School Speed Zones: Before and After Study
City of Saskatoon

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Paper prepared for presentation

at the Traffic Operations Research and Applications Session

of the 2003 Annual Conference of the
Transportation Association of Canada
St. John's, Newfoundland and Labrador

ABSTRACT

This paper examines the effectiveness of school speed zones.

In 2002, the City of Saskatoon reduced the speed limit in school zones to 30 km/h from the previous 50 km/h. The change was implemented at all elementary and high schools and was effective from 8:00 a.m. to 5 p.m., Monday to Friday from September to June.

This presented an opportunity for the Infrastructure Services Department of the City of Saskatoon to conduct a comprehensive "before and after" study to monitor and determine the resulting change in driver's behaviour and general compliance with the 30 km/h speed limit. A number of school locations throughout the city were selected for this study. Traffic volume and speed data were collected at these locations before and after the installation of school speed zones.

Following is a brief summary of the study findings:

- Street use and prevailing traffic conditions influence motorist's behaviour and speed compliance.
- During the posted school hours:

  - on average, 85th percentile speed was reduced by 10 km/h, from 54.5 km/h to 44.5 km/h;
  - **on average, only 23% of motorists comply with the speed limit and drive at or below 30 km/h; and,**
  - majority of motorists drive in the 30 to 40 km/h range.
- No significant change in speed was observed outside the restricted hours and on weekends.
- Average weekday traffic volume dropped by approximately 13%, suggesting that some drivers may be avoiding school zones and using alternate routes.

In conclusion, despite the less than satisfactory compliance with the 30 km/h speed limit, the achieved reduction in speed of 10 km/h still represents an improvement to child pedestrian safety during the school hours in terms of increased reaction time and driver's general awareness of school zones. Nevertheless, the 85th percentile speed of 45 km/h is still considered to be excessive. The observed low compliance shows that posting a reduced speed limit alone does not guarantee the desired change in driving speeds. It is only one method that can be used as a part of pedestrian safety program around schools.

TEXT

Introduction

The City of Saskatoon employs a variety of school safety measures to enhance safety of school age pedestrians. The safety measures include marked pedestrian crossings, pedestrian corridors, pedestrian actuated signals, traffic calming devices, warning signage, parking restrictions, and a public education program. The City had implemented school speed zones in the 1960's; however, the zones were later removed, as they were considered ineffective.

In 2001, a Saskatoon elementary student was hit and killed on his way to school by a vehicle travelling at the legal speed limit. As a result of the debate surrounding this issue, Saskatoon City Council resolved to implement reduced speed zones for schools throughout the city. The adopted policy and implementation strategy defines that:

- Reduced speed zones be employed at each elementary and secondary school – no distinction made between public and private school;
- All reduced speed zones use a speed limit of 30 km/hr;
- Reduced speed zones be in effect from 8:00 a.m. to 5:00 p.m., Monday to Friday from September 1 to June 30 – no exceptions made for statutory holidays; and,
- Playgrounds abutting schoolyards be considered for inclusion in the school zones; however, stand-alone playgrounds in parks will be given future consideration.

The Infrastructure Services Department was directed to proceed with the implementation of reduced speed zones prior to the start of 2002/2003 school year. The earlier study and research showed that many municipalities do not re-asses their school speed zones once implemented and are therefore unaware if their use is an effective pedestrian safety measure, or if the resources allocated to the program could be better utilized for other pedestrian safety initiatives.[1] Understanding the importance of a comprehensive monitoring program in determining the effectiveness of school speed zones, Infrastructure Services decided to carry out a formal before and after study on the effect of the zones in reducing speed.

15 school locations throughout the city were selected for this study, ensuring a good mix of elementary/high and public/private schools as well as arterial, collector and local streets. First set of traffic volume and speed data was collected at these locations in May and early June of 2002, before the end of the school year. Following the consultations with each school regarding the best location for the speed zones in their specific environment, signs were then installed during the summer months. A total of 102 schools throughout the city received a school speed zone. Immediately prior to the start of the following 2002/2003 school year, a public education program was initiated. Shortly after the introduction of the speed zones, in October of 2002, a new set of speed and volume data was collected at the same locations. Another set of data was collected at the same locations again in April of 2003, providing sufficient time for new traffic patterns and driving habits to become established. The data was collected in both directions, over the 24 hour period, for seven days.

The collected speed and volume data for each location were then compiled in spreadsheets. Instead of presenting the results in tables, which could be difficult to absorb at a glance, the changes in traffic characteristics as a result of the reduced speed limit were illustrated graphically. Frequency distribution tables showing the number of vehicles recorded for each speed bin were generated and used to create speed distribution curves and determine vehicle speed percentiles. The following graph illustrates a typical speed distribution on a given roadway.

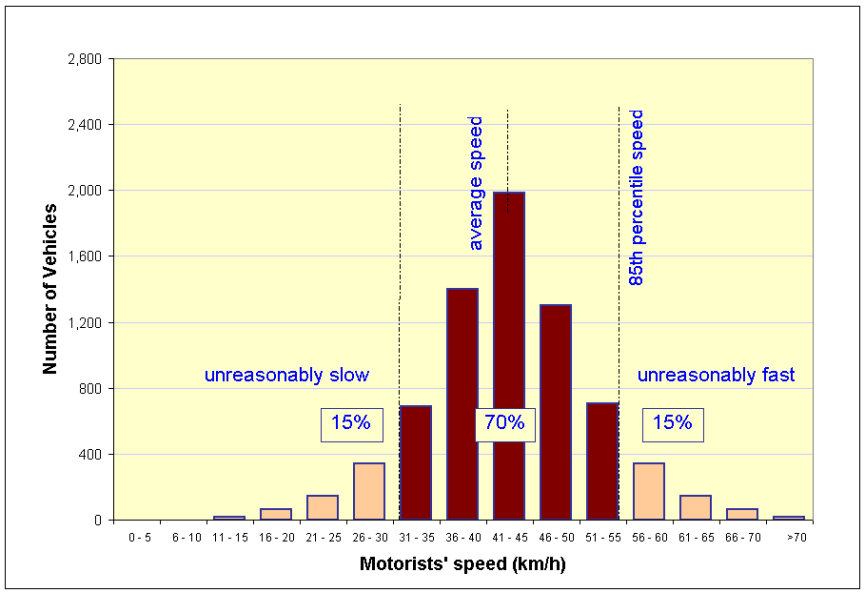


Figure 1: Frequency histogram showing typical distribution of driver speed

The number of observations in the same speed category is plotted versus the mean speed for each speed group. The speed groupings are 5 km/h. One statistic shown on the graph commonly used to study travel speeds is the 85th percentile speed. The 85th percentile speed is the speed at or below which 85% of the observed vehicles are travelling. This is considered to be a reasonable and safe speed that reflects the behaviour of the majority of drivers under favourable conditions. It is often used in evaluating and recommending the posted speed limit. The 70% of drivers who maintain a speed within the reasonable range of the average speed, plus the 15% of slow drivers, equal the 85th percentile speed. Fifteen percent travel above the 85th percentile and may be traveling too fast for conditions. For ease of illustration, frequency distribution curves wherein the points are joined by a smooth curve, are used instead of histograms further in the report.

Speed Evaluation: Arterial vs. Local Streets

Figure 2 shows the distribution of speed among drivers during weekday school hours, recorded on a cross-town arterial fronting a high school. The arterial carried approximately 13,500 vehicles per day before the introduction of reduced speed in school zones.

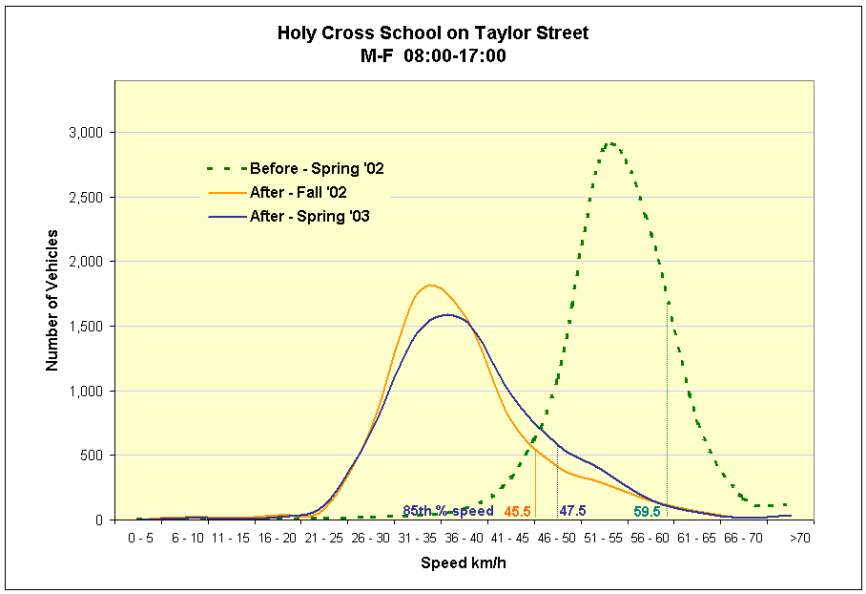


Figure 2: Speed distribution on an arterial street

Before the speed limit was changed, the 85th percentile speed was determined to be 59.5 km/h. On average, 79% of motorists were exceeding then the legal speed limit of 50km/h. It should be noted that the speed distribution curve was rather uniform, with a relatively small speed variation between vehicles on the road. The 50 to 60 km/h range was the pace speed, with 66% percent of drivers in this range. After the changes, the 85th percentile speed measured in the Fall 2002 and Spring 2003 dropped to 47.5 and 45.5 km/h respectively. This represents a reduction in speed of 13 km/h, or 22%, on average. However, these speeds are clearly in excess of the posted speed limit of 30 km/h., with as many as 86% of motorists in violation. It appears that the majority of drivers (approximately 55%) are driving in the speed range between 30 and 40 km/h, but even more concerning is that some drivers are disrespecting the school speed zone and still drive at or near 50 km/h. If speed variation is used as a criterion of safety, this larger variation in driver speed, as it could be observed from the graph, represents a larger risk of traffic accidents. Enforcement or some other action is necessary to improve the low compliance at this location.

Figure 3 illustrates the speed distribution on a local street in front of an elementary school. Since this is a non-through, low volume residential street, it was interesting to see if it would realize a benefit from the implementation of a speed zone.

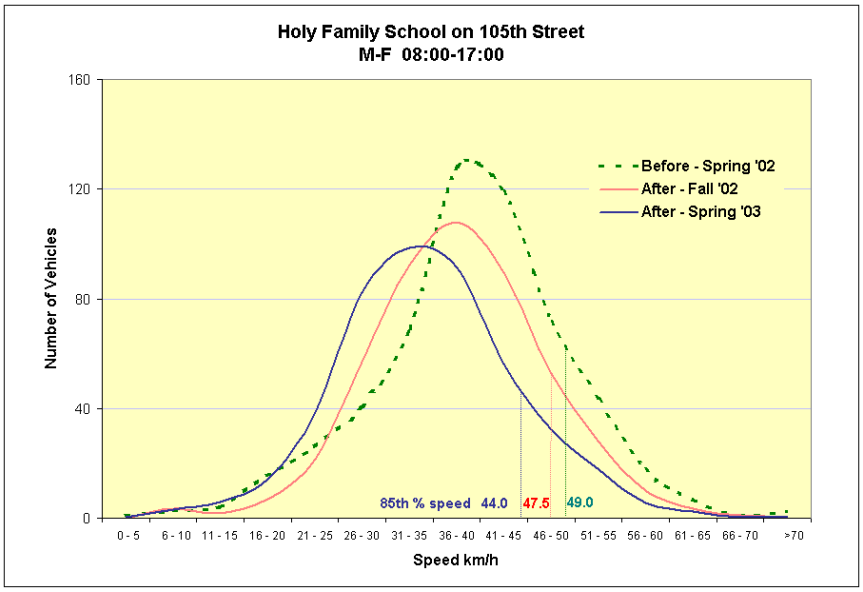


Figure 3: Speed distribution on a local street

Comparing the before and after data, the 85th percentile decreased by 1.2 km/h and 5.0 km/h respectively. As expected, the before speed was reasonable. The 85th percentile speed was 49.9 km/h and the majority of motorists were already exercising caution and due diligence in the school zone during school hours driving at a pace speed of 35 to 45 km/h. No significant change in speed was observed shortly after the introduction of speed zones. The latest speed study revealed that the 85th percentile speed has since further dropped to 44 km/h, while most drivers now drive in the range of 30 to 40 km/h. Though very marginal, the reduction of 5 km/h is still a positive change, but it is not evident that the school benefited significantly in terms of improved pedestrian safety as a result of reduced speed limit.

The findings of the study suggest that the speed zones have greater effect on arterial than on local streets. It could be rationalized that due to the fact that arterial roadways carry large volumes of traffic and serve longer trips usually at a higher rate of speed, the reduced speed zones have bigger impact on speeding drivers forcing them to slow down. Hence, the achieved speed reduction is more notable than on local streets where local drivers are usually aware of the school zones and are more watchful for pedestrians. The study also showed that the compliance with the 30 km/h speed limit is nevertheless relatively low on both types of roadways. This is especially true for arterials because of the nature of trips and better operating road conditions. Enforcement in school zones is necessary to motivate drivers to reduce their rates of travel and to achieve a satisfactory compliance. This, in turn, could magnify another problem; discourage drivers from traveling along arterial roadways through school zones. Some drivers may choose alternate routes not suitable for through traffic in order to avoid school zones. Changes in traffic volumes during and outside school hours are discussed later in the report.

Speed Evaluation: Effect of Existing Traffic Conditions

The following diagram illustrates drivers' speed within a school zone on a busy major arterial with a series of traffic signals both upstream and downstream of the zone. The arterial carries approximately 15,000 vehicles per day. As a result of the traffic signals and higher congestion level, traffic flow is restricted and unstable. Vehicles clearing the intersections during the green interval travel in platoons at similar speeds, which is reflected on the graph through a very uniform distribution of driver speed.

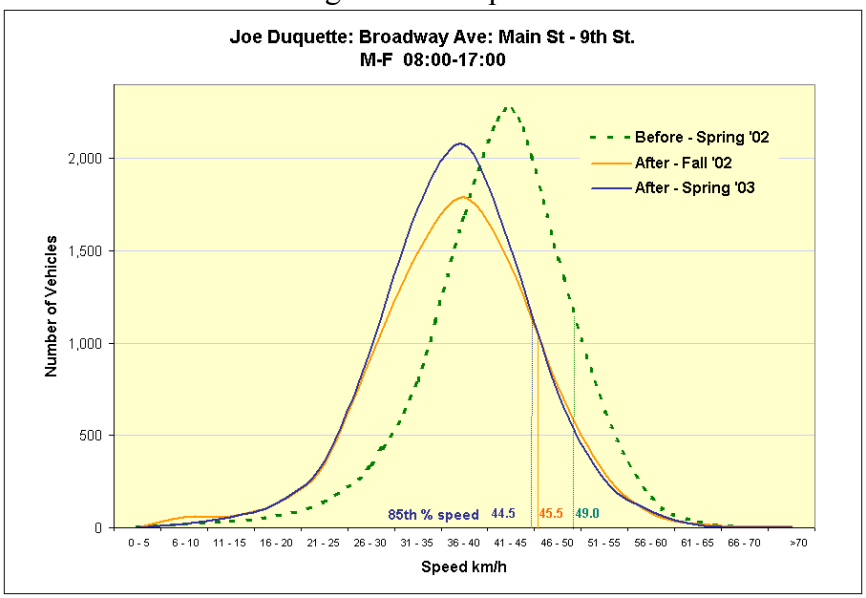
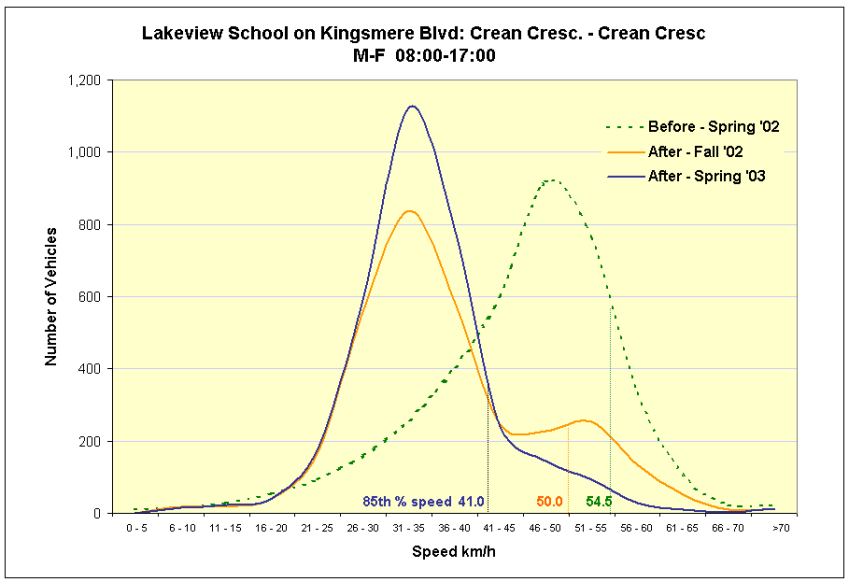


Figure 4: Speed distribution on a congested street

Figure 5, on the other hand, shows a speed distribution for a school on a collector street with close to a free flow condition. In other words, motorists are free to select their own rate of speed most of the time.



As the graph illustrates, the results show a somewhat non-uniform distribution of speed. Shortly after the zones were implemented, a considerable percentage of drivers did not even slow down in the school zone, whether they intentionally ignored the limit or were unaware of the change. The second "after" speed count revealed that compliance has since improved.

Figure 5: Speed distribution on a free flow street

Speed Evaluation: Average School

In order to evaluate the resulting change in driver behaviour on a citywide basis and draw some general conclusions regarding the effectiveness of school speed zones, the before-and-after speed data for individual locations were averaged. To eliminate the possibility of higher volume locations governing the percentile speeds and shapes of curves, vehicle percentages for each speed group were averaged instead of the actual values. Figure 6 below shows the resulting averaged distribution of driver speed during weekday school hours.

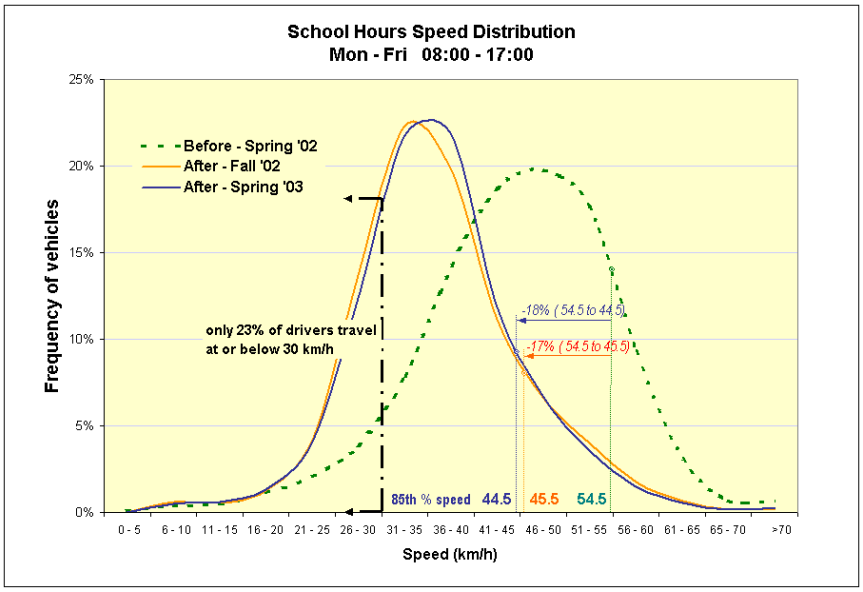


Figure 6: Averaged speed distribution during school hours

On average, the 85th percentile operating speed was reduced by about 10 km/h, from 54.5 km/h to 44.5 km/h. This is still considered to be rather excessive speed for the speed limit of 30 km/h. As indicated in Table 1, before the change 69% of drivers complied with the speed limit of 50 km/h. One month after the change, only 23% of motorists were in compliance with the new 30 km/h speed limit, and another six months later, compliance was still at the same low level. About 50% of motorists travel in the 30 to 40 km/h range, which appears to be the most comfortable pace speed for most drivers.

Table 1. Speed characteristics during school hours before-and-after the speed limit change

	Percentage of vehicles in each speed group					Median speed (km/h)	85th % speed (km/h)
	≤ 30 (km/h)	30 to 40 (km/h)	40 to 50 (km/h)	50 to 60 (km/h)	≥ 60 (km/h)		
Before - Spring '02	8.1%	22.1%	38.5%	27.0%	4.4%	46.0	54.5
After - Fall '02	23.3%	48.4%	20.4%	6.7%	1.2%	34.5	45.5
After - Spring '03	21.7%	50.1%	21.3%	5.8%	1.1%	35.0	44.5

Figure 7 below shows the speed distribution on an average weekday over the 24-hour period. It illustrates how the shape of the curve changed as a result of the speed limit change during school hours. The first peak in the curve corresponds to the prevailing speed during school hours, and the second peak represents the trend outside the school hours when drivers resume normal speed.

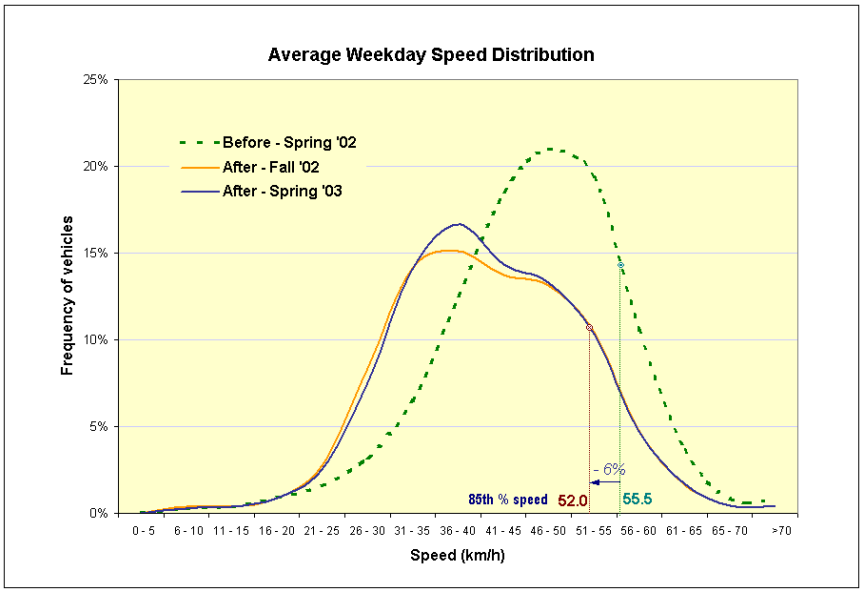
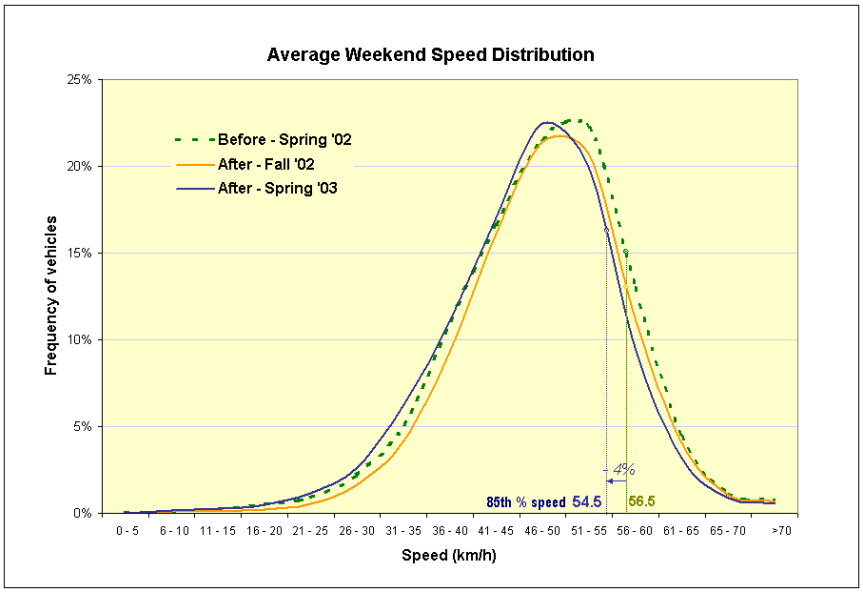


Figure 7: Average weekday speed distribution

Figure 8 below shows that there is no significant change in driving speed on weekends, when restriction is not in effect, revealing that the speed zones have no influence on driver behaviour outside the posted school hours. It is clear that reducing speed at schools during school hours does not provide increased protection for children outside these hours or on weekends.

Figure 8: Average weekend speed distribution



Traffic Volume Evaluation

One of the concerns was that a reduction of the speed limit to 30 km/h on major arterial roadways could not only adversely affect the efficient movement of traffic during the morning and afternoon peaks, but also result in avoidance of school zones and a shift of traffic to inappropriate neighbouring streets. Figure 9 illustrates traffic volumes on such arterial street with a series of school zones over a relatively short distance.

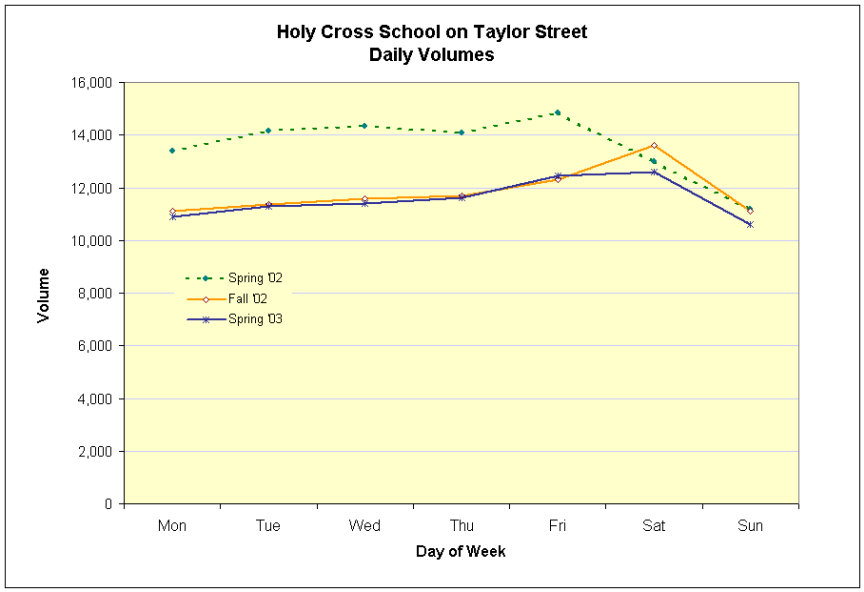


Figure 9: Traffic volume change on an arterial roadway

A considerable reduction in traffic volume during weekdays can be observed from the graph. The average daily traffic on this arterial has dropped by 2,500 vehicles since the introduction of speed zones. No other major roadway projects or construction restrictions were underway at he time in the area that could cause this decrease in traffic volume. It is therefore a reasonable conclusion that some drivers decided to avoid the school zones on this arterial street and selected alternate routes. It would be of interest to establish where this traffic diverted to; unfortunately, no vehicle count program was put in place on surrounding streets to monitor the resulting changes in travel patterns in the area.

Some of the streets monitored through this study experienced notable reduction in traffic volumes within the school speed zones, and others saw no significant change in the volume of roadway users. To determine the overall change in volume due to the reduction of speed limit at schools, percentage changes for all individual locations were averaged together to create average weekday and weekend traffic volume variations by hour of day.

Figure 10 shows that, on average, a 13% reduction in traffic volume was observed. Again, it could only be presumed that this occurred as a result of some motorists' preference to avoid school zones, but there is insufficient data to support this conclusion.

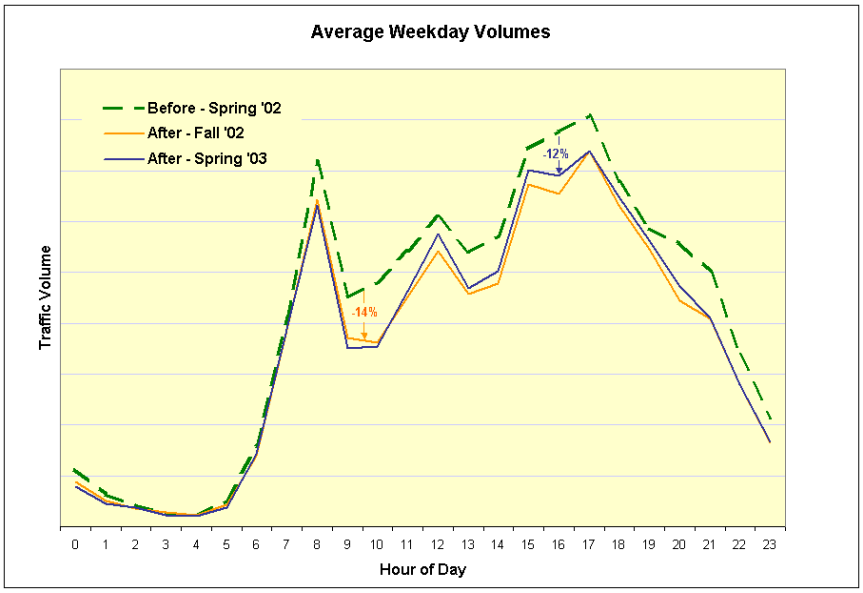


Figure 10: Average weekday volume change

No definite conclusion can be drawn as to what effect the reduced speed zones had on traffic volume on the subject streets during weekends. As shown in Figure 11, the slight reduction of 6.5% was recorded after the change.

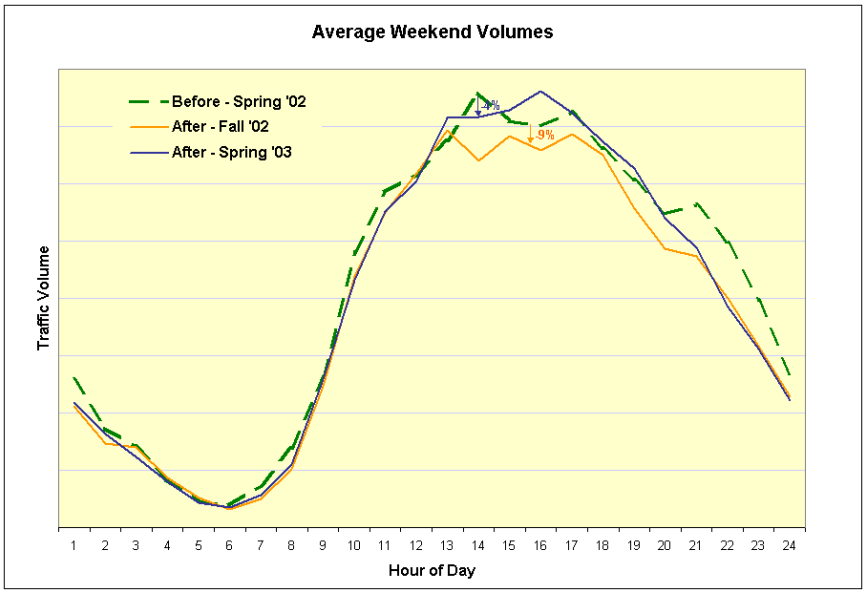


Figure 11: Average weekend volume change

Conclusion

The study concluded that the overall, general compliance with the 30 km/h speed limit in school zones in Saskatoon is relatively low. That is, only a low percentage of drivers (23%) actually drive at or below that speed limit during the school hours when the zone is in effect. On the other end, a very small percentage of drivers continued to travel at the previous rate of speed and exceed 50 km/h. The majority of motorists compromise and drive in the speed range of between 30 and 40 km/h, as this seems to be the pace at which most drivers feel comfortable. However, a considerable portion of less patient motoring public drive in the 40 km/h to 50 km/h range pushing the 85^{th} percentile speed to 45 km/h, which is considered to be excessive for the given speed limit.

Despite the less than satisfactory level of compliance with the 30 km/h limit, it could be argued that the overall speed reduction of 10 km/h still represents an improvement to child pedestrian safety in terms of improved reaction time. More importantly, the observed reduction in speed at all study locations suggests that drivers are now more aware that they are in a school zone. As a result, they are hopefully more attentive to school children crossing the street, even though not all are slowing down to the speed limit.

At the same time, an argument could be made that a greater variation in speed, combined with pedestrian propensity to take greater chances against assumingly slower moving vehicles, poses another safety concern. It is still early to compare the frequency and severity of accidents involving pedestrians in school zones before and after the speed zones, at this point in time.

Meanwhile, an effort must be made to improve drivers' compliance with the speed limit through stepped up enforcement, education, and other measures. An example of such supplementary measures could be the dynamic message speed signs that show the passing motorists how fast they are going. The City of Saskatoon does not have sufficient experience with school speed zones to draw a definitive conclusion as to their overall benefits/disbenefits or make a recommendation for or against their use, but the findings of this study confirm that posting a reduced speed limit alone does not guarantee the desired change in driving speeds. It is only one method to be used as a part of a pedestrian safety program around schools. To ensure the desired level of safety 24 hours a day, other traffic safety measures, such as traffic calming, must continue to be used in conjunction with speed zones.

For additional information, contact Goran Lazic at 306-975-2896, or email at Goran.Lazic@City.Saskatoon.sk.ca .

REFERENCES

1. Stantec Consulting Ltd., "*Proposed Policy for Reduced Speed Zones for Schools and Playgrounds*", 2002

TABLES

FIGURES