Identifying Thresholds for Run-Off-Road Events

Abhisek Mudgal
Institute for Transportation
Iowa State University
2711 S. Loop Drive, Suite 4700
Ames, IA 50010-8664
abhisek@iastate.edu

Shauna Hallmark
Center for Transportation Research and Education
Iowa State University
2711 S. Loop Drive, Suite 4700
Ames, IA 50010-8664
shallmar@iastate.edu

ABSTRACT

Run-off-road crashes cause one-third of all traffic fatalities, and two-thirds of those crashes occur in rural areas. In order to better address run-off-road and other crashes, the Strategic Highway Research Program 2 (SHRP2) program is planning a large naturalistic driving study that will instrument around 2,500 private vehicles. The advantage to the study is that it allows a snapshot into all driving behavior. The data collected will allow researchers to observe actual crashes as well as situations, called crash surrogates, where a crash may have occurred had the situation been slightly different. However, since a large amount of data will result, it will be necessary to identify vehicle parameters that indicate that a vehicle has left the roadway or its lane of travel. The Center for Transportation Research and Education at Iowa State University is working on a preliminary project to identify critical thresholds that indicate a run-off-road event has occurred. The study is attempting to identify vehicle kinematics, such as a lateral acceleration of a certain magnitude, which indicates this has occurred.

Key words: critical threshold—natural driving study—run-off-road crashes
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Abhisek Mudgal\textsuperscript{1}, Shauna Hallmark\textsuperscript{2}, Institute for Transportation, Iowa State University

\textbf{SUMMARY}

In order to better address run-off-road and other crashes the (University of Michigan, Transportation Research Institute) UMTRI has done a initial data collection pertaining to vehicle kinematics and driving behavior.

Run-off road events are followed by roll-over events which form the basis of this work. Thresholds are identify which would indicate whether a vehicle would roll over and thus run off the road. We are linking into UMTRI data for lateral acceleration of a certain magnitude which indicates this has occurred. Equations were derived and preliminary analysis was done.

\textbf{DATA USED}

- UMTRI driving study data
- Forward Speed
- Radius road curvature was estimated using vehicle traces and GIS (ArcMap 9.3)

\textbf{RESULT}

\textbf{ANALYSIS}

- NHTSA uses static stability factor
  \[ SSF = \frac{\tau}{2h} \]
  \( \tau \) = track width,
  \( h \) = height of centre of gravity
- Need for taking into account the dynamic nature
  \[ a_{\text{threshold}} = \frac{t}{2h} + \varphi - \frac{v^2}{gR} \]
  \( \varphi \) = is the road grade,
  \( v \) = vehicle forward speed
  \( R \) = radius of curvature for the road
  \( g \) = acceleration due to gravity (9.8 m/s\(^2\))
- If the vehicle is moving on a flat straight road, \( \varphi \) becomes zero and \( R \) is very large
  \[ a_{\text{threshold}} = \frac{t}{2h} = SSF \]

\textbf{CRASH STATISTICS}

- Run-off-road crashes
  - 15\% of all crashes reported in FARS,
  - 1/3\% of all fatal crashes.
- NHTSA reported 10,666 fatalities in roll over crashes (Roll over crashes are considered in this work).

\textsuperscript{1} Abhisek Mudgal, graduate Student, Institute for transportation, Iowa State University, Ames, IA
\textsuperscript{2} Shauna Hallmark, Traffic Engineer, Institute for Transportation, Iowa State University, Ames, IA