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Improving safety in school and playground zones through harmonization

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Abstract

Public demand for improving safety on our roads continues to be a top concern in Calgary and across Canada. This demand is most pronounced around schools and playgrounds where concerns for the safety of children are greatest and where we also know that children are overrepresented in collisions. Safety improvement in these areas of Calgary has been approached from several angles but one recurring issue was the different times and different days of effect for the two zone types, playground and school. This resulted in inconsistent expectations and confusion for motorists and a perception that non-compliance with reduced speeds was occurring due to the inconsistency of the zone days and hours. Between 2014 and 2016 Calgary's school and playground zone times were harmonized, followed by a conversion of school zones to playground zones. An evaluation of School and Playground Zone Harmonization was recently completed to determine the impacts the changes had on operational speeds and collisions as indicators of road safety.

The key findings of the evaluation are:

- The mean speed decreased from 36 km/h to 30 km/h during zone hours.
- Reduction in speeds with an increase in speed compliance showing that most drivers are aware of the changes and adhering to the new zone timing.
- Overall, the number of collisions involving pedestrians within school and playground zones decreased by 33%, with a 70% decrease between 5:30 pm and 9 pm.
- The collision rate decreased from 0.049 to 0.011 collisions per million vehicle kilometers of travel per year.
- Based on a survey conducted, 58% of respondents knew the exact start time of school and playground zone, whereas 73% knew the end time. More than 80% of the respondents find it easier to remember the zone times with single zone type that is consistent throughout the year.

The results of the study will be of interest for road authorities who balance 1) reduced speeds to 'logical' time windows by maintaining both playground and school zones, and 2) harmonization of zones and times to increase uniform behaviour resulting from clear(er) motorist expectation. The findings of this study create some interesting questions regarding the validity of having two types of zones and present a case for a single type of speed zone to simplify the driving task for motorists which will be discussed along with potential avenues of future research.

1 Introduction

Calgary has made use of school zones and playground zones for decades to improve the safety of children near the places where we expect higher concentrations of vulnerable road users, many without the physiological and cognitive ability, skills or knowledge to safely interact with traffic. The difference between Zones and Areas is important to note: Zones have reduced regulatory speed limits while Areas serve as a warning to motorists but without a change in speed limit. The selection of a zone or area is influenced by many factors and the guiding document for most municipalities is the TAC *School and Playground Zones: Guidelines for Application and Implementation* (2006). Although the presence of these zones does assist in moderating speeds and increasing motorist awareness of the need to watch for pedestrians and cyclists, there are frequent requests to improve compliance. These requests come in many forms but generally fall into two categories: increase awareness of the zone and increase compliance in the zone.

Calgary previously studied measures to increase awareness of motorists entering zones and found that the existing and standard signs are generally good at this task and that the group of motorists who would comply with the speed limit but are unaware they are in a zone is relatively small (1). Efforts to improve compliance have generally been approached from an education and enforcement angle, but more recently increased effort has been placed on traffic control enhancements, traffic calming and physical measures to assist in moderating speeds. A commonly referenced concern was the uncertainty about the type of zone motorists were entering as well as the days and hours that the zone was in effect. This paper summarizes the process Calgary followed to harmonize the zones and our evaluation of the effects of the change.

2 Speed, Human Factors and Traffic Safety

Before continuing with the Calgary case study, it is important to highlight the link between speed and collision outcomes. Many of the rationale for our geometric design and traffic control standards are largely based on speed, whether posted (~desired), design (~assumed), or operating (~reality). These standards most clearly take this into account based on PIEV time (perception, intellection, emotion and volition) and the associated time/distance to complete a movement whether stopping, changing lanes, etc.

There have been great advances in our professional and scientific knowledge about the relationship between speed and traffic safety outcomes since Solomon's work in 1964 which, unfortunately, continues to be a popular mythology despite being based on a biased data set and obsolete methodologies. Research on this topic since the 1990's has clarified the relationship and has consistently demonstrated that increases in speed results not only in increased severity of collisions but also increased frequencies of collisions (2).

Scientific research over the past few decades has been focused, in large part, on the survivability of collisions as a function of impact speed (kinetic energy = $\frac{1}{2} M V^2$) and bio mechanic limits of the human body. The International Transportation Forum recently released a report summarizing the latest literature on the subject (3). The report highlights the Nilssen Model and the underpinnings of 'reasonable speeds' common to Vision Zero, Safe(r) System(s) and Sustainable Safety approaches to improving traffic safety. The Nilsson Model has recently been calibrated for various environments but a general rule of thumb is that a 1% increase in speed will result in a 2% increase in collisions, 3% increase in injury collisions and a 4% increase in fatal collisions. Reasonable speeds are defined as having a fatality risk of approximately 10% for vulnerable road users at impact speeds of 30 km/h, vehicle occupants in side impact speeds of 50 km/h and vehicle occupants in head-on impact speeds of 70 km/h. If there is no risk of these types of collisions higher speeds may be considered. In summary, there are many well founded reasons to moderate speed in these zones.

One of the main rationale behind uniform application of standards, including speed limits, is to meet the expectations of users; if someone knows what to expect they are less likely make an error and, therefore, more likely to act in a predictable manner. For these reasons, harmonization of the times and zones eliminates the guess-work of if a zone is in effect on a certain day or at a certain time of day. Another complication with time of day or day of week variations in traffic control is that motorist may believe that outside of the posted times a risk of conflict does not exist; this is notable in Calgary where many motorists reported that there are no children out after dark, and yet collision data shows that a significant number of children (and adults) were being struck in playground zones after the 'one hour after sunset' end of the zone time. Furthermore, confusion regarding the effective times existed even though the days and hours were posted on each sign.

3 Calgary's approach to Harmonizing Reduced speed zones

On 2014, June 1, the Province of Alberta brought into force an amendment to the *Traffic Safety Act* which enabled municipalities to set start and end times for playground zones. Calgary had approximately 1510 playground zones, some of which at school sites, and 180 school zones requiring motorists to reduce their speed to 30 km/h. Prior to the legislative change in Alberta, school zones were in effect on school days from 7:30 a.m. to 5:00 p.m. and playground zones were in effect daily from 8:30 a.m. to one hour after sunset. One hour after sunset varies by about five and a half hours in Calgary throughout the year, from 5:30 p.m. to 11:00 p.m. The different start and end times for each zone were reported to be confusing to the general public. Local school boards and communities voiced their preference for a consistent start and end time for both school and playground zones through public consultations on the subject.

Discussions were held with eighteen Alberta municipalities and districts about the potential to coordinate playground zone timing and create consistency for drivers in the Province. As part of the study into playground zone times, a number of external stakeholders were also engaged including the Calgary Board of Education, the Calgary

Catholic School District, the Federation of Calgary Communities, the Alberta Motor Association, and Calgary Police Service. All of these stakeholders were supportive of changes to harmonize playground zone times in Calgary. Calgary City Council approved the plan to harmonize times and zones in June 2014 (4).

4 Implementation

Following Council's approval of changes to the Traffic Bylaw (29M96) for the school and playground zone hours, implementation of the changes was undertaken in a two-stage process:

- 1) The hours of the existing playground and school zones were changed on the existing signage through the use of vinyl decals that overlaid the posted times on each sign with the revised hours. This step was undertaken as it allowed a quick conversion to align the hours of the two zone types immediately after the bylaw changed prior to the beginning of the new school year. This stage required changes to 4335 signs at a cost of \$127,000 and was completed by September 2014.
- 2) As per the request from the City's two school boards during the consultation process, all existing school zones in Calgary were replaced with playground zones. This stage required replacing 1800 existing signs at a cost of \$545,000 and was completed by September 2015 before the start of the 2015 school year.

In addition to the costs and time required to change signage, a robust public education campaign was carried out collaboratively by the City and the Calgary Police Service at a cost of approximately \$30,000.

6 Evaluation

A report to evaluate the School and Playground Zone Harmonization was commissioned to determine the impacts that harmonization had on safety and was conducted by the University of Calgary through the Urban Alliance Partnership to maintain a level of independence. The report evaluated the effects on speed, collisions, and motorist perceptions of the harmonization where the City of Calgary supplied the speed data, the Calgary Police Service provided the collision data and the Citizen's View online panel provided public survey data. The report is publicly available online at Calgary.ca (5). The results of the studies are presented below.

6.1 Before-After speed study

The main purposes of the speed study were to determine whether there was a reduction in speed after the changes in the regulations of school and playground zones were implemented in Calgary as well as to determine the percentage of speed compliance by road users. The before speed data for playground zones was collected on August 2013,

and the before speed data for school zones was collected in September and October 2013. After the regulation changes were made where the times of the playground and school zones were harmonized and school zones were converted to playground zones, the after speed data was collected in May and June 2017. After data were collected for 11 playground zones and 18 school zones throughout the city.

The overall average speed in all school and playground zones before harmonization was 35.9 km/h, and the standard deviation was 11.8 km/h, whereas after harmonization, the speeds decreased to 30.1 km/h and 6.7 km/h, respectively. The 85th percentile speed before and after harmonization were 49.2 km/h and 37.2 km/h, respectively. The mean and 85th percentile speeds for both the before and after cases were significantly less than the default speed of 50 km/h at a 95 % confidence level. If we consider school zones and playground zones separately, both the mean speed and 85th percentile speed decreased after harmonization.

When the mean speed and 85th percentile speed were observed during different time periods of the day, 6 p.m.-9 p.m., 7 a.m.-9 a.m. and 2 p.m.-5 p.m., the values were lower after harmonization compared to the values before harmonization. The values were significantly lower than the default speed of 50 km/h and higher than the reduced speed limit of 30 km/h at a 95 % confidence level.

A t-Test was used to check whether the mean speed in school and playground zones after harmonization was significantly less than before harmonization. The test was done for two time periods from 8 a.m.-9 p.m. and 6 p.m.-9 p.m. For both time periods, the t-test showed that the null hypothesis, "mean speeds were not significantly different," was rejected, which indicated that the mean speed after harmonization was significantly less than before harmonization at a 95% confidence level. Table 1 shows the mean speed, 85th percentile speed, simple compliance and high-end compliance percentage (up to 10 km/h above the posted speed limit) in school and playground zones for all considered cases. There were more than 700 observations for all cases except in playground zones between 7 a.m. and 9 a.m., which had 446 observations.

TABLE 1. MEAN SPEED, 85TH PERCENTILE SPEED AND COMPLIANCE BY ZONE TYPE

Time	Type of Zone	Before			After (All Zones are playground zones)			Change in % compliance		Change in speed	
		Mean Speed(km/h)	85 th Percentile Speed(km/h)	Simple Compliance(%)	High-end Compliance(%)	Mean Speed(km/h)	85 th Percentile Speed(km/h)	Simple Compliance(%)	High-end Compliance(%)	Mean Speed(km/h)	85 th Percentile Speed(km/h)
8 a.m.-9 p.m.	School Zone	36.3	49.6	53	71	30.1	37.1	79	97	26	26
	Playground Zone	31.4	38.6	68	88	30	37.1	80	96	12	8
6 p.m.-9 p.m.	School Zone	45.2	56.3	78	96	31.6	38.9	73	96	-5	0
	Playground Zone	31	40.5	70	92	29.9	37.4	80	95	10	3
7 a.m.-9 a.m.	School Zone	33	47.6	66	79	30	38.6	77	92	11	13
	Playground Zone	34.9	46.4	49	80	31.8	40.1	71	90	22	10
	Both	33.1	47.5	65	78	30.3	38.9	76	94	11	16
2 p.m.-5 p.m.	School Zone	32.7	44	67	86	29.4	35.9	83	97	16	11
	Playground Zone	30.9	40.5	69	92	30.6	38.1	75	96	6	4
	Both	32.5	43.7	67	87	29.6	36.4	81	97	14	10

Figure 1 and Figure 2 below depict cumulative percentage frequency curves for before and after harmonization, respectively. The simple compliance of speed (30 km/h) from 8 a.m.-9 p.m. in playground zones before and after harmonization was 68% and 80%, respectively, whereas the simple compliance in school zones before and after the changes was 53% and 79%, respectively. There was also an increase in the high end compliance (up to 10 km/h above the posted speed limit) after harmonization for both school and playground zones.

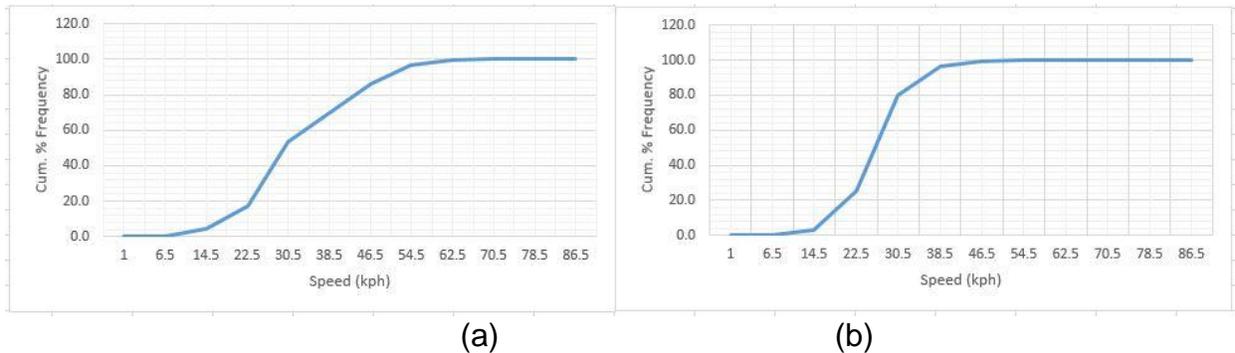


FIGURE 1. CUMULATIVE PERCENTAGE FREQUENCY CURVE FOR A) BEFORE AND B) AFTER THE CHANGES IN REGULATION IN PLAYGROUND ZONES FROM 8 A.M.-9 P.M.

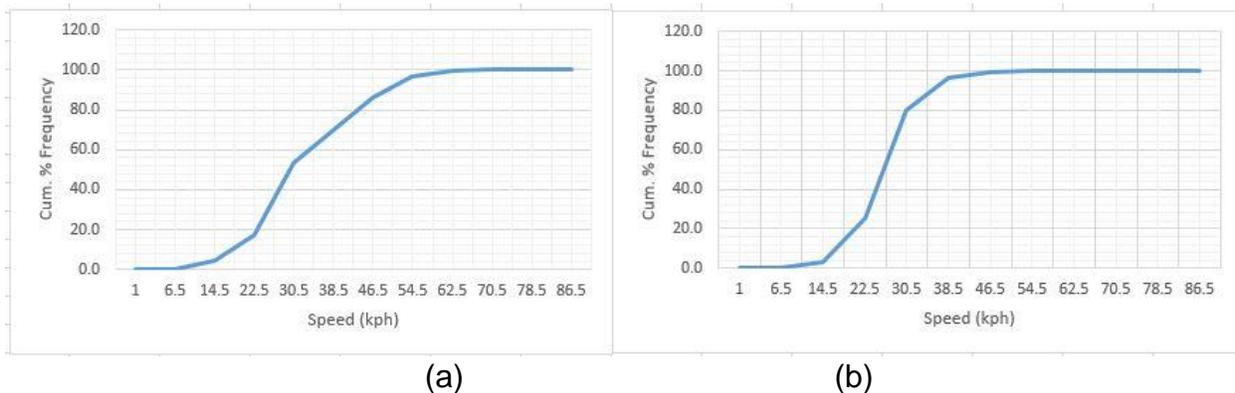


FIGURE 2. CUMULATIVE PERCENTAGE FREQUENCY CURVE FOR A) BEFORE AND B) AFTER THE CHANGES IN REGULATION IN SCHOOL ZONES FROM 8 A.M.-9 P.M.

Figure 3 shows the cumulative percentage frequency curve from 2 p.m.- 5 p.m., which considers the speed data of both school and playground zones together. The simple compliance before and after harmonization was 67% and 81%, respectively. The high-end compliance rate also increased after harmonization during the 2 p.m.-5 p.m. time period.

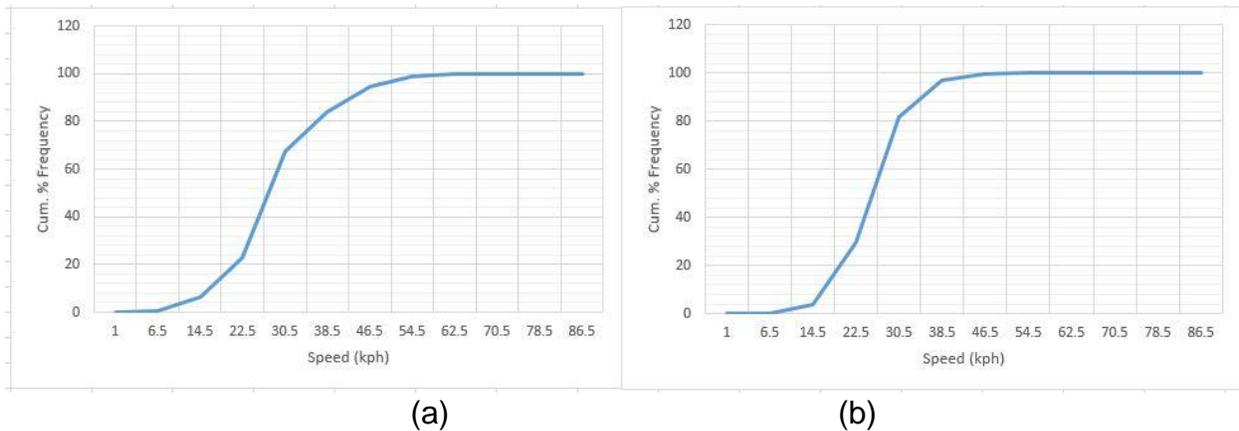


FIGURE 3. CUMULATIVE PERCENTAGE FREQUENCY CURVE FOR A) BEFORE AND B) AFTER THE CHANGES IN REGULATION IN BOTH SCHOOL AND PLAYGROUND ZONES FROM 2 P.M.-5 P.M.

The simple compliance and high-end compliance increased for all considered time periods of the day after harmonization for all scenarios (only school zones, only playground zones, and both together) except for only school zones for the time period 6 p.m.-9 p.m., which correspond to a reduction and a no change in the simple and high-end compliance percentages, respectively.

The speed study before and after the harmonization of school and playground zones showed a decrease in mean speed and standard deviation after the changes were implemented. The mean speed dropped from 35.9 km/h to 30.1 km/h, whereas the standard deviation dropped from 11.7 km/h to 6.7 km/h. Both the decrease in mean speed and standard deviation were statistically significant at a 95% confidence level. The speed compliance percentage also increased after harmonization except in school zones during the time period 6 p.m.-9 p.m. This exception may be because the speed limit was 50 km/h in school zones before the changes during the time period 6 p.m.-9 p.m., and it changed to 30 km/h after harmonization. The mean speed during this period decreased from 45.2 km/h to 31.6 km/h. This result showed that road users were aware of the changes and were following the new zone timing and speed. Overall, given the reduction in mean speed, 85th percentile speed and speed compliance, it was concluded that the changes made to school and playground zones were successful in reducing speed and, therefore, increasing speed compliance.

6.2 Before-After collision study

As shown in Table 2, a total of 30 and 20 pedestrians were involved in collisions in both school and playground zones before and after harmonization, respectively. The number of collisions per million km of vehicle travel per year decreased from 0.115 before harmonization to 0.074 after harmonization.

Table 2. Collisions in school and playground zones

	School and playground zone pedestrian collision	
	Before the Harmonization	After the Harmonization
Pedestrians Involved in Collision	30	20
Total length of school and playground zones(km)	457	458
Average daily Traffic in School and Playground Zone	1560	1607
Number of collisions per million vehicle km of travel per year	0.115288926	0.07444847
Number of collisions per million vehicle km of travel per month	0.00960741	0.006204039

A t-Test was used to check whether the number of collisions per million km of travel per month after harmonization was significantly less than before harmonization. The t- test showed that the null hypothesis, “mean scores were not significantly different,” was rejected, which indicated that the number of collisions per million km of travel per months after harmonization was significantly less than before at a 95% confidence level. The results of the t-test are shown in Table 3.

Table 3. t-Test: before and after collision rates

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	0.009607	0.00062
Variance	6.31E-05	1.85E-07
Observations	12	12
Hypothesized Mean Difference	0	
Df	11	
t Stat	3.913379	
P(T<=t) one-tail	0.00121	
t Critical one-tail	1.795885	
P(T<=t) two-tail	0.00242	
t Critical two-tail	2.200985	

Before harmonization school zones ended at 5:00 pm and playground zones were in effect until one hour after sunset. The new regulation of the combined zones, commonly referred to as playground zones, was changed to end at 9:00 p.m. To accurately identify any changes in collision rates during the new time period for the zones, we conducted our analysis using the number of collisions in playground zones between 5:30 p.m. and 9 p.m. for both before and after harmonization. The decision to exclude collisions noted as 5:00 was based on some occurring a few minutes before or after 5:00 that are rounded to that time and a desire to examine collisions which were clearly in a time that changed.

As shown in Table 4, a total of 10 and 3 pedestrians were involved in collisions before harmonization and after harmonization, respectively, between 5:30 p.m. and 9 p.m. The number of collisions per million km of travel per year for this time period decreased from 0.038 before harmonization to 0.011 after the changes were implemented.

TABLE 4. COLLISIONS IN SCHOOL AND PLAYGROUND ZONES BETWEEN 5:30 P.M. AND 9 P.M.

	School and playground zone pedestrian collision		
	Before the Harmonization	After the Harmonization	
Pedestrians Involved in Collision	10	3	
Total length of school and playground zones(km)	457	458	
Average daily Traffic in School and Playground Zone	1560	1607	
Number of collisions per million vehicle km of travel per year	0.038429642	0.01116727	
Number of collisions per million vehicle km of travel per month	0.00320247	0.000930606	

The t-test showed that the null hypothesis, “mean scores were not significantly different,” was rejected, which indicated that the number of collisions per million km of travel per month between 5:30 p.m. and 9 p.m. after harmonization was significantly less than before harmonization at a 95% confidence level. The results of the t-test are shown in Table 5.

TABLE 5. T-TEST: BEFORE AND AFTER COLLISION RATES BETWEEN 5:30 P.M. AND 9 P.M.

	<i>Variable 1</i>	<i>Variable 2</i>
Mean	0.00320247	0.000930606
Variance	1.29783E-05	5.35362E-06
Observations	12	12
Hypothesized Mean Difference	0	
df	19	
t Stat	1.838101004	
P(T<=t) one-tail	0.040867632	
t Critical one-tail	1.729132812	
P(T<=t) two-tail	0.081735263	
t Critical two-tail	2.093024054	

Comparing the number of pedestrians involved in collisions per km in school and playground zones, we can see from Figure 4 that most of the collisions are of minor severity. The number of pedestrians involved in fatal collisions was zero in all years except in 2014.

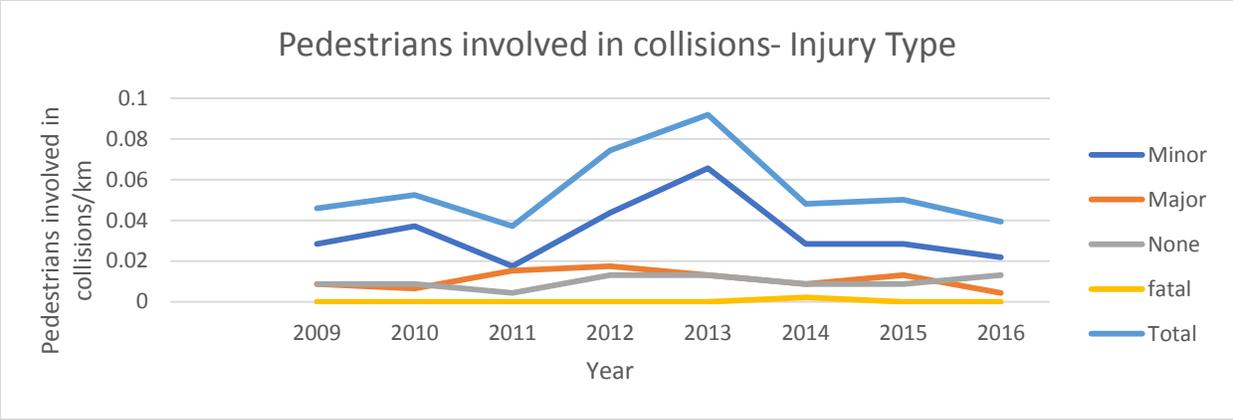


Figure 4. Pedestrians involved in collisions- Injury Type

As shown in Figure 5, more pedestrians were involved in collisions in school and playground zones between intersections or at unmarked crossings, compared to intersections with traffic controls such as stop signs, traffic lights or pedestrian crosswalks. More pedestrians were involved in collisions in 2013, which was the same result as for the number of pedestrians involved in collisions by injury type.

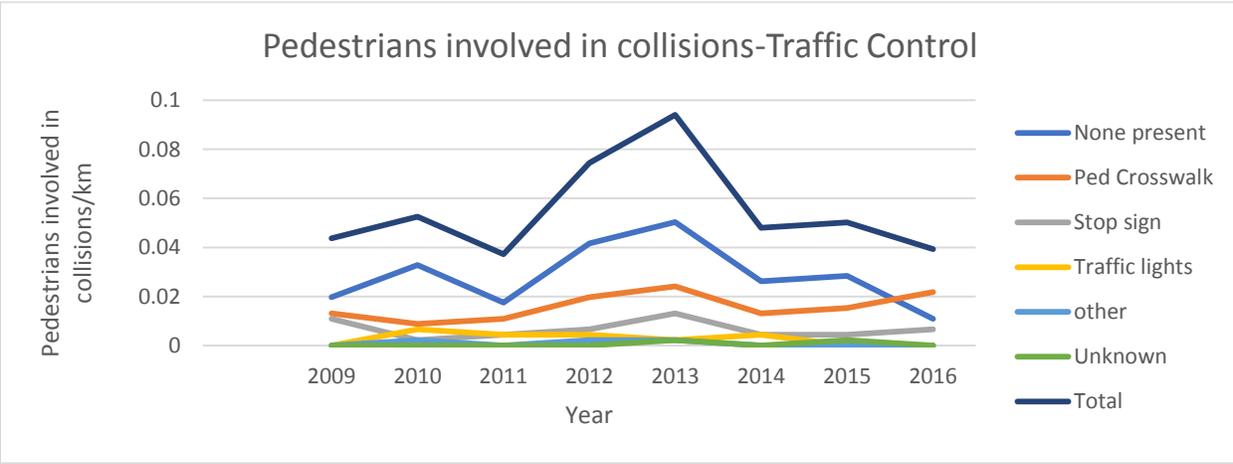


Figure 5. Pedestrians involved in collisions- Traffic Control

Figure 6 below shows the number of pedestrians involved in collisions per km in school and playground zones from 2009 to 2016 based on the road surface conditions. Surprisingly, more pedestrians were involved in collisions when the road surface was dry than when roads were covered with slush, snow, or ice. Possible explanations include drivers and pedestrians are generally more cautious in winter conditions or that there are more outdoor activities in school and playground zones in dry weather.

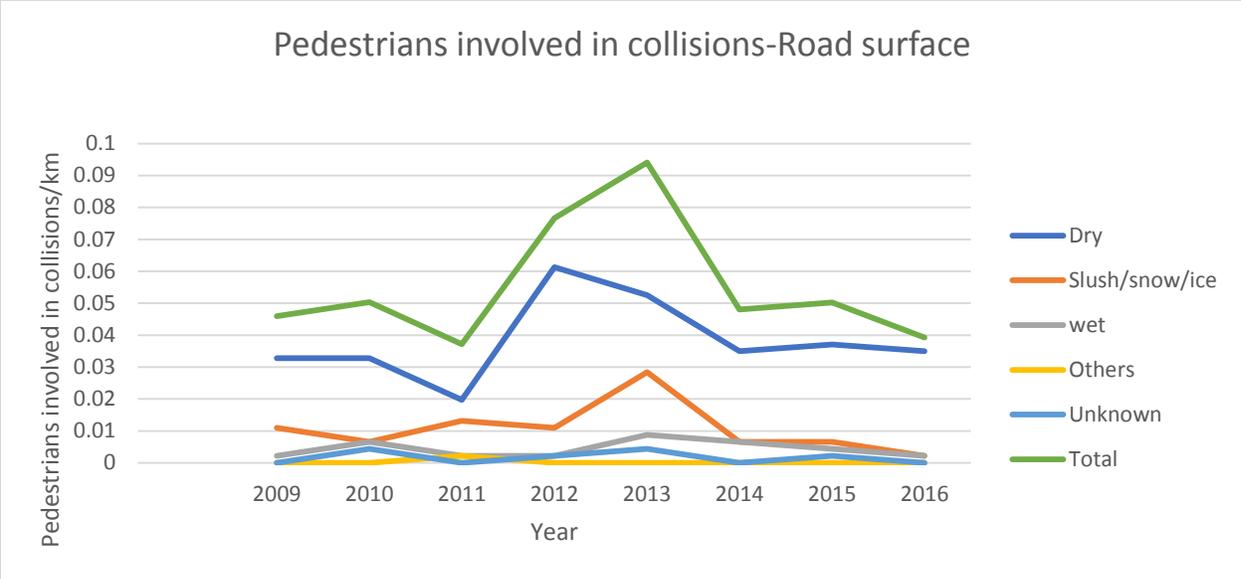


FIGURE 6. PEDESTRIANS INVOLVED IN COLLISIONS- ROAD SURFACE

We expect more children to use school and playground zones compared to adults, and therefore, they are at a higher risk in these areas (6). As shown in Figure 7, in 2013 there were more pedestrians 16 years old and under involved in collisions in school and playground zones compared to other years. As shown, the collision rate decreased in 2014 and 2015 after the harmonization of school and playground zones, but it increased slightly in 2016.

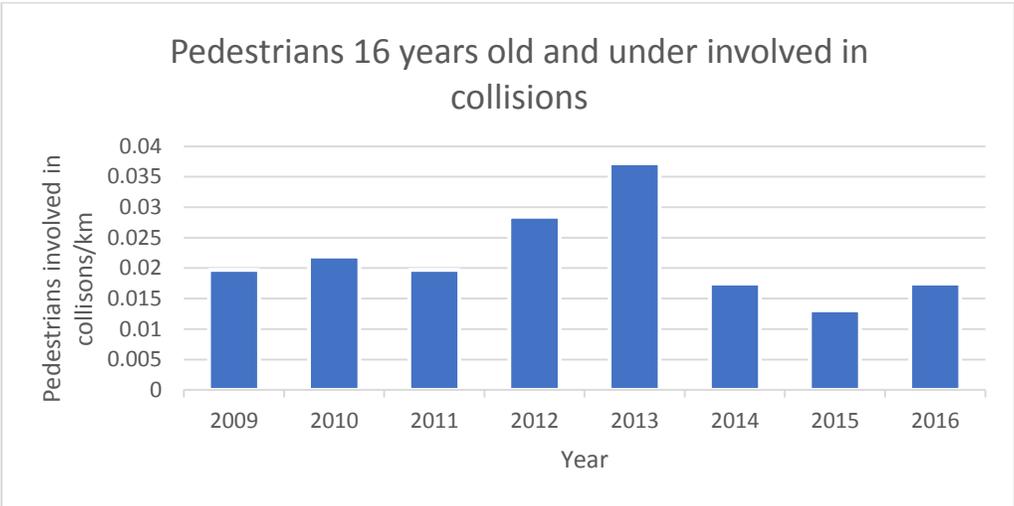


FIGURE 7. PEDESTRIANS 16 YEARS OLD AND UNDER INVOLVED IN COLLISIONS

As shown in Figure 8, the number of male pedestrians involved in collisions per km in school and playground zones was more than that of females from 2009 to 2013,

whereas the number of male and female pedestrians involved in collisions was almost equivalent in 2015 and 2016.

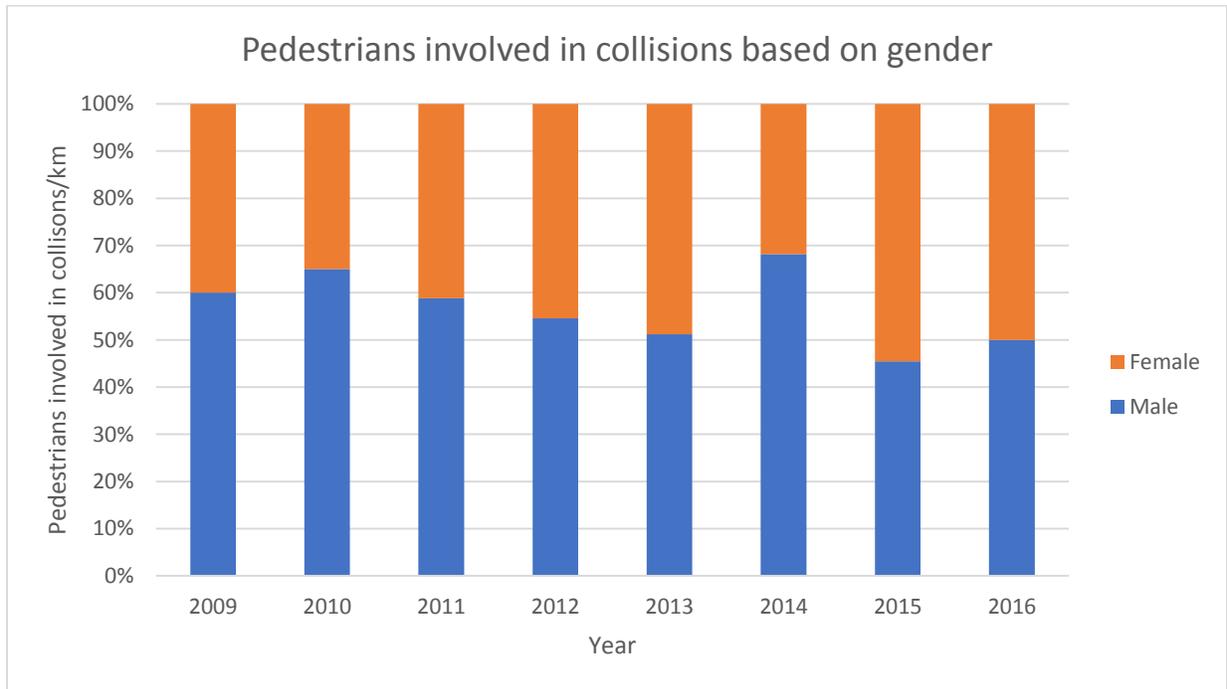


FIGURE 8. PEDESTRIANS INVOLVED IN COLLISIONS BASED ON GENDER

The collision study determined the changes in collision rates in school and playground zones before and after harmonization. The results showed that the collision rate decreased after harmonization: the collision rate dropped from 0.049 collisions per million km of vehicle travel per year to 0.011 collisions per million km of travel per year throughout the city. This change in the collision rate after harmonization was significantly less than that of before harmonization at a 95% confidence level. When the number of collisions per km from 2009 to 2016 in school and playground zones was observed, the rate was highest in 2013, which was possibly due to the high snowfall that year. The collision rate decreased after 2013; the new consistent zone times might have helped in terms of reducing the collision rate. In terms of injury type, most pedestrians involved in collisions had minor injuries and most collisions happened in locations with no traffic control. The results showed that the number of pedestrians under 16 years old that were involved in collisions was fewer 3 years after harmonization compared to 5 years before harmonization.

6.3 Awareness survey

School and playground zones are critical areas because there are more children and pedestrians in these zones. Both zones were combined into playground zones with one

consistent time from 7:30 a.m.-9 p.m. all year around with a speed limit of 30 km/h to improve safety in these zones. It is therefore necessary for all road users to be aware of the new changes in regulations. The revealed preference (RP) survey was conducted to determine people’s awareness of the changes in regulations in school and playground zones.

Scenarios were provided to the respondents in the revealed preference survey. The survey included questions on demographic characteristics (age, gender, income, and education), driving characteristics, awareness of the current school/playground zone times, and agreement/disagreement on a few statements relating to the new changes made to school and playground zones.

The online survey was conducted with respondents from all over the city and was conducted between July 7, 2017 and July 14, 2017. The survey was sent to 2598 respondents, out of which 804 completed the survey and 139 started the survey but did not complete it. Only the completed responses were used for analysis.

Respondents were asked whether they agreed/disagreed with the changes made in school and playground zones. The results of the survey are shown in Figure 9. Sixty-six percent of the respondents strongly agreed or somewhat agreed that converting school zones to playground zones was a good idea, whereas 31% somewhat disagreed or strongly disagreed with the changes. Fifty-one percent of the respondents felt that there was improved compliance after harmonization and 21% did not know whether compliance had improved or not. Eighty-one percent of the respondents agreed that having one zone type with a set time made it easier for them to remember the times than having two separate zone types.

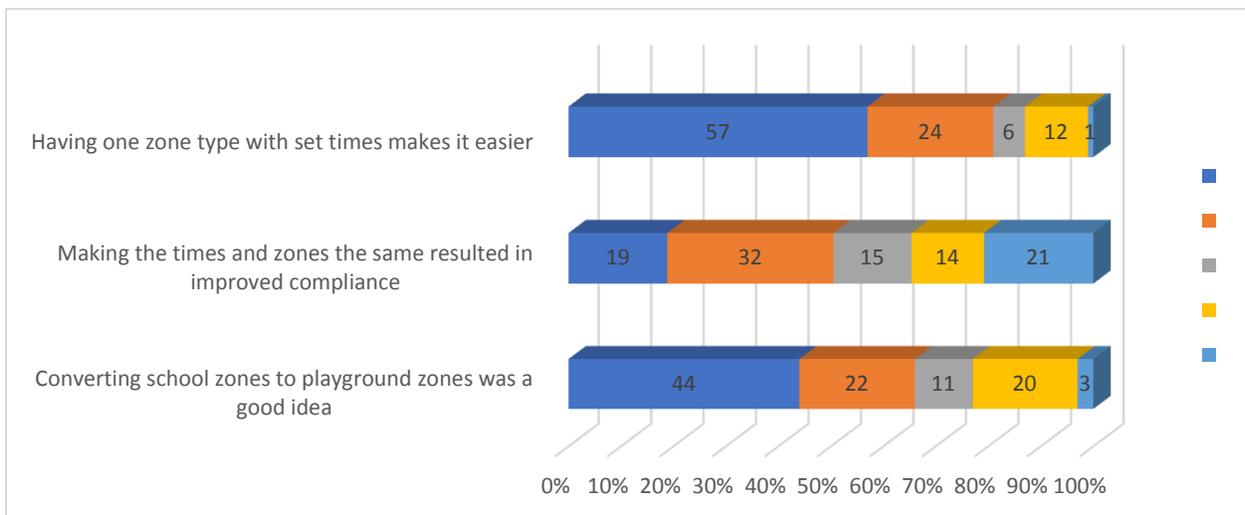


Figure 9. Users’ perceptions on the changes made in school and playground zones

Figure 10 shows the respondents' responses regarding the start time of school and playground zones for all days in a week. The results showed that around 58% knew the new start time of the school and playground zones which was an improvement over previous studies. For every day in the week, the results showed a similar trend.

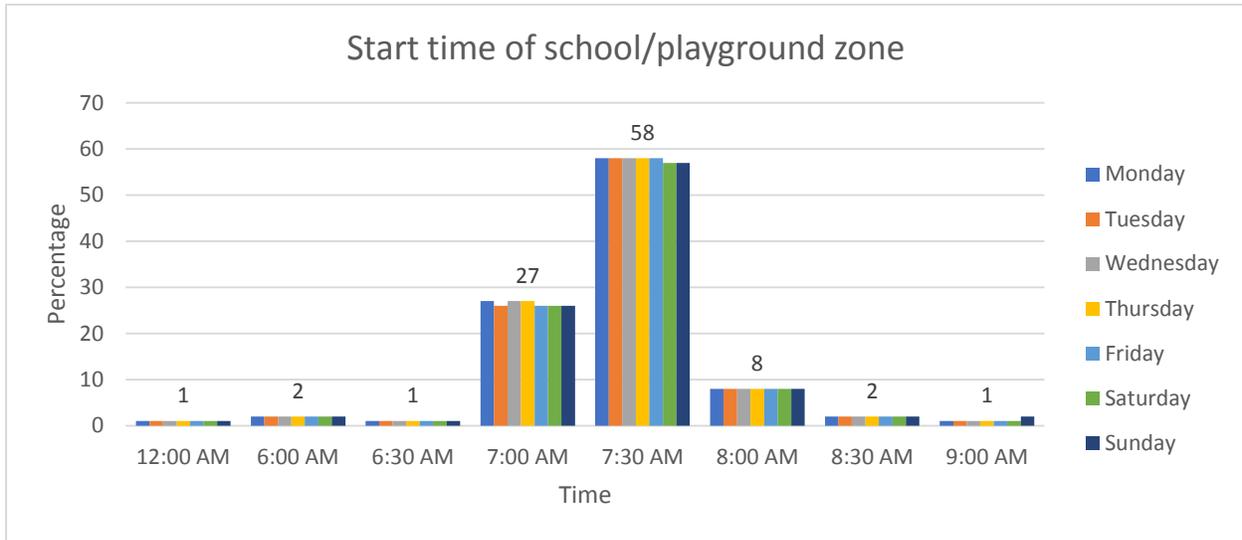


FIGURE 10. START TIME OF SCHOOL AND PLAYGROUND ZONES

Figure 11 shows the respondents' awareness of the end time of school and playground zones for all days in a week. The results showed that approximately 73% knew the new end time of the school and playground zones. For every day in the week, the results showed a similar trend. More participants knew the end time of the school and playground zones compared to the start time.

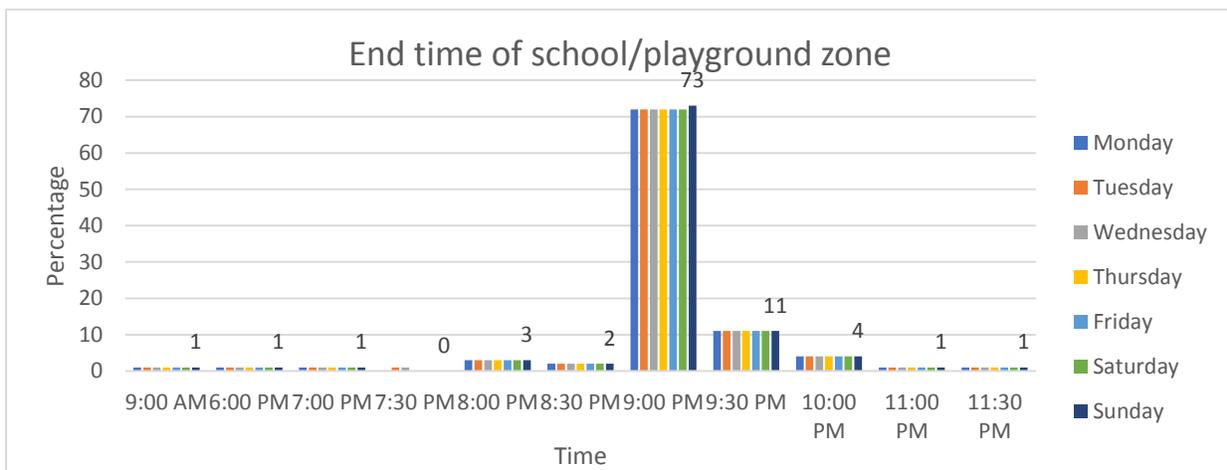


FIGURE 11. END TIME OF SCHOOL AND PLAYGROUND ZONES

From the results of the Improving Playground and School Zone Awareness project (1), completed in 2014 by the City of Calgary, 57% of the respondents knew the start time of the new zones, whereas 64% of the respondents knew the end time. Comparing the current survey results with the survey done in 2014, we can see an increase in awareness although there is room for improvement.

The main purpose of the survey was to understand the public awareness of the harmonization of school and playground zones. The results showed that 58% of respondents knew the exact start time of school and playground zones, whereas 73% knew the end time. Therefore, there was increased awareness after harmonization compared to people's awareness before harmonization as demonstrated by the results from the playground and school zone harmonization project completed in 2014 by the City of Calgary. Consequently, more people are now aware of the harmonization project although there is still room for improvement. Sixty percent of the respondents drove daily; therefore, almost all those who drove on daily basis knew the new zone times, whereas those who drove occasionally did not know the new zone times. Sixty-six percent of the respondents agreed that harmonization was a good idea, and 81 % felt that having one zone with consistent times made it easier for them to remember than having separate zones.

7 Lessons learned and future areas of study

Based on the results of the evaluation, it appears that harmonization of the zone times and conversion of school zones to playground zones in Calgary had the desired effect of improving compliance and reducing uncertainty regarding when the zone is in effect. It is important to note that the observed reductions in speeds were accompanied by a reduction in collisions consistent with what we would expect based on literature. The experience in Calgary, though, may not translate as well to other municipalities who have not had a long history of zones and therefore a relatively high level of awareness and compliance to start with. Recent media has highlighted potential opposition to zones in municipalities where none existed previously. High quality data and evaluation of the effects is critical to support discussions about the tradeoff between speed/mobility efficiency and safety, particularly in these areas where we anticipate higher concentrations of vulnerable road users in the form of children who do not have the ability to judge speeds and gaps of oncoming traffic if they even look.

As municipalities across Canada discuss and move toward Vision Zero or other approaches with 'reasonable speeds' where the general speed limits within a municipality match the 30 km/h speed zones currently used in most playground and school zones, it will be interesting to evaluate the effect of playground and/or school zones or if they will become de facto playground and/or school areas if adjacent segments of roadway also operate at 30 km/h. One possibility to maintain the importance of the playground and school areas where there is a high concentration of children would be to work with legislators to have higher penalties and lower tolerances in these areas.

8 References

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