Parachute
**Vision
Zero**

Case Study Series

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Vision Zero:
Using data to make decisions and take action

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*Parachute Vision Zero Network has launched a series called **Word on the Street**; one of the elements of the series is a quarterly Case Study that will feature a variety of issues and examples of Vision Zero from across Canada and around the world. We hope that these practical, evidence based case studies will help educate, inform and inspire those who are interested in getting to zero.*

What's in this issue?

The implementation of cost effective, data driven road safety solutions is a key aspect of Vision Zero.[1] This Case Study highlights the importance of this issue by providing a behind the scenes look into how traffic safety departments in Toronto and Edmonton are using data to inform their approach to Vision Zero.

City of Toronto

The City of Toronto's Traffic Safety Unit (Traffic Safety) is group of approximately 25 employees responsible for overseeing the city's red light camera program, collecting traffic operations data (e.g., traffic signals and signs) and analyzing and reporting on collision data. In November of 2015, they were asked to go a step further by participating in the Vision Zero Road Safety Committee, a group of 12 partner agencies, to help develop a Vision Zero Road Safety Plan for Toronto.

Prioritizing vulnerable road users

Toronto's Transportation Services Division[2] has typically approached road safety through the steady implementation of best-practice road safety interventions. For example, over the course of several years they have been gradually increasing pedestrian walk times at signalized intersections across the city.

However, the citywide implementation of proven road safety interventions, in a city with over 9,500 streets and 26,300 intersections, requires considerable time and money. This approach also fails to address those currently experiencing the greatest number of serious injuries and fatalities, a key component of Vision Zero.

With this in mind, the Vision Zero Road Safety Committee decided to prioritize the city's most vulnerable road users (including pedestrians, school children, older adults, cyclists, and motorcyclists) through a combination of 50+ countermeasures that make improvements through education, engineering, technology and enforcement.

Analyzing collision trends

In developing the plan Traffic Safety analyzed historical collision trends, especially for those killed or seriously injured (KSI), to locate collision hot spots, identify those most at risk and determine causal factors that could explain how or why such incidents occurred. Like most jurisdictions, their collision data comes from police reports and insurance claims. Every year they receive between 300–400 police reports documenting KSI collisions and another 50, 000 reports from Collision Reporting Centres (CRC) documenting collisions with minor property damage.

One of their main priorities is to "validate" collision data, which involves double-checking collision reports to make sure they are accurate and consistent. Quite often, this involves looking at full-length collision reports and police diagrams to make sure everything matches up.

The pros and cons of KSI collision data

Police or KSI collision data is the most comprehensive collision data available. It is more thorough, detailed and objective than CRC data and covers those incidents that don't make it to hospital or emergency room departments. However, there are limitations around accuracy and consistency of evidence that can influence how the data is interpreted. Table 1 provides hypothetical examples of common challenges traffic analysts encounter when validating police collision data:

TABLE 1 – LIMITATIONS OF KSI COLLISION DATA	
COLLISION LOCATION	
For example	An older adult is hit by a motorist when crossing at mid-block but the report indicates the collision occurred at the adjacent intersection.
Why it matters	24% of collisions involving an older adult in Toronto during the last 5 years occurred mid-block.
INCONSISTENT CODING	
For example	A motorist hits a cyclist while making a northbound left at an intersection, but it's mistakenly coded as an eastbound left in the report.
Why it matters	More than one northbound left KSI collision at an intersection could influence the decision to implement a protected left turn, which can reduce such collisions by 99%
DETERMINING FAULT	
For example	A pedestrian crossing at mid-block[3] is hit by a motorcyclist and deemed to be at fault. However, the collision report indicates there was little to no traffic and that the motorcyclist ran a red light.
Why it matters	The number of KSI collisions with a pedestrian at fault declines significantly when excluding those incidents which involve driver error, such as failure to obey traffic signals and speed limits.

A new way forward

Using Big Data

Since 2015 the Transportation Services Division has been creating a [big data innovation team](#). Traffic Safety has started the process of merging their databases with this big data group in the hopes of increasing access to information that can help to inform new road safety strategies. For example, Toronto Hydro data

matched with collision data could tell them more about street lighting conditions during a pedestrian collision at night. Whereas an injury report from a Trauma Centre could provide more detail on what exactly happened.

This type of cross agency evaluation is already happening in other Vision Zero cities. For example, in New York City, the Department of Health and Mental Hygiene (DOHMH) has recently completed a data matching process to link hospital records with crash reports (see [NYC Vision Zero Year Three Report](#) for more detail).

Getting proactive

In year one of Vision Zero, the focus has been primarily on reducing KSI collisions. However, as the plan evolves they are looking to prevent collisions before they happen through collision forecasting and a focus on casual factors. For example, through a network screening process Traffic Safety can now estimate the number of collisions for an intersection based on traffic volume, which has helped them to identify over 500 high-risk locations. With better access to data on causal factors, like areas of activity for older adults, they can develop solutions to prevent a crash before it happens. For example, an area populated by seniors, with multiple trip generators (e.g., shopping mall, medical centre, bus stop) and two signalized intersections 600 meters apart is well suited for a mid-block traffic signal.

Lessons learned so far

Promote safety to elevate industry standards

KSI collisions in Toronto commonly occur in areas that meet road engineering safety standards. However, in the event of a fatality, Traffic Safety will conduct a review and make recommendations for added safety features. Any infrastructure changes are subject to a traffic engineering warrant analysis and safety recommendations that go beyond industry standards are often rejected due to their delay on the flow of traffic and the risk for driver non-compliance. Traffic safety is working to change this by advocating for an enhanced industry standard of safety and by ensuring that engineering changes are always accompanied by public education (e.g., increased signage, media coverage) and proper enforcement to ensure compliance.

Conduct an environmental scan up front

When the City of Toronto announced their new five-year $80 million Vision Zero plan, there was criticism from the media that the plan didn't go far enough. At the same time, many in the public questioned the need for such a sizeable budget.

Soon after (in July of 2016), the Transportation Services Division presented a supplementary report for Toronto's Vision Zero Road Safety plan. This included an environmental scan of benchmarks and levels of investment for road safety plans in other comparable municipalities. Looking back, Roger Brown (manager of Traffic Safety), thinks this would have been useful information to have in the beginning: "Starting with industry scan of other successful Vision Zero cities would have helped in our planning and to set people's expectations for what kind of investments were necessary." Traffic Safety is now in regular communication with their road safety counterparts in NYC and other similar Vision Zero cities identified in the supplementary report.

City of Edmonton

In 2009 Edmonton's Traffic Safety teamed up with engineering researchers from the University of British Columbia (UBC) to track and analyze video footage of all the near misses between cars at one of the highest crash prone intersections in the city. After reviewing the data the city decided to install a right-turn traffic light and within a year they managed to reduce the number of collisions by 95%.[4]

Video-based road-safety analytics

Video-based road-safety analytics is a relatively new method of traffic safety analysis developed by UBC Civil Engineering Professor and road safety expert Dr. Tarek Sayed. It proactively identifies collision risk by measuring traffic conflicts, or near collisions that were suddenly avoided at the last moment, and allows traffic engineers to quantify collision risk and develop suitable road-safety countermeasures.
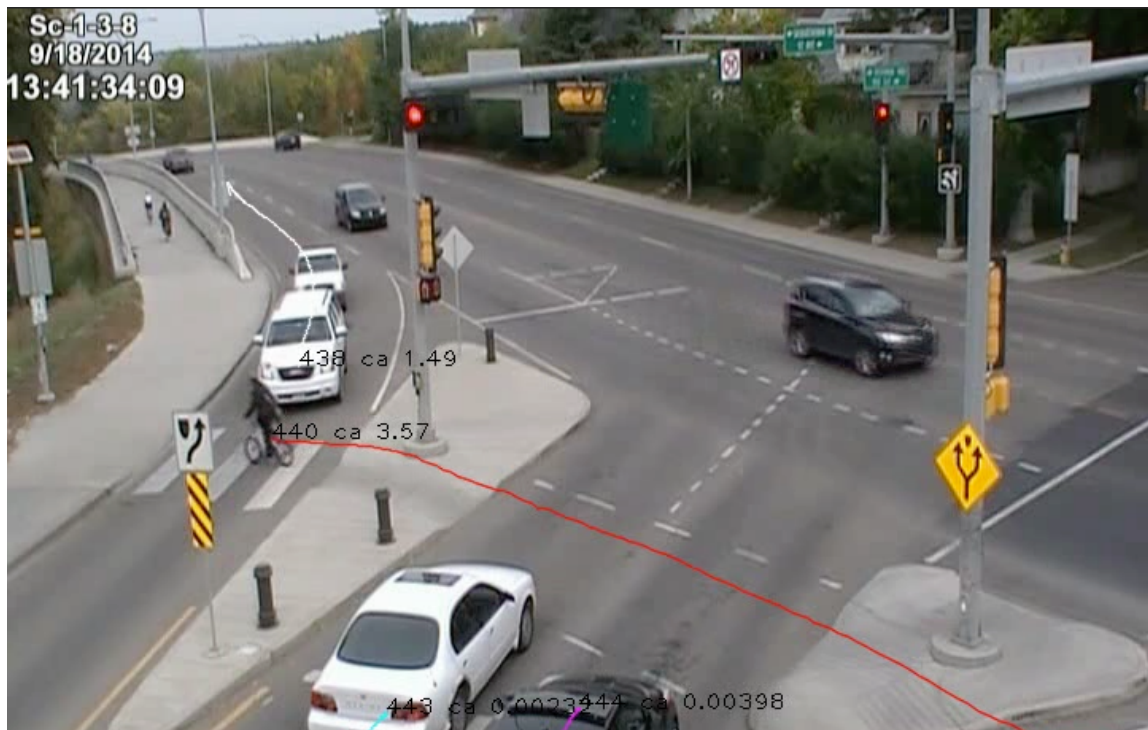
Traffic conflict

A traffic conflict between two road users includes two components: a collision course and an emergency evasive action.[5]

How does it work?

Typically, Sayed and his research team will position digital video cameras at multiple vantage points of an intersection and record the traffic behaviour of all road users for one to three days, depending on the volume of traffic. A software program then scans the footage and analyzes the trajectory and frequency of each person walking, driving or cycling and picks out the conflicts or potential collisions (see Figure 1 for more detail). One way they do this is by measuring time-to-collision (TTC), which is the number of seconds it would have taken for a collision to occur had someone not suddenly changed course.[5] A TTC of three seconds or less indicates a high risk for a collision, whereas a TTC of three seconds or more indicates a reduced risk for a collision. By developing models to increase TTC above three seconds, researchers can suggest countermeasures to reduce collision risk and estimate a collision reduction factor.

Figure 1 – Vehicle-cyclist conflict

Retrieved from Edmonton, [Scona Road Safety Review](#)

What are the benefits?

Stopping collisions before they happen

One of the main advantages of measuring traffic conflicts using video-based analytics is that it helps mitigate risk before a collision occurs, which saves lives, time and money.

For example, road improvement programs traditionally evaluate collision data over a few years, whereas video conflict data can be collected in a few days.[4] This allows traffic safety engineers to intervene proactively, effectively eliminating the need to wait for collisions and risk further serious injury or loss of life. This is a main reason why Gerry Shimko, Executive Director of Traffic Safety for City of Edmonton, believes traffic conflicts will be the new standard in road safety moving forward: "Why wait for the crashes if you can mitigate the conflicts right off the top?"

Reliable and precise data

As discussed earlier, historical collision data is not always available or reliable and it typically does not reveal the causal factors for a crash. By contrast, video-based analytics provides rich, detailed, inexpensive and permanent observations of traffic scenes. It also provides a better understanding of the split-second responses and behaviours of drivers during traffic conflicts.[4]

Furthermore, by measuring variables like TTC, researchers are able to quantify collision risk and estimate a collision reduction factor for proposed countermeasures, which helps nail down the exact dollar amount to be spent on safety improvements.

This information can help decision makers set priorities for road safety projects in a way that's objective and transparent, which is important for a city with competing road safety needs.

Moving from collisions to conflicts

Collisions
- Reactive
- Requires waiting for 3+ years
- Involves serious and fatal consequences

Conflicts
- Proactive
- Shorter time to evaluate safety
- Provides actual insight into behaviour
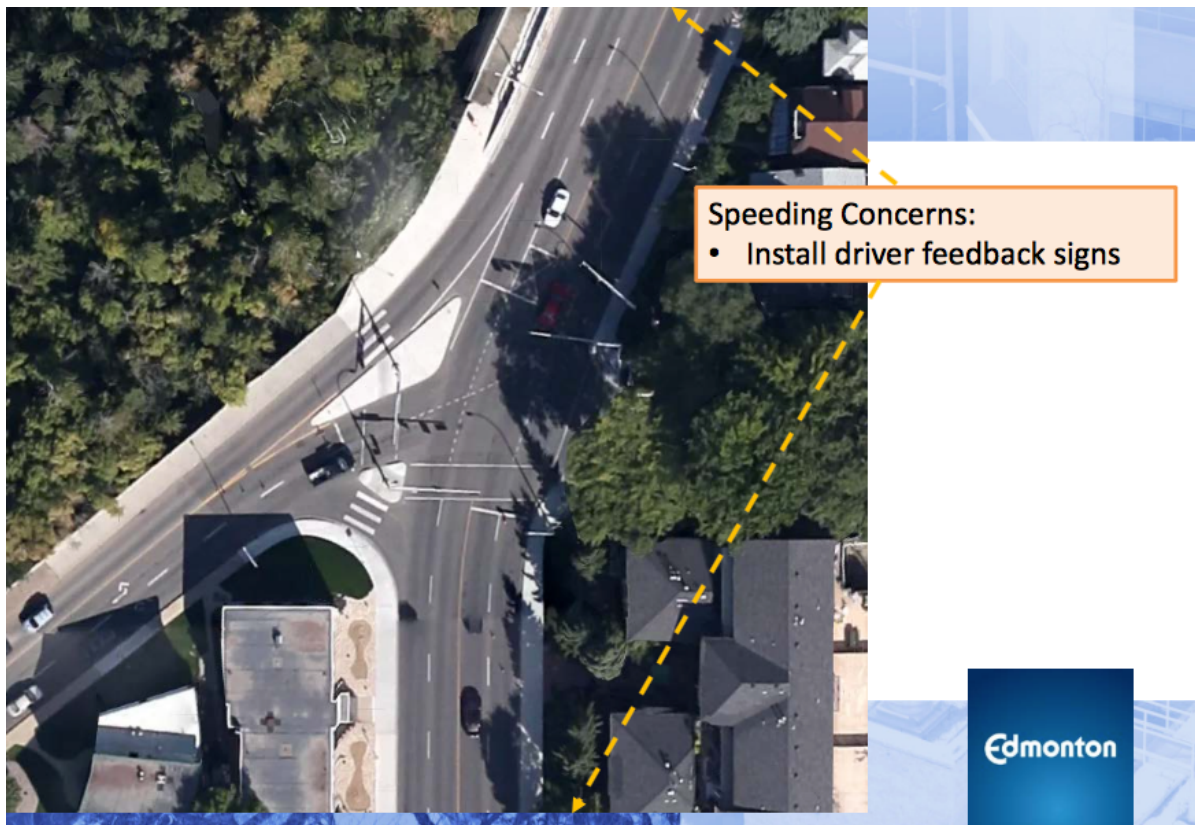- Occurs more frequently - more data

Adapted from Edmonton Traffic Safety

A multimodal perspective

Another advantage of video-based analytics is that it reviews pedestrian, cyclist, and motor vehicle traffic behaviour all at once, which can help to identify collision risk not readily available in collision data.

For example, when Scona Road, a residential street in Edmonton, was widened in 2011, residents complained about increased speeds, conflicts between vehicles and pedestrian safety hazards near the crosswalk. Although there was little difference in collision data before and after the reconstruction, a traffic assessment of current conflict footage between vehicles, pedestrians and cyclists captured many close calls, unsafe lane changes and near rear-end collisions. Traffic Safety used this analysis to develop a series of countermeasures; including driver feedback signs to reduce speeding and enhanced pavement markings to prevent improper lane changing (see Figure 2 for more detail).

Figure 2 - Traffic safety countermeasure

Retrieved from Edmonton, Scona Road Safety Review

Obtaining buy-in

Another benefit of video-based analytics is that the footage of traffic conflicts can be used as a tool for explaining to parents, police officers, council members or transit professionals why changes are needed. For example, upon seeing the conflict videos from the Scona Road traffic assessment, city officials immediately approved new signage and a rapid flashing beacon for the pedestrian crossing. Remarkably, Edmonton Transit Services changed the location of a bus stop within days of seeing conflict footage that showed the current location was blocking the Scona Road intersection and forcing cars to change lanes quickly. Click [here](#) to see the video.

What's Up Next?

Over the past few years Edmonton's Traffic Safety has developed their own equipment for collecting video analytics and they are currently training staff to do it as part of their road safety reviews. They continue to work closely with researchers from UBC on expanding their in-house capabilities, especially for conflict analysis, and are constantly exploring new opportunities for research and application of the technology. For example, they are now using the technology to assess collision risk in school zones and are currently evaluating a series of countermeasures that were recently developed from a traffic conflict analysis at one of the city's most problematic locations.

Summary

✦ Collecting, analyzing and using various forms of road safety data is an essential aspect of Vision Zero that can help guide traffic safety decision making

✦ Traffic safety departments in Toronto and Edmonton are using road safety data to prioritize vulnerable road users and develop appropriate countermeasures.

✦ Traditional police collision data has limitations and can be integrated with other forms of transportation and injury data to better understand collision risk.

✦ The use of proactive road safety data (e.g., causal factors, traffic conflicts) can help to predict and prevent collisions before they happen.

✦ Multi-sector collaboration can enhance data collection and analysis capabilities of traffic safety departments planning, implementing and evaluating road safety initiatives.

References

1 Milligan, C., & Peterniak, R. (2015). Vision Zero: Principles and checklist for effective adoption. Paper presented at The 25th CARSP Conference, Ottawa Ontario, May 27-30, 2015.

2 Transportation Services is responsible for improvements to the City's public realm, road right-of-way regulation, road repair, maintenance, traffic operations, enforcement, cleaning/removing activities as well as Toronto's Road Classification System.

3 The Highway Traffic Act does not stipulate how far from the nearest crosswalk one must be in order to legally cross mid-block, but Toronto Police generally use 30 metres as a 'rule of thumb.'

4 University of British Columbia. (2010). Ingenuity. Faculty of applied Science engineering news / Fall 2010 / winter 2011. Retrieved from: https://engineering.ubc.ca/sites/engineering.ubc.ca/files/ingenuity_2010_fall_winter_s.pdf

5 Saunier, N & Sayed, T. (2007). Automated Road Safety Analysis Using Video Data. Paper submitted to the 2007 Transportation Research Board Annual Meeting.

Note: Information for this case study was collected via interviews with Roger Browne and Gerry Shimko. We thank them for their time and commitment to road safety and Vision Zero.