An Objective Evaluation of an Education-Based Distracted and Drowsy Driving Intervention for Teen Drivers in Rural America

by

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SUMMARY

There is compelling evidence to suggest that the risk of a fatal crash resulting from distracted and drowsy driving is highest among novice teen drivers in rural areas. Accordingly, it is rational to develop evaluations that are specific to this form of hazard and demographic group. Education and licensing is a form of intervention that can be broadly applied across a range of jurisdictions. The NHTSA Invitation for Application concludes that only a few education curricula are available for driver distraction and drowsiness nationwide. Those curricular that do exist provide limited education about methods to cope with these impairment conditions. Moreover, it appears that none of these curricular have been formally evaluated in terms of the objective impact on driver distraction and drowsiness nor associated driving behavior.

As early as 1985, McKnight noted that it may be advisable to introduce more safety-oriented driver training following initial licensing and after some driving experience has been gained. Consistent with this recommendation, the education module identified for evaluation in this proposal serves as an additional education component by focusing on the impairment effects of distraction and drowsiness on perceptual and decision-making skills. The proposed solution to be evaluated in this project involves a theory-grounded driver education module designed for the Montana State driving license curriculum to instruct novice teen drivers on the specific hazards of distracted and drowsy driving. Moreover, this intervention is feasible as demonstrated by its current implementation in Montana. This intervention may be broadly implemented by virtue of being flexible, portable, and linked to Graduated Driver Licensing (GDL) programs in various states.

The goal of this project is to quantify the behavioral effect of an education module specific to the hazards of distracted and drowsy driving for novice teen drivers in rural communities. This project will use a randomized mixed-factor design to evaluate the effect of module exposure on driving behavior and episodes of distracted and drowsy driving among a sample of students. Students will be randomly assigned to an exposure condition for the module (no exposure, exposure). Students will be observed over time during the data collection phase to assess short-term, long-term, and perseverance effects. The evaluation will be based on the measurement and characterization of driving behavior recorded by a remote data collection system fitted to participant vehicles during the data collection phases of this project.

The evaluation will assess the capacity of the module to affect changes in distraction and drowsiness amongst teen drivers receiving hazard specific training. It is important to recognize that the potential benefits of this traffic safety intervention for rural teen drivers are not limited to Montana. Indeed, the evaluation of this module and its demonstrated effects may generate interest in adapting and applying this form of intervention more broadly across all states – both rural and urban.

PROBLEM STATEMENT

The NHTSA *Distracted and Drowsy Driving* Invitation for Application provides a sufficient summary of the basis for concern with distraction, inattention, and fatigue as significant crash risk factors. Accordingly, this proposal will not restate these concerns. Instead, a number of additional facts will be discussed that are relevant to the effective targeting traffic safety interventions for distracted and drowsy driving.

First, traffic crashes are the largest source of fatality from traumatic injury in rural America (Ward, 2007). Notably, exposure to rural driving is highly correlated with fatal crash risk as shown in Figure 1. For example, rural states such as Montana and Wyoming, which have high percentages of rural driving, also report the highest annual traffic fatality rate per capita. In such cases, human factors such as driver impairment predominate as the primary cause of fatal crashes.

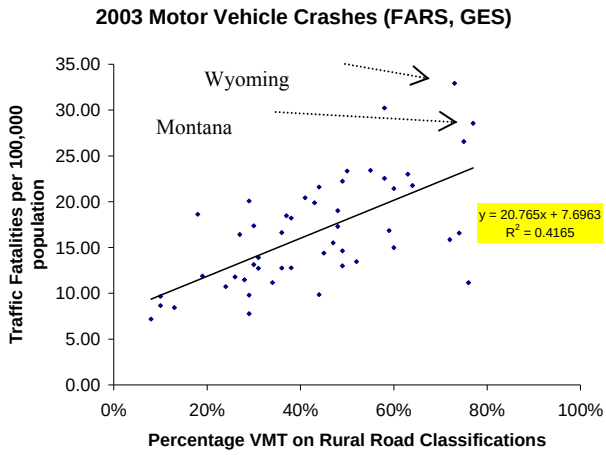

Figure 1. Relationship between rural VMT and fatal crash risk.

Second, Figure 2 illustrates that drowsiness and distraction are significantly more prevalent as particular forms of driver impairment amongst rural crashes compared to urban crashes.

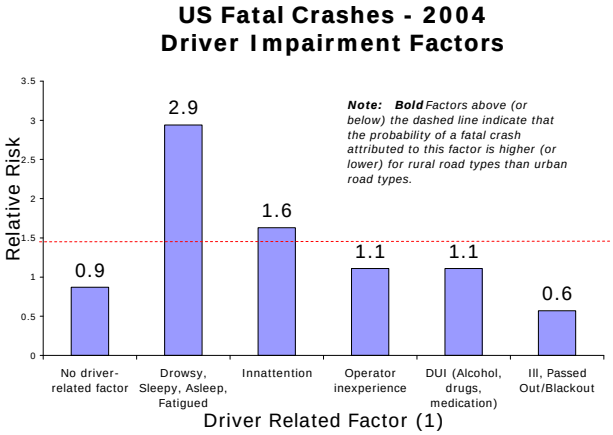

Figure 2. Risk ratios comparing the probability of attributing driver-related factors to vehicle drivers in rural and urban fatal crashes (adapted from Ward, 2007 and based on FARS 2004 data).

Third, Figure 3 illustrates that distraction has the highest propensity as a crash risk factor amongst (novice) teen drivers (Stutts et al., 2001).

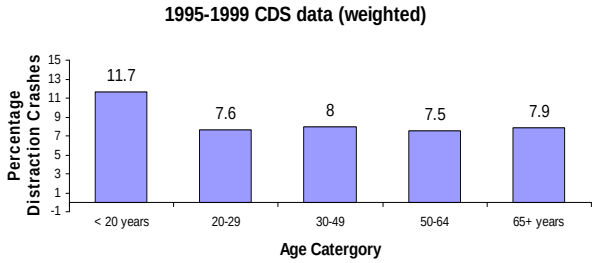

Figure 3. Age distribution of distraction crashes (adapted from Stutts et al., 2001).

Based on this evidence (Figures 1 – 3), it is logical to assert that *rural teen drivers* have the greatest need for distracted and drowsy driving safety interventions. Consequently, distracted and drowsy driving interventions that are applied to teen drivers in rural regions of the US may afford the most efficient and effective increase in traffic safety. Accordingly, this project will evaluate the effectiveness of an intervention directed toward distracted and drowsy driving that is applied to rural teen drivers during their graduated licensing process.

PROPOSED INTERVENTION

The NHTSA *Distracted and Drowsy Driving* Invitation for Application comments that legislation, enforcement, and information campaigns are the most common form of intervention applied to distracted and drowsy drivers. One reason for the popularity of these forms of intervention is that it is feasible to apply them broadly across a range of jurisdictions. Education programs are one method of providing information to drivers about driving hazards.

The FRA concludes that only a few education curricula are available for driver distraction and drowsiness. Those curricular that do exist provide limited education about methods to cope with these impairment conditions. Moreover, it appears that none of these curricular have been formally evaluated in terms of the objective impact on driver distraction and drowsiness nor associated driving behavior.

Driver Education and Licensing

Novice-based driver education programs aim to teach young drivers the skills, knowledge, and attitudes necessary to drive safely and efficiently. Traditionally these programs have included a formal course of study that mixes classroom instruction with behind-the-wheel training delivered by an instructor. The standard program was developed in 1949 and typically includes 30 hours of in-class education and 6 hours of in-vehicle instruction. Today this program remains the standard across many jurisdictions (Bishop et. al., 2005). However, despite this program's best intentions the effectiveness is at best questionable and mostly controversial (Clinton & Lonero, 2006; Mayhew & Simpson, 1996, 2002: Mayhew et al., 1998). This has lead to a renewed interest in evaluating driver education programs. For example a recent report by the AAA Foundation for Traffic Safety, co-sponsored with BMW of North America, Inc. created a series of reports on "Guidelines for Evaluating Driver Education Programs" (Clinton & Lonero, 2006). These reports provided a comprehensive set of guidelines for evaluating new driver education programs; specifically identifying the key questions that must be considered when evaluating education modules or programs, these include:

1. *Do driver education programs enhance or detract from safety?*
2. *Do some types of driver education programs lead to better educational and safety outcomes than others?*
3. *Can we identify which components of driver education programs do and do not work?*
4. *Do programs meet their learning objectives?*
5. *How can driver education programs be improved in order to yield safer young drivers?*

Not until the 1990's, with the introduction of graduated driver licensing did the safety benefits of driver education programs begin to materialize. During this period, NHTSA put forth a recommendation to include a multi-phase driver education program as part of graduated licensing (NHTSA, 1994); the first phase included teaching basic vehicle handling skills and rules of the road; the second phase was oriented to teaching safe driving practices, which included perceptual and decision-making skills. For example, Michigan has implemented the two-phase driver education program which has proven to have significant safety benefits.

Because of apparent improvements in safety benefits, graduate driver licensing continues to witness rapid proliferation into the driver education process (Simpson, 2003). This success has lead to a strengthened relationship between driver education and driver licensing. Specifically the graduated licensing, with its multi-phase approach process, can be integrated within the driver education process to help overcome the limitations of driver education, as mentioned by Mayhew (2007):

> *"Driver education should complement graduated driver licensing and contribute to its overall safety benefits. Current and future efforts to improve driver education and better integrate it with graduated licensing programs need to be rigorously evaluated to determine what does and does not work to reduce young driver crashes, and as importantly, to understand why this is the case."*

As early as 1985, McKnight noted that it may be advisable to introduce more safety-oriented driver training following initial licensing and after some driving experience has been gained. Consistent with this recommendation, the education module identified for evaluation in this proposal serves as an additional education component by focusing on the impairment effects of distraction and drowsiness on perceptual and decision-making skills. The proposed education module fits this model precisely, where after gaining some driving experience the novice driver will receive further safety-oriented driver training (that will include the effects of driver distraction, drowsy driving, etc.). Uniquely, the proposed module can address the novice driver's safety needs in a personalized format, speaking specifically to that particular driver's needs, rather than a generic overview of safe driving practices as traditionally done.

Furthermore, it is well known that the elevated crash risk among young drivers occurs over the first months and miles of driving when drivers are the most inexperienced and unskilled. The most common factor of these crashes is primarily attributed to visual search and attention errors/driver distraction (Preusser, 2006 and McKnight, 2006). Therefore, it has been suggested that to improve safety outcomes the driver education process must be more clearly focused on addressing these errors over the first months and miles of driving (Mayhew, 2007). Accordingly, this module has the potential to augment the graduated licensing approach to the driver education process by targeting specific hazards identified for (rural) teen drivers.

Montana Curriculum Module: Distracted and Drowsy Driving

The proposed solution to be evaluated in this project involves a theory-grounded *driver education module* designed for the Montana State driving license curriculum (www.opi.mt.gov/DriverEd/index.html) to instruct novice teen drivers on the specific hazards of distracted and drowsy driving. Moreover, this intervention is feasible as demonstrated by its current implementation in Montana. This intervention may be broadly implemented by virtue of being flexible, portable, and linked to Graduated Driver Licensing (GDL) programs in various states.

Rationale

Research has show that learning with understanding is superior to just learning a procedure when it comes to adapting to varying conditions. "Transfer is affected by the degree to which people learn with understanding rather than merely memorize sets of facts or follow a fixed set of procedures" Bransford, et. al., 2000). Judd (1908) demonstrated that students who learned to hit

a target with a dart underwater and were instructed in the abstract principle of refraction of light, were able to hit the target much better when the depth of water was changed than did students who learned to hit the target without instruction on refraction of light, even though the two groups performed the same before the depth of water was changed (as described by Judd, 1908; also replicated by Hendrickson and Schroeder, 1941; both reported in Bransford, et.al., 2000).

The variables of driving vary greatly. Providing understanding of safe driving principles as a part of practicing and learning the skill of driving is superior, as adaptation to rapidly changing driving conditions is essential to avoid crashing. Understanding the nature of how distractions to driving compromise ones ability to monitor and adjust to the driving conditions will enable a driver to successfully manage a wider array of distractions than can be possibly envisioned and addressed in practice sessions.

Non-drivers gain knowledge about driving through vicarious driving experiences. Non-drivers have witnessed drivers successfully deal with distractions. However, pre-existing notions can interfere with subsequent learning. If a new driver is not properly instructed and engaged in illuminating activities about driving distraction prior to driving a vehicle in traffic, it is likely they will not recognize those activities as distractions they are unprepared to handle. (Bransford and Johnson, 1972; Dooling and Lackman, 1971; both reported in Bransford, et.al., 2000).

Background

In 2002, Montana embarked upon the process of developing a new driver education and training curriculum guide. A curriculum specialist developed the standards for curriculum development. A driver education curriculum expert developed the lesson materials. The standards are simple and utilize eight statements to address content requirements. These eight content standards address are:

1) Laws and Highway System,
2) Responsibility,
3) Visual Skills,
4) Vehicle Control,
5) Communication,
6) Risk Management,
7) Lifelong Learning, and
8) Driving Experience.

Rationale and benchmarks were developed to define the basis and scope of the standards, and a sample of performance standards were developed for mastery levels of Advanced, Proficient, Nearing Proficiency, and Novice. This last category is needed to inform educators and parents that the completion of a teen driver education and training class results in teens who are novice drivers in need of extensive additional practice and experience to become proficient. To this were added the development of essential skills and knowledge topics of instruction that were needed to meet the standards developed. Those topics were then organized into instructional modules.

Module

Driver impairment is a major topic within the driving education curricula. Specifically, Module 17 covers Operator Fitness - Aggressive, Drowsy, Distracted, Alcohol, Drugs. Each topic in the module contains a standardized lesson plan that includes (1) a PowerPoint presentation to illustrate key concepts, (2) student participation activities to demonstrate, practice and reinforce hazard knowledge and coping skills, and (3) a student worksheet including sample questions for quizzes. A comprehensive test bank for the whole curriculum contains additional questions for aligning a summative assessment with each module's formative assessments.

The ideal driver education and training curriculum converts the classroom into a training laboratory where learning is student centered and facilitated by an instructor who engages the student in activities that simulate behaviors needed to drive a car safely. Content is focused specifically on driving and understanding of behaviors needed to drive safely.

Knowledge needed for safe driving is gained by active participation in activities that provide reasonable simulation of real driving behaviors with sufficient cognitive instruction to provide a foundation of understanding. The learner is engaged in a variety of learning roles that include instructor, assessor, and student to engage more of the brain and to facilitate a stronger cognitive and psychomotor retention. In addition, in-vehicle training is phased to coincide with the classroom learning to provide timely opportunity for the student to "demonstrate" the proper behaviors and skills learned in the vehicle, and to gain additional real-world learning and reinforcement. Formative and summative assessments are geared to determine levels of mastery of needed skills and knowledge and used to further tailor instruction and practice driving (Bransford, et.al., 2000).

Further, parents are engaged in the process and provided tools to supervise, motivate, and encourage their teen's practice driving in accordance with best graduated driver licenses processes and consistent with the procedures provided in the teen's driver education and training class. The parent will also receive assessment tools that correlate with recommendations for improvement that they can use to tailor their supervision to the teen's needs and the teen's practice driving.

PROJECT DESCRIPTION

Project Goal

The goal of this project is to quantify the behavioral effect of an education module specific to the hazards of distracted and drowsy driving for novice teen drivers in rural communities.

Project Method

This project will use a randomized mixed-factor design to evaluate the effect of module exposure on driving behavior and episodes of distracted and drowsy driving. Several schools with licensing curricula that can incorporate the module will be identified in rural areas of southwestern Montana. From these schools, Driver Education Instructors will be recruited to administer the module to a random sample of students enrolled in the local driver education program (stratified by gender). Students will be classified based on their *module exposure*: No Module (NM) or Module (WM). Students will then be recruited for the *data collection phases* of this project: (A) one month duration preceding intervention; (B) one month duration after intervention exposure; and (C) one month duration initiated five months after intervention exposure. These data phases will permit the analysis of short-term (A-B) and long-term (A-C) effects of the intervention, as well as the perseverance of these effects (B-C).

Project Data

Given the stipulations of the NHTSA Distracted and Drowsy Driving Invitation for Application, this education intervention will only be characterized in terms of objective data. Given a budget that limits the duration of an evaluation phase, it is not practical to consider the analysis of actual crashes or traffic citations. Instead, this evaluation will be based on the measurement and characterization of driving behavior recorded by a remote data collection system temporarily fitted to participant vehicles during the data collection phases of this project.

Data Collection System

Objective data on driving behavior and video recordings of evidence of driver distraction and drowsiness will be recorded by a portable data collection system (DriveCam) that will be fitted to each participants own vehicle. The DriveCam system is housed in a small case that attaches to the windshield of a vehicle just behind the rearview mirror. It houses two cameras, accelerometers, infrared illumination of vehicle interior, memory, cell data modem and a small processor. The device captures the view to the front of the vehicle and simultaneously inside the vehicle from a view just beneath the rearview mirror. The device is g-force triggered. Trigger thresholds are set by the researcher in both the lateral and longitudinal planes. When thresholds are surpassed the device saves a few seconds of data before and a few seconds of data after that moment. The data collected includes 4 Hz video of the interior and exterior views, audio, g-force readings, device ID info and date/time stamp. The data captured from before the trigger moment is configurable for 0 to 30 seconds and the data captured after the moment is configurable to 0 to 30 seconds as well, but total record time can not exceed 30 seconds per event. The device has the capacity for more than thirty 15-second events. In addition, models to be released in the very near future provide GPS data for location of the event and "bread crumb trails" to determine location, distance and speed during vehicle trips.

The DriveCam device can be equipped for various modes of data offload including direct by USB cable to a laptop, WiFi to a local or networked PC or via cell data modem. The device checks in each day via WiFi or cellular so continued operability can be confirmed (assuming vehicle is in an area of reasonable coverage for 30 to 60 minutes per day). Camera parameters are configurable remotely and upload to the device upon the next connection.

In addition to DriveCam's hardware solutions, HindSight software provides an interface to configure and track devices, drivers, vehicles and system users. HindSight is a relational database that stores and tracks data on each event captured by the device. An integrated player and data coding screen allow for viewing and coding of each captured event. Through SSL technology, the HindSight client can be operated on any PC or laptop with a connection to the Internet. DriveCam provides secure, always on power to servers that centrally store data and control access.

Each night, all events are automatically offloaded to DriveCam's secure servers through the cellular data network. Events are automatically routed to the research project's sector where they are securely stored until accessed by authorized system users (discretion of the researcher). Each stored event is identifiable to the vehicle from which it came from and each vehicle in the system is associated with possible drivers of that vehicle. Specially trained observers at DriveCam and project researchers can then log in to the HindSight system and view each video event and code it for behaviors and outcomes observed. Videos can be output from the system for additional analysis at a later time. By using DriveCam's video event scoring system, each event can be graded and scored and then trends for each driver can be created, compared and further analyzed. Typically, researchers create additional coding mechanisms keyed to each event's unique identification number as assigned in HindSight.[1]

DriveCam has been validated as a robust and practical data collection system for naturalistic studies. Notably, the system is in current use at the University of Iowa – Daniel McGehee, and at UNC Highway Safety Research Center – Rob Foss. It is planned to go into use at U of Michigan Transportation Research Institute (UMTRI) this month.

Project Analysis

Data for the independent variables in this evaluation study will be characterized by descriptive statistic and tested by inferential statistics using an Analysis of Covariance (ANCOVA) analysis with *module exposure* treated as a between-subject factor (NM, WM) and *data collection phase* treated as a within subject factor (A, B, C). Relevant covariates such as prior driving experience

[1] Another feature of this system is web-based viewing of events, but video quality is less than when viewing locally on a dedicated machine. Typically, this feature is incorporated into a "feedback program" for teen drivers in which parents review event recordings with their teen drivers to discuss the event cause, significance, and future mitigation strategies. This feedback program alone has been demonstrated to reduce teen driver risk behaviors (McGehee et al., 2007). Future research could investigate the potential benefit of combining an education module specific to distraction and drowsiness with a feedback program based on parent mentoring and designed to monitor these types of risky driving events. An evaluation of this combination of interventions could be accommodated in the current proposal with additional funding given that the hardware for the feedback program is already being used in this proposed evaluation of the education module to record driving data.

(e.g., farm equipment driving experience) will be explored for possible inclusion in the ANCOVA. Planned comparisons (based on non-orthogonal contrasts) will be specified to test the short-term, long-term, and perseverance effects.

Project Outcomes

The evaluation of the distracted and drowsy driving module in this project will characterize the effect of exposure to the module on safety-relevant driving behavior in terms of short-term, long-term, and perseverance effects. Specifically, the evaluation will assess the capacity of the module to affect changes in distraction and drowsiness among teen drivers receiving hazard specific training. As a result, this project will discuss the potential effectiveness of this intervention strategy to reduce crashes related to distraction and drowsiness among a high risk demographic group defined as rural novice teen drivers. This project will then conclude on the possible extension of this form of intervention (and potential effectiveness) to other demographic groups including non-rural (urban) states across the nation. The conclusion will identify the legislative, curricula, and administration factors that may need to be considered and addressed in order to broadly adapt this intervention to other jurisdictions.

It is important to recognize that the potential benefits of this traffic safety intervention for rural teen drivers are not limited to Montana. Whereas Montana is functioning as a case site for this evaluation, the evidence and interventions that emerge here will also be relevant to other rural states. Indeed, the evaluation of this module and its demonstrated effects may generate interest in adapting and applying this form of intervention more broadly across all states – both rural and urban. Moreover, it is expected that conclusions about the specific hazard training evaluated in this project may motivate the development of additional education modules specific to other risk factors.

RESEARCH PLAN

Table 1 presents a summary of key project tasks as well as a risk analysis of potential factors that may significantly impede progress and the proposed mitigation strategies to minimize that risk. Note that much of the potential risk is mitigated by (1) the partnership and participation of the Montana Department of Public Instruction that manages driver education programs in Montana (see Appendix A), (2) the previous intervention module, and (3) the considerable research history of the specific type of data collection system proposed for this evaluation (see Data Collection System, p. 8).

Table 1. Description and Risk Analysis of Project Tasks.

#	Task	Description	Risk	Mitigation [Milestone see Table 5]
0	Manage	**Manage** project and liaise with PIRE and NHTSA	NONE	-
1	Work plan	**Iterate** project work plan with PIRE and NHTSA	NONE	-
2	IRB	Submit and **obtain** IRB approval from MSU	Low	[A] Benefit from prior experience with IRB applications for previous projects involving assessment of teen drivers.
3	Recruit	**Recruit** participating schools and driving education instructors to administer the module as well as recruiting students to participate in the data collection phase.	Medium	[B] Driving education in Montana is managed by the Office of Public Instruction whose director (David Huff) has committed to work with local school boards to facilitate recruitment (Appendix A). In addition, stipends are included in the budget as incentives for schools, instructors, and students to participate.
4	Design	**Design and implement** random assignment protocol and scheduling of module exposure and data collection across participant sample.	Medium	[C] Project team has significant prior experience scheduling and conducting research activities with cooperation of school boards. Regular project review meetings will monitor specific challenges associated with this task.
5	Install	**Install and verify** data collection system and wireless data collection.	Low	[D] This data collection system has been used with several prior research projects and has demonstrated simplicity and safety for installation.
6	Intervention	**Administer** module to exposure group of students.	NONE	Module has previously been available to curriculum and utilized (without any formal evaluation).
7	Data	**Record and store** data during data collection phases	Low	[E] This data collection system, used with several prior research projects, has demonstrated as a reliable and robust data collection and interpretation tool.
8	Analyze	**Analyze** data recorded from data collection phases	NONE	Standard data analysis techniques are planned.
9	Draft	Draft preliminary **report** for review by PIRE and NHTSA	NONE	-
10	Report	**Submit** final report	NONE	-

PROJECT BUDGET

The proposed budget (< $200,000) by expenditure category is presented in for this 19 month project. A detailed representation of this budget is presented in Appendix E.

Table 2. Summary Budget by Expenditure Category.

Category	Year 1 (Month 1-12)	Year 2 (Month 13-19)	Total Project
Staff	$62,368.10	$36,064.30	$98,432.40
Minor Equipment	$3,750.00		$3,750.00
Major Equipment	$18,000.00		$18,000.00
Travel	$5,000.00	$5,000.00	$10,000.00
Operations/Communications	$300.00	$300.00	$600.00
Other (Participant Support)	$6,000.00	$2,250.00	$8,250.00
Subcontract	$5,000.00	$4,000.00	$9,000.00
Indirect Costs	$32,477.69	$19,279.83	$51,757.52
GRAND TOTAL	**$132,895.79**	**$66,894.13**	**$199,789.92**

As summarized below, WTI is providing at total of $73,000 to supplement project costs:

- An additional 145 hours for Nic Ward and 173 hours for Laura Stanley will be covered by College of Engineering funds over the 19 month duration of the project ($23,000)
- Remaining state funds (Montana Department of Transportation) from an existing project on the topic of teen driver training (Appendix C) will be used synergistically with the current proposal to leverage knowledge and resources (including staffing) for teen driver education research ($30,000).
- WTI is supplementing the project effort by providing a graduate student fellowship to provide the second research assistant at no cost to the project budget ($20,000)

Notably, if the WTI proposal is awarded by NHTSA, the Montana Department of Transportation has agreed to review the project for possible state funding to contribute toward the budget or extend the proposed work plan (see Appendix A).

STAFFING

University

The Montana State University, College of Engineering offers fully accredited undergraduate and graduate degree programs in a diverse range of engineering disciplines and is particularly noted for its strong interdisciplinary approach to teaching, learning and research. Montana State is highly research oriented and is classified among the top 94 Carnegie Foundation research-intensive universities. College of Engineering faculty and staff work closely with industry and local communities focusing on addressing regional needs.

Within the College of Engineering, the Mechanical & Industrial Engineering Department provides outstanding leadership and contributions in knowledge discovery, student learning, innovation and entrepreneurship. Within the college, the human factors laboratory concentrates on industrial ergonomics with equipment to address biomechanical and physiological aspects of industrial tasks. Facilities for decision support system, facilities design, and expert systems are undergoing expansion.

Western Transportation Institute

The Western Transportation Institute (WTI) is the nation's largest transportation institute focusing on rural transportation issues and is designated as a US Department of Transportation University Transportation Center. The Institute was established in 1994 by the Montana and California Departments of Transportation, in cooperation with Montana State University – Bozeman. A primary focus for WTI has been developing, deploying and evaluating ITS technologies that address transportation challenges in the rural environment. Currently, WTI has research and demonstration projects in 30 states. WTI has a 55 person multidisciplinary research staff of professionals, students, and associated faculty from engineering (mechanical/electrical/industrial/civil), psychology, computer science, fish and wildlife, business, biology and economics. With this connectivity across different university colleges, a consortium of university faculty and staff that is organized to focus research interests and expertise in human factors and traffic safety (MSU-HFC) that will utilize and collaborate with these facilities (see Appendix B).

Project Team

Management and research functions will be staffed by principal investigators Professor Nicholas Ward and Assistant Professor Laura Stanley (Department of Mechanical and Industrial Engineering). Complete resumes for these principal investigators are provided in Appendix D.

> ***Professor Nicholas Ward (M. Erg. S)*** obtained his Ph.D. in Human Factors psychology from Queen's University (Canada) with a dissertation on driver (visual) behaviour at rural railway crossings. He then spent 10 years conducting Human Factors research in driver impairment and Intelligent Transportation Systems (ITS) at Loughborough University and the University of Leeds. Prof. Ward moved to the USA to become the Director of the ITS Institute human factors research laboratory (www.humanfirst.umn.edu) at the University of Minnesota (UMN). This program comprised a multi-disciplinary team of University researchers and visiting international scholars to adopt a human-centered approach to improve traffic safety. While at UMN, his research focused on distraction, alcohol, teen drivers, and rural safety as well as driver support systems. Prof. Ward is currently a Professor of Mechanical and Industrial Engineering at Montana State University and a Senior Research Scientist at the Western Transportation Institute (www.coe.montana.edu/wti/**).** Current research interests include system design, interface usability,

Intelligent Transportation Systems and traffic safety (driver distraction, alcohol impairment, older and novice drivers, safety cultures). Prof. Ward is a member of the Human Factors and Ergonomics Society and the International Association of Applied Psychology. He is on the editorial advisory Board of Accident Analysis and Prevention and Transportation Research Part F: Traffic Psychology and has published extensively in academic journals and international conference proceedings. Prof. Ward is also an active member of several Transportation Research Board committees including AND30 (Simulation and Measurement of Vehicle and Operator Performance) and AND10 (Vehicle User Characterstics).

Assistant Professor Laura Stanley obtained her Ph.D. and M.S. in Industrial Engineering from Montana State University and B.S. in Industrial Engineering from Virginia Tech. She has spent the last seven years working on transportation safety issues at Western Transportation Institute and Virginia Tech Transportation Institute. At Western Transportation Institute, she worked on projects that included: the distraction of hands-free and hand-held cell phones, evaluation of enhanced animal crossing warning messages, evaluating the safety benefits of an advanced defensive driving training program for teenage drivers, and human factor principles of interface design for collision avoidance systems during run-off-road and head-on collisions. While at Virginia Tech Transportation Institute, she has worked on projects including: the development and assessment of a driver fatigue monitoring system, driver distraction evaluations of in-vehicle communication and navigation devices, and the evaluation of advance collision avoidance displays for garnering attention towards forward collisions. Dr. Stanley serves on review committees for the Human Factors and Ergonomics Society and the National Rural Intelligent Transportation Systems and is also an active member in Transportation Research Board committees AND10 (Vehicle Users Characteristics) and AND20 (User Information Systems).

Research support functions will be staffed by two qualified graduate research students (as yet unnamed) appointed from various colleges at Montana State University.

Budgetary, administrative, and communication functions will be staffed by dedicated WTI personnel with over 20 years combined budget management and communications experience.

Technical and Management Skills

Table 3 and Table 4 provide lists of published research and managed projects to demonstrate the technical and management skills of the principal investigators with respect to the key topics involved in this project. **N. Ward** (Ph.D., Professor Department of Mechanical and Industrial Engineering) has more than 16 years experience in human factors traffic safety research focusing on driver impairment and project management including prior certification under ISO-9001 – Quality Assurance for Project Management. Dr. Ward will coordinate and manage this research project as well as contribute to deliverables.

Table 3. Demonstration of Technical Expertise in Key Project Areas (e.g., publications and deliverables).

Staff	Rural Safety	Teen Drivers	Distraction	Drowsiness	Evaluation
N. Ward	Ward, N.J. (2007). The Culture of Traffic Safety in Rural America. AAA Traffic Safety Foundation.	Brovold, S., Donath, M., Simons, S., Ward, N. & Shankwitz, N. (2007). In-vehicle Technology to Correct Teen Driving Behavior: Addressing Patterns of Risk. *Journal of Safety Research*, 38, 413 – 422.	Rakauskas, M., Gugerty, L., & Ward, N.J. (2004). Effects of Cell Phone Conversation on Driving Performance with Naturalistic Conversations. *Journal of Safety Research*, 35, 453-464.	Ward, N.J. & Smith, L. (2000). Shift work and driver fatigue. International *Conference on Traffic and Transport Psychology, Berne, Switzerland* (September 4-7).	Parkes, A.M. & Ward, N.J. (2001). Case study: A safety and usability evaluation of two different car phone designs. *International Journal of Vehicle Design*, 25, 12-29.
L. Stanley	**Stanley**, **L**., Hardy, A., and Lassacher, S. (2006) Driver Responses to Enhanced Wildlife Advisories in a Simulated Environment. *Transportation Research Record: Journal of the Transportation Research Board*, No. 1980, pp 126-133.	Kelly, M. and **Stanley**, **L**. (2005). Effects of Defensive Vehicle Handling Training on Novice Driver Safety: Phase 1. Preparation for Advanced Driving Training Report. *For Montana Department of Transportation in cooperation with the U.S. Department of Transportation Federal Highway Administration.*	**Stanley**, **L**., Kelly, M., and Lassacher, Suzanne (2005). Driver Performance While Interacting with the 511 Travel Information System in Urban and Rural Traffic. *Third International Driving Symposium on Human Factors in Driver Assessment Training and Vehicle Design Proceedings*, Rockport, ME.	**Stanley**, **L**., Wierwille, W., Hanowski, R., and Blanco, M, (2006). Development and Assessment of a Driver Fatigue Monitoring System: Literature Review and Functional Specifications. *Federal Motor Carrier Safety Administration: DTNH22-05-D-01019*, National Highway Traffic and Safety Administration Task Order No. 0007,	Weigand, D., Tidwell, S., **Stanley**, **L**., Nakata, A., Blanco, M. (2006). Safety Evaluation of an In-Vehicle Communication Device for Commercial Trucks, *propriety work.*

Table 4. Demonstration of Management Expertise in Key Project Areas (e.g., principal investigator, project manager roles).

Staff	Rural Safety	Teen Drivers	Distraction	Drowsiness	Evaluation
N. Ward	LRRB (2005 – 2006): *Rural and urban safety cultures* ($190k)	MnDOT (2006 – 2007): *Generational perspectives on teen and older drivers on traffic safety in rural and urban communities (*$119k).	MnDOT (2003 - 2005): *Driving performance during cell phone use and common secondary tasks combined with conditions of driver impairment* ($180k).	EEC (2001 - 2004): *Impaired motorists, methods of roadside testing, and assessment for licensing* ($1000k).	FHWA (2003-2005): *An evaluation of Intersection Decision Support concepts* ($500k).
L. Stanley	MDT (2004-2005) *Bozeman Pass Channelization ITS Project* ($208k).	MDT & FHWA (2005-2008) *Effects of Defensive Vehicle Handling Training on Novice Driver Safety* ($250k).	FHWA (2003-2004) Driver *Performance while using a Cellular Telephone Interface to a Traveler Information System.* ($25k).	FMCSA (2006-2008) *Development and Assessment of a Driver Fatigue Monitoring System* ($300k).	GM (2007) Effects of Visual Alert Location and Gaze *Location on Driver's Ability to Respond to Forward Scene Changes* ($158k).

MANAGEMENT PLAN

The project management structure will interface both with the administration and review function of NHTSA (COTR) and the monitoring and evaluation functions of PIRE (Mark Johnson. Co-Investigator and Professor Nicholas Ward will serve as *Project Manager* to manage and monitor the project in relation to the project goals (see Project Goal, p. 8) and to serve as the primary contact point with PIRE and NHTSA (Figure 4). Note that an advisory panel has been proposed as a resource for the project manager in order to ensure access to information and facilities necessary to develop and complete the module intervention. This panel is based on a partnership with *Montana Office of Public Instruction and Montana Department of Transportation* (see Appendix A) to ensure that the results of the project are relevant to stakeholders and amiable to support best practice in driver education and licensing. Co-Investigator and Assistant Professor Laura Stanley will serve as the *Research Manager* to plan, coordinate, and monitor the individual project research tasks.

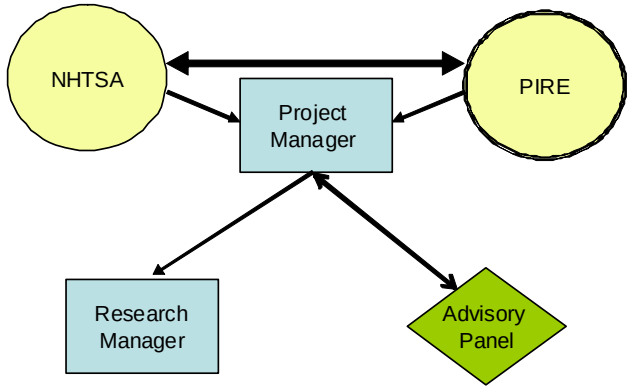

Figure 4. Project management structure.

Within this management structure, the Project Manager will develop and propose a **work plan** with the Research Manager. This proposed work plan will be presented and discussed with PIRE and NHTSA to reach agreement on the goals, methods, and forms of data collection to be evaluated in this study. Once agreement has been achieved, the Research Manager will execute the work plan with and conduct regular reviews by the Project Manager. This review process will involve **weekly internal meetings** amongst research staff to document progress, plan future actions, and identify risk factors that require mitigation (e.g., Table 1). The minutes from these meetings will be circulated to the Advisory Panel for comment and specific discussion on their participation in supporting the project methodology and risk mitigation strategies. These minutes will then be integrated to serve as the basis for interim project meetings with PIRE and for the formal submission of a **quarterly progress reports**. Feedback provided by PIRE will then be incorporated into **forward action plan** that will mandate for the research tasks in the subsequent project quarter by documenting task objectives, indentifying critical milestones, and assigning deadlines.

PROJECT SCHEDULE

The proposed schedule for this **19 month** project is outlined in Table 5.

Table 5. Project Schedule (including Project Milestones │, Meetings, and Deliverables).

Project Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Task 0. Manage	M_1			D_1			D_1			D_1			D_1		D_1			D_1	
Task 1. Work Plan	D_2			D_3															
Task 2. IRB																			
Task 3. Recruit																			
Task 4. Design								M_2											
Task 5: Install																			
Task 6. Intervention																			
Task 7. Data																			
Task 8. Analyze											M_3								
Task 9. Draft																	D_4		
Task 10. Report																		M_4	D_5

Milestone A:
Letter from IRB certifying approval.

Milestone B:
Letters of commitment from schools and instructors, as well as signed consent forms from students (and parents).

Milestone C:
Completed calendar schedule specifying instructors and students assigned to module exposure conditions and data collection phases.

Milestone D:
Final testing of installation and data transfer of data collection systems.

Note: Dashed vertical bars represent "low" risk milestones; Solid vertical bars represent "medium" risk milestones.

MEETINGS, DELIVERABLES, AND MILESTONES

With reference to Table 5, the following is a list of interim project meetings (M) and submitted deliverables (D) that are specified within the project schedule:

Meetings

M_1 Initial project meeting (review proposal and project administration)
M_2 Interim project meeting (review research design and data collection)
M_3 Interim project meeting (review collected data and analysis plan)
M_4 Final project briefing (present and review draft project report)
M_5 Final (revised) project report

Deliverables

D_1 Quarterly progress reports (Maximum 6 reports)
D_2 Preliminary work plan
D_3 Final (revised) work plan
D_4 Draft project report
D_5 Final (revised) project report

In addition, a specific set of ***Milestones*** are identified that correspond to resolution activities for the anticipated risk factors in this project (see Table 1).

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APPENDIX A – LETTERS OF SUPPORT

OFFICE OF PUBLIC INSTRUCTION
PO BOX 202501
HELENA MT 59620-2501
www.opi.mt.gov
(406) 444-3095
(888) 231-9393
(406) 444-0169 (TTY)

Linda McCulloch
Superintendent

March 24, 2008

Nicholas Ward
Western Transportation Institute
College of Engineering
Montana State University
PO Box 174250
Bozeman, MT 59717-4250

Dear Nic.

The Montana Office of Public Instruction administers the novice teen driver education program in Montana through local school districts. There is debate in research circles about the effectiveness of education in driver education. Many if not most present-day driver education is rooted in a 50 year old model that does not embrace more recent advances in educational theory, nor does it take into consideration a more complicated driving environment. Montana has embarked upon a process of trying to update its driver education program. A new curriculum completed in 2006 is one step toward the goal of re-inventing driver education in Montana. In order to do this, formal evaluation of particularly significant aspects of the curriculum are essential.

During the period of time it takes teens to learn and master the complex set of skills and behaviors that are needed to drive safely, distractions are particularly troublesome, and can result in tragic consequences to the driver, his or her passengers, and other roadway users. Because of this, and as part of the Montana Graduated Driver License law, Montana adopted the following statute as part of its Graduated Driver License package, " (1)The department (Department of Justice), in consultation with the superintendent of public instruction, shall encourage schools providing traffic education to include in their traffic education curriculum information regarding the dangers of physical and cognitive distractions while driving. (2) To reduce the risks for novice drivers, the department shall include in its publications intended for novice drivers information concerning the dangers of physical and cognitive distractions while driving, including but not limited to mental inattentiveness because of stress, fatigue, heightened emotion, conversation with passengers, stereo or climate control adjustment, food and drink, use of electronic devises, and personal grooming." (61-5-135 M.C.A.)

"It is the mission of the Office of Public Instruction to improve teaching and learning through communication, collaboration, advocacy, and accountability to those we serve."

An evaluation that tests educational models that address the distractions of driving have value nationwide as the teen problem of learning to drive and dealing with distractions is a national problem, not just a Montana problem.

In this context, I fully support your proposal submission to NHTSA to fund a formal and objective evaluation of our education module. As you know, we have collaborated with the Western Transportation Institute in past years on research into teen driver safety, and look forward to future collaborations into improving the prospects of learning to better handle teen driver education for high risk factors.

In order to support this project, my office is willing to provide access and descriptions of the module materials as well as assist you in recruiting schools, instructors, and students to participate in the study. Moreover, I accept your invitation to participate on the study Technical Advisory Panel to advise on driver licensing and education in Montana as well as provide insight for how the results of this project may be utilized at the state and national levels. In this advisory capacity, I am willing to direct 1% of my salary toward my effort in supporting this project which will represent an in kind investment in the project's success.

Best Regards,

David C. Huff, Director
Traffic Education Programs
(406) 444-4396
dhuff@mt.gov

TOTAL P.03

MDT serving you with pride

Montana Department of Transportation
2701 Prospect Avenue
PO Box 201001
Helena MT 59620-1001

Jim Lynch, Director
Brian Schweitzer, Governor

March 21, 2008

Dr. Nicholas Ward
Western Transportation Institute
College of Engineering
Montana State University
PO Box 174250
Bozeman, MT 59717-4250

Dear Dr. Ward

The Montana Department of Transportation (MDT) is committed "to serve the public by providing a transportation system and service that emphasize quality, safety, cost effectiveness, economic vitality, and sensitivity to the environment". The National Highway Transportation Safety Administration's initiative to study countermeasures to distracted and drowsy drivers is expected to support a primary element of the Department's Strategic Highway Safety Plan to reduce crash risk for teen drivers. As such, the Department is encouraged that the Western Transportation Institute in collaboration with the Montana Office of Public Instruction has put forth a proposal to study the effectiveness of teen driver training in mitigating this problem. Although the deadline for this proposal does not afford us sufficient time to fully consider our financial commitment, if this proposal is successful, the Department may further consider committing resources to the project.

Sincerely,

Susan C. Sillick
Manager, Research Programs

cc: File

APPENDIX B – HUMAN FACTORS BROCHURE

Human Factors and Traffic Safety Research at Montana State University

PC-based desktop simulators running same software as advanced driving simulator for infrastructure and transportation visualization, as well as traffic modeling and basic research.

Three-channel virtual reality non-motion driving simulator with quarter-cab installation (sedan) for visualization, human factors experiments and system evaluations.

Eight-channel virtual reality motion-based (6 degrees of freedom) driving simulator with dual-cab installation (sedan, pickup) for human factors experimentation and system evaluations.

Comprehensive test track facilities (infrastructure and vehicle-based) for human factors experimentation, system evaluations, and prototype demonstrations.

Infrastructure instrumentation and forthcoming instrumented vehicle fleet for system evaluations, system validation and naturalistic studies.

Fidelity
(Ecological Validity)

Human Factors Facilities

In addition to traditional on-road and test-track research capabilities, WTI manages a suite of driving simulators that represent a range of simulation fidelity. This suite represents the largest fidelity range and most advanced simulation capabilities funded and operated by any research university in North America. This range of capability provides for the appropriate matching of simulation fidelity to research question complexity (and magnitude of research budget). The advantages of simulation include the ethical exposure to risk factors, realistic interaction with near-crash events, and the reliable control of all scenario conditions.

The WTI simulators are used both for experimental research and the visualization of future Intelligent Transportation Systems and traffic engineering designs, including roadway network infrastructure and configurations. Controlled test-track studies and naturalistic on-road studies are then used to validate and extend research conclusions with deployable systems.

Example Human Factors Projects

- **Driver competency** - Study of effectiveness of defensive driver training among young drivers (Montana DOT).
- **Driver impairment** - Evaluation of driver distraction during mobile phone interaction with the 511 information systems (USDOT/RITA).
- **Interface design** - Transportation Research Applications and Instrumentation Lab (USDOT/RITA); Bozeman Pass ITS Evaluation (FHWA).
- **System evaluation and visualization** - A high fidelity driving simulator as a tool for the design and evaluation of highway infrastructure upgrades (Montana DOT); Cooperative advanced warning system evaluation (Preventive Safety Research, Inc.).

For more information, please contact

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Program Leader, MSU-HFC
Western Transportation Institute
College of Engineering
Montana State University
P.O. Box 174250
Bozeman, MT 59717-4250
Tel: (406) 994-6114 Fax: (406) 994-1697

Western Transportation Institute
Safety and Operations

Human Factors and Traffic Safety Research at Montana State University

As a social goal, sustaining transportation mobility while reducing fatal and disabling traffic crashes is vitally important. In support of this goal, the Western Transportation Institute (WTI) at Montana State University (MSU) was constituted in 1998 by the U.S. Department of Transportation as a University Transportation Center (UTC) to contribute to the national mission of "providing fast, safe, efficient, and convenient transportation."

This mission is most salient in rural America, which consistently has the worst traffic safety record and the least developed public transportation and emergency response systems. The decision, then, to locate WTI in Montana, a state that records the highest percentage of rural vehicle-miles traveled in the nation and has a traffic fatality rate double the national average, was a natural one.

As a national center of excellence for rural transportation research, WTI employs 40 researchers and 20 students among a staff of 75, and operates with a research budget of $7.5 million. It has close affiliations with many leading state, regional, and national organizations including:

- **U.S. Department of Transportation**
- **Transportation Research Board**
- **Federal Highway Administration**
- **California and Montana Departments of Transportation**

Research at WTI is sponsored through an intramural program using UTC funds in conjunction with external funding from state, federal, and commercial sources. The UTC funding is also used as leverage to attract and match external funds. The management of this research is directed toward the development, evaluation, and deployment of viable systems and programs to support the national strategy for transportation research.

"All too often, research is conducted that examines issues from one dimension, follows the interests of the investigator rather than the sponsor, ignores possible interrelationships with other work being done on the same or related issues, and is irrelevant to the national strategy for surface transportation. In contrast, WTI conducts research that supports the national research strategy by focusing on high quality, collaborative, and sponsor-driven activities to make significant advancements in both traditional methods and advanced technologies in rural transportation."
Steve Albert, WTI Director

Among its several areas of focus, WTI conducts research in transportation safety, operations, and systems

engineering to support national priorities for improved traffic safety and mobility. These programmatic areas of research rely on the analysis of the "human factor" in the transportation system.

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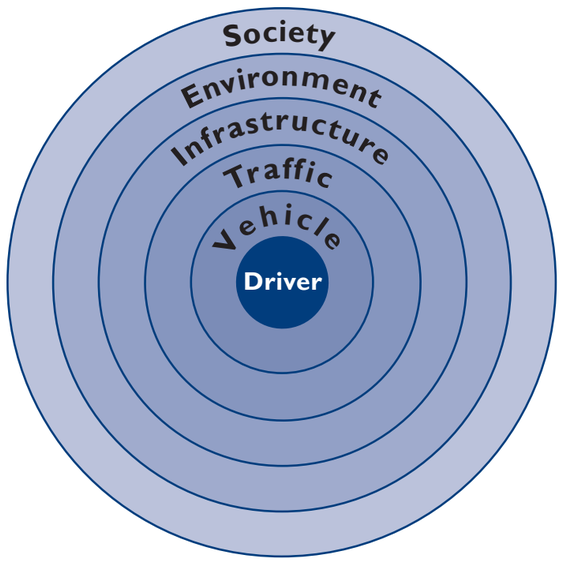
MONTANA STATE UNIVERSITY
Western Transportation Institute

Human Factors Research

Human factors research analyzes driver-related crash factors such as competency (novice driver, elderly driver) and impairment (alcohol, fatigue, distraction) to support the design of advanced technologies and safety management policies to mitigate high-risk driving behaviors. The research adopts a driver-centered perspective to design interfaces for vehicle- and infrastructure-based driver support systems. This approach supports a system-based perspective to that considers the hierarchical layers of factors that influence driver cognition and behavior. The research process includes visualization, demonstration and evaluation in order to assess overall system effectiveness and social acceptance for future deployment.



Human Factors Consortium

Human factors research at WTI is conducted by an interdisciplinary consortium of WTI and MSU scientists. Given the multifaceted nature of traffic safety and mobility issues, this research consortium is naturally comprised of qualified professionals from multiple and interrelated disciplines. Consortium members work closely with transportation and civil engineers to approach transportation problems in a holistic manner. The benefit of this collaborative model is that flexible research teams can be quickly formed to provide an interdisciplinary methodology to comprehensively address any complex transportation research question. Adopting a human-centered perspective allows us to consider not only the psychological determinants of high-risk behaviors, but also the interaction effects of the traffic, infrastructure, and natural and social environments. In particular, research expertise of consortium members can be used to analyze and model the driver from the physiological (including eye-glance behavior) and cognitive level up to the macroscopic level of societal processes.

Human Factors

Dr. Mike Kelly, C.P.E., (WTI Senior Research Scientist, Safety and Operations) is a senior human factors engineer and project manager with over 30 years of post-doctoral experience managing, directing and performing human factors research and development on advanced transportation systems, communication systems and centers, aviation systems and industrial facilities.

Suzanne Lassacher, M.Sc., (WTI Research Associate, Systems Engineering) has nine years of experience in computer programming and systems administration. She has been (co) principal investigator on several transportation management and safety projects, including the Transportation Research Applications and Instrumentation Lab (TRAIL), Facilitating Special Event Congestion Management in Small Communities project, and TMC to TMS communications. She also manages operations of and conducts research in WTI's Driving Simulation Laboratory.

Industrial Engineering

Dr. Robert Marley, C.P.E., (Dean of the MSU College of Engineering) conducts research on ergonomic design and human factors in surface transportation systems, particularly related to special populations such as the elderly and disabled. His interests include industrial ergonomics, transportation and engineering safety, project management and statistics.

Human Factors and Traffic Safety Research at Montana State University

Dr. Nicholas Ward, M.Ergs., (Professor) has been involved with international traffic safety research for 15 years (University of Loughborough and University of Leeds in the UK, University of Minnesota–ITS Institute) and conducts research on driver impairment, interface design, and driver support systems using driving simulators for visualization and experimentation.

Dr. Laura Stanley, C.P.E., (Assistant Professor) is a WTI research scientist studying crash risk and crash avoidance technologies. She has been a research associate at the Virginia Tech Transportation Institute where she conducted studies on older adults and their driving impairments. She has worked with car manufacturers to develop crash-avoidance technologies, evaluated simulator use in driver licensing, and studied the safe use of in-vehicle communication devices.

Physiology

Dr. Michael Hahn (Assistant Professor) conducts research on human biomechanics, with an emphasis on the neuromuscular effects of aging, and on the interaction between cognitive function and upper extremity reaching tasks.

Dr. Frank Marchak (President, Veridical Research) conducts basic and applied research in visual perception and cognition using eye tracking and physiological measures to support system interface designs and usability analyses.

Psychology

Dr. Richard Block (Professor and Department Chair) conducts research on memory and attention and has conducted research on methods to influence driver fatigue.

Dr. Keith Hutchison (Assistant Professor) conducts research on individual differences examining the interplay between attention and memory in terms of automatic and controlled processes.

Dr. Michelle Meade (Assistant Professor) conducts research on the effects of aging on such functions as attention and human memory and the interplay of cognition and social processes.

Sociology and Anthropology

Dr. Steve Swinford (Associate Professor) studies social science methodologies including surveys and conducts research on the application of social theory for the modification of anti-social behaviors.

Dr. Jeff Linkenbach (Director, Social Norm Project) and *Gary Lande M.D., (*Associate Director, MOST of Us)) together lead a program of research that applies social norm theory to modify health-related behaviors such as seat-belt compliance, driving impairment, and commercial vehicle safety.

Civil Engineering

Dr. Pat McGowen, P.E. (Assistant Professor) conducts research on rural Intelligent Transportation Systems, transportation impacts on wildlife, traffic safety, travel and tourism. He is also the founder and co-chair of the TRB subcommittee on Animal-Vehicle Collisions (ANB20-2).

Dr. David Veneziano (Research Scientist) conducts research in safety and operations including remote sensing, Intelligent Transportation Systems, and geographic information systems (GIS).

Computer Sciences

Dr. Rafal Angryk (Assistant Professor) conducts research on computer modeling and data mining including time series, fuzzy logical, and neural net applications to support the quantification and statistical analysis of human factors research data.

Economics

Dr. Douglas Young (Professor) has a background in economics and alcohol in relation to traffic safety. He has conducted research and published on the effects of alcohol advertising, taxation, and pricing on traffic fatalities. This has included funding from the National Institute on Alcoholism and Alcohol Abuse. Most recently, Dr. Young has been involved in research on commercial vehicle safety.

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APPENDIX C – SYNERGISTIC PROJECT

Research shows that drivers under age 19 have a crash rate four times that of the general driving population with the highest accident rate experienced within two years of receiving the driver's license. Therefore, it could be assumed there is a decrease in crash rates with experience. WTI has begun a controlled study designed to validate training in advanced vehicle handling for novice drivers. In the first of three phases, researchers analyzed accident records for young Montana drivers and designed a defensive driving curriculum to address the most common risks.

In Phase Two, WTI and the Office of Public Instruction recruited approximately four hundred young drivers in central Montana to take part in the actual presentation of training to the young drivers. Of the teens who are graduates of school-sponsored driver education, half received an intervention approximately six months after they took driver education. The intervention involved a one-day classroom and behind-the-wheel workshop. Students received training in the key habits that address the greatest number of driving crashes teens in Montana experience, and personalized suggestions on how to improve their driving abilities. Students also completed a survey of demographic and driving experience information.

For this project (Phase Three), all the teens will be tracked for four years following the project to determine the driving history comparisons of the control group to those who received the intervention. Reported accidents, violations and driving experience will be compared.

Funds available from this project total $30,000.

APPENDIX D – RESUMES

Nicholas J. Ward, PhD

Professor, Department of Mechanical and Industrial Engineering

Montana State University

Senior Research Scientist,

Western Transportation Institute

Professional Preparation

- Simon Fraser University, Bachelor with Honors, Psychology Social Psychology, Statistics, 1987
- Queen's University, Psychology Human Factors, Organizational Psychology Masters 1990
- Queen's University, Psychology Human Factors, Organizational Psychology, Ph. D. 1993.

Appointments

- Professor, Department of Mechanical and Industrial Engineering, Montana State University; Senior Research Scientist, Western Transportation Institute. 2007 – present
- Associate Research Professor, Director of Program for Human Factors Interdisciplinary Research in Simulation and Transportation (HumanFIRST Program), Department of Mechanical Engineering, University of Minnesota. 2001 – 2007
- Tenured faculty (Lecturer), School of Psychology (and Principal Scientist in the Institute for Transport Studies), University of Leeds. 1996 - 2000
- Research Fellow at the Human Sciences and Advanced Technology (HUSAT) Research Institute, Loughborough University of Technology. 1993 - 1996
- Graduate Teaching Assistant Introduction to Psychology, Human Factors Psychology and Research Methodology and Statistics, Queens University. 1989 – 1993

Fellowship and Awards

Fellow of the Ergonomics Society as well as a member of the Human Factors and Ergonomics Society and the International Association of Applied Psychology.

Five Most Relevant Publications

Ward, N.J. (2007). The Culture of Traffic Safety in Rural America. AAA Traffic Safety Foundation.

Brovold, S., Donath, M., Simons, S., Ward, N. & Shankwitz, N. (2007). In-vehicle Technology to Correct Teen Driving Behavior: Addressing Patterns of Risk. Journal of Safety Research, 38, 413 – 422.

Rakauskas, M., Gugerty, L., & Ward, N.J. (2004). Effects of Cell Phone Conversation on Driving Performance with Naturalistic Conversations. Journal of Safety Research, 35, 453-464

Ward, N.J. & Smith, L. (2000). Shift work and driver fatigue. International Conference on Traffic and Transport Psychology, Berne, Switzerland (September 4-7).

Parkes, A.M. & Ward, N.J. (2001). Case study: A safety and usability evaluation of two different car phone designs. International Journal of Vehicle Design, 25, 12-29.

Additional Example Publications

Ward, N. J., Gorgestani, A., Shankwitz, C., & Donath, M. A preliminary demonstration study of the usability of a vision enhancement system for state patrol vehicles. Journal of Intelligent Transportation Systems, 8, 169-185. 2004.

Bernat, E., Cadwallader, M., Rakauskas, M., Ward, N.J, Collins, P., & Patrick, C., Effects of intoxication on attention allocation in a naturalistic driving environment. Psychophysiology, 41, S40. 2004

Smith, P., Ward, N. J., & Waterman, M. Driving aggression in forensic and non-forensic populations; relationships to self-reported levels of aggression, anger, and impulsivity. British Journal of Psychology, 97, 387 – 403. 2006

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Ward, Nicholas, Alexander, Lee, Cheng, Pi-Ming, Gorjestani, Alec Newstrom, Bryan, Olson, Curt, Shankwitz, Craig, Trach Jr., Walter, and Donath, Max. A Demonstration of a Vision Enhancement System for State Patrol Vehicles. In Intelligent Transportation Systems, 8:169-185, 2004

Ward, Nicholas J., Shankwitz, Craig, Gorgestani, Alec, Donath, Max, De Waard, Dick, Boer, Erwin. An Evaluation of a lane support system for bus rapid transit on narrow shoulders and the relation to bus driver mental workload. In Ergonomics, Vol.49, No 9:832-859, 2006

Creaser, Janet I., Rakauskas, Michael E., Ward, Nicholas J., Laberge, Jason C., Donath, Max. Concept evaluation of intersection decision support (IDS) system interfaces to support drivers' gap acceptance decision at rural stop-controlled intersections. Transportation Research Part F: Traffic Psychology. 2006

Ward, Nicholas J., The Culture of Traffic Safety in Rural America. AAA Foundation for Traffic Safety. 2007

Laberge, J. & Ward, N.J. Cannabis and driving: Research needs and policy issues. Journal of Drug Issues, 34(4), 971-990. 2004

Synergistic Activities

- Member of the editorial board for two leading international journals related to human factors and traffic safety: Journal of Accident Analysis and Prevention, and Transportation Research Part F - Traffic Psychology and Behavior.
- Member of funding agency review panels including the Safety and Human Factors Committee of ITS America and the Biobehavioral and Behavioral Process IRG for Study Section 2 of the National Institute of Health.
- Active member of the National Academy of Science (TRB) Committees on Simulation and Measurement of Vehicle and Operator Performance (AND30) and Vehicle User Characteristics (AND10).

Current Support

- "Rural EMS Drivers Safety Research Program: Phase 1 Feasibility Study" USDOT $168,461. 2008 – 2009
- "Advanced Vehicle Based Countermeasures for Alcohol Related Crashes" University of Iowa, $40,500. 2007 – 2008.

Laura Stanley, Ph.D.

Assistant Professor Mechanical & Industrial Engineering Montana State University
Research Scientist, Western Transportation Institute, Montana State University

Professional Preparation

Virginia Polytechnic Institute & State University, Industrial & Systems Engineering, B.S., 2000.
Montana State University, Industrial & Management Engineering, M.S., 2002.
Emphasis: Human Factors, Ergonomics, Biomechanics
Montana State University, Engineering – Option: Industrial Engineering, Ph.D., 2006.
Emphasis: Human Factors Engineering, Applied Statistics, Transportation Engineering

Appointments

Assistant Professor Mechanical & Industrial Engineering, Montana State University, August 2008
Research Scientist, Western Transportation Institute, Montana State University, August 2008
Research Associate-Automotive Safety Research Group, Virginia Tech Transportation Institute, June 2006-June 2008
Research Associate/Graduate Professional Fellow, Western Transportation Institute-University Transportation Centers Program, College of Engineering, Montana State University, September 2003-May 2006
Graduate Research Assistant, Industrial and Management Engineering Department, Montana State University, August 2000-December 2001
Research Assistant, Virginia Tech Transportation Institute, Virginia Tech, Aug 1999-May 2000
Research Assistant, Department of Human Factors and Ergonomics Engineering, Virginia Tech, Apr 1998-Aug 1998

Fellowship and Awards

Western Transportation Institute University Transportation Center Outstanding Student of the Year (2006)
ENO Transportation Foundation Award (2005)
Western Transportation Institute Professional Advancement Fellowship (2003-2005)
Philip E. Rollhaus, Jr. Essay Competition Finalist Best Student Paper Award (2004)
Institute of Transportation Engineers Best Student Paper Award Recipient (2004)
Institute of Transportation Engineers James Kell Award – Sacramento, CA (2004)
Boeing Academic Engineering Scholarship (2002)
National Science Foundation Women in Engineering Academic Scholarship (2001)
USA Olympic Collegiate Cycling Scholarship (2001)

Five Relevant Publications

Stanley, L., Hardy, A., and Lassacher, S., Driver Responses to Enhanced Wildlife Advisories in a Simulated Environment. Transportation Research Record: Journal of the Transportation Research Board, 2006, No. 1980, pp 126-133.

Kelly, M. and Stanley, L. (2005). Effects of Defensive Vehicle Handling Training on Novice Driver Safety: Phase 1. Preparation for Advanced Driving Training Report. For

Montana Department of Transportation in cooperation with the U.S. Department of Transportation Federal Highway Administration

Stanley, L., Kelly, M., and Lassacher, Suzanne. Driver Performance While Interacting with the 511 Travel Information System in Urban and Rural Traffic. Third International Driving Symposium on Human Factors in Driver Assessment Training and Vehicle Design Proceedings, Rockport, ME, June 2005.

Stanley, L., Wierwille, W., Hanowski, R., and Blanco, M, (2006). Development and Assessment of a Driver Fatigue Monitoring System: Literature Review and Functional Specifications. Federal Motor Carrier Safety Administration: DTNH22-05-D-01019, National Highway Traffic and Safety Administration Task Order No. 0007,

Stanley, L., Wierwille, W., Hanowski, R., and Blanco, M, (2006). Development and Assessment of a Driver Fatigue Monitoring System: Literature Review and Functional Specifications. Federal Motor Carrier Safety Administration: DTNH22-05-D-01019, National Highway Traffic and Safety Administration Task Order No. 0007,

Additional Relevant Publications

Kelly, M., Lassacher, S., and Stanley, L. Formative Evaluation of Engineering Designs using Driver Performance in an Immersive Driving Simulator. Fourth International Driving Symposium on Human Factors in Driver Assessment Training and Vehicle Design Proceedings, Stevenson, WA, July 2007

Stanley, L., Carson, Jodi L., and Marley, R. Shifting the Design Paradigm to Accommodate Older Drivers at Intersections & Work Zones. Annual Regional National Occupational Research Agenda Symposium Proceedings, Salt Lake City, UT, April 2004.

Stanley, L. and Kelly, M. Validating Transportation Safety Deployments and Highway Design Elements. Canadian Multidisciplinary Road Safety Conference, Whistler, British Columbia, June 2008.

Stanley, L., Marley, R. Whole Body Vibrations on the Low Back Using a Suspension Versus Non-Suspension Seat Post During Off-Road Cycling. Medicine and Science in Sports and Exercise Journal, Volume 38(5), May 2006.

Stanley, L., Hardy, A., and Lassacher, S. Enhanced Wildlife Warnings as a Potential Means of Reducing Wildlife-Vehicle Collision. National Rural ITS Conference Proceedings, Bozeman, MT, August 2006.

Stanley, L ., Marley, R., and Kelly, M. Haptic and Auditory Cues for Roadway Departure Warnings. Human Factors and Ergonomics Society Annual Meeting Proceedings, San Francisco, CA, October 2006.

Stanley, L., Carson, Jodi L., and Marley, R. Shifting the Design Paradigm to Accommodate Older Drivers at Intersections & Work Zones. Annual Regional National Occupational Research Agenda Symposium Proceedings, Salt Lake City, UT, April 2004.

Stanley, L., Carson, Jodi L., and Marley, R. Shifting the Design Paradigm to Accommodate Older Drivers at Intersections & Work Zones. Annual Regional National Occupational Research Agenda Symposium Proceedings, Salt Lake City, UT, April 2004.

Synergistic Activities

Human Factors and Ergonomics Society Surface Transportation Group (2005 to present)

United States Department of Transportation's Research for the Undergraduate Experience Mentor (2005)

Driving Simulation Systems User Group Member (2004 to present)
Montana Apprenticeship Program for Native Americans Encouraging Participation in Science and Engineering Mentor (2004)
Bridges and Dams: Exciting Young Girls about Engineering Volunteer (2003-2006)
Women in Engineering MentorNET Mentor (2002 to present)

Current Support

"Older Driver Naturalistic Observation," Federal Highway Administration and U.S. Department of Transportation, August 2007- June 2008, $280,000
"Cooperative Agreement for Advanced Crash Avoidance Technologies Program," National Highway Traffic Safety Administration (NHTSA) in Response to Cooperative Agreement DTNH22-06-H-00011, August 2006- June 2008, $4,000,000.
"Design of the In-Vehicle Driving Behavior and Crash Risk Study," National Academy of Sciences' (NAS) Strategic Highway Research Program 2 (SHRP 2), August 2007- June 2008, $3,000,000.

APPENDIX E – DETAILED BUDGET

		Nic Ward Principal Investigator	Laura Stanley Co-Investigator	Graduate student	Carol Diffendafer Technical Editor	Total Hours/Total Costs	Travel	Operations/Communications	Minor Equipment (<5000)	Other (Participant Support)	Subcontract: Drive CAM	Equipment >5000	Total Costs
	Task Title	$95.00	$55.00	$14.70	$23.81								
		224	422	1200	10	1856							
	Year 1 - months 1-12	$21,280.00	$23,210.00	$17,640.00	$238.10	$62,368.10	$ 5,000.00	$ 300.00	$ 3,750.00	$ 6,000.00	$ 5,000.00	$ 18,000.00	$100,418.10
		126	238	700	30	1094							
	Year 2 - months 13 - 19	$11,970.00	$13,090.00	$10,290.00	$714.30	$36,064.30	$ 5,000.00	$ 300.00		$ 2,250.00	$ 4,000.00		$47,614.30
	TOTAL HOURS	350	660	1900	40	2950							
	TOTAL DIRECT COSTS (includes ben.)	$33,250.00	$36,300.00	$27,930.00	$952.40	$98,432.40	$10,000.00	$600.00	$3,750.00	$8,250.00	$9,000.00	$18,000.00	$148,032.40
0.425	Indirect Costs at 42.5%	$14,131.25	$15,427.50	$11,870.25	$404.77	$41,833.77	$4,250.00	$255.00	$1,593.75	$0.00	$3,825.00	$0.00	$51,757.52
	Total Project Costs	$47,381.25	$51,727.50	$39,800.25	$1,357.17	$140,266.17	$ 14,250.00	$ 855.00	$ 5,343.75	$ 8,250.00	$12,825.00	$ 18,000.00	$199,789.92

The **Staffing** budget category includes salary and fringe costs for the co-investigators (N. Ward, L. Stanley) to perform the technical and management function necessary for this project, as well as one Graduate Research Assistant (GRA) to support the research tasks An additional GRA will be sought through the Western Transportation Institute *Graduate Transportation Award* program (www.wti.montana.edu/Education/Funding.aspx). Communication, administration, and accounting staff costs are also subsumed in this budget category.

The **Equipment** budget categories (major, minor) include equipment costs for the data collection system (vendor: DriveCAM) for the data collection phase. This will include 45 units to provide coverage for the anticipated sample of 40 students with 5 spare units. In addition, equipment costs are included for a laptop with portable printer, scanner, and projector for onsite recruitment and research at participating schools.

The **Travel** budget category includes overnight trips to Washington, DC for project meetings with NHTSA and PIRE. Two trips for two persons (N. Ward, L. Stanley) are planned in each project year (8 person trips).

The **Subcontract** budget category includes the five month contracted services (vendor: DriveCAM) to retrieve, code, and archive the data recordings and events during the data collection phase.

The **Other** budget category includes stipend amounts allocated to schools [5 x $500], driving instructors [5 x $250], and students [45 x 100] for consenting to participate in this study [estimated numbers in brackets].