Traffic Safety Studies for Highway Sections through Small Urban Communities in Saskatchewan

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ABSTRACT

Almost all Saskatchewan highways have long stretches of rural roads through flat agricultural land with little roadside development and very few intersections. Traffic volumes are often relatively low on these rural highway sections and the travel speeds on these highways are normally high. However these rural highways often have short sections passing through small urban communities. These highway sections in small urban communities often have higher traffic volumes than the adjacent rural highway sections. These highway sections in small urban communities may have to accommodate through traffic as well as provide access to local businesses and residences. At some of these locations, due to economic and population growth, transportation needs have evolved beyond what these highway sections and communities were originally designed for. Highways at some of these locations may also function as local community main streets, which mean that these highway sections can be characterized by frequent intersections, property accesses, pedestrians and cyclists, school zones, and roadside parking. As a consequence unique safety concerns are identified. For example vehicles accustomed to the high travelling speed outside the towns tend to drive fast and pose risks to local traffic, pedestrians, and cyclists in towns. Accommodation of the local traffic and vulnerable road users while maintaining appropriate mobility is very important in these situations. The Saskatchewan Ministry of Highways and Infrastructure has conducted safety studies for highway sections near and within towns' urban limits to proactively identify safety issues for improvement. The first phase study was for highways through small towns with population less than 1,000 and the second phase study was for highways through larger towns with population greater than 1,000. The studies used methodologies such as stakeholders (ministry regional traffic engineers, municipal officials, and RCMP officers) surveys and discussions to identify situations/locations with potential safety risks, site visits and assessment, GIS analysis tool in collision data analysis and assessment of roadway geometrics and signings etc. The studies have identified some common opportunities for safety improvements system wide and have also identified some safety concerns at some specific locations in towns. Countermeasures have been recommended such as establishing graduated speed transitions on highway approaches to towns, improving conspicuity of intersections, and enhancing highway sections in town centres as community streets among others for traffic safety improvements.

INTRODUCTION

Almost all highways in Saskatchewan have mainly long stretches of rural highways through flat agricultural land with little roadside development and very few intersecting roads. Highways on the Canadian Prairies are generally similar. These rural highways normally have relatively low traffic volumes and allow high speed travel. These rural highways often have short sections passing through small urban communities. Some of these highways just pass through the edge of the urban limit, and these highway sections are not very different from other rural highways in their function and traffic operation. There are also highway sections that pass through developed urban areas or even urban centers. These highway sections in small urban communities often have much higher traffic volumes than the adjacent rural highway sections. In some cases these highway sections may even function as the urban community's main streets. These highway sections are short and will have to accommodate through traffic as well as provide access to local businesses and residences. There can be frequent intersections, roadside parking spaces, property accesses, pedestrian walkways and crossings, school zones, skew-angle intersections and service roads in near proximity of these highway sections through small urban areas.

Over the years, economic development and subsequent growth in population and traffic have evolved beyond what many of these highway sections and communities were originally designed to accommodate. In locations where this is the case, unique road safety concerns are beginning to arise. The safety concerns are partly due to the conflicting demands for road services by different road user groups. Local residents and business owners are more concerned with local access and safety for local traffic and other vulnerable road users, whereas through traffic from rural highways would generally like to move quickly and safely through the communities. Safety concerns for road users and communities are different from those on pure rural highways but they are also different from those on normal urban streets in the cities because of the short length of urban environment and traffic composition. There is not much system-wide safety studies on the issue in the literature. For example, in the Highway Safety Manual (1), the safety performance function (SPF) for rural highways is defined as for highways in communities with population less than 5,000. This SPF is certainly meaningful for high population density areas, however, the SPF does not differentiate safety issues of the pure rural highway conditions from the highway sections through small urban communities in the Canadian Prairies. Roadside safety is also shown to be influenced by driveways associated with commercial and industrial land uses in the urban environment (2).

Saskatchewan Ministry of Highways and Infrastructure (MHI) recognized the unique safety issues on these highway sections and conducted safety studies to identify safety improvement opportunities for these highway sections. Two phases of the safety study for the highway sections in towns have been conducted in recent years to better understand the safety issues and to identify the traffic safety improvement opportunities. The first phase study investigated safety concerns for highway sections through small towns with populations less than 1,000 and the second phase study investigated safety concerns for highway sections through larger towns with populations over 1,000 in Saskatchewan.

OBJECTIVES OF THE STUDY

The study intended to be high level system-wide traffic safety audits for these highway sections through all towns in the province to identify general and location specific safety concerns. More detailed and location specific safety study may be required for the identified priority safety concerns to assess appropriate safety countermeasures. The objectives of the study were to:

- Identify system-wide general and highway section specific safety concerns and improvement opportunities for the highway sections through towns
- Investigate safety concerns for the identified highway sections and provide preliminary recommended countermeasures
- Prioritize safety improvement measures for the identified highway sections
- Prepare inventory data of the studied highway sections for further studies

ROAD AND TRAFFIC CHARACTERISTICS OF HIGHWAY SECTIONS THROUGH TOWNS

First phase study conducted a safety review for the highway sections through all 85 small towns with population less than 1,000 plus three communities in the north. Second phase study conducted a safety review for the highway sections in all the remaining 42 relatively larger towns with population over 1,000.

Through historical collision analysis and consultation with ministry traffic operation engineers and district managers, it was confirmed that the highway sections just pass through the edge of a urban community boundary normally do not have additional safety concerns from normal rural

highways. Both the studies concentrated on the highway sections having some urban characteristics when passing through urban communities. It is not easy to obtain very accurate data for road inventory and location specific traffic volumes and historical collision data for all highway sections through all towns because of different jurisdictional responsibility, traffic counting practices, and imprecise collision location identification. The highway inventory and location specific traffic volumes and collision data in and outside sixteen example towns are extracted to illustrate the characteristics of the road, traffic volumes, and collision history of the highway sections through the studied towns in following tables. These example sixteen towns are relatively large in Saskatchewan and they all have population more than 1,000.

One of the most important road characteristics of these highway sections through towns is that they are short sections as part of long rural highways. Table 1 shows the lengths of these highway sections through the example sixteen towns and their cross section characteristics.

Table 1: Highway sections through sixteen example towns (with more than 1,000 people): segment lengths and cross-section characteristics

Segment length (km)	**0.00-0.99**	**1.00 – 1.99**	**2.00-2.99**	**3.00-3.99**	**4.00-4.99**	**5.00-5.99**	**Total**
No. of Segments (%)	19 (23.5%)	20 (24.7%)	22 (27.1%)	16 (19.7%)	2 (2.5%)	2 (2.5%)	81 (100%)
Roadway lengths with different characteristics for all sixteen towns							
Rural cross section (km)	8.13	20.82	22.72	21.14	1.62	8.71	83.14 (44.4%)
Suburban cross section (km)	2.93	7.45	19.82	26.42	7.94	3.75	68.31 (36.5%)
Urban cross section (km)	0.00	6.84	16.16	12.89	0.00	0.00	35.89 (19.1%)

From the data in the table, it is seen that the highway cross section is changing from rural, to suburban, to urban even within the short length. Ninety-five per cent of these roadway segments are shorter than 4km. Fifty-five per cent of the highway sections in these towns are of suburban or urban character, which is even much shorter. This has indicated that the traffic operating conditions will also likely change in these short distances. As these example sixteen towns are relatively larger towns in the province, it is reasonable to assume that the highway sections through smaller towns would be even shorter.

Table 2: Sixteen example towns' traffic volumes on highway sections inside towns and adjacent rural highway sections outside towns

Town	Highway section length in town (km)*	AADT on highway sections inside town	AADT on Adjacent highway outside town	AADT Increase on Highway inside town over adjacent highway outside town
Assiniboia	4.42	1,924	818	135%
Fort Qu'Appelle	5.18	4,066	3,697	10%
Gravelbourg	3.08	2,141	492	335%
Maple Creek	4.62	1,631	389	320%
Moosomin	9.75	2,837	1,874	51%
Canora	7.04	1,096	939	17%
Esterhazy	3.03	3,210	1,660	93%
Kamsack	6.17	2,005	877	129%
Kerrobert	4.99	1,430	686	108%
Preeceville	3.33	2,395	480	399%
Rosetown	7.15	2,759	2,554	8%
Wadena	4.15	1,638	944	74%
Watrous	4.95	1,123	769	46%
Wilkie	5.42	1,386	1,376	1%
Nipawin	5.69	3,729	1,541	142%
Tisdale	6.18	4,204	1,679	150%
Total	**85.15**	**37,574**	**20,774**	81%

* Note: there are often more than one highways passing through each town.

Table 2 shows traffic volumes on highway sections through sixteen example towns compared to the traffic volumes on the adjacent rural highway sections. Traffic volumes data analysis has shown that the traffic volumes on highway sections inside the towns are all higher than the adjacent rural highway sections.

Traffic volumes inside all towns listed are higher than on the adjacent rural highway sections outside town with the increase ranging from mostly more than 50 per cent to the highest up to 400 per cent. The reason to use urban boundaries for the traffic and collision analysis and comparison is the relative easiness to extract data. It is recognized that use of urban boundary approach may have missed the important transition zones and some industrial development just outside the urban limits in some towns. Nevertheless, the results in Table 2 are still a good illustration of increased traffic activities for highway sections through towns.

Table 3 shows the same sixteen example towns' traffic collisions over the recent five years on these highway sections compared to those on the adjacent rural highway sections.

Table 3: Sixteen example towns' traffic collisions (2010-2014) on highway sections inside towns and on adjacent rural highway sections outside towns

Town	Highway section length inside town (km)*	Total collisions inside town	Total casualty collisions inside town	Adjacent highway length outside town (km)	Total collisions outside town	Total casualty collision outside town
Assiniboia	4.42	29	1	134.73	139	27
Fort Qu'Appelle	5.18	38	6	92.06	363	78
Gravelbourg	3.08	7	2	116.75	58	8
Maple Creek	4.62	6	1	75.24	62	2
Moosomin	9.75	70	13	196.2	265	44
Canora	7.04	13	2	128.53	280	67
Esterhazy	3.03	9	1	40.00	110	17
Kamsack	6.17	15	0	138.57	158	37
Kerrobert	4.99	25	8	166.25	128	21
Preeceville	3.33	10	3	114.72	139	18
Rosetown	7.15	26	7	131.13	293	54
Wadena	4.15	13	1	143.39	204	31
Watrous	4.95	10	1	89.43	147	17
Wilkie	5.42	10	2	79.42	100	12
Nipawin	5.69	40	7	75.73	150	30
Tisdale	6.18	52	15	125.25	245	52
Total	**85.15**	**373**	**70**	**1847.4**	**2841**	**515**

* Note: there are often more than one highways passing through each town.

From the data in Table 3, annual collision rates per km can be calculated for total collisions and casualty collisions for roadways of the sixteen example towns inside the towns and on the adjacent rural highways as follows:

$$Annual\ collision\ per\ km = \frac{Five\ year\ collisions}{(5\ X\ Roadway\ Length)}$$

Annual collision rates for highway sections inside and outside sixteen example towns are shown in Table 4. With the exception of one town where the collision rates inside town are slightly lower than on the adjacent highway and two other towns (one of these towns did not have any casualty collision during the period) with lower casualty collision rates inside the towns compared to adjacent highway, the vast majority of the collision rates and casualty collision rates on the highway sections inside the towns are much higher than that for the adjacent rural highway sections outside the towns for the sixteen example towns.

Table 4: Annual collision rates for highway sections inside and outside sixteen example towns

Town	Annual Total Collisions per km		Annual Casualty Collisions per km	
	Inside Town	Outside Town	Inside Town	Outside Town
Assiniboia	1.31	0.21	0.05	0.04
Fort Qu'Appelle	1.47	0.79	0.23	0.17
Gravelbourg	0.45	0.10	0.13	0.01
Maple Creek	0.26	0.16	0.04	0.01
Moosomin	1.44	0.27	0.27	0.04
Canora	0.37	0.44	0.06	0.10
Esterhazy	0.59	0.55	0.07	0.09
Kamsack	0.49	0.23	0.00	0.05
Kerrobert	1.00	0.15	0.32	0.03
Preeceville	0.60	0.24	0.18	0.03
Rosetown	0.73	0.45	0.20	0.08
Wadena	0.63	0.28	0.05	0.04
Watrous	0.40	0.33	0.04	0.04
Wilkie	0.37	0.25	0.07	0.03
Nipawin	1.41	0.40	0.25	0.08
Tisdale	1.68	0.39	0.49	0.08
Average	**0.88**	**0.31**	**0.16**	**0.06**

* Note: there are often more than one highways passing through each town.

The average annual total collision rate and average annual casualty collision rate for highway sections inside and outside towns for the sixteen example towns are as follows:

	Inside Towns	Outside Towns
Average annual total collision per km	0.88	0.31
Average annual casualty collision per km	0.16	0.06

These collision results indicate that the highway sections through towns do have higher collision rates and its associated unique safety concerns. It is necessary to investigate the issue further.

STUDY METHODOLOGIES

The methodologies adopted for the studies include the following (3, 4):

- Stakeholder consultations/survey: Stakeholders were consulted to gather information on the roadway safety issues for the studied towns. The stakeholders include MHI district managers and traffic operation engineers familiar with local highway infrastructure, community specific safety issues, historic traffic patterns, safety concerns from public, and

historical perspectives of different safety countermeasures and programs. For larger town study, in addition to discussing with MHI district managers and traffic operation engineers, a comprehensive survey questionnaire was also sent to stakeholders including town municipal officials and local RCMP officers for traffic safety concerns on these highway sections.

- Development of GIS tool: GIS tools were developed to collect information on collisions, traffic volume, speed, road classification, roadway characteristics and other map information, and potential safety issues from various sources such as CAD and GIS maps, virtual tours using Google Street Views, etc.
- Desk top analysis of historical collision data, traffic volume data, and roadway geometrics, and traffic signs and controls measures, and literature review for relevant information and countermeasures.
- Site visits and assessment: based on the stakeholder consultations and desk top analysis, site visits and assessment were conducted for the selected 52 Saskatchewan small towns in first phase study and 31 larger towns in the second phase study. Experienced traffic safety engineers drove through and assessed highway sections in these towns, took photos and videos, and assessment descriptions were documented.
- Location specific safety improvement prioritization and preliminary countermeasures: The prioritization method included *safety performance functions* and a*djustment factors* and "risk assessment matrix" to prioritize the safety issues considering the risk levels of identified issues and risk exposures (based on relative importance of the highway functions).

STUDY FINDINGS AND RECOMMENDATIONS

After stakeholder consultations and surveys, data analysis, literature review, site visits and assessment, and many committee discussions, although there were no critical safety concerns identified, which are specific location traffic safety concerns with high event occurrence probability and very serious consequence and require immediate attention, many safety concerns and improvement opportunities for the highway sections passing through towns were identified at both system wide level and at specific towns and locations (3, 4).

System-wide safety improvement opportunities for the highway sections passing through towns

Major system-wide safety improvement opportunities for safety infrastructure identified by the studies based on the system-wide summary of analysis and observation of safety issues are summarized from the two phases of the studies (below:

1. Intersection design and conspicuity

Intersections between highways, or between highways and a minor road or community access road is a location for potential hazards. Situations noted in the studies that pose safety risks at intersections include:

- speed differentials between through, turning, and accelerating vehicles
- skewed intersections which can limit sight distance in some directions
- grade change between highway and intersecting road reduces sight distance, and
- inconspicuous intersections

Intersection safety improvement opportunities identified include improvement of intersection design and intersection conspicuity. More specifically,

- Intersection design improvements: removal of obstructions to improve sight distance, provide/lengthen turning lanes for highway traffic and merging lanes for intersecting /access roads, re-align the roadway at skew intersections, limit access point close to intersections, re-grading of municipal roads at approaches to intersections, conversion to roundabouts if appropriate.

- Intersection conspicuity: Intersections of highways with other secondary highways or access roads should appear significant and be conspicuous to the drivers to prompts drivers about upcoming intersections and to take necessary caution. This can be done by well sized and placed signs, advance warning signs, red flashing beacon, clear pavement markings and stop bars, avoid excessively wide access road approaches, speed limit reductions, and providing illumination.

2. Vulnerable users (pedestrians/cyclists) accommodation

In some towns highways pass through the residential/commercial areas and there is a significant amount of pedestrian activity adjacent to the roadway. In such scenario there can be potential safety concerns for pedestrians and cyclists. Lack of facilities to accommodate pedestrians, inconsistent and non-standard markings and signage for cross walks were observed during the study. The suggested opportunities to improve pedestrians and cyclists safety include: review existing design standard of highway through small urban community to consider pedestrians and cyclists, provisions of sidewalks, crosswalks, curb-extensions, well maintained crossing signs and pavement markings, re-alignment of existing crossing by the desire lines, installation of advanced signage and signage at the crossing, reduced speed in the vicinity of crossing, installation of pedestrian refuge area at special crosswalks, etc.

3. Access Controls:

Accesses to residences and businesses are common features of highway sections passing through towns. It was noted that access management is not uniform among the towns. Wide and poorly-defined driveways, driveways very close to intersection, and service roads not clearly separated from the main lanes were found to exist that create situation that pose safety risks to the vehicles. The suggested countermeasures can include review access management policy for highways through small urban communities, narrowing down the wide driveways, consolidating multiple driveways, removing the service roads and use the right of way width gained to install a median and suitable U-turn facilities.

4. Enhance urban highway section's function as community streets in town centres:

In some communities highways' role transforms from being a high speed high capacity transportation corridor to a local/community street that need to accommodate pedestrians and cyclists, provide accesses to local properties and parking, while still facilitating the through travel for people and goods. If vehicles accustomed to the high travelling speed outside town will not reduce their speed while passing through towns, this presents risks to the pedestrians, cyclists, and vehicles in towns. In many cases streets have angle parking,

which may encroach on the intersection sight line between the main street and side street. This situation is risky for the pedestrians approaching the crosswalk.

The suggested improvement measures include enhancing the highway's role as community street through the town with roadway features that increase driver workload, such as: lane narrowing, medians with bushes/trees, concrete islands, pavement markings to define lanes and parking areas, sidewalks and painted curbs, and curb extensions at intersections etc.

5. Clear and adequate urban rural transition zones:

Unclear transition in roadway cross-section design characteristics in the urban fringe areas was observed or abrupt changes in speed limit are observed in some communities. This can be a safety concern if the existing roadway conditions continue to be conducive to speeds higher than the posted speed. Countermeasures suggested to reduce the risk as follows: update design guidance on graduated transition zones on rural highway approaches to towns with adequate distances for vehicles to slow down, rumble strips on the approaches to towns, overhead warning signage about upcoming towns, visible gateways/landmarks outside towns, and flashing beacons, speed display signs for approaching vehicles.

6. Divided highway medians:

Medians are used at intersections on divided highway to provide access in all directions. Left turning vehicles from an access road onto a divided highway must cross two high-speed through lanes and then wait in the median area before turning. Several potential safety risks may occur, including drivers on the access road may not accurately perceive the approaching vehicle speed due to visibility or sight distance issues and may misjudge the time required to cross the oncoming traffic lanes; turning trucks from the highway may complicate operations within the median area; confusion with respect to driver priority in median area and drivers waiting on the highway approach may be uncertain when it is safe to proceed into the median; and unfamiliar drivers (especially at night and in the winter) may not realize that it is a divided highway crossing.

Possible countermeasures to improve safety at these divided highway medians include: a consistent set of guidelines for signage, pavement markings, traffic controls, and accounting for available storage to apply throughout the province; installation of stop or yield sign where sufficient storage is available in the median, divided highway crossing signs on the approaches, clear pavement markings delineating safe zone for vehicles in the medians, and post-mounted yellow delineators, etc.

7. Railway crossings

There is prevalence of rail crossings of highways in towns due to historical role railway played in connecting communities. Safety concerns arise due to potential collisions between trains and vehicles. Various controls are applied such as on-board warning, railway crossing ahead signs on the road, crossbucks only or in combination with flashing lights, crossing bell, and gates all work to alert drivers to rail traffic. However roadway features such as horizontal or vertical curves, obscured sight lines, or skewed intersections can limit visibility at rail crossings. Following countermeasures are suggested to improve safety at rail crossings: adequate sightlines along rail corridor, avoiding new crossings at the location where railway is at higher elevation, avoiding skewed rail/road crossing, avoiding

rail/road crossing following a horizontal or vertical curve, putting advance notice for drivers about approaching crossing, avoiding vehicle queues backing onto rail crossings.

8. Condition of roadway and safety infrastructures

Condition of roadway and safety infrastructure that can increase risk of collisions were noted during the studies such as poorly maintained pavements, faded stop bars, damaged/missing signs, and non-standard/inconsistent signs. Countermeasures suggested include: maintain and improve existing roadway maintenance programs to ensure that safety infrastructure are in good condition, consider additional durable pavement markings and wet night high visibility pavement markings, increase width of pavement markings, standardize signs (signs for truck route, speed limit, and community), increase sign retro-reflectivity.

9. Passing Zones in/near communities

Permitting passing through a community zone can encourage drivers to increase speed where speed reduction would be better from safety perspective. There are locations where passing is permitted relatively near urban area.

It is recommended to consider reviewing province-wide design standards regarding passing locations on horizontal and vertical curves and implementing solid centre line through urban areas with gaps for driveway accesses.

Location Specific Safety Improvement Opportunities

The studies also identified some specific safety improvement opportunities at various locations of the highways passing through different towns. The ranked safety concerns of specific town locations are based on safety performance functions supplemented by field visits, or based on the 'Risk Scores' of a risk assessment matrix. The first phase of the study used the SPF concept and factors such as intersection characteristics, highway segment characteristics (such as divided or not), speed limit for the sections, and the presence or absence of sidewalks were also used in conjunction with decisive factors identified by MHI district manager and traffic engineers based on location specific conditions to determine a Performance Index for comparison of each town. Second phase of the study (for larger towns) did not use the SPF concept, and risk scores were used. Risk Scores are determined from risk level of a safety issue and its risk exposure. Observed vulnerable road users on the road, history of serious collisions, situations being confusing or violating driver expectation, observed geometric or traffic guidance issues, non-regulatory signage, and non-standard guide signs were the factors considered in assigning risk level value to a safety concern. Relative importance of the highway as represented by the highway sections' functional classification levels was considered in assigning risk exposure value. Risk Score is the product of the values assigned to risk level and risk exposure of each issue on a five-point scale.

The types of safety improvement opportunities identified at these specific locations are mostly similar to the system-wide safety issues summarized earlier, such as lack of accommodation for pedestrian and cyclist, the need to improve pavement markings, sightline, and intersection conspicuity, pedestrian crossing locations not on the desire line, proper speed reduction zones, allowing for greater storage length for turning vehicles,

minimizing access points, adding acceleration lane, realigning skewed intersection and accesses etc. Some of these locations have multiple issues or have some clear safety concerns and thus warrant some early attention. Safety improvement opportunities in following two towns were identified for example as warranting some early attention.

The Town of Gull Lake: The section of Highway 37 through the town is characterized by residential properties, driveways, access roads, stop signs, intersections and visual distractions. High volume of truck traffic carrying dangerous goods through residential area and the two tight 90 degree turns in a short distance for these trucks make the highway section a major safety risk.

The Town of Kindersley: With the high number of historical collisions of the highway section in the town, the highway section as part of National Highway System route has been considered as having major safety concern. The multiple access points, narrow space between service roads and the main lane highways, and frequent large turning trucks are part of safety concerns. The frequency with which traffic signals are damaged at this location has been presenting significant maintenance challenge and also may contribute to safety risk.

IMPLEMENTATION AND SOME ISSUE DISCUSSIONS

MHI has accepted the study results and started to implement the identified system-wide safety improvement opportunities through its normal safety improvement program. The issues of above examples of the specific towns identified with safety improvement opportunity have been addressed or are in the process to be addressed.

For the Town of Gull Lake, MHI worked with local communities in a partnership and designated a truck bypass route around the town for trucks carrying dangerous goods. Ministry has started to conduct a detailed comprehensive corridor functional design plan for the highway section through the town of Kindersley, with safety improvement of the highway section as the focus.

During the study, some issues have emerged and affected the study. One issue is the difficulty in identifying precise locations having safety concerns through historical collision data for these highway sections through towns. This is mainly due to the generally low volume nature of rural highways in Saskatchewan with low collision occurrence on a specific highway section. The difficulty was also made worse by the fact that many collision records do not have precise location description. Since these highway sections through towns are very short, the imprecise collision locations make the analysis difficult. This is the part of the reason why the safety improvement opportunities are mainly identified through safety audit type of assessment.

The other issue is the use of safety performance function (SPF) in assessing relative safety concerns. A SPF is a mathematical function describing the relationship between the number of collisions and road functional class, traffic volume, and other road characteristics (1). The Highway Safety Manual (HSM) has established SPFs under different conditions; the conditions are often not exactly the same in an actual safety study. It may not be practical to establish reliable local specific SPF for all local safety conditions. Use of the HSM methods to Canadian jurisdictions needs an assessment of the HSM SPFs as the base condition for base model SPFs may not reflect the base condition for a Canadian jurisdiction and the SPFs will need recalibration using the local data and evaluation for satisfactory performance (5). For example, HSM SPF defines highways in communities with population less than 5,000 as rural and SPF formulas for urban highways are based on research primarily from arterials in large American

cities. However, it is clear that rural highways in Canadian Prairies are very different from highways in communities with population up to 5,000. Obviously, HSM does not differentiate "pure" rural highways from highways through small towns. Roadways in studied small towns though are quite urban in design and characters compared to the "pure" rural highway sections, they however have very short length and low traffic volume, still are not comparable with general case of urban arterials in US and Canada which would include major streets in very large metropolitan areas. Local data for such assessment were not readily available and it was not within the scope of the study to undertake these analyses. Can the concept of SPF be used if the conditions are not exactly the same as in the Highway Safety Manual and without all the necessary data? The first phase of the study (for small towns) considered that the objective of the study was not to quantify the safety improvement, rather it was to compare relative safety concerns for action considerations, and the SPF concept was relevant and useful, while the second phase study used a different approach. Both approaches have achieved the objective of identifying safety improvement priorities.

Jurisdiction collaboration in implementing the safety improvement for highway sections through towns is also very important. The roadways, signs, markings, intersecting roads may belong to different jurisdictions, which may have different standards, rules, resources, and interests. Cooperation and partnership is critical for satisfactory safety improvement on these highway sections.

SUMMARY

Saskatchewan highway sections through small urban communities generally have different roadway and traffic characteristics than the rest of the highway sections in rural areas. These roadway sections are very short and many of them have suburban or urban characters. They normally have higher traffic volumes than on adjacent rural highway sections outside the urban community. Traffic collision rates on these highway sections in towns are also generally higher than on the adjacent rural highway sections. Safety concerns for road users and communities on these highway sections are different from those on pure rural highways and from those on normal urban streets in the cities because of the short length of urban environment and traffic composition. Recognizing the need to investigate the unique safety issues on these highway sections Saskatchewan Ministry of Highways and Infrastructure has conducted system-wide safety studies to better understand the safety issues and to identify the traffic safety improvement opportunities for these highway sections.

Based on the system-wide observation and assessment of safety issues, some system-wide safety improvement opportunities for these highway sections have been identified. The studies have also identified some specific safety improvement opportunities at various locations of the highway sections passing through the towns in Saskatchewan. The studies noted that none of the location specific safety concerns identified were critical that require immediate countermeasures.

MHI has started to implement the system-wide safety improvement opportunities through its normal safety improvement program. MHI has also taken actions to address or in the process to address some location specific safety improvement opportunities.

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