

THE American Surveyor

A FOOT IN THE PAST... AN EYE TO THE FUTURE Vol. 8, Issue 5

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RECONSTRUCTING



An RCMP member uses GNSS RTK from Altus Positioning Systems to collect a point needed to reconstruct a collision scene and create a formal drawing of it.

AN ACCIDENT SCENE



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As do many police forces, the Royal Canadian Mounted Police (RCMP) investigates motor vehicle collisions as part of its mandate. The RCMP has trained some police officers to provide additional investigative expertise as collision analysts and collision reconstructionists.

The “K” Division RCMP Collision Reconstruction Program—which covers the Province of Alberta—has 11 full-time collision reconstructionists plus 12 or more support analysts who assist part time with collision investigations. RCMP policy requires that a reconstructionist be contacted for fatal, serious-injury and high-profile collisions. The reconstructionist then decides on attending and providing assistance with the investigation.

>> By Daniel C. Brown



RCMP policy requires that a reconstructionist be contacted for fatal, serious injury and high-profile collisions.

Last year, RCMP collision analysts and reconstructionists were called to assist with nearly 900 fatal, serious-injury and high-profile collisions. Of those 900, they reconstructed 586 collisions.

RCMP members who investigate and map a collision examine the scene and record the locations of important features such as roadway edges, road lines, stop signs, traffic signals and so forth. Secondly, the reconstructionist examines the evidence itself and records precise locations of skid marks, scuff marks, tire prints, gouge marks made in the pavement by skidding vehicles and the like. Physical evidence includes metal marks and scars and the final resting positions of the vehicles.

RCMP measurements are used to create a formal drawing of the scene to present in court. The drawing assists the court in visualizing the event. The advent of the CAD program has changed the court presentation. Time and distance issues can be shown. Momentum and vector sum problems can be worked in the CAD program to determine vehicle speeds, and events can even be animated.

RCMP's mandate includes the enforcement of criminal and provincial laws. In many ways, the RCMP carries out similar duties to the U.S. Federal Bureau of Investigation and State Police. RCMP investigations assist in the laying of criminal charges appropriate to the circumstances. The end result for the investigator is preparing for and presenting his investigation in criminal court.

A Start with RTK GPS

In the early to mid 1990s, the RCMP started acquiring total stations for use in collision investigations. Budgets did not permit every division to have one, but over time, the RCMP upgraded from measuring tapes to total stations.

Two years ago, RCMP began to consider RTK units for collision investigation purposes. Through a process of writing specifications and putting the purchase out for bids, K division acquired 12 Altus GPS systems which allowed them to create six RTK sets. The RCMP had not used RTK equipment before, so using it was somewhat of an

experiment. The Altus dealer, Butler Survey Supplies, provided training and K Division members began to use them on some of the collisions.

"Once we got past the start-up glitches, we realized that these RTK units are sophisticated pieces of equipment," said Sergeant Sam Hewson, Collision Reconstruction Program Manager, K Division Traffic Services. "Once your RTK equipment is communicating well, the advantages become obvious."

This year, the RCMP has purchased an additional six Altus APS-3 sets. RCMP uses Allegro data collectors and MapScenes Evidence Recorder (EvR) software.

RCMP members investigating collisions often work under severe time constraints. The majority of serious collisions occur after hours in the evenings and nights and on weekends. Often heavy volumes of traffic are using the road where the accident occurred. The officer often must shut down the roadway to gather evidence. "We have to get on the site quickly, gather our evidence in



the shortest time possible, and leave the scene,” Sgt. Hewson said.

Sometimes the collision involves multiple vehicles, perhaps several semi-trailers and cars. That makes the investigation more complex and it requires more time. Traffic must be halted.

“We find that with the RTK GPS we can save about 40 to 60 percent of “on-scene” time,” said Sgt. Hewson. “We can set up quickly and get through the scene quite rapidly. It is a huge savings in time, which is critical to us on the spot.”

If you consider a four-way intersection with two cars that collided, it might take an hour to examine the scene and record locations using measuring tapes or a total station. But RCMP has found that once the GPS system is up and running, such a scene can be investigated and recorded in 20 minutes.

RCMP members like the Altus units because they take two batteries that are hot swappable and removable. Without that feature, if a battery dies halfway through an investigation, the RCMP member might have to shut down and

recharge the unit. That means switching to a different method of mapping the scene, or coming back later.

But with the Altus units, if one battery goes down, the RCMP member switches immediately to the other one. No time is lost. “We can run on one battery while charging the second and then swap out the battery,” said Sgt. Hewson. “We don’t have to power off the instrument and restart to change batteries. That saves us significant time.”

With the Altus units, the range between base and rover units is three to five kilometers. By changing antenna position, the range between units can be increased to 10 kilometers. With the addition of external radios, it would be possible to increase the range between units to 35 kilometers. That can save time by avoiding traverses that are required with a total station. “Recently we mapped a murder scene that would have required seven traverses with a total station,” said Sgt. Hewson. “But with the GPS system, the operator was able to set up the base unit once and work from there.”

On the Scene

Upon arrival at a collision scene, the RCMP member sets up a base station and links it to a rover unit. The two communicate by radio. Available frequencies that do not interfere with something else are easy to find. Plus or minus one centimeter accuracy is quite sufficient for collision reconstruction.

If time is extremely limited, and the RCMP member must open the road quickly, it may be necessary to develop a traffic-oriented plan to clear the road. The Force member may start on one side of the roadway and gather evidence there first so that a shoulder can be cleared, then the first lane of traffic, next the second, and so on until all lanes are cleared.

The points to collect are the points needed to draw the scene. A CAD program needs those points to reproduce the scene of the collision. A simple straight two-lane road with shoulders requires ten points: the road edge, the fog line, the centerline, the opposite road edge, and the opposite fog line—all at both ends. The drawing will connect the points from end to end.



RCMP measurements are used to create a formal drawing of the scene to present in court.

The locations of signs—stop signs, yield signs, curve signs and so forth—are important and must be recorded. If those features have a bearing on the collision, the RCMP member collects them. Sight lines are important and can be measured.

Other than the roadway features, the collision reconstructionist collects physical evidence at the scene. The positions of vehicles after the collision are vital, as are the marks the vehicles make prior to the collision. Skid marks need to be measured, collected and recorded. The locations of gouge marks made by a vehicle during the collision must be collected and recorded.

After collecting all of those points, they are downloaded from the data collector into a CAD program. The data points are then used to make a drawing of the scene.

The drawing is only one part of what a collision reconstructionist does. The


RCMP member also takes measurements and photographs to illustrate points. The drawing shows an overview of what the event looked like. The courts use this information because they are trying to determine whether there is guilt or innocence by the persons involved.

Speeds are important to determine. How fast was a vehicle traveling before the impact? Could the person have reacted sooner if he had been more alert or sober?

The drawing can assist when using momentum to determine the speeds of one or more vehicles in the event. With some drawing programs, one can import Google Earth photos into the drawing and create a 3D photograph with the data incorporated in it.

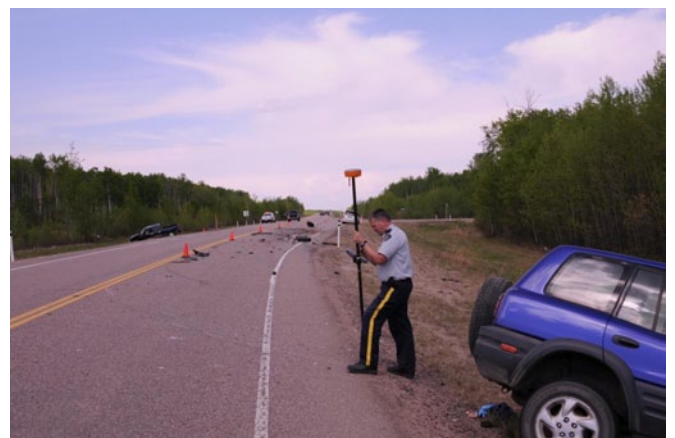
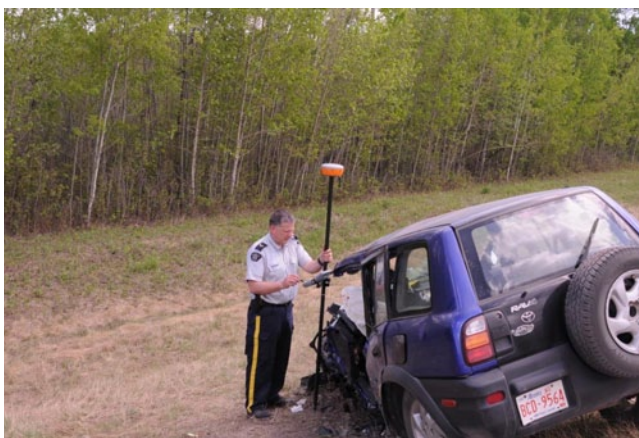
Some CAD programs can animate the collision. You can see the vehicles driving and animate it with them moving. With some programs you can introduce

camera views, or a view from overhead of the collision.

Sgt. Hewson says K Division's experience in moving from measuring tapes to total stations to RTK systems has been positive. The RTK systems are more expensive than a two-person total station, but because RTK units only require one person to operate, they are more efficient. They are easy to learn, and they permit on-site investigations to be completed 40 to 60 percent faster. That minimizes traffic disruptions and inconvenience to the traveling public. 

All photos courtesy of the Royal Canadian Mounted Police.

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An RCMP member collects points needed to map the accident scene.