Easy Method for Collecting Vehicle Crush Profile Data

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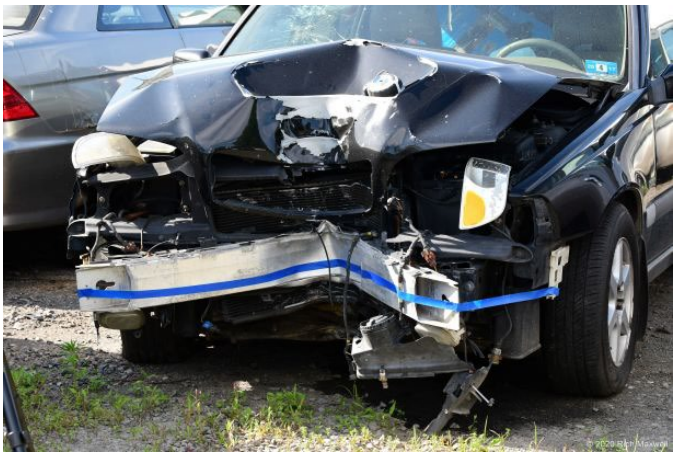
Photos and case study data courtesy of: Rich Maxwell, RLM Enterprises, LLC

Today's Crash Investigator makes use of all possible data sources at their disposal when reconstructing an incident. The more information that can be analyzed by the team, the more confidence they have in their assessment of the situation. Most of this data is collected with mapping tools and photography in short order right at the scene so it can be cleared quickly. However, some data like vehicle crush profile is typically not due to the time and personnel resources it requires. It is important to know this information when determining the maximum engagement between a vehicle and another object. It contributes to finding the principle direction of force, which is a critical parameter for the investigator. For example, crush profile is essential for putting vehicles together in scaled diagrams and showing the sequence of the crash.

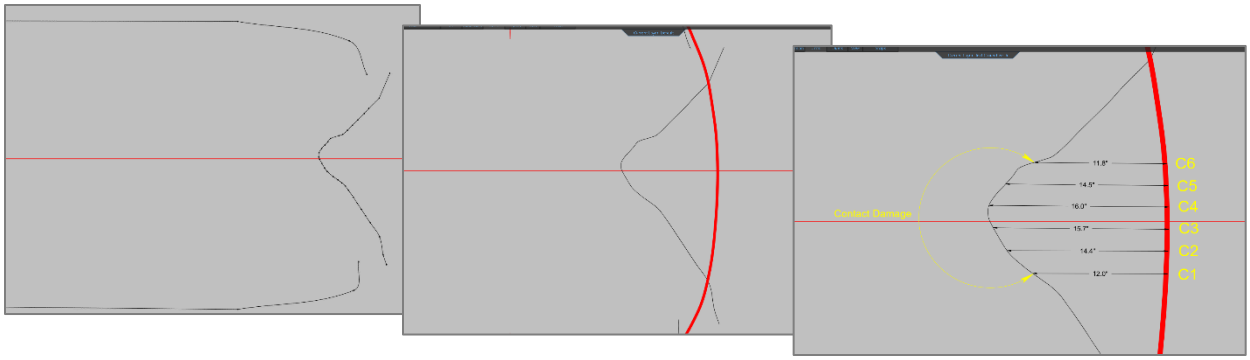
Measuring crush on a vehicle may be done by manual methods and the tools required to do the job can be inexpensive items like tape measures and simple levels. There are also slightly more expensive jigs or gauges that can be used to outline the damage with more accuracy. Two operators hold each end of the tool, and the data is recorded by hand. As is usual when delineating crush, one axis is set up laterally across the extent of the damage and then measurements are taken to the vehicle along another at right angles to it. Much care needs to be taken when measuring by hand, to keep everything square and record the data accurately.

Here is where high-tech comes in to play. A much better method is to use a total station type device, that measures horizontal and vertical angles, as well as distance to the target. These instruments do require a little bit of training but can be very simple to operate. And a single operator can collect all the data necessary, making best use of the available manpower. After a short setup procedure with the total station and software, data points along the line of crush on the vehicle can be collected in seconds. The operator can now capture more data, at whatever interval they choose. Perhaps one of the biggest benefits of this method is the accuracy it provides. Using very simple precautions, the operator can collect data that is more precise than the manual method and the survey is performed with very little risk of error. The investigator can have complete confidence in the results of a vehicle crush profile measured properly by a total station-type instrument. High-speed scanner technology can also gather very precise crush data. Large data sets are gathered with this method and very fine detail can be detected. Although more expensive than the manual tools, high-tech solutions make short work out of what can be a difficult measurement scenario.

The following case study demonstrates all the benefits of this easy to operate, high-tech method for measuring the crush profile on a vehicle that has been involved in a crash. A total station system was used along with a data collection app. The system is fully capable of recording all the important measurements for crush profile down to mm-level accuracy.



Access to the front of this vehicle where the damage in question occurred was already present, so moving a vehicle to gain sight to the entire extent of the damage was not necessary. It is always best to visibly mark the point of maximum impact and construct a 2D plane of measurement across the boundary of the deformation. In this case a strip of blue tape was used. The total station is positioned at a comfortable distance away from the vehicle so that the operator may walk in between them without risk of bumping the instrument. It should be positioned in a spot where all the significant surfaces of the damage can be seen with a clear line of sight. Next, a Backsight point is established nearby where the horizontal angle can be referenced to begin the survey and then checked after when complete for quality. Now in a matter of minutes, hundreds of data points could be collected, if necessary, with just the single operator. In this case, approximately 40 points were taken along the 2D plane that was marked. Other critical points of reference on the vehicle important to the crash investigator may be gathered at this time as well. These can be the corners of the body or more importantly, the axles or center of the wheels - which are critical in when comparing the data collected to an exemplar vehicle. If the spots happen to be out of direct sight of the total station, a target pole may be used to accurately locate points of evidence hidden from view. If more than one side of the vehicle has sustained damage that needs to be measured, the total station can be easily moved to another point and the survey of other crush areas continued. In this manner, all the points will be properly joined in the field and no stitching together of two data sets will be necessary later.



After the vehicle crush profile data is checked for quality in the field, it can be imported directly into any popular CAD based (or other) diagramming software. Above are shown screen shots from a typical CAD program being used to process the crush profile data. If we all remember the simple Baseline-Offset mapping method that was taught in academy, you can see how the crush measurements are broken down in the same manner. This data is then fed into equations for determining the speed of the vehicle from crush. In crashes where two vehicles are involved, the profiles will help to put them together at maximum engagement and show the principle direction of force.

There is no doubt that a crush profile of a vehicle can be an extremely useful piece of the puzzle for the Crash Investigator. Today's high-tech mapping method, using a simple total station system, makes the job of collecting this critical data quick and easy. Now this important piece of evidence can be gathered with a minimum impact on valuable resources.