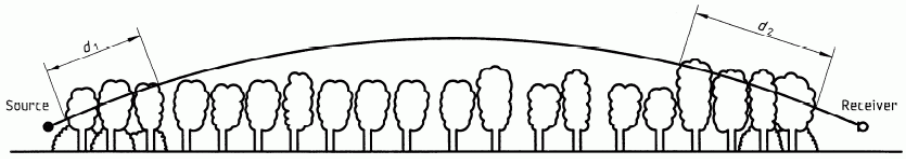
- Can be an effective absorber due to large area covered
- Only effective at low height above ground. Does not affect sound transmitted direct from source to receiver if there is line of sight.
- Typically less absorption than atmospheric absorption when there is line of sight.
- Approximate rule of thumb based on empirical data is:

$$A_g = 18\log_{10}(f) - 31 \qquad (dB/100m)$$

Where: A_g is the absorption amount

Trees

- Provide absorption due to foliage
- Deciduous trees are essentially ineffective in the winter
- Absorption depends heavily on density and height of trees
- No data found on absorption of various kinds of trees
- Large spans of trees are required to obtain even minor amounts of sound reduction
- In many cases, trees can provide an effective visual barrier, even if the noise attenuation is negligible.



NOTE — $d_f = d_1 + d_2$

For calculating d_1 and d_2, the curved path radius may be assumed to be 5 km.

Figure A.1 — Attenuation due to propagation through foliage increases linearly with propagation distance d_f through the foliage

Table A.1 — Attenuation of an octave band of noise due to propagation a distance d_f through dense foliage

Propagation distance d_f	Nominal midband frequency Hz							
m	63	125	250	500	1 000	2 000	4 000	8 000
	Attenuation, dB:							
$10 \leq d_f \leq 20$	0	0	1	1	1	1	2	3
	Attenuation, dB/m:							
$20 \leq d_f \leq 200$	0,02	0,03	0,04	0,05	0,06	0,08	0,09	0,12

Tree/Foliage attenuation from ISO 9613-2:1996

Bodies of Water

- Large bodies of water can provide the opposite effect to grass and trees.
- Reflections caused by small incidence angles (grazing) can result in larger sound levels at great distances (increased reflectivity, Q).
- Typically air temperatures are warmer high aloft since air temperatures near water surface tend to be more constant. Result is a high probability of temperature inversion.
- Sound levels can "carry" much further.

Snow

- Covers the ground for approximately 1/2 of the year in northern climates.
- Can act as an absorber or reflector (and varying degrees in between).
- Freshly fallen snow can be quite absorptive.
- Snow which has been sitting for a while and hard packed due to wind can be quite reflective.
- Falling snow can be more absorptive than rain, but does not tend to produce its own noise.
- Snow can cover grass which might have provided some means of absorption.
- Typically sound propagates with less impedance in winter due to hard snow on ground and no foliage on trees/shrubs.

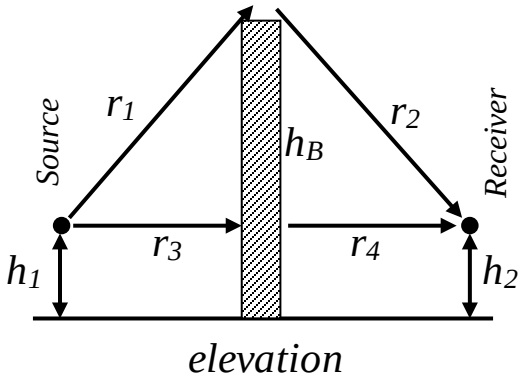
Road Noise Barriers

One of the most common methods for noise mitigation is through the use of a physical barrier. Noise travels over the barrier and is refracted down to the other side. The general formula for the Insertion Loss (level of noise attenuation) for a noise barrier is:

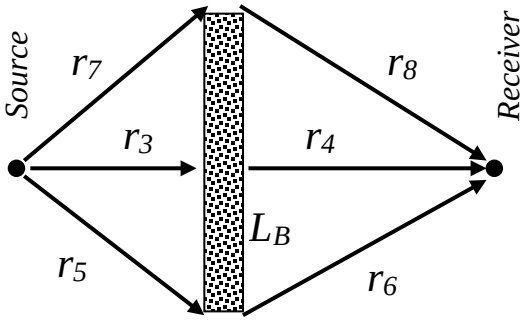
$$\therefore\ IL = -10\log_{10}\left[\sum_{i=1}^{3}\left(\frac{\lambda}{3\lambda + 20\,\delta_i}\right)\right]$$

Where: λ = the wavelength of the sound

δ_i = the pathlength difference between the ith diffracted path and the direct path



elevation



plan view

$$\delta_1 = (r_1 + r_2) - (r_3 + r_4)$$
$$\delta_2 = (r_5 + r_6) - (r_3 + r_4)$$
$$\delta_3 = (r_7 + r_8) - (r_3 + r_4)$$

Note that the preceding was derived with a point source. The attenuation due to a barrier in a free field for a line source is slightly less than that for a point source. The following table illustrates the differences

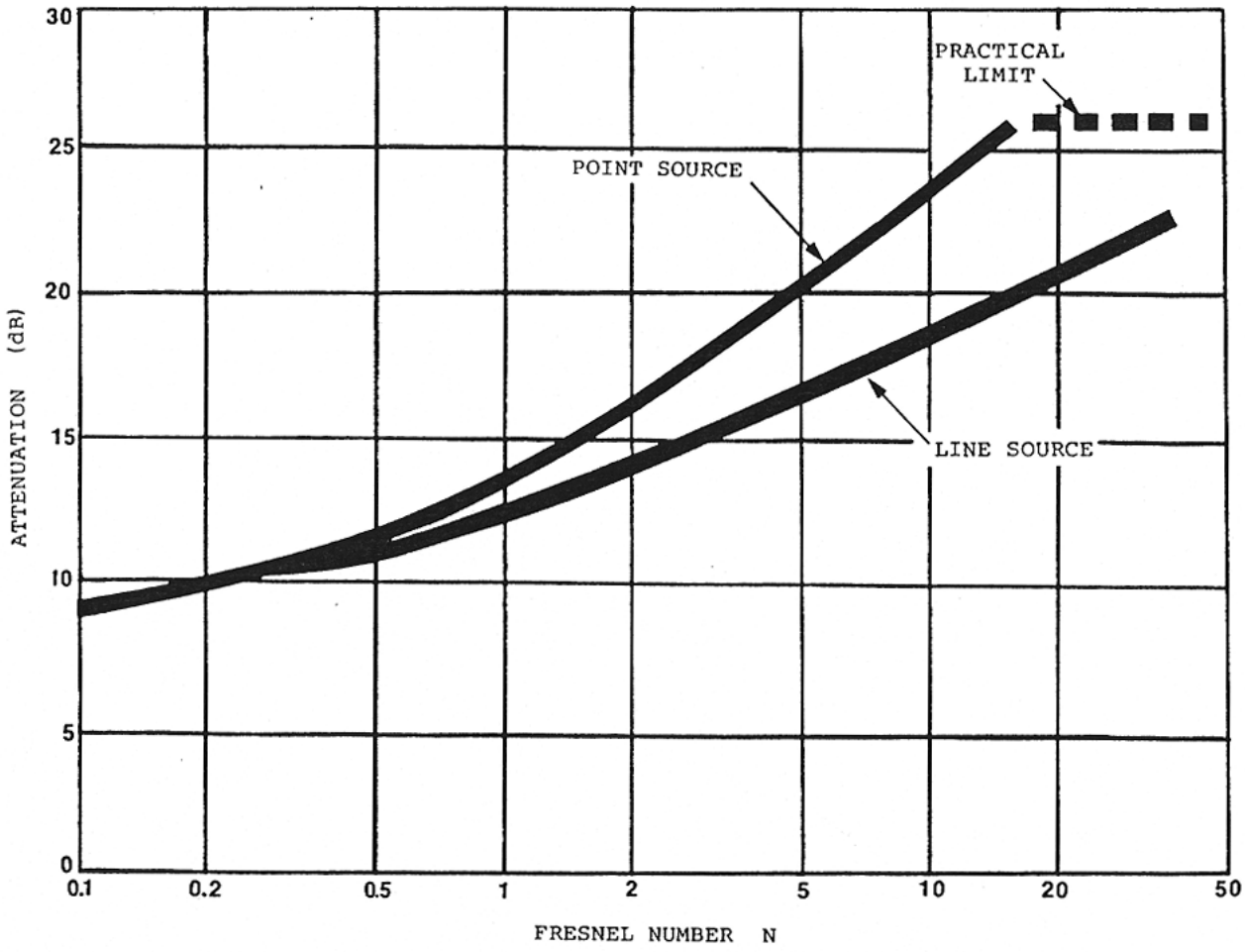
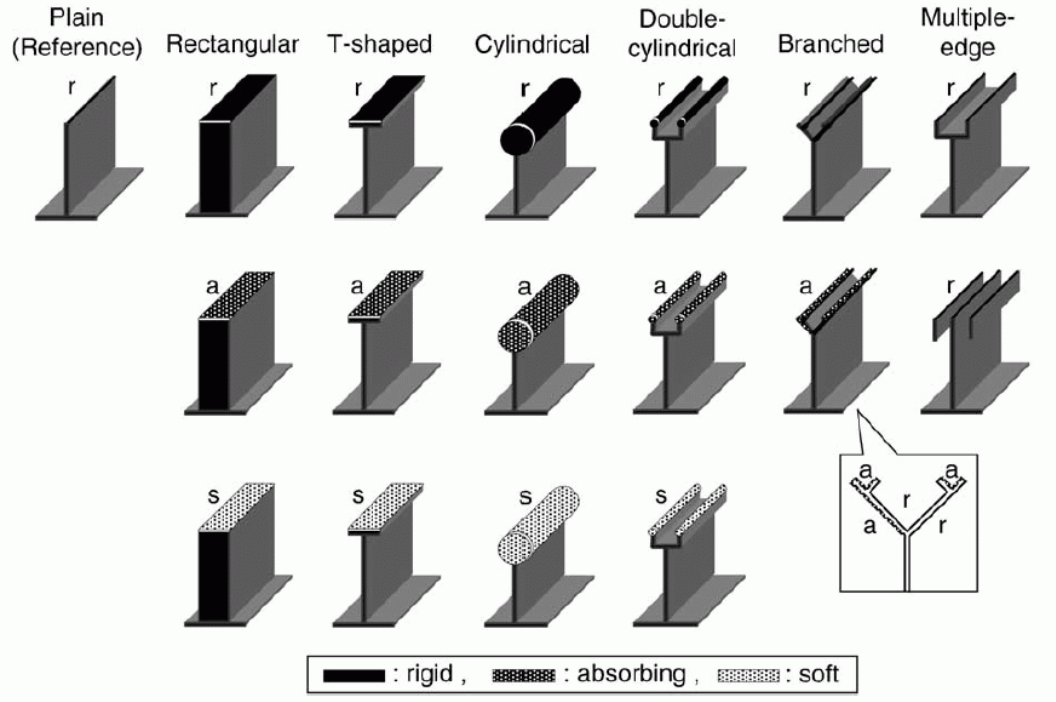


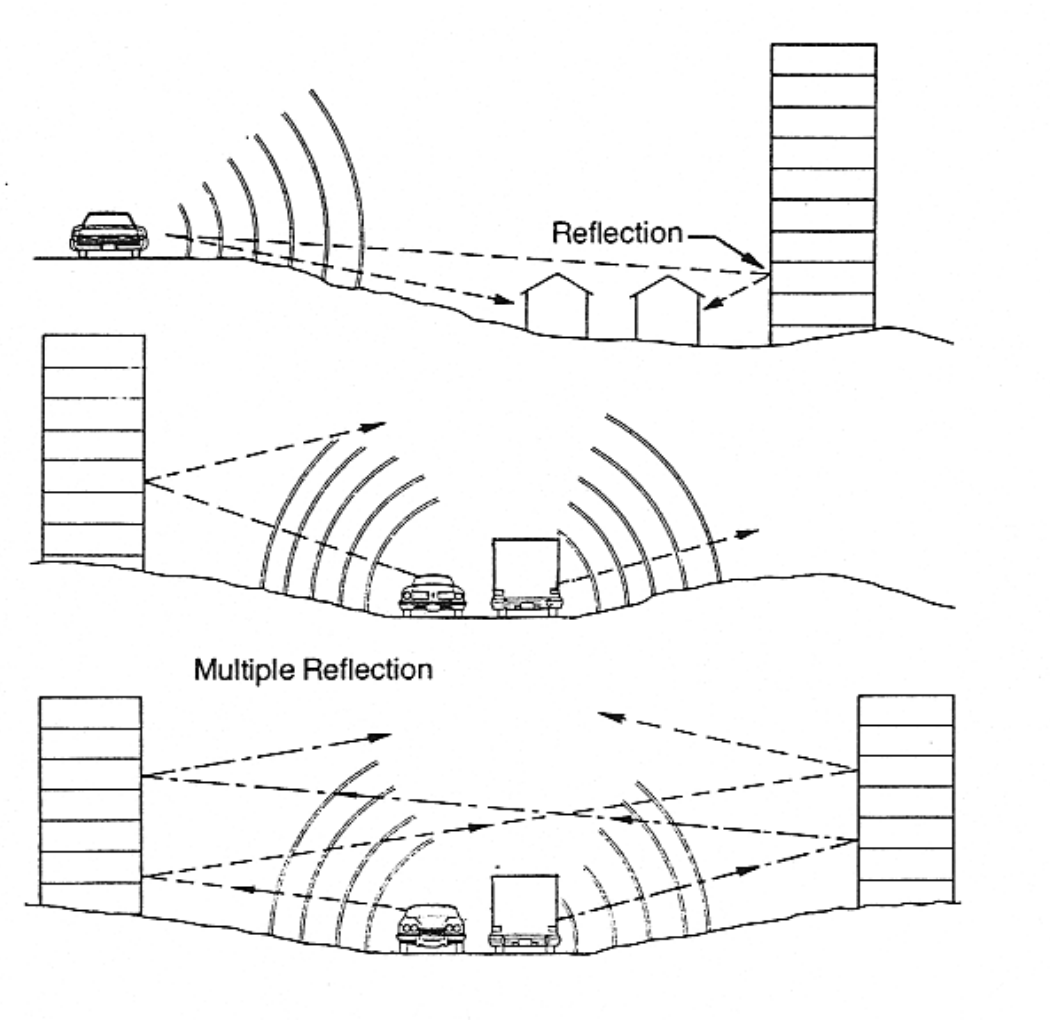
Figure 4.12 Attenuation due to a partial barrier for point and line sources.

Industrial Noise Control, Lewis Bell, Marcel Dekker, Inc. 1994

- Barriers are least effective when placed in the middle between source and receiver (smallest path length difference).
- Barriers are most effective when located near the source or receiver.
- Most road noise barriers are placed as close as possible to the road for this reason
- Barrier attenuation is VERY dependent on the frequency of noise attenuated (Example of mouse and giant).
- Practical limit of about 20 dB of attenuation.
- Attenuation depended on barrier construction. If the materials used are only good for 5 dB of reduction (light weight or many holes) then that is the practical limit of the barrier.
- Materials need to be selected such that the noise transmitted through the barrier is at least 10 dB less than the noise transmitted over the barrier (typically use concrete / masonry / heavy steel).
- Recent barrier designs have incorporated various toppings in an attempt to alter the amount of sound refracted from the top. *(T. Ishizuka, et. al., Applied Acoustics 65 (2004) 125-141)*


Plain (Reference)
Rectangular
T-shaped
Cylindrical
Double-cylindrical
Branched
Multiple-edge
r
a
s
: rigid , : absorbing , : soft

- Barriers can provide adequate attenuation from one side to another but will also act as a reflector for the opposite side (increasing the sound level as much as 3 dB).
- This can be a problem depending on what is on the opposite side.
- Multiple parallel barriers can result in the "swimming pool effect"
- Can incorporate absorption into the barrier (fibrous materials, concrete, etc.)



Road and Rail Noise: Effects on Housing, Canadian Mortgage and Housing Corporation, 1981

Appendix II SOUND LEVELS OF FAMILIAR NOISE SOURCES

Used with Permission Obtained from the Alberta Energy Regulator Directive 038 (February, 2007)

Source [1]	Sound Level (dBA)
Bedroom of a country home	30
Soft whisper at 1.5 m	30
Quiet office or living room	40
Moderate rainfall	50
Inside average urban home	50
Quiet street	50
Normal conversation at 1 m	60
Noisy office	60
Noisy restaurant	70
Highway traffic at 15 m	75
Loud singing at 1 m	75
Tractor at 15 m	78-95
Busy traffic intersection	80
Electric typewriter	80
Bus or heavy truck at 15 m	88-94
Jackhammer	88-98
Loud shout	90
Freight train at 15 m	95
Modified motorcycle	95
Jet taking off at 600 m	100
Amplified rock music	110
Jet taking off at 60 m	120
Air-raid siren	130

[1] Cottrell, Tom, 1980, *Noise in Alberta*, Table 1, p.8, ECA80 - 16/1B4 (Edmonton: Environment Council of Alberta).

SOUND LEVELS GENERATED BY COMMON APPLIANCES

Used with Permission Obtained from the Alberta Energy Regulator Directive 038 (February, 2007)

Source [1]	Sound level at 3 feet (dBA)
Freezer	38-45
Refrigerator	34-53
Electric heater	47
Hair clipper	50
Electric toothbrush	48-57
Humidifier	41-54
Clothes dryer	51-65
Air conditioner	50-67
Electric shaver	47-68
Water faucet	62
Hair dryer	58-64
Clothes washer	48-73
Dishwasher	59-71
Electric can opener	60-70
Food mixer	59-75
Electric knife	65-75
Electric knife sharpener	72
Sewing machine	70-74
Vacuum cleaner	65-80
Food blender	65-85
Coffee mill	75-79
Food waste disposer	69-90
Edger and trimmer	81
Home shop tools	64-95
Hedge clippers	85
Electric lawn mower	80-90

[1] Reif, Z. F., and Vermeulen, P. J., 1979, "Noise from domestic appliances, construction, and industry," Table 1, p.166, in Jones, H. W., ed., *Noise in the Human Environment*, vol. 2, ECA79-SP/1 (Edmonton: Environment Council of Alberta).

Table 2.1 Summary of Reviewed Traffic Noise Attenuation Policies

City / Municipality	Policy Document	Source	Noise Level Criteria	Funding	Assessment Location	Assessment Height	Future Assessment Timeline
City of Saskatoon (Historical)	Historical information previously posted on the City of Saskatoon Website	Historical information previously posted on the City of Saskatoon Website	65 dBA Ldn (Historically)	No information for New Development City to pay for Retrofit Barriers based on need and budget	Not Defined	Not Defined	Not Defined
City of Regina	Regina Traffic Division Procedure Manual Section 6.0	Received via e-mail after calling City. Otherwise not available online.	65 dBA Ldn	Developers to pay for New Development City to pay for Retrofit Barriers based on need and budget City to pay for barriers as part of Capital Cost for new/upgraded roads where required	3 m from dwelling facade in direction of noise source	1.5 m above grade	20 year planning horizon
City of Edmonton	Urban Traffic Noise Policy (UTNP) C506A	City of Edmonton Website (easily found through Google Search)	65 dBA Leq24	Developers to pay for New Development City to pay for Retrofit Barriers based on need and budget City to pay for barriers as part of Capital Cost for new/upgraded roads where required	Private Backyards	1.5 m above grade.	20 year planning horizon
City of Calgary	Surface Transportation Noise Policy TP003	City of Calgary Website (easily found through Google Search)	60 dBA Leq24	Developers pay for New Development (up to 10-years planning for new roadways) City pay based on need and budget through specific Noise Barrier Retrofit Program City pay as part of Capital Cost for new/upgraded roads where required	Outdoor Leisure Area	Not Defined	10 year planning horizon
City of St. Albert	Municipal Engineering Standards, Section 3.9	City of St. Albert Municipal Engineering Standards Document available at City website	65 dBA Leq24	Developers to pay for New Development City to pay for Retrofit Barriers based on need and budget City to pay for barriers as part of Capital Cost for new/upgraded roads where required	Not Defined	Not Defined	Not Defined
Strathcona County	SER-009-027	Strathcona County Website (easily found through Google Search)	55 dBA Leq24 New Residential 65 dBA Leq24 Existing Residential	Developers to pay for New Development City to pay for Retrofit Barriers based on need and budget City to pay for barriers as part of Capital Cost for new/upgraded roads where required	5 m from dwelling facade in direction of noise source	1.5 m above grade	Future volumes based on design capacity of road
City of Leduc	Engineering Standards Section 1.15	City of Leduc Engineering Design Standards Document available at City website	55 dBA Leq24 New Residential No Criteria for Existing Residential	Developers to Pay for New Development No information/precedent regarding retrofits or new/updgraded road construction	5 m from dwelling facade in direction of noise source	Not Defined	Not Defined
Fort McMurray	Engineering Servicing Standards and Development Procedures, Section 4.9	RMWB Engineering Services Standards and Development Procedures document available at RMWB website	65 dBA Leq24 New Residential No Criteria for Existing Residential	Developers to Pay for New Development No information/precedent regarding retrofits	2 m inside residential property line, in direction of noise source	1.2 m above grade	10 year planning horizon
City of Red Deer	Engineering Services Design Guidelines, 2016 Edition. Section 13	City of Red Deer Engineering Services Design Guidlines Document available at City website	60 dBA Leq24 New Residential No Criteria for Existing Residential	Developers to Pay for New Development No information regarding retrofits	3 m from dwelling facade in direction of noise source. 4.5 m from Property Line if building unknown	1.5 m above grade	20 year planning horizon
Alberta Transportation	Noise Attenuation Guidelines for Provincial Highways Under Provincial Jurisdiction Within Cities and Urban Areas	Website that is not directly accessable by the public	65 dBA Leq24	Developers to pay for New Development Alberta Transportation to pay for Retrofit Barriers based on need and budget Alberta Transportation to pay for barriers as part of Capital Cost for new/upgraded roads where required	2 m inside residential property line, in direction of noise source	1.2 m above grade	10 year planning horizon
British Columbia Ministry of Transportation and Infrastructure	Policy for Assessing and Mitigating Noise Impacts From New and Upgraded Numbered Highways	BC Ministry of Transportation and Infrastructure Website	Range based on comparison to the "pre-project" noise levels with maximum allowable noise limit	Applicable for retrofits/upgrades and paid for by the Province of BC. No specific information regarding new Development	Not Defined	Not Defined	10 year planning horizon
Ontario Ministry of the Environment	Publication NPC-300. Environmental Noise Guideline, Stationary and Transportation Sources - Approval and Planning	Ontario Ministry of the Environment Website (easily found through Google search)	55 dBA LeqDay for Outdoor Living Area 50 dBA LeqNight at Window for Bedrooms	Developers to Pay for New Development No information/precedent regarding retrofits	3m from dwelling façade for outdoor living area. Plane of window for indoor.	1.5 m above grade	10 year planning horizon

Recommended Traffic Noise Sound Attenuation Monitoring List

as of November 2, 2016

Adjacent Roadway	Adjacent Neighbourhood	Limits	2015 / 2016 Sound Measurement (dBA)	Length (m)	Average Daily Traffic (vehicles per day)
College Drive	Arbor Creek	Rail Line to McOrmond Drive	65	1820	29,500
Circle Drive East	Sutherland	108th Street to CPR Bridge	62	1080	50,000
22nd Street	Mount Royal / Meadowgreen	Circle Drive West to Witney Avenue	61	820	38,900
Circle Drive West	Meadowgreen	Vancouver Avenue South	61	830	26,500
Attridge Drive	Forest Grove	Kellins Crescent	60	740	27,200
Circle Drive West	Hudson Bay Park	adjacent to Howell Avenue	60	940	37,500

Locations Removed from Active Monitoring List

Adjacent Roadway	Adjacent Neighborhood	Limits	Rationale for removal from list
Boychuk Drive	Wildwood	Taylor Street to Heritage Crescent	under construction 2016/2017
Circle Drive West	Mount Royal	29th Street to 31st Street	under construction 2016/2017
College Drive	College Park East	McKercher Boulevard to CPR Bridge	under construction 2016/2017
McKercher Drive	College Park East	Boychuk Drive to College Drive	under construction 2016/2017
Circle Drive East	Lakeview	Taylor Street to Highway 16	under construction 2016/2017
Circle Drive East	Eastview	Taylor Street to Highway 16	under construction 2016/2017
Circle Drive West	Massey Place	Milton Street to Avenue W	under construction 2016/2017
College Drive	College Park West	Central Avenue to McKercher Drive	under construction 2016/2017
22nd Street	Pacific Heights	Haviland Crescent to Michener Crescent	under construction 2016/2017
Central Avenue	Silverspring / Forest Grove	Attridge Drive to Konihowski Road	included in NCPP project
Circle Drive East	Forest Grove	Attridge Intersection	included in NCPP project
Taylor Street	Lakeridge	Weyakwin Drive to Boychuk Drive	12,200 vehicles per day
8th Street	College Park East	McKercher Drive to Boychuk Drive	16,000 vehicles per day
McOrmond Drive	Erindale	Kerr Road to Attridge Drive	14,800 vehicles per day
Warman Road	North Park	7th Avenue to Empress Street	18,100 vehicles per day; construction of sound wall not recommended due to number of access points for lanes / driveways and portions of residential frontage
Idylwyld Drive	Buena Vista/Nutana	Kilburn Avenue to Saskatchewan Cres	sound wall construction not feasible on structure over 8th Street
Idylwyld Drive	Nutana	Sen. Sid Buckwold Bridge	sound wall construction not feasible on structure over Saskatchewan Crescent