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REPORT

101120614 Saskatchewan Ltd.

Eagle Heights
Traffic Impact Assessment

April 2018

CANADA'S BEST MANAGED COMPANIES Platinum member

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1 Introduction

Associated Engineering, on behalf of the developer of Eagle Heights, studied the traffic impacts of a proposed 83-lot country residential community located in the W ½ 11-37-4-W3, approximately four kilometers west of the City of Saskatoon. The site is located one kilometer to the east of Highway 41 which is designated as a major arterial highway by the Saskatchewan Ministry of Highways and Infrastructure (MHI). The study location is shown in Figure 1-1 (Background Image: Google).

Figure 1-1
Study Location

Since the site is located outside City limits and is adjacent to a provincial highway, MHI design standards apply to this report. This report is designed to meet MHI traffic impact study requirements and focuses on motor vehicle traffic at the intersection of Highway 41 and Agra Road. As this site is a rural location, the site is excepted to have negligible active transportation and no transit services.

2 Background

2.1 SPEED LIMITS AND DESIGN SPEEDS

The speed limit on Highway 41 is 100 km/h and the speed limit on Agra Road is 80 km/h. The design speed of Highway 41 is 130 km/h based on Annual Average Daily Traffic (AADT) and outlined in Ministry Standard Plan 20020. The grid road design speed is 80 km/h in accordance with the Saskatchewan Association of Rural Municipalities (SARM) guidelines.

2.2 CROSS SECTIONS AND GEOMETRY

Both Highway 41 and Agra Road have rural cross sections. There are no sidewalks, curbs, or gutters adjacent to the road structure.

The intersection of Highway 41 and Agra Road lies on a skew angle of approximately 45°.

2.3 SURROUNDING LAND USE

Surrounding land uses are predominately agricultural. The rural residential subdivision of Eagle Ridge lies directly to the west of the proposed development. Both developments use Agra Road as their sole access to Highway 41. The development is approximately 4 km west of Saskatoon.

2.4 SIGHT DISTANCE

Sight distance was observed in the field during the manual count. The surrounding terrain is flat with a slight rise to the east of Highway 41. Sight distance from the proposed development access on Agra Road to the northeast and southwest exceeds 1 kilometer, well over the MHI minimum sight distance.

Standard Plans 20630 and 20632 outline the entering sight distance standards for passenger vehicles and trucks. Both Standard Plan requirements are met with sight distances over 1 km in both directions.

2.5 ACCESS MANAGEMENT

Highway 41 is an undivided highway with Access Management Level R-3. No new access to Highway 41 is contemplated as part of the proposed development. No changes to the access management plan are proposed as a result of this study.

2.6 DRAINAGE

No changes to highway ditch drainage geometries are proposed. On-site storage and other drainage considerations are the subject of a separate study by Associated Engineering.

3 Traffic Volumes

3.1 DESIGN HOUR AND HORIZON YEAR

The proposed country residential community consists of an 83-lot single family dwelling subdivision. The half section development will be completed in four phases over the course of 20 years.

Traffic at the study intersection was obtained by manually counting for two hours in the morning and two hours in the afternoon of January 11, 2018 at the intersection of Highway 41 and Agra Road. The peak hour within each count period was used in the analysis as the design hour. The AM peak hour was observed from 7:15 AM to 8:15 AM and the PM peak hour was observed from 4:30 PM to 5:30 PM.

The expected project completion year is 2038, which is used as the design horizon year in this report.

3.2 BACKGROUND TRAFFIC

Background traffic volumes were obtained through a manual traffic count. The detailed count can be found in Appendix A. The volumes obtained through the count were adjusted to annual averages based on day of week and month of count using MHI document *Travel on Saskatchewan Highways*. A count-date factor of 1.24 was used for the study intersection.

A 15-year growth factor of 1.35 was provided by MHI for this portion of Highway 41. Using the MHI Equation SKS 2.3.1-C-Eq.10, the traffic volumes from the 2018 manual count were converted to background traffic volumes for the design horizon year using a factor of 1.47.

Traffic counts identified between 1.5% and 10.0% heavy trucks on Highway 41 in peak periods, depending on direction of travel and time of day. An average value of 6.0% was used for all through movements on Highway 41.

The west leg of the intersection, Agra Road, is currently a low volume grid road. During the count period nine vehicles were observed on Agra Road west of Highway 41. There is no plan for Agra Road to connect to the North Commuter Parkway and become an access point to the City of Saskatoon transportation network. Because of the low traffic volume, the west leg was not considered in detail.

Background traffic volumes in the AM and PM peak hours in the base year are summarized in Figure 3-1. Projected background traffic volumes in the AM and PM peaks hours of design year are summarized in Figure 3-2.

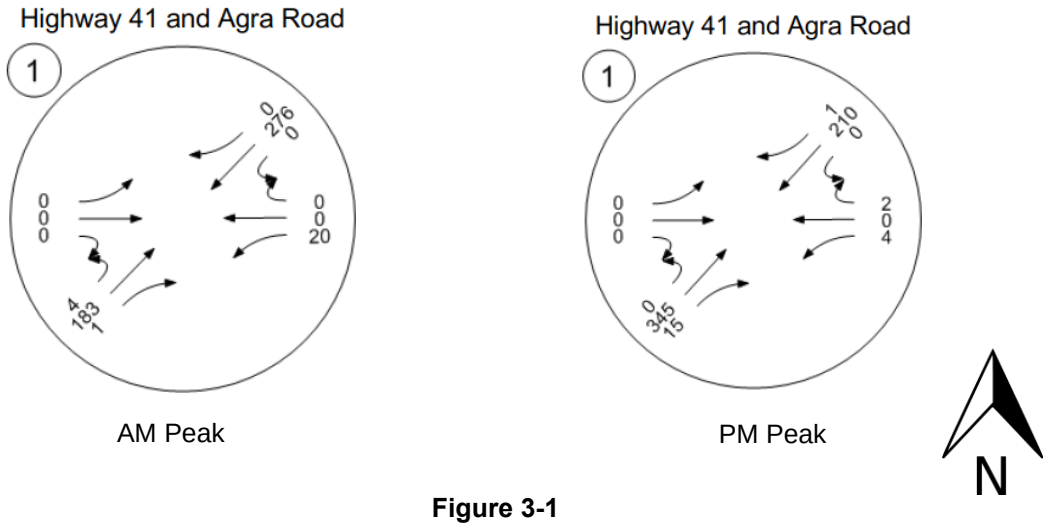

Figure 3-1
Background Traffic Volume, 2018

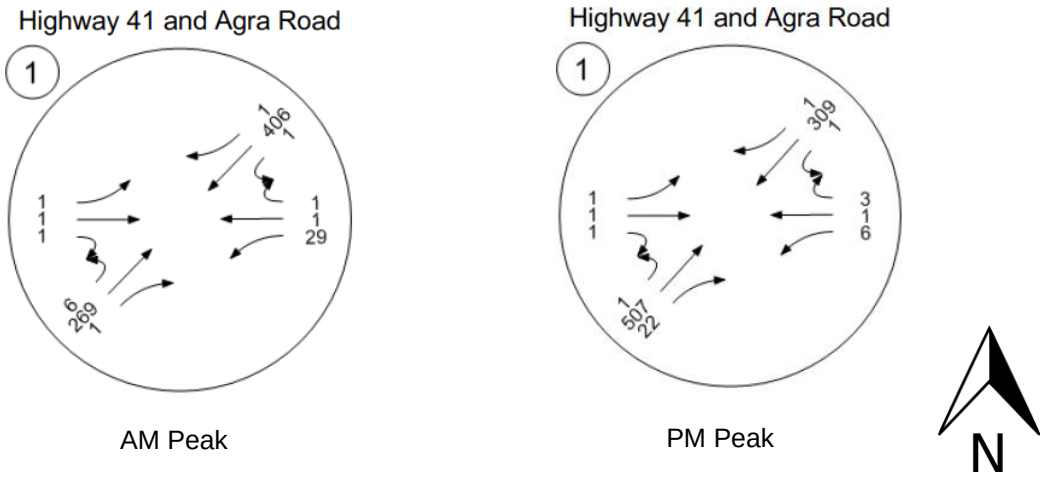

Figure 3-2
Background Traffic Volume, 2038

3.3 DAILY TRAFFIC VOLUMES

MHI uses annual average daily traffic (AADT) volumes on Highway 41 and the minor leg when calculating lighting warrants and flared intersection treatment warrants. 2016 daily traffic volumes for Highway 41 are available through MHI. The AADT values provided were grown to 2018 and 2038 using the growth factor supplied by MHI. AADT along Agra Road was estimated by converting the manual four-hour count to daily traffic based on the MHI distribution graphs for hour of day. The manual count represents an estimated 24.8% of daily traffic; a factor of 4.03 was used to convert hourly data to daily traffic. Table 3-1 summarizes the estimated AADT for Highway 41 and Agra Road.

Table 3-1
Estimated Annual Average Daily Traffic

Year	Highway 41 (vpd)	Agra Road East of Highway 41 (vpd)	Agra Road West of Highway 41 (vpd)
2016 from MHI	4,900	NA	NA
2018 Background	5,100	160	8
2038 Background	7,500	240	10
2038 Full Buildout	8,500	680	10

3.4 DEVELOPMENT TRIP GENERATION

Eagle Heights trip generation was estimated using the Institute of Transportation Engineer's *Trip Generation Manual*, 8th Edition. The proposed 83-lot country residential development is expected to generate traffic similar to Single Family Detached Housing, Land Use Code 210. A factor of 0.8 was applied to the average trip generation rate of adjacent street traffic to represent the expected lower trip generation of a country residential unit relative to the published case of a typical U.S. suburb. The percent traffic entering and exiting remained consistent with Land Use Code 210 in the TGM. This assumption was compared to the traffic volumes generated by the nearby 27-lot country residential development of Eagle Ridge and the TGM specified trip generation rates for the AM and PM peak hours. Table 3-2 summarizes the trip generation rate comparison for the existing country residential community.

Table 3-2
Trip Generation Comparison

	AM Peak hour WB Left Turns		Total AM Trips	PM Peak hour NB Right Turns		Total PM Trips
	Rate (Trips/ Dwelling Unit)	Trips Exiting		Rate (Trips/ Dwelling Unit)	Trips Entering	
Count Data, Eagle Ridge	0.63	16	17	0.63	12	17
ITE TGM Land Use Code 210	0.75	15	20	1.01	17	27
Adjusted Country Residential	0.60	12	16	0.81	14	22

The trips generated by the existing development of Eagle Ridge more closely resemble the trips generated by the adjusted TGM rates. In the PM scenario, the adjusted rates remain conservative relative to the counted rates.

Using the adjusted rates, the results of the total trip generation for the proposed development of Eagle Heights are illustrated in Table 3-3.

Table 3-3
Trip Generation for Eagle Heights

	Inbound Trips	Outbound Trips	Total Trips
AM Peak Hour	12	38	50
PM Peak Hour	42	25	67

3.5 PASS-BY, DIVERTED LINK, AND INTERNAL CAPTURE

Pass-by, diverted link and internal capture were considered negligible due to land use type and distance from commercial or industrial areas. These trip types were not considered further in this study.

3.6 TRIP DISTRIBUTION AND ASSIGNMENT

All site generated traffic was assigned to the intersection of Highway 41 and Agra road as the only viable exit from the development, with 0% of vehicles continuing to Agra Road, 3% travelling towards Aberdeen, and the remaining 97% towards Saskatoon. Inbound vehicles are expected to arrive from the same direction from which they departed.

3.7 TOTAL TRAFFIC

The combined traffic volume for 2038 was calculated by adding the development traffic to the future background traffic. To avoid zero-volume movements an additional 1 vehicle per hour (vph) was added to any traffic movement without existing volume. This addition facilitates traffic analysis and acknowledges the possibility of traffic on lower volume roads. Figure 3-3 shows the total traffic volume for both peak hours. Appendix B includes detailed traffic volumes at the study intersection.

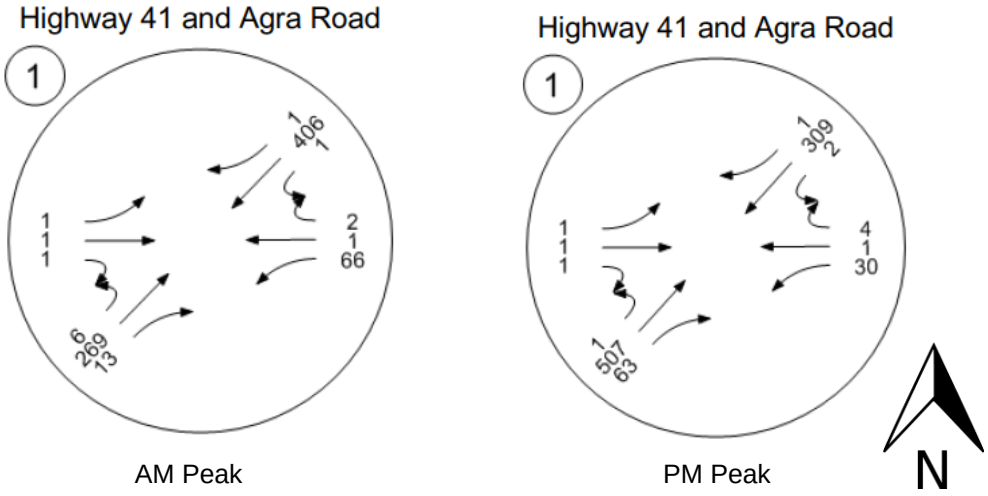

Figure 3-3
Combined Future Volume, 2038

4 Traffic Analysis

4.1 ANALYSIS METHOD

The study intersection was analysed using PTV Vistro ™ software and methods from the *Highway Capacity Manual*, 6th Edition (HCM) to determine level of service (LOS) and delays for background and combined traffic volumes for the design year. Appendix B contains the results of the traffic analysis.

A number of assumptions were made based off the manual traffic count or to facilitate analysis in Vistro. The following assumptions were made:

- Trip generation is 80% of the TGM average rate for Single Family Detached Housing.
- The heavy truck proportion is 6.0% for Highway 41 through movements.
- The peak hour factor is 0.96 for the study intersection.
- A minimum traffic volume of 1 vph was used.

Level of service analysis and MHI warrant analyses were completed for the current year, the 2038 background traffic conditions, and combined traffic volumes.

4.2 LEVEL OF SERVICE

The level of service for all movements in each scenario is within acceptable limits. Level of service for all movements, including turning movements, on Highway 41 remain A across all scenarios. Movement from the stop controlled Agra Road range between B to C, with average delays no worse than 19.5 s. Table 4-1

summarizes the LOS and delay for the worst approach in each scenario. Appendix B includes detailed level of service reports for each scenario.

Table 4-1
Capacity Analysis for Study Intersection

		Worst Approach			
Scenario	**Control**	**Approach**	**Delay**	**LOS**	**v/c**
2018 Background Traffic					
AM Peak	Stop	WB	12.6 s	B	0.04
PM Peak	Stop	WB	12.7 s	B	0.01
2038 Background Traffic					
AM Peak	Stop	WB	16.3 s	C	0.09
PM Peak	Stop	WB	16.3 s	C	0.02
2038 Full Build-out Traffic					
AM Peak	Stop	WB	18.1 s	C	0.20
PM Peak	Stop	WB	19.5 s	C	0.12

4.3 MHI WARRANTS

4.3.1 Traffic Control

The intersection of Highway 41 and Agra Road has stop signs installed on the minor leg for Agra Road eastbound and westbound. No traffic control changes are recommended as part of this study.

4.3.2 Intersection Lighting

The junction of Highway 41 and Agra Road does not currently have any lighting. MHI provides warrants for intersection delineation and intersection area lighting. The warrant sheets for all three scenarios are included in Appendix C.

Intersection delineation lighting refers to a single street light placed over the minor leg on an intersection, typically above the traffic control device. According to MHI DM 2621-01, intersection lighting is warranted at highway intersections where the minor leg AADT is 150 or higher. As discussed in Section 3.3, the four-hour manual count was assumed to account for 24.8% of the daily traffic volume. The estimated background traffic on Agra Road exceeds 150 vpd in both the background 2018 and 2038 scenarios. The addition of new site trips brings the estimated AADT to 680 vpd. Table 4-2 summarizes the delineation lighting warrant results. Delineation lighting is deemed warranted on the east side of the study intersection.

Table 4-2
Delineation Lighting Warrant

	Agra Road East of Highway 41	Agra Road West of Highway 41
2018 Background Traffic	Warranted	Not Warranted
2038 Background Traffic	Warranted	Not Warranted
2038 Full Build-Out	Warranted	Not Warranted

Intersection area lighting is more extensive than delineation lighting, and includes several streetlights adjacent to the highway to illuminate the through and auxiliary lanes of the main highway. According to DM 2621-2, intersection area lighting is warranted if the average through highway AADT exceeds 1,500 vpd, and the intersecting roadway AADT sum is greater than 1,000 vpd. The first condition is met as the average forecasted volumes on both legs is 5100 vpd in 2018. The second condition is not met with an estimated total AADT of 680 vpd. Intersection area lighting is not warranted.

4.3.3 Intersection Treatment

A warrant analysis was carried out for the study intersection on Highway 41 using MHI standard plans 20611 through 20614 for channelization intersection treatment, bypass intersection treatment, flared intersection treatment, and right turn lanes. The turning lane warrant calculations for all three scenarios are included in Appendix D.

Table 4-3 summarizes the results of the intersection warrant analysis. A northeast-bound right turn lane is warranted in all PM peak hour scenarios and its installation is recommended.

Table 4-3
Turning Lane Warrant Analysis Summary

	AM Peak Hour		PM Peak Hour	
	Northeast-bound	Southwest-bound	Northeast-bound	Southwest-bound
2018 Background Traffic	Nil	Nil	Right Turn Lane	Nil
2038 Background Traffic	Nil	Nil	Right Turn Lane	Nil
2038 Full Build-Out	Right Turn Lane	Nil	Right Turn Lane	Nil

4.4 GEOMETRIC GUIDELINES

The intersection of Highway 41 and Agra road lies on a right intersection skew of approximately 45°. The Transportation Association of Canada (TAC) *Geometric Design Guide to Canadian Roads*, 2017 Edition

(GDG) Section 9.4.5 recommends that design domain range from 70° to 90°. The MHI *Geometric Design Guide Supplement* SKS 2.3.2-B recommends intersection angles between 64° and 105°. Realignment of the grid road is recommended to align with these criteria.

5 Recommendations

Based on the analysis described in this report, the following is recommended:

1. Install intersection delineation lighting on east side of Highway 41 before full build-out. Intersection delineation lighting is warranted under baseline conditions.
2. Install a right turn lane for northeast-bound traffic on Highway 41 before full build-out. A right turn lane is warranted under baseline conditions.
3. Reconfigure Agra Road to meet with Highway 41 at a right-angle intersection.

Certification Page

This report presents our findings regarding the Traffic Impact Assessment for 101120614 Saskatchewan Ltd.

Respectfully Submitted,

Prepared By

Ellen McLaughlin, B.Sc.

Reviewed By

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SASKATCHEWAN

Kevin Sturgeon, P.Eng.

ASSOCIATION OF PROFESSIONAL ENGINEERS
AND GEOSCIENTISTS OF SASKATCHEWAN
CERTIFICATE OF AUTHORIZATION
ASSOCIATED ENGINEERING (SASK.) LTD.
NUMBER
C116
Permission to Consult Held By:

Discipline	Sask. Reg. No.	Signature
Transportation Planning	06372	

ASSOCIATED ENGINEERING
QUALITY MANAGEMENT SIGN-OFF
Signature:
Date: Apr. 11/18

Appendix A – Detailed Traffic Count

Traffic Count Data Summary

Hwy 41 & Agra Road		Northbound						Southbound						Eastbound						Westbound						Total	Pedestrians *(Crossing in front of vehicles facing)*				Departure Leg Vehicle Totals			
Date: January 11, 2018		Left		Through		Right		Left		Through		Right		Left		Through		Right		Left		Through		Right			E/W	E/W	N/S	N/S				
Time Interval		Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck	Car	Truck		*(NB)*	*(SB)*	*(EB)*	*(WB)*	NB	SB	EB	WB
6:30	6:45																									0					0	0	0	0
6:45	7:00																									0					0	0	0	0
7:00	7:15			14	6	1				48	2									2						73					20	52	1	0
7:15	7:30			19	5					65	1									3						93					24	69	0	0
7:30	7:45			30	1					67	1									3						102					31	71	0	0
7:45	8:00	1		51	3	1				41	1									3						101					54	45	1	1
8:00	8:15	2		35	4					45	2									7						95					39	54	0	2
8:15	8:30	1		26	5					46	2									5						85					31	53	0	1
8:30	8:45	1		16	9	1				52										5						84					25	57	1	1
8:45	9:00			15	2					37	3									5						62					17	45	0	0
9:00	9:15																									0					0	0	0	0
9:15	9:30																									0					0	0	0	0
9:30	9:45																									0					0	0	0	0
9:45	10:00																									0					0	0	0	0
10:00	10:15																									0					0	0	0	0
10:15	10:30																									0					0	0	0	0
10:30	10:45																									0					0	0	0	0
10:45	11:00																									0					0	0	0	0
11:00	11:15																									0					0	0	0	0
11:15	11:30																									0					0	0	0	0
AM Peak Subtotal		3	0	135	13	1	0	0	0	218	5	0	0	0	0	0	0	0	0	16	0	0	0	0	0		0	0	0	0	148	239	1	3
AM Peak Total (non-PCE)		**3**		**148**		**1**		**0**		**223**		**0**		**0**		**0**		**0**		**16**		**0**		**0**										
AM Peak %Truck		0%		9%		0%		0%		2%		0%		0%		0%		0%		0%		0%		0%										
15:00	15:15																									0					0	0	0	0
15:15	15:30																									0					0	0	0	0
15:30	15:45																									0					0	0	0	0
15:45	16:00																									0					0	0	0	0
16:00	16:15			40	1	2				40	7							2								92					41	49	2	0
16:15	16:30			45	5			1		34	5									1	2					93					50	42	1	0
16:30	16:45			58	2	3				49	6	1								1				1		121					61	56	3	1
16:45	17:00			62		2				41	5															110					62	46	2	0
17:00	17:15			82	1	5				27	3									1						119					83	31	5	0
17:15	17:30			73	1	2				35	4									1				1		117					75	40	2	0
17:30	17:45			76	1	3				29	1	1														111					77	30	3	1
17:45	18:00			62	2	3				20	3													1		91					65	23	3	0
18:00	18:15																									0					0	0	0	0
18:15	18:30																									0					0	0	0	0
18:30	18:45																									0					0	0	0	0
18:45	19:00																									0					0	0	0	0
PM Peak Subtotal		0	0	275	4	12	0	0	0	152	18	1	0	0	0	0	0	0	0	3	0	0	0	2	0		0	0	0	0	281	173	12	1
PM Peak Total (non-PCE)		**0**		**279**		**12**		**0**		**170**		**1**		**0**		**0**		**0**		**3**		**0**		**2**										
PM Peak %Truck		0%		1%		0%		0%		11%		0%		0%		0%		0%		0%		0%		0%										

Appendix B - Traffic Volumes and Capacity Analysis

Eagle Heights TIA

Vistro File: \...\Eagle_Heights_TIA_20180305.vistro
Report File: \...\AM_2018_no_dev.pdf

Scenario 1 AM Peak
3/29/2018

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Highway 41 and Agra Road	Two-way stop	HCM 6th Edition	WB Thru	0.002	12.8	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Highway 41 and Agra Road

Control Type:	Two-way stop	Delay (sec / veh):	12.8
Analysis Method:	HCM 6th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.002

Intersection Setup

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [m]	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	80.00			80.00			100.00			100.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Base Volume Input [veh/h]	0	0	0	20	0	0	4	183	1	0	276	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	1	1	1	0	1	1	0	0	0	1	0	1
Total Hourly Volume [veh/h]	1	1	1	20	1	1	4	183	1	1	276	1
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	5	0	0	1	48	0	0	72	0
Total Analysis Volume [veh/h]	1	1	1	21	1	1	4	191	1	1	288	1
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

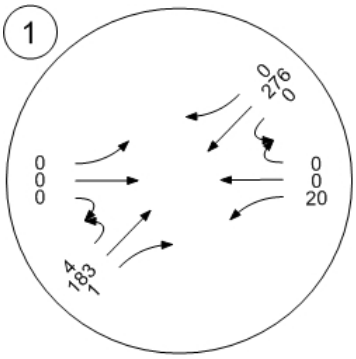
Priority Scheme	Stop	Stop	Free	Free
Flared Lane	Yes	Yes		
Storage Area [veh]	2	2	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	12.39	12.53	9.79	12.71	12.84	9.54	7.81	0.00	0.00	7.59	0.00	0.00
Movement LOS	B	B	A	B	B	A	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.01	0.01	0.01	0.14	0.14	0.14	0.54	0.54	0.54	0.78	0.78	0.78
95th-Percentile Queue Length [m]	0.09	0.09	0.09	1.08	1.08	1.08	4.10	4.10	4.10	5.97	5.97	5.97
d_A, Approach Delay [s/veh]	11.57			12.58			0.16			0.03		
Approach LOS	B			B			A			A		
d_I, Intersection Delay [s/veh]	0.71											
Intersection LOS	B											

Traffic Volume - Base Volume

Highway 41 and Agra Road



Eagle Heights TIA

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Report File: \...\AM_2038_no_dev.pdf

Scenario 1 AM Peak
3/29/2018

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Highway 41 and Agra Road	Two-way stop	HCM 6th Edition	WB Left	0.087	16.5	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Highway 41 and Agra Road

Control Type:	Two-way stop	Delay (sec / veh):	16.5
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.087

Intersection Setup

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [m]	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	80.00			80.00			100.00			100.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Base Volume Input [veh/h]	0	0	0	20	0	0	4	183	1	0	276	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00
Growth Rate	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	1	1	1	0	1	1	0	0	0	1	0	1
Total Hourly Volume [veh/h]	1	1	1	29	1	1	6	269	1	1	406	1
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	8	0	0	2	70	0	0	106	0
Total Analysis Volume [veh/h]	1	1	1	30	1	1	6	280	1	1	423	1
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

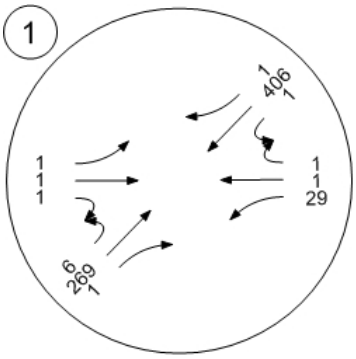
Priority Scheme	Stop	Stop	Free	Free
Flared Lane	Yes	Yes		
Storage Area [veh]	2	2	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.09	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	15.53	15.20	10.71	16.50	16.16	10.72	8.16	0.00	0.00	7.79	0.00	0.00
Movement LOS	C	C	B	C	C	B	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.02	0.02	0.02	0.30	0.30	0.30	0.99	0.99	0.99	1.45	1.45	1.45
95th-Percentile Queue Length [m]	0.13	0.13	0.13	2.25	2.25	2.25	7.57	7.57	7.57	11.04	11.04	11.04
d_A, Approach Delay [s/veh]	13.81			16.31			0.17			0.02		
Approach LOS	B			C			A			A		
d_I, Intersection Delay [s/veh]	0.83											
Intersection LOS	C											

Traffic Volume - Future Total Volume

Highway 41 and Agra Road



Eagle Heights TIA

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Scenario 1 AM Peak
3/29/2018

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Highway 41 and Agra Road	Two-way stop	HCM 6th Edition	WB Left	0.203	18.3	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Highway 41 and Agra Road

Control Type:	Two-way stop	Delay (sec / veh):	18.3
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.203

Intersection Setup

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [m]	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	80.00			80.00			100.00			100.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Base Volume Input [veh/h]	0	0	0	20	0	0	4	183	1	0	276	0
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00
Growth Rate	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	37	0	1	0	0	12	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	1	1	1	0	1	1	0	0	0	1	0	1
Total Hourly Volume [veh/h]	1	1	1	66	1	2	6	269	13	1	406	1
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	17	0	1	2	70	3	0	106	0
Total Analysis Volume [veh/h]	1	1	1	69	1	2	6	280	14	1	423	1
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

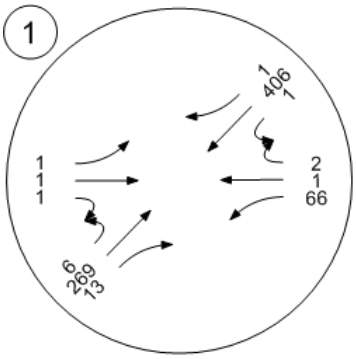
Priority Scheme	Stop	Stop	Free	Free
Flared Lane	Yes	Yes		
Storage Area [veh]	2	2	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.20	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	15.66	15.37	10.71	18.25	17.90	12.41	8.16	0.00	0.00	7.82	0.00	0.00
Movement LOS	C	C	B	C	C	B	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.02	0.02	0.02	0.76	0.76	0.76	1.05	1.05	1.05	1.47	1.47	1.47
95th-Percentile Queue Length [m]	0.13	0.13	0.13	5.80	5.80	5.80	8.03	8.03	8.03	11.22	11.22	11.22
d_A, Approach Delay [s/veh]	13.92			18.09			0.16			0.02		
Approach LOS	B			C			A			A		
d_I, Intersection Delay [s/veh]	1.75											
Intersection LOS	C											

Traffic Volume - Future Total Volume

Highway 41 and Agra Road



Eagle Heights TIA

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Scenario 2 PM Peak
3/29/2018

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Highway 41 and Agra Road	Two-way stop	HCM 6th Edition	WB Left	0.010	13.7	B

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Highway 41 and Agra Road

Control Type:	Two-way stop	Delay (sec / veh):	13.7
Analysis Method:	HCM 6th Edition	Level Of Service:	B
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.010

Intersection Setup

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [m]	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	80.00			80.00			100.00			100.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Base Volume Input [veh/h]	0	0	0	4	0	2	0	345	15	0	210	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00
Growth Rate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	1	1	1	0	1	0	1	0	0	1	0	0
Total Hourly Volume [veh/h]	1	1	1	4	1	2	1	345	15	1	210	1
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	1	0	1	0	90	4	0	55	0
Total Analysis Volume [veh/h]	1	1	1	4	1	2	1	359	16	1	219	1
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

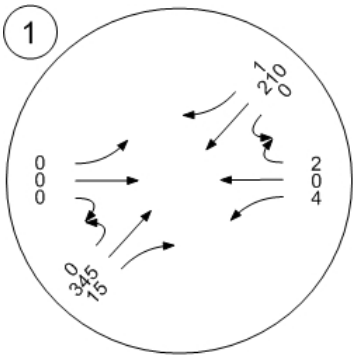
Priority Scheme	Stop	Stop	Free	Free
Flared Lane	Yes	Yes		
Storage Area [veh]	2	2	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	13.63	13.65	9.39	13.66	13.61	10.35	7.65	0.00	0.00	8.02	0.00	0.00
Movement LOS	B	B	A	B	B	B	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.01	0.01	0.01	0.04	0.04	0.04	1.13	1.13	1.13	0.68	0.68	0.68
95th-Percentile Queue Length [m]	0.11	0.11	0.11	0.28	0.28	0.28	8.64	8.64	8.64	5.16	5.16	5.16
d_A, Approach Delay [s/veh]	12.23			12.71			0.02			0.04		
Approach LOS	B			B			A			A		
d_I, Intersection Delay [s/veh]	0.23											
Intersection LOS	B											

Traffic Volume - Base Volume

Highway 41 and Agra Road



Eagle Heights TIA

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Scenario 2 PM Peak
3/29/2018

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Highway 41 and Agra Road	Two-way stop	HCM 6th Edition	WB Left	0.022	18.4	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Highway 41 and Agra Road

Control Type:	Two-way stop	Delay (sec / veh):	18.4
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.022

Intersection Setup

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [m]	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	80.00			80.00			100.00			100.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Base Volume Input [veh/h]	0	0	0	4	0	2	0	345	15	0	210	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00
Growth Rate	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	1	1	1	0	1	0	1	0	0	1	0	0
Total Hourly Volume [veh/h]	1	1	1	6	1	3	1	507	22	1	309	1
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	2	0	1	0	132	6	0	80	0
Total Analysis Volume [veh/h]	1	1	1	6	1	3	1	528	23	1	322	1
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

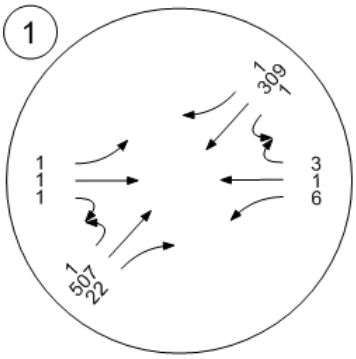
Priority Scheme	Stop	Stop	Free	Free
Flared Lane	Yes	Yes		
Storage Area [veh]	2	2	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	18.29	17.55	10.04	18.39	17.54	11.83	7.89	0.00	0.00	8.50	0.00	0.00
Movement LOS	C	C	B	C	C	B	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.02	0.02	0.02	0.08	0.08	0.08	2.32	2.32	2.32	1.36	1.36	1.36
95th-Percentile Queue Length [m]	0.16	0.16	0.16	0.59	0.59	0.59	17.66	17.66	17.66	10.35	10.35	10.35
d_A, Approach Delay [s/veh]	15.29			16.34			0.01			0.03		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	0.25											
Intersection LOS	C											

Traffic Volume - Future Total Volume

Highway 41 and Agra Road



Eagle Heights TIA

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Report File: \...\PM_2038_w_dev.pdf

Scenario 2 PM Peak
3/29/2018

Intersection Analysis Summary

ID	Intersection Name	Control Type	Method	Worst Mvmt	V/C	Delay (s/veh)	LOS
1	Highway 41 and Agra Road	Two-way stop	HCM 6th Edition	WB Left	0.118	20.3	C

V/C, Delay, LOS: For two-way stop, these values are taken from the movement with the worst (highest) delay value. for all other control types, they are taken for the whole intersection.

Intersection Level Of Service Report
Intersection 1: Highway 41 and Agra Road

Control Type:	Two-way stop	Delay (sec / veh):	20.3
Analysis Method:	HCM 6th Edition	Level Of Service:	C
Analysis Period:	15 minutes	Volume to Capacity (v/c):	0.118

Intersection Setup

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Approach	Eastbound			Westbound			Northeastbound			Southwestbound		
Lane Configuration												
Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Lane Width [m]	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70	3.70
No. of Lanes in Pocket	0	0	0	0	0	0	0	0	0	0	0	0
Pocket Length [m]	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48	30.48
Speed [km/h]	80.00			80.00			100.00			100.00		
Grade [%]	0.00			0.00			0.00			0.00		
Crosswalk	No			No			No			No		

Volumes

Name	Agra Road			Agra Road			Highway 41			Highway 41		
Base Volume Input [veh/h]	0	0	0	4	0	2	0	345	15	0	210	1
Base Volume Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Heavy Vehicles Percentage [%]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.00	0.00	0.00	6.00	0.00
Growth Rate	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47
In-Process Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Site-Generated Trips [veh/h]	0	0	0	24	0	1	0	0	41	1	0	0
Diverted Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Pass-by Trips [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Existing Site Adjustment Volume [veh/h]	0	0	0	0	0	0	0	0	0	0	0	0
Other Volume [veh/h]	1	1	1	0	1	0	1	0	0	1	0	0
Total Hourly Volume [veh/h]	1	1	1	30	1	4	1	507	63	2	309	1
Peak Hour Factor	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
Other Adjustment Factor	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total 15-Minute Volume [veh/h]	0	0	0	8	0	1	0	132	16	1	80	0
Total Analysis Volume [veh/h]	1	1	1	31	1	4	1	528	66	2	322	1
Pedestrian Volume [ped/h]	0			0			0			0		

Intersection Settings

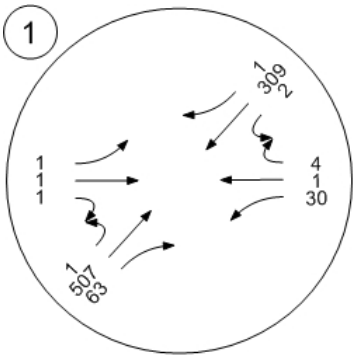
Priority Scheme	Stop	Stop	Free	Free
Flared Lane	Yes	Yes		
Storage Area [veh]	2	2	0	0
Two-Stage Gap Acceptance	No	No		
Number of Storage Spaces in Median	0	0	0	0

Movement, Approach, & Intersection Results

V/C, Movement V/C Ratio	0.00	0.00	0.00	0.12	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00
d_M, Delay for Movement [s/veh]	18.84	18.35	10.05	20.32	19.38	13.44	7.89	0.00	0.00	8.64	0.00	0.00
Movement LOS	C	C	B	C	C	B	A	A	A	A	A	A
95th-Percentile Queue Length [veh]	0.02	0.02	0.02	0.41	0.41	0.41	2.65	2.65	2.65	1.44	1.44	1.44
95th-Percentile Queue Length [m]	0.17	0.17	0.17	3.11	3.11	3.11	20.17	20.17	20.17	10.95	10.95	10.95
d_A, Approach Delay [s/veh]	15.75			19.53			0.01			0.05		
Approach LOS	C			C			A			A		
d_I, Intersection Delay [s/veh]	0.81											
Intersection LOS	C											

Traffic Volume - Future Total Volume

Highway 41 and Agra Road



Appendix C - Lighting Warrants

Warrants for Intersection Lighting

MHI Design Manual 2621-01

Intersection Description	**Highway 41 and Agra Road - 2018 Background**			
Through Highway	**Highway 41**	Highway Class	Major Arterial	5
Minor Leg 1	**Agra Road E**	Road Type	Other All-Season Road (AADT >150)	OK
Minor Leg 2	**Agra Road W**	Road Type	Other All-Season Road (AADT <150)	NO

☑ Intersection is skewed (<70° or >110°)	2	Night Collision Rate	**0.0** crash/year	0

Other Nearby Lighting		Traffic Volumes		
None	0	On Through Highway	**5100** AADT	25
☐ Urban street light within 25 m of Minor Leg 1	OK	On Minor Leg 1	**160** AADT	8
☐ Urban street light within 25 m of Minor Leg 2	OK	On Minor Leg 2	**150** AADT	8

Existing Intersection Channelization		Intersection Road Surface Visible from…		
☐ On Through Highway	0	On Through Highway	> 370 m	0
☐ On Minor Leg 1	0	On Minor Leg 1	> 180 m	0
☐ On Minor Leg 2	0	On Minor Leg 2	> 180 m	0

Divided Roadway		Proximity to Horizontal Curves		
☐ On Through Highway	0	On Through Highway	> 100 m	0
☐ On Minor Leg 1	0	On Minor Leg 1	> 60 m	0
☐ On Minor Leg 2	0	On Minor Leg 2	> 60 m	0

Hospital Access Routes		Obstructed Sight Triangles		
☐ Minor Leg 1	0	On Minor Leg 1	None	0
☐ Minor Leg 2	0	On Minor Leg 2	None	0

Notes:

1. Delineation lighting has no minimum warrant score. Lights are warranted for the following cases:
   - All Provincial Highway intersections
   - All designated Community Access roads (Control Section 40-series)
   - All roads where AADT>150
   - All seasonal/recreational roads where SADT>250
   - Never when an urban streetlight is within 25m
2. For Night Collision Rate use the average annual night time intersection collisions over the last 3 years
3. For sight distances use eye height of 1.15m and object height at the road surface

	Result	Score
Leg 1 Delineation	**Warranted**	**40**
Leg 2 Delineation	**Not Warranted**	**40**
Intersection Area	*Not calculated*	**N/A**

Warrants for Intersection Lighting

MHI Design Manual 2621-01

Intersection Description	**Highway 41 and Agra Road - 2038 Background**			
Through Highway	**Highway 41**	Highway Class	Major Arterial	5
Minor Leg 1	**Agra Road E**	Road Type	Other All-Season Road (AADT >150)	OK
Minor Leg 2	**Agra Road W**	Road Type	Other All-Season Road (AADT <150)	NO
☑ Intersection is skewed (<70° or >110°)	2	Night Collision Rate	**0.0** crash/year	0

Other Nearby Lighting		Traffic Volumes		
None	0	On Through Highway	**7500** AADT	25
☐ Urban street light within 25 m of Minor Leg 1	OK	On Minor Leg 1	**240** AADT	12
☐ Urban street light within 25 m of Minor Leg 2	OK	On Minor Leg 2	**150** AADT	8

Existing Intersection Channelization		Intersection Road Surface Visible from…		
☐ On Through Highway	0	On Through Highway	> 370 m	0
☐ On Minor Leg 1	0	On Minor Leg 1	> 180 m	0
☐ On Minor Leg 2	0	On Minor Leg 2	> 180 m	0

Divided Roadway		Proximity to Horizontal Curves		
☐ On Through Highway	0	On Through Highway	> 100 m	0
☐ On Minor Leg 1	0	On Minor Leg 1	> 60 m	0
☐ On Minor Leg 2	0	On Minor Leg 2	> 60 m	0

Hospital Access Routes		Obstructed Sight Triangles		
☐ Minor Leg 1	0	On Minor Leg 1	None	0
☐ Minor Leg 2	0	On Minor Leg 2	None	0

Notes:

1. Delineation lighting has no minimum warrant score. Lights are warranted for the following cases:
   - All Provincial Highway intersections
   - All designated Community Access roads (Control Section 40-series)
   - All roads where AADT>150
   - All seasonal/recreational roads where SADT>250
   - Never when an urban streetlight is within 25m
2. For Night Collision Rate use the average annual night time intersection collisions over the last 3 years
3. For sight distances use eye height of 1.15m and object height at the road surface

	Result	Score
Leg 1 Delineation	**Warranted**	**44**
Leg 2 Delineation	**Not Warranted**	**40**
Intersection Area	*Not calculated*	**N/A**

Warrants for Intersection Lighting

MHI Design Manual 2621-01

Intersection Description: **Highway 41 and Agra Road - 2038 with Development**

Through Highway	**Highway 41**	Highway Class	Major Arterial	5
Minor Leg 1	**Agra Road E**	Road Type	Other All-Season Road (AADT >150)	OK
Minor Leg 2	**Agra Road W**	Road Type	Other All-Season Road (AADT <150)	NO

☑ Intersection is skewed (<70° or >110°) — 2

Night Collision Rate: **0.0** crash/year — 0

Other Nearby Lighting

None — 0

☐ Urban street light within 25 m of Minor Leg 1 — OK

☐ Urban street light within 25 m of Minor Leg 2 — OK

Traffic Volumes

On Through Highway	**8500** AADT	25
On Minor Leg 1	**680** AADT	34
On Minor Leg 2	**150** AADT	8

Existing Intersection Channelization

☐ On Through Highway	0
☐ On Minor Leg 1	0
☐ On Minor Leg 2	0

Intersection Road Surface Visible from…

On Through Highway	> 370 m	0
On Minor Leg 1	> 180 m	0
On Minor Leg 2	> 180 m	0

Divided Roadway

☐ On Through Highway	0
☐ On Minor Leg 1	0
☐ On Minor Leg 2	0

Proximity to Horizontal Curves

On Through Highway	> 100 m	0
On Minor Leg 1	> 60 m	0
On Minor Leg 2	> 60 m	0

Hospital Access Routes

☐ Minor Leg 1	0
☐ Minor Leg 2	0

Obstructed Sight Triangles

On Minor Leg 1	None	0
On Minor Leg 2	None	0

Notes:

1. Delineation lighting has no minimum warrant score. Lights are warranted for the following cases:
   - All Provincial Highway intersections
   - All designated Community Access roads (Control Section 40-series)
   - All roads where AADT>150
   - All seasonal/recreational roads where SADT>250
   - Never when an urban streetlight is within 25m
2. For Night Collision Rate use the average annual night time intersection collisions over the last 3 years
3. For sight distances use eye height of 1.15m and object height at the road surface

	Result	Score
Leg 1 Delineation	**Warranted**	**66**
Leg 2 Delineation	**Not Warranted**	**40**
Intersection Area	*Not calculated*	**N/A**

Appendix D - Turning Lane Warrants

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2018 Background Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**1**	188
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	4	191	1	196
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	4	191	1	196
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

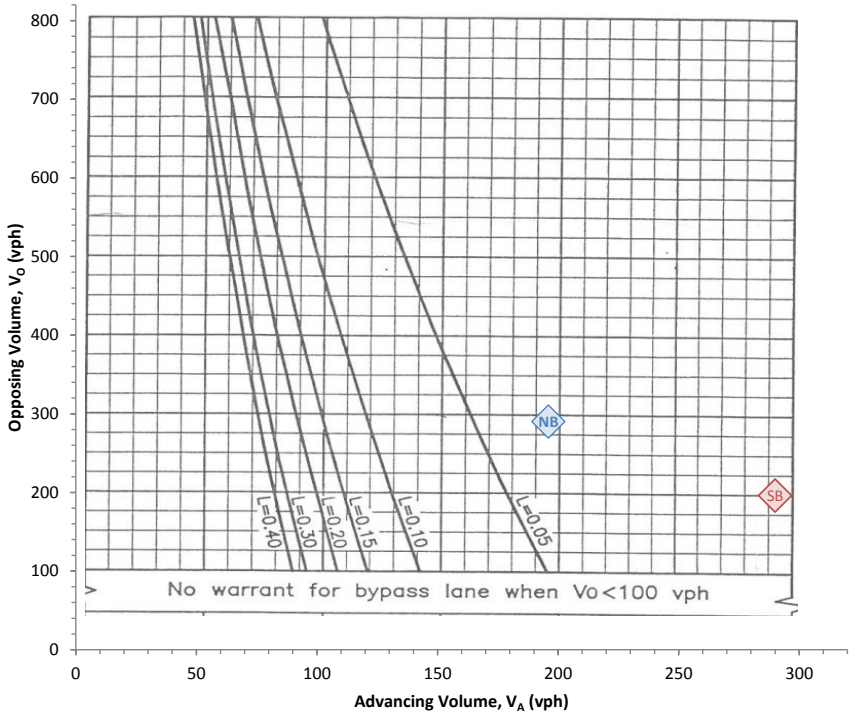
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	1	288	1	290
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Bypass Lane
Standard Plan 20612

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	196	290	196	290
Opposing Volume, V_O	290	196	290	196
L (V_L / V_A)	0.02	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2018 Background Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**1**	188
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	4	191	1	196
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	4	191	1	196
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

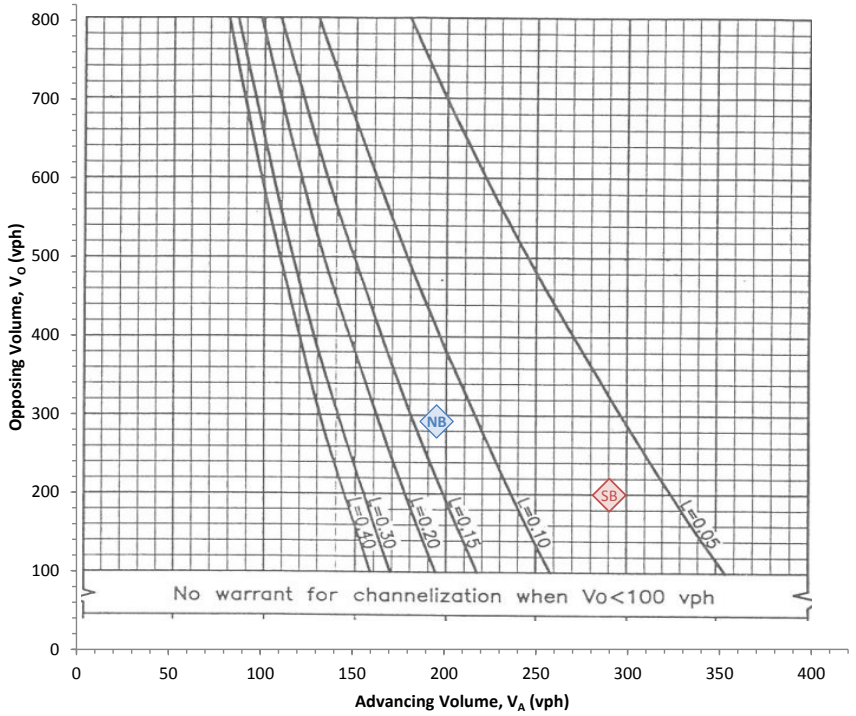
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	1	288	1	290
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Channelized Intersection
Standard Plan 20611

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	196	290	196	290
Opposing Volume, V_O	290	196	290	196
L (V_L / V_A)	0.02	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2018 Background Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**1**	188
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	4	191	1	196
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	4	191	1	196
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

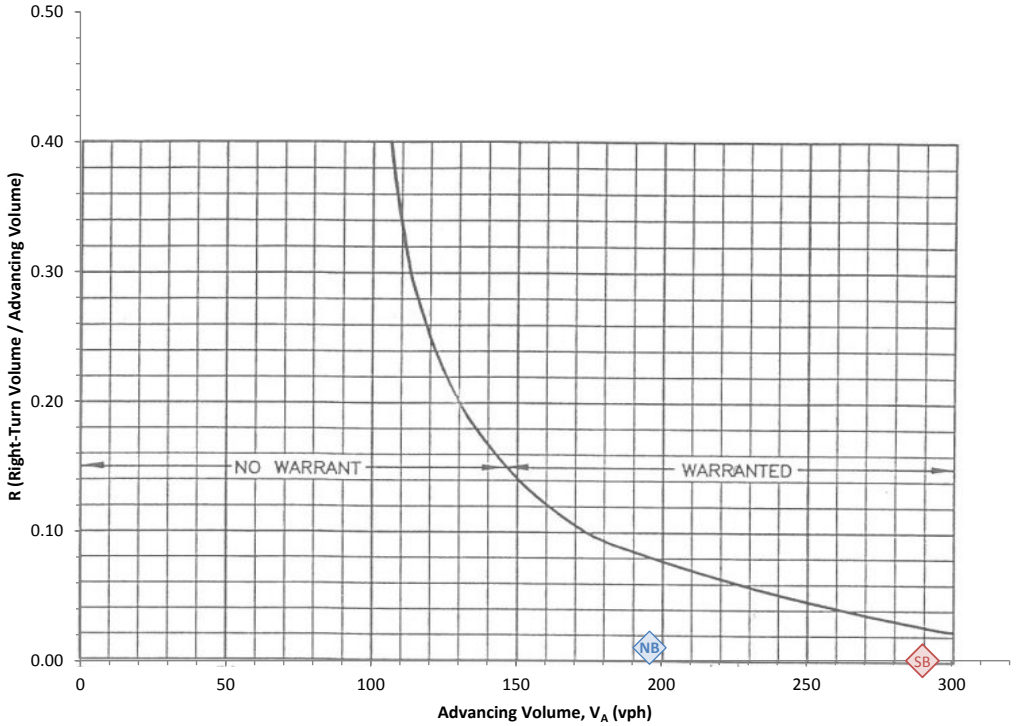
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	1	288	1	290
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Right Turn Lanes - Rural Highways
Standard Plan 20614

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	196	290	196	290
R (V_R / V_A)	0.01	0.00	0.01	0.00

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2018 Background Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**0**	**345**	**15**	360
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	0	359	15	374
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	0	359	15	374
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

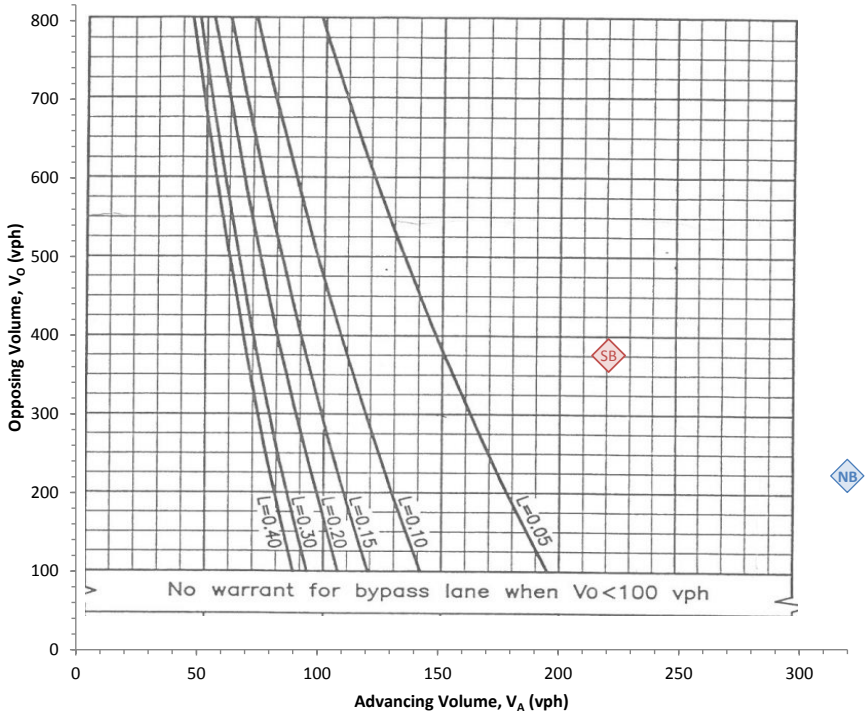
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	1	219	1	221
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Bypass Lane
Standard Plan 20612

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	374	221	320	221
Opposing Volume, V_O	221	374	221	374
L (V_L / V_A)	0.00	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2018 Background Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**0**	**345**	**15**	360
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	0	359	15	374
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	0	359	15	374
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

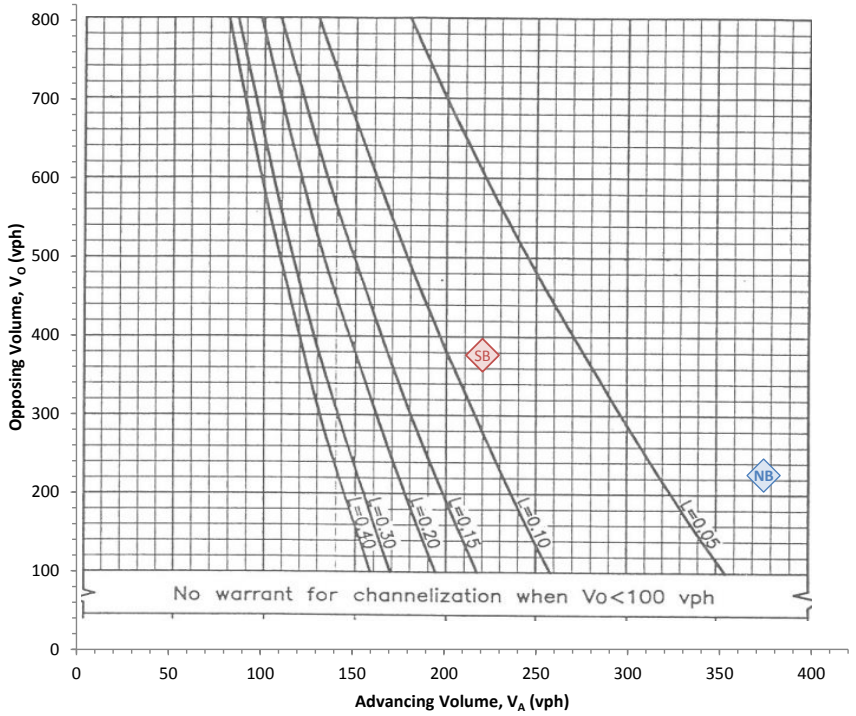
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	1	219	1	221
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Channelized Intersection
Standard Plan 20611

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	374	221	374	221
Opposing Volume, V_O	221	374	221	374
L (V_L / V_A)	0.00	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2018 Background Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**0**	**345**	**15**	360
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	0	359	15	374
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	0	359	15	374
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

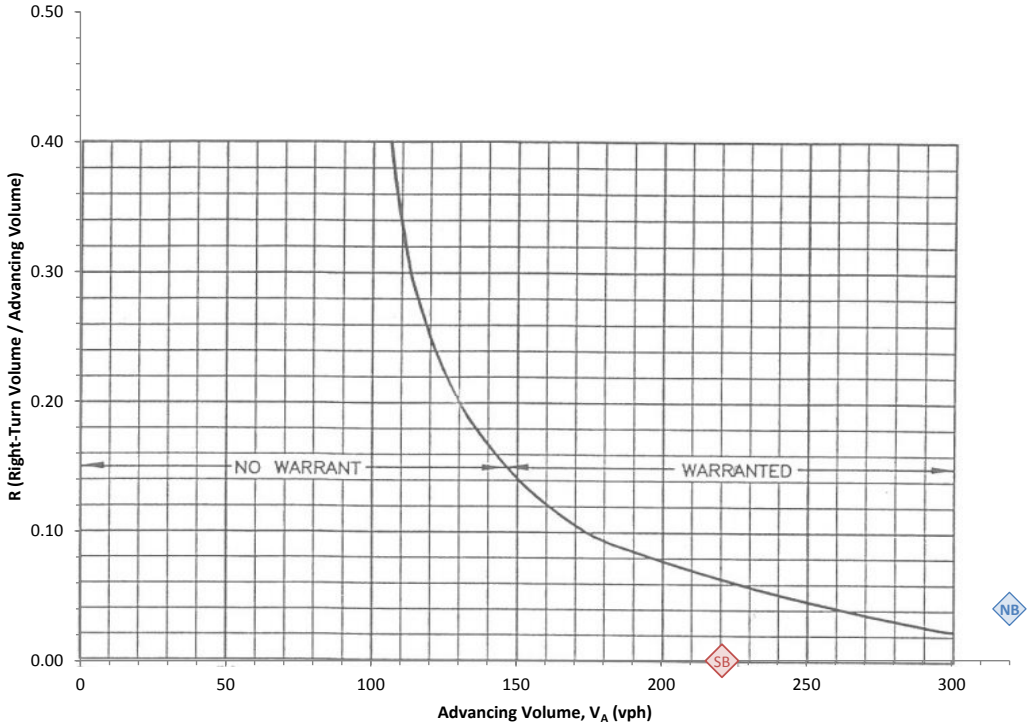
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.00**	**1.00**	
Future Equiv Vol (pce/h)	1	219	1	221
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Right Turn Lanes - Rural Highways
Standard Plan 20614

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	374	221	320	221
R (V_R / V_A)	0.04	0.00	0.04	0.00

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 Background Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**1**	188
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	4	191	1	196
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	4	281	1	286
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

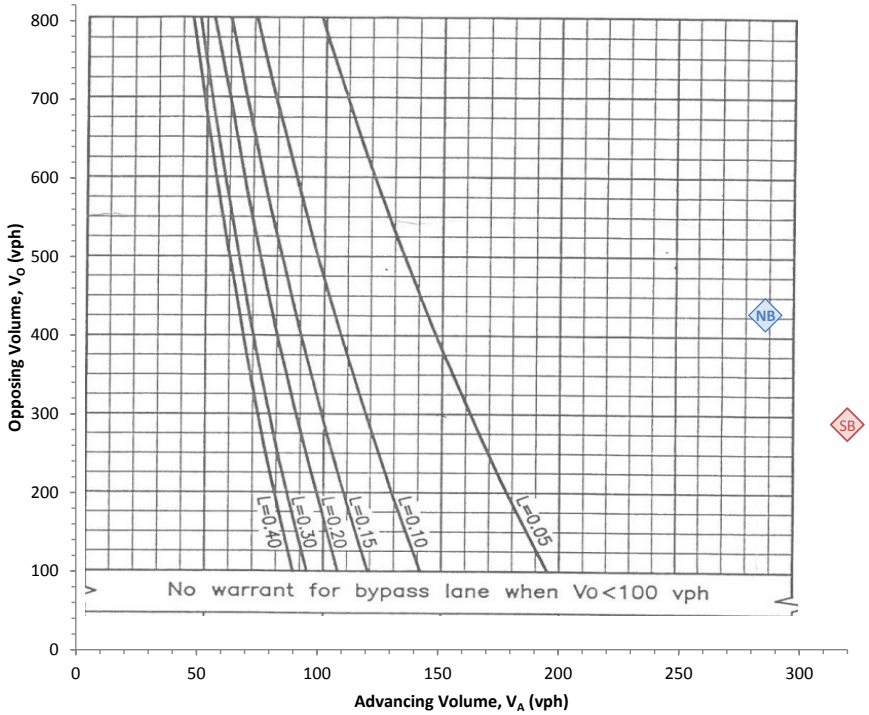
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	423	1	425
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Bypass Lane
Standard Plan 20612

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	286	425	286	320
Opposing Volume, V_O	425	286	425	286
L (V_L / V_A)	0.01	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 Background Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**1**	188
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	4	191	1	196
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	4	281	1	286
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	423	1	425
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
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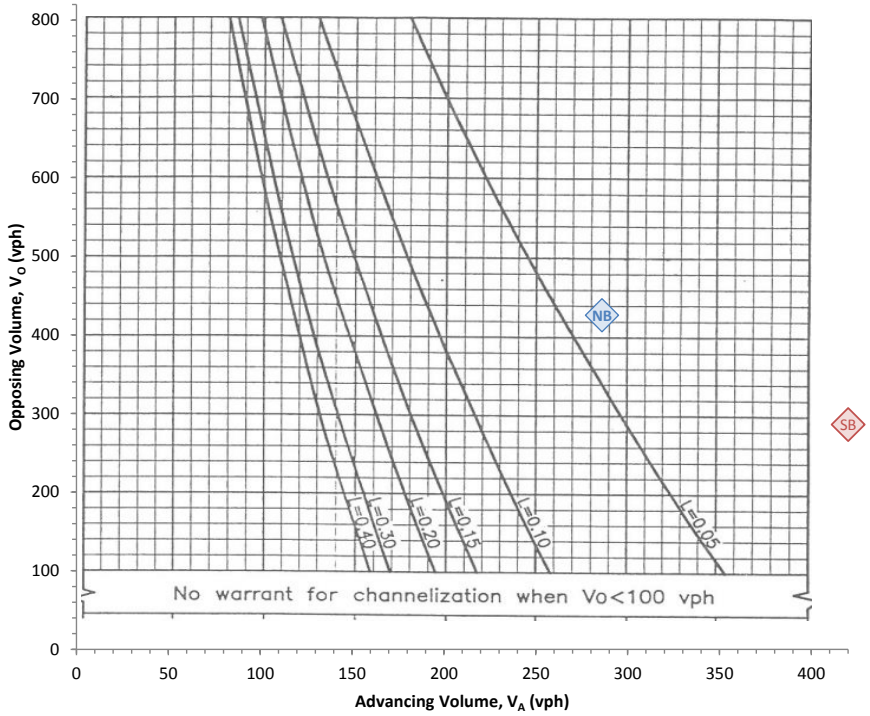
Saskatchewan Ministry of Highways and Infrastructure
Warrants for Channelized Intersection
Standard Plan 20611

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	286	425	286	420
Opposing Volume, V_O	425	286	425	286
L (V_L / V_A)	0.01	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 Background Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**1**	188
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	4	191	1	196
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	4	281	1	286
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

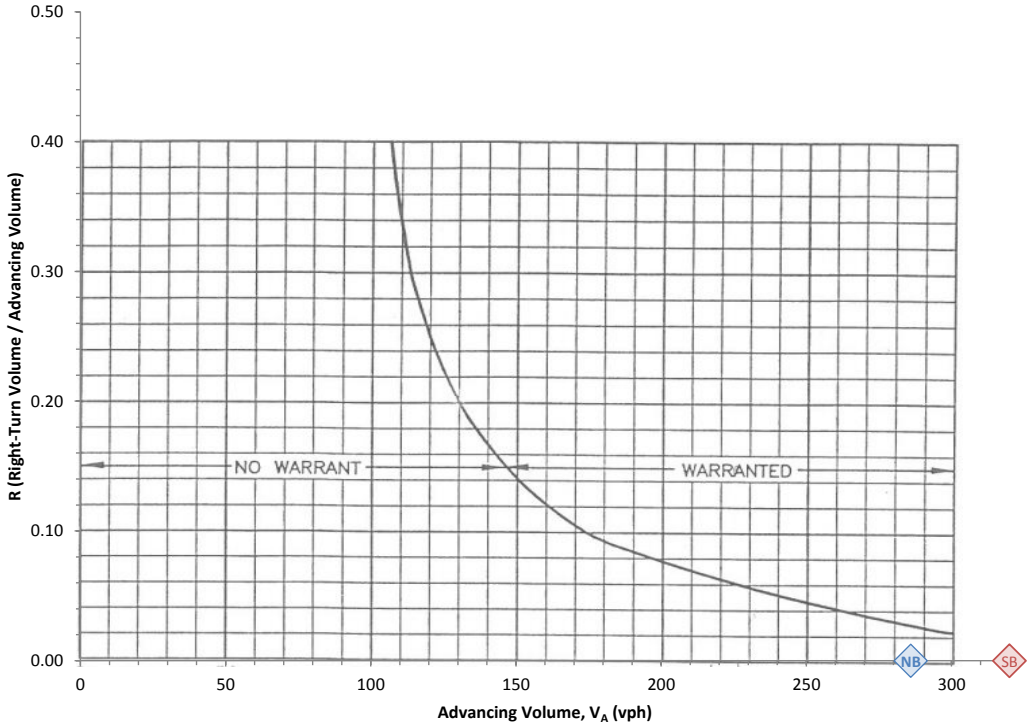
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	423	1	425
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Right Turn Lanes - Rural Highways
Standard Plan 20614

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	286	425	286	320
R (V_R / V_A)	0.00	0.00	0.00	0.00

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 Background Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**0**	**345**	**15**	360
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	0	359	15	374
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	0	528	15	543
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

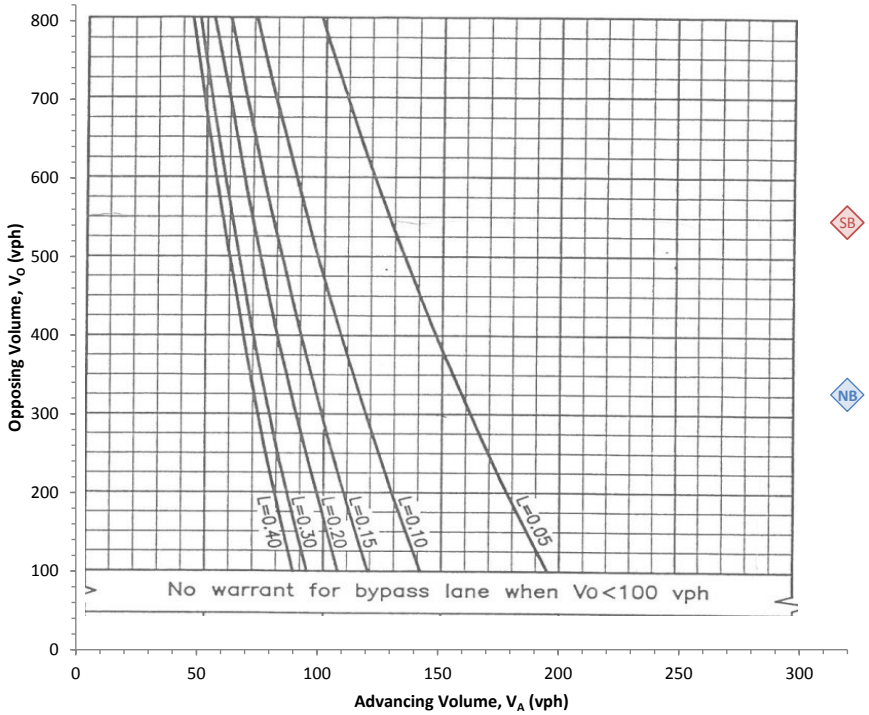
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	322	1	324
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Bypass Lane
Standard Plan 20612

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	543	324	320	320
Opposing Volume, V_O	324	543	324	543
L (V_L / V_A)	0.00	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 Background Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**0**	**345**	**15**	360
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	0	359	15	374
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	0	528	15	543
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

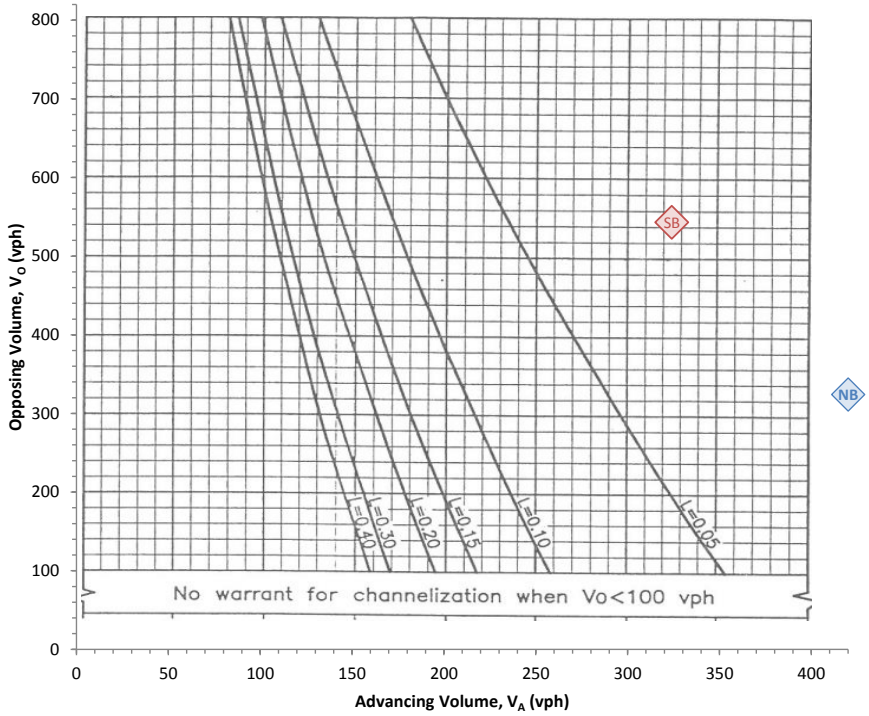
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	322	1	324
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Channelized Intersection
Standard Plan 20611

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	543	324	420	324
Opposing Volume, V_O	324	543	324	543
L (V_L / V_A)	0.00	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 Background Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**0**	**345**	**15**	360
Truck %	**0.0%**	**6.0%**	**0.0%**	6%
Equiv Vol (pce/h)	0	359	15	374
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	0	528	15	543
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

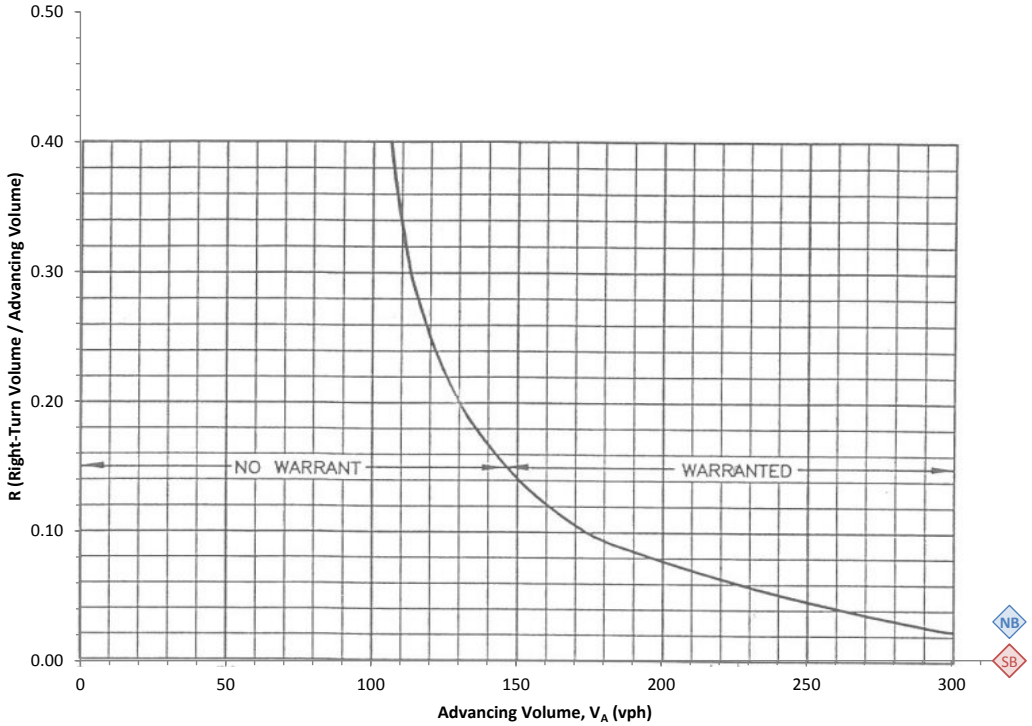
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	322	1	324
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Right Turn Lanes - Rural Highways
Standard Plan 20614

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	543	324	320	320
R (V_R / V_A)	0.03	0.00	0.03	0.00

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 w Development Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**13**	200
Truck %	**0.0%**	**6.0%**	**0.0%**	5%
Equiv Vol (pce/h)	4	191	13	208
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	4	281	13	298
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	423	1	425
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
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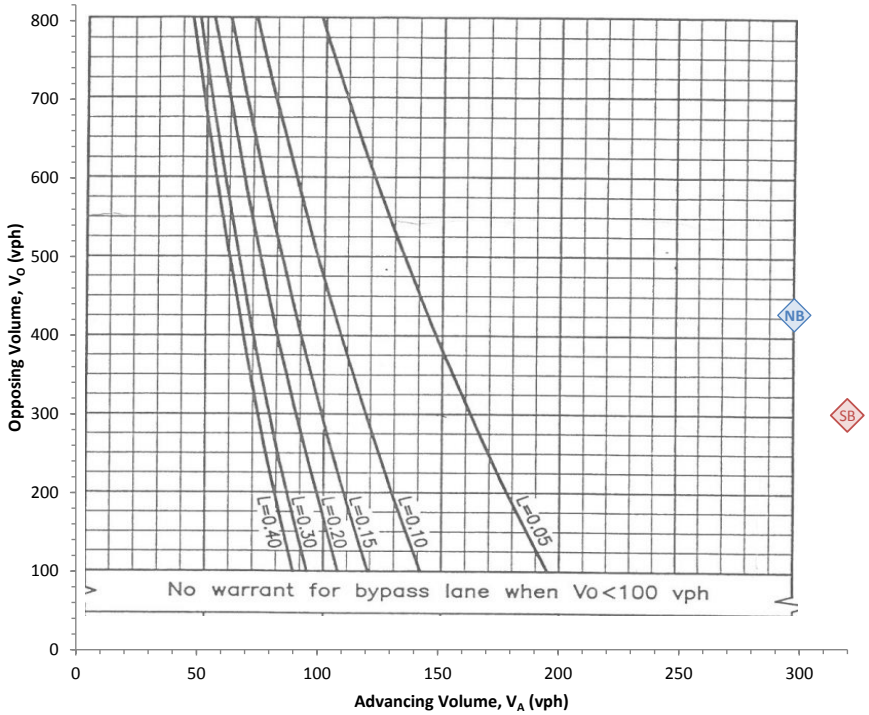
Saskatchewan Ministry of Highways and Infrastructure
Warrants for Bypass Lane
Standard Plan 20612

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	298	425	298	320
Opposing Volume, V_O	425	298	425	298
L (V_L / V_A)	0.01	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 w Development Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**13**	200
Truck %	**0.0%**	**6.0%**	**0.0%**	5%
Equiv Vol (pce/h)	4	191	13	208
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	4	281	13	298
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	423	1	425
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
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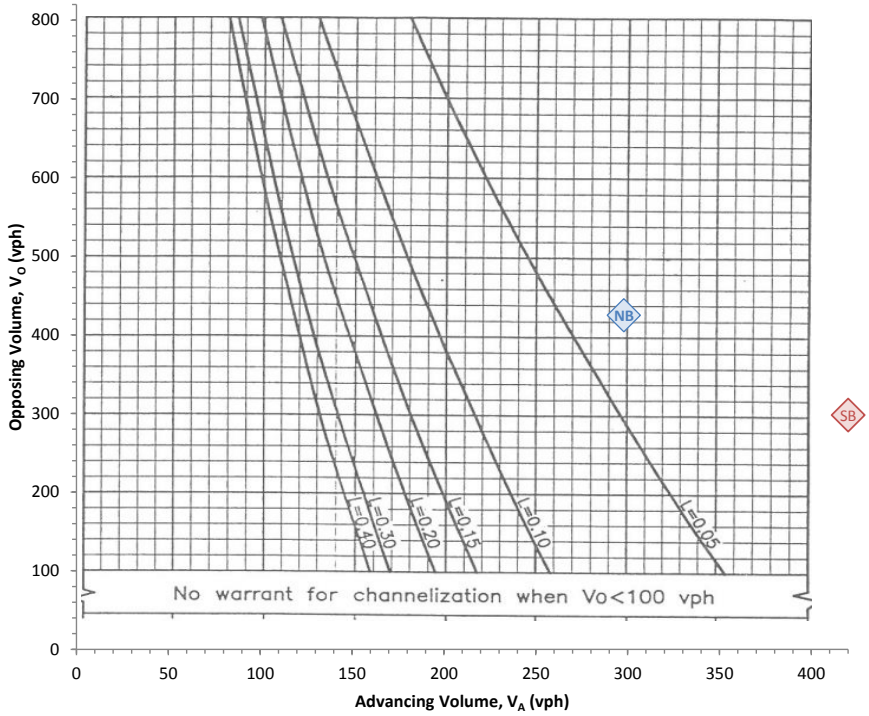
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Channelized Intersection
Standard Plan 20611

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	298	425	298	420
Opposing Volume, V_O	425	298	425	298
L (V_L / V_A)	0.01	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 w Development Scenario - AM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**4**	**183**	**13**	200
Truck %	**0.0%**	**6.0%**	**0.0%**	5%
Equiv Vol (pce/h)	4	191	13	208
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	4	281	13	298
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**276**	**1**	278
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	288	1	290
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	423	1	425
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
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  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
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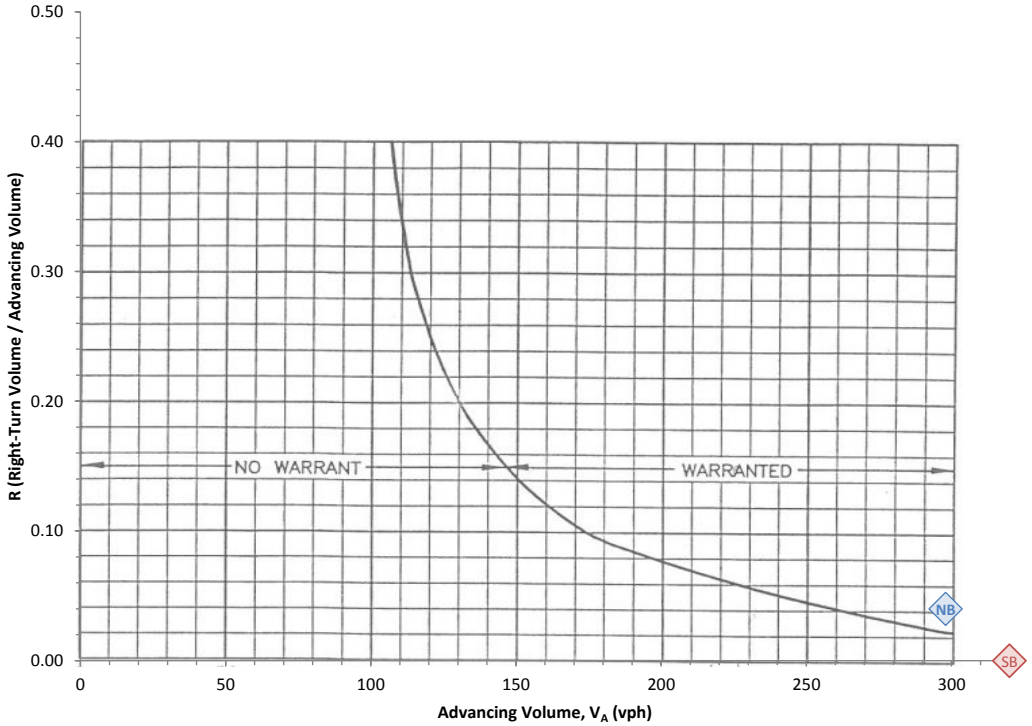
Saskatchewan Ministry of Highways and Infrastructure
Warrants for Right Turn Lanes - Rural Highways
Standard Plan 20614

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	298	425	298	320
R (V_R / V_A)	0.04	0.00	0.04	0.00

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 w Development Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**1**	**345**	**56**	402
Truck %	**0.0%**	**6.0%**	**0.0%**	5%
Equiv Vol (pce/h)	1	359	56	416
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	528	56	585
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	322	1	324
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
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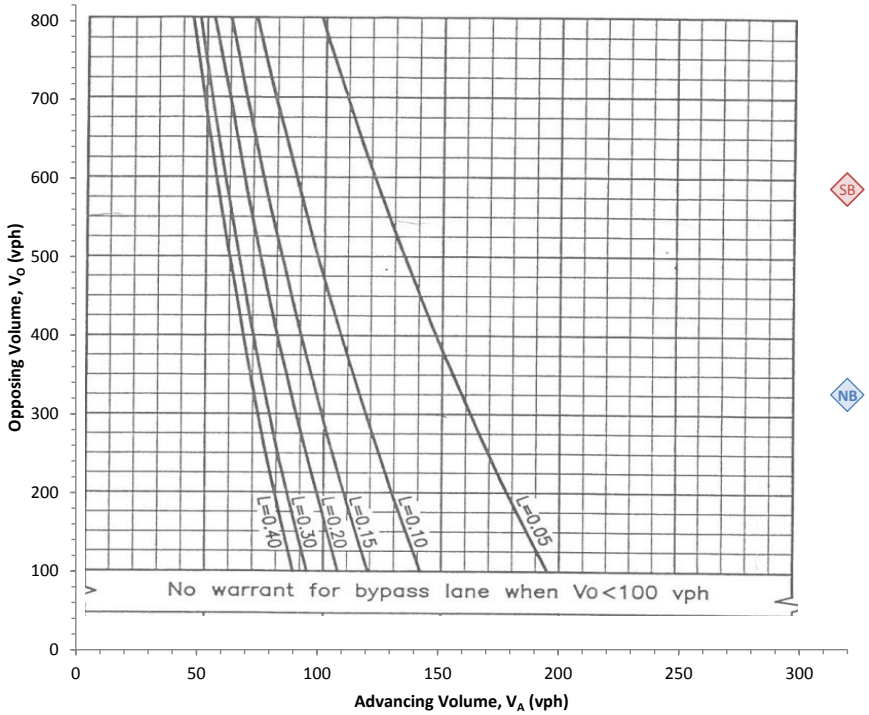
Saskatchewan Ministry of Highways and Infrastructure
Warrants for Bypass Lane
Standard Plan 20612

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	585	324	320	320
Opposing Volume, V_O	324	585	324	585
L (V_L / V_A)	0.00	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 w Development Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**1**	**345**	**56**	402
Truck %	**0.0%**	**6.0%**	**0.0%**	5%
Equiv Vol (pce/h)	1	359	56	416
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	528	56	585
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

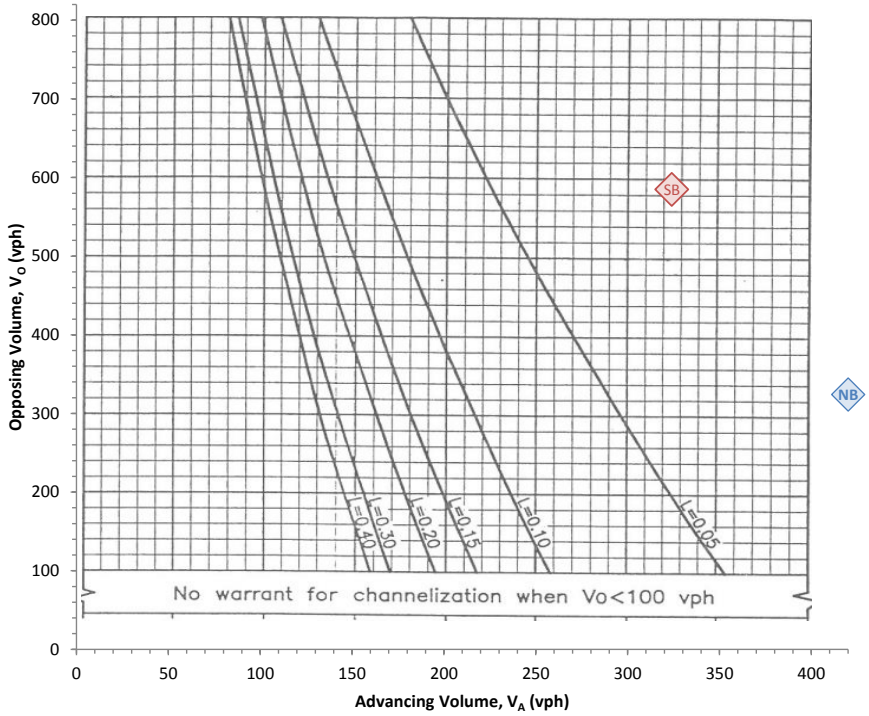
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	322	1	324
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Channelized Intersection
Standard Plan 20611

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	585	324	420	324
Opposing Volume, V_O	324	585	324	585
L (V_L / V_A)	0.00	0.00		

Turning Lane Warrants
Worksheet for Two Lane Rural Highways

Highway:	**Highway 41**
Crossroad:	**Agra Road**
Scenario:	**2038 w Development Scenario - PM Design Hour**

Highway Direction A:	**NB**	Usually WB or NB
Highway Direction B:	**SB**	Usually EB or SB
Truck Equivalency (E_T)	**1.7**	MHI Standard: 1.7

NB Data	NBL	NBT	NBR	NB Total
Hourly Vol (veh/h)	**1**	**345**	**56**	402
Truck %	**0.0%**	**6.0%**	**0.0%**	5%
Equiv Vol (pce/h)	1	359	56	416
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	528	56	585
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

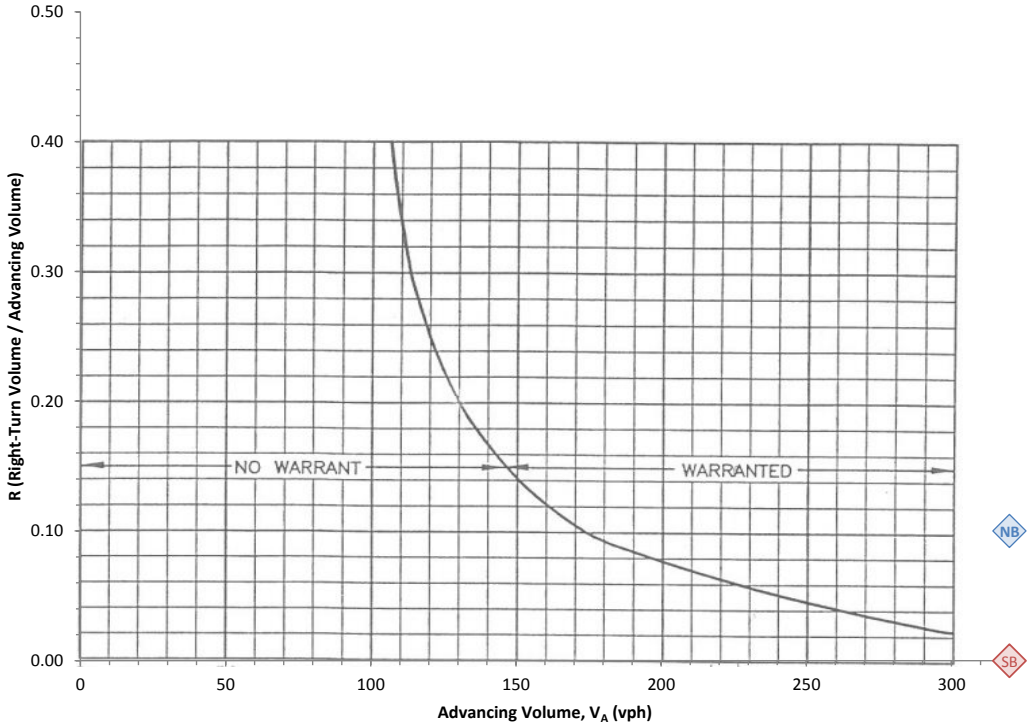
SB Data	SBL	SBT	SBR	SB Total
Hourly Vol (veh/h)	**1**	**210**	**1**	212
Truck %	**0%**	**6%**	**0%**	6%
Equiv Vol (pce/h)	1	219	1	221
Growth Factor	**1.00**	**1.47**	**1.00**	
Future Equiv Vol (pce/h)	1	322	1	324
Advancing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0
Opposing Conflict?	**1**	**1**	**1**	Yes: 1 No: 0

Notes:

- No warrant if the plotted point falls to the left of the applicable line
- No warrant for bypass/channelization if L <0.05
- Right turn lanes are warranted at:
  - -Intersections with other Provincial Highways
  - -Industrial Access Roads
  - -Provincial Campgrounds and Picnic Sites
- Length of right turning lane is related to speed. See SP 20618.
- Use the corrected peak hour volumes (vph) projected to the 10th year after construction. See SKS 2.3.1-C (formerly DM 502-3) for correction factors.

Saskatchewan Ministry of Highways and Infrastructure
Warrants for Right Turn Lanes - Rural Highways
Standard Plan 20614

Associated Engineering



	Calculated		Plotted	
	NB	SB	NB	SB
Advancing Volume, V_A	585	324	320	320
R (V_R / V_A)	0.10	0.00	0.10	0.00