

Accelerating Vision Zero with Advanced Video Analytics

Video-based Network-wide Conflict and Speed Analysis to Support Vision Zero in Bellevue (WA) United States

Executive Summary | July 2020



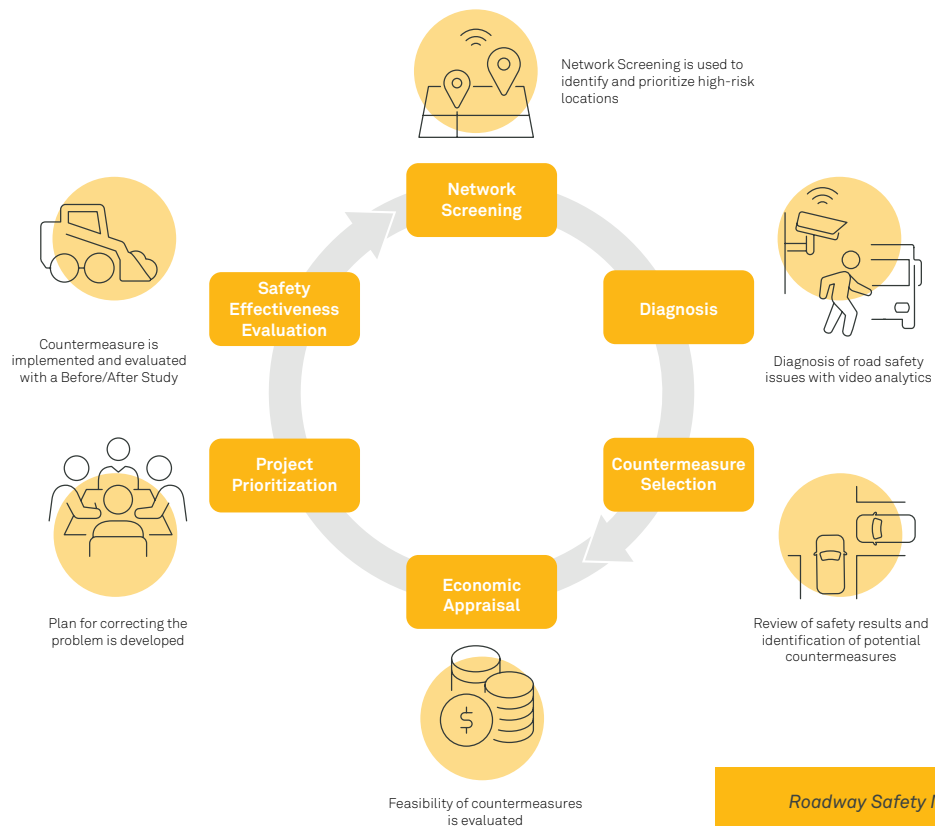
Smarter Technologies for Safer Roads

The city of Bellevue, Wash., has partnered with Transoft Solutions Inc., formally Brisk Synergies, and Together for Safer Roads on a first-of-its-kind, citywide analysis of traffic camera video with the goal of improving road safety for people who walk, bicycle and drive. The project used data from Bellevue’s network of existing 360 HD traffic cameras. Transoft Solutions’ road safety technology processed, analyzed, and diagnosed problematic intersections from Bellevue’s video feed.

This project demonstrated the application of video analytics in the transportation management process of improving road safety: identify problematic intersections, diagnose the nature of site-specific issues, select and implement improvements, and evaluate outcomes. The results of this work have been

published in three technical reports available on the [project web page](#). The project, among other findings, shows that intersection conflicts, or near-crash events, are an accurate predictor of where future crashes could occur.

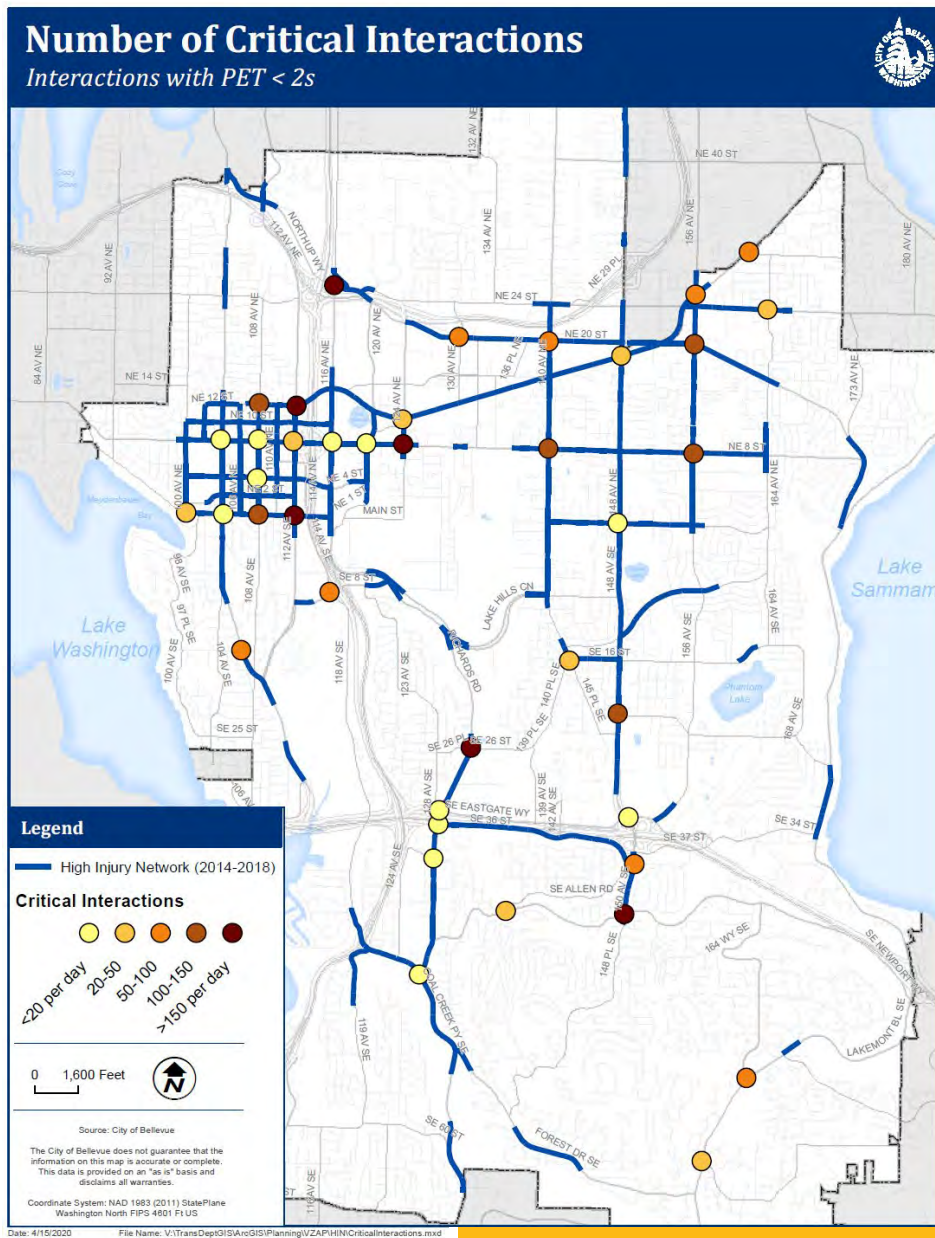
For Bellevue, the project grew from its Vision Zero effort, which strives to eliminate traffic fatalities and serious injuries on city streets by 2030. The city found natural partners in Transoft Solutions, a leader in automated road safety analysis and the use of video analytics technology, and Together for Safer Roads, an innovative coalition that brings together members’ knowledge, data and technology to improve road safety.



Roadway Safety Management Process

Leverage Data Innovation

This project made use of video data from the City of Bellevue's network of existing 360 HD traffic cameras. Forty intersections were selected representing different geographic locations, land uses, population density, and road geometry. Data analysis was performed for footage collected daily (16 hours per day) for a week (7 days) in September, resulting in approximately 5,000 hours of footage. The three technical reports summarize this data in which over 8.25 million road user observations and 20,000 critical conflict interactions were observed.



BriskLUMINA and BriskVANTAGE, products of Transoft Solutions, use artificial intelligence algorithms to process traffic camera footage to obtain traffic volume, road user speed, and near-crash event data. Results from the products are used to identify high-conflict interactions at intersections and to evaluate the efficacy of road safety improvements. Without improvements, these intersections are prone to future crashes.

Video-based monitoring is an effective method to obtain conflict data:

- Unlike traditional traffic safety evaluation methods, video-based monitoring is detailed enough to identify near-crashes, classify road user types and their movements, and detect speeding infractions and lane violations.
- Cameras capture high-resolution data for ALL road users and modes of transportation within the field of view, compared to GPS or Bluetooth sensor data, which only capture some of the road users.
- Unlike LIDAR the use of video analytics is easily scalable and cameras are relatively easy to deploy and maintain alongside a traditional surveillance system.
- Videos are easy for people to review and understand, unlike many other data collection technologies that simply provide numerical data.



Implement Proactive Measures To Reduce Risk

Data is critical to making effective decisions about safety: identifying problem areas, selecting appropriate safety countermeasures, and monitoring countermeasure impact. Typically, government agencies intervene only after enough police crash reports are filed to trigger a high-crash corridor designation. Vision Zero communities recognize that a reliance on crash data alone does not provide a complete picture of the safety risks on our roads and has well-documented limitations:

- The infrequent nature of traffic collisions necessitates years of observation to achieve statistical significance — 5 or even 10 years of data at low-traffic volume locations;
- Not all crashes are reported, and the level of reporting is uneven with respect to the type of road users involved, exact location, and contributing factors; and
- Using crash data by itself leaves staff with a purely reactive approach – identifying locations where crashes have already happened.

Bellevue is looking beyond crash records to inform its road safety program. By supplementing crash data with conflict analytics, transportation staff aim to develop a more in-depth understanding of road user interactions that contribute to crash risk. These surrogate warning indicators – observable non-crash traffic conflict events – provide insight into when, where, and why crashes are most likely to occur. Understanding the root causes for conflict events enables staff to take proactive corrective measures – before a crash occurs.

BriskLUMINA and BriskVANTAGE deliver a stream of information including traffic volumes, road user speeds, and near-crash traffic conflict indicators. This continuous flow of data can help cities like Bellevue implement a proactive road safety program and reach their Vision Zero goal.



Drive Safety Outcomes With Video Analytics

Three reports were produced through this partnership

1. Video-based Network-wide Conflict Analysis:

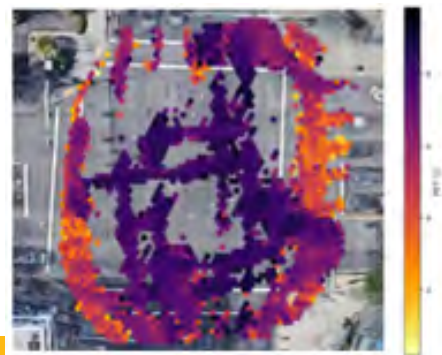
This report summarizes data on traffic patterns and conflict rates at study locations. Conflicts were identified based on post-encroachment time (PET), which is the time between when one road user leaves the conflict point and another road user arrives at that point. Variations in both metrics were obtained based on urban density, location, time of day, and day of week. For each type of road user, the intersection with the highest critical conflict rate was identified and further analyzed.

2. Video-based Network-wide Speed and Speeding Analysis:

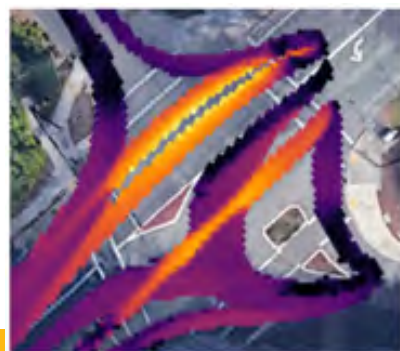
This report contains data on road user speeds and speeding incidence rates for the study locations. Variations in both metrics were obtained based on urban density, location, time of day, and day of week. A deeper analysis was performed at the intersection with the highest speeding incidence rate.

3. Video-based Conflict, Speeding, and Crash Correlation:

This report explores the correlation between conflict and speeding measurements to historical crash data in Bellevue at a sample of intersections having the highest number of crashes. Count regression models were generated and found a positive and statistically significant, non-linear association between conflicts and crash rates.



Conflict heatmap at Bellevue Way and NE 8th St.



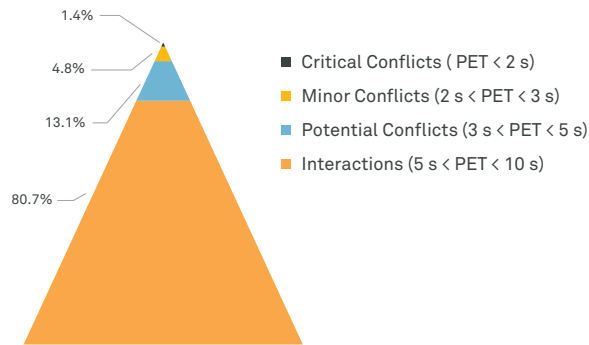
Speed heatmap at Bel-Red Road and NE 30th St.



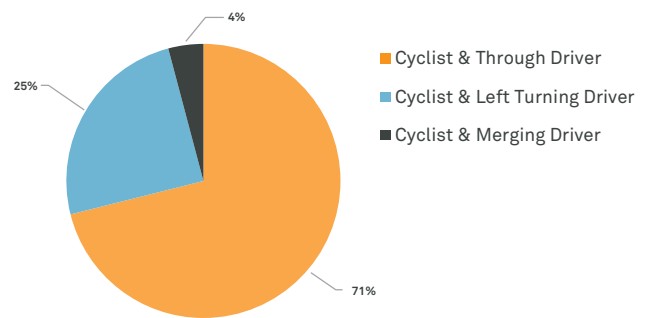
Example of conflict at 112th Avenue and Main St.

The key findings from the reports include identifying the intersections with the highest volumes, conflict rates, and speeding incidence rates.

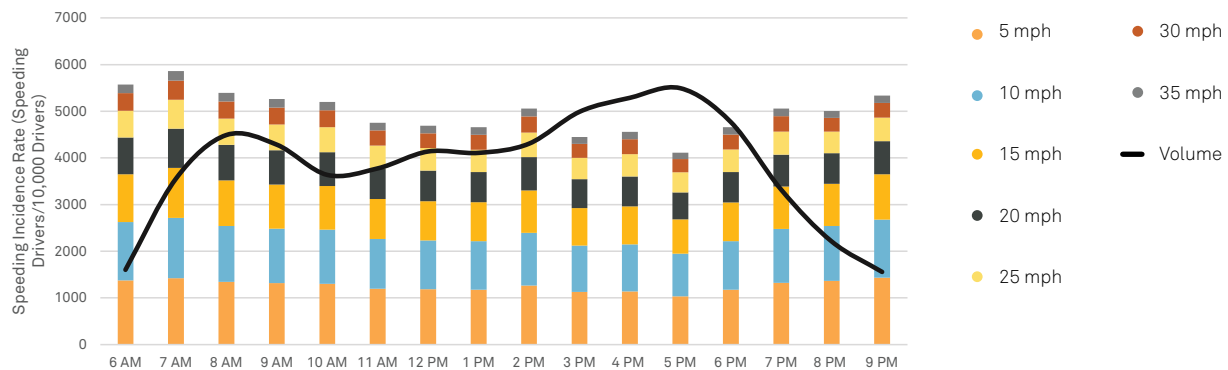
- Preliminary success was achieved in modeling a relationship between crashes and conflicts in the City of Bellevue. The models found a positive correlation between conflicts and crash rates. Results indicated that 38% of crash causes can be explained by a combination of road user volume and conflict data. This shows evidence that conflicts are an indicator of future crashes.
- Intersections on arterials in residential areas experienced consistently higher conflict rates, speeds, and speeding incidence rates compared to intersections in commercial areas.
- 20,000 critical conflicts (PET < 2 seconds), 0.14% of all events, were observed during one week at the 40 intersections.
- Motorcyclists travelled at higher speeds and generated more critical conflicts than any other road user.
- People riding bicycles represent 0.1% of observed road users (motorists = 97.3% and pedestrians = 2.6%); however, they are 10 times more likely to be involved in a conflict than motorists.
- Throughout the network, over 10% of drivers were speeding (and half of these drivers speeding were traveling in excess of 11 MPH over the posted speed limit). Speeding incidence rates were relatively uniform on weekdays with a noticeable decrease around peak hours.



Frequency of interactions with different post-encroachment times (PET)



Critical conflicts involving a bicyclist across the network by type



Hourly Excessive Speeding Distribution

Achieve Vision Zero Together

In June 2020 the City of Bellevue adopted a Safe Systems approach to move towards its Vision Zero goal. This new way of thinking about safety recognizes that crashes are the result of design, infrastructure, and systemic issues that affect people's ability to travel safely on city streets. Data is a foundational element to the City of Bellevue's Safe Systems approach.

In this approach, Bellevue leverages traditional crash data, community input, and now conflict analytics to identify areas with a potential road safety risk. Then, engineers and planners can select appropriate safety countermeasures and evaluate their impacts to proactively prevent safety problems before they arise.

Identifying potential problems before they manifest themselves as serious outcomes is vital for Vision Zero road safety programs. Video-based traffic safety solutions, particularly surrogate safety methods such as those delivered by Transoft Solutions' BriskLUMINA and BriskVANTAGE offerings, are essential tools that will help transportation agencies achieve the goal that matters most. Zero is the only acceptable number of deaths and serious injuries on our streets.



Safe Systems approach to Vision Zero goal