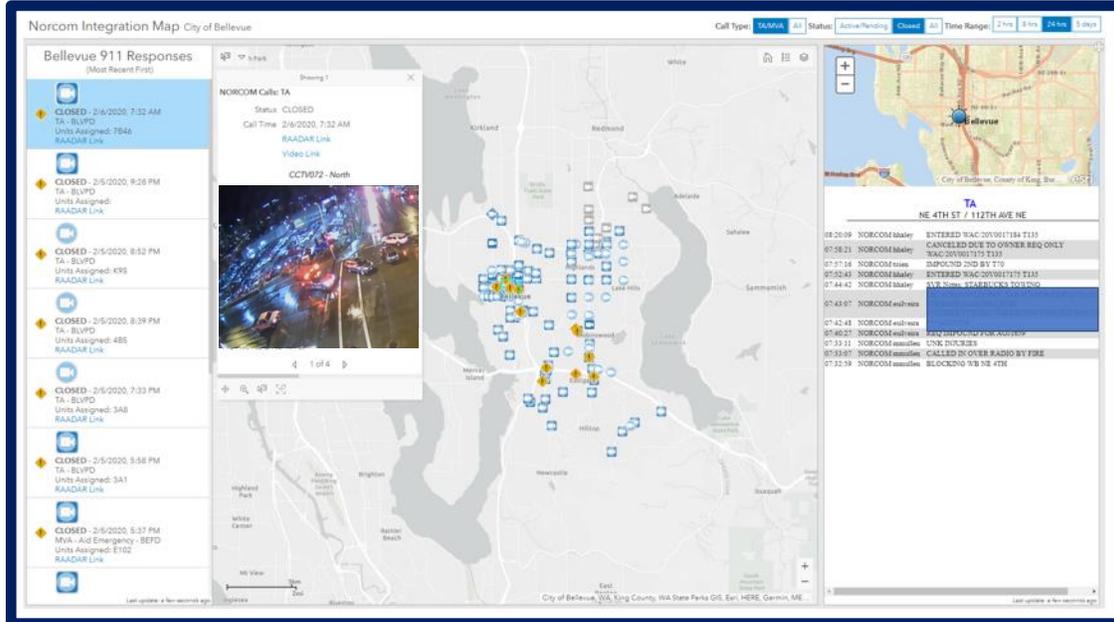


Bellevue Integration Dashboard for Traffic Incident Management



Fred Liang, P.E.
Intelligent Transportation Systems (ITS) Manager
City of Bellevue, Washington
Email: fliang@bellevuewa.gov

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Introduction

According to Federal Highway Administration (FHWA) report¹, about half of all roadway congestion is caused by temporary disruptions or "nonrecurring" congestions. The three main causes of nonrecurring congestion are: incidents ranging from a flat tire to an overturned hazardous material truck (25 percent), work zone traffic (10 percent), and weather-related incidents (15 percent). Nonrecurring events reduce roadway capacity and the reliability of the transportation system, triggering unanticipated travel delays to scheduled personal activities and goods deliveries. A normal twenty-minute trip could turn into a frustrating forty-minute trip. Timely and effective incident management can help to handle and restore traffic flow safely and quickly. However, most of the incident managements are focused on freeway operation. This paper describes managing real time incidents that occur on arterial streets.

Background and Obstacles

Bellevue, a fast-growing city located to the east of Seattle, is the fifth largest city in Washington with a resident population of 145,300 and daily workforce of over 150,000.² Major employers include Microsoft, T-Mobile, Boeing, Concur and Symetra Financial. The Bellevue Traffic Management team operates 205 signalized intersections, of which 100% are controlled by the Sydney Coordinated Adaptive Traffic System (SCATS). See Figure 1.

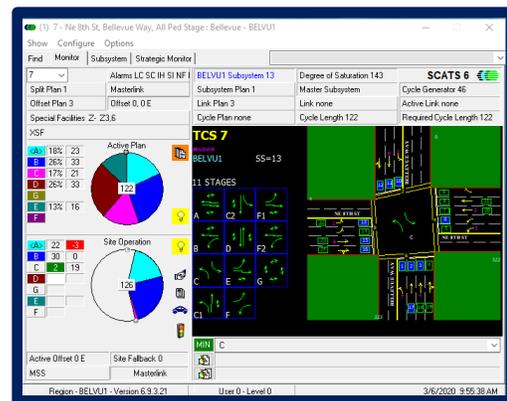


Figure 1



Figure 2

When Bellevue city Hall was relocated to a new location in 2006, Bellevue leadership decided to co-locate 911 North East King County Regional Public Safety Communication Agency (NORCOM) and Bellevue Traffic Management Center (TMC) on the same floor. In fact, the two centers are separated only by a bullet proof window and a steel wall (Figure 2).

¹Source: https://ops.fhwa.dot.gov/program_areas/reduce-non-cong.htm

²Source: <https://bellevuewa.gov/city-government/departments/community-development/data/demographic-data/population-trends>

NORCOM manages the emergency 911 calls, and the TMC staff manages the arterial traffic in Bellevue. The vision of the leadership at that time was to integrate emergency 911 calls with traffic management. After 14 years, as technology advances, we finally have made major progress to realize this vision.

In 2018, NORCOM received an average of 482 calls per day of which 5 to 10 calls were related to traffic collisions or led to roadway closures in Bellevue.³ NORCOM already developed a Real-time Agency Activity Displaying and Reporting program (RAADAR) to

deliver traffic collision notifications to the Traffic Management staff through email (Figure 3). However, it was a time-consuming process to verify each notification and then go through multiple steps to decide if an incident warrants further attention. As a result, responses to many critical incidents were left unattended or delayed.



Figure 3

Solution

In 2019, Bellevue decided to develop a dashboard tool to manage incidents by integrating real-time 911 emergency dispatch data with notification, verification, monitoring, real time management and archiving (Figure 4). The goal was to provide a seamless process to efficiently manage 911 emergency calls for immediate response and post-event assessment.

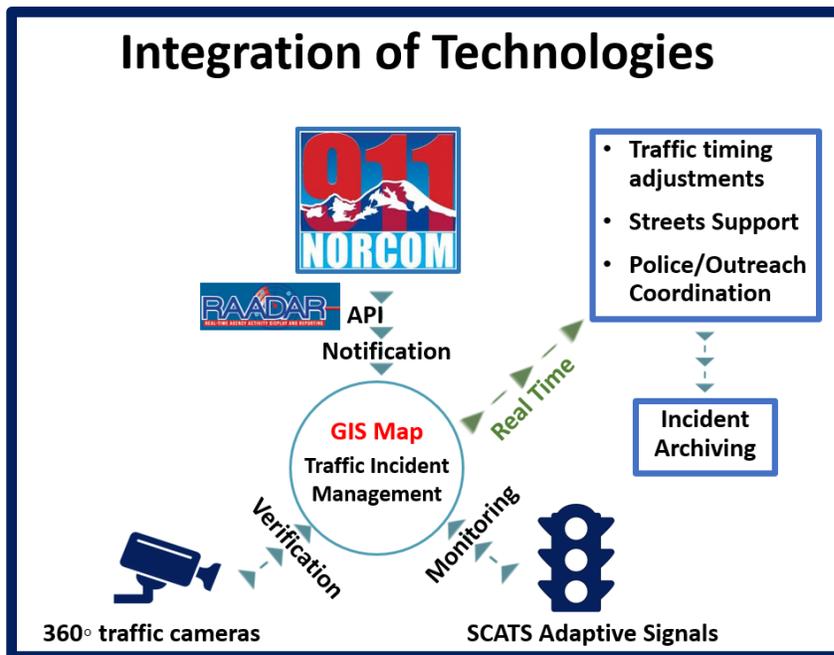


Figure 4

³Source: <https://www.norcom.org/agency.cfm.html>

Incident Verification

The dashboard integrates the location of the incident with Bellevue's high-resolution traffic cameras. Bellevue Information Technology staff helped setup the Real Time Streaming Protocol (RTSP) feeds so that live video can be accessed through the dashboard without affecting the communication bandwidth. A "camera" icon would indicate any incident identified within 300 feet of a nearby camera location. The Traffic Management staff can click on the icon to bring up the live video to verify and assess the incident. Together with the details gathered from the 911 call logs, the Traffic Management staff can promptly determine the impact and severity of an incident for appropriate actions (Figure 7).

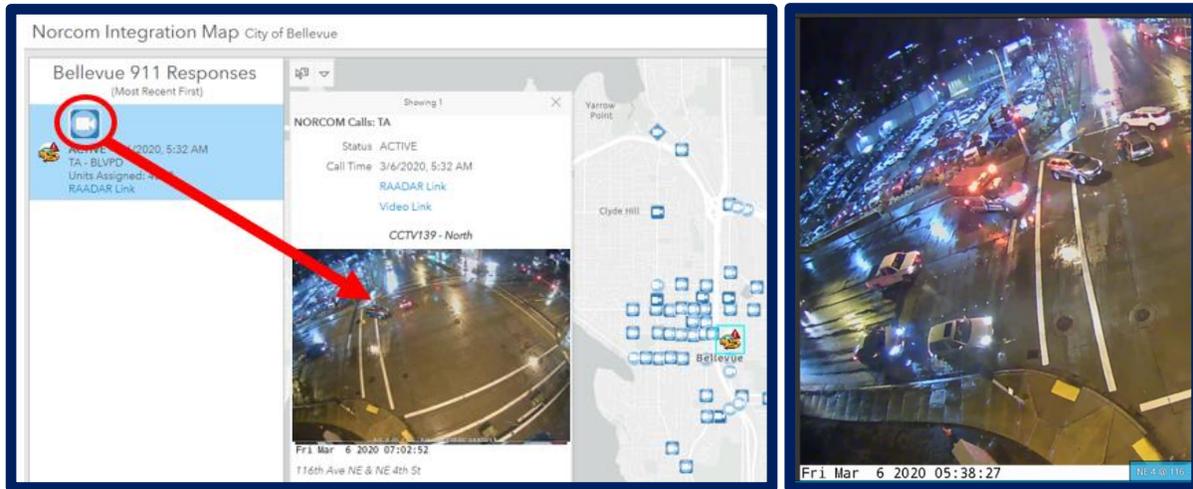


Figure 7

Currently, 60% of the 205 Bellevue signalized intersections are covered by 360° traffic cameras with 30 days of recordings. The 360° fixed lens traffic camera system is a cost-effective mean to capture the four directional views of an intersection (Figure 8).

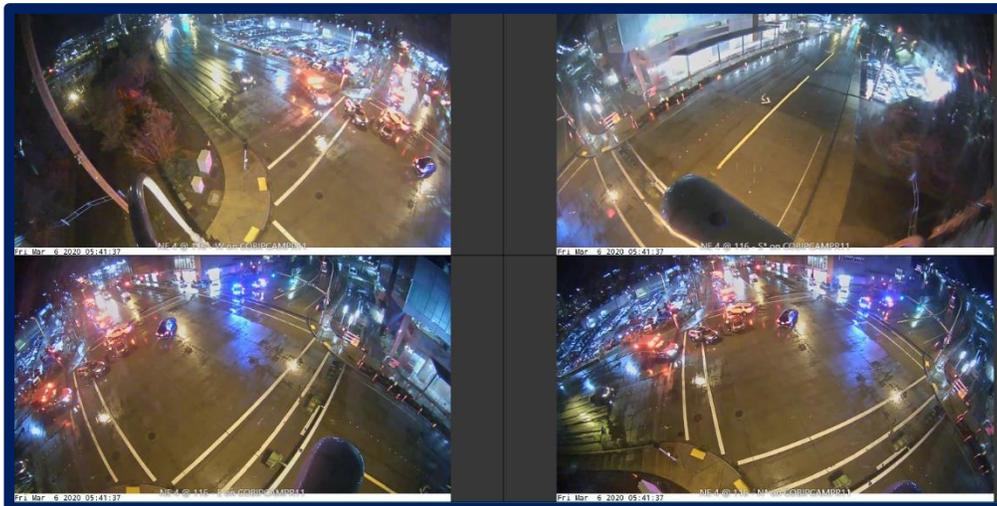


Figure 8

The goal is to provide 360° video camera coverage for every signalized intersection in Bellevue by 2021. When the implementation is finished, any incident that occurs at or near a signalized intersection can be captured and managed by the Traffic Management staff.

Incident Monitoring through SCATS

The dashboard has become a mission-critical tool to complement the advance SCATS adaptive signal system. SCATS uses Degree of Saturation (DS) to measure the congestion level. Unusual high DS values would confirm the congestion linked to an incident. SCATS constantly monitors the congestion level by comparing the current data with historical data and provides alerts to the staff when unusual congestion is detected (Figure 9).

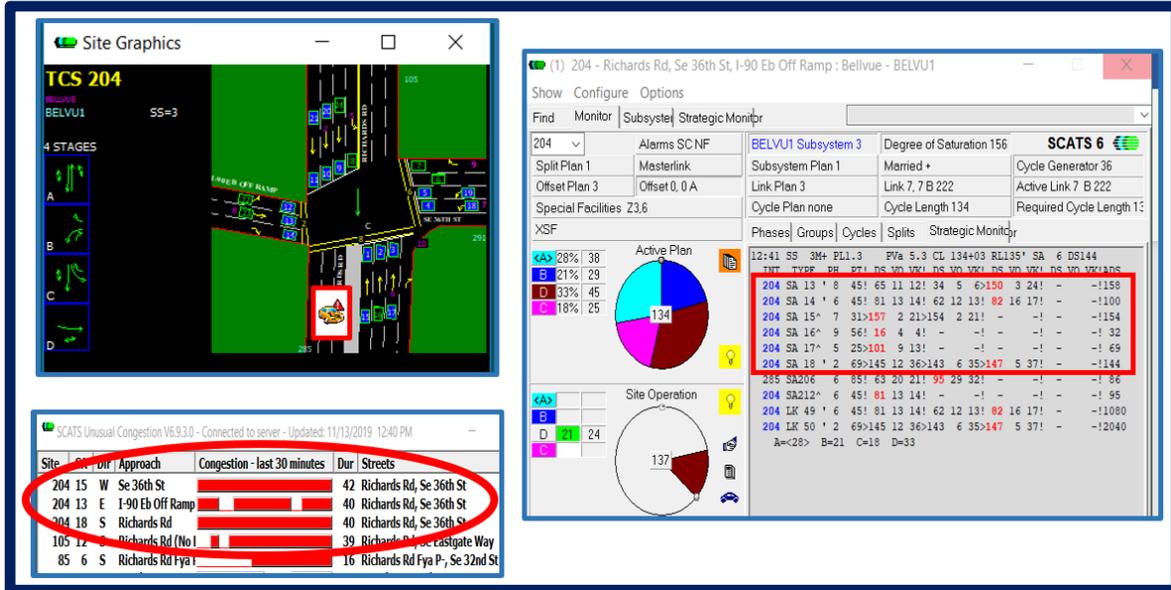


Figure 9

Real Time Incident Management

When incidents are confirmed, the Traffic Management staff can adjust SCATS signal timing parameters to alleviate congestion. Unlike traditional signal system that requires the manipulation of fixed timing plans, the Traffic Management staff can rapidly set up temporary adaptive parameters and adjustments to manage the congestion during and after the incident. It is possible to reduce the recovery time by as much as 50%. The



Figure 10

availability of tow trucks to arrive and clear the scene of the incident can be a key factor to determine the recovery duration (Figure 10). The public reaps the benefit for less travel delays when the congestion duration is shortened. Any critical information of a major incident can also be relayed to the Bellevue Public Information Officer (PIO) until the incident is cleared. The Officer can deliver timely and accurate travelers' information to road users to avoid the congested areas.

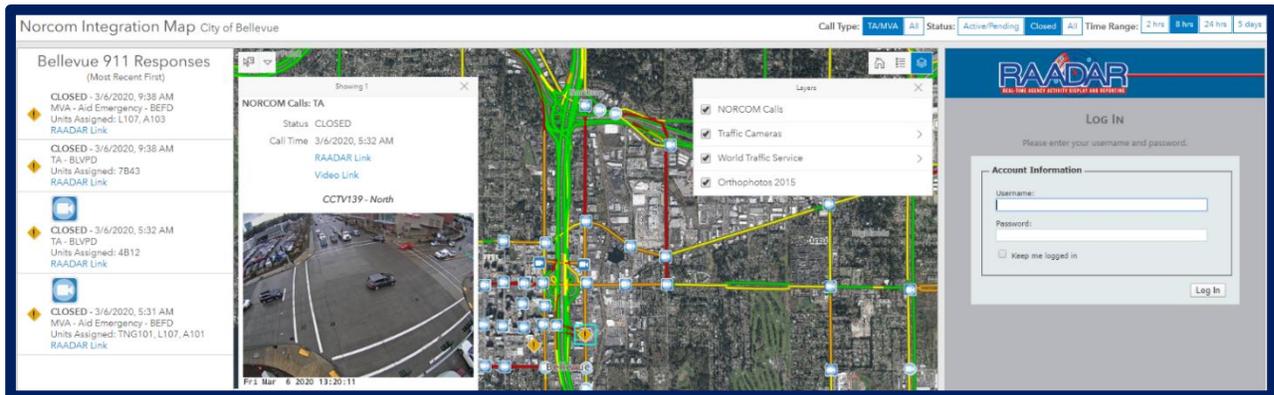
Incident Archiving and other Features

While the focus is to monitor active or pending traffic incidents, the Traffic Management staff also has access to monitor other crucial incidents like major fire, gas leak, bomb threat, enforcement, theft, etc. that may impact roadway traffic. From the dashboard, the Traffic Management staff can access up to 5 days of closed or historical 911 incidents. This feature helps to search and archive incidents that happened during non-working hours. With thirty days of recordings stored and maintained, the Traffic Management staff can promptly review and archive the video footage of the incidents.

In 2019, because of the alerts, the Traffic Management staff archived more than 500 incident video footages. Not only do the footages help police investigation of the incidents, they are available for public disclosure request and post-event engineering review. In 2019, the Traffic Management staff processed 4-5 requests weekly from legal entities, insurance companies and individuals. The recorded footage helps disputing parties to identify the causes and resolve disagreements. The footage speaks for itself, without the need to explain the signal sequence and timing or to provide depositions for litigations and lawsuits. During the snowstorms of 2019, the Traffic Management staff was able to trace and capture “hit and run” damages to city property, thus allowing Risk Department to identify the responsible parties and recover over \$50,000 in damages. The incident footages also provide valuable insight to identify collisions for improvement. Potentially, the improvement could prevent certain repeating incidents. Below are some snapshots of different incidents that the Traffic Management staff had captured and archived.



Conclusion and Future Plan



By tactfully managing and utilizing the emergency 911 calls data, other RAADAR-equipped agencies can exercise this solution to streamline and improve incident management efforts on arterial streets. The same principles can be applied to agencies with other dispatch platforms similar to RAADAR API application.

For Bellevue, this is just an initial step. We plan to build on this platform for other creative solutions, such as, integrating with third party applications (Google, Waze, Inrix, etc.); providing signal timing information; monitoring construction zones; allowing a public interface to receive the alerts/updates; and including weather and snowplowing information.

The integration dashboard has transformed how the city manages and processes traffic incidents in order to provide the best possible operations to benefit the general public. It is an innovative tool that saves lives, money and time.

Acknowledgements

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¹GIS Developer/Analyst, Information Technology Department, City of Bellevue

^{2,4,5}Senior ITS Engineer, ITS Transportation Department, City of Bellevue

³Application and Security Architect, Information Department, NORCOM

⁶ITS Technician, ITS Transportation Department, City of Bellevue