Improved Driver Education
IDOT End-Product Final Report
May05-05

Client: Iowa Department of Transportation

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Advisors:
John Lamont
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April 26, 2005
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Table of Contents

List of Tables

List of Figures

List of Symbols

AASHTO	American Association of State Highway and Transportation Officials
CDL	Commercial driver's license
FHWA	Federal Highway Administration
IDE	Improved driver's education
IDOT	Iowa Department of Transportation
PDA	Personal digital assistant
ODAPC	Office of Drug & Alcohol Policy & Compliance

List of Definitions

2-Lane Highway: A highway road which has two lanes of traffic total, each traveling in the opposite direction.

Annual average daily traffic (AADT): The estimate of typical daily traffic on a road segment for all days of the week over the period of one year. It provides a quick indication of the average usage of a road.

Alternatives grid: A grid which outlines the various alternatives and technologies and their applications and ranks them on various criteria to arrive at a final decision.

CTRE: Center for Transportation Research and Education at Iowa State University

Gantt chart: A workload distribution graph based on projected time versus tasks.

IDOT: Iowa Department of Transportation – The client for the improved driver education project.

Problem and solution matrix: The matrix that the team devised to organize their problem and solution lists.

Public service announcement (PSA): An announcement on television or radio serving the public interest (or a non-profit cause) and run by the media at no charge.

Queue length: The distance between the stopping point before entering the controlled area and the last stationary car in the queue.

IDE: Improved driver's education. This is the project main subject and objectives.

PDA: Personal digital assistant. This is an electronic device that functions as a handheld computer.

Executive Summary

This document contains end product information regarding the improved driver education project that is to be completed April of 2005 by the May05-05 senior design team.

General Problem Statement

Every year, more than 11 million crashes take place on U.S. roads, resulting in more than 5 million injuries and 40,000 deaths. Unfortunately, the most serious crashes are not always accidents. They are often the direct result of dangerous driving or mechanical failures. The current driver education system tends to be too general and has many limitations; some important driving techniques and requirements are often neglected and not observed. Some of the obvious important factors needed to be included with driver education are weather-related driving, different road-condition driving techniques, construction-zone driving rules, and night driving. Besides learning how to drive, the driving education system should also prepare drivers to eliminate bad driving habits and human error such as talking on cellular phones, reading, turning to talk to passengers, eating, listening to loud music, changing CDs, watching TV or DVDs, drunk driving, speeding, lacking of attention, road rage, sleeping, and other distractions while driving. Mechanical failure is also a big factor that causes accidents. Even if the drivers are well prepared for the driving obstacles mentioned above, as time goes by, people tend to forget proper driving guidelines and behaviors learned during the driver education period.

The purpose of this project is to improve the driver education in general by emphasizing neglected/ignored information. The team also completed research on the current driver education system, driving behavior statistics, driving accident statistics, driving legislation, recommendations for the vehicle manufacturers, add-on solutions provided by public organization, and people in the communities through their driving experience. The team composed this information together to get a good understanding on the current problems and how to reduce them. The team focused the study and proposed solutions for different age groups. These age groups included 5 year olds to the age when the driver is no longer able to drive. These age groups are as follows: 5 to 14 year olds, 15 to 21 year olds, 22 to 55 year olds, 55 to 70 year olds, and those that are no longer driving.

General Solution Approach

The team has the advantage of having two team members who come from other countries and have fresh knowledge on the United State's driver's education system. This brought an outside perspective on how to improve the driver education system.

The team has composed a problem and solution matrix which was used to correlate different problems to their solutions in an organized manner. The team has also composed lists of problems and solutions that will help to organize thoughts and help to extrapolate research documents.

The problem list is composed of approximately two hundred different problems associated with today's driving. It includes a range of problems from talking on cellular phones while driving to how to handle a driving in a snow storm. Each problem requires a unique solution. The team categorized both problems and solutions to narrow the overall scope of the project. Further research may help to bring more projects to be implemented.

General End Product

The final document is mainly composed of different solution methods to the identified problems. Some problems have more than one solution. These solutions range from displaying billboards to planning awareness events. Each solution was defined and evaluated by cost and risk. The final document also includes solutions that the team decided would not be effective.

This final document will be reviewed by the client, project advisors, and people from different fields to check for the effectiveness and practical use of the solution. The team also made recommendations to improve public knowledge of driving related information while obtaining driver licenses (i.e. new licenses, renewing licenses, and obtaining licenses for people from other states/countries), vehicle registrations, transferring vehicle ownership, car insurance, driving laws and regulations, driving manuals, and contact information.

This end product report explains how the team has progressed throughout the project. It also evaluates the resources used and the team's schedule. It also provides documentation of the final product.

Suggested Solutions

Below is a list of solutions that the team has thought of. Eleven of these solutions are explained in detail in the Appendix. These lists are divided into three subgroups according to who should actually implement their design. These subgroups are defined to be DOT projects, senior design projects, and other.

Table 1: Solution DOT Projects

DOT Projects	
Advertising Campaigns	New advertising campaigns that restate a certain area of bad driving habits.
Bad Weather Training	A class that people will gain experience for driving in bad weather.
DOT Banquet / Fund Raiser	A banquet or fund raiser that will help to reinforce good driving habits and public awareness.
DOT Day	A specific day of the year that will bring awareness of safe driving practices to the community
Driving Rewards	Special rewards for drivers with perfect records: Local tickets to shows, frequent driver miles, hotel stays, etc.
Emergency Handling Class	A class that will help drivers/non-drivers to become more prepared to handle car accidents.
Hazardous Driving Area Classes	A class that people will get experience at driving in hazardous road areas: E.g. Big city driving, gravel roads, interstate driving, etc.
Informational Videos	Videos that can be played in public places that reinforce safe driving practices. E.g. While waiting at the Driver Licenses Bureau.
Personal Car Training	A person buy a new car will receive special training on that car.
Problem Awareness Week	A week that will bring awareness of safe driving practices to the community.
Public Speaker / Icons	A public speaker or icon that will speak out on a topic: E.g. Crash test dummies
Revisal Of Educational Methods	New classes and information to be discussed as well as the standards to becoming a driver.
Revisal of Exams / Retake Policy	Different requirements for age groups, and repeat offenders. Also standard retake after so many years.
Safe Driving Cartoon	A cartoon that will focus on safe driving: E.g. Captain Planet
Safe Driving Contest	A contest that will help people to report and correct bad driving behaviors
School Presentations	Presentations to local schools about safe driving practices.
Senior Driver Bad Driving Reporting	Promote family members to report senior citizens that should have restrictive driver's licenses.

Table 2: Solution Senior Design Projects

Senior Design Projects	
Added Lights / Turn Signals	Lights that could be added to the side of the car, E.g. Door frames that light up when tuning or getting out of car.
Backing Up Sensor / Signal	A sound that signals drivers when there is something in the vehicle's path while backing up.
Bad Weather / Accident Alert System	A radio station override that will alert all car drivers of bad weather, accidents, construction.
Bad Weather Devices	Car enhancements that will sense bad weather and adjust how the car performs.
Blind Spot Devices	Added mirrors or cameras that will remove blind spots for drivers.
Car Pet Carrier	A pet carrier that is either built into the car or can be easily added and removed.
Distance / Collision Sensors	Sensors that will alert the driver when in close proximity to objects.
Educational Ride / Simulator	A simple ride that focuses on safe driving that is at video arcades, outside stores, carnivals, etc.
Enhanced Car Maintenance Signals	Signals for drivers that something needs to be done with the cars: Replace lights, oil change, rotate tires, turn of turn signals, etc.
Internal Car Sign Reader	Radio frequency (RF) signals added to sign or road surfaces that will be detected by the car and display road conditions to driver: speed limit, mile marker, traction Etc.
Intersection Control Devices	Redesign intersection systems that will allow pedestrians and vehicles to cross more safely.
Keeping Driver Alert System	Alert system that monitors drivers and keeps them awake and alert.
Safe Driving Board Game / (In Car?)	A game that can be played by children in the car that will enforce safe driving procedures, and will not distract driver.
Safe Driving Car Toy	Toys that can be used in a car, e.g. a doll that needs to be buckled up.
Safe Driving Video Game	A video game that focuses on safe and proper driving instead of racing.
Speed Governor System	A speed limiting system that will keep the driver from exceeding speed limits.
Trash Compactor for Car	A device that will help drivers to keep their cars clean and safe from trash.
Web Database Of Driver Information	Local place to store driving information in the US.
Web Database Of Driving Statistics	Local place to store driving statistics in the US.

Table 3: Solution Other

Other	
Cell Phone Law	A law that limits or eliminates cell phone use while driving in a car.
Breathalyzer in Vehicle	A requirement that cars have a breathalyzer installed in the car that only allows the driver to start the vehicle while sober.
Bumper Height Laws	Law to make all bumpers of uniform height.
Decoy Enforcement	Dummy police cars that will keep people more conscious of their driving practices.
Driver Distraction Laws	Laws that will limit the driver distractions.
Headphone Laws	Laws the will prevent the wearing of headphones while driving.
Helmet Laws	Laws that will require helmets while driving motorcycles, bicycles, etc.
Maintenance Inspection Laws	Laws to require annual mechanical inspection of vehicle.
Window Tinting Laws	Laws that limit dark window tinting on vehicles.

Acknowledgements

The improved driver education project team would like to recognize the following people for their contribution of time and resources:

Mark Bortle, and the Iowa Department of Transportation

John Lamont, Ralph Patterson III, and the Iowa State University Department of Electrical and Computer Engineering

Duane Smith, Max Porter and the Iowa State University Department of Civil, Construction, and Environmental Engineering

These resources were the key factors that drove and guided the team in the completion of the project end product. All of the knowledge and information that are given to the team from these resources are used in every part of this end-product report.

Problem Statement

The current driver education system does not effectively prepare drivers for a lifetime of driving under poor or distracting conditions. Education needs to be improved to prevent future car-related accidents.

General Problem Statement

According to the U.S. Department of Transportation, there are about 3 million car related injuries a year, 2 million permanent injuries and 40,000 deaths in the U.S. The current driver education is not effectively training today's drivers. Many drivers are not prepared for, nor have sufficient driving experience under adverse driving conditions, such as weather-related conditions and road construction zones. They may also be unaware of other dangerous habits while driving, i.e. talking on cellular phones, eating while driving, or turning to talk with passengers. The main goal of this project is to determine the current driving problems and to develop a set of materials to significantly reduce these problems.

General Solution Approach

The team researched car accidents and fatalities to determine how better education and possible technology improvements can prevent these situations. The team identified the parties affected by these situations and the best method of education. The team also produced a comprehensive list of materials to better educate drivers, and identify the technology to be used most effectively with the training materials. The research and materials produced, is not limited to drivers only, but to everyone who is affected, this includes passengers and pedestrians of all ages. The team also sought out professional help from experienced members of the psychology, education, and driving communities.

Intended Users and Uses

The improved driver education project is intended for the IDOT, but ultimately drivers and the public are the real benefactors. By researching the defined driving related problems and solutions matrix, the team has been able to suggest necessary improvements and new ideas to improve driver education and the general public awareness of driving related problems to reduce future driving related accidents and promote safety. The uses of the end product are defined as the IDOT driving education improvement proposal, early childhood education, facility utilization, international or foreign driver information, driving informational reminders and updates, and elder driver performance evaluation.

Intended Users

The intended users of the improved driver education end project completion report are broadly stated as IDOT, driving instructors, and public safety offices and anyone indirectly related to driver's education. Users are referred to driver education section of IDOT throughout the majority of the design project.

DOT - Primarily these designs are developed for the driver education section of IDOT. If the end project is found to be successful, users may include other states, their contractors, and agencies which have a similar problem. Some of the proposed end products may be used by construction personnel, IDOT personnel, vehicle driver, and/or become a part of an external database. The ones who educate these people should also utilize the educational components created. Depending on the degree of system integration, the system may be incorporated into other systems currently used by the IDOT.

Figure I: Iowa Department of Transportation Logo

Driving groups are divided into two subgroups. One subgroup is composed of drivers that are specifically involved in driving the vehicle. The second is the passengers and other people associated with the vehicle but not directly involved in the driving process.

Drivers - Along with the primary users of the end product, some related group of people will have a differentiated impact from the end product. All of the consumers of the driving legislation will be using the end product in some points of their driving life.

General Non-driving Public - The end product should also be used by non-drivers, such as construction workers and people working or living in road construction areas. These people interact with extreme driving potential hazards everyday and should be aware of their environment. Other people affected are joggers, roller-bladders, pedestrians, and passengers etc

Intended Uses

The primary use of the research is to prevent future driving-related accidents. The idea driving this project is the use of fresh minds to think of new ways to improve safety. The research performed in this project should also be used in the future for follow up as technology improves and other possibilities present themselves. Additionally, the findings may be used to educate drivers (in driver training, in license renewal, in brochures, public service announcements, etc.) of warnings and dangers associated with construction zones as well as general driving including bad weather. The system may be used both locally in the IDOT Driver Education systems and as a precautionary measure before licensing a future driver.

Figure II: Patrol Car

The intended uses will vary depending on the user. However, there are some similar uses for different kinds of users.

IDOT Driving Education Improvement Proposal - The relay point for any new or prospective driver is the IDOT. Here the IDOT is situated so that a driver may receive a driver's license. The prospective driver, regardless of background and previous experience, can explore information regarding the process and requirements of receiving a driving license. The IDOT also provides an information packet for the prospective driver. Relevant to this, the basic driving requirements (i.e. what to prepare before driving, what part of the car to be inspected before driving, what time is the best driving time, what to avoid while driving, etc.) are important to know for new and old drivers alike.

Figure III: Driving Simulator

Early Childhood Education - Another interesting use shall be early childhood education. The improved driver education project shall provide basic driving and safety information that can be transferred into an easy, informative fun approach. The information transferred to the children can be forwarded to their parents, through reminders.

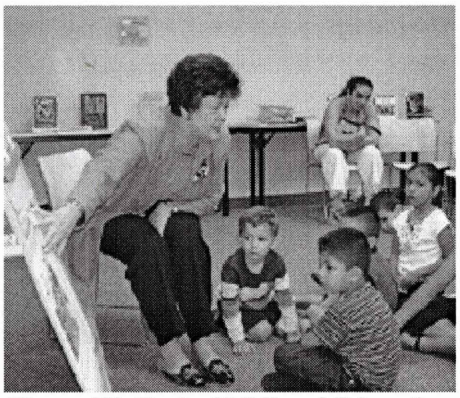

Figure IV: Early Childhood Education

Public Driving Facilities - Twenty-four hour auto service stations, auto safety condition inspection facilities, city road and highway patrol offices, and rest areas are of typical need of anyone driving. These facilities can support the improved driving education project and help to distribute information and hopefully minimize accidents.

International/foreign driver information method - If the user is an international/foreign driver who uses a different driving system than the one applied in Iowa, they can find information about many of the pitfalls of American driving at the IDOT, as well as where to go for more driving practice, what is the required paper work, and to whom to talk.

Figure V: Foreign Driving System

Driving Informational Reminders and Updates - The other use of the end product is to constantly remind the driver about good driving techniques and habits. The end product also intends to update the drivers of any changes in the driving related legislation.

Elder Driver Performance Evaluation - The end product also considers elder drivers whose skills are decreasing. These drivers may not be aware of their diminishing skills and therefore will need to be revaluated. New testing procedures may also need to be implemented.

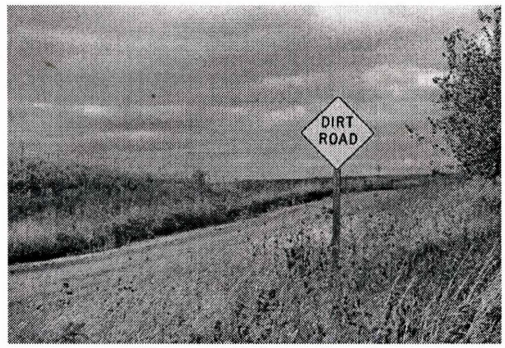

Figure VI: Dirt Road

The overall performance of the improved driver education is not to be tedious, fixed, or easy to forget. It is flexible, not require too much of user's time, easy to adapt, easy to update, easy to implement, and incorporates with the busy schedule of the driver.

Assumptions and Limitations

These two separate lists, one for the updated assumptions and the other for the updated limitations, recognize any decisions and define constraints of this project. These are the updated lists which were developed during the project design. The team has made additions to one or both lists when a decision was made that affected the design or implementation during the course of this project.

Updated Assumptions List

Assumptions made during the implementation of the improved driver education project are listed below:

- If implemented the proposed solutions will actually benefit the people that they are directed toward
- The proposed solutions will actually reach the public for which they are intended
- The design concepts will be evaluated by the IDOT
- Some required information that has sensitive and restricted characteristics are not likely able to be accessed by the team (i.e. new technology development by car manufacturers)
- The effectiveness of the solution/product will be measurable (to some extent) in some definitive manner
- The problems and solutions defined in the problems/solutions matrix are complete and goes through every detail related to the project
- The cost of the product and its results are not necessarily correlated
- Improvements on results are possible along with new technologies
- New technologies may also add more problems, i.e. cellular phones
- Different types of road construction may require different types of solutions
- The design report is concise and describes the project progress throughout the development and completion of the project
- Comprehensive proposed solutions spans all recognized problems
- Psychologist and all other resources will be available throughout the project development in discussing the end product prototype
- There are three primary groups of involved people: non drivers, potential drivers, and current drivers.

Updated Limitations List

Physical limitations that came into effect when the team implemented the improved driver education project are listed below:

- There is a limit to how much information can be extrapolated from statistic research
- Any designs for legislation must meet federal and state guidelines before implementation
- Cost-effectiveness is a significant factor
- The end-product is a set of proposals for the education system and anything related to the issue; the final decision of the implementation are outside the team's control
- The data result of the end product testing will not be instantaneously achieved
- The research of the design is following the defined problems and solutions in the problems and solutions matrix only
- The group meeting schedules with the resources and clients throughout the project design development are not flexible
- The end product can not be tested by the team

Problems with Current Driving Situation

The end product contains a large amount of information and therefore must be extremely organized to make sense to the reader. Therefore the team has implemented a several lists and tables to reference this information. The problem information will be referenced in this section.

Lists of Current Problems

The team has created a list of current problems with the driving situation. This list was composed by doing research and individual experience and knowledge of the current driving situation. They have divided the list into seven subgroups.

Table 4: List of Driving Distractions

Distractions
Changing Music
Children
Day Dreaming
Driving Games
Eating While Driving
Gadget Distractions
Health Emergency
Homeless People
Human Waste Emergency
People Trying to Distract Drivers
Pets
Portable Music (Headphones)
Putting on Makeup/shaving
Racing
Radio Too Loud
Reading
Showing Off
Singing While Driving
Smoking While Driving
Talking on Phone
Turning to Talk While Driving
Trash in Car
Watching TV

Table 5: List of Hazardous Road Vehicles

Hazardous Road Vehicles
Bicycles
Buses
Construction Equipment
Emergency Equipment
Farm Equipment
Horse Drawn Vehicles
Modified Vehicles
Motorcycles
Over-Sized Vehicles
Police Vehicles
Road Graders
RV's
Semi-Trucks
Slow Moving Vehicles
Snowmobiles
SUV's
Trailers

Table 6: List of Hazardous Driving Areas

Hazardous Driving Areas
Accident Sites
Animals on Road
Big City Driving
Bike Routes
Blind Hills
Blind Turns
Braking Procedures
Changing Lanes
City Driving
Class B Roads
Construction Zones
Cross Walks
Deer Crossings
Desert Driving
Dips
Driveways
Gravel Roads
Intersections
Interstate Driving
Jay Walking
Litter on Roads
Merging
Mountain Driving
Narrow Bridges
On/Off Ramps
Parking Lots
Parking on Side of Road
Parks
Pedestrian Crosswalk
People on Shoulder
Railroad Crossings
Reduced Speed Zones
Residential Driving
Safety Barriers
School Bus
School Zones
Speed Traps
Spilled Items on Road
Toll Booths
Traffic Jams
Unfamiliar Areas
Yellow Lights

Table 7: List of Non Drivers

Non Driving
Bicyclers
Children at Play
Construction Workers
Disabled Vehicles
Jaywalkers
Joggers
People Entering/Exiting Vehicles
People Doing Car Maintenance on Roads
People Retrieving Lost Items, Getting Mail
School Children
Sidewalks and Intersections

Table 8: List of Personal Hazards

Personal
Age
Color Blind
Drinking and Driving
Failing Eyesight
Foreign to State
Height (Too Short or Tall)
Helmets
Loss of Hearing
Loss of Mind
Loss of Reflexes
Medication
New Drivers
Physical Condition
Road Glare
Road Rage
Rude Gestures
Sleeping/To Tired to Drive
Speeding
Sunglasses
Tailgating
Unaware of Laws

Table 9: List of Vehicle Hazards

Vehicle Hazards
Air Bags
Blind Spot
Bumper
Car Maintenance
Child Seat
Cruise Control
Excessive Weight
Exhaust
Gas Tank
Gasoline
Governors
High Beams
Lights Out
Loss of Brakes
Loss of Control
Loss of Steering
Mirrors
Muffler
Oil
Reflections off Vehicles
Seat Belts
Stuck Accelerator
Tires
Windshield
Windshield Wipers

Table 10: List of Weather Conditions

Weather Conditions
Floods
Fog
Frost
Hail
Heat
High Wind
Hurricanes
Ice
Night
Rain
Snow
Sunset and Sunrise
Tornados

List of Problem Definitions

Each problem has been defined for further clarification. They are listed in alphabetical order ad arranged in their subgroups. The team used this list to better understand the problems with the current driver's educational system. Therefore they were able do defines better solutions to the overall problem.

Distractions

Driving distractions consist of any activities inside or outside the vehicle that divert the driver's attention off the road. Common activities that distract the driver are playing with gadgets, eating/drinking, and conversing with passengers.

I. Changing Music – Drivers often change stations on the radio, or tracks on the CD player. This momentarily diverts the drivers attention off the road and can lead to an accident

II. Children– Children often play or argue in the car and may cause the driver to discipline them. This can be very distracting to the driver, and may cause the driver to use mirrors for monitoring instead of looking for vehicles

III. Day Dreaming – The driver may not be consciously thinking about driving and may have difficulties reacting to problems on the road.

IV. Driving Games – Driving games divert the driver's attention off the road and can hinder the driver's vision and hearing.

V. Eating While Driving – Sudden spills may cause the driver to be more worried about work attire than oncoming traffic. Spills can also injure the driver which can lead to an accident. Eating also takes the driver's hands off of the steering wheel.

Figure VII: Fast Food

VI. Gadget Distractions – A driver who is constantly fumbling with technology, i.e. GPS, On Star, stereo, etc. has at least one had off of the steering wheel and may cause the driver to remove eyes from the road.

VII. Health Emergency – Unexpected health emergencies can force a driver to loose concentration on the road, this can be especially dangerous in heavy traffic and highway driving.

VIII. Homeless People – Homeless people, especially in big cities, interact with drivers at intersections and may beg for money. This may cause some drivers to avoid time spent at intersections and also the homeless are in danger of being hit.

IX. Human Waste Emergency – A person in desperate need of relief may speed and drive more dangerously in order to get to a restroom.

X. People Trying to Distract Drivers – If other people are distracting the driver, the driver cannot have full focus on the road and may cause accidents.

XI. Pets – Drivers driving with pets not restrained can lead to accidents because of pets misbehaving and drivers forced to discipline their pets reduces the driver's concentration on the road. Also the pet could get in the way of the drivers view or may cause a driver to loose control if it gets under the drivers feet.

Figure VIII: Dog in Truck

XII. Portable Music (Headphones) – It is illegal in most states to use headphones while driving because the driver will not be able to hear outside the car which includes emergency vehicles. Also music may be very loud and distracting

XIII. Putting on Makeup/Shaving – The driver may be more focused on putting on make up rather than paying attention to the road. Also mirrors may be readjusted so that they are reflecting the driver instead of other traffic. Putting on eye makeup could be extremely dangerous due to the danger of poking or inserting makeup into the eye which may impair vision.

XIV. Racing – Racing causes drivers to speed and drive extremely dangerously. It is also illegal. A driver that is racing may loose control of the vehicle and cause accidents.

XV. Radio Too Loud – Driving with the music too loud hinders the driver's hearing and judgment of what is happening outside the car. The driver may not be able to hear emergency vehicles, or accidents near the driver.

XVI. Reading – Reading while driving causes the driver to lose focus on the road and incoming traffic. The driver may not even be looking at the road, but instead may be looking onto one's lab or steering wheel where the map, book or newspaper may be resting.

XVII. Showing Off – A driver that is showing off maybe speeding or swerving wildly. This can cause accidents to other vehicle or may allow the driver to loose control of the car.

XVIII. Singing While Driving – A driver that is singing while driving has a reduced reaction time and may not be able to hear important signals coming from other vehicles.

XIX. Smoking While Driving– Smoke can hinder the driver's ability to see; also lighting tobacco product removes hands from the steering wheel. Also a dropped tobacco product may start a fire or cause the drive to loose control of the car.

XX. Talking on Phone - Conversing on a cellular phone while driving takes the drivers attention off the road and onto the phone conversation and reduces the driver's reaction speed.

Figure IX: Cellular Phone

XXI. Turning to Talk While Driving – Talking takes the driver's attention off of the road, and causes them to not react as fast to things encountered while driving. Some people tend to do hand gestures while talking. The driver may be spending much of their attention to listening to the conversation than listening to traffic and signals coming from outside of the vehicle.

XXII. Trash in Car – A piece of trash can accidentally get under the brake pedal or acceleration pedal and cause accidents or cause the driver to loose control of the car.

XXIII. Watching TV - Watching TV completely takes the drivers eyes off the road and oncoming traffic. The sound of the TV can also hinder a driver's ability to hear signals coming from outside of the vehicle.

Hazardous Driving Areas

These are areas where there are poor driving conditions. In these areas the driver may have limited visibility, the road may be in a poor condition, and pedestrian safety may be an issue as well.

Figure X: In the Tree

I. Accident Sites – Accident sites can be potentially dangerous and it is important to be cautious when entering an accident site. Emergency vehicle are speeding trying to get to the site. Also, roads may be blocked, or glass may be on the road that may hinder driving. People may also be confused as to what to do or where to go.

II. Animals on Road – Animals suddenly running onto the road may cause a driver to suddenly stop or swerve which can cause a chain of accidents. Large animals such as deer can cause fatal collisions. Dead animals may also cause people to swerve into other lanes or cause drivers to loose control if they actually run over the animal.

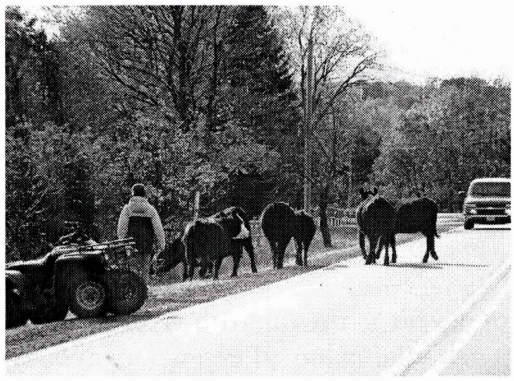

Figure XI: Cows on Road

III. Big City Driving – Drivers without driving experience in big cities can be intimidating and dangerous. Big city driving tends to have more traffic and more aggressive drivers. At times, city streets are full of pedestrians, and some streets may not be developed to handle the amount of traffic. People new to the city may get lost on massive interstates, and may swerve suddenly to make an exit. Driving conditions change due the time of day. And traffic jams may occur.

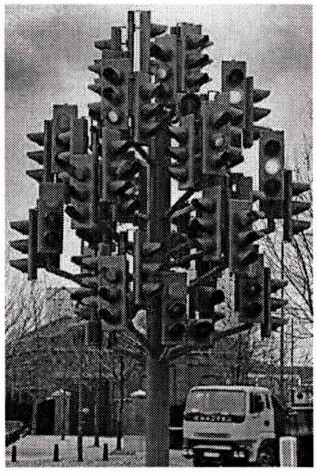

Figure XII: 30 Lane Intersection

IV. Bike Routes – Bike routes tend to be placed next to roads and are very narrow. Drivers need to take extra precaution when driving by bike routes to avoid injuring a biker. Bike routes may also intersect with roads. Bikers may be unaware that they have to stop and obey all traffic laws that a car has to.

Figure XIII: Bike Lanes

V. Blind Hills – Blind hills make it difficult for a driver to see the road ahead and oncoming traffic. Overtaking a car can be potentially dangerous if the driver doesn't make sure there is no oncoming traffic.

VI. Blind Turns – Making a blind turn can be dangerous as well if the driver doesn't make sure there is no oncoming traffic. People may try to pass during one of these turns, which is illegal and dangerous. People may also go too fast and drive off the road, especially in hazardous driving conditions. People unaware of the turn, may not see it at night or in the fog. Also some driveways are hidden or blind. It may be hard to see a vehicle that is exiting a driveway. They may even be backing into traffic.

VII. Braking Procedures – Different vehicles, depending on the size and weight, have different stopping distances and procedures. These stopping distances and procedures also change with different weather and environment conditions. Not following these procedures can lead to accidents.

VIII. Changing Lanes – Changing lanes without checking blind spots can be dangerous and increases the risk of accidents. A person may change lanes due to a slower driver

or obstacles in the road. They may also need to merge. Drivers should pay attention to other drivers trying to change lanes especially if in a driver's blind spot.

IX. City Driving – There is not as much traffic as big city driving, but drivers need to pay special attention to pedestrians and children crossing streets. Residential areas may have small children that run into the street. People may also be unaware of intersection and try to go straight when they have to turn, or drive the wrong way on a one-way.

X. Class B Roads – These roads are usually in very poor condition and many times the road may be unfit for driving. This can result in accidents such as a vehicle roll over. During bad weather vehicles should try to take other routes than class B, or chance themselves getting stuck. Also people should be aware of animals, hunters, and farm machinery that frequent these types of roads.

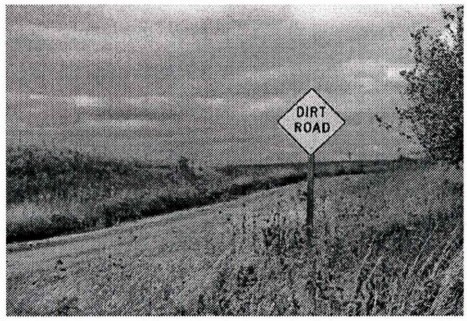

Figure XIV: Dirt Road

XI. Construction Zones – Construction zones tend to have the road in poor condition and a very narrow driving lane. Drivers need to pay special attention to construction workers and drive at the appropriate speed limits to prevent accidents from occurring. Construction machinery may also back up into the road, without checking to see if traffic is clear. Construction materials also have a habit of falling off of trucks and into the roadway. Drivers should be driving slow incase they need to avoid obstacles.

XII. Cross Walks – Pedestrians should always cross at a crosswalk so that drivers are more aware of them crossing. Pedestrians should also follow traffic signals, instead of trying to cross when traffic is clear. Drivers should also pay special attention at cross walks, because pedestrians may try to run across the road when the driver has the right of way. Pedestrians are very vulnerable at these times.

XIII. Deer Crossings - Drivers need to caution and slow down and prepare to stop in case of a deer crossing the road. Running into a deer is very hazardous especially at night when deer stop and get blinded in headlights, or run out onto the road without the driver noticing. Also deer travel in groups, so if one deer is seen crossing the road, many more may be following.

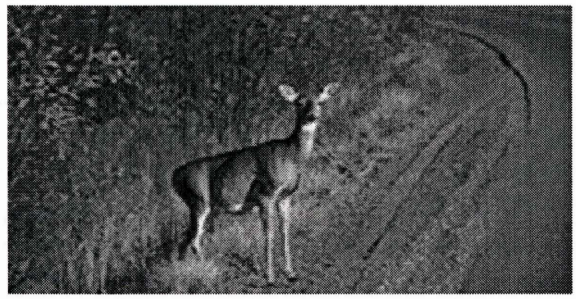

Figure XV: Deer in Road

XIV. Desert Driving - Desert driving can be very dangerous. Drivers may get tired and fall a sleep due to the long and boring drive. Also, the dust clouds can prevent driver from seeing far distances. Drivers may also become stranded if the car overheats, due to the hot weather. Gas stations are also few and far between. Therefore drivers should also be aware how many miles may need to be traveled before they can stop for gas.

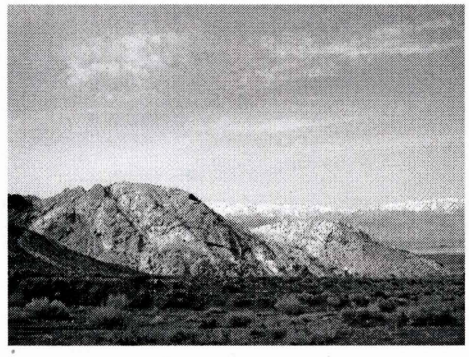

Figure XVI: Desert

XV. Dips – Dips in the road may be very dangerous if drivers try to cross at high speeds. A car may bottom out, or a river may loose control of the car, if approached too fast.

XVI. Driveways – Driveways along busy roads can be dangerous. People may be trying to pull out into busy traffic. Some driveways have blind spots or reduced vision due to trees, buildings, shrubbery, etc. Also some driveways may require the driver to back into oncoming traffic. All of these situations can be extremely dangerous. Drivers should be aware of these and signs may be posted that will warn drivers of these situations.

XVII. Gravel Roads – Gravel roads can be hazardous due to the lack of lanes. Both directions of traffic share the road. Drivers may also drive too fast for the gravel conditions and loose control of the vehicle. Also, dust can be very dangerous. When passing or following a car, it is hard to see, especially other traffic. Farm vehicles also frequent these roads as well as animals. Other cars may also throw rocks from there tires, which may cause damage.

XVIII. Intersections - Vehicles might run through stop lights or speed up to beat the yellow or red lights. The driver needs to caution, and slow down when crossing intersections. They should also be prepared to stop when they see yellow light and stop at red light. When the light turns green, they need to check to see if other vehicles are stopped before proceeding through the intersection. Pedestrians may also be trying to cross at these intersections. And people may be trying to turn. This can be hazardous if people turning left are trying to cross while someone is trying to beat a yellow light.

XIX. Interstate Driving - Drivers need to stay awake during long interstate driving. People may be distracted by music, food, people, etc. They may also be using speed control which limits their reaction time. People that speed will change lanes frequently and sometimes dangerously. Also people may be trying to merge or change lanes when there is traffic in their blind spots.

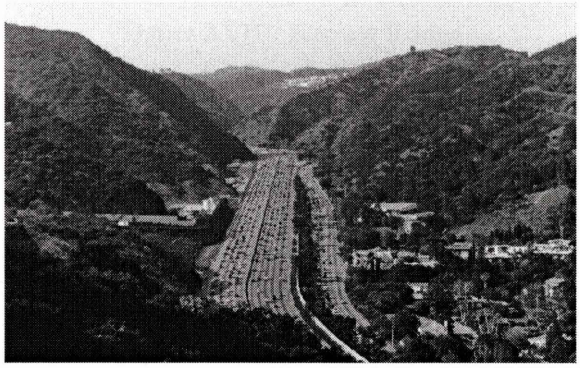

Figure XVII: Interstate

XX. Jay Walking - People may walk across the street anytime and any place even if it is not at an intersection. Be aware to slow down when see people on the side of the road. It is illegal to jay walk, but it is not highly enforced by law enforcement.

XXI. Litter on Roads - Items on the roads may cause the driver to change lanes unexpectedly and may cause collisions with the up coming vehicles. Or at worst, if the driver doesn't see the item, it may run over it which can flatten a tire and may make the car run off the side of the road or turn the car up side down.

XXII. Merging - Merging onto streets or onto highway can be dangerous if not looking for incoming traffic, Check for incoming traffics before merger and speed up to get out of merging lane is usually required. People may also not check blind spots before merging the vehicle.

XXIII. Mountain Driving - Drivers need to be focus, cautious and drive at the appropriate speed limit. While going up or down a mountain it may be hard to see oncoming traffic. Also, hairpin turns can be difficult to maneuver and require the car to slow down. Loss of brake while driving down a mountain can be extremely dangerous; a driver should use gears to keep a car going at the appropriate speed instead of trying to use the brakes. Over breaking may cause the brakes to overheat and fail. Some mountains may have sheer drop offs and may not have places to stop or shoulders on the side of the road.

XXIV. Narrow Bridges – Wide vehicles and wide load vehicles are the prominent hazard in this driving area. In many cases of accidents the other drivers are trying to avoid collision with the wide vehicle. And often high speed driving in this area cause a strong wind effect that can blow smaller vehicle off of the road. The snow plow machines couldn't get rid of a lot of the snow off of the road in this area, and snow accumulation is in maximum level on this driving area. Drivers should not try to pass on the bridge, and should be prepared to stop for oncoming traffic to finish crossing the bridge before proceeding over it.

Figure XVIII: Narrow Bridge

XXV. On/Off Ramps – Drivers merging/exiting need to either speed up (on ramps) or slow down (off ramps), which affects the drivers on the highway lanes and city roads. Drivers need to be more cautious of the on-off ramps areas. The chance of accidents is at the maximum level when the highway lanes are busy and full. Any disturbance of traffic flow on the off ramps could cause a traffic jam busy interstates. Some more cautious drivers may even stop at the end of an on ramp, which could be very hazardous.

XXVI. Parking Lots – A lot of drivers in this area don't realize the danger of speeding through a parking lot environment. There are a lot of pedestrians and people getting out/in to their cars in this area, and most of them are not easily visible. High numbers of accidents are from the collision between the cars going in and out of parking lots. During winter the parking lots are often slippery and uneven due to the cold and snow. Drivers may also travel in the wrong directions, or not stop at intersections. Drivers may also be cutting through the parking areas.

XXVII. Parking on Side of Road – To an inexperienced driver, parking on the side of the road may require several attempts and which will cause disturbances in the traffic flow. Many times accidents happen due to speeding drivers who are careless or do not see the car that are getting in and out of the parking area. Poor parking placing of the vehicle and entering/exiting the car from the driver side are also a driving hazard, which will make the other drivers trying to avoid the parked car, and disturb the flow of the traffic of the other lanes. The parked car could also decrease the drivable lane's width, and make the two-way lanes into one.

XXVIII. Parks – A lot of children running around not knowing the hazard that they are endangered in. Some times there are children chasing a frisbee/ball that goes out to the parking ramp or street of the parks, other than the people, the object that are flying around the parks could can also be a driving hazard to a vehicle or other pedestrians. Some parks still have wild animals wandering around and some blind spot due to the trees and bushes.

XXIX. Pedestrian Crosswalk – The pedestrian need to be cautious, make sure it is safe to cross by using body language/eye contact. Some non-verbal language should be exchanged between the driver and the crossing pedestrian, sometimes one of the sides needs to understand what's going on (either to stop for the driver or not to cross for the pedestrian). Both sides need to understand the situation especially if they see a build-up in one of the side (vehicle or the pedestrian).

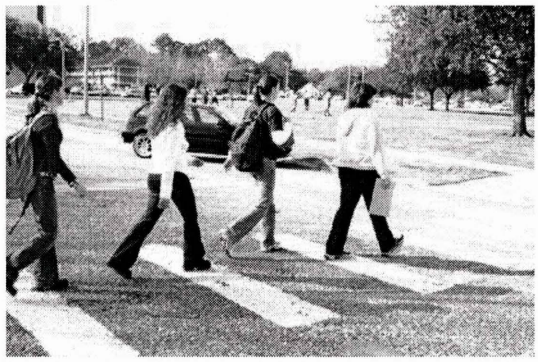

Figure XIX: Cross Walk

XXX. People on Shoulder – This driving area are similar to the parking on side of a road. People walking on the shoulder put themselves in danger. The people on shoulder could cause a distraction that leads to the vehicle driver missing a traffic sign, turn, or fail to react to the traffic flow. Also emergency vehicle may travel on the side of the road to avoid traffic. Broken vehicles may be parked on the side of the road, with people trying to repair them.

XXXI. Railroad Crossings –These areas may be extremely hazardous. Some vehicles are required by law to stop at all railroad crossings whereas others only have to stop when posted. If a car breaks down on the railroad tracks, it may be hit by a train. Also a driver that is distracted may not look for a train crossing especially when there are no crossing bars.

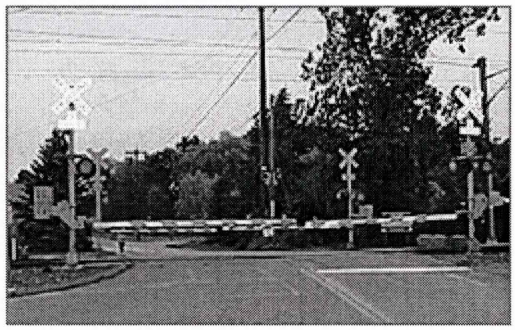

Figure XX: Railroad Crossing

XXXII. Reduced speed zones – Driving into an area where there will be an expectation for the motorists to do a sudden stop or yield. While driving in a high

speed zone it is difficult for the driver to be aware of the road signs around them and even harder for them to react in a timely manner to avoid collisions/accidents. While the reduced speed signs is available to help the driver themselves to avoid accidents, sometimes the drivers are not aware of the reduced speed sign and neglect it all the way.

XXXIII. Residential Driving – Residential areas often have children running around, and most of the time children are not paying attention to their surroundings, which makes them a hazard to themselves and to the drivers in this area. Most of the time there are high number of cars that are using small amount of the road side to park their car, which decreases the drivable area. Some turns and signs are camouflaged by the trees that blocked the view of the driver in this area.

XXXIV. Safety Barriers – Some drivers have problems adjusting their vehicle position with respect to the road lanes/boundaries. They tend to avoid their vehicle from contact with hard concrete/boundaries, which decrease the drivable space on the other side of the road. In high speed driving this can trigger multiple traffic collisions. Knocked out center road safety fences can cause disturbance on the traffic flow.

XXXV. School Bus – Most of foreign and new driver don't know the rules of driving around a school bus. The information about school bus driving rules that are available is not easily acquired. Small mistakes and careless driving around a school bus can result in a fatal accident. Stopped school buses that are loading/unloading passengers must not be passed, especially the ones signaling a stop sign. The light code of the bus is not understood by most drivers.

Figure XXI: School Bus

XXXVI. School Zones - School zones have a lot of students walking and running around, most of them do not pay attention to the surrounding traffic. They tend to play around the school, and some of them show off by endangering themselves (e.g. running passed a moving vehicle, jumping in-and-out vehicle, etc.). Many students use skateboards, bicycles, unicycles, and in-line skates in the middle of the road. Some students will play and push other students, some play frisbee, football, soccer, etc. and most of the time the ball will be thrown into the road.

XXXVII. Speed Traps – In order to limit the amount of speeding, police may use a control system known as a speed trap. Here police officers will use radar to measure the speed of every individual driving on a particular street. Speed violators are then

pulled over and issued tickets. This can be a particularly hazardous driving area due to people suddenly realizing that they are in a speed trap and then trying to slow down to avoid a ticket. This can lead to a lot of rear end collisions.

XXXVIII. Spilled Items on Road - Oil, gasoline, antifreeze, water, windshields cleaning liquid, etc, spilled on the road from running car that can reduce the friction of the road which causing car to slide and may run onto another vehicle easily.

XXXIX. Toll Booths – The driver's lane selection on the entry to the toll booth are a potential accident hazard, the driver in this area can't react to a sudden lane change by the vehicle in front. Some drivers not paying attention may go into the wrong lane (exact change, card toll member, etc.).

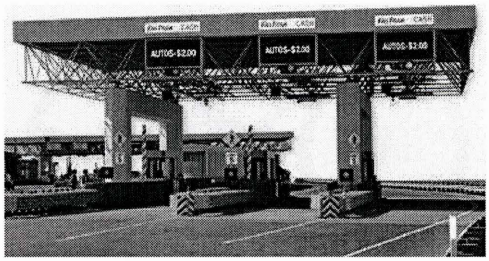

Figure XXII: Toll Booth

XL. Traffic Jams – Traffic jam are a patience test for most drivers. Drivers are easily offended and become angry when someone cuts into his/her lane, someone in front may drive too slow, someone crossing the lane back and forth, someone playing with their horn, etc. Traffic jams can be damaging to the vehicle engine. Overheating is a common effect from a traffic jam, and this could lead to worse traffic. Also people may not be aware of jams and end up rear ending other vehicles.

XLI. Unfamiliar Areas - Drivers in unfamiliar areas often need to slow down, stop, or make U-turns because of difficulty in finding certain streets, or missing turns. They may also be reading a map while they drive. This irregular driving can be dangerous for the surrounding vehicles, i.e. a sudden stop can result in a rear-end collision by the following vehicle.

XLII. Yellow Lights – Driving through yellow light is a spontaneous decision made by the driver to either go through the traffic light, or to make a sudden stop. The decision will affect the surrounding vehicles also by the pedestrian who are trying to cross the road.

Hazardous Road Vehicles

These vehicles can be grouped into emergency vehicles, large/oversized vehicles and motorcycles/bicycles. Drivers need to pay special attention to emergency vehicles that are responding to an emergency because emergency vehicles can be driving at very high speeds through traffic and can result in a serious accident. Oversized vehicles can reduce a driver's ability to see; they can also block a road and create traffic. Drivers need to pay

special attention to motorcyclists and bicyclist as well, because motorcyclists/bicyclists do not have as much protection as driver in a car.

I. Bicycles – Drivers need to pay special attention to bicyclers because they can easily be injured. Also bicyclers riding at night can be difficult to see if the rider is not using proper reflective gear. Bicycles also go much slower than other road vehicles and they may be operated by youths. A learning rider may fall down accidentally; also groups of bicyclers may be unaware of a passing car or take up more space than needed.

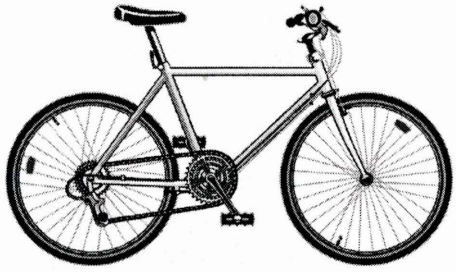

Figure XXIII: Bicycle

II. Buses – Buses are large vehicles that can hinder a driver's vision. They also need to make sudden stops which can create traffic and cause accidents. Pedestrians may be crossing in front of a bus. A school bus carries small kids that are unaware of driving dangers. Also due to the weight and size of a bus, it may not be able to stop quickly and has to make wide turns.

III. Construction Equipment – Construction vehicles vary from dump trucks to large tractors. Most will have some type of warning light and will be painted brightly to help drivers to be aware of them. These vehicles may be oversized and slow moving. This may cause drivers to want to pass these vehicles. This can be hazardous due to the driving conditions. These vehicles are usually around construction zones where the may be pulling into or out of traffic. They may also put debris on the road such as mud, gravel, dust, etc.

IV. Horse Drawn Vehicles – In some rural areas and tourists attraction (e.g. Michigan Avenue, Chicago, IL) the horse drawn vehicles are mixed with the other motored/engine powered vehicle in the road. The horse drawn vehicle has poor performance, slow acceleration, poor signal (for turning, braking, and stopping), organic waste problem, and low top speed. The horse drawn vehicle operates under the required minimum speed; the minimum speed rule prohibits a person from operating a motor vehicle at such a slow speed as to impede the normal and reasonable movement of traffic.

Figure XXIV: One Horse Powered Car

V. Emergency Equipment – Emergency vehicles are in a hurry to react to accidents and may cause drivers to react differently than normal. Many emergency vehicles are big and cannot stop effectively. Also the drivers may be distracted because they are in such a hurry. Inexperienced drivers may be unaware of what to do when emergency vehicles are present.

VI. Farm Equipment – Farm equipment tends to be large (possibly wider than a lane), slow moving vehicles that hinder a driver's vision and creates traffic buildup. People may dangerously try to pass farm machinery. Also a farm may unexpectedly slow down and turn into a field that doesn't have a driveway. Not all tractors have waning light, and some may not have turn signals. Also the driver of farm equipment may not be able to hear due to the noise of the machine.

Figure XXV: Tractor

VII. Modified Vehicles – Drivers have been modifying their vehicles ever since the car was invented. Lately drivers have been adding window tinting, hydraulic lift kits, and other accessories. Although some of these modifications look cool. Most of them are not safe or legal to drive with. It is extremely dangerous when drivers modify their vehicle and remove safety features or change the bumper height.

VIII. Motorcycles – Motorcycles are able to accelerate and stop faster than cars. Because of this, drivers need to give motorcyclists enough space on the road. Motorcyclists are more easily injured in an accident than the passengers in a car. Also people on bike tend to travel in groups, and at night two bikes may be recognized as a car. Motorcycle drivers also tend to show off more and drive dangerously. Also due to the size of a motorcycle, they may drive in the center or side of a road. Motorcycles are also more prone to the elements.

IX. Over-Sized Vehicles - Over-loaded vehicles on the street that can cause distraction to other drivers on the road. These vehicles normally run at or under speed limit causing traffic jam, and may lead to traffic accident. Moreover, the over-loaded items on the vehicle may fall over on top of near by vehicle or on the road which is extremely dangerous and accident is surely taking place.

X. Police Vehicles – Police officers drive distinct vehicles the usually include lights attached to the top of the car. Usually the drivers are trained in how to handle these vehicles at top speed. The problem comes in when other drivers see these vehicles. Drivers may speed up or slow down or may not know how to react when they are confronted with a police cruiser.

XI. Emergency Vehicles – Police officers, firefighters, and paramedics need to be ready to respond to an emergency. Because of this, they need to be able to drive through heavy traffic and sometimes through oncoming traffic. An emergency vehicle may also cause cars to unexpectedly slow down, and react to driving differently. An emergency vehicle may also be speeding without lights on. An inexperienced driver may be unaware of what to do when an emergency vehicle is trying to get to an emergency.

XII. Road Graders – It is required to stay behind these machines at least 50 feet. These machines are extra wide and slow moving, they are also usually on gravel roads. Cars may have difficulties passing them due to large piles of gravel that they create. They are also capable of throwing gravel and create huge dust clouds that may affect driver's ability to see. After a road has been freshly graded, drivers have to driver slower, or they can loose control of their vehicle, until the road gets compacted again.

Figure XXVI: Road Grader

XIII. RVs - Due to their large size, RV's tend to create traffic. They also have a longer stopping distance and are unable to avoid obstacles on the road as easily as smaller vehicles. This increases the chances of a rear-end collision with the vehicle in front. They block the vision of the vehicles following behind. Also on small roads, RV's may take up more than one lane.

XIV. Semi-Trucks – Semi-trucks are large vehicles that can hinder a driver's vision. Some are composed of more that one trailer. There are large blind spots for drivers of semi-trucks and cannot easily see the cars driving beside them. Semi-trucks also have

a larger stopping distance than cars due to there weight. A semi driver also has to make wide turns, and may pull into the left lane to make a right hand turn. Also, semi-drivers may not be fully aware of the surroundings do to drowsiness and fatigue. During wet and snowy conditions they tend to throw debris onto the windshield.

XV. Slow Moving Vehicles – Slow moving vehicles range from mopeds and farm equipment, to oversized loads. These can be dangerous to other drivers that are traveling too fast. Drivers may not be aware of their speed and have to jump on the brakes which may cause a rear-end accident. Another problem is when people try to pass these vehicles. Some pass on the wrong side of the road, or pass dangerously. They may also cause traffic similar to traffic jams.

XVI. Snowmobiles – Snowmobiles, snow plows and other snow vehicles appear in the winter when driving conditions are not the best. They can appear out of nowhere hoping out of a ditch or forest. They may also throw snow at drivers that are following close. Like motorcycles, these tend to travel in groups, and at night two snowmobiles may be recognized as a car. Snowmobile drivers also tend to show off more and drive dangerously.

XVII. SUV's – These vehicles sit high off the ground, and are therefore hard to see around. They also weigh more and therefore have a longer stopping time than a car. Many families have these and therefore the driver may be distracted with children. Also, people get a false feeling of safety while driving an SUV and therefore tend to drive more aggressively. SUVs also have a problem with cornering and may flip over.

Figure XXVII: SUV

XVIII. Trailers – Trailers are usually pulled by bigger vehicles. Some may not have functional break or turning lights. They also will have problems with stopping because they stop too fast they may jack-knife. A driver may be inexperienced when pulling U-Hauls and other moving equipment. They may also come unattached to the pulling vehicle if not secured correctly.

Non Driving

This list consists of problems dealing with pedestrian and general public safety. For example joggers and bicyclers need to take the necessary safety precautions when jogging/biking at night and make sure they can be seen. Another example is child supervision; parents need to watch over the children when playing near the street.

I. Bicyclers - Drivers need to pay special attention to bicyclers because they can easily be injured. Also bicyclers riding at night can be difficult to see if the rider is not

using proper reflective gear. Bicycles also go much slower than other road vehicles and they may be operated by youth. A learning rider may fall down accidentally; also groups of bicyclers may be unaware of a passing car or take up more space than needed.

II. Children at Play – Children that are playing around roads and parking lots may not be paying attention to the traffic. Also, items such as balls or frisbees may inadvertently be thrown into traffic which may damage vehicles or cause a driver to suddenly swerve or lose control of the vehicle. A driver may also end up running into a child that is trying to enter or exit a play area. Or they may run into a child that is trying to retrieve an object such as a ball or frisbee.

Figure XXVIII: Children Playing

III. Construction Workers – A group of people that are constructing, maintaining, repairing, or building something (road, building, park, road decorations, etc.). The attention and awareness of the construction workers are mostly set to their work. The construction workers sometimes are wearing ear muffs to cover their ears from the loud machinery sounds around them making it almost impossible for them to concentrate to the vehicles that are going pass through their working environment. To help reduce the possibility of accidents and to increase their visibility by the motorists the construction workers are wearing a vivid colored uniform when they are working. The motorists around the construction zone have more awareness and expected to yield for the construction workers activity and be prepared to stop at any given time to avoid accidents/collisions.

IV. Disabled Vehicles - Drivers on the road may need to suddenly swerve to the side of the road to avoid hitting an object in the road; disabled vehicles prevent drivers from doing that. Also on narrow roads, the disabled vehicles take away available driving space, and drivers may need to slow down, or driver around the vehicle through oncoming traffic, which can possible result in a head on collision.

V. Jaywalkers – People who do not cross at designated intersections are considered jaywalkers. These pedestrians are putting both themselves and drivers at risk of an accident. Drivers may not see the pedestrian try to cross the street. The pedestrian may also misjudge the time it will take for them to cross the street.

VI. Joggers – Joggers may not be aware of traffic, due to concentration. They may also suddenly cross or road, of not stop at intersections. They may also not be able to hear traffic due to a CD player. Joggers that jog on the road may cause traffic to slow ant change lanes in order to pass the jogger.

VII. People Entering and Exiting Vehicles – In parking lots and along streets that allow parking people will be entering and exiting vehicles. These people may be opening car doors into traffic or may actually walk into oncoming traffic. Drivers in these situations should be driving slower and should pay extra attention to these pedestrians. If a person is sitting in a car, they should expect this person may open their car door.

VIII. People Doing Car Maintenance on Road - Due to car failure cause by various reasons, cars may need to stop on the side of the road or even in the middle of the road. For example, people can be found on the side of the road changing tires, refueling, and an overheating engine. These people put themselves at risk of getting hit by oncoming traffic, for example people with gas tanks on the driver's side refueling on the highway. These people run the risk of getting hit by a driver not paying attention.

IX. People Retrieving Lost Items - Children playing by a street often lose a ball or Frisbee and chase after it into the street. These children put themselves in danger of getting hit by oncoming traffic. Drivers are often caught off-guard and have difficulty stopping or swerving to avoid an accident. This becomes more difficult for the driver if there are no signs warning the driver of a school/ or park area. Another situation is people driving on the highway losing items out the window, such as a hat, or important papers. These people may make a sudden stop and pull over to the side of the road to go retrieve these items. The drivers following this vehicle may be unable to react quickly enough to this sudden stopping, resulting in a collision.

X. School Children - Students who get off the school bus and run across the street unexpectedly run into incoming vehicles which lead to serious injury or death to people who are involved. Students also play on the side walk while they wait for the bus and may step onto the road unintentionally which may cause incoming vehicle to changing lane, stop, or run onto the sidewalk. Either way, it could create a major accident and damage to all who are involved.

XI. Sidewalks - People on sidewalks are not usually aware of drivers on the streets. But when they try to cross at intersections and pedestrian crossing, they will interact with vehicles. Trash may also be thrown from the sidewalks and accumulate in the streets.

Personal

These consist of problems dealing with a driver's build/stature and physical abilities and condition. They also consist of a driver's emotional/psychological state which can result in aggressive driving. Another issue is the driver's knowledge on driving laws and his/her driving experience.

I. Age – Along with age comes experience and maturity. A young driver may be more applicable to racing and unsafe driving practices, whereas an older driver may be loosing reflexes, mind or stature.

II. Color Blind – A person who is color blind may not be able to distinguish between colors of traffic lights and signs, therefore may misinterpret warnings.

III. Drinking and Driving – A person who is under the influence of alcohol is unable to react as fast as other drivers. Therefore they are a hazard to themselves as well as other drivers and pedestrians.

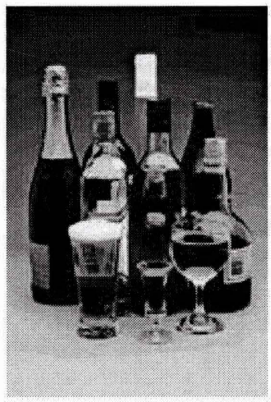

Figure XXIX: Alcohol

IV. Failing Eyesight – A person may be unaware of failing eyesight, and therefore may not be able to see hazards and warnings on the road.

V. Foreign to State – A person who is foreign to the state may not know the current safety laws instated by the state. They may also be unaware of weather driving conditions, or hazards specific to the state.

VI. Height – A shorter driver may not be situated correctly in the car and may not be able to either use the accelerator or brake correctly. They may not be able to see correctly through mirrors or in general.

VII. Helmets – A person riding a motorcycle may choose not to wear a helmet while riding a motorcycle in the State of Iowa. This can be an added risk taken on by the rider. Also, helmets without visors can be difficult to see out of when there is added debris, insects, or rain.

VIII. Loss of Hearing – A person who is hard of hearing may not be able to hear other vehicle, horn signal, or train whistles, therefore they can be a danger to themselves and others.

IX. Loss of Mind – A person who is not in the right state of mind while driving, i.e. having personal problems with girlfriend, or actually be mentally insane, may not be focused on safe driving procedure and maybe a hazard to anyone around them.

X. Loss of Reflexes – A person who has lack of reflexes may not be able to react to dangers that he or she may encounter while driving. They might not be able to react to break lights or an unexpected object in the road.

XI. Medication – A person who is on medication that can interfere with driving should not drive. Likewise a person who is required to take medication to operate vehicles should be aware of the hazards associated with the medications. Otherwise he or she may be putting themselves or others into danger.

XII. New Drivers – New drivers are not fully aware of how to drive a vehicle. They may not even have a full license. These drivers will have different reaction times and may also react differently to situations. They usually are also teenagers, which may also mean that they might be more concerned about looking "cool" instead of driving safely.

XIII. Physical Condition – A person who in not physically fit, either through weight, heart conditions, or muscle fatigue should understand that they are a problematic driver and should take precautions before driving.

XIV. Road Glare – During sunset or sunrise and during the winter months a glare may be created that affects the driver's ability to see properly. This is quite dangerous if the driver is not equipped with sunglasses or a visor. The intense light makes it impossible for the driver to see oncoming traffic or objects on the road.

XV. Road Rage – A person who has anger management issues may become upset at other drivers and begin to drive over aggressively. This may distract other drivers and is not a safe condition.

Figure XXX: Road Rage

XVI. Rude Gestures – A person who submits rude gestures upon others may be encouraging road rage as well as distracting other drivers.

XVII. Sleeping/Too Tired to Drive – A person who is too tired to operate a vehicle may fall asleep while driving. Therefore this person may run into other objects, vehicles, or might drive dangerously off of the road.

XVIII. Speeding – A person who speeds is likely to be weaving in and out through traffic and therefore may cause accidents, as well as they might not be able to react or stop in the time needed.

XIX. Sunglasses – Sunglasses at night or lack of glasses during sunrise or can affect a driver's ability to see and therefore not be able to react to obstacles encounter while driving.

XX. Tailgating – A driver who tailgates another vehicle, follows too closely, may not be able to stop or react in time if the person he is tailgating chooses to abruptly stop, and therefore may run into the other driver.

XXI. Unaware of Laws – A person unfamiliar with the laws of the area may cause confusion to other drivers and maybe a hazard to themselves or others, i.e. a person driving on the wrong side of the road.

Vehicle Hazards

Vehicle hazards are often associated with car maintenance. It is important to make sure the vehicle and individual parts are running properly. If not, a serious accident can result. It is also important to understand the safety equipment in a vehicle and to make sure they are being used correctly (airbags, safety belts).

I. Air Bags – Malfunctioning airbags can injure a driver. Airbags are also dangerous for children, especially babies still in car seats. Airbags come out at a high speed and can actually injure a person. Lack of airbag is also dangerous in high speed crashes for the driver may be thrown into the steering column.

II. Blind Spot – Blind spots occur in different places for multiple vehicles. A person not aware that they are in a blind spot is at serious risk to accidents. Lack of mirrors also causes blind spots.

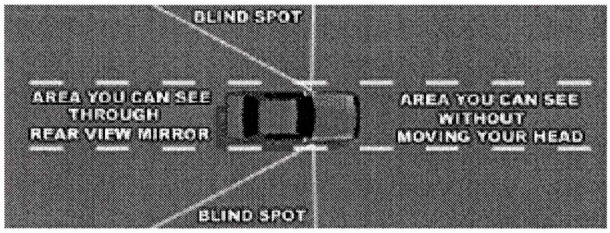

Figure XXXI: Blind Spot

III. Bumper – Some vehicles do not have a proper bumper or have a bumper located at a different level than the general public. This can be potentially dangerous if there is an accident. Bumpers are put into place to reduce the amount of impact and damage a car will inflict if there is a collision.

IV. Car Maintenance – Cars that are not properly maintained are at risk of breaking down while driving. There are many accidents that can happen if a car is mot maintained correctly. A car can lose brakes or have a tire blow which can cause a serious accident, or traffic jam.

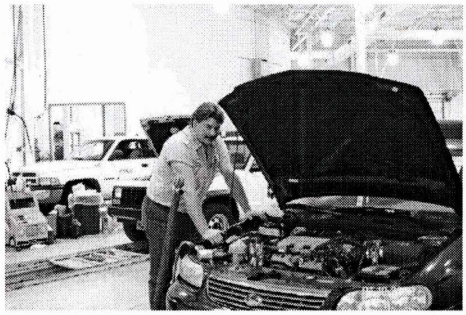

Figure XXXII: Car Maintenance

V. Child Seat – Child seats are a necessity for children up to 8 years old, or under 4 ft tall. Child seats in the front seat or in a truck are not as safe as when they are poisoned in the backseat. Seats should be positioned differently depending on the age of a child. Also a child seat should never be placed next to an active airbag.

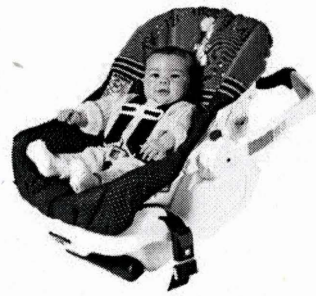

Figure XXXIII: Child Seat

VI. Cruise Control – Cruise control allows a car to stay at a constant speed without the driver using the accelerator. This can be dangerous, and should never be used during city driving. A driver may choose to swerve around cars instead of slow down and release cruise control. A person's attention may also veer and reaction speed will slow down.

VII. Excessive Weight – A vehicle that weighs more that a car has a slower stopping speed than a car. They may also not be able to travel on certain roads, or during certain driving conditions, or may actually sink into the road. An overweight semi is not only illegal, but may burn out brakes before coming to a complete stop. These vehicles also have difficulties accelerating, especially going up hills. Drivers may tray to pass during these horrible and illegal conditions.

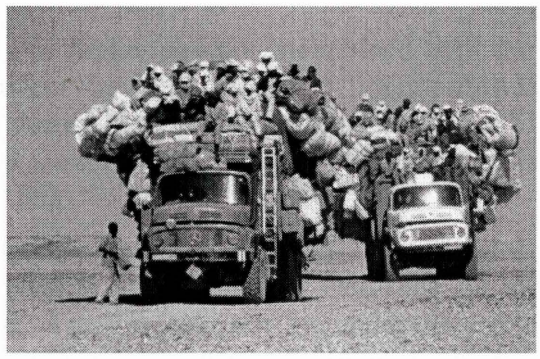

Figure XXXIV: Excessive Weight

VIII. Exhaust – If exhaust leaks into the car it can be very dangerous due to the carbon monoxide. Also, if a car is run indoors the exhaust can accumulate. In California, and other heavily populated states, there are laws against cars that have too much exhaust.

IX. Gas Tank – The gas tank is one of the most dangerous parts of the car. People should not smoke around there gas tank. A gas tank may be exposed to accidents if a car collides at a wrong angle.

X. Gasoline – Gasoline is one of the most combustible materials there is. Any spark of flame exposed to gasoline will cause it to explode. Event the fumes are flammable.

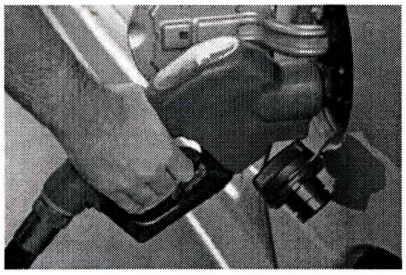

Figure XXXV: At the Pump

XI. Governors – Some cars now have governors. Governors are devices that limit the cars top speed. Once a governor is installed on a car it should not be removed or changed because it is there for the drivers own safety.

XII. High Beams – These bright lights are used to help see at night when there are no street lamps. These lights should never be used in the cities, or around other traffic. They may blind other drivers and cause accidents. When approaching other cars they should be shut off. High beams should also never be used as a communication device.

XIII. Lights Out – Loss of a headlight, turn signal, or brake light, is not only illegal but extremely dangerous. Vehicles may not be able to see a vehicle without lights. Also, light should be turned on during dawn, dusk, dreary days, and bad weather to improve the visibility of the car.

XIV. Loss of Brakes – If brakes are not maintained well they may fail. Also if the brake line of a car is cut they may fail. It is important to be aware of proper brake maintenance. Also, during mountain driving conditions, a lower gear should be used to keep the car going slow instead of brakes. Over use of brakes will cause them to heat up and possibly fail.

XV. Loss of Control – Sudden loss of control can happen several different ways. Weather conditions such as ice or rain may cause the car to loose traction especially while driving too fast. Trash or pets may get under the legs of the driver not allowing him to slow down or accelerate properly. Car malfunction can also give many different problems.

XVI. Loss of Steering – Sudden loss of steering can happen either by weather conditions such as rain, ice or snow due to loss of traction, or can be produce by car problems such as a flat tire, or broken tire rod.

XVII. Mirrors – The review mirror do not always point towards blind spots. Some vehicles also have limited mirrors or may have items blocking the mirror's view.

New current mirrors are now angled to display blind spots more effectively. Also some side mirrors show object much farther back than what they actually are.

XVIII. Muffler – Cars without a proper muffler are endangering themselves as well as others. The excess noise and vibrations may distract the driver as well as keep the driver from hearing signals from outside of the car. Also a hole in a muffler may allow exhaust to leak into the car.

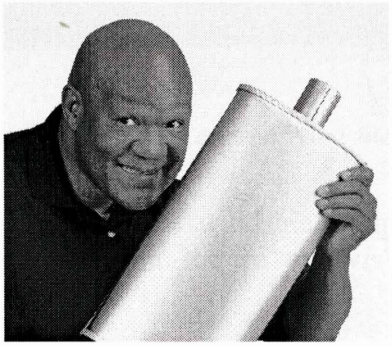

Figure XXXVI: George's Muffler

XIX. Oil – Proper oil changes are necessary to keep the engine of a car working properly. Loss of oil will cause the engine to burn up and seize. Also leaking oil can be hazardous because it can cause a lot of smoke if it burns and will limit vision. Spilt oil on paved roads can also cause the road to become slippery. On gravel roads, some property owners use oil as dust control. This driving surface should not be driven on until dry, and may make a car extremely messy.

XX. Reflections off Vehicles – Reflections off vehicles especially of the back of semi trailers can cause intense light that may blind a driver. Sunglasses may be required to avoid glare. Also semis should either paint the back of the trailer or add diamond plating to avoid glare.

XXI. Seat Belts – Seat belts are used to keep passengers safe in a vehicle. All passengers should use them to keep safe incase of an accident. Young children should use special harnesses, or child seats to keep them safe. Some older vehicles and machinery do not have safety belts.

XXII. Stuck Accelerator – On rare occasions a driver may find him or herself in a condition where the accelerator may become stuck. This can be extremely dangerous due to the drive not being able to slow down. A driver with a stuck accelerator may be driving erratically while honking the horn. If other drivers are aware of another vehicle in this condition they should pull over and let the driver pass and then call the police for help.

XXIII. Tires – Tires should be checked regularly for leaks, pressure and wear. Leaking tires should be fixed immediately, or the problem could get worse. Worn out tires (lack of tread), should be replaced. And pressure should be checked regularly to avoid tires from failing while driving.

XXIV. Windshield – Windshield should be repaired or fixed if cracked or broken. Cracks impair a driver's visions. Windshields should also be cleaned regularly and

should always have a good set of windshield wipers and washer fluid to clear debris and rain.

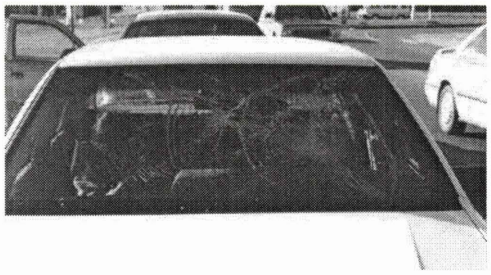

Figure XXXVII: Cracked Windshield

XXV. Windshield Wipers – A good set of windshield wipers should be on a vehicle at all times to clear debris and rain from the driver's vision. They should be checked regularly and be replaced if needed.

Weather Conditions

Weather conditions are changes in weather. These changes can affect the driver's senses, and change the driving environment. These changes may require the driver to change his/her driving habits.

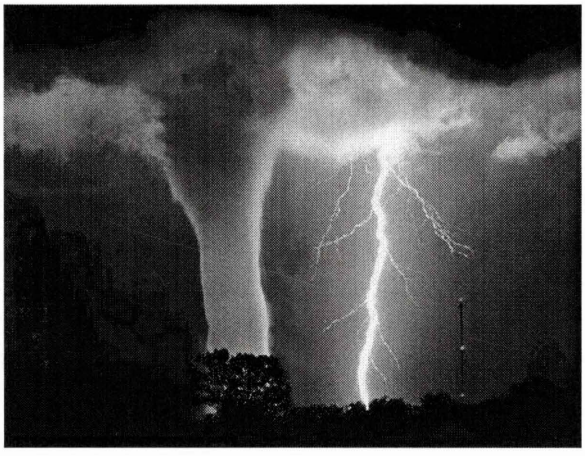

Figure XXXVIII: Bad Weather Conditions

I. Floods – A rising and overflowing body of water especially onto normally dry land due to the continuous rain, and poor water drainage system of the road. The flood can cause water to enter the electrical part of the car and can cause short-circuit/machine failure, the movement of the car is also limited and most of the time the driver can not control the car during the flood.

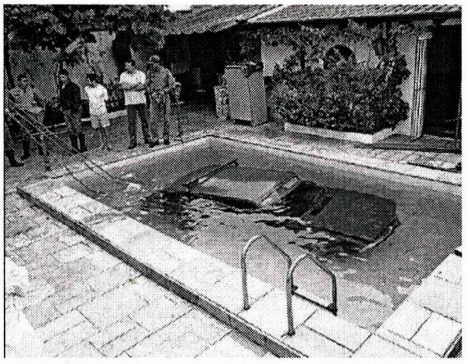

Figure XXXIX: Water Hazard

II. Fog - Vapor condensed to fine particles of water/ice suspended in the lower atmosphere that differs from cloud only in being near the ground. The fog will limit the visibility of the driver to one or two car lengths ahead. The visibility limit is the accident trigger, the driver can't tell if there are car(s) in front of his/her car, also the drivers can't see the road signs, and the driver can't see the way that they are going. Most of the time when the driver already sees what is in front of them, the driver reflex system doesn't have sufficient time to react/counter-react to avoid accidents.

III. Frost – During the winter months water that condenses on windshield will freeze and turn to frost. This frost can inhibit vision. Frost must be removed before driving either by melting it of or by using a windshield scrapers. Drivers may be in a hurry and may not remove the frost from the windshield before driving. This may cause accidents because the driver will not be able to see clearly.

IV. Hail - Precipitation in the form of small balls or lumps usually consisting of concentric layers of clear ice and compact snow. The bombardment of solid and often big chunks of ice may hit and even break the windshield, headlights, turn signals, or side mirrors of the car, and may cause a lot of dents. The situation of the hail will also limit the hearing of the driver due to the noise from the contact of the hail and the car, and the contact of the hail with any objects surrounding the car.

V. Heat – Excessive heat may cause several types of mechanical failure to the vehicle. It may also cause the car to perform differently. The heat may cause the car to overheat. It may also cause the tires to either loose air pressure or in the worst case pop. Also, areas of the car may be too hot for a person to touch, if it has been sitting in the sun for too long.

VI. High Wind - The natural movement of air of any velocity. The aerodynamics of the car plays an important role to handle this weather condition. Most large vehicles (vans, SUVs, trucks, busses, etc.) are affected greatly by this weather condition. High speed wind could affect the balance of the car; slight weakness in the steering wheel handling could be amplified by the wind and make the car turn in a sudden manner. The high speed car could create a malicious wind effect surrounding itself when they are passing through another car, and if the wind is strong enough, this could make another car be thrown of the road or into another lane.

VII. Hurricanes - Although not usually in Iowa, large storms along coastlines are called hurricanes. These storms pack a huge punch and can literally blow a car from the road. This is a very dangerous situation and people should not be driving during a hurricane.

VIII. Ice - Frozen water that has very slippery surface and frictionless on impact/contact. Ice formed on the road, especially black ice (a thin film of ice on paved surfaces (as roads) that is difficult to see) may cause the car to skid due to the loss of friction on the car tire(s) to the road, and may cause the car to loose control. An inexperienced driver does not know the balancing procedure for the car and may hit another car or drive off of the road.

IX. Night - The time from dusk to dawn when no sunlight is visible. The driver's visibility is very limited and the only light available on the road is from the moon, car, or road lights. Night driving affects the body behavior. It also takes time for the eyes adjust to the dark environment and tends to set the body into rest cycle (sleep). All of the road hazards that are not refracting light are invisible to the driver and impossible to avoid. Often a problem for elderly drivers.

X. Rain - Water falling in drops condensed from vapor in the atmosphere. The accumulation of the rain water in an uneven road or dip could make the car uncontrollable. Also rain causes the car to loose traction and may cause the car to begin to hydroplane. First rain in a season may cause slick roads because of oil accumulation.

XI. Snow - Precipitation in the form of small white ice crystals formed directly from the water vapor of the air at a temperature of less than 32°F (0°C). The snow build-up on the car tire area will limit the tire's movement, and decrease the tire's grip of the road. The snow on the road will make a frictionless surface on the road that may affect the movement from the sudden acceleration of the car. The cool temperature will also create ice on the road, and freeze certain parts of the car (clogged windshield washer, clogged gas line, engine failure, frozen gas-pump, etc.). The white environment of the road surroundings will affect driving condition during clear weather; the sunlight reflecting off of the snow will may blind the driver.

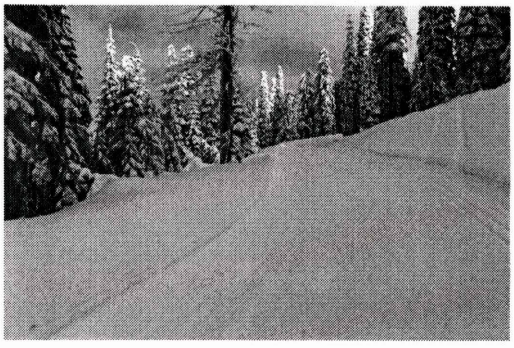

Figure XL: Snow Covered Road

XII. Sunset and Sunrise - The time when the upper limb of the sun disappears (sunset)/appears (sunrise) below the horizon as a result of the diurnal rotation of the earth. During these times of the day the sunlight is vividly visible (horizontally/directly) and often increases the blind spot area of the driver. Also the intense light may cause the driver to dawn sunglasses or use the sun visor, which may restrict the vision of the driver.

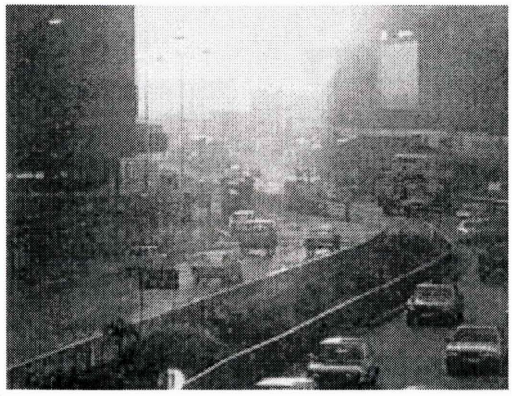

Figure XLI: Sun Rise

XIII. Tornados - A violent destructive whirling wind accompanied by a funnel-shaped cloud that progress in a narrow path over the land. The driving condition is very dangerous during this condition, there are numerous solid objects flying around lifted by the tornado, and even the car itself can be lifted and thrown away randomly. People may also foolishly be chasing a tornado in a vehicle which endangers themselves and others.

List of Solutions to Problems

This project has a variety of solutions that could improve the current driving situation. They range from having advertising certain issues, to creating new devices that may in fact save lives. Below are solutions that the team has come up with. They are divided into twelve sub groups and arranged alphabetically.

Table 11: List of Awareness Campaign Solutions

Awareness Campaign
Awareness Week
Banquets
Community Service
Door to Door
DOT day
Educational Rides (Epcot)
Fund Raisers
Public Events
Public Service Announcements
Public Transportation
Rewards/Positive Reinforcement
Sponsorship

Table 12: List of Device Solutions

Devices
Decoy Enforcement
Driving Alert System
On-Star
Reflective Clothing
Simulators

Table 13: List of Educational Class Solutions

Educational Classes
Alcohol Abuse Classes
Anger Management Classes
Drug Abuse Classes
Environment Training
Ongoing Education
Police Education
Refresher Courses
School Driver's Education
School Children Presentations
School Presentations

Table 14: List of Game Solutions

Games
Contests
Crossword/Paper Games
Games
Toys
Video Games

Table 15: List of Information Material Solutions

Informational Materials
Accident Information
Books
Children Books
Drivers Education Manuals
Flyers In License Plate Renewals
Handouts
How to report accidents
Internet
Internet Advertising
Introductory Handouts
Magazine Article
Newspaper Article
Pamphlets
Statistics
White Papers

Table 16: List of Legislative Solutions

Legislation
Check Points
Company/Job Write-Offs
Different Test Requirements for Seniors
Frequent Offenders
Helmet Laws
Law Enforcement
Pass Laws
Police/DOT Help
Warnings

Table 17: List of Peer to Peer Solutions

Peer to Peer
Carpool
Community Enforcement
MADD/SADD
Parents/Family
Peers
Religious Gatherings
Reports on Family
Teach Through Children
Word of Mouth

Table 18: List of Public Speaker Solutions

Public Speakers & Events
Celebrities
Public Appearances
Public Icon (Crash Test Dummy)
Public Speakers
Public Tours
Safety Presentations

Table 19: List of Signs

Signs
Advertising
Bill Boards
Brochures/Flyers
Pamphlets
Posters
Road Signs

Table 20: List of Television & Radio Solutions

Television/Radio
Cartoons/TV Shows
Informative Videos
Muzak
Public Radio Stations for Hazardous Areas
Public Service Announcement
Radio
Radio and TV Commercials
Songs
TV News

Table 21: List of Test Solutions

Tests
Driver's Driving Exam
Driver's Written Exam

Table 22: Vehicle Improvements

Vehicle Improvements
Added Side Car Blinkers
Back Up Sensor
Bad Weather Alert System
Blind Spot Devices
Car Pet Carrier
Collisions Detectors
Enhanced Car Maintenance System
Driver Alert System
RF Road Sensors
Split Mirrors
Trash Compactor for Car

List of Solution Definitions

Here each solution has been given a definition. This list helped the team to further explain the solutions and derive their implementations of the final product.

Awareness Campaign

These are methods of solutions that utilize public organizations providing group meetings and gatherings to promote a certain cause of driving habit or behaviors. The solutions include fund raisers, special days or events, social gatherings and community service.

I. Awareness Week – Set a certain week to be a driver education awareness week. Everyday of the week will be filled with educational, informational, and preventive events for all age groups. Various groups of people including the government and non-profit organizations will put on the events.

II. Banquets - An elaborate and often ceremonious meal for numerous people often in honor of a person. A banquet combined with reward presentation to an exceptional driver record could motivate people to follow the recognized/rewarded people of the banquet. Plus fundraising could go on at these events to help supply funds for other safe driving campaigns. Important or refresher material could be handed out at these events plus vital feedback from the community.

III. Community Service – Services that are performed for the benefits of the public or its institutions. This solution serve a win-win situation where the public get some values of the services also the information about driver education, and the community service get the information needed transferred to the public. Driving offenders could do community service such as donating time in hospitals for accident victims. This will help drivers to become more aware of there driving safety.

IV. Door to Door – Going door to door to spread information about driver safety and pedestrian safety can be effective in neighborhoods and small communities. It is a more personal way of communicating and can be used to talk to parents about child safety. For example supervising children when biking, or playing outdoors, helmet safety etc.

V. DOT Day - Set a day in a year to be a DOT day. It is all about Department of Transportation promotion and advertisement. This solution can be combined with other solutions, such as giving special grants/rewards to some good record drivers. Public awareness should be made available, as well as special events.

VI. Educational Rides – The education approach by giving a vivid example. This solution requires voluntary effort of the public to come to the educational rides. The on-hand examples that are showed to the participant is easy to understand and can be practiced by the participant on later time. These rides could be transported to schools or special events. Such rides such as simulators could test and help people to become more aware of their own driving behavior.

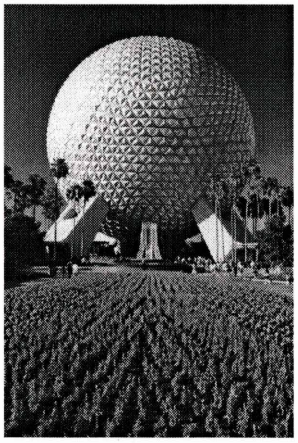

Figure XLII: Epcot

VII. Fund Raisers – Raise money for a cause or project. This activity can transfer the information to the public by going door-to-door and educating people in the convenient of their own place. Big fund raising events, or booths at certain events would get the DOT actively involved with the community as well as get vital feedback back from the general public.

VIII. Public Transportation – The increased use of public transportation can reduce number of people driving their own vehicles which directly reduce the amount of traffic and reduce accidents. This will also keeps the road in better condition and reduce the amount of road construction. Public transportation will also help to clean the environment, by reducing the amount of resources consumed. Advertisements on public transportation will help people to be more aware of safe driving practices. Also by enforcing public transportation to be more safety conscious, and show correct driving procedure, this may help people to realize their own driving flaws.

IX. Public Events - Utilizing events that draw the attention of people for driver education purposes. The education itself shouldn't be tedious and boring, creative and innovative methods of education can be implemented in this solution.

X. Public Service Announcements – By the use of the radio or television information could be broadcasted to people as a public service announcement. This information is able to reach a variety of individuals with a sing broadcast.

XI. Rewards/Positive Reinforcement – Recognition of good drivers could motivate the people to do better at following the rules and maintain a good driving record. Reward such as tickets to public events or incentives on car maintenance or fuel would encourage the public to drive better.

XII. Sponsorship – The DOT can sponsor public events or sporting events so that they can have the right to display signs and advertisements at these events. These signs are very effective since these events will attract many people who are currently driving. At these events, these signs can promote driving related problems. E.g. Beer companies can promote messages such as "Don't drink and drive".

Devices

These are methods of solution that utilizes mechanics, physical and/or electronic tools to prepare, to help, to guide, and to prevent a driver and the surrounding from accidents. The solutions included in this category are decoy enforcement, driving alert system, on-star, reflective clothing, and simulators.

I. Decoy Enforcement – To increase public awareness of the rules and regulation, the decoy enforcement can be utilized by placing them in random places and move them regularly to avoid pattern recognition by the traffic offenders. This will help to remind people that they should be focused on safe driving. Parking police cars in speed areas will help to reduce speeders.

II. Driving Alert System – Driving alert system in newer vehicles have helped drivers dramatically. These systems will send out signals when the driver is beginning to fall asleep, veer off the road or get too close to other vehicles. These systems should be put into more vehicles and more safety features should be added.

III. On-Star – This new technology is good to help remind people of current driving hazards. It can be used to tell the driver the current weather, accident sites, and even give directions. It could also help drivers to get familiar with different driving conditions of different states. It can also be used to reduce drowsiness.

IV. Reflective Clothing – Pedestrians should wear more reflective clothing at night to increase their visibility to drivers. Night joggers, bicycle riders, and walkers are at serious risk at night if they do not have any reflective clothing. Cars may be unaware of these people and run into them. Clothing manufactures, should be more aware of this hazard and should produce more reflective clothing.

V. Simulators - Simulators can be used to help train and educate drivers for driving under hazardous driving conditions such as winter driving, or city driving. This training can be done in a safely with minimal risk, but still allow drivers to drive through challenging conditions virtually risk free. Simulators are currently available in most drivers' education programs, but these should be available in other places.

Education Classes

These are methods of solutions that utilizes academic atmosphere to educate drivers and anyone related to driving. This method of solution is typical in educating groups of people and can be done privately or in a large mass of people. The solutions included in this category are anger management classes, drug abuse classes, environment training, ongoing education, police education, refresher courses, school driver's education, and school presentations.

I. Alcohol Abuse Classes – During these classes information could be given to the people. The information should probably focus on the effects of drunk driving and other alcohol related activities.

II. Anger Management Classes – To help prevent acts of road rage and aggressive driving, anger management classes should be offered to those who seek help and required for those with offenses related to road rage and aggressive driving. By

attending these classes, people will be able to recognize the cause of their anger and how to control it. This will help prevent future acts of road rage and aggressive driving. Other driving problematic issues could also be introduced here.

Figure XLIII: I Feel Pretty

III. Drug Abuse Classes – To help prevent accidents due to drug use, drug abuse classes should be offered to those who seek help and required for those with offenses related to drug use. Requests from family or friends for a person to take drug abuse classes should be taken seriously as well. By attending these classes, people will be able to get help with their drug use and can free themselves from their addictions. This will help prevent future accidents and fatalities due to drivers driving under the influence. Other driving problematic issues could also be introduced here.

IV. Environment Training – Depending on the environment, drivers will need to adjust their driving practices and strategies. Many drivers lack the experience for driving under certain environment conditions such as driving through snow/ice or big city driving. By training drivers to driven under these different environment conditions the driver will gain experience in driving under this situations and will help them prevent possible accidents.

V. Ongoing Education – For new and inexperienced drivers who have passed the driving exam, classes should be offered to help prepare them for driving in hazardous conditions. For example weather related driving techniques, or hazardous area driving, etc. The refresher courses previously mentioned would also be included in this category.

VI. Police Education – Educational programs taught by police can help people better understand the driving laws and allow people to learn from a different view point, from the people that actually enforce the laws. Police education can also be targeted towards children, the police officers will be able to effectively influence the children and that will allow the information that being taught more meaningful.

VII. Refresher Courses - Once a driver passes the driving exam, he/she often does not review the material needed to pass the test. Overtime this information is lost. To keep this information fresh, drivers should take a class to review this material; this class could be taken when renewing a driver's license or other similar situations.

VIII. School Driver's Education – The public school driver education program should have set standards on what is taught. Students should be taught how drive under

hazardous conditions and other safety issues such as what to do at the scene of accident. Stricter requirements for passing would increase the general knowledge of drivers on the road.

IX. School Children Presentations – School presentations can be a good way for children to learn about driving related accidents and safety. The children will do research on a topic and will have a good understanding of the material. They can also influence their peers and ignite interest in driver's safety.

X. School Presentations – Public speakers that tour schools could speak on the importance of safe driving practices. They could tell personal experiences to the impressionable children that could last with them into their driving years. They may also pass on this information to their parents.

Games

These are methods of solutions that utilize physical activity to transfer information to the public. The information packet is disguised in a form of fun activity and most of the time the public is not aware that they're being educated by the activity. The solutions included in this category are contests, crossword and games, toys, and video games.

I. Contests – Driving contests such as simulators, or safe driving obstacle courses could be instated at special events, or be available at the DOT. They could also travel to schools, or schools could have field trips to these events. Making it competitive will make the general public to try and do their best as well as reinforce good driving practices.

II. Crosswords/Paper Games – Many people find that doing a crossword in a paper to be relaxing. If it is a crossword about safe driving, it could also be used to help reeducate the public on correct driving procedure. This method can be fun and get the word out.

III. Games – Games that include correct driving practices can help to educate children and remind adults of good driving habits. This information can be displayed as a fun method, instead of some kind of education. Teachers can also make up their own games to help children learn, who which can bring this information to their parents.

IV. Toys – Early childhood education could easily be accessed through toys. Toys appeal to the children, and the children don't realize that they're actually learning about new information by playing with these toys. Since children memory will last much longer, this method is sensitive and needs to be thoroughly screened as to not pass any wrong information to the children. Such toys as will help to promote safety. Whereas other toys such as a driving board game will help children become more familiar with driving laws for the future of driving, they may also pass on this information to their parents.

V. Video Games – By creating a video game that will enforce or reward good driving behavior, will help to educate the youth on correct driving habits. On the other hand, games that promote bad driving practices will do the exact opposite.

Informational Materials

These are methods of solutions that utilize written information transfer. The information can be dense and heavy and/or light and entertaining depending on the age group that are tried to be reached. Documentation, facts, and research results about driving related activity are presented and explained to the public by this solution.

I. Accident Information – Whether directly involved, victims or witnesses to an accident, many people do not know what to do at the scene of an accident. Everyone should be educated on this matter, not just drivers. People should know who to call for help, whether the accident scene is safe enough before getting involved, how to assist the injured and bring them to safety. Widely teaching this information could help prevent deaths and injuries in future accidents. Also information on accidents may scare people into driving in a safer manner.

II. Books – Books can be informative to the reader, and teach important driving habits. These books can range from educational to novels. The importance is that readers must actually read the book. But once this is done, the reader is free to pass on the information to the general public.

III. Children Books – Informative children books on good driving behavior shall help children learn good driving habits as they learn to read. These driving habits may be carried with them to adulthood, but they may also influence parents to also practice correct driving procedures.

IV. Drivers Education Manuals – Driver education manuals are used in preparing for the driver's written and driving exam. They should be standardized for the state of Iowa and contain safety information which includes safety measures and precautions at the scene of an accident, instructions for driving in hazardous driving areas and weather.

V. Flyers in License Plate Renewals – This is a great way to get information to the drivers. Every year cars have to be reregistered and information could be transmitted to the driver during this time.

VI. Handouts – Handouts about driver education that consist of important information, reminders, updates of laws and regulations, maintenance, and preventive accident methods of driving related activities. They could be handed out at large social gatherings, or handed to kids to take home to their parents. They could also be posted on cars or distributed through the mail.

VII. How to Report Accidents - Accident reporting is crucial to save lives and prevent problems that develop into a more complex and sophisticated problems that are much more expensive to handle. Some people do not know how to report problems and accidents correctly, and therefore they make the situation much worse than it actually is. Also, some safety issues may go unfixed if they are never reported to the correct authorities.

VIII. Internet – Internet websites can contain any information that relates to or may be a problem of driving. These can be a good resource to raise awareness on safe driving. There needs to be more informational websites where people can go to get

information on driving statistics, and how to drive safe and other driving related information.

Figure XLIV: Internet Explorer

IX. Internet Advertising – Advertising through the internet can be difficult, but still informative. Bad types of advertisements such as pop-ups, and spam can be used, but may be unethical. Other types of internet advertising can be used to get surfers to browse internet sites that are directly related to driving hazards.

X. Introductory Handouts – These handouts can provide quick and basic information regarding driver or pedestrian safety. They can also be used as quick review and can possible be used as material in refresher courses.

XI. Magazine Article – A magazine article on a certain topic or problem with driving can help to inform the general public. In these articles, statistics could be shown as well as other information that is relative to the topic. These articles could be passed on to schools, or family and friends.

XII. Newspaper Article – A newspaper article brings instant awareness of a certain topic or problems and usually works as a shock factor. The general public will hopefully then take the information into account the next time they drive.

XIII. Pamphlets – Pamphlets are a good way to spread information and make information much more accessible. Pamphlets can include information on safety, car maintenance, and laws. They could be handed or mailed out to the public the public. Special events, or when people go to renew licenses are a good place to hand out pamphlets that will help to inform individuals.

XIV. Statistics – Statistics are an effective way to present information regarding car accidents and driving related deaths. They make it easy to view information over a long period of time and discuss many factors. This is also a way to find problem areas related to car accidents, and a way to judge the effectiveness of methods being used to solve these problems.

XV. White Papers – White papers are specifications on an actual part or product. Making these more available to the public help drivers to understand the actual limitation of their vehicle. They will also be able to see problems associated with their vehicle.

Legislation

These are methods of solutions that utilize strict, clear, detailed, enforced, and legal set of laws and regulations. The solutions determine the safety levels of driving in an area, needs to be updated, and have all group of social level in a community into consideration. The solutions included in this category are checkpoints, company/job write-offs, different test requirements for seniors, frequent offenders, helmet laws, pass laws, police/DOT help, and warnings.

I. Check Points – Check points can help the law enforcement control the traffic flow and give constant reminder in a friendly manner. The time consumed in the check points is not necessarily long and tedious, but can be very useful to detect drunk driving and distracted drivers.

II. Company/Job Write-Offs – Companies and businesses can offer special benefits for their employees. This could be especially useful with companies that do a lot of driving such as delivery or trucking services. They can offer incentives if their employees stay out of problems, or if they report other unsafe driving practices.

III. Different Test Requirements for Seniors – Along with the decreasing function of the overall driving skill of the seniors, a distinct and much more suitable testing are needed to be implemented. By testing seniors more often, and testing them differently, (because lack of knowledge of new technology, i.e. 8 lane highway, etc.) will help seniors be prepared for current driving situations.

IV. Frequent Offenders – The information gathered from the frequent offenders is very helpful to formulate the cause of poor level of driver education of the public. Harder penalties for frequent offenders could be helpful to make people think more before committing a vehicle related crime.

V. Helmet Laws – Currently there are no helmet laws in Iowa. The state should set laws regarding helmets with the use of motorcycles and bicycles. Also educational programs should encourage the use of helmets for motorcyclists and bicyclists, especially for children.

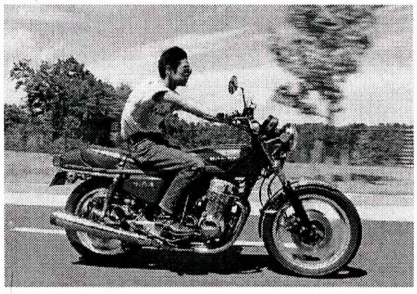

Figure XLV: No Helmet

VI. Law Enforcement – Law enforcement is the basic tool to educate drivers. The driver will learn through the penalty that is being enforced on the offenders. This solution has the element of shock-therapy that is pretty effective to the drivers that are closely related to the offenders. The more that law enforcement cracks down, the more the public will respond and be aware of bad driving behavior.

VII. Pass Laws – The legislative approach of the solution by suggesting new laws and improving the current laws to enforce safe driving environment. Extra enforcement on such things as talking on cellular phones, and driving without lights on will help the public to become safer drivers.

VIII. Police/DOT Help – There could be places for the community to get help directly from the police or DOT about laws and driving regulations as well as car maintenance issues. Even police officers could assist people who need something repaired and then tell them exactly how to get it done.

IX. Warnings – The media and road signs can be utilized to communicate important warnings regarding driving conditions of a certain areas to the driver. These warnings could take the shape of portable signs to radio announcements of traffic jams and other hazardous situations.

Peer to Peer

This method of communicating information is sometimes the best form. Parents, family and friends can influence a person to have better driving habits than anyone else. They are also more aware of a person's driving habits and history.

Figure XLVI: Peer to Peer

I. Carpool – A good way to help the environment is to carpool, and many drivers nowadays take advantage of carpools to get to work everyday. This is a perfect time for peers to discuss driving practices as the drive to work.

II. Community Enforcement – This type of solution is the joint effort of the majority of the community to promote safe driving to all the people related to the community. People can come together to share their experiences, and try to influence others to change their bad driving habits. They can also report any bad driving behavior to the law enforcement. They can also report on the overall effectiveness of Law enforcement in a particular area.

III. MADD/SADD - Although they have similar names, SADD is a separate organization from MADD (Mother's Against Drunk Driving). SADD recently expanded its focus to a variety of issues other than impaired driving, and also underwent a name change to 'Student's Against Destructive Decisions'. The movements of MADD/SADD are along the way with the improvement of driver education. They are organizations that

focus on habitual problems, mainly alcohol. But they could expand their resource also to include other problems mentioned.

Figure XLVII: MADD

IV. Parents/Family – Parents and/or family can be used to educate their children and themselves about the correct driving methods. This information transfer is effective and very cheap. This should be a primary resource for younger drivers. Parents have the control and should enforce good driving practices among their family.

V. Peers – Peers are able to get information to drivers the most effectively. This is because peers are usually trustworthy and they don't appear to be lecturing drivers on bad driving practices. Therefore it is possible for drivers to get information this way.

VI. Religious Gatherings - The utilization of religious gatherings (i.e. churches, synagogues, mosques, etc.) are helpful to reach all elements of public; the information being transferred will be easily accepted due to the similar religious background of the educator. Also religion usually defines what is right and wrong. By mentioning certain driving aspects as wrong, they can influence good driving behavior. Also, this is a good place to remind, and advertise good driving practices through personal experiences.

VII. Reports on Family – This solution is the smaller part of the community enforcement. The smaller number of people related to it and also means the higher control over the situation. People will want to keep a good name for themselves, and therefore will enforce good driving practices.

VIII. Teach Through Children – Early child education is cheaper and most useful to improve driver education. Children have an outstanding memory that will last their entire lifetime. Children tend to accept and grasp all of the information that they encounter without using any information filtering/selection. Children will also pass on this information to their parents, and friends. E.g. teach a kid how to use a seat belt and what it is used for, and that child will enforce seatbelts with his/her parents.

IX. Word of Mouth – Rumors spread quickly. By spreading information in this manner, the message can be transferred quickly and effectively. The hard part is how to get people to start talking about driving safety.

Public Speakers

These are methods of solutions that utilize verbal information transfer by an expert or well-known individuals. The solution can be seasonal, regular, or once in a lifetime method. The solutions included in this category are celebrities, public appearances, public icon (crash test dummies), public speakers, public tours, and safety presentations.

I. Celebrities - Celebrities have tremendous power over the general public, especially teenagers. If these celebrities started to speak on the behalf of safe driving it would influence other to do the same. They could also be used to get people to come to a special event or fundraiser.

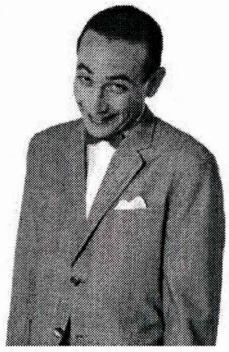

Figure XLVIII: Pee Wee

II. Public Appearances – Public appearances by individuals such as the mayor, head of DOT, president, or any other political figure will bring instant recognition of a certain topic or driving hazard. This will help to educate the general public and hopefully change their driving habits.

III. Public Icon – Create and utilize public icons such as crash test dummies to educate people about driving accidents and prevention methods. This solution is more applicable to children and very effective in transferring information to them. These icons can be advertised trough television, and then make public appearances.

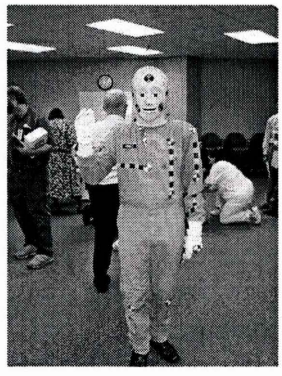

Figure XLIX: Learn From a Dummy

IV. Public Speakers – Public speakers are able to talk to and appeal to a large group of people. They can provide first hand experiences and testimonials to help people better understand certain problems and also provide a way to prevent them. These presentations can take place at special events or other places. Word to mouth education is directly related to public events.

V. Public Tours – Public tours to police departments and vehicle testing facilities can provide a first hand experience and technical insight to how safe vehicles really are and what limitations they have. They can be informative and will provide valuable information to the public. E.g. an engineer telling a person that there is a good chance of fatalities under a certain condition will make that person think twice about something.

VI. Safety Presentations – Safety presentations can be used in the driver education program to inform the students about safety and promote awareness. But safety presentations can also be used in elementary schools to promote safety awareness to children. They can also be used to inform the general public on some new driving hazard such as cell-phones and fast food.

Signs

These are methods of solutions that utilize general public information transfer, the cost of the solution method is fixed, and the solution has an easy access by anyone. The solution will display a memorable phrases and/or images to promote safety in driving. The solutions included in this category are advertising, billboards, flyers, pamphlets, posters, and road signs.

I. Advertising – This can be used to display current problems to the general public. Everyone will be affected by these advertisements and will cause people to become more aware of driving problems and save people from getting into some accidents.

II. Billboards – Billboards are an excellent tool in encouraging the public to act differently in their driving habits. An effective billboard can display a certain event, topic or problem and effectively communicate it to a driver, and hopefully help them to realize their own driving weaknesses.

III. Brochures/Flyers – Flyers can be handed out at special events or be put on cars to help inform the driving public. These flyers can include statistics on driving problems, or include stories of accident victims. This will help to educate the general public or scare them into using better driving practices.

IV. Pamphlets – Pamphlets are a good way to spread information and make information much more accessible. Pamphlets can include information on safety, car maintenance, and laws. They could be handed or mailed out to the public the public. Special events, or when people go to renew licenses are a good place to hand out pamphlets that will help to inform individuals.

V. Posters – Poster can be used to draw people's attention and have them learn information that can be used to help improve driving skills. These posters can be placed just about anywhere and will subconsciously attract people to read them.

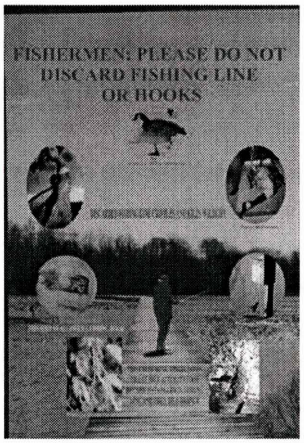

Figure L: Poster

VI. Road Signs – Road signs can help people to understand different driving conditions in different areas. Signs such as slippery when wet, or signs that help drivers to understand how to drive during heavy traffic will help drivers that are unfamiliar with the area understand driving procedures. Other signs may also help drivers in general be telling them where they need to go from getting lost, or help to take advantage of other safe driving media.

Television/Radio

These are methods of solutions that utilize wave information transfer, more user-friendly and easier to comprehend. The solution is available virtually everywhere and very effective as constant/regular reminder and updates. The solutions included in this category are cartoons/TV shows, informative videos, muzak, and public radio station for hazardous areas, public service announcement, songs, TV commercials, and TV/radio news.

I. Cartoons/TV Shows - Cartoons and TV shows can be a resource to help improve safe driving. By displaying correct driving procedures through educational programming, people will learn correct driving habits. Also people try to mimic celebrities. A TV celebrity will help to reinforce correct driving procedure.

Figure LI: Drake Mallard

II. Informative Videos – Informative videos on problems with current driving procedure could be used to inform the general public. These videos could be displayed at public presentations, or special events. They could also be displayed at the driver's license stations.

III. Muzak – Muzak is the music that is played in elevators, movie theaters, and doctor's offices, stores, etc. Advertisements combined with this music will help remind drivers of safe driving practices. Most of the time people are totally unaware that they are even listening to it and therefore it will be embedded into people's minds subconsciously.

IV. Public Radio Stations for Hazardous Areas – Certain radio stations can be used to help inform people of accidents and help them to avoid being in one themselves. If these stations broadcasted not only where the accidents were but also how the accidents started and how to avoid accidents such as these, it would help to inform drivers and make them think twice about there own driving habits.

V. Public Service Announcement - This can be used to let the public know about the driving laws, rules, regulations and any new legislation that effects their driving. This can also be used to let the public become aware of driving accident statistics, and how to improve driving, as well as other driver information such as renew licenses, car registrations, etc.

VI. Radio - Like TV, newspapers, books, and magazines, radio is another resource to inform the public on safe driving. This can be the effective tool since many drivers listen to radio while driving. This is a constant reminder to the driver and it may play a major role in changing driving habits.

VII. Radio and TV Commercials – Constant repetition of a problem through radio and TV commercials will make the general public aware subconsciously of a problem. They will hopefully change their habits.

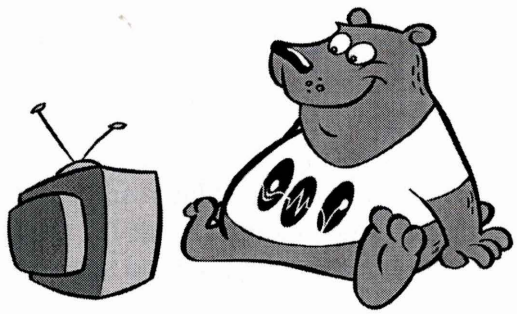

Figure LII: Watching TV

VIII. Songs – Music can be an effective tool when paired with an education program. This program, especially targeted towards children, can be a fun and interactive learning tool to teach children about safety issues related to driving and also regarding pedestrian safety. These songs may even be passed onto adults that will remind them of safe driving practices.

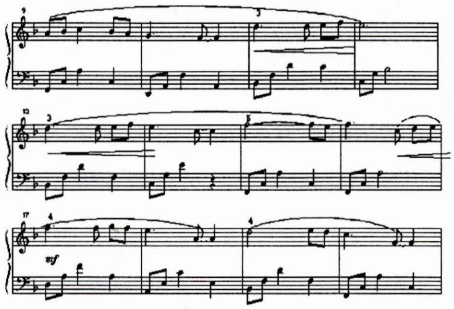

Figure LIII: Music

IX. TV News – A current TV news story will bring an unknown hazard to the general public's attention. They are also a good place to advertise a certain problem with driving. If they include an actual individual they can relate to viewers and make them think before they drive.

Tests

These are methods of solution that are available in the driving license application procedure. The solution should evaluate the driver ability to perform on the road effectively and suggest some preventive action if any sign of poor driving is detected. The solutions included in this category are driver's driving exam, driver's written exam.

I. Driver's Driving Exam – This test must be passed in order to get a standard driving license. More instructional material can be added to give people a better understanding of laws and safety. More testing will also act as a refresher and inform individuals on correct driving procedures. Driver's exam could be extended to include vehicle maintenance and weather condition driving.

II. Driver's Written Exam – This test must be passed in order to take the driver's driving exam. More instructional material can be added to give people a better understanding of laws and safety. More testing will also act as a refresher and inform individuals on correct driving procedures.

Vehicle Improvements

These are methods of solutions that could be added to the vehicle in order to either assist the driver or prevent accidents. If these improvements are created they could be put onto a vehicle by the manufacturer and be sold to the general public.

I. Added Side Car Blinkers – Added lights to the side of a vehicle could alert other drivers when the vehicle is about to change lanes or turn. This allows drivers to be along side of another vehicle and still be able to see the signal instead of behind the driver. Some vehicles already have this feature.

II. Back Up Sensor – A back up sensor would alert the driver of objects when he or she is driving the car in reverse. This would be helpful since it is difficult to see behind a vehicle especially on larger vehicle that may not have a rear window.

III. Bad Weather Alert System – This could be and added feature to a vehicle that would automatically get the weather forecast from a local radio or TV station and display it in a car. This would allow the driver to know exactly what the weather conditions are like and alert the driver to any problems such as a flash flood or tornado.

IV. Blind Spot Devices – Added mirrors and videos are perfect devices that allow drivers to eliminate blind spots. New devices such as split mirrors have already been added to some vehicles but they should become a standard and allow drivers to see the road better.

V. Car Pet Carrier – Transportation of pets can become cumbersome. Therefore pet owners should be able to get a vehicle with a pet carrier built into it. This would allow the pet to be transported safely and keep it from distracting the driver.

VI. Collision Detectors – These devices would alert the driver that there is something unusually close to the car and that the may be in danger of running into it. This device could be very effective especially in blind spot areas.

VII. Enhance Car Maintenance System – Added warning lights could help the driver remember to get oil changes and check tires. They could also detect burnt out lights that would help the driver to know that should perform some type of car maintenance.

VIII. Driver Alert System – This device would monitor the driver and make sure that the driver is safe to drive. This device would help drivers keep alert and awake on long trips or whenever the driver is not at attention.

IX. RF Road Sensors – These sensors could allow the driver to know road conditions such as upcoming turns or other slippery conditions. This would help the driver to know his or her surroundings better and always know the current speed limit.

X. Split Mirrors – These devices help to remove blind spots. They allow the driver to see these places without actually turning his or her head. These mirrors could be either side view mirrors or rear view mirrors. Some vehicles are already being made with this added feature.

XI. Trash Compactor for Car – Many cars are messy and this trash may hinder the driver from driving correctly. A trash compactor built into the car would allow drivers a place to store trash and keep the car cleaner. This device could be put in the front dash so that it would be easily accessible to the driver and passengers.

Correlation of Problem and Solution Lists

This matrix was used to correlate problems with there proposed solutions. This matrix currently has a list of problems along with the solutions. The solution headings have been abbreviated so that they fit properly onto a page.

Table 23: Matrix of Problems & Solutions - Distractions

Problems	Solutions*[1]										
	AC	DEV	EC	GAM	IM	LEG	P2P	PS	SIG	T/R	TES
Distractions											
Changing Music	X	X			X		X				
Children	X	X	X			X			X		
Day Dreaming		X					X				
Driving Games	X						X			X	
Eating While Driving	X				X	X	X		X		
Gadget Distractions	X	X		X			X	X			
Health Emergency	X				X		X				
Homeless People						X					
Human Waste Emergency									X		
People Trying to Distract Drivers				X		X					
Pets	X	X			X	X	X				
Portable Music		X				X	X				
Putting on Makeup/shaving							X	X			
Racing	X					X	X			X	
Radio Too Loud	X	X				X	X				
Reading						X	X				
Showing Off						X	X				
Singing While Driving							X				
Smoking While Driving	X				X		X				
Talking on Phone	X		X	X		X	X	X			
Talking While Driving			X	X			X				
Turning to Talk While Driving			X	X			X				
Trash in Car						X	X		X		
Watching TV						X	X				

Driving distractions consist of any activities inside or outside the vehicle that divert the driver's attention off the road. Common activities that distract the driver are playing with gadgets, eating/drinking, and conversing with passengers.

[1] AC – Awareness Campaign, DEV – Devices, EC – Educational Classes, GAM – Games, IM – Informational Materials, LEG – Legislation, P2P – Peer to Peer, PS – Public Speakers, SIG – Signs, T/R - Television/Radio, TES – Tests, VI – Vehicle Improvements

Table 24: Matrix of Problems & Solutions - Hazardous Driving Areas

Problems / Hazardous Driving Areas	Solutions*[1]										
	AC	DEV	EC	GAM	IM	LEG	P2P	PS	SIG	T/R	TES
Accident Sites	X		X		X		X				
Animals on Road	X	X		X					X		X
Big City Driving			X		X				X		
Bike Routes		X				X			X		
Blind Hills		X	X						X		
Blind Turns		X							X		
Braking Procedures	X		X	X	X			X	X	X	X
Changing Lanes		X	X								X
City Driving			X							X	X
Class B Roads		X			X				X		
Construction Zones	X	X	X		X	X		X	X	X	
Cross Walks		X				X				X	
Deer Crossings	X	X	X						X		
Desert Driving		X			X		X		X		
Dips							X		X		
Driveways					X				X		
Gravel Roads		X	X	X	X	X	X		X		X
Intersections		X				X			X		X
Interstate Driving	X		X		X		X		X	X	X
Jay Walking	X					X	X		X		
Litter on Roads						X					
Merging			X				X		X		X
Mountain Driving					X				X		X
Narrow Bridges		X					X		X		X
On/Off Ramps	X	X		X	X	X	X		X		
Parking Lots			X				X		X		
Parking on Side of Road			X		X		X				X
Parks						X	X		X	X	
Pedestrian Crosswalk	X	X	X		X	X			X		
People on Shoulder						X				X	
Railroad Crossings		X	X		X				X	X	X
Reduced Speed Zones	X		X			X	X	X	X	X	X
Residential Driving	X				X	X	X		X		X
Safety Fences			X		X					X	
School Bus	X	X	X			X	X	X	X		X
School Zones		X	X			X		X	X	X	X
Speed Traps					X				X		
Spilled Items on Road	X					X					
Toll Booths		X				X			X		
Traffic Jams					X					X	
Unfamiliar Areas					X		X		X		
Yellow Lights	X		X			X			X		X

These are areas where there are poor driving conditions. In these areas the driver may have limited visibility; the road may be in poor condition; and pedestrian safety may be an issue as well.

[1] AC – Awareness Campaign, DEV – Devices, EC – Educational Classes, GAM – Games, IM –Informational Materials, LEG – Legislation, P2P – Peer to Peer, PS – Public Speakers, SIG – Signs, T/R - Television/Radio, TES – Tests

Table 25: Matrix of Problems & Solutions - Hazardous Road Vehicles

Problems / Solutions*[1]	AC	DEV	EC	GAM	IM	LEG	P2P	PS	SIG	T/R	TES
Hazardous Road Vehicles											
Bicycles		X	X		X	X			X		X
Buses	X	X			X	X		X		X	
Construction Equipment	X	X				X	X				
Emergency Equipment	X	X			X	X			X	X	X
Farm Equipment		X	X		X	X	X		X	X	X
Horse Drawn Vehicles	X	X	X		X	X			X		
Modified Vehicles	X					X	X				
Motorcycles		X	X	X	X	X	X				X
Over Sized Vehicles		X	X		X				X	X	
Police Vehicles		X				X					
Road Graders	X	X			X	X			X		
RV's		X	X	X	X	X	X	X		X	X
Semi-Trucks	X	X	X		X						X
Slow Moving Vehicles		X	X		X	X	X	X	X	X	
Snowmobiles	X	X	X	X	X	X		X	X	X	X
SUV's	X	X			X		X				
Trailers	X	X	X		X	X	X		X	X	X

These vehicles can be grouped into emergency vehicles, large/oversized vehicles and motorcycles/bicycles. Drivers need to pay special attention to emergency vehicles when responding to an emergency because emergency vehicles can be driving at very high speeds through traffic and can result in a serious accident. Oversized vehicles can reduce a driver's ability to see; they can also block a road and create traffic. Drivers need to pay special attention to motorcyclists and bicyclist as well, because motorcyclists/bicyclists do not have as much protection as driver in a car.

[1] AC – Awareness Campaign, DEV – Devices, EC – Educational Classes, GAM – Games, IM – Informational Materials, LEG – Legislation, P2P – Peer to Peer, PS – Public Speakers, SIG – Signs, T/R - Television/Radio, TES – Tests

Table 26: Matrix of Problems & Solutions - Non Driving

Problems	Solutions*[1]										
Non Driving	AC	DEV	EC	GAM	IM	LEG	P2P	PS	SIG	T/R	TES
Bicyclers	X	X	X	X	X	X	X	X	X	X	X
Children at Play	X	X	X		X		X		X	X	
Construction Workers	X	X	X	X		X		X	X	X	
Disabled Vehicles		X					X		X		
Jaywalkers	X					X	X		X		
Joggers	X	X	X	X	X	X	X	X	X	X	X
People Entering/Exiting Vehicles	X	X	X				X		X		
People Doing Car Maintenance	X	X			X	X			X		
People Retrieving Lost Items				X							
School Children	X	X	X	X	X	X	X	X	X	X	X
Sidewalks		X							X		

This list consists of problems dealing with pedestrian and general public safety. For example joggers and bicyclers need to take the necessary safety precautions when jogging/biking at night and make sure they can be seen. Another example is child supervision; parents need to watch over the children when playing near the street.

[1] AC – Awareness Campaign, DEV – Devices, EC – Educational Classes, GAM – Games, IM – Informational Materials, LEG – Legislation, P2P – Peer to Peer, PS – Public Speakers, SIG – Signs, T/R - Television/Radio, TES – Tests

Table 27: Matrix of Problems & Solutions - Personal

Problems	Solutions*[1]										
	AC	DEV	EC	GAM	IM	LEG	P2P	PS	SIG	T/R	TES
Personal											
Age	X					X	X				X
Color Blind	X	X	X	X						X	X
Drinking and Driving	X	X		X	X	X	X	X	X	X	X
Failing Eyesight	X					X	X			X	X
Foreign to State		X	X	X	X	X	X		X		X
Height		X				X					
Helmets	X		X		X		X		X	X	
Loss of Hearing	X				X	X	X			X	X
Loss of Mind	X					X	X			X	X
Loss of Reflexes	X					X	X			X	X
Medication					X	X	X			X	
New Drivers	X		X		X	X	X	X	X	X	X
Physical Condition	X		X		X	X	X				X
Road Glare		X									
Road Rage	X		X		X	X	X	X		X	
Rude Gestures	X				X	X	X	X		X	
Sleeping/To Tired to Drive	X	X	X	X	X	X	X	X		X	X
Speeding	X	X	X		X	X	X		X	X	
Sunglasses	X	X			X		X				
Tailgating	X	X	X			X	X	X	X	X	X
Unaware of Laws	X	X	X	X	X	X	X		X	X	X

These consist of problems dealing with a driver's build/stature and physical abilities and condition. They also consist of a driver's emotional/psychological state which can result in aggressive driving. Another issue is the driver's knowledge on driving laws and his/her driving experience.

[1] AC – Awareness Campaign, DEV – Devices, EC – Educational Classes, GAM – Games, IM – Informational Materials, LEG – Legislation, P2P – Peer to Peer, PS – Public Speakers, SIG – Signs, T/R - Television/Radio, TES – Tests

Table 28: Matrix of Problems & Solutions - Vehicle Hazards

Problems	Solutions*[1]										
	AC	DEV	EC	GAM	IM	LEG	P2P	PS	SIG	T/R	TES
Vehicle Hazards											
Air Bags	X	X	X		X	X	X	X		X	
Blind Spot	X	X	X		X		X		X		X
Bumper		X			X	X					
Car Maintenance	X	X	X	X	X	X	X	X		X	X
Child Seat		X	X		X	X	X	X		X	X
Cruise Control		X	X		X						
Excessive Weight	X	X	X		X	X			X		X
Exhaust		X			X	X					
Gas Tank		X			X	X					
Gasoline		X	X		X		X				X
Governors	X	X			X	X	X				
High Beams	X	X	X		X	X	X				
Lights Out	X	X			X	X	X	X		X	
Loss of Brakes		X	X	X	X				X		X
Loss of Control		X	X	X	X						X
Loss of Steering		X	X	X	X						X
Mirrors	X	X	X	X	X	X	X				X
Muffler	X	X			X	X	X				
Oil	X	X	X		X			X		X	
Reflections off Vehicles		X	X		X	X	X		X		
Seat Belts	X	X	X	X	X	X	X	X	X	X	X
Stuck Accelerator		X	X		X						X
Tires	X	X	X	X	X	X	X	X		X	X
Windshield		X			X						
Windshield Wipers	X	X	X	X	X	X	X	X		X	

Vehicle hazards are often associated with car maintenance. It is important to make sure the vehicle and individual parts are running properly. If not, a serious accident can result. It is also important to understand the safety equipment in a vehicle and to make sure they are being used correctly (airbags, safety belts).

[1] AC – Awareness Campaign, DEV – Devices, EC – Educational Classes, GAM – Games, IM – Informational Materials, LEG – Legislation, P2P – Peer to Peer, PS – Public Speakers, SIG – Signs, T/R - Television/Radio, TES – Tests

Table 29: Matrix of Problems & Solutions - Weather Conditions

Problems / Weather Conditions	Solutions*[1]										
	AC	DEV	EC	GAM	IM	LEG	P2P	PS	SIG	T/R	TES
Floods			X		X					X	
Fog	X	X	X	X	X	X	X			X	X
Frost		X	X		X					X	
Hail			X		X					X	
Heat		X	X		X					X	
High Wind	X	X	X	X	X		X		X	X	X
Hurricanes	X				X					X	
Ice	X	X	X	X	X	X	X		X	X	X
Night	X	X	X	X	X	X	X			X	X
Rain	X	X	X	X	X	X	X			X	X
Snow	X	X	X	X	X	X	X		X	X	X
Sunset and Sunrise		X	X		X					X	
Tornados			X		X					X	

Weather conditions are changes in weather. These changes can affect the driver's senses, and change the driving environment. These changes may require the driver to change his/her driving habits.

[1] AC – Awareness Campaign, DEV – Devices, EC – Educational Classes, GAM – Games, IM – Informational Materials, LEG – Legislation, P2P – Peer to Peer, PS – Public Speakers, SIG – Signs, T/R - Television/Radio, TES – Tests

Implementations

Implementation of this final project was done by correlating the problem and solution lists together. This was done by use of a matrix. By using the matrix the team was able to see how each problem could be solved.

The team then took several solutions and defined them more thoroughly in the appendix. Listed in the appendix are eleven solutions to the current driver situation. Each on incorporates its own definition, procedure, risk and risk management. These solutions were created by the team to help improve the current driver situation. These solutions can be implemented by a number of associations, including IDOT, car manufactures, legislature, and future Iowa State senior design teams.

Recommendations for Future Work

This project has much room for future work. Since this project was simply a research project many sub projects could be extended from the work done. This project should be a stepping stone for any future IDOT senior design or road safety project. Here are some suggested recommendations for future work:

- Implementation of solutions – The IDE team has proposed several solutions in this report that they feel should be immediate solutions to the current driving situation. These should be implanted through further senior design projects or by the IDOT directly.
- Further research on topics – Two semester's work of research by a project team of four busy senior engineers is not enough to analyze the entire driving education program. More research could be done in this area as well as more in depth research on the topics listed in this report.
- Further testing and evaluation of proposed solutions – The solutions provided in these reports are merely suggestions that may or may not be implemented as defined. Further research needs to be done on some of these topics before final implementation.

Team Information

Here is a list of the entire client's, team members', and faculty advisors' information.

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Closing Summary

For many years accidents related to driving have been a major problem that causes loss of lives and injuries. Some research is crucial in identifying the problems and will help find solutions to better educate people to improve safe driving. Some interesting facts, behaviors or habits that lead to accidents that the team discovered are listed in the Problems and Solutions Matrix (i.e. eating/drinking/talking/reading while driving, unfamiliarity with the driving system, road sign poor visibility, careless driver/pedestrian, decreasing driving skill performance, driving distraction, physical and psychological driver condition, etc). The problems and proposed solutions are recognized, identified and used as the end product completion in the design. The team did in-depth research on the current driving statistics and explored the solutions available, as well as introduced new tools, and developed solutions to improve driver education and hopefully reduce the number of accidents and save lives.

References

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Appendix

Listed here are eleven solutions that the team has devised. Each solution attempts to attack a problem with the current driver situation. Each solution is unique and may be implemented either by the IDOT or another Iowa State senior design team.

Solution 1 - Awareness Week

Awareness week – Set a certain week in a year/semester to be a driver education awareness week. Everyday of the week will be filled with educational, informational, and preventive events for all age groups. Various groups of people including the government and non-profit organizations will put on the events.

Suggested Content

Awareness week would facilitate various methods of driving safety publication, commercialization, and socialization. It is an event that will trigger creativity, increase awareness, and introduce new devices and laws to the public. The education will be camouflaged in fun activities which help the people to learn easier.

The event could provide valuable time and place for families to gather and bond with each other. Some possible activities that could be integrated to the awareness week are:

- A day without car
- Anger management
- Children activity
- Contests
- Driving safety tips and practice
- Driving simulation
- Lectures
- Movies
- New Device(s)/Technology presentation
- New law(s) presentation
- Public feedback/suggestion forum
- Quizzes
- Rewards/Honor distribution
- Seminars
- Etc.

The activities could stand alone or be gathered in an area where people will have easy access. The whole goal of the event is to remind people of the importance of safety in driving for their personal and environment benefit.

Potential Benefits

Awareness week is a fun event where people will meet, play, and learn at the same time. Each time people remember about the fun week they've spent they'll also remember the importance of the safety in driving. The children who were being educated could remind their parents of the safety in driving, and vice versa. The DOT and other driving related companies could utilize the event for advertising their products to the people in a one-to-one and more personal approach. The event can produce feedbacks, suggestions, and maintain the flow of communication between the public and the government about the law and other problems that they may have.

Potential Drawbacks

The event needs preparation and needs to be organized by professionals and a large group of people. The cost for the event is fairly large. Security during the event will be tightened to prevent any riot or other mass public problems. The event will attract large gathering of people which could lead to a more serious problems when the event is not organized and not well secured.

Potential Hazards

The event will be attended by the local governors (mayor, board of council members, etc.), the law enforcements agencies, companies, etc. The number of people that expected to be in the event is huge, and along with the increase of number of people that are coming to the event, the risks are also increasing. Some of the risks that might be triggered related by the event are:

- Bad weather condition
- Boring/unattractive
- Criminal activities (vandalism, stealing, etc.)
- Fighting
- High cost with less result/outcome
- Not organized
- People are not showing up
- Riot
- The number of companies that are interested to be involved is less than expected
- Etc.

All of these risks can be avoided with the cooperation of the event organizer/committee and the public.

Constraints and Considerations

The event is a big project that involves a large number of people (approximately 100-200 people). The flexibility in organizing the event is in minimal, since the event will most likely be organized and helped by volunteers.

Security

Large gathering of people is a source of different criminal activities, the number of law enforcements need to be adjusted with the number of people attending the event. If the event is scattered around and not being focused in a certain place the number of possible crime scene area is multiplied.

Safety

The event is expected to be attended by families who'll most likely bring their children along, which means the safety level is need to be increased. The area of the event needs to be calculated so that people able to breathe and move swiftly.

Commercialization

The event can be organized by first designing a general template that can be used by other people in other area. The template is designed so that more people can utilize the method of education nationwide.

Estimated Resources

The event may need about two months to prepare, this is due to the scheduling with the companies and advertising. The event it self may take 5-10 hours everyday of the week (7 days in a week) with approximately as many as 100-200 people working on it.

Research

Some research needs to be done to help prepare the event to a more desired and effective method of education for all age group in the community. Some awareness week events may need to be researched more extensively than others.

Development

The development of this solution need a flexible time frame and will never be done. Some feedback and suggestions from the people attending the event can be utilized as one of the development resource.

Proposed Cost

The possible cost expenses on the event are the people working hour that are organizing and helping in doing the event. The other costs are for advertising, materials, and event giveaways.

Personnel Effort

There will be an integrated of personal and group effort in the event, it's all depend on the responsibility of each committee of the event. Most of the work could probably be volunteer work with and estimated cost of 20,000 person hours.

Materials

The materials for the event will be used for safety, decoration, and information (map/handouts) during the event. Also multi-media will be needed in order for people to make presentations.

Totals

The total resources that will be needed for the event will consist of the combination of worker's salary, materials, and advertising.

Possible Results

The event could open ways to increase safety in driving. This is the list of possible use for the solution to improve the driver education:

- Incorporate all possible solutions that are available to improve driving education.
- The education can be done in various methods during the week, so different people with different learning preferences can benefit from the event.

Summary

The awareness week is an efficient method to educate all age group of people in a community. Various method of education can be applied in the event to promote driving safety and to build a stronger character to the community by helping each other in reminding, training, and discussing the driver education. The government could safe a lot of resources in educating people, the family can bonded better by doing group activities, children will have fun while learning, and people will be competing positively in order to promote safety.

Solution 2 - Bad Weather Training

Changes in weather can result in hard to drive in weather conditions. These changes can affect the driver's senses, and change the driving environment. These changes may require the driver to change his or her driving habits. Bad weather includes snow, ice, rain, and fog. Driving in these various weather conditions such can be dangerous. By providing training for such conditions, driving can gain the experience and prepare themselves for future situations.

Figure LIV: Driving Through Snow Covered Parking Lot

Suggested Content

Many new drivers and even experienced drivers are unfamiliar with driving in various bad weather conditions. By providing training for these various situations throughout the year, drivers will know what to expect and how to handle the situation when they encounter the problem.

The training can be divided into two parts: in class, and hands on training. For example, a winter driving course could have an in class training session where drivers learn about proper driving procedures such as what to do in case the car starts slipping on an icy road. The course should also teach proper safety precautions such as making sure wiper fluid is available and working, as well as having an ice scraper, etc.

After the in class session the drivers will get to apply this knowledge in a vehicle. The course can set up a controlled environment, for example in an icy parking lot (natural or man made), and under the supervision of an instructor the driver can practice what to do in case the car begins to slide. This is a safer way to gain experience for driving under bad weather conditions.

Potential Benefits

This is a safer way to gain experience for driving in bad weather conditions. Rather than be unprepared for the first time driving through snow and ice. The driver will know what to expect by practicing in a controlled environment. This is good for new and inexperienced drivers. This will also benefit drivers unfamiliar with a certain type of weather condition, such as foreign drivers who have never experienced snow.

Potential Drawbacks

The success of these courses will depend on the amount of people willing to take the courses and how much people are willing to spend for these courses. Also the courses will be taught during certain parts of the year depending on the weather, to most effectively utilize the hands on portion of the training course.

Potential Hazards

This is a feasible project, which can be very successful in preventing accidents related to bad weather conditions. The effectiveness of the training courses will depend on the amount of people interested and willing to take these courses. With proper advertisement and making the courses easily accessible will attract more people. Without enough interest in the courses, the courses may have to be canceled due to the expenses being too great.

Constraints and Considerations

This event will require the use of driving instructors as well as a location in order to develop the bad weather conditions. It will also require vehicles and safety personnel in case there are accidents.

Security

For the hands on portion of the courses, it will be important to maintain a controlled environment when possible. By maintaining a controlled environment, students will have a better and safer experience.

Safety

This is project would be safe way to help drivers gain experience driving in bad weather. Although 100 percent safety can not be guaranteed, practice in a controlled environment under instructor supervision provides a safer alternative to practicing on one's own.

Commercialization

These courses are not meant for commercialization, but as educational courses for the public to promote driver safety, and a safer community. However private driving schools may wish to utilize these courses.

Estimated Resources

This event will require a lot of work to prepare. A parking lot would be needed that could be flooded to create ice as needed. Advertising would need to be developed and presented to the public. Instructors would need to be trained and a curriculum would need to be developed. Also many of these things could be found by good research and volunteer work.

Proposed Human Hours

These courses will take time to prepare. Feedback will be needed from those interested in taking the courses. Instructors will be needed, and lesson plans needed to be developed. Some courses may be offered only seasonally. At least 20,000 human hours would be needed to make this a successful event.

Research

Various driving techniques and educational methods should be researched to best educate the students on driving in different weather conditions.

Development

Feedback from students will be gathered from students to improve the courses. Also statistical information should be gathered to evaluate the effectiveness of the courses.

Proposed Cost

The cost will include an hourly pay for the instructors as well as costs of the materials and equipment needed for the courses.

Personnel Effort

Much of the success of the courses will depend on the effectiveness of the instructor, but it will also depend on how much effort students are willing to put in.

Materials

The materials needed for the course will consist of informational materials such as books and packets. The hands on portion will need access to vehicles and a place to practice driving under various weather conditions.

Totals

The total resources required will consist of the instructor's salary, materials, equipment, and advertising the class.

Possible Results

The event could open ways to increase safety in driving. This is the list of possible use for the solution to improve the driver education:

- Instructional classes can help prepare people for the worst of seasonal weather conditions. It could also be beneficial to new drivers and people that relocate to the state.
- The hands on classes can help drivers to understand the dangers of bad weather driving and how to react to situations better.
- The main goal of the courses is to reduce the number of accidents happened related to driving by preparing the driver with experience in bad weather driving and hopefully saving more lives.

Summary

Under the supervision of an instructor and in a controlled environment, these courses provide a safer alternative to gain experience for driving in bad weather. Bad weather conditions include driving through snow, ice, rain, fog, and at night. By knowing what to expect and how to handle the situation, drivers will be able to react to these situations more calmly and with more confidence to prevent accidents.

Solution 3 - Safe Driving Video Games

Video games utilize physical and mental activity to transfer information to the public. The information packet is disguised in a form of fun activity and most of the time the public is not aware that they're being educated by the activity.

Figure LV: Driving Video Game

Suggested Content

Software can be developed to address various problems associated with driving and accidents. The software developed can be used to simulate various situations. Weather conditions would be beneficial to simulate, for example fog, ice, rain, snow, high wind, and night driving. Drivers inexperienced with these weather conditions could safely familiarize themselves with these conditions and be better prepared when these weather conditions really occur.

A variety of other situations could also be simulated. Vehicle hazards which include brake failure, loss of steering, and car maintenance, will give drivers an idea of what to expect in case a mechanical malfunction occurs. And at the same time express the importance of car maintenance to drivers.

Personal problems relating to driving can also be simulated. For example drunk driving, a drunk driver's vision, hearing, and reflexes will all be affected. The game could be used to simulate these problems to show the dangers of driving under the influence.

The person will have to interact with other drivers and be careful around motorcyclists and large vehicles. The person will also have to be careful around non-drivers such as pedestrians and construction workers.

By simulating all these situations drivers can gain experience for driving under these actual conditions. At the same time drivers will learn proper driving procedures and

driving legislation. This is also a safe way to simulate mechanical malfunctions and worse case scenarios.

Potential Benefits

Video game simulations will be a fun, educational, and safe way to gain experience driving. Many driving accidents are related to drivers not having much experience driving under certain conditions. The video game should be able to simulate weather conditions, vehicle hazards, hazardous driving areas, etc. to prepare the driver. And at the same time the driver will learn proper driving procedures and laws.

Potential Drawbacks

The effectiveness of the video game simulation will depend on how realistic the simulated environment will be and how believable the situations are. The game can not perfectly simulate real life, if the driver tries to apply the simulated situations to real life exactly as in the game, the results could be dangerous. On the other hand, if they game is taken too lightly and seen as just a game, the effect could be counter productive. This solution may not appeal to a large range of people, the people most likely to benefit from this solution, will be teenagers and young adults.

Potential Hazards

This project could be very useful to teach a younger generation. It could even be used as a teaching tool, or even as a test for new drivers, therefore it must operate realistically and try to counteract the current negative driving games.

Manageable

The team may be able to create a driving game/simulation, but may not be as realistic as desired. The project could be created by a variety of companies and schools. It could also incorporate a number of ideas and solutions.

Unmanageable

This project depends on the resources available: the software, equipment, and knowledge needed to create such a realistic simulation may be inadequate.

Constraints and Considerations

This project will require the use of extensive programming. Only a professionally trained team of software designers could attempt to create such a program. This project should be of high quality so that it is entertaining and visually appealing to drivers and therefore would be useful in teaching driver's safety.

Security

If the product is intended for commercialization, keeping information on the project such as the software's code will need to be kept carefully. Intellectual property rights will be an important issue.

Safety

This is project would be safe to implement and test, and is a safe way to educate the public about driving procedures and safe driving. It is important to use this software as a learning tool and should not influence drivers to bad driving practices.

Commercialization

This project could be commercialized successfully as a video game and/or training simulation.

Estimated Resources

Resources vary with time and technology. As video games progress, so should this project. It needs to be exciting and visually appealing to the audience as well as teaching good driving behavior.

Proposed Human Hours

This project could take several years, and may need to be worked on by several different teams. The resources available and the amount of team members will affect time needed to complete the project

Research

Research should be done on various educational methods and who will benefit most from this project. Feedback from users will be used to make improvements to the software.

Development

Many hours of coding, testing, and debugging will need to be spent on the project. Also user feedback will be essential in making the simulation as effective as possible.

Proposed Cost

The software and equipment needed to make such a system may be very costly. Through the use of grants and use of college research the cost could be lowered.

Personnel Effort

The success of the project will depend on the efforts of the team members and possible sponsors.

Materials

Various type of software will be needed to develop the simulation, as well as equipment to test and run the driving simulation software. Informational and instructional material will need to be made for future teams working on the project, and users of the simulation

Totals

The resources for this project will consist of the workers' salary, software, and equipment. Money would also need to be set aside for additional versions and updates.

Possible Results

The event could open ways to increase safety in driving. This is the list of possible use for the solution to improve the driver education:

- The software developed could be used in a driving simulator that could be used for test or training drivers safely. After design, schools could purchase simulators cheaper than cars.
- The program could be sold along with regular driving games. These games could be used at home and counteract the bad habit forming driving games.

Summary

A driving video game/simulator would be a great tool for education people about safe driving. New drivers will be able to safely practice driving in different conditions such as: bad weather driving and driving through hazardous areas. The driver will also learn about correct driving procedures and legislation.

Solution 4 - Simulators

Simulators - Simulators can be used to help train and educate drivers for driving under hazardous driving conditions such as winter driving, or city driving. This training can be done safely with minimal risk, but still allow drivers to drive through challenging conditions virtually risk free. Simulators are currently available in most drivers' education programs, but these should be available in other places.

Suggested Content

Simulators have been around for a while. The operation, maintenance, and usage of simulators have proven effective in saving time, money and lives. Simulators don't differ much with real life on-hand application/training, with the increasing level of resolution of the graphics technology, and other artificial sense technology, most people couldn't tell the difference between simulators and real on-hand training.

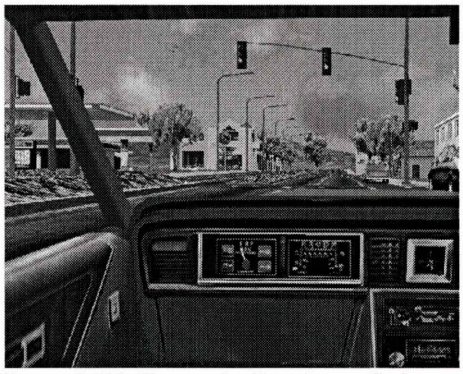

Figure LVI: Example Simulator Software

Above is a picture of the consumer market available driving software. The level of details and depth of the simulator is similar with the real life driving situation.

Potential Benefits

Simulators could save time, effort, cost, and especially lives. It is an easy and convenient way to practice the simplest turns to the most complex maneuvers even when it is dark, wet, windy, cold, etc. Simulators can artificially imitate real life situation very close to the original. Simulators provide almost risk free operation for the user. Simulators can be distributed into video games products, which are largely accessible by almost anyone, especially younger inexperienced drivers. Simulators are appealing for children, fun to use, and crashing the car on the simulator doesn't impose damage or injury to the user nor to the equipment.

Potential Drawbacks

Simulators could have a large initial and maintenance costs. The operation and maintenance requires trained professionals and is not easily done by anyone. Professional simulators often require large amount of space. New technology could make available simulators obsolete, especially those which can't be updated. Poor designed simulators have low resolution and could mislead the user of the device.

Possible Hazards

Vandalism and theft are the common issues that follow high-end device existence. Vandalism is often done by people with irrational emotion communication/expression. The quality and resolution of the simulator might be far off of the real life, especially for emergencies and other sensitive situations. The user of the simulators might be deceived by the poor design or the less detail that is being inserted to the simulator. Another risk is the compatibility of the simulator with other or new technologies.

All of these risks can be avoided or suppressed by the law enforcement, monitoring system, easy access of the simulator design details, and continuous research to improve the simulator performance.

Constraints and Considerations

The simulator is a big project that involves a large number of trained experts. The more details the simulator has the better result and more enjoyable by the user, also the result impacted to the user is significantly increased.

Security

The current monitoring system is sufficient to be utilized to secure the area surrounding the simulator to maintain the full performance of the simulator.

Safety

The safety level of the simulator is depend on the simulator designer, the product packaging should provide safety for the user, doesn't limit the user movement, and be as similar as possible to the real driving activities.

Commercialization

The simulator can be produced by private or government companies. The commercialization of the simulator can easily been done through PC video games, or console video games. The real high-end device could be stationed in a secured area such as DOT driving training vicinity, police station, etc.

Figure LVII: Current Large Scale Simulators

Above is the picture of current available high-end simulator. The qualities of the simulators resemble the real-life driving experience. A mass produce of these high-end simulator should be made available in every driving training station to help the driving student learn easier with smaller difficulties and costs.

Estimated Resources

The resources used for the simulator is pretty much the same as other software and/or hardware device production. Most of the resources go to design and updating the simulator. There also may be some cost associated with training.

Proposed Human Hours

The simulator requires a lot of details, which means it requires a lot of time spent on research. The choice of technology approach, end-product final form (video games, full-impression high-end device, etc.) could change in the middle of product development and add more human hours to complete the desired simulator. An estimated 20,000 human hours will be required for initial research the simulator, as well as an estimated 100,000 hours will be required to develop the simulator.

Research

Some research needs to be done to help prepare the simulator to a more desired and effective method of education for all user group of the simulator. Also research may be needed in order to actually implement the device properly.

Development

The development of the simulator is continuous along with the new technology development. By keeping the technology of the simulator updated, more detail and features can be added to the simulator to better mimic the real driving experience.

Proposed Cost

The possible cost expenses on the simulator are the research, advertising, materials, and simulator maintenance. These costs could be minimized by grants and making use of college design.

Personnel Effort

There will be an integrated of personal and group effort for the production of the simulator. If simulators are used to teach, a teaching staff will be required to test students. Also a staff will be needed to update, maintain, and repair simulators.

Materials

The materials of the simulator are mostly on the hardware part of the device, which includes the screens, electrical parts, safety precaution, and product packaging.

Totals

The total resources that will be needed for the simulator will consist of the combination of worker's salary, materials, and advertising. Most of the cost will be associated with the design of the simulator.

Possible Results

The simulator utilization could open ways to increase safety in driving. This is the list of possible use for the solution to improve the driver education:

- Incorporate all possible solutions that are available to improve driving education. The solutions can be implemented on the simulator usage package. Each user of the simulator needs to go through a certain set of procedures and education before actually using the simulator.

- Provide some type of pre-training of the simulator to make sure everyone is prepared to use the device.

- The education can be done in various methods during the waiting turn of the simulator user, so different people with different learning preferences can benefit the simulator usage experience maximally.

- The main goal of the simulator is to reduce the number of accidents happened related to driving by preparing the driver with experience in various driving situation with almost none/zero risk involved and hopefully saving more lives.

Summary

The simulator is an efficient method to educate all age groups of people in a community, and more appealing and fun to use by the children. The simulator operator could examine the driver behavior during driving and suggest improvement for better driving performance. Various method of education can be applied in the simulator waiting procedure to promote driving safety by helping each other in reminding, training, and discussing the driver education. The government could save a lot of resources in educating people, children will have fun while learning, and people don't need to be afraid of getting injured or damaging a vehicle by using the simulator.

Solution 5 - Accident / Bad Weather Alert System

A device can be developed and placed in various areas, especially in hazardous driving areas, that would alert all car drivers within a certain range of road and weather conditions. This can be done by overriding radio stations or signs could be posted to tell drivers to turn on their radios to a specific channel. The device could also be used to alert drivers of accidents in a certain area.

Solution Content

Often times drivers reach a hazardous driving area, such as a construction zone or a sharp turn, and signs marking the area are inefficient. When driver enters the hazardous driving area, radio stations could be overridden or ask drivers asked to turn radios on to a certain station. An alert will then notify the driver of the upcoming hazardous area with information about road and weather conditions.

Figure LVIII: Pictures of Places Where it Would be Beneficial to Alert Drivers

This alert system could be very effective in preventing accidents related to bad weather and hazardous driving zones. Since the driver will be notified in advance of the upcoming area, the driver will know what to expect and adjust to the situation properly by reducing speed, or changing lanes, etc.

Potential Benefits

This can be a cost effective and simple way to reduce accidents related to bad weather and hazardous driving areas. By simply turning on the car's radio, drivers can be alerted about upcoming road and weather conditions, and knows what to except. The driving can then properly adjust to the situation.

Potential Drawbacks

Not all drivers listen to their radio while driving, so a sign may be needed to tell drivers to do so. Also if the driver does not have a working radio, or refuses to turn on the radio

he/she will not be alerted of the upcoming road conditions. This feature may also annoy some drivers, or some drivers may feel that their listening rights have been violated.

Possible Hazards

This is a feasible project, which can be very successful in preventing accidents related to bad weather conditions and hazardous driving areas. The effectiveness of the alert system will depend if drivers are using their radio and if not, whether they are willing to turn on the radio when prompted. If drivers are not willing to do so, the system would be a waste resources and money.

Constraints and Considerations

Security and safety issues regarding the alert system will be discussed. The alert system will have to guard against tampering and be maintained properly to ensure the safety of the public.

Security

It will be important to make sure there is no tampering with the equipment and signs, and the message signals being transferred by the AM/FM systems. Making sure there is no tampering with the system will help insure the safety of drivers.

Safety

This is project would be safe and efficient way to help prevent accidents due to hazardous driving areas and bad weather conditions. Pre-recorded messages can be played in these areas alerting drivers of the road and weather conditions. This will help drivers properly adjust to the situation.

Commercialization

The alert system is meant for driver safety, and a safer community. This system can be commercialized. Special receivers can be made various third party companies.

Estimated Resources

The alert system will require many hours of work and the contribution of many people. It will be costly implement and maintain the alert system on a large scale. But it can be a potentially effective and efficient way to prevent accidents related to bad weather and hazardous driving areas.

Proposed Human Hours

Many hours will need to be contributed to make sure the alert system is running and properly maintained. The alert system can be implemented using modern AM/FM technology. The alert messages can be pre-recorded and updated when needed. The messages will then be played repeatedly. The alert system will need to be checked occasionally to make sure it is running properly. An estimated 10,000 human hours may be needed to implement this technology.

Research

Feedback and information regarding the hazardous driving areas will need to be recorded to evaluate the effectiveness of the alert system. Accident statistics in the area and the number of drivers who use the system will need to be monitored.

Development

Feedback from drivers and the accident statistics in a given area will be analyzed to view the effectiveness of the system and to see how it can be improved in order to more effectively prevent accidents.

Proposed Cost

Installation of the system in various locations throughout the state, may be costly, but would be an efficient way to alert drivers and prevent accidents.

Personnel Effort

Much of the success of the alert system will depend on how well it is maintained, whether drivers are using their radios, and whether they're willing to turn them on when prompted.

Materials

The alert system will utilize modern AM/FM technology to override radio stations to alert drivers. Signs will also be needed to alert drivers who do not have their radio on and will prompt them to do so.

Totals

The total resources required will consist of the equipment needed to override radio stations and maintain equipment, worker salary, and road signs.

Possible Results

This device could be used by a variety of people. Construction workers, emergency vehicles and police cruisers could all make use of this technology. Hazardous areas where the alert system would be most effective are:

- Accident sites
- Bridges
- Cliffs
- Construction zones
- Detours
- Flooding
- Icy roads
- Road blocks
- Sharp turns
- Tunnels

The main goal of the system is to reduce the number of accidents happened related to driving by alerting the driver with information related to road and weather conditions and hopefully saving more lives.

Summary

Although installing and maintaining the system may be costly, overriding radio stations to alert drivers of upcoming hazardous areas, such as construction zones and accident sites, can be a very efficient way to prevent accidents. With this system drivers will be alerted of upcoming hazards and will given information on road and weather conditions to better prepare them. The driver can then adjust to the situation, for example by slowing down, or changing lens. However drivers must have their radio on for the system to work. Similar systems are already being used in certain parts of the nation.

Solution 6 - Advertising Through Celebrities

Celebrities - Celebrities have tremendous power over the general public, especially teenagers. If these celebrities started to speak on the behalf of safe driving it would influence others to do the same. They could also be used to get people to come to a special events or fundraiser. To increase the success rate of the solution, the celebrities that are being chosen to promote driving safety should have a good driving record.

Suggested Content

Celebrities are the people that have the power to move certain groups of people, especially celebrities who have a big fan bases throughout the world. The media help the celebrities get public attention. Most of the attraction between celebrities and the public are due to popularity of the time and current new related status. The public feels that their life is being portrayed by a certain celebrities, which make the public have a strong attachment to some celebrities.

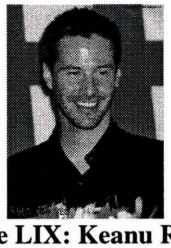

Figure LIX: Keanu Reeves

Above is a picture of Keanu Reeves the actor, who is well-known for his acting in the trilogy movie, titled The Matrix.

Potential Benefits

Asking the celebrities to promote safe driving could have an almost instant result and have cheaper cost compared to regular methods that needs to be maintained and updated. Celebrities combined with the media are a very strong tool to influence and educate people. Some people even share the same views on the things that their favorite celebrities do.

Potential Drawbacks

Celebrities are just normal human beings, who make mistakes and do silly things. When a celebrity's actions do not follow what they are promoting, the celebrity would lose credibility with the public, and the public may even copy the bad examples of the celebrity. The impact could cause the public feel that their efforts to do well in driving are futile and that they don't have a great role model for their life that are dependable.

Possible Hazards

Some celebrities should not be role-models and are therefore not qualified to promote safe driving; the choice of these celebrities promoting safety in driving would undermine the results of the program. Some celebrities are not well known enough and need more time to build public appreciation.

All of these risks can be decreased with the cooperation of the committee of the celebrity promoting a safe driving program and the celebrities themselves. The commitment of the celebrities in giving examples and being role models for the general public is crucial to ensure the success and better results of the program.

Constraints and Considerations

The program requires a good choice of celebrities to promote driving safety. The seriousness and commitment of promoting safety lays a heavy burden on the celebrities as the leader of the people in giving examples.

Security

The program can be done through media for nationwide distribution. The program could also be integrated with an event (DOT day, Awareness week, etc.). The security aspect of the program differs, depending on the method used for the information transfer.

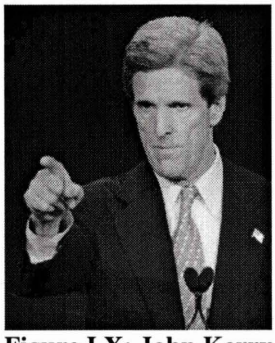

Figure LX: John Kerry

Safety

The program might trigger public protest for those who dislike some celebrities, and this could endanger the safety of the celebrities. Some safety precaution needs to be cleared to those who involved in the program, which they need to maintain good record on the eye of the public to ensure the success of the program.

Commercialization

The event can be organized by first designing a general template that can be used by other people in other area. The template is designed so that more people can utilize the method of education through the celebrities promoting driving safety program nationwide.

Estimated Resources

Most of the resources will be used through advertising and getting celebrities to endorse certain driving concerns.

Proposed Human Hours

The program needs may differ from several weeks to months depending on the method of the program distribution that is being used (media, event integration, etc.). A professional media should only spend 100 to 200 hours to recruit a celebrity. Celebrities time differ and may change on a weekly basis.

Research

Some research needs to be done to help prepare the program to a more desired and effective method of education for all age group in the community.

Development

The development of this solution needs a flexible time frame and may continue indefinitely. Some feedback and suggestions from the people knowing the program can be utilized as one of the development resources.

Proposed Cost

The possible cost expenses on the event are the people working hourly that are organizing and helping in running the program. The other costs are for advertising, materials, and event giveaways.

Personnel Effort

Personal and group efforts will be integrated in the program, it all depends on the responsibility of each committee of the program. The largest responsibility is laid on the celebrities themselves, to keep public interest.

Materials

The materials for the event will be used for safety, advertising, decoration, and information (map/handouts) during the program.

Totals

The total resources that will be needed for the event will consist of the combination of worker's and celebrities' salary, materials, and advertising.

Possible Results

The program realization could open ways to increase safety in driving. This is the list of possible use for the solution to improve the driver education:

- Utilizing the power of influence which potentially available in the celebrities combined with the media to promote safety in driving
- The education can be done with various group of celebrities for the program, so all different people and age group with different learning preferences/habits can benefit the program maximally

Summary

The celebrities promoting safety in driving is an effective method to educate all age groups of people. Various groups (children, teenagers, seniors, music, movies, etc.) of celebrities promote driving safety reminding and discussing driver education. The program could have almost an instant result to the public who adore certain celebrities. The government could save a lot of resources in educating people, the program has also proven effective in product advertising, and people will have more role models to look up to in their lives.

Solution 7 - Cell Phone Law

Due to cell phones becoming more affordable and accessible, conversing on a cellular phone while driving is becoming more of a problem, especially with all the features and functions available today, for example checking emails, reading the news, text messaging, etc. Many people have conference calls and conduct business on their cell phones. Using a cell phone while driving takes the drivers attention off the road and onto the phone conversation and reduces the driver's reaction speed. Laws should be passed restricting the use of cell phones while driving. Doing so could help prevent numerous accidents.

Suggested Content

Many countries have already passed laws restricting the use of cell phones while driving. Such countries include Australia, Germany, Japan, and the UK. The fines for not following the restrictions vary in amount. In the United States, there is no federal law prohibiting the use of cell phones while driving, but a few states have set restrictions. Some states have banned the use cell phones while driving, however allow hands-free headsets to be used. Other states have placed restrictions on certain drivers, for example bus drivers can not use cell phones while driving.

Some may argue that cell phones are no different from any other distractions and that they offer benefits, such as calling in case of an emergency, however they are a distraction nonetheless.

Laws should be passed in each state banning the use of cell phones while driving. Even with the use of hands-free head sets, cell phones are still a distraction. Although the headsets allow use of both hands while driving, the driver's mind is still on the conversation, and therefore not focused on the road. However, a complete ban of cell phones including hands-free headsets seems unlikely. Setting partial restrictions in each state on cell phones, such as banning the use of cell phones while driving unless using a hands-free headset and restrictions for certain drivers would make big improvement and deter many people from using a cell phone while driving. Also many new cars allow drivers to use their cell phones with a built-in intercom system. This could be an alternative to hands-free headsets or laws could be passed for car manufacturers to restrict the use of this feature only when the car is in park.

Potential Benefits

Any restrictions regarding the use of cell phones would help prevent people using cell phones while driving with the exception of a hands-free headset. This could reduce the number of people driving distracted by cell phone conversations. The law can be amended in the future to include other distractions such as TVs, DVD players, etc.

Potential Drawbacks

Not all drivers need laws restricting the use of their cell phones, many drivers can decide for themselves when use is appropriate, however restrictions need to be set. Cell phones do have benefits, for example in the case of emergency cell phones can help save lives. In these cases and for emergency vehicle operators, exceptions to the law need to be made.

Possible Hazards

A cell phone law may be difficult to enforce, and if it is not enforced strictly, the public will not follow it strictly. Also as mentioned before, exceptions need to be made to allow the use of cell phones in cases of emergency, and for certain drivers such as drivers of emergency vehicle operators.

Constraints and Considerations

Since this is a bill, it only has the possibility of becoming a law. Therefore many drafts should be formed in order for the bill to succeed. Many smaller drafts will not cause as much chaos as one large law that incorporate much of technology. Consideration for all people should be taken into account while devising a bill that is there to benefit drivers and their safety but not hinder their progress.

Estimated Resources

Writing and passing a cell phone law will require many hours of work and the contribution of many people. If the law is passed it will have to be enforced by law enforcement. But it can be a potentially effective way to prevent accidents related to cell phone distraction.

Proposed Human Hours

A bill must first be written, discussed, and then be made into a law. An estimate of 10000 man hours to write and draft a law and up to 2 years to get the law passed.

Research

Once the law has been passed and put into effect, statistical information will have to be collected and recorded to view the effectiveness of such a law. Analysis of the information can then be used to improve the law.

Development

Eventually the law can be amended to include other distractions such as TVs, DVD players, and video games in cars.

Proposed Cost

Much of the cost will be from salary of the man hours used to research and draft the bill. Once the law has passed, feedback will have to be gathered to improve the law.

Personnel Effort

Many hours will go into the writing of the bill. The bill will have to be thoroughly checked and revised. Then the bill will have to be discussed before it can be made into a law. Once the law is passed it is up to law enforcement to strictly enforce the new law.

Multimedia Requirements

Advertisements and awareness campaigns should be used to promote and notify the public of the new law. These can include the use of television/radio advertisements, billboards, and magazine/news ads.

Totals

The total resources required will consist of the hours spent writing and revising the bill before it can be made into a law and the efforts of law enforcement to strictly enforce it. Totals will also include all the multimedia resources needed to notify and promote the new law to the public.

Possible Results

Awareness campaigns and advertisements can be used to promote the bill and gain supporters. Once the bill is passed and made a law, advertisements can be used to notify and promote the new law to the public. This new law will help reduce accidents related to cell phone distractions and serve as a guideline to when the use of cell phones is appropriate. Below are their tips for using a phone safely while driving:

- Do not engage in stressful or emotional conversations that may divert your attention
- Do not look up phone numbers while driving
- If possible, place calls when you are not moving or before pulling into traffic
- If possible, suspend the call in heavy traffic and poor weather
- Notify person with whom you are speaking that you are driving
- Position your phone within easy reach
- When available, use a hands-free device

Summary

With the improvement of technology, cell phones are becoming more affordable and accessible. Cell phones offer a variety of functions and features. Many people conduct business and conference calls on their cell phones. This can be very dangerous while driving. Conversing on a cell phone while driving takes the drivers concentration off the road and increases the risk of accident. Passing laws in each state that restrict the use of cell phones with the exception of hands-free headsets, and restrictions for certain drivers, i.e. bus driver, would help reduce accidents caused by the distraction of cell phones. Laws could also be directed to car manufactures which require them to include built-in intercom systems for use with cell phones.

Solution 8 - Driver Information Database

The current information about driving is scattered all over the media especially those available on the internet. The information available is also varying and inconsistent. A standardized website database is required to provide all related information and statistics about driving in the U.S. The website would be required to have some of these features: easy navigation, user-friendly, updateable, upgradeable, accessibility, compatibility, multi-language, secured, all age group content, and feedback.

Suggested Content

There is huge number of important information available on the internet related to driving. Most of the information in different websites is not related. Some are more detailed, but some are less dependable than others. The people need a central location where all driving related information and statistics are available, which is dependable and professional.

A driver information database could save people from getting lost in the internet trying to find certain laws or maintenance that needs to be done. With the current condition of the internet people might spend days to get the exact desired information.

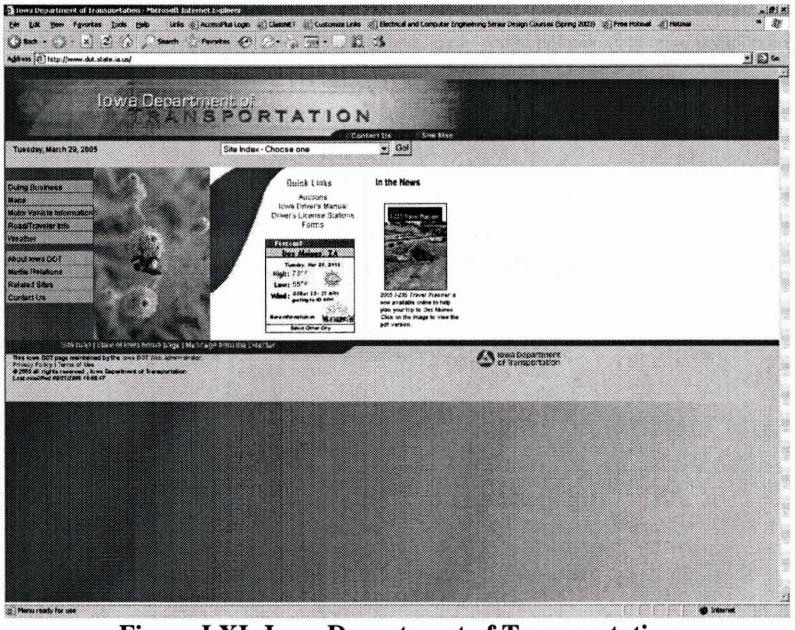

Figure LXI: Iowa Department of Transportation

The image above is the screen-shot of the Iowa Department of Transportation (IDOT) website (http://www.dot.state.ia.us/). The website is one of the examples where some information about driving is available. The information in the website is accurate but not detailed enough to cover everything about driving.

Potential Benefits

A driver information database could help a researcher to complete their tasks faster, save the public some time to look for specific information related to driving, accessible nationwide, as source of reference, new laws socialization, reminder of available laws, etc. The database is very flexible in terms of design. Different age groups could be represented on different website templates to add more value to the information that is being transferred to the public of that age.

Potential Drawbacks

The driver information database, as well as other websites in general is a potential victim of internet attack (hackers, crackers, viruses, etc), server crashes, browser compatibility issues, missing links, exceeding bandwidth threshold, etc. Security of sensitive information is crucial and very important to always be updated and controlled.

Possible Hazards

The database could mislead people if it is not carefully composed. The statistics available need to be precise and need to be reminded to the user for them not to take the information available in the statistics for granted. Statistics are there and available based on the occurrence that is currently happening or have passed, and nothing about new or future incidents is taken as resource. Statistics are available for people to learn from the incidents, expect what will happen in a situation, and try to find solution based on the history of the occurrences.

However people need to be prepared of those that are unexpected, each incident is unique and does not always have the same exact results. All of these risks can be decreased by continuous update, upgrade, research, and endless feedback from the user of the database.

Constraints and Considerations

The database needs to cover all information and focuses on different aspects. The theme and presentation of the information is adjusted to the type of audience. All age groups should be considered in compiling the content of the website.

Security

The internet is full with unknown malicious potential attackers, malicious software, harmful scripts, and so much more danger available that could decrease the performance of the database. Page encryption, anti-virus, anti-spy ware, firewall, and other security tools are need to be available to secure the database at all time.

Safety

The database information could be taken for granted, some pre-cautions need to be available to remind people about keeping away from sensitive and dangerous activities. If they really need to do some life-threatening activities (stunts, setting records, etc.), always have a supervisor and safety equipment available at all time.

Commercialization

The database can be organized by first designing a general template that can be used by other people in other area. The template is designed so that more people can utilize the method of education nationwide. Copyright issue need to be cleared to all the potential user of the database template.

Estimated Resources

The estimated resource for the database is mostly on software, documentation, and research. The information need to be verified and keep updated regularly to ensure the credibility of the data.

Proposed Human Hours

The compilation of the database may require extensive research and testing. The preparation could take about eight months to twelve months, the implementation and testing could take about four to six months. So the total time required to implement the driver information database twelve months to fourteen months for a team of four people.

Research

Research is important for the base of the database preparation and maintenance. All of the information is tested on-hand for reliability and accuracy.

Development

The development of this solution needs a flexible time frame and will never be done. Some feedback and suggestions from the user of the database can be utilized as one of the development resource. Personal experience may as well be used as resource for the database development.

Proposed Cost

The possible cost expenses on the event are the people working hour that are organizing and creating the database. The other costs are for advertising, materials, printing, server system, and data security.

Personnel Effort

There will be an integrated of personal and group effort in the event, it's all depend on the responsibility of each committee of the database. A webmaster group will have full access to the database for input new data and updating available data.

Materials

Most of the material for the database is just software, the rest of the materials for the database will be used for safety, hardware, and information back-up.

Totals

The total resources that will be needed for the event will consist of the combination of worker's salary, materials, and advertising.

Possible Results

The database realization could open ways to increase safety in driving. This is the list of possible use for the solution to improve the driver education:

- Incorporate all possible information related to driving to support safety in driving
- All age group considered for the website content, there will be available information for everyone.

Summary

The driver information database is an efficient method to educate all age group of people. Various method of software/internet education can be applied in the website to promote driving safety and to help each other in reminding and discussing the driver education. The database is a very convenient source of information for all people that need anything related to driving. The government could safe a lot of resources in educating people. The database facility is available 24-hour everyday, and easy to access for anyone that has access to internet.

Solution 9 - Internal Car Sign Reader

With the use of technologies such as radio frequency or infrared, signals can be added to sign or road surfaces that will be detected by the car and display road conditions to the driver. Some of the information sent can include speed limit, mile markers, road conditions, etc.

Suggested Content

Often road signs and warnings may be difficult to see and may not supply enough information. Infrared technology can be used, and have certain signs output signals which will be received by a receiver built into the vehicle. This receiver could be a stand alone product or be integrated into other systems such as On-Star and GPS navigation interfaces. Signals would be added to signs containing information on the type of sign, for example, the signal could notify the driver that he/she is approaching a school or construction zone.

The signals could even be placed in known problem areas and be used to send information regarding road conditions for hazardous areas and prompt the driver on what to do. The receiver in the vehicle could then take the message signals and output the information by using audio and video.

Potential Benefits

The internal car sign readers could help drivers with vision problems be aware of signs or hazardous road conditions they might not be able to see, for example older drivers with poor night vision. It can also help drivers that are unfamiliar with a certain area. In this case, the driver may not be aware of school zones, speed limits, or poor road conditions in the area, and the internal car sign reader could prepare the driver for what to expect.

Potential Drawbacks

Infrared and radio frequency technology have their limits. For the internal car sign reader to work, the car may have to be driving at certain speed, for example 30mph, and in a certain lane so that the receiver can pick up the signal being sent with minimal error.

Possible Hazards

The internal car sign reader system must be operating and functioning properly at all times. If the equipment and signals are not maintained or have been tampered with, the information being sent to drivers could be old and false. This could pose a serious threat to driver's safety.

Constraints and Considerations

Security and safety issues regarding the internal car sign reader will be discussed. The system will have to guard against tampering, be well maintained, and updated properly to ensure the safety of the public.

Security

It is important that the information being sent to drivers is up to date and correct. The system will have to beware of tampering as it could send false information to drivers and put them at risk to accident.

Safety

Correct and up to date information about signs and road conditions is important for the safety of drivers. Any failure to keep the information up to date and correct will be a liability.

Commercialization

The product could be marketed as a stand alone device or be developed by car manufacturers and be integrated into existing systems such as GPS navigation and On-Star telematics.

Estimated Resources

The internal car sign reader system must first be designed, and then the signals will be added to various signs and locations through out the state. Research and data will need to be recorded over several years to better understand the impact and effectiveness of such a system.

Proposed Human Hours

This project could take eight months or 1200 hours to complete, which would consist of designing the device, technology research, actual implementation, and testing of the device.

Research

Research may need to be done to see if the technology suggested is feasible. The problem with RF and infrared technology is the range. The range may be too small or cars may be traveling too fast in order to read the information.

Development

Data and feedback regarding the amount of accidents in relation to signs and areas equipped with the internal car sign reader will be recorded to evaluate the system's effectiveness. The data will help to improve the system in the future

Proposed Cost

Most of the cost will come from the design. RF technology is cheap and easy to use. The sign reader device may cost around 200 dollars to produce after design. The RF or infrared transmitter should not cost more than a dollar to add to a sign.

Personnel Effort

Most of the personnel effort will be spent on the design of the receiver. This could be a complex device that would require team of engineers up to a year to develop and bring to market.

Multimedia Requirements

Advertisements can be used to promote and notify the public of the new system and explain how the system works.

Totals

The total resources required will consist of the hours spent designing the system. The manufacturing costs for the equipment, and the labor needed to keep the system running and up to date.

Possible Results

As mentioned before using RF and IRF technology, signals can be added to signs and hazardous driving areas. As cars pass by these signs and areas the receiver in the vehicle will pick up information regarding the type of sign, and various road conditions. Below are signs and hazardous driving areas where signals can be added:

- Bridges
- Construction zones
- Detours
- Parks
- Railroad crossings
- Road blocks
- School zones
- Sharp turns
- Tunnels

Summary

RF and IRF signals can be added to signs and hazardous areas, to be received by the internal car sign reader placed in cars. Information on the type of sign and road conditions can be displayed. This will help the visually impaired and ensure that signs are not missed due to signs poorly placed and drivers with poor night vision. The internal car sign reader can be developed as a stand alone device, or be developed by car manufacturers and be integrated into to GPS navigation systems and telematic systems such as On-Star.

Solution 10 – Driver's Exam Revisal

In order to obtain a driver license, people need to pass both a writing exam and driver exam monitored by DOT staff. Most people have little trouble passing both exams with a very limited knowledge of the driving laws, regulations and driving skills. Some of these people will become reckless drivers and could cause trouble on the road to themselves and others. As time goes on, their driving habits get more dangerous and they may forget laws and regulations they've once learned. To help solving this problem, we need to re-examine the driving exam procedures, make recommendations to increase driver knowledge on driving laws/regulations, and improve driver skills.

Research Content

First of all we need to examine the current driver exam to make adjustments to the process to make it harder for people to obtain a driving license. Before driving, a potential driver must complete the written exam. The written exam needs to cover most of the current driving laws, regulations, driving skills, ways to avoid car accidents, potential accident situations, different weather and road condition driving, construction zone, and school zone driving.

In order for one person to obtain a license, they need to accomplish the following:

1. They need to drive free of accidents for 100 hours under adult supervision.

2. This person needs to provide the DOT examiner a signed recommendation form from the person who supervised this candidate and state that this person indeed had 100 hours of driving training. This person is then allowed to take the driving exam.

3. After passing the writing exam and completing the training, the candidate is required to demonstrate the driving skills on both local roads and highway.

4. The examiner needs to instruct the candidate to drive on busy local road, demonstrate lane changes, signals, turns, parallel parking, etc.

5. The examiner should also take the candidate on a highway to test their abilities and observe their behavior.

6. In order to pass and earn driving licenses everyone needs to score 85% or above on both their writing and driving exams.

The driving license should expire every 5 years in which the driver is required to pass the written exam before renewing their license. And every 10 years, the driver needs to re-take both writing and driving exam in order to renew their license. This way, the driver knows that they need to drive carefully everyday and be more aware of their driving

habits in which might affect him during the next exam. They also will have the opportunity to re-learn the laws and regulations. Also, people will need to take a driving class every time they receive three driving tickets or get into an accident and then re-take both writing and driving exams. Seniors who are sixty-five or older will need to re-take both writing and driving exam every five years. This will refresh the senior driver on their driving skills and their knowledge on driving laws and regulations. It also would help keep the senior who is loosing the ability to drive, off the road and keep the road safer and more enjoyable to drive.

Potential Benefits

The benefits of giving more difficult driver exams would require a potential driver to carefully prepare for their exam by learning the laws, regulations and driving techniques. The driver also needs to practice to drive safely and smoothly under any condition including bad weather, busy traffic, school zones and highways. The proposal also requires driver to re-take the driver exam after a period of time to re-test their knowledge and update them with new information. This is a good opportunity for the DOT staff to remind a driver to drive safely and testing their driving skills.

Potential Drawbacks

The disadvantage of this method is that it requires people to complete the re-take exam more often, which some people don't prefer to do, or have the tendency of forget to complete the re-take exam when their time comes. It will require a lot of effort on the law enforcement and DOT staff to notify people of their up-coming exam. It is also the law enforcements job to keep the people who violate the law off of the road. This will surely cost a lot of money. This also will cause more people coming frequently to the driving exam stations which may overwhelm some locations.

Potential Hazards

There are several potential problems that need to be looked at before implementation of the new procedure.

- The DOT could provide the public with more testing locations or expanding the current location
- The DOT could hire more staffs to help provide the public with fast and smooth services
- The DOT could remind driver when they need to re-take their driver exams
- The law enforcement officer could suspend the driver license of those who have six tickets and above to force them to re-take the driver exams
- People will not happy with the law enforcement and DOT as these agency required them to take the driver exams too often
- People might not re-take the exams even when they know they have to
- People might forget when they need to re-take the exam
- People who have their license suspend still driving on the street

Constraints and Considerations

Although the proposal solution is critical to help the DOT, law enforcement officers to ensure safe driving, reduce accidents and making the road safe and more enjoyable to drive by everyone. It has some constraints and considerations that need to take in to account for it to work effectively.

- More and more people will come to the DOT everyday for their driving exams, therefore the DOT need to increase security to ensure public safety
- People might not re-take the driving exam even if they know when to re-take them
- People might forget when they need to re-take the exam
- People who have their license suspend still driving on the street
- The public opinion might divide; some may support the recommendation some will not
- The recommendation need to be pass into law by congress
- The DOT and law enforcement will need to have a bigger budget to accommodate the changes

Security

The proposal will increase the number of people taking the driving exam at DOT locations in the nation. Therefore to ensure the safety of DOT staff and public, security will need to be tightened. The number of law enforcement at these locations need to increase to check for any suspicious activities. The possibility of cheating, driving license bootleg, and any illegal activities need to be prevented.

Safety

The safety of DOT staff, law enforcement officers, and the public needed to be taken into careful consideration. The exam station facilities need to be updated, all of the required equipments (sanitation, first aid, emergency exit, etc.) need to be increased and constantly monitored.

Commercialization

The proposal needs to be widely available to those interested. People need to know their rights and requirements when it comes to obtaining a driving license. The DOT also needs to keep their testing locations clean and free of trouble. They also need to provide the public with fast and reliable service.

Estimated Resources

The estimate resource of this solution is very hard to calculate due to the increasing number of people taking the test. This will require DOT to open new location and

expand their current location. DOT also needs to hire more professional staff members, increase security, print more flyers, and advertisements.

Research

This is only a proposal and it needs to be reviewed carefully by the DOT, law enforcements, and the public. There is more research needed to be done to write new exams and determine the time period for when the driver needs to re-take their driving exam.

Development

The development of this proposal will take place overtime. The public needs to be notified in order to get their support before implementing the solution. It will also take time for research and preparing the new writing exam as well as new criteria for the driving exam.

Proposed Human Hours

The human hours will include the number of DOT staff and law enforcement workers to ensure that drivers know how to obtain the new driver license as well as when to re-take the exams. DOT and law enforcement will most likely need to hire more personnel to help accommodate the public with a fast, smooth, and efficient process.

Proposed Cost

The proposed cost of this solution includes the cost to do more research on the topic, salary for more DOT staff, law enforcement officers, build and expand DOT facilities, and printing/advertising costs.

Personnel Effort

Again, personnel effort is the total increment in number of hours DOT staff and law enforcement officers work to ensure the changes are working efficiently. They need to provide the public with fast and reliable services. They also need to remind drivers of when they need to re-take the exam and keep reckless drivers off the road.

Materials

The material cost will include the printing cost of driving manuals, driving laws and regulations, flyers, written exams, computer usage, and various office equipments.

Totals

The total cost includes materials, equipment, personnel salary, and security equipment.

Possible Results

This data could be used by the DOT, driver instructors, schools, universities, public organizations, companies, government agencies, current drivers, potential drivers, senior drivers, non-drivers, and anyone interested in learning to become a better driver. This will serve as a recommendation for the DOT to ask congress to introduce a new law that requires people to take stricter driving exams and require drivers to re-take the exam after a certain period of time.

Summary

To help reduce car accidents, we need to make the current driver examination more difficult. The exam needs to test people's knowledge on the current driving laws/regulations, and their ability to drive safely on both local roads and highways. Drivers also need to re-take the exam after a period of time to ensure they know the driving laws and regulations through out their lifetime. This recommendation may not be favored by the majority of the public, but it is very critical to ensure the safety of all users of the road. This will also cause tax payers more money as it requires more staff members at the DOT, and law enforcement officers may have to work more hours on the road.

Solution 11 – Elder Driver Restrictions

People tend to only listen to people who are older than them. They especially listen to senior citizens. They believe that senior citizens are well experienced and know what they are talking about. Therefore it is hard for family members to tell senior citizens that they are loosing their ability to drive.

Suggested Content

Elder drivers are usually unaware of their failing ability to drive. Many of them are also stubborn and will not admit that their driving skills are diminishing. The family is usually more aware of their bad driving habits than the senior citizens themselves. Therefore it usually comes down to the family intervening in the restriction of the elder driver.

This could be a difficult task and therefore it should be eased by the DOT. Family members should be able to report elder drivers to the DOT and then the DOT should have them take exams regarding their driving ability.

It is also important to check elder citizens more often. Therefore older citizens should have their driving skills checked once a year, or once every two years. Older drivers often loose their eyesight and have slower reaction times, these changes happen gradually and therefore the changes often go unnoticed. Therefore it is important to monitor them closely.

Being able to report an elder, and to have their driving skills checked more frequently will help to keep the roads safer. It is a difficult time in a person's life and should be handled carefully and responsibly. It is a big change loosing the ability to drive.

Potential Benefits

It is beneficial to the community to remove unsafe drivers from the road. An elder driver with failing eyesight and slower reaction times is definitely a hazard to the community. Therefore testing this driver more often, helps to make sure that this driver is safe.

Potential Drawbacks

The disadvantage of this method is that it requires people to commit to learning and sharing their knowledge with other people from time to time which is sometimes considered to be an unpleasant topic to discuss with your friends, family members and neighbors. People tend to not want to discuss or admit to their decreasing driving ability.

Possible Hazards

It is really hard on an elderly citizen to loose his or her license to drive. But elderly drivers do experience a loss in their ability to drive. This is a harsh reality that almost everyone one day will have to face, and it is a starting point of realization.

Constraints and Considerations

Many things need to be considered when devising this rule. It is important to remember that it is a lifestyle of an individual that is being changed. It is a harsh reality that must be faced. Here is a list of constraints that might need to be considered:

- The elder may be living alone and need a vehicle to function normally
- The elder may believe that his or her rights have been violated
- An elder may not believe that his or condition is failing
- A social breakdown may occur from loosing a license
- An elder may still try to drive without a license
- Family issues may arise when the elder looses his license
- An elder may forget to retake the exam more frequently
- The policy can be misused for wrong purposes (practical jokes)

Security

The proposal will increase the number of people taking the driving exam at DOT locations in the nation. Therefore to ensure the safety of DOT staff and public, security will need to be tightened. The elder may move and react slower than younger people, which mean more time is needed to process the system. To avoid long queue on the DOT vicinity a special office to implement the system could be considered as one of the solution. The number of law enforcement at the locations need to increase to check for any suspicious activities. The possibility of cheating, counterfeiting driving license, and any illegal activities need to be prevented.

Safety

The safety of DOT staff, law enforcement officers, and the public needed to be taken into careful consideration. The exam station facilities need to be updated, all of the required equipments (sanitation, first aid, emergency exit, etc.) need to be increased and constantly monitored. The elder have poor sight and reflexes, for this reason the area of the office should be accessible and safe for the elder to move around on their own.

Estimated Resources

The estimated resource of this solution is very hard to calculate due to the nature of the solution. More DOT workers will be needed to retest the elder drivers as well as social workers to help the elders adapt to the change of loosing a license.

Research

Research needs to be done to estimate the number of elders that this rule will affect. Also research needs to be done to estimate the amount of resources that will be needed to expand the testing procedure. Data and feed back will have to be collected to evaluate the effectiveness of this solution.

Development

The development of the retesting procedure will have to be gradual so as not to alarm people too much. After five or so years the full development should be enforced. Added DOT and social workers will be needed and trained in order to handle the extra testing needed. Also more testing sites may need to be developed.

Proposed Human Hours

There will be an initial amount of hours that will be needed to develop the new rule. This may take a couple of individuals a year to plan. It will also take more DOT and social workers in order to keep up with the demand of testing. The amount will be unknown until research is done.

Proposed Cost

The cost of this project will be composed of the hourly wages of the added DOT and social workers. The exact number of workers will vary as the population of elders varies.

Personnel Effort

As stated above, the personnel effort will include the amount added workers needed to be added to the staff to handle the added amount of testing.

Materials

There should not be many materials needed to handle this project. More information will be needed to be sent to the elders and new testing sites may need to be developed.

Totals

The total cost of this solution will be composed of the amount of research done plus the added labor for the solution of the problem. The added labor could vary as the population of the elder drivers varies.

Possible Results

The results could be used by a variety of people. Elder drivers are the most effected by this rule, and their thoughts and considerations should be listened to first. Families and friends should also be aware of the new rule so that they can help elder to get tested or to report elders that have failing abilities. And of course, the DOT should make use of this to construct a plan that will help the community but not hinder the elderly drivers. This is a daunting task, and should be considered with the highest of consideration for the elderly citizens.

Summary

Elderly drivers are loosing their abilities to drive more rapidly than other individuals, and therefore they should be tested more often than the standard driver. This task should be handled by the family reporting and more frequent testing. Elder drivers may be loosing eyesight, reaction speed, and in some cases even memory. All of these things should be tested on almost a yearly basis. It is needed in order keep the community safe. This comes at a cost though. It is a big life change to loose the ability to drive. Social workers may be needed to help the elders adjust to the change. The change should be as easy as possible for them. It could lead to a total life breakdown in some cases, but it is needed in order to keep the community safe.

Solution 12 - Vehicle Safety Package

Often times special safety features are only offered on the higher end models of a car manufacturer's vehicle line up. Some of these features include backing up sensors, adjustable seating/steering wheel/pedals, controls on steering wheel, and split-view mirrors. If car manufacturers could put together an affordable package containing these features, many drivers would be willing to pay for the added benefits and safety these features provide.

Suggested Content

By offering drivers a simple safety package at a reduced price, many car buyers who normally wouldn't be able to afford these features could pay an affordable for set safety package or a package that let's drivers specify the features.

With more drivers having these safety features on their vehicles, accidents can be significantly reduced. By simply adding split-view mirrors to a vehicle, blind-spots are virtually eliminated. Controls placed on the steering wheel for the car's sound system can help keep the drivers on the road and reduce driving distractions. Sensors placed at the back and front of vehicles to alert the when the driver gets too close to another vehicle or object will help drivers in parking situations and reduce injuries from drivers backing into pedestrians.

Potential Benefits

This can be a cost effective and simple way to reduce accidents related to driving distractions and blind-spots. By offering a simple and affordable safety package more drivers can simply add on these features when buying a new car.

Potential Drawbacks

If not enough people are interested, or do not purchase this affordable safety package, the car manufacturers decide to offer these packages will be losing money.

Possible Hazards

This is a feasible project, which can be very successful in preventing accidents related to driving distractions and blind spots. The more features available in the package and the more affordable it is will greatly affect the sales of this package. Car manufacturers have to consider the risk of not finding a large enough interest in the package. If not, they will be losing money.

Constraints and Considerations

Security and safety issues regarding the add-on safety package will be discussed. The features included in the package must be installed properly and apply federal standards and regulations to ensure the safety of the public.

Security

It will be important to make sure each feature is installed properly and that there are no defects. Making sure the features are in proper working condition will help insure the safety of drivers.

Safety

This is project would be safe and efficient way to help prevent accidents due to hazardous driving areas and bad weather conditions. These simple features can be added to vehicles fairly easily and prevent a number of different accidents related to driving distractions and blind spots.

Commercialization

The package can be easily commercialized by car companies. This is a simple add-on that car manufactures can add to their existing vehicle line-up.

Estimated Resources

The safety package can be easily added to a car manufacturer's vehicle line-up and resources should be based mainly on installation labor.

Proposed Human Hours

The technology for these features is already available on many of the higher end vehicle models. Incorporating these features on lower end vehicles should be simple and mainly consist of installation labor.

Research

Consumer feedback should be recorded to determine the interest in such a product and what safety features are most desired.

Development

Feedback from drivers and the accident statistics for drivers with the add-on safety package should be recorded to evaluate the effectiveness of the effectiveness of the package and how to improve it.

Proposed Cost

The cost of this package will vary depending on which items are included in the package. Also different car companies may choose to charge different amounts for the package.

Personnel Effort

This package would not use many personnel resources. There will be a design phase needed for each device and then it will add some time to the actual manufacturing process to install the devices onto the actual vehicle.

Materials

The materials will be based on which safety features are included in the package. Examples of safety features are split view mirrors, steering wheel controls, and sensors.

Totals

The total resources required will consist of the equipment needed to make the safety features and the labor hours needed to make and install the safety package.

Possible Results

Possible safety features included in the package:

- Split-view mirrors
- Adjustable seating
- Adjustable steering wheel
- Adjustable pedals
- Controls on steering wheel
- Parking Sensors (backing up, advancing)
- Auto-dimming mirrors
- Lights placed on inside of doors to increase visibility at night when doors are open

Summary

Creating an affordable add-on package for car manufacturers exiting vehicle line is a simple to implement and profitable product that can significantly reduce accidents due to driving distractions and blind spots. Making an affordable package would allow car buyers who normally wouldn't be able to afford the features to now do so and have the added safety these features provide. However car manufacturers face the risk of consumers having little interest in the safety package, if that is the case car manufacturers will be losing money.