Volume 5 Issue 1

CRASH TALK

IN THIS ISSUE

Vehicle Rollover Analysis

NEXT ISSUE: Toyota "Runaways"

Vehicle Rollover Analysis

By Martin J. Davidson, P. Eng.

In the United States in 2007 there were over 41,000 traffic related fatalities. Of these, almost 11,000 occurred in rollover collisions, or more than a quarter. Clearly, there is a need to understand the circumstances of these common events.

Rollover collisions can be classified into three categories; side-to-side roll, barrel roll, and end-over-end.

A side-to-side roll can take place as a result of steering input, a prior collision, a curb strike, a tire encountering softer ground, or a surface change such as a gravel shoulder to pavement transition.

Barrel rolls, also referred to as a 'tip over', are rollover events more commonly associated with tractor–trailers that tip over onto their sides and slide to a stop. A steep bank or snow filled ditch will trap a set of tires leading to a rollover. Loading factors may play a part in the event, and load shifting can contribute to a loss of control. Dynamic loads such as hanging meat or bulk liquids require additional attention to maintain control.

End-over-end rolls, sometimes referred to as "endos" are highly energetic rollover events. This airborne event, often a result of a vault, can be associated with riding up a guardrail, launching from embankments or roadside approaches.

Evidence gathering for rollover collisions should encompass four areas; the scene, vehicle exterior evidence, vehicle interior evidence, and electronic data retrieval.

At the scene the investigator should examine the rollover event as three distinct phases. These are the initial loss of control, the trip, and the tumble to final rest.

Tire marks on the pavement, gravel or grass surfaces lead up to the trip point during the first phase.

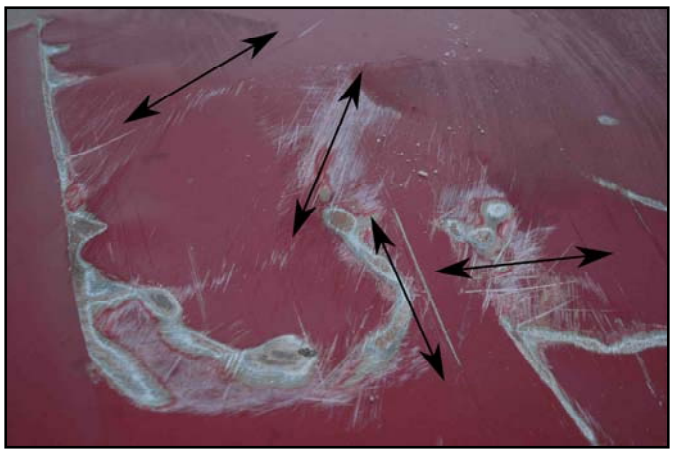
Prior to the initial trip the leading side of the vehicle may generate distinct roadway evidence. Asphalt, mud, and grass in the leading wheels may correlate to roadway evidence such as tire and gouge marks.

At trip, there is a distinct change in tire marks. Following the trip, the tumble phase can include impact gouges, a debris trail, occupant and cargo ejection.

The final vehicle point of rest can often be established by engine oil, battery or radiator fluid stains, and debris such as broken glass.

First rollover contact may take place at the leading or trailing roof edge, depending on the aggressiveness of the event. The first contact will usually be the most energetic and usually results in the greatest roofline crush. This may be relevant for occupant identification and seating position issues.

Ground contact as the vehicle rolls can generate panel deformation and overlapping scratches with differing orientations indicating multiple contacts. For example, four distinct directions of overlapping scratching on this hood panel (above) would indicate the panel has contacted the ground four times, a result of the vehicle rolling at least three and one-half times.



An examination of the vehicle interior should include a seat belt examination - not only for occupant use evidence, but to verify proper seatbelt functionality. Occupant contact evidence such as the location of hair fibers, blood spatters, upper and lower dash imprints, and scuffs should correlate with the seat belt evidence.

Occupant ejections can be full or partial. The windshield, side windows, rear hatches, and sunroofs are common means of egress. As the vehicle often continues to roll during and after ejections, there is a strong likelihood that an occupant will be ejected forwards along the vehicle path (ahead of the rolling vehicle) and then be crushed by the vehicle. Partial ejections also carry a high likelihood of crushing and statistically tend to be the most likely to result in serious or fatal injury.

"GRC CRASHTALK" is produced by
Graham Ryan Consulting Ltd.
www.grahamryan.com

EDMONTON
#201, 17823-106 Avenue
Edmonton, AB T5S 2H1
Tel (780) 425-1150
Fax (780) 425-1555

CALGARY
#34, 11410-27 Street SE
Calgary, AB T2Z 3R6
Tel (403) 290-1150
Fax (403) 290-0659

If you would like to subscribe to "GRC CRASHTALK", have feedback, or wish to have CRASHTALK in pdf please e-mail us at crashtalk@grahamryan.com

Analysis methods include critical speed yaw (CSY), tumble to rest, vault trajectory analysis, and simulation (such as PC-Crash™) . The increasing sophistication of event data retrieval (EDR) technology allows for the possibility of obtaining information from an air bag control module (ACM), powertrain control module (PCM), or rollover sensor (ROS).

EDR pre-crash data may encapsulate information such as a loss of control speed, yaw angle, and steering inputs. In some cases, there may be a confirmation of restraint use for some seating positions.

As the automotive manufacturing industry moves towards compliance with United States Code of Federal Regulations Title 49 Part 563 (see CrashTalk Volume 2 Issue 2, Summer 2007), the likelihood of useful downloadable data being present for passenger vehicles will increase. The investigator should consider either capturing the available data *in situ* or harvesting the available modules for a later download and analysis.

Martin J. Davidson, P.Eng. has been with Graham Ryan Consulting Ltd. since 1999. He has a background in commercial vehicle accident investigations with the largest bulk commodity trucking company in North America.

Did you know?

Graham Ryan Consulting Ltd., offers accredited presentations for your staff on all vehicle accident reconstruction topics. Contact one of our offices for details.

Crash Corner

In the US in 2007, there were 41,059 traffic fatalities, of whom 10,896 occurred in rollovers. Of these, 7,213 were unrestrained, 2,983 were restrained and 700 were unknown / unclassified.
Source: Fatality Analysis Reporting System (FARS)

Recalls

On several Toyota models, 2005 to 2010 the accelerator pedal may become rough or stick, which could lead to a loss of control and collision.

On Infiniti 2008 to 2010 M35, M45 and Nissan 2008 and 2009 Cube, Murano and Rogue the nut used to secure the sensor-transmitter of the Tire Pressure Monitoring System (TPMS) may corrode and crack causing rapid loss of tire air pressure. This may affect the vehicle control.