

# **Motor Vehicle Accident Forensic Survey**

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**Key Words:** Motor Vehicle Accident Reconstruction Process

## **SUMMARY**

The phrase “Forensic Surveying” can represent many types of crime scene surveys. Forensic surveys consist of homicides, bomb explosions, building collapses, motor vehicle accidents, and much more. The precision of a forensic survey has many determining factors such as weather, human error, the response time of a forensic surveyor and the equipment used. Forensic surveys have come a long way in the equipment that has been used in conducting the survey, from tapes to total stations. For a forensic survey to be the most accurate it can be that the scene has to remain undisturbed. Once the survey has been complete the data is then imported in to Crash Zone, an AutoCAD based program. Once all the data has been collected, processed and made into diagrams an accident re-constructionist will have a pretty good idea whether it was the fault of a driver or what the key components were that caused the accident and could present them to a court to prove it.

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## **1. INTRODUCTION**

The phrase “Forensic Surveying” can represent many types of crime scene surveys. Forensic surveys consist of homicides, bomb explosions, building collapses, motor vehicle accidents, and much more. The precision of forensic surveys can vary for many reasons. Today’s forensic surveys when compared to surveys before total stations have very little, if any difference in them besides how they were surveyed. Motor vehicle accidents use to be very difficult, for forensic surveyors to complete and still can be. A re-constructionist is always racing the clock on collecting data in the field, due to the fact that vital evidence can be compromised easily due to weather and to other people. That’s why it is so important that a forensic surveyor / re-constructionist be informed of an incident right way. Once the re-constructionist has arrived it is crucial that they be briefed on what happened and then allowed to collect data with out any major interruption. After the data has been collected in the field it is down loaded to an AutoCAD based program in which the re-constructionist can figure out what happened at the scene, and create a diagram that could be used in court if necessary.

## **2. PRECISION DUE TO HUMAN ERROR VS. EQUIPMENT/INSTURMENT ERRORS**

The equipment that is used today by forensic surveyors has a precision of plus or minus 3 millimeters. The actual precision of a forensic survey is in the hands of the surveyors. A forensic survey’s precision has several major factors. The first one is that as soon as a scene happens it starts to disappear. An example is a skid mark left by a tire. The skid mark is created due to heat and friction, and as soon as it starts to cool the skids outer edges start to disappear. But for large pieces of evidence such as motor vehicles, the precision depends on the prism man, on how level and close the prism is to the evidence. These are all major determining factors in the precision of a forensic survey. Besides the evidence and human faults, errors could also be caused due to equipment.

## **3. EQUIPMENT USED BY OREGON STATE FORENSIC SURVEYORS**

The Oregon State Police have several types of total stations that they use today in the field. The majority of the total stations they have are Leica 1610’s and Leica 1010’s. These total stations are slowly being replaced by the Sokkia Set 530R3. Even though these pieces of equipment allow forensic surveyors to survey a large area faster than they were able to do before the equipment was available, Oregon State Police still use some of the older techniques to survey smaller scenes. If a scene is small they may opt to use tape measurement, because

the amount of time it would take to setup the total station and start shooting points they could have a small scene basically measured out, by using tapes.

#### **4. BEFORE TOTAL STATIONS / TRANSITION TO TOTAL STATIONS**

Oregon State Police used to survey every scene by using tape measures and recording the distances of evidence from a central point. This data was then taken back to the office and a drawing was produced. Then as total stations started to be used by Oregon Department of Transportation, forensic surveys were handed over to Oregon Department of Transportation to be completed. ODOT was notified of any accidents and then reported to the scene to complete a survey. Once ODOT completed the survey they would then return to the ODOT office and produce a diagram of what happened and that would then have been given to Oregon State Police. Over time as Oregon State Police bought their own total stations they were trained on how to use them by the Oregon Department of Transportation. Eventually Oregon State Police took over the surveying of scenes and Oregon Department of Transportation was no longer used to survey scenes. But Oregon Department of Transportation is still used to train Officers on how to use the surveying equipment.

#### **5. CRIME SCENE PROTECTION OR FIRST ON SCENE**

The first officer on scene has several duties before the re-constructionist arrives on scene. They first need to determine if the scene is safe for themselves and others who may be in or near the facilities of the scene. After determining that the scene is safe, they then check on the victims, and administer first aid as needed. Once everyone has been attended to, protection of the scene is top priority. This could consist of restricting sightseers or other vehicles from driving over top of the evidence.

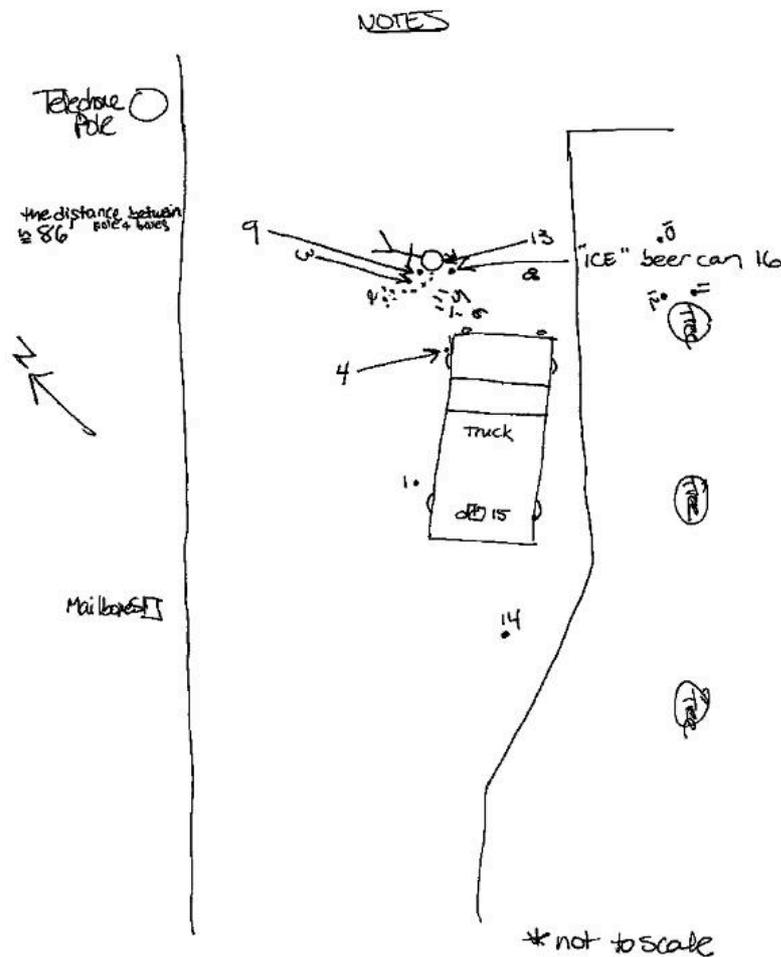
#### **6. ARRIVAL OF RE-CONSTRUCTIONIST**

When the re-constructionist arrives on scene the first thing that happens is they are briefed about the scene. Once they have been briefed they do a walk around, through out the scene. While they are walking around the scene they are completing a quick sketch of what they see. During the walk around an officer is also using spray paint and marking where everything is at. Such as, the beginning and end of skid marks and yawes, to the position of bodies if they were ejected from the vehicles. After completing the walk around, the location of where the total station is going to be set up is determined. The total station is usually located on the edge of the road and at a location that will allow the officers to take shots of everything with out having to relocate the instrument during the survey. After locating the point in which the instrument is going to be set up at, a "PK nail" is inserted into the ground as reference one. Once the total station is set-up they locate a utility pole in the near facilities of the scene and shot it as the second reference for the data in which is collected during the survey. Once the second reference has been shot, then the scene is shot. During the process of shooting a scene, it may take up to three officers. The two officers are located at the

instrument; one is running the instrument while the second officer is recording the information in a field book. The third officer is walking around the scene with the prism. The officers will shot in what they think is important for the investigation. In a forensic survey there is never to may shot's that can be taken, the more there is the more clarification the diagrams will provide.

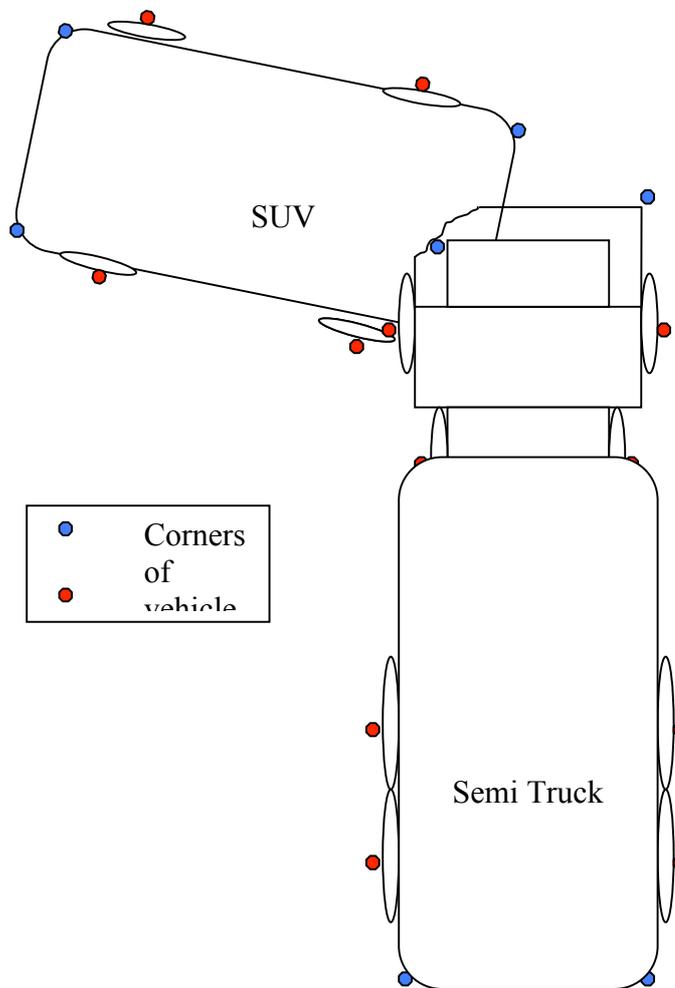
### 6.1 EXAMPLE DIAGRAM OF SKETCH'S

The sketches are not to scale; it is just for a reference as to where the vehicles and evidence are located from the accident. Sketches usually contain the following but are not limited to these items: vehicle's location/position, mail boxes, utility poles, trees, beer cans, and any other evidence, all of these items on the sketches are usually numbered and correspond with a list of evidence in which was collected at the scene.



## 6.2 PLACEMENT OF SHOTS AND PRIORITY

There is a wide range of what is shot-in at a scene. The first items to be shot-in at a motor vehicle accident scene, is the skid/yaw marks. These marks are created do to friction between the tires of the vehicle and the pavement. When the friction between the two heats up; it brings the oils from the pavement to the surface. As the skid/yaws cool the outer edges will start to disappear, making it hard for the officers to determine the actual starting and end points of the skids/yaw marks. After shooting-in the skids/yaws they begin to work on shooting-in the rest of the scene. If a body has been ejected from a vehicle they will take shots at the top of the head, hands, feet and one in the center of the chest. Shots will also be taken where skin and clothing may be on the pavement due to a body sliding across the pavement. When it comes to vehicles the officers will take a shot at the end of each axle and the corner of the vehicle. If the vehicle has been caved in as shown in the diagram below they will take a shot in the middle as a reference to were the vehicle's hit. If the vehicle went off the road and hit a tree the officers will shot-in the tree as well as other trees that are near it. Other items that may be shot-in are mailboxes; driveways, trees, fences, and any other thing that would help clarify why a scene looks the way it does.



## 7. OFFICE WORK

After the completing of all of the field work the officer(s) will then return to the office, to process all the data collected at the scene. The information on the data collectors is downloaded, then imported into an Auto CAD software called “Crash Zone”. Once the data is imported in to Crash Zone, an officer can then connect points creating diagrams which can then be used to determine what happened. The diagrams contain north arrow scale and location, date and time of the accident. These diagrams can usually give an officer a good idea of what happened before and during the accident, before the vehicles came to there final resting places. The following two diagrams are of accidents which have occurred in the last year and half in the State of Oregon.





## 8. CONCLUSION

Forensic Surveying will always have variation with the precision due to the fact that it might take a few minutes for a forensic surveyor to arrive on scene, and that as soon as the scene becomes one, the evidence starts to disappear. With the equipment that has become available to Oregon State Police officers, it allows them to collect more data faster and efficient, compared to when they measured out large scenes using tape measures. The evidence which is surveyed is only good to them if it has been undisturbed, and is in its original resting position after the accident. Even though it might not have been disturbed by humans re-constructionist are racing the clock to collect data quickly but accurately. Once all the data has been collected, processed and made into diagrams an accident re-constructionist will have a pretty good idea whether it was the fault of a driver or what the key components were that caused the accident and could present them to a court to prove it.

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My name is Daniel Helmricks, I'm a sophomore currently enrolled at Oregon Institute of Technology, in Geomatics (BS). During the summer of 2009 I worked for the US Department of Interior Bureau of Land Management Nevada, I worked out of the State office in Reno. In between college and work I'm apart of many societies/organizations, Boy Scouts of America, Dog 4-H, Professional Land Surveyor of Oregon, Professional Land Surveyor of Oregon Student Chapter on OIT campus, American Congress of Surveying and Mapping, Phi Delta Theta Fraternity, The Associated Students of Oregon Institute of Technology, Sigma Alpha Pi – National Leadership and Success, Psychology Club.

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