

Traffic Safety at Intersections: The Edmonton Experience

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Abstract

Over the past five years, the City of Edmonton has averaged approximately 21,000 total collisions annually, resulting in an average of approximately 6,800 injury collisions and \$74,000,000 in property damage annually. Approximately 60 percent of these collisions have occurred at intersections, accounting for 65 percent of the total injuries and 40 percent of the total fatalities reported. Through engineering, education, enforcement and evaluation, the City of Edmonton and Edmonton Police Service are working to reduce the number of collisions and injuries, which are resulting from driver behaviour and related human factors.

Edmonton has been an active partner of the Capital Region Intersection Safety Partnership (CRISP) since its development in 2000. The mandate of CRISP is to build awareness for traffic safety issues at intersections. The group has successfully implemented public awareness campaigns addressing red light running, pedestrian safety and speeding through intersections.

The Edmonton Red Light Camera Program was launched in 1999 and will ultimately operate with 20 cameras and 60 locations by the end of 2004. Existing locations have shown an average of less than 3 violations per day, which is down from the 9.6 violations per day that were observed in the early stages of our pilot project. This program is currently being reviewed with the intent of expanding enforcement strategies to include automated intersection speed enforcement.

Since the early 1990's Edmonton has maintained a High Collision Location Program to address traffic safety at intersections. Each year, high collision intersections with a history of injuries, fatalities and property damage are assessed for engineering alternatives, enforcement strategies and signed to build awareness for the predominant collision types. Edmonton is currently enhancing this program through the development of Safety Performance Functions and an accompanying Network Screening Tool. The Network Screening Tool will allow the City to quantify the worst intersections based on several factors including collision number, collision rate, property damage and injuries

The Edmonton Police Service has developed a program that targets high-risk drivers. This program correlates several behaviours and characteristics such as driving history, criminal record, age and other factors to develop a profile of a high-risk driver. Drivers who fall into this category are identified and enforcement is focused on them.

This paper discusses the programs and initiatives the City of Edmonton and Edmonton Police Service are undertaking to reduce the frequency and severity of the traffic collisions that are influenced by driver behaviour and related human factors.

Introduction

The City of Edmonton has a population of approximately 700,000 residents and has a land area that encompasses more than 70,000 hectares. It is the Capital City for the province of Alberta and, with the neighbouring communities, encompasses the sixth largest metropolitan region in Canada with a metro population of 953,000 residents (City of Edmonton Forecast Committee¹). A total of 3,100 kilometres of road exists within the city to accommodate the 380,475 vehicles registered in Edmonton.

Over the past five years, the City of Edmonton has averaged approximately 21,350 total collisions annually, resulting in an average of approximately 6,850 injury collisions, 22 fatalities and \$78,000,000 in property damage per year. Approximately 55 % of these collisions have occurred at intersections, accounting for 66 % of the total injuries and 42 % of the total fatalities reported. As the speeds involved in these crashes increase, the risk of serious injury or death rise exponentially. Through engineering, education, enforcement and evaluation, the City of Edmonton is working to reduce the number of collisions and the related property damage, injuries and fatalities occurring at our intersections.

High Collision Location Program

The City of Edmonton High Collision Location Program was developed in 1991 to improve traffic safety through the components of engineering, education and enforcement. The program targets specific intersections that have experienced a high collision activity, a high number of injuries and a high amount of property damage. Each year, traffic safety investigations are completed for 20 high collision intersections in an effort to minimize the collision risk at these locations and consequently reduce the frequency and severity of the traffic collisions.

Each year, the locations included in the program are chosen based on the collision rates at the end of the year and the resulting number of injuries and property damage. These factors are currently analyzed to allow the intersections to be more consistently compared to other locations throughout the city. The injury and property damage factors are weighted based on the Canadian Guide to 3R/4R estimates that indicate an average property damage related collision costs approximately of \$6,000 and an average injury cost as a result of a collision of approximately \$30,000 (Transportation Association of Canada²). The collision rate and the collision severity weighting factors identified are both used to establish the top 20 high collision locations each year.

Traffic safety audits of the intersections are completed in accordance with the Transportation Association of Canada (TAC) Canadian Road Safety Audit Guide. An audit team of at least four members comprising representatives from the Traffic Operations Branch, Transportation Planning Branch and the Edmonton Police Service is formed to conduct the investigations. Initially, a site inspection, critical incidence survey and a review of the collision history is completed at each intersection. Short term and long term alternatives related to signal timings, pavement markings, signage, geometry and enforcement are then assessed. The

results and recommendations of the traffic safety audits are documented in a report with the objective of trying to reduce the collision risk and activity. The report is distributed to areas within the City's Transportation and Streets Department and the Edmonton Police Service to implement changes.

Each year, the 20 intersection locations included in the program have High Collision Location signs installed (Figure 1). The signs are temporarily installed approximately 80 metres upstream of the approaches to each intersection for a period of one-year. In the past, these signs have been supplemented with a tab describing the predominant collision activity.



Figure 1 - High Collision Location Sign

The true impact of the program on driver behaviour is difficult to measure or quantify. However, the program is an important part of the City of Edmonton's efforts to reduce traffic collisions by building public awareness and improving the traffic safety at our intersections.

This program was expanded in 2002 to include external traffic safety audits. An outside consultant was commissioned to complete traffic safety audits for three intersections and two arterial corridors. Following the processes of the TAC Canadian Road Safety Audit Guide, over 35 operational issues were identified, improvement strategies were documented and benefit/cost analyses were completed. The results of the audits were reviewed and changes were implemented where possible based on budget prioritization. External audits were continued in 2003 and 2004 including an audit of a 12-block corridor which had a history of pedestrian safety concerns. This study was completed in 2004 and the results are currently being reviewed to incorporate the strategies. In 2005, further external audits will be planned.

In 2004, the High Collision Location Program is being expanded through the development of a severity index and accompanying performance functions. The project, titled "Safety Performance Functions and Network Screening", involves an analysis of the collision history, traffic volumes and geometric conditions for the 600 signalized intersections within the City of Edmonton using 5 years of data. This evaluation will result in a ranking of all of the signalized intersections and will prioritize the locations based on collision number and rate, property damage and injuries. In conjunction with the severity rankings, performance factors for each intersection will identify collision solutions along with the projected improvements in terms of collision, injury and property damage reductions.

Red Light Camera Program

Collisions caused by motorists running red lights are a serious issue within the City of Edmonton. Each year, Edmonton experiences approximately 1,400 collisions as a result of red light violations, with close to half ending in injury. The property damage attributed to motorists failing to observe traffic signals amounts to close to eight million dollars per year. The City of Edmonton Transportation and Streets Department and the Edmonton Police Service have worked closely to address this serious traffic safety issue through the implementation of automated photo enforcement in combination with public education.

In September 1998, a 14-month pilot project was initiated at a single intersection to determine the effectiveness of the red light camera technology. The red light camera was installed at the intersection of 170 Street southbound and 100 Avenue to capture red light violations across four lanes in the eastbound direction. The eastbound approach acts as a main artery into Edmonton, accommodating approximately 21,900 vehicles per day. The speed limit through the intersection is posted at 60 km/h. In 1997, the intersection ranked 30th in the city with 49 reported collisions and a collision rate of 1.99 collisions per million vehicles. The intersection collision activity, which ranked 2nd in the city, included 15 collisions caused by motorists failing to observe the traffic signal. Of these collisions, 10 were caused by motorists travelling in the eastbound direction.

During the first phase of the pilot project, the public was not made aware of the red light camera in order to gather background information on the number of red light violations occurring. Over this initial three-week period, an average of 9.6 red light violations per day was reported. To begin the second phase of the pilot project, the red light camera was announced to the public through a press conference and signs were installed along the eastbound approach of the intersection to inform approaching drivers of the automated enforcement. It was also announced that warning notices would be mailed to the registered owners of the vehicles photographed by the red light camera. As the second phase of the pilot project continued over the next five months, the number of red light violations decreased to an average of 7.8 per day. In January 1999, Bill 215 was passed in the Alberta Legislature that would allow tickets to be issued for red light violations photographed by red light cameras. After Bill 215 was passed, red light camera tickets were issued and the number of violations decreased to 5.4 per day over the eight-months of the pilot project's third phase.

At the end of the pilot project, the number of red light violations gradually declined by approximately 45 percent over 14 months. Due to the success of the pilot project and the results of an intersection safety survey that showed Edmontonians strongly support the use of the technology, a Red Light Camera Program was developed.

The Edmonton Red Light Camera Program began in 1999 and included 6 red light cameras rotating amongst 12 intersections. As of the end of 2003, the program operated with 15 cameras at 48 locations. By the end of 2004, the program will ultimately consist of 20 cameras that will rotate amongst 60 intersections throughout the city.

The red light camera system used by the City of Edmonton uses wet film and consists of fixed and portable components. Vehicle detection inductive loops are placed upstream of the stopline to detect the passing vehicles and determine the speeds. Approximately 30 metres upstream of the intersection, a 3.5 metre high pole is permanently installed to house the camera. At some intersections, an additional pole is permanently installed to provide an auxiliary flash for the camera. The portable portion of the system is a mobile enforcement unit composed of a traffic camera, flash system, digital loop detector and a microprocessor. This portable unit may be easily rotated amongst a number of fixed locations.

Once a red light violation has been detected, the camera takes two photographs to show the motorist's illegal progression through the intersection. The first picture shows the vehicle entering the intersection during the red phase while the second picture shows the vehicle in the intersection approximately one second later. The system superimposes a data box on each photograph documenting the time, date and location of the violation as well as the amber and red times when the violation occurred.



Figure 2 - Red Light Camera

The selection criteria developed to identify the red light camera locations consider many factors. The total number of collisions and the collisions caused by red light violations, motorists turning left and motorists following too closely, are reviewed for each potential location over the previous five-year period. An effort is made to distribute the red light camera intersections evenly throughout the city on major travel routes to maximize their exposure. Experiences from the City of Edmonton Transportation and Streets Department, Edmonton Police Service and local residents are considered as part of the selection process. Planned construction activities and possible red light camera installation difficulties are identified for each potential intersection.

For the success of the Red Light Camera Program, it is crucial that the enforcement component be complemented by a strong awareness campaign to educate the public about the serious issue of red light running. Since 1999, a “Red Means Stop!” campaign has been promoted to educate drivers about the purpose, locations and function of the red light cameras. The intersections enforced by a red light camera are public information and are included on the web sites of the Edmonton Police Service and the City of Edmonton. The red light camera locations are identified with photo enforcement signs along each of their approaches. In 2001, students from the local schools painted camera poles at four city locations to increase the awareness of the cameras (Figure 2).

Since the beginning of the program, the red light camera locations have shown a drop down to an average of less than 3 violations per day. This average is down from the 9.6 violations per day that were observed during the early stages of the red light camera pilot project. In addition to evaluation of the violation numbers, the collision activity at the red light camera locations is monitored on an ongoing basis. The impact of the red light camera technology on reducing collisions will be assessed over a long-term period to determine its effectiveness.

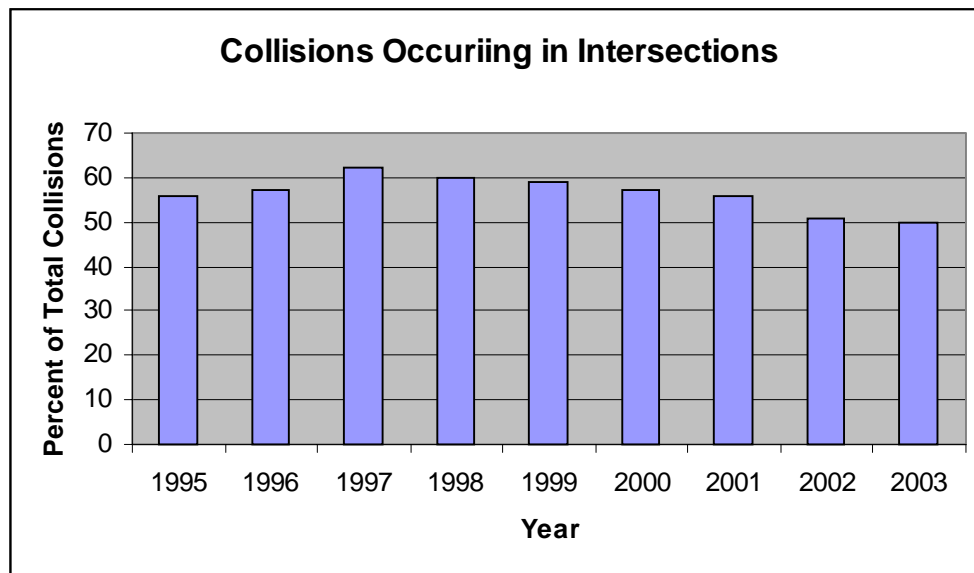


Figure 3 - “Percent of Collisions in Intersections”

A preliminary evaluation of the program has shown that the Red Light Cameras appear to be having an impact on intersection collisions in general. Collision data for the entire City shows that intersection collisions have been steadily declining since the program began in 1999 (Figures 3 and 4). In 2004, a detailed evaluation will be completed to include an analysis of the before and after five-year collision history period for the specific red light camera intersections.

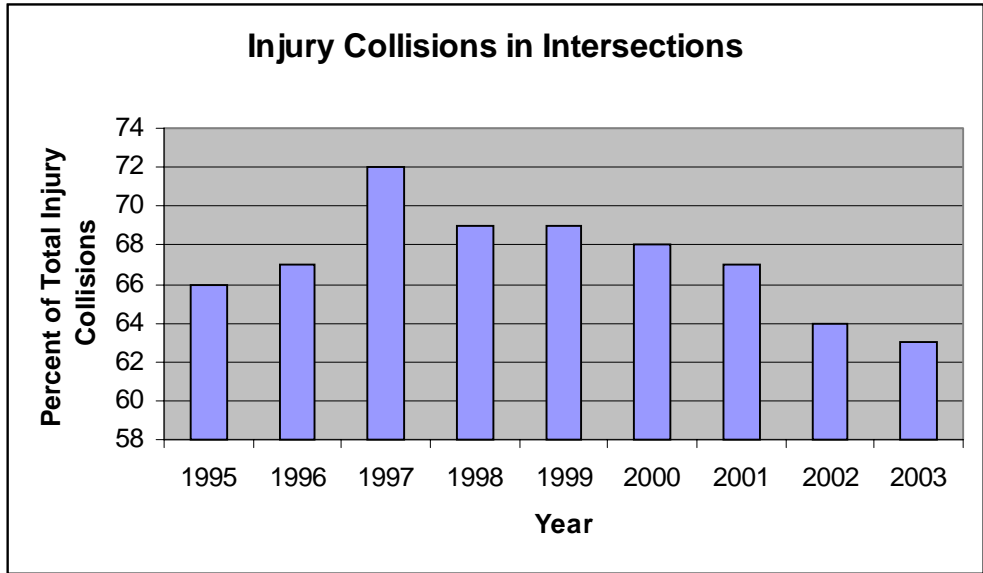


Figure 4 - “Percent of Injury Collisions in Intersections”

Automated Intersection Speed Enforcement

Studies completed over the past three years have consistently shown vehicles travelling at excessive speeds through several of Edmonton’s high collision intersections. For example, over a 19-day period in September of 2001, an average of 400 vehicles per day were observed to be travelling at more than 86 km/h through the intersection of 23 Avenue and Gateway Boulevard, which is posted at a speed limit of 70 km/h. Of these violations, 33 vehicles were travelling in excess of 121 km/h. This intersection was ranked first in the city for total collisions and injuries in 2002. These high speeds require greater braking distances for motorists to react and stop, which may increase the chance of collisions.

Conventional enforcement is difficult to be safely undertaken at high collision intersections. The act of intercepting speeding vehicles at these intersections places the officers and the public at risk due to the number of travel lanes and high traffic volumes through these locations. In addition, the operation of photo enforcement at intersections is difficult due to geometric constraints at many high collision intersection locations.

The red light cameras used in the City of Edmonton do have the capability to measure the speeds of vehicles travelling through the intersections resulting in the ability to ticket violators. Unfortunately, no legislation currently exists in Alberta to allow this technology to operate. A recent survey in the City of Edmonton showed that 75 percent of Edmonton residents support the use of red light cameras to enforce speed limits at intersections (Banister Research & Consulting Inc³). The Edmonton Police Service recently submitted a proposal to Alberta Justice to support a legislative amendment for the use of automated intersection speed enforcement. This legislative process was supplemented in the fall of 2003 with a public awareness campaign about speeding through intersections.

The Capital Region Intersection Safety Partnership

The most challenging issue affecting traffic safety in the City of Edmonton is driver and pedestrian behaviour. To address this issue, the City of Edmonton Transportation and Streets Department became a member of the Capital Region Intersection Safety Partnership (CRISP) when it was first developed in 2000. The partnership is comprised of the Edmonton Police Service, Capital Health, RCMP detachments in St. Albert and Sherwood Park, City of St. Albert, Strathcona County and the Alberta Motor Association, all of whom share common concerns for traffic safety. The mandate of the group is to develop integrated traffic safety initiatives and programs to build awareness for traffic safety issues at intersections and consequently improve user behaviours.

In the spring of 2001, the group launched a “Red Means Stop!” (Figure 5) regional campaign to increase public awareness for the serious consequences of red light running. The campaign coincided with the addition of new red light camera locations within the Capital region. Over a two-month period, the public was reminded of the serious consequences associated with red light violations through the use of radio, newspaper, billboards, bridge banners and bus tails.



Figure 5 - “Red Means Stop!” Sign

In 2002, a similar campaign, titled “Look Out For Each Other” (Figure 6), was introduced to address the issue of pedestrian safety. The campaign reinforced the message that both motorists and pedestrians must work together to ensure the safety of pedestrians. Motorists must slow down and be courteous to crossing pedestrians. In turn, pedestrians must take due care and attention and use the Point, Pause and Proceed method when crossing the road. The media of radio, newspaper, billboards, bridge banners and bus tails were used for this two-month spring campaign. A brochure was also developed to provide basic safety tips for both pedestrians and motorists.

This regional partnership continued in 2003 to work towards building public awareness for red light running and pedestrian safety at intersections. In April 2003, an abbreviated version of the pedestrian safety campaign was conducted for a one-month period. This pedestrian safety initiative was followed by campaign in the fall of 2003, which addressed speeding at intersections. Currently an annual plan is being developed which will identify priorities for 2004 and 2005 along with an awareness plan which will detail traffic safety initiatives. This plan will include a budget along with campaign scheduling, program themes and potential co-ordination opportunities with other traffic safety initiatives in the region.



Figure 6 - Pedestrian Safety Campaign Sign

Pedestrian Countdown Pilot Project

In July of 2001, the City of Edmonton Traffic Operations Branch installed pedestrian countdown devices as part of a pilot project at two intersections (100 Avenue and 102 Street, 82 Avenue and 109 Street). The devices operate as a supplement to the traditional walk man, flashing hand and solid hand pedestrian fixtures. The countdown devices display the number of seconds remaining during the pedestrian flashing hand (clearance) phase (Figure 7). The devices are intended to improve pedestrians' comfort level and safety while crossing the intersection.

The City receives frequent complaints from pedestrians regarding short walk times at numerous crosswalks. Many of these calls are related to a misunderstanding of the pedestrian fixtures that operate with the walk man, flashing hand and solid hand. A common misconception is that the length of the walk phase should be timed in order to provide adequate time for a pedestrian to cross the entire width of a crosswalk. With the countdown devices in operation, pedestrians gain a better understanding of pedestrian timings. As the devices provide additional information and “peace of mind” to slow-moving pedestrians, they are particularly beneficial at intersections where the presence of seniors is relatively high.



Figure 7 - Pedestrian Countdown Device

Pedestrian countdown devices have become quite common in the United States within the past few years. The devices have been recently installed in Western Canada in the B.C. Lower Mainland, Lethbridge and Banff. In order to assess the operation of the countdown devices, the City of Edmonton conducted telephone surveys with the following jurisdictions:

- Banff, Alberta
- Lethbridge, Alberta
- British Columbia Lower Mainland (Richmond, Burnaby & Delta)
- Sommerville, Massachusetts
- Hampton, Virginia
- Boulder, Colorado
- Grand Junction, Colorado
- Lakewood, Colorado
- Farmington, New Mexico
- Syracuse Region, New York
- Chandler, Arizona

After completing the telephone surveys to identify the use of the devices in other jurisdictions, the two pilot locations were chosen in the City of Edmonton using the following criteria:

- Strong presence of seniors in the area
- Relatively wide crossings
- High pedestrian volumes throughout the day
- High vehicle volumes throughout the day
- History of complaints from pedestrians regarding inadequate walk times

The City completed before and after studies at both pilot locations in order to assess the operation of the devices. The studies included data collection regarding vehicle and pedestrian behaviour. Signs were also posted at both locations to inform pedestrians that the devices were part of a pilot project. A phone number was included on the signs, so citizens could phone the Traffic Operations Branch with questions or comments. A summary of the pedestrian behaviour before and after study results is provided in Table 1.

Entered Crosswalk On:	Before-Jun 01	After-Mar 02
Walk Phase	92.1%	89.1%
Flashing Hand Phase	7.4 %	10.6 %
Solid Hand Phase	0.5 %	0.3 %
Walk Phase and Cleared on Solid Hand	0.6 %	0.3 %
Flashing Hand and Cleared on Solid Hand	34.9 %	22.2 %

Table 1 Pedestrian Crossing Activity

The pedestrian data collected during the before and after studies demonstrates that the countdown devices do not appear to have an adverse effect on pedestrian behaviour. Slightly more pedestrians entered the crosswalk during the flashing hand (clearance) phase, but more pedestrians appeared to use the countdown information and walked more quickly in order to clear the crosswalk prior to the solid hand, as the field results show.

The data collection for motorists was more subjective. Field staff were asked to report observations on the number of vehicles that appeared to accelerate through the intersections at the end of the green lights to clear the intersections on amber. This data was collected before and after the devices were installed. These results indicate that the countdown devices do not appear to encourage motorists to increase their speed to clear the intersection on amber or red. The occurrence of motorists running amber or red lights was found to be almost identical before and after the installation of the countdown devices. Many motorists who phoned commented that they liked the countdown since it enabled them to prepare to slow down and stop for the amber light as opposed to “trying to beat the light”.

Since the installation of the pedestrian countdown devices in July of 2001, response from both pedestrians and motorists has been very positive. Of the over 300 phone calls received from the public, 90 percent of the callers are in favour of the new devices.

Two additional locations were installed in 2003 and additional five installations are planned for 2004. The City of Edmonton is continuing to review the application of these devices and is currently participating in the TAC TOMSC Project – “Optional Use of Pedestrian Countdown Timers”. In correspondence with this project, the City of Edmonton will continue with its own review of the devices with an emphasis on driver behaviour. The focus of studies at these locations will be on the effects that countdown timers have on collisions, intersection approach speeds and adherence to the signals.

Summary

The City of Edmonton uses a multi - faceted approach to address traffic safety at intersections. Through a strong partnership between the Transportation and Streets Department and the Edmonton Police Service, programs have been developed in the three areas of engineering, enforcement and education. Along with this partnership, additional programs and resources are leveraged through regional initiatives with other traffic safety stakeholders including the insurance and health agencies along with adjacent municipalities. This approach has allowed Edmonton to take a proactive stance in addressing driver and pedestrian safety by targeting various aspects of traffic safety. Edmonton’s experience has confirmed that driver behaviour cannot be changed easily and that often a combination of measures must be taken to change a driver’s environment in order to improve safety.

References

1. City of Edmonton Forecast Committee; Edmonton Socio-Economic Outlook; 2003
2. Banister Research & Consulting Inc.; 2002 Pedestrian Safety Survey Final Report Capital Region Intersection Safety Partnership; pp. 47; 2002
3. Transportation Association of Canada; Canadian Guide to 3R/4R; 2001