The use of video feedback in urban teen drivers

Proposal Submitted to:

General Motors
Iowa Department of Transportation
Minnesota Department of Transportation

By

Daniel V. McGehee

THE UNIVERSITY OF IOWA

Nicholas J. Ward

THE UNIVERSITY OF MINNESOTA
ITS INSTITUTE

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PROPOSAL

Project Title:	The use of video feedback in urban teen drivers
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Principal Investigators:	Daniel V. McGehee (University of Iowa) Nicholas Ward (University of Minnesota)
Team Members:	Cher Carney, John Lee. Mireille Raby, Lisa Troyer (University of Iowa) Jan Creaser, Mick Rakauskas (University of Minnesota)

1. Project Objective

The objective of this project is to examine the use of event-triggered video feedback to reduce urban teen unsafe driving. Using system and parent feedback, we hope to significantly reduce the number of unsafe driving behaviors of newly licensed urban teens. This research project is different from other interventional studies because it gives clear, in-context driver feedback in the form of video and audio of the entire event. It is hoped that such feedback will help teen drivers improve their driving for the long-term so that they learn to anticipate other traffic and maneuvers.

2. Project Administration

The Iowa Department of Transportation will serve as the lead state for the execution of this pooled fund study. The Iowa Department of Transportation, through the Human Factors and Vehicle Safety Research Division at the University of Iowa Public Policy Center, will therefore handle all administrative duties associated with the work. The University of Iowa will also serve as the lead research institution for the project. The Minnesota Department of Transportation and General Motors Corporation will serve as the other funding partners. MnDOT's interest is to examine technology solutions for the teen driver crash problem. GM's interest in the project is to learn more about teen driver behavior and event driven video as a research tool.

3. Project Background

Newly licensed teens have an extremely high risk for crashes. According to the Insurance Institute for Highway Safety, in 2003 there were 5,691 teenagers (13-19 year olds) that died in motor vehicle crashes (IIHS, 2003). This amounts to more than a third of deaths from all causes for teenagers (Chen, Baker, Braver, & Li, 2000; IIHS, 2005). Thus, motor vehicle crashes are a primary cause of death amongst young teens. Moreover, teen drivers (15 to 19 years) are the demographic group with the largest number of fatalities in the state of Minnesota as shown in Figure 1.

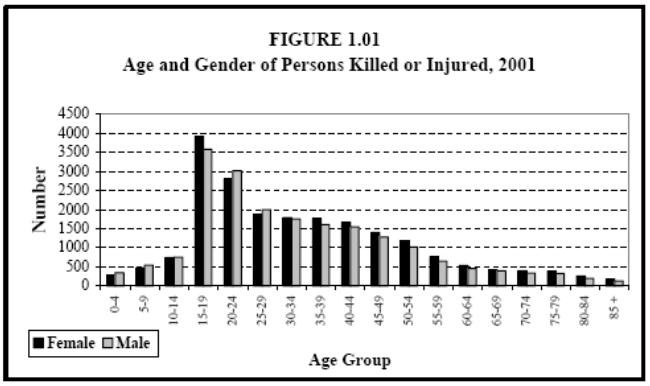

Figure 1. Number of fatalities in Minnesota by driver age (Minnesota Motor Vehicle Crash Facts, 2001)

In response to the epidemic of teen driver fatalities, the Universities of Iowa and Minnesota propose leading a pilot project examining the use of new methods to motivate safe teen driving. This method will examine teen driving during the first 6-12 months after obtaining a driver license and is based on using an event-triggered video system to record and give feedback about unsafe driving behavior for teen drivers. The system provides two forms of feedback to the teen driver. First, the system gives blinks and LED to tell the driver that an event trigger has been detected and recorded. Second, video feedback recorded during the unsafe driving episodes is combined with a parent-teen 'coaching' protocol. The coaching protocol is used to provide support for expected behavioral changes in teen drivers. This pilot research program will provide new insights that can be applied to the long-term development of positive driving habits for urban teens.

Iowa and Minnesota human factors researchers will study teens using naturalistic methods to capture potentially unsafe driving. Such methods mean that drivers will use their own vehicles rather than test vehicles or simulators. About the size of a deck of playing cards, the event recorder is mounted behind the rear-view mirror (see Figure 2). The system will be installed into urban teens' vehicles to capture potentially unsafe driving behaviors. Only certain 'unsafe' events will 'trigger' the system to begin recording a 20-second video and audio clip. Triggered events include situations where a driver exceeds a lateral or longitudinal physical limit, such as when abrupt accelerations, braking or erratic steering occurs. Data from the on-board diagnostics port, such as speed, throttle position and brake activity may also be recorded and synched with the video clips. The video data makes it possible to understand the context of the unsafe event and the task occupying the driver at that time, such as distraction or risky behaviors with passengers.

Figure 2. DriveCam event recorder

The central issue to be studied is how these brief video events of unsafe driving can be used in the context of 'teachable moments' both for parents and teens. 'Coaching' protocols for parents to use in discussing the unsafe events will be developed. Parents receive a weekly report card of their teens driving that describes each event in narrative form. Unsafe events are tracked for each driver by week and month for themselves as well as against their peer group (figure 3). It is hoped that improved safety in driving will result when 'report card' information is communicated between parents and teens.

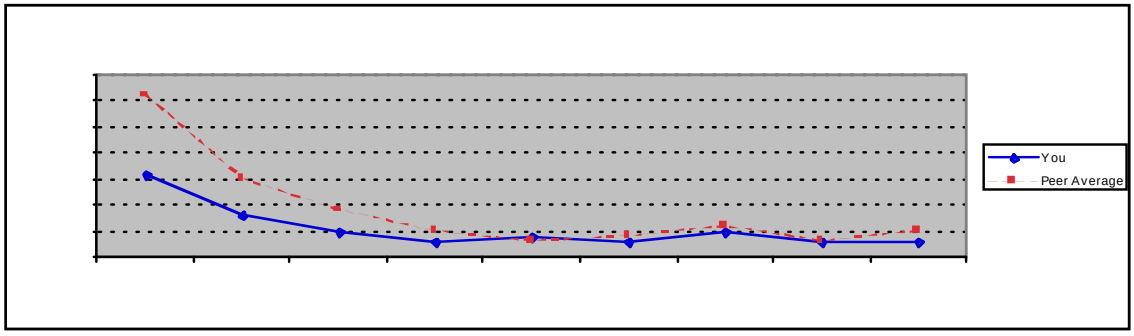

Figure 3. Safety relevant events of each driver and peer group.

The proposed study will recruit 40 teens (20 males and 20 females) from one high school in the twin cities area. This study would be built on the framework and protocols of a rural teen driver study currently underway in rural Tiffin, Iowa being conducted by the University of Iowa.

Data will be collected with and without system and parental feedback. Following the baseline period with no feedback, the LED and parental feedback will begin. The system

will remain in the cars for six months and the data will be downloaded weekly through a wireless network located in the high school parking lots of the respective cities.

4. Work Plan and Task Structure

Task 1. Select urban high school.

Urban high school crash causes differ from their rural counterparts because of the roadway structure and traffic patterns in cities. Crash rates among urban youth are higher than those in rural areas, however they are generally less injuries and fatal by mile traveled. Urban high schools in the Twin Cities will be examined to determine which is the most representative for teen crash rates for the state. Principals will be contacted to determine whether such a program would be supported. Study researchers will need some access to students during school hours.

Deliverable: A short report on the description of the selection process and the rational of why the final high school was selected.

Task 2. Obtain Institutional Review Board (IRB) and NIH Certificate of Confidentiality

Any study that involves minors has an extra burden to ensure that confidentiality of all data (video and electronic) is maintained at the highest level. The University of Iowa has obtained both IRB and NIH approval for the rural teen study currently underway so a precedent has been set. However, adjustments in protocol, and reviews in each participating state will require additional time and resources.

Deliverable: All IRB related documents and NIH certificate of confidentiality.

Task 3. Finalize research questions

In order for each state to answer questions that are relevant to their local jurisdictions, the UI and UMN research teams will ensure that a comprehensive and focused set of research questions are addressed. A draft set of questions will be supplied for review and comment and joint meetings will be held in person or via telephone conference call.

Each video clip of an unsafe driving behavior will be categorized into a set of precipitating factors. A preliminary list of factors might include:

- Distraction
- Attention
- Awareness
- Attitude and demeanor (anger, rage, lack of concern)
- Outcome (crash, near-miss, traffic law violation)
- Seat belt on/off

These factors will be used to better understand the driving styles and errors of the drivers inducted into this pilot study. Additional environmental factors will also be examined, such as road type, weather conditions, time-of-day, and unusual traffic.

Deliverable: A report on the final data coding strategy.

Task 4. Recruit teen participants

Using a variety of word-of-mouth, school assemblies, and media campaigns, we will solicit teen volunteers from the high schools of interest. In order to attract participants to the project, we will offer monthly compensation of $25. Additional compensation will be provided for installation, surveys and removal of the system. We will budget $300 per subject for compensation.

Deliverable: A status report that describes the number of participants that have volunteered along their gender, age and driving experience.

Task 5. Instrument Vehicles and Parking lots

A subcontract with DriveCam to fund the purchase and installation of the systems into each of the participant's vehicles will be let. In addition, each high school parking lot will be equipped by DriveCam, Inc. with a secure wireless network so that video files are automatically downloaded and sent over a secure network to the UI and UMN. DriveCam will also provide onsite support for any systems that malfunction.

Deliverable: A status report on the instrumentation phase and any difficulties that may have occurred.

Task 6. Baseline data collection

Data collection will begin with a one-month baseline period of driving without feedback. Drivers will have the system in the car but will receive no feedback in the form of LED lights or parental feedback. This period of time will be used to allow drivers to get used to having the system in the car and to capture 'normal' driving. Data will be downloaded automatically on a daily basis via the school parking lot wireless network. Video clips will be coded during this time.

Deliverable: A status report that describes an overview of the number and type of safety relevant events among the participants.

Task 7: Data collection with feedback

After the four-week baseline, the DriveCam systems will have their feedback LED lights turned on. Teens and parents will receive a CD in the mail with feedback during this four-month phase. Parents will coach their first session at home after a mock coaching

session that will be held during the installation phase. Parents will receive a CD in the mail for review each week. CDs will come with appropriate communication strategies that parents can use. Parents and teens will have weekly "coaching sessions" where the most recent events are reviewed along with the standard messages for the broad category of concerning driver behavior.

Once there are enough data from all drivers, the coaching session will also include review of teen's performance compared to their peers. A weekly report card will be supplies with the CD that show progress or lack thereof.

Deliverable: A status report that describes an overview of the number and type of safety relevant events among the participants during the feedback phase.

Task 8: Data collection: Baseline 2, no feedback

Of overall interest is to determine whether such systems have an effect on safety related behaviors for the long-term. Since this is a very limited pilot study both in terms of number of participants and time, there are limitations with what we will be able to determine with the data. We would like to, however, examine different effectiveness measures for the future large-scale studies that will have many more participants and much longer time. It is hoped that the use of such systems will lead to life-long changes in safe driving behavior.

A second baseline period with no feedback will commence after 4 months of feedback. Each vehicle will have the LED feedback light turned off and parents will no longer receive triggered events for an additional two month time period.

Deliverable: A status report that describes an overview of the number and type of safety relevant events among the participants during the second baseline phase.

Task 9: Final data analysis

Following a seven-month data collection, the systems will be removed from the participants' vehicles. Final data analyses for the three phases of the study will be finalized and run.

Deliverable: Data analyses will be presented in the final report.

Task 10: Final reporting

Deliverable: After the data analyses are complete, the final report with executive summary will be produced for all partners. Tech transfer issues will also be addressed along with future recommendations and implementation strategies. In addition to the final report, a mini-conference will be planned to present the results directly to the partners and Technical Advisory Committee. Approved photos and selected videos may also be released for additional documentation by the partners/TAC.

5. Research Team

The Human Factors and Vehicle Safety Research Division at the University of Iowa Public Policy Center will serve as the lead technical team with the University of Minnesota providing on-site logistical support. Senior human factors analysts will both universities will be involved on the project.

The UI team will be Dan McGehee, Cher Carney, Mireille Raby, Lisa Troyer and John Lee.

The UMN team will be Nic Ward, Mick Rakauskas, and Jan Creaser. Both institutions have a long track record in the collection of driver performance and behavior and have run several large-scale field, test track and simulator studies.

6. Research Tasks and Team Involvement

Task	U of Iowa	U of Minn
Task 1. Select urban high school	***	**
Task 2. Obtain Institutional Review Board (IRB) and NIH Certificate of Confidentiality	***	**
Task 3. Finalize research questions	***	*
Task 4. Recruit teen participants	*	***
Task 5. Instrument Vehicles and Parking lots	***	*
Task 6. Baseline data collection	***	*
Task 7: Data collection with feedback	***	*
Task 8: Data collection: Baseline 2, no feedback	***	*
Task 9: Data analysis	***	*
Task 10: Final reporting	***	*

*** = Heavily Involved; ** = Moderately Involved; *= Involved

7. Timeline

Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Task 1. Select urban high school																		
Task 2. Obtain IRB and NIH Certificate/Approval																		
Task 3. Finalize research questions																		
Task 4. Recruit teen participants																		
Task 5. Instrument Vehicles and Parking Lots																		
Task 6. Baseline data collection																		
Task 7: Data collection with feedback																		
Task 8: Data collection: Baseline 2, no feedback																		
Task 9: Data analysis																		
Task 10: Final reporting																		

Months after award

8. Budget

Task	U of Iowa	U of Minn	Total
Task 1. Select urban high school	$ 7	$ 3	$ 10
Task 2. Obtain Institutional Review Board (IRB) and NIH Certificate of Confidentiality	$ 7	$ 3	$ 10
Task 3. Finalize research questions	$ 12	$ 3	$ 15
Task 4. Recruit teen participants	$ 5	$ 22	$ 27
Task 5. Instrument Vehicles and Parking lots	$ 70	$ 3	$ 73
Task 6. Baseline data collection	$ 12	$ 3	$ 15
Task 7: Data collection with feedback	$ 35	$ 5	$ 40
Task 8: Data collection: Baseline 2, no feedback	$ 12	$ 3	$ 15
Task 9: Data analysis	$ 12	$ 3	$ 15
Task 10: Final reporting	$ 17	$ 3	$ 20
Total	**$ 189**	**$ 51**	**$ 240**

Drivecam, Incorporated will receive a subcontract to pay for the individual units, installation, secure wireless network install at the high school. Total subcontract amount to DriveCam is estimated at $50K.

To distribute the task load evenly between the partners, task funding will be divided so that each partner contributes $80K over the course of the project. Additional funds could be requested from the partners to continue data collection with feedback beyond the four months currently budgeted.

Task	Iowa DOT	MnDOT	GM	Total
Task 1. Select urban high school	$ 10	$ -	$ -	$ 10
Task 2. Obtain Institutional Review Board (IRB) and NIH Certificate of Confidentiality	$ -	$ 10		$ 10
Task 3. Finalize research questions	$ -	$ 13	$ 2	$ 15
Task 4. Recruit teen participants	$ 27	$ -	$ -	$ 27
Task 5. Instrument Vehicles and Parking lots	$ -	$ 35	$ 38	$ 73
Task 6. Baseline data collection	$ 15	$ -	$ -	$ 15
Task 7: Data collection with feedback	$ -	$ 20	$ 20	$ 40
Task 8: Data collection: Baseline 2, no feedback	$ 15	$ -	$ -	$ 15
Task 9: Data analysis	$ 13	$ 2	$ -	$ 15
Task 10: Final reporting	$ -	$ -	$ 20	$ 20
Total	**$ 80**	**$ 80**	**$ 80**	**$ 240**

9. Technical Advisory Committee (TAC)

The TAC will be comprised of the following members:

Iowa DOT	*Minnesota DOT*	*General Motors*
Sandra Larson	Ray Starr	Linda Angell
Scott Falb	James Klessig	

The TAC will meet twice during the project. The first meeting will be held after the baseline data (after approximately the eighth month of the project) are collected. The second meeting will be to brief the TAC on the final results and recommendations.

Quarterly progress reports will be submitted to the Iowa DOT and emailed to call TAC members throughout the project. Iowa DOT will post progress reports to FHWA's pooled fund web site.

Investigator contact information:

Daniel V. McGehee (Principal investigator)
Director
Human Factors & Vehicle Safety Research Division
Adjunct/Colleges of Engineering & Public Health
University of Iowa
Public Policy Center/227 SQ
Iowa City, Iowa 52242-1192
Tel 319.335.6819
E-mail: daniel-mcgehee@uiowa.edu

Nicholas J. Ward (Co-principal investigator)
Director
HumanFirst Program
Department of Mechanical Engineering
University of Minnesota
111 Church Street, SE
Minneapolis, MN 55455
Tel 612.625.6446
E-mail: nicw@me.umn.edu

10. References

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