3D Spatial Visualization Analysis of Safety Related Driving Events of Newly Licensed Teens in Proximity of Home and School

Tika Ram Adhikari, Daniel V. McGehee, Michelle Reyes, and Cher Carney

In 2005, motor vehicle crashes (MVCs) accounted for more teen deaths (5,253) than homicide (2,219), suicide (1,809), and all forms of cancer (981) combined. Fatal crashes of teenagers, especially of newly licensed teens, are higher than for any other segment of the population. In fact, the crash rate per mile driven for 16-year-olds is roughly four times that of drivers of all ages (61.4 per 1,000 drivers vs. 16.8 per 1,000 drivers).

Existing data recorders and global positioning systems can provide data to parents on general driving behavior (e.g., speed, acceleration, location), and while there is a lack of research on traditional monitoring technologies, recent studies have shown that event-triggered video-based interventions may have the potential to improve driving safety among teens.

A byproduct of such event triggered video recorders is additional location data for safety related events (e.g., abrupt braking, steering or accelerating). Integrating naturalistic driving location data into GIS models offers new opportunities to explore spatial patterns of safety related driving events. Geospatial technologies allow the integration of multiple datasets so that data can be visualized. In this context, spatial proximity analyses and visualization can assist pattern exploration of safety related driving errors to predict driver behavior. In this paper, we investigated such safety related driving errors in the proximity of a new licensed teen’s home, and in their primary destination, school.

In this analysis, forty-six newly licensed teen drivers aged 14-16 were recruited from three rural high schools in eastern Iowa. There were 1,756 safety related driving errors recorded using event triggered video recorder (see Carney et al, 2010, McGehee et al, 2007). Safety related driving errors (events) and home addresses were geocoded into a local geographic coordinate system. Spatial distribution of the safety-related events were visualized in a 3-dimensional space along with 1 meter resolution of satellite imagery, detailed road network, and a digital elevation model using the available visualization facilities of ArcGIS 10. To examine the concentration of the safety related driving errors relative to the proximity of the home and school location, different radii were created around the participant’s home and school address. The safety related driving errors were aggregated in these radii and analyzed spatial variation of these events using a Chi-Square test.

Results indicated that the majority (87.25%) of safety related events (e.g., abrupt braking, steering and accelerating) occurred within 1/10th of a mile from their home and 12.75% occurred around school. A Chi-square analysis indicated that this difference is significant ($X^2 = 22$, $N=149) = 63.22$, $p<0.0001$). This study suggests that 3D visualization and spatial proximity analysis are complementary each other to explore the patterns and concentration of safety related driving errors relative to home and school.

Key words: spatial visualization--naturalistic driving data--teen driving

References
