

ROADWAY SAFETY INSTITUTE

Human-centered solutions to advance roadway safety

Smartphone-Based Teen Driver Support System

#1 Teen Safety Problem

Although teen drivers make up a small percentage of the U.S. driving population, they are at an especially high risk of being involved in a crash. Factors that contribute to teen drivers' risk include their lack of experience and their tendency to engage in unsafe behaviors such as speeding, driving aggressively, or using a cell phone while behind the wheel.

An Innovative Solution

To help teen drivers stay safe on the road, researchers at the U of MN's HumanFIRST Laboratory have been working for nearly 10 years on the development of the Teen Driver Support System (TDSS). The smartphone-based system is a comprehensive application that provides real-time, in-vehicle feedback to teens about their risky behaviors—and reports the behaviors to parents via text message if teens don't heed the system's warnings.



The TDSS device, mounted on the vehicle's dashboard, provides visual and auditory warnings to the teen driver about speeding, stop sign violations, upcoming curves, and excessive maneuvers—hard turning, hard braking, and hard accelerations. It also prevents teens from using their phones to text or call (except 911) while driving. If an infraction continues after the TDSS warning, a text message is sent to parents. Information is also available to parents through weekly summary e-mails and on a website that summarizes and archives their teen's driving behaviors for review over longer time periods to help assess risky driving patterns.

Research and Field Test Results

In early 2015, the research team completed a 12-month field operational test of the system involving 300 newly licensed teens driving on Minnesota roads. The test included a control group that received no feedback, a TDSS group that received only in-vehicle feedback, and a second TDSS group that received both in-vehicle and parental notification. The study was designed to measure the effectiveness of the TDSS on teens' driving behavior and examine the benefits of providing real-time feedback to parents.

Research results indicate an overall safety benefit of TDSS, demonstrating that in-vehicle monitoring and driver alerts, coupled with parental notifications, is a meaningful intervention to reduce the frequency of risky driving behaviors that are correlated with novice teen driver crashes.

- Teens who knew TDSS would text their parents engaged in fewer risky behaviors over the course of the study. These teens were significantly less likely to speed or to exhibit excessive maneuvers—hard turning, hard braking, and hard accelerations; all factors associated with teen driver crash risk.
- Blocking cell phone use while driving was successful in significantly reducing the rate of calls and texts and nearly eliminating all potential distractions associated with smartphones.
- Parents and teens alike responded favorably to the TDSS, indicating they would recommend the system to others.

The TDSS is a tool to help equip parents with critical and timely information to effectively coach and supervise their teens' driving during a time when most teens increase risky driving behaviors—the first 12 months of independent driving.

Field Operational Test System Components

- A **smartphone that runs the TDSS app**. Drivers download the TDSS software application to their smartphone. The phone software downloads additional segments of the digital map containing speed limits and other roadway sign assets as the driver travels. The smartphone collects driving data and determines speed, excessive maneuvers, and stop sign violations and provides real-time feedback when system risk violations and/or thresholds are exceeded. The smartphone periodically sends the relevant data to laboratory data servers for storage and analysis. While the TDSS software is providing driving feedback, it blocks incoming phone calls and hides notifications for incoming text messages and social media applications.
- **Small on-board diagnostic device (OBD-II)**. This device communicates both with the vehicle and with the smartphone (speed, excessive maneuvers, and stop sign violations). Information is communicated wirelessly to the smartphone using Bluetooth technology. This device was used in the field operational test to track the vehicle at all times, even if the teenager's phone was turned off.
- A **digital map**. Digital data map for speed limit, stop sign, and curve data was obtained commercially.



System Deployment

The use of a smartphone platform for real-time alerts and feedback allows TDSS to be available to a wide-range of drivers seeking to strengthen safe driving behaviors—newly licensed drivers, commercial vehicle drivers, and mature drivers. The University is exploring options for deployment of the TDSS without the OBD-II. At present, the system is not available to the public.

TDSS vs. Other Market Devices

The TDSS is a unique feedback system that provides geographically specific, real-time feedback to a teen driver at the time unsafe driving behavior occurs so that behaviors can be immediately corrected, resulting in reduced crash risk. Other market devices document and record unsafe behavior, and some prevent text and cell phone communication, but none are as comprehensive as the TDSS in providing context-based feedback to immediately alert the teen making risky driving decisions. The real-time text messages mean parents can engage in conversations with their teen soon after violations occur. This makes any potential consequences more salient and directly linked to specific behaviors. In addition, the weekly summary e-mail and website allow parents to track behavioral patterns and provides updates about positive improvements in behavior over time.

TDSS Supports Novice Driver GDL Requirements

- Nighttime driving curfew alerts to parents.
- Supports supervised driving and nighttime supervised driving logging requirements using parental key FOB.
- Cell phone blocking and silencing notifications for incoming calls, texts, e-mail, and social media.
- Speed alerts help prevent teen moving violations and resulting delayed full licensure penalties.

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