NOCoE National Operations Center of Excellence

CASE STUDY

ACCELERATING VISION ZERO WITH ADVANCED VIDEO ANALYTICS: VIDEO-BASED NETWORK-WIDE CONFLICT AND SPEED ANALYSIS

By City of Bellevue, WA

IN THIS CASE STUDY YOU WILL LEARN:

1. How Video monitoring can provide important and useful data on traffic volumes, road user speeds, and near-crash traffic conflict indicators.
2. How software platforms can analyze data on near-crash incidents to identify future safety issues.
3. How identifying these issues can help meet a goal of zero incidents in the near future (Vision Zero).

BACKGROUND

The project, formally titled "Video-based Network-wide Conflict and Speed Analysis to Support Vision Zero in Bellevue (WA) United States," began in August 2019 and used data supplied from the city's network of 360-degree, high-definition traffic cameras at 40 intersections chosen for the study. Transoft Solutions' products, BriskLUMINA and BriskVANTAGE, collected traffic volumes, road user speeds, and near-crash traffic conflict indicators from the video feed. It then used advanced artificial intelligence algorithms and video analytics to process, analyze and identify safety issues at the intersections.

The Vision Zero project in Bellevue started as an effort to eliminate traffic fatalities and serious-injury crashes by 2030. The City of Bellevue partnered with Transoft Solutions' road safety analysis technology and Together for Safer Roads, who convened and funded the project to improve road safety in Bellevue. Public-private partnerships like this help demonstrate the lifesaving power and scalability of predictive analytics. This project demonstrated the application of video analytics with respect to the Roadway Safety Management Process outlined in AASHTO's Highway Safety Manual. Surrogate safety analysis can assist practitioners in identifying problematic intersections, diagnosing the nature of site-specific issues, selecting and implementing improvements, and evaluating outcomes. The results of this work have been published in three technical reports. The project, among other findings, shows that intersection conflicts, or near-crash events, are accurate predictors of where future crashes could occur.

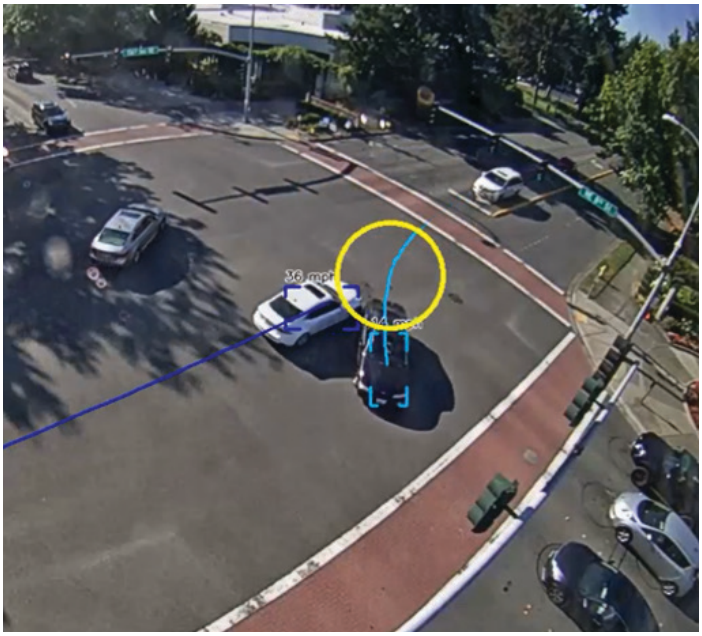

Figure 1: Near-collision conflict between left-turning motorist and through motorist in Bellevue

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TSMO PLANNING, STRATEGIES AND DEPLOYMENT

The initiative in Bellevue has several steps including site selection, video-based traffic monitoring platform deployment, data analysis, and conflict analysis.

Site Selection

The project leveraged data from the City of Bellevue's network of existing 360 HD traffic safetycameras. The City selected 40 intersections representing different geographic locations, land uses, population density, and road geometry. The cameras collected data daily (16 hours per day) for a week (7 days) in September 2019, resulting in approximately 5,000 hours of footage with 8.25 million road user observations and 20,000 critical conflict interactions.

Video Based Monitoring Platform Deployment

The video monitoring platform provided livestreaming of the intersection video footage, calibration and validation of the data, video-based AI processing and safety analysis, quality control and data filtering, and presentation of analytics results on the dashboard.

Data Analysis

The project team used artificial intelligence algorithms from Transoft Solutions' BriskLUMINA and BriskVANTAGE products to process traffic camera footage. The camera footage provided traffic volume, road user speed, and near-crash event data. The project team used results from this process to identify high-conflict interactions at intersections and to evaluate the efficacy of targeted road safety improvements. The results were summarized in 3 separate reports:

- *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.
- *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.
- *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.

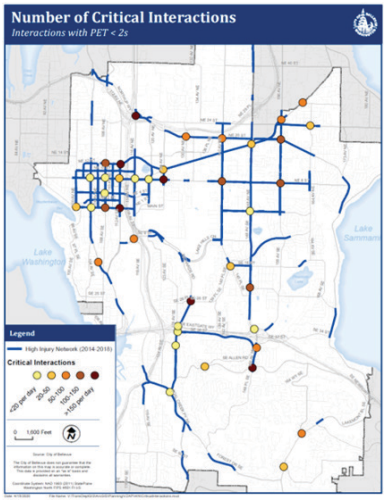

Figure 2: 20,000 critical conflict events observed during one week at 40 sites

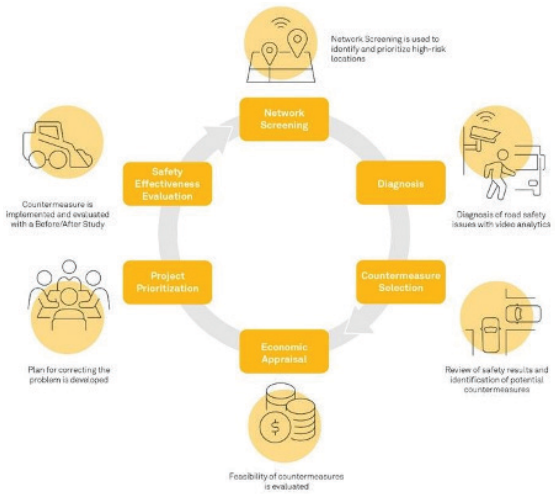

Figure 3: HSM 6-Step Roadway Safety Management Process, AASHTO (2010)

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OUTCOME, LEARNINGS AND PUBLIC BENEFIT

Data collected from over 5,000 hours of video footage were used to produce the three reports available on the City of Bellevue's Vision Zero Partnerships page:
1) Video-based Network-wide Conflict Analysis
2) Video-based Network-wide Speed and Speeding Analysis
3) Video-based Conflict, Speeding, and Crash Correlation

One of the major findings is that intersection conflicts or near-crash events are an accurate predictor of where future crashes could occur. The data also found that people riding bicycles are at greater risk than vehicle occupants. Bike riders represent 0.1% of observed road users, pedestrians were 2.6% and motorists accounted for 97.3%. However, bicyclists were 10 times more likely to be involved in a conflict than motorists. Data also found that motorcyclists travelled at higher speeds and generated more critical conflicts than any other road user. More than 10% of drivers were speeding, with half of them traveling at more than 11 mph over the posted speed limit. Speeding incidence rates were relatively uniform on weekdays with a noticeable decrease around peak (commute) hours. Video footage showed 20,000 critical conflict interactions among the 8.25 million road users recorded during one week.

Video-based monitoring is an effective method to obtain conflict data in different ways. 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.

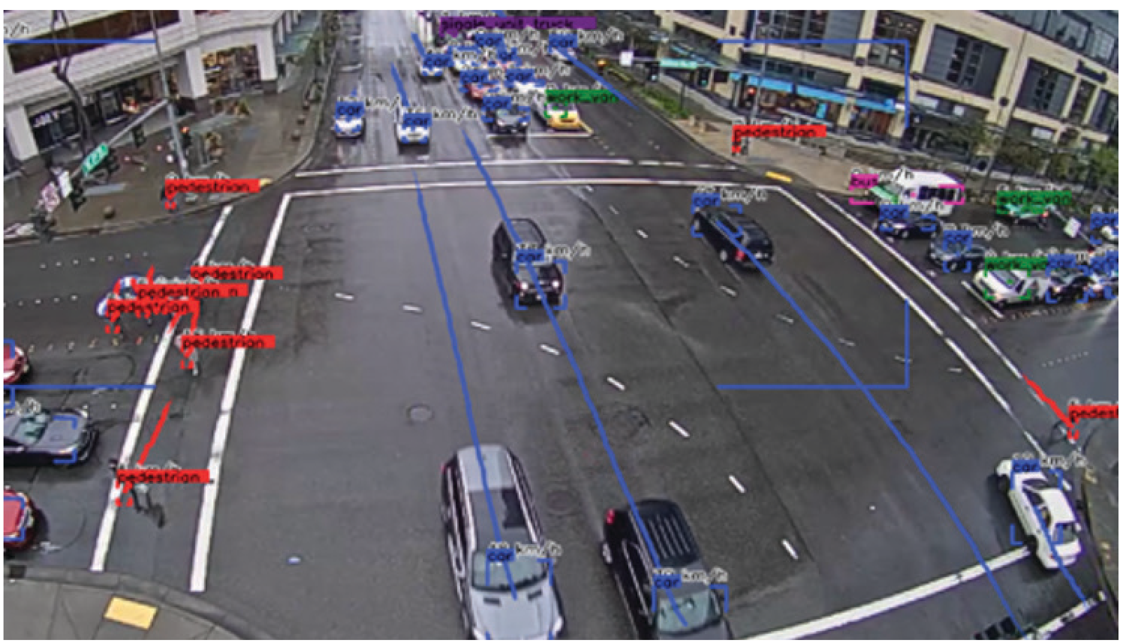

Figure 4: AI used to detect, monitor and measure displacements of all road users to a high degree of precision