



September 15, 2017
Roads - Traffic Engineering
City of Calgary

Cover Report – Review of School and Playground Zone Harmonization in Calgary

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 commissioned to determine the impacts the changes had on safety. The evaluation was conducted by the University of Calgary through the Urban Alliance Partnership to maintain a level of independence. The data used for the study was supplied by the City of Calgary, including speed data, collision data (owned by Calgary Police Service), and survey data collected through the Citizen's View online panel.

The key findings of the evaluation, *The Review of School and Playground Zone Harmonization in Calgary* (September 2017), are summarized below:

- The mean speed decreased from 36 km/h to 30 km/h.
- Reduction in speeds with an increase in speed compliance for all categories (8 am–9 pm, 7 am–9 am, 2 pm–5 pm) except school zones between 6 pm and 9 pm, where the compliance decrease of 5% was accompanied by a decrease of average speeds from 45 km/h to 32 km/h, 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.

Please contact Traffic Engineering if you have any questions or comments.

The Review of School and Playground Zone Harmonization in Calgary

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September 2017

Summary

In Calgary, school zone and playground zone hours were changed to one consistent time as of September 1, 2014. By March 2016, all school zones were changes to playground zones. Playground zones are now in effect from 7:30 a.m. to 9:00 p.m. all year around and have a speed limit of 30 km/h.

A before and after speed study was done to determine the impacts of combining school and playground zones signs and the times they are in effect, which is called harmonization in this paper. The results showed a decrease in average speed and standard deviation after the changes. The average speed decreased from 35.9 km/h to 30.1 km/h. A speed compliance study was also done, and the results showed an overall improved compliance after harmonization. When school zones were examined between 6 p.m. and 9 p.m.; 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 made in school and playground zones.

The collision data of school and playground zones in Calgary were analyzed to determine if there were any effects of harmonization on the number of collisions. The results showed that the collision rate in Calgary dropped from 0.049 collisions per million km of vehicle travel per year to 0.011 collisions per million km of vehicle travel per year after the harmonization of school and playground zones. We observed the number of collisions per km from 2009 to 2016 in school and playground zones and determined the collision rate was higher in 2013. The high collision rate in 2013 was possibly due to the high snowfall that year.

An online survey was conducted to understand the public perception towards the changes (i.e. harmonization) and their awareness of the start and end times for school and playground zones in Calgary. More than 80% of respondents found it easier to remember the zone times when there

was only one time that was consistent throughout the week. Fifty-eight percent of respondents knew the exact start time of school and playground zone, whereas 73% knew the end time. More than 60 % of respondents drove daily. Therefore, we concluded that those who drove regularly were more aware of the changes in zone times compared to those who only occasionally drove.

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1. Introduction

1.1 Background

School zones and playground zones are important in making streets safer for children. In Calgary, several suggestions on ways to change school and playground zone regulations have been put forward since 2014. The main purpose of the changes was to reduce complexity, enhance comprehension, and improve the safety of all road users. In Calgary, before 2014, school zones were in effect from 7:30 a.m. to 5:30 p.m., whereas playground zones were in effect from 8:30 a.m. to one hour after sunset. School zone and playground zone hours were changed to one consistent time as of September 1, 2014 to improve pedestrian safety. By March 2016, all school zones were changed to playground zones. Playground zones are now in effect from 7:30 a.m. to 9:00 p.m. all year around and have a speed limit of 30 km/h. Before the changes, there were approximately 1500 playground zones and 180 school zones in Calgary (www.calgary.ca).



Figure 1. Playground zone hours (source: City of Calgary web)

1.2 Study Objectives

The objective of this study is to evaluate the impact of the changes in regulations on improving safety by reducing the number of collisions and vehicle speed and increasing driver compliance and comprehension.

2. Review of School and Playground Zone Harmonization

Three different types of studies were conducted to review the impact of regulation changes made to school and playground zones. The studies are as follows:

- Before- After speed study
- Before- After collision study
- Awareness survey

2.1 Before – After speed study

The main purpose of this study was to determine whether there was a reduction in speed after the changes in the regulations of school and playground zones were implemented in Calgary and to determine the percentage of speed compliance by road users. The City of Calgary provided the before and after speed data. The before speed data for playground zones were collected on August 2013, and the before speed data for school zones were collected in September and October 2013. After the changes in the regulations were implemented, school zones were converted to playground zones, and the times of the playground zones also changed. The speed data after harmonization were collected in May and June 2017. Data were collected for 11 playground zones and 18 school zones throughout the city.

2.1.1 Mean speed and 85th percentile speed

The overall 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, they 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 we observed the mean speed and 85th percentile speed 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 10km/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. The detailed information is provided in the appendix.

Table 1. Mean speed, 85th percentile speed and compliance percentage in school and playground zones

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(%)	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	6.2	12.5
	Playground Zone	31.4	38.6	68	88	30	37.1	80	96	12	8	1.4	1.5
6 p.m.-9 p.m.													
	School Zone	45.2	56.3	78	96	31.6	38.9	73	96	-5	0	13.6	17.4
	Playground Zone	31	40.5	70	92	29.9	37.4	80	95	10	3	1.1	3.1
7 a.m.-9 a.m.													
	School Zone	33	47.6	66	79	30	38.6	77	92	11	13	3	9
	Playground Zone	34.9	46.4	49	80	31.8	40.1	71	90	22	10	3.1	6.3
	Both	33.1	47.5	65	78	30.3	38.9	76	94	11	16	2.8	8.6
2 p.m.-5 p.m.													
	School Zone	32.7	44	67	86	29.4	35.9	83	97	16	11	3.3	8.1
	Playground Zone	30.9	40.5	69	92	30.6	38.1	75	96	6	4	0.3	2.4
	Both	32.5	43.7	67	87	29.6	36.4	81	97	14	10	2.9	7.3

2.1.2 Compliance Study

Figure 2 and Figure 3 below depict cumulative percentage frequency curves for before and after harmonization, respectively. The simple compliance of speed (30km/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 10km/h above the posted speed limit) after harmonization for both school and playground zones.

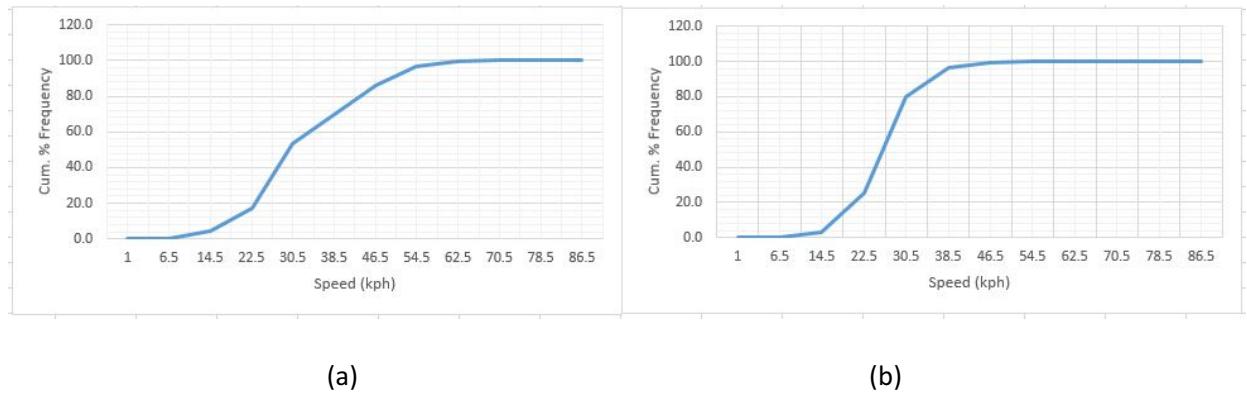


Figure 2. Cumulative percentage frequency curve for a) before and b) after the changes in regulation in playground zones from 8 a.m.-9 p.m.

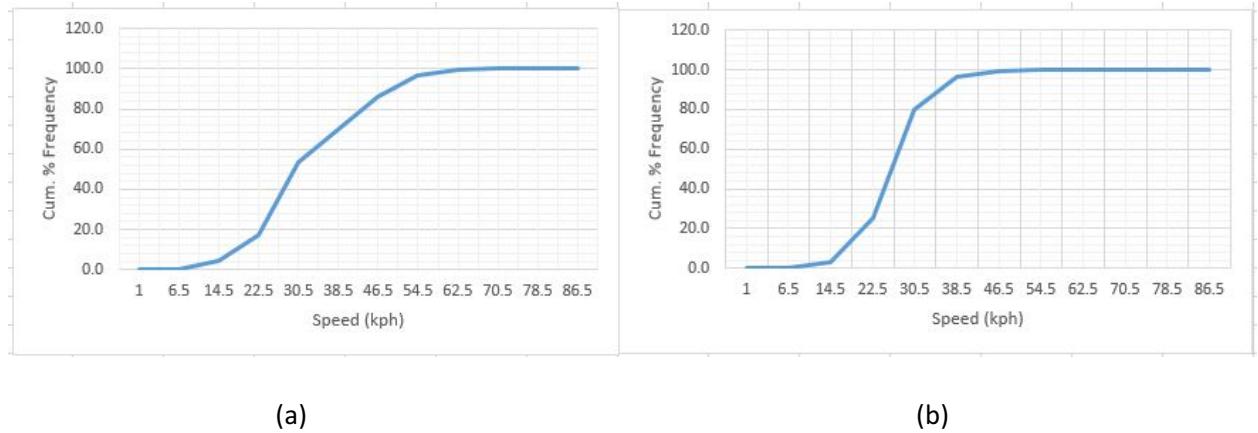


Figure 3. Cumulative percentage frequency curve for a) before and b) after the changes in regulation in school zones from 8 a.m.-9 p.m.

Figure 4 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.

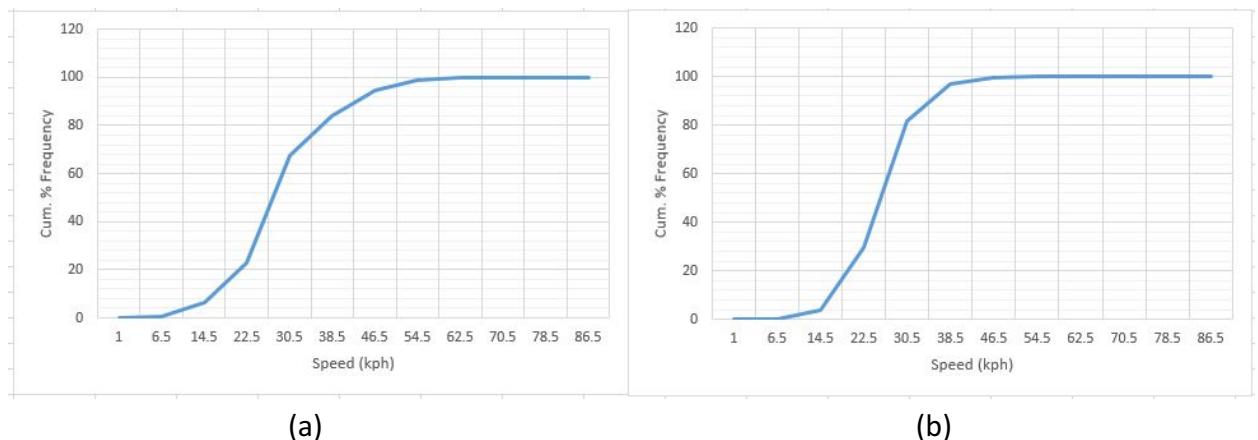


Figure 4. Cumulative percentage frequency curve for a) before and b) after the changes in regulation in both school and playground zones from 2 p.m.-5 p.m.

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 cumulative frequency curves for all other cases are provided in the appendix.

2.1.3 Conclusion

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, we could conclude that the changes made to school and playground zones were successful in reducing speed and, therefore, increasing speed compliance.

2.2 Before – After collision study

In this study, we compared the number of collisions in school and playground zones before and after the changes in regulations made by the City of Calgary.

The rate per million of entering vehicles (RMEVs) is used to compare crash rates (Garber and Hoel, 2009). The RMEVs is the number of crashes per million vehicles entering the study location during the study period. It is expressed as follows:

$$RMEV = \frac{A \times 1,000,000}{V \times MI}$$

Where A= number of crashes occurring in a single year at the location

V= average daily traffic $\times 365$

MI= Length of section in miles

Data from September 2013 to August 2014 were considered as “before data,” whereas collision data from November 2015 to October 2016 were considered as “after data.” Twenty-four hour traffic was considered as the average daily traffic flow in school and playground zones. A 3% increase in traffic volume was assumed to calculate the average daily traffic flow after harmonization. In terms of combined length, the City of Calgary had approximately 100 km of school zones and 357 km of playground zones before 2014, but after 2014, there was 358 km of playground zones.

2.2.1 Average collision rate in school and playground zones

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

	Variable 1	Variable 2
Mean	0.009607	0.00062 1.85E-
Variance	6.31E-05	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 5:30 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 accident rates during the new time period for the zones, we conducted our analysis using the number of

accidents in playground zones between 5:30 p.m. and 9 p.m. for both before and after harmonization.

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.

	Variable 1	Variable 2
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	

2.2.2 Descriptive analysis

Pedestrians involved in collisions- Injury Type

Comparing the number of pedestrians involved in collisions per km in school and playground zones, we can see from Figure 5 that most of the collision types are minor. Every injury type followed the same pattern with a maximum collision rate occurring in 2013. The number of pedestrians involved in fatal collisions was zero in all years except in 2014.

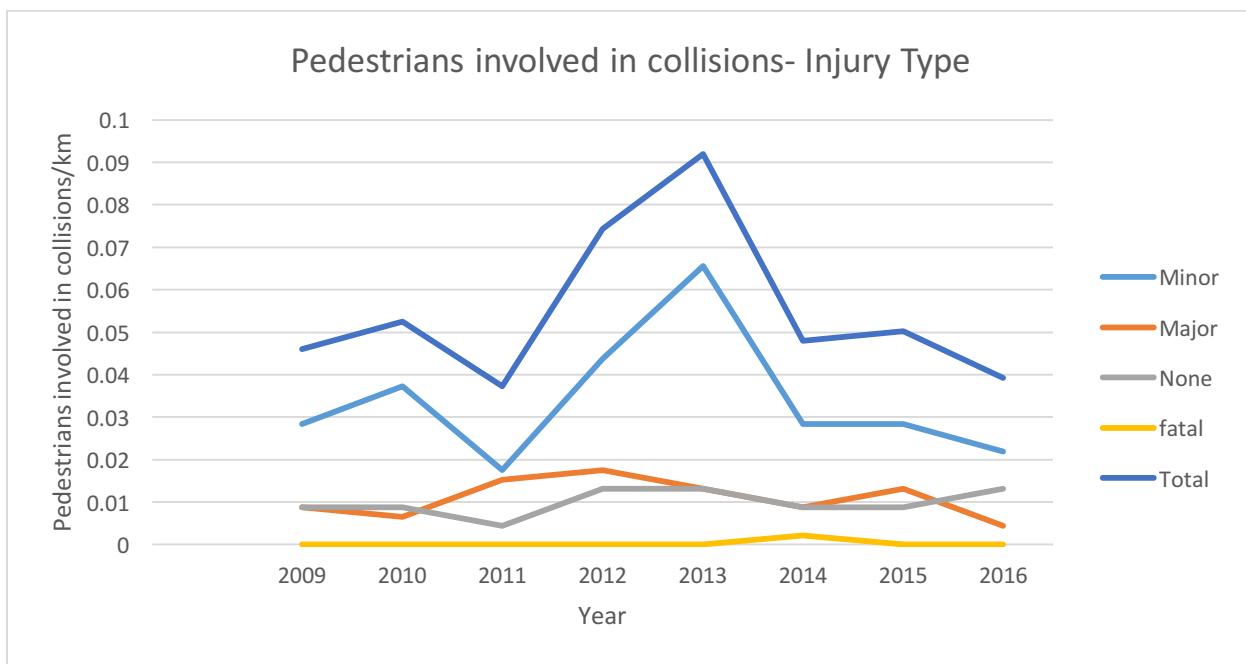


Figure 5. Pedestrians involved in collisions- Injury Type

Pedestrians involved in collisions- Traffic Control

As shown in Figure 6, more pedestrians were involved in collisions in school and playground zones with no traffic controls 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.

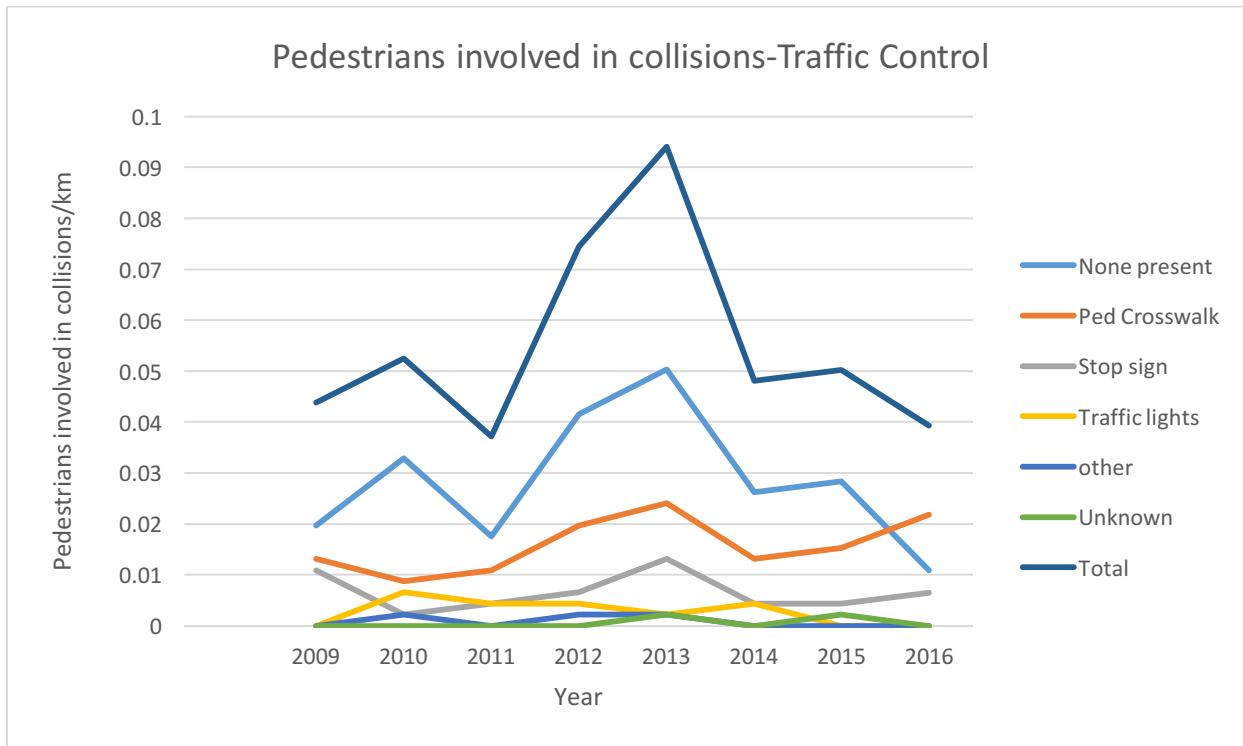


Figure 6. Pedestrians involved in collisions- Traffic Control

Pedestrians involved in collisions- Road Surface

Figure 7 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.

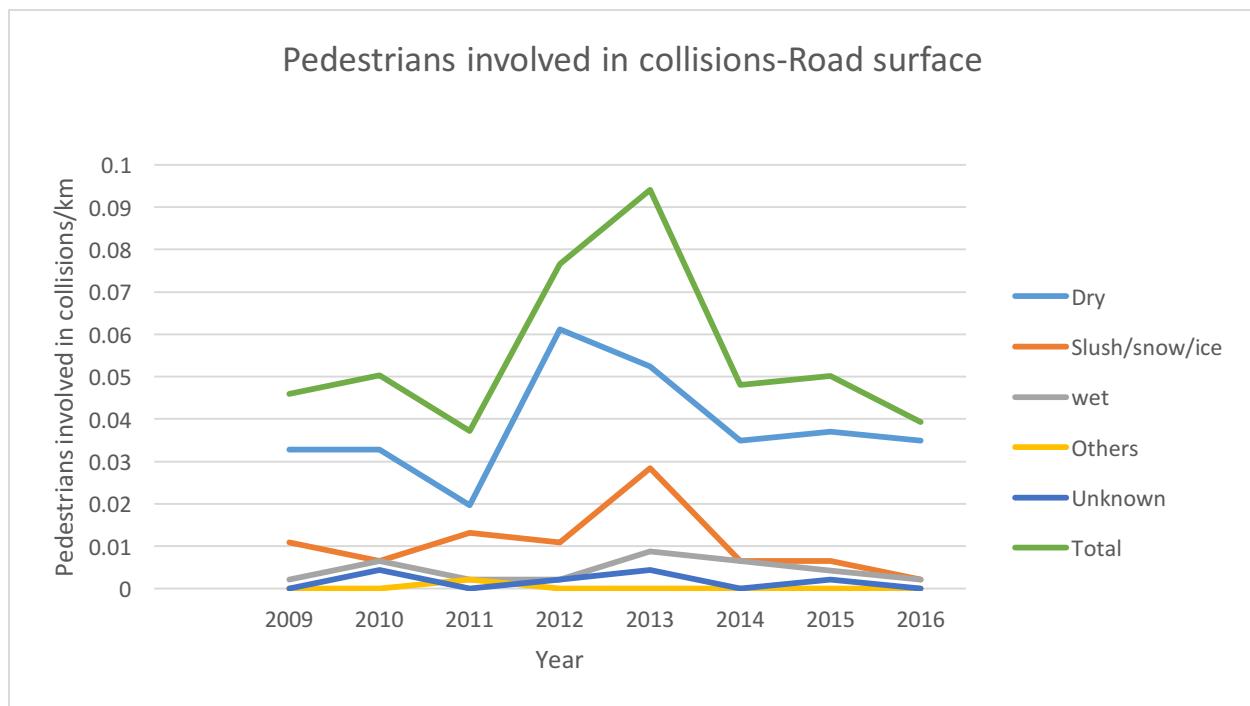


Figure 7. Pedestrians involved in collisions- Road Surface

Pedestrians 16 years old and under involved in collisions

We expect more children to use school and playground zones compared to adults, and therefore, they are at a higher risk in these areas (Kattan et. al, 2011). As shown in Figure 8, 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.

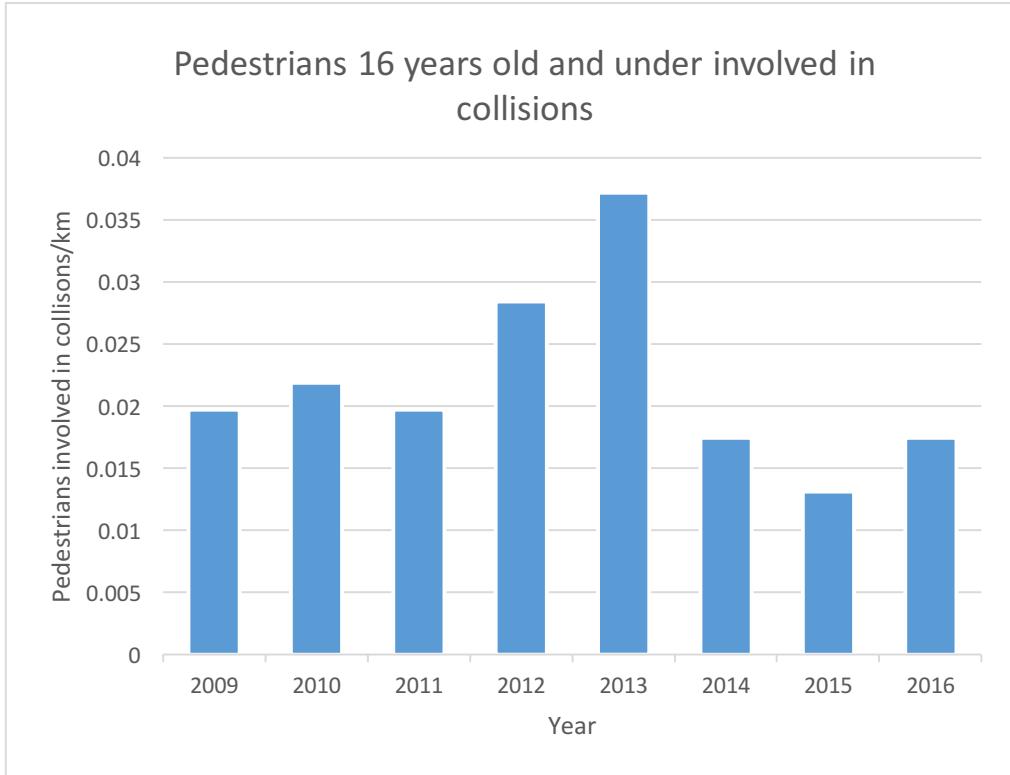


Figure 8. Pedestrians 16 years old and under involved in collisions

Pedestrians involved in collisions based on gender

As shown in Figure 9, 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.

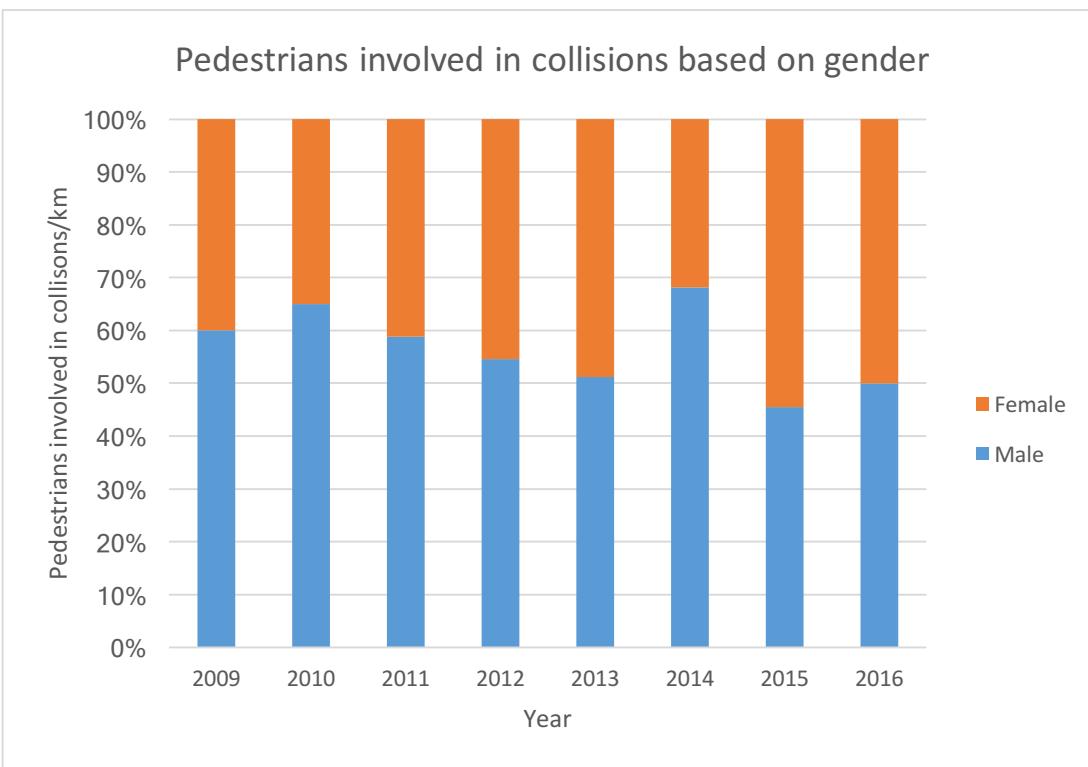


Figure 9. Pedestrians involved in collisions based on gender

2.2.3 Conclusion

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 we observed the number of collisions per km from 2009 to 2016 in school and playground zones, 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. Since children under 16 used school and playground zones more than adults, they were more at risk. 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.

2.3 Awareness survey

2.3.1 Background

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.

2.3.2 Methodology

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. The survey 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. Only the completed responses were used for analysis.

2.3.3 Descriptive Statistics Results

Demographics

Table 6 and Table 7 summarize the demographic characteristics of the respondents. The results showed that 42% of the respondents were male and 56% were female. A large number of participants in the survey were between 55-64 years of age. Only 2% of participants in the survey were under 24 years of age. The sample showed that the family income of the respondents varied; the majority of respondents (30%) had average annual income of \$120000 and over, and 19% were not willing to disclose their salary. In terms of education, the majority of the respondents had completed a university degree, whereas very few of them had only completed high school or less.

Table 6. Demographics of the sample (Gender, Age and Income)

Variables	Frequency (%)	Variables	Frequency (%)
Gender		Income	
Male	42	Under \$30000	6
Female	56	\$30000 to <\$45000	6
Age		\$45000 to <\$60000	9
18-24 yrs.	2	\$60000 to <\$75000	6
25-34 yrs.	10	\$75000 to < \$90000	8
35-44 yrs.	18	\$90000 to <\$105000	8
45-54 yrs.	22	\$105000 to <\$120000	7
55-64 yrs.	30	\$120000 or more	30
65 or over	19	No response	19

Table 7. Demographics of the sample (Education)

Variables	Frequency (%)
Education	
Completed high school or less	7
Some post-secondary or completed a college diploma	28
Completed university degree (undergraduate or graduate)	64

Driving Characteristics

Respondents were asked for how many years they were an active and licensed driver. Figure 10 shows the responses of the participants in the survey. The results showed that 92% of them had been driving for 10 years or longer. Four percent of the respondents were not licensed drivers. Those who had been driving for less than 5 years and between 5 to 9 years constituted the remaining 4%.

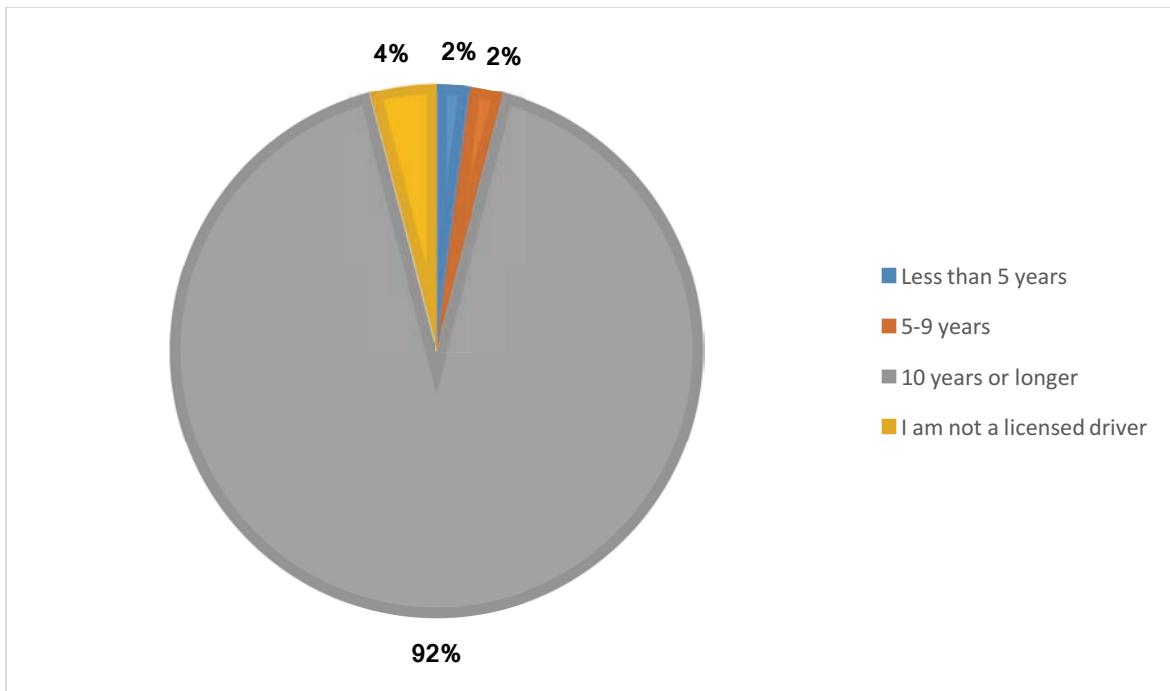


Figure 10. Driving characteristics of the respondents (number of years being an active and licensed driver)

Figure 11 is a bar graph that shows how often the respondents drive. The bar graph shows that more than 60% of the respondents drive on a daily basis with another 26 % driving a few times a week. Those who do not drive, drive less than once a month, drive once a month, drive a few times a month and drive once a week constituted a small percentage of the total respondents.

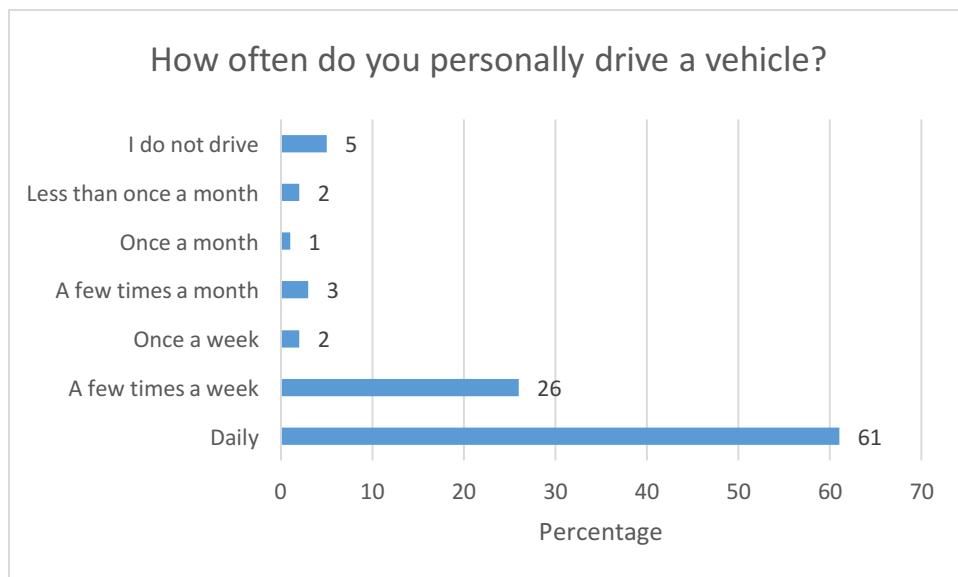


Figure 11. Driving characteristics of the respondents (how often they drive)

Users perception on the changes made in school and playground zones

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 12. 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.

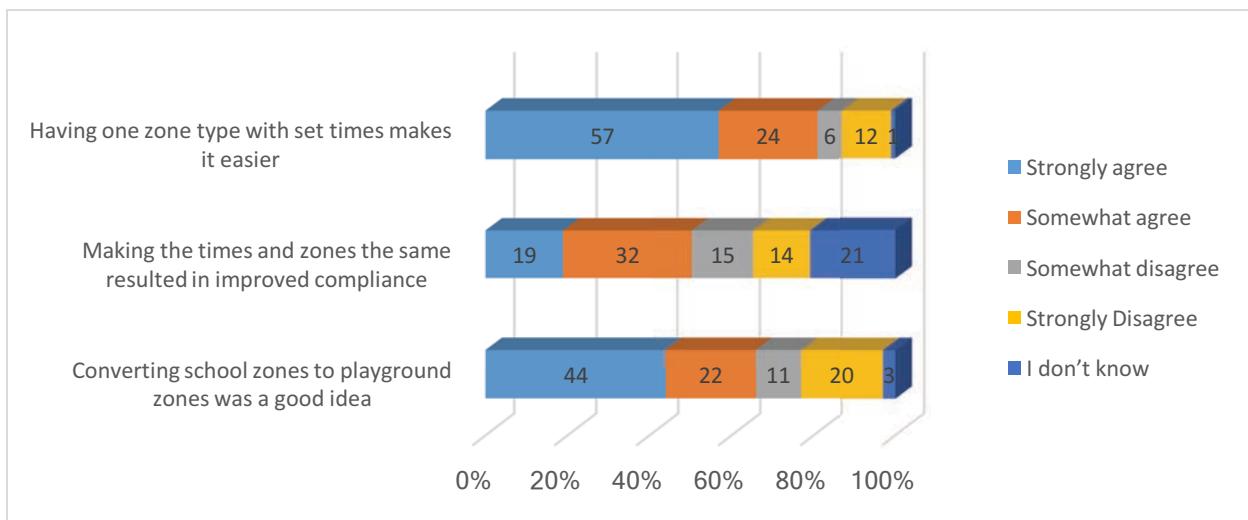


Figure 12. Users' perceptions on the changes made in school and playground zones

Awareness of start and end time of school and playground zones

Figure 13 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. For every day in the week, the results showed a similar trend.

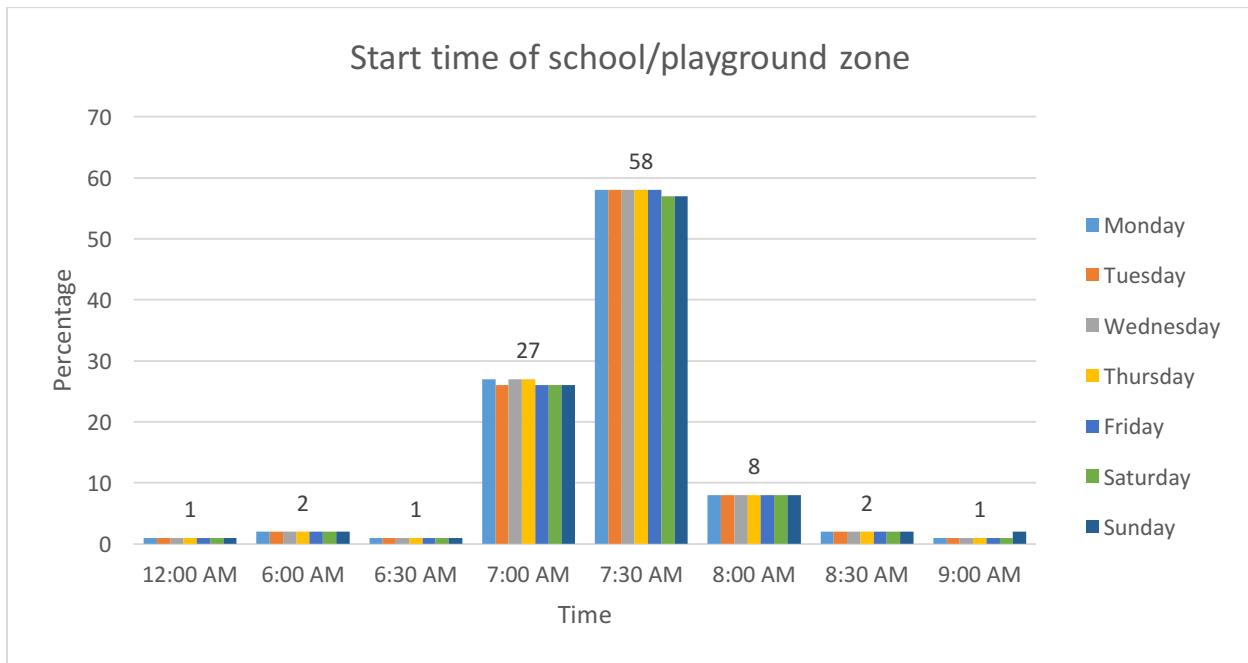


Figure 13. Start time of school and playground zones

Figure 14 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. From the results of the playground zone and school zone harmonization project, 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 more room for improvement.

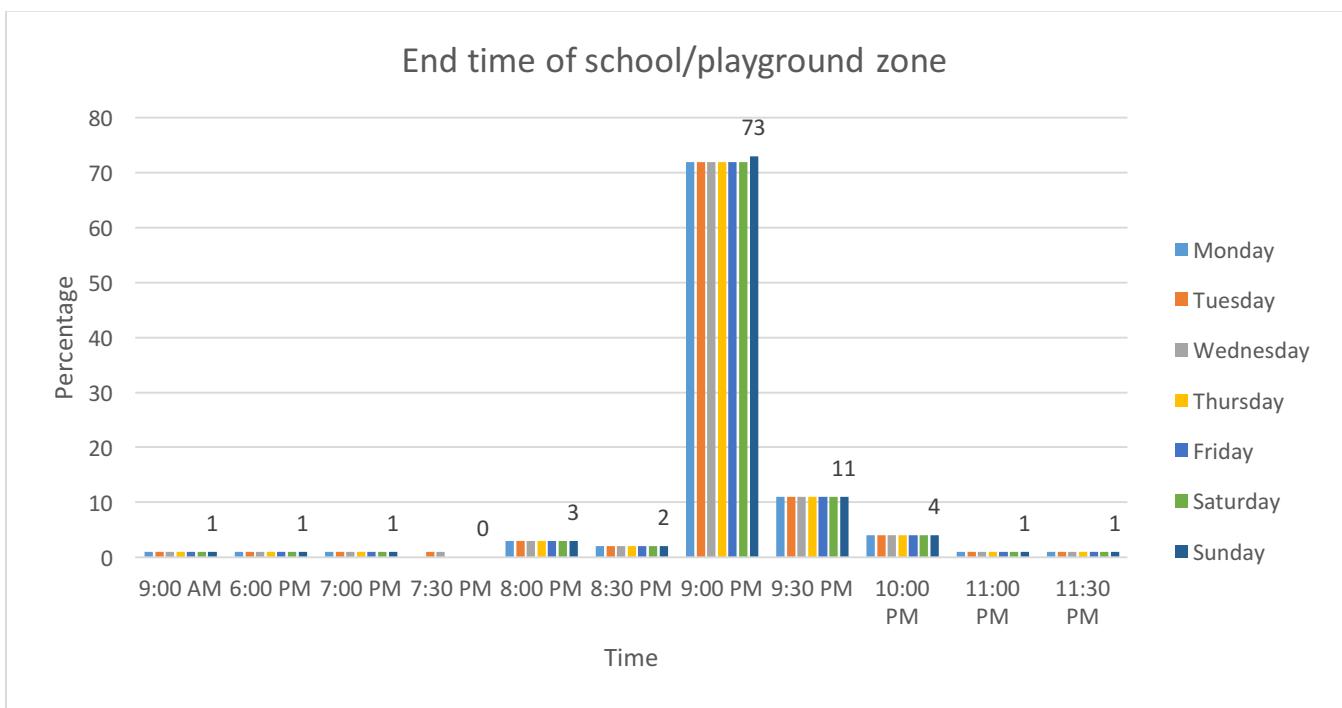


Figure 14. End time of school and playground zones

2.3.4 Conclusion

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.

3. References

1. R. Tay, Speed compliance on school and playground zones. ITE Journal 79(3), 36-38, 2009.
2. Kattan et.al., Managing speed at school and playground zones, Accident analysis and prevention 43, 2011.
3. A report on the playground and school zone awareness project, City of Calgary, 2014.
4. Nicholas J. Garber and Lester A. Hoel, A text book on Traffic and highway Engineering, fourth edition, 2009.
5. Roger P. Roess et.all, A text took on traffic engineering, third edition, 2004.

4. Appendix

1. Cumulative percentage frequency curves for different scenarios.

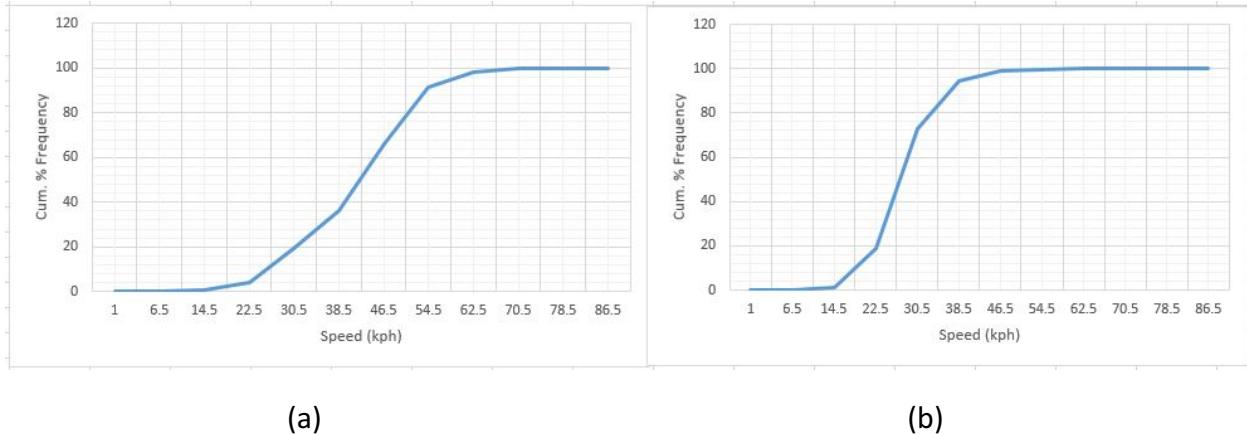


Fig: Cumulative percentage frequency curve for a) before and b) after the changes in regulation in school zones from 6 p.m.-9 p.m.

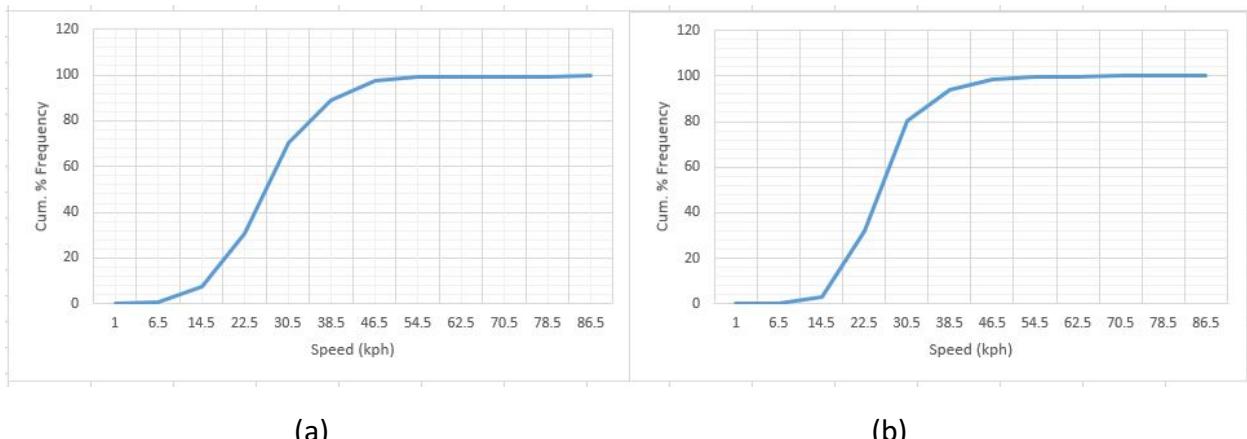
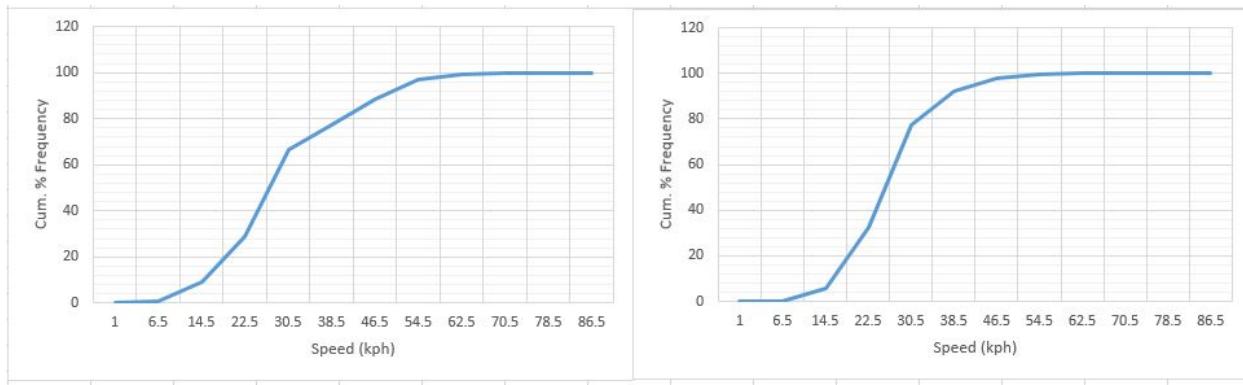


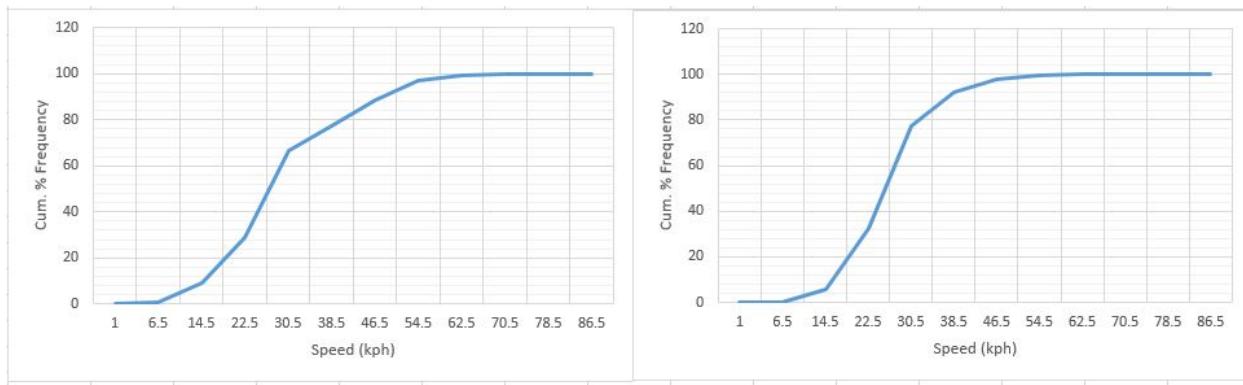
Fig: Cumulative percentage frequency curve for a) before and b) after the changes in regulation in playground zones from 6 p.m.-9 p.m.



(a)

(b)

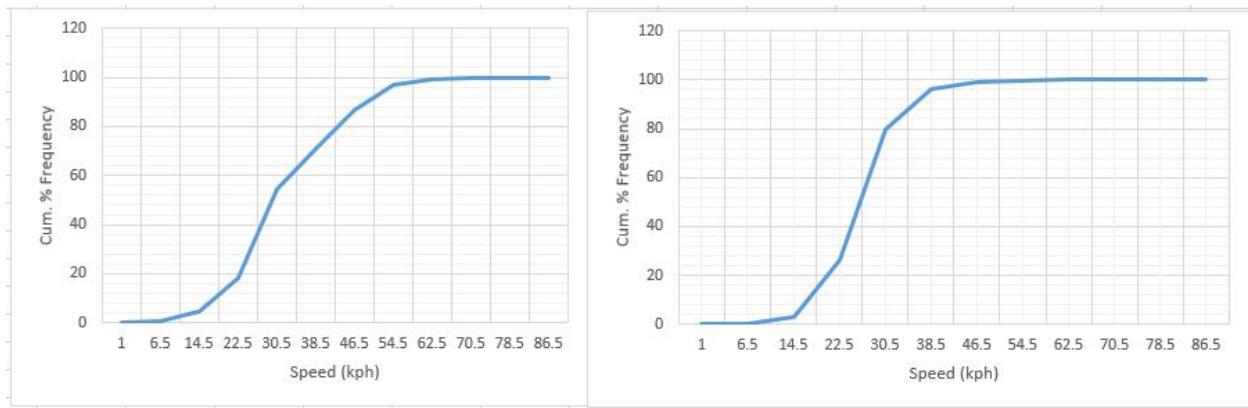
Fig: Cumulative percentage frequency curve for a) before and b) after the changes in regulation in playground zones from 7 a.m.-9 a.m.



(a)

(b)

Fig: Cumulative percentage frequency curve for a) before and b) after the changes in regulation in school zones from 7 a.m.-9 a.m.



(a)

(b)

Fig: Cumulative percentage frequency curve for a) before and b) after the changes in regulation in both school and playground zones from 8 a.m.-9 p.m.

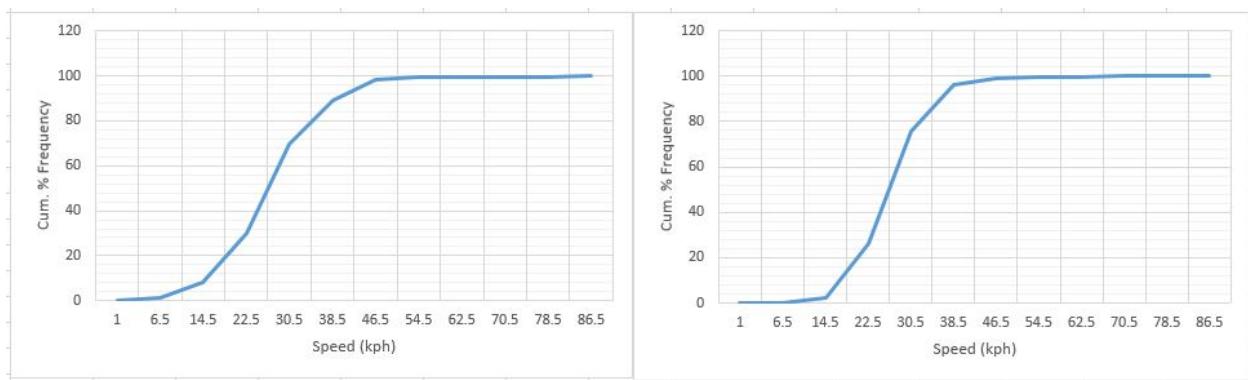


Fig: Cumulative percentage frequency curve for a) before and b) after the changes in regulation in playground zones from 2 p.m.-5 p.m.

2. Mean speed, 85th percentile speed and speed compliance in school and playground zones

Time	Type of Zone	Number of observations	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(%)	Type of zone	Number of observations	Mean Speed(km/h)	85 th Percentile Speed(km/h)	Simple Compliance(%)	High-end Compliance(%)	Simple Compliance(%)	High-end Compliance(%)	Mean Speed(km/h)	85 th Percentile Speed(km/h)
8 a.m.-9 p.m.	School Zone	29342	363	49.6	53	71	Playground zone now that was school zone before	29481	30.1	37.1	79	97	26	26	6.2	12.5
	Playground Zone	2901	314	38.6	68	88	Playground zone	6304	30	37.1	80	96	12	8	14	15
6 p.m.-9 p.m.	School Zone	6555	45.2	56.3	78	96	Playground zone now that was school zone before	6556	31.6	38.9	73	96	5	0	0	0
	Playground Zone	782	31	40.5	70	92	Playground zone	1499	29.9	37.4	80	95	10	3	1.1	3.1
7 a.m.-9 a.m.	School Zone	5969	33	47.6	66	79	Playground zone now that was school zone before	5507	30	38.6	77	92	11	13	3	9
	Playground Zone	446	34.9	46.4	49	80	Playground zone	1218	31.8	40.1	71	90	22	10	3.1	6.3
	Both	6415	33.1	47.5	65	78	Both	6725	30.3	38.9	76	94	11	16	2.8	8.6
2 p.m.-5 p.m.	School Zone	8085	32.7	44	67	86	Playground zone now that was school zone before	7953	29.4	35.9	83	97	16	11	3.3	8.1
	Playground Zone	708	30.9	40.5	69	92	Playground zone	1587	30.6	38.1	75	96	6	4	0.3	2.4
	Both	8793	32.5	43.7	67	87	Both	9540	29.6	36.4	81	97	14	10	2.9	7.3