Safety Issues of Airbags

An Interactive Qualifying Project
Presented to the faculty of Worcester Polytechnic Institute
In partial fulfillment for the degree requirements
of Bachelor of Science

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May 5, 1999

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1.0 Abstract

The purpose of this project is to investigate the development and safety issues of airbags. The literature review will show the present status of airbags. It will also bring forth the advantages and disadvantages of airbags. The paper has been written from a neutral position, presenting all issues from both sides of the airbag debate. At the end of the paper, the writers' thoughts are given.

The written surveys, interviews and case studies were done for comparison to statistics from the National Highway Traffic Safety Administration (NHTSA). The surveys also serve as a media to display the many misconceptions that are held by the general public about airbags. A more educated conclusion about the safety of airbags will be able to be made after reading this report.

2.0 Introduction

Presently, as of 1999, under Federal law all cars and trucks are required to be equipped with both front and dual-side airbags. Even with airbags and seatbelts, driving can still be very dangerous. There are over 42,000 people killed each year in car accidents. Fortunately, this number has been constantly decreasing over the past ten years. The drop in number of automobile related deaths is partially due to the increase in technology that is provided in the vehicles of today. Included in this technology are airbags. It has been estimated that airbags save roughly 9,000 lives each year. Although there is proof that airbags have reduced deaths in automobile crashes, they have definitely not saved the 9,000 lives they were originally estimated to save each year. Compared to early cars, in addition to airbags, today's vehicles have antilock brakes, better handling, automatic seatbelts, and other safety technologies. Today's car is even engineered for impact. "Crumple" zones are becoming very common in family vehicles.

Although airbags have become a standard in every car made today, there is some question whether they really are a lifesaver. Since 1990, airbags have been installed in over 75 million vehicles and have deployed in over 650,000 crashes. With an increasing number of cars on the road with airbags the number of deployment will only increase significantly. The question is whether airbags deploy when necessary and how many lives are actually saved?

In the early 1900's, when cars were first on the road, safety was not a major issue. There were very few cars and speeds were very low. By the 1950's, the number of cars had greatly increased along with speed, and number of accidents. By the late, 1960's, the first airbags were installed in automobiles. They were engineered by General Motors and were installed as an extra-cost option. Soon after, airbags grew in popularity and were

considered a standard safety device. In 1990, it became law that passive restraint systems be installed in all new vehicles. This law included automatic seatbelts.

It is estimated that barely 60% of adults wear seatbelts. This is a shocking percentage since 49 out of the 50 states require seatbelts to be worn by people of all ages. The refusal of seatbelt use can be blamed on ignorance towards automobile safety, accompanied with the many myths that have developed about safety belts. There are many that believe that it is actually safer to ride unbuckled. However, in reality, they have just greatly reduced their chances of survival in a crash. Common excuses for not wearing a safety belt include, "I will be trapped inside the car after a crash if I am wearing a safety belt", or "My car has airbags, so I don't need to wear a safety belt", and "I am only driven a short distance. I don't need to wear my belt." Of coarse, the decision to buckle up is in the hands of the occupants of the vehicle, but under better judgement they should take the slim chance of being trapped in their vehicle rather than be thrown into oncoming traffic. Here is an additional fact for those who believe that they do not need a seatbelt because they are only traveling a short distance. It has been proven that most motor vehicle accidents occur within 25 miles from home and at speeds less than 40 mph.

3.0 Literature Review

3.1 How Airbags Work

The mechanics behind how an airbag functions is really pretty simple. Impact sensors are placed in front, and on the sides of the vehicle, if side airbags exist. Once an impact occurs, the sensors send a signal to a computer located just behind the airbag, which then triggers the bag to inflate by activating a small canister of sodium azide. This canister which is contained within the airbag mechanism, which expels nitrogen gas and sodium hydroxide into the airbag, thus inflating it. On an average car, from the point of impact it takes about .05 seconds to detect the crash and for the airbag to begin to inflate. It then takes an additional .1 second for the airbag to fully inflate. Therefore, on average, it takes a total of .15 seconds for an airbag to inflate. The fastest airbag on the market takes a total of .1 seconds to react and fully deploy. Once the airbag has reached its maximum inflation it immediately begins to deflate. The bag will be effectively deflated in about a half-second. To insure that airbags do not stick together while they are folded very compact inside the dash or steering wheel, they are coated with talc powder or starch. This creates the dust that is seen when an airbag is deployed.

Most airbags are designed to be effective at crash speeds between 25 and 50 miles per hour, but will deploy at crash speeds at low as 10 miles per hour. Because it is not known who will be the occupant behind the airbag it has become a government requirement, that airbags be designed to protect an unbelted average size male (5'9", 165 lbs.) in the event of a collision. The crash speed depends on what type of collision occurs. In any type of head on collision the sum of the speed of both vehicles is the actual speed of the crash. For example, if to vehicles traveling at 30 mph are engaged in

an head on collision the speed of impact is equivalent to a vehicle driving into a concrete wall at a speed of 60 mph.

When the airbag is deployed it breaks through a plastic panel which is located on the steering wheel, side door panels or the dash. The exact location and number of airbags depends upon the make and model of the vehicle. On the passenger's side the airbag is either mounted on the vertical face of the dash slightly above the glove box or on the top of the dash. These are referred to as mid-mounted or top-mounted airbags. The placement greatly affects how the airbag is deployed. The bags, which are mounted on top of the dash, are projected upward and outward towards the passenger. This direction of deployment When deployed this style of airbag usually causes a broken windshield. One the other hand the vertically mounted airbag seems more practical. Upon deployment it is simply projected directly towards the passenger. This style of airbag cannot always be installed in cars because of space constraints and the interior design of the car. see appendix C for example of mid-mounted airbag

see appendix B for example of top-mounted airbag

3.2 What this means to you

What this translates into, as far as the forces involved in the inflation of the bag, is astounding. In order for the bag to inflate in .1 seconds, the velocity of the bag moving out of the steering wheel or dash can exceed 200 miles per hour and the pressure inside the bag at maximum size, can reach 1000 pounds per square inch. This creates enough force to kill an occupant if he/she is positioned closer than 10 inches from the steering wheel or dash, or if they are unbelted. Another danger in the airbag mechanism is a small canister of sodium azide. Not only does it reach temperatures above 300°F due to the

rapid exothermic chemical reaction that takes place, but it also yields nitrogen gas and sodium hydroxide, which are both compounds toxic to humans when ingested. The process described above will only occur when the airbag functions as designed. With a large amount of stored force there is a high potential of catastrophe.

3.3 Airbag Malfunctions

The major disadvantage of airbags is the small circumstances in which they are deployed. The sensors, which are located in the front or side of vehicles, are designed to trip the airbag deployment when an impact is sensed. However, these sensors do not always work as planned. There are recorded cases of airbags deploying for no apparent reason, and there are cases where airbags are deployed because of very minor accidents such as bumping a vehicle while parking or hitting a shopping cart in a parking lot. In these cases more damage was caused by the deployment of the airbag than the accident itself. If an airbag is deployed it not only destroys the steering wheel and the dash and side panels of the car but it also cost roughly 200 dollars to have the airbag replaced. Not only does the airbag directly cause damage to the vehicle but can also cause injury to the driver. In a very small accident an airbag could be deployed and blind the driver causing even a greater accident. For example, a driver may run into some type of obstruction such as a construction cone and then blinding the driver and or knocking the operators hands off of the wheel and causing the vehicle to run off of the road or even into oncoming traffic.

3.3.1 Recalls

This section will describe some of the recalls issued due to airbag malfunctions. Malfunctions are much more common than many people believe. Naturally, car companies like to keep their mistakes covered from the general public.

Both General Motors and Honda Motors have issued recalls of defective air-bag systems. In the case of GM, nearly 1 million cars were recalled in July of 1998 because it was discovered that the airbags installed in these vehicles could fire inadvertently. The models that were affected in the recall are 1995 Cadillac Eldorado's, Seville's, and DeVille/Concour's, 96-97 Chevrolet Cavaliers and Pontiac Sunfire's. Roughly 103,000 Cadillac's were affected along with 863,000 Cavaliers and Sunfire's. The problem with the Cadillac's was caused by electrical shorts, which were created by water seepage onto the air-bag sensors. The manufacturer planned to fix the problem by sealing the compartment that houses the air-bag computer. In the case of the Cavaliers and Sunfire's, the problem was with the computer itself. There was an increased risk of airbag deployment, in a low speed crash or when an object strikes the floor pan. In this case the computer was found to have a very low deployment threshold. The solution to this problem is to alter the computer program that controls deployments. The recall by Honda Motors concerned the owners of 1994 and 1995 Accord models. A bug in the electronic control unit may cause bags to activate unexpectedly. Also under investigation for mis-deployment are Subaru's 1994-95 Impreza and 1995-96 Legacy and Mazda Motor's 1995-96 626 sedans and MX-6 coupes. In another investigation, an engineering analysis of airbag systems in 500,000 1994 Chrysler minivans and 250,000 GM 1995-96 Cadillacs was performed by the National Highway and Traffic Safety Agency (NHTSA). The analysis revealed that airbags inflated when water was doused on them or when

windows were left open during a rainstorm, allowing water to soak into the interior. These problems can be expected, as can problems with any newly developed mechanical or electrical systems. However, there is still a danger associated with airbags even when the system works exactly as designed. (Cole, 98)

3.4 Window of Effectiveness

Today's airbags are only rated to be effective from 25-50 miles per hour. This means that in an impact less than 25mph the force felt by the impact would be less than the force felt by the airbag. While at speeds over 50mph the bag does not have time to deploy to cushion the occupant. It takes approximately .15 seconds from the instant of impact to full inflation of the airbag. In this amount of time traveling at a speed of 60mph an unbuckled driver will have traveled 8 feet if the vehicle had decreased its speed suddenly in an accident. Since, the occupant is usually positioned only a few feet from the dash they will have hit the dash and be on the rebound when they will be meet with the airbag which is inflating at 200mph.

3.5 Political issues

With a device that generates so much uncontrollable force it can be expected that for every so many lives it may save, it will also take one. Although this was occurring in the early 1990 both NHTSA and automobile manufacturers kept this fact quiet. In 1991, the NHTSA and automobile manufacturers in Detroit had records of at least a half-dozen deaths caused by airbags. However, instead of making this information public, the organization agreed that releasing this information "could cause a lot of harm to the positive perception and receptiveness to airbags and that NHTSA/industry needed to share information and develop a statistical basis of understanding". After more than a

year, in December of 1992, the NHTSA requested public input into deciding what warning labels should be used to express the dangers of airbags. The American Automobile Manufacturers Association wanted strong language included on the labels. For example, "An occupant who is sitting too close to the inflating airbag can be seriously injured" (Bedard, 97). On the other hand the Advocates for Highway and Auto Safety (AHAS) objected to the wording proposed by the NHTSA, "Do not sit unnecessarily close to the airbag." The AHAS objected to the phrase "unnecessarily close" as possibly causing drivers to alter their normal seating position and also instilling anxiety. They felt that it would be counterproductive to express the dangers of airbags by way of alarming statements. The Coalition for Consumer Health & Safety and The Insurance Institute for Highway Safety agreed with the AHAS on this issue. Today because of the fear of lawsuits by injury victims and the well known fact that airbags are deadly as well as protective, these agencies have changed their stance on this issue. The IIHS now hands out an advisory that lists phone numbers of two sources of pedal extenders. (Doherty, 97)

The problems surrounding the airbag issue has raised the question whether having airbags installed in your car should be a choice. In some model vehicles, such as Ford's F150 1997 line of trucks, they offer an on/off switch for the passenger side airbag. This option is installed so that the driver's side airbag may be shut off to protect a small child who is riding in the passenger side. This option is a good enough solution to the problem because it does not offer the choice to the driver of the vehicle and it is not available in every model of car sold today.

It is possible for a consumer to have their airbag dismantled. However, this can be only done by the owners themselves or done by a mechanic if the owner of the vehicle received permission from NHTSA. Neither of these options are very good because it is dangerous for an untrained person to be tampering with an airbag device and some mechanics will not disable airbags even with permission from NHTSA for fear of a lawsuit.

Automobile safety technology has also stirred some moral issues. It is common in the automobile industry that all high priced vehicles offer the best and latest in safety technology. This makes sense financially, but some people are questioning whether it is right. They believe that all basic car models should be equipped with the top of the line safety technology, therefore making safety affordable to every car automobile owner.

3.6 Advantages and Disadvantages of Airbags

In the past 9 years, it has been estimated that airbags have saved thousands of lives, while at the same time injuring 1/3 the number of accident victims they have been protecting. (The Economist, 96) Also, driver deaths in frontal crashes was reduced by approximately 20% nationally. Recent studies have showed that for females airbags have increase harm by 9.2% in accidents and decreased injuries by 11.2% in males. Although these facts may seem very conflicting they actually are not. The airbags are doing their job for which they were designed to do. That is save the average size male (5'9" and 165 lbs.). Many women, children, and the elderly who are generally smaller than this are suffering from the airbags. Their bodies simply can not withstand the impact from the airbag.

The greatest reason for death by an airbag is the driver or passenger being crushed during deployment. NHTSA estimates that 108 people have been killed by airbag related injuries since mid 1980's, 63 of whom were children. An additional 27 people have also been seriously injured during this time. (Dowd, 99) Some of these deaths happened at very low collision speeds and can be attributed to a person being "out of position" upon deployment, or too close to the steering wheel. This is the case for the smaller passengers or drivers of a vehicle. Many people also are injured from airbags because they do not wear a seatbelt. Airbags simply can not be the only safety prevention used.

There are also many other smaller injuries that may occur from airbags. An airbag is going to push whatever is between the occupant and the bag into their body. A pair of glasses or a scorching cup of coffee can not feel too good being pressed into your face with 1000 lbs. of force per square inch. The panel which the airbag breaks through when deployed does not always stay attached to the dash or steering wheel. It too can be pushed into the victim behind the airbag.

Sodium hydroxide, a by-product during airbag explosions has been known to cause a painful itchy rash to some crash victims. Although NHTSA says that sodium hydroxide is harmless, they advise EMS personnel to wear protective masks and clothing when extracting victims from a crash with a recent deployment of an airbag. In addition, chemists consider sodium hydroxide as a very caustic liquid. (autostream.com)

British medical researchers have done a recent study, which connects hearing loss to airbags. When an airbag is deployed it generates a noise 150 to 170 decibels. This noise is louder than a jet engine, and is great enough to cause temporary or permanent

hearing loss. The research also pointed out that side airbags increase the chance of hearing loss as compared to front airbags. (Healy & O'donnell, 99)

3.7 Airbags and the Future

As we grow closer to the year 2000, the technology in the world is growing in leaps and bounds. Society is taking previous ideas and improving them beyond our imaginations. The only questions that have to be asked are "Are we going too far?" and "Are we doing enough research on all of the variables involved?";
"Is there a solution to be found by improving the airbag" meanwhile many people are formulating their own opinions about airbags and taking control.

Due to the fact that society has not been educated enough on this subject, people may not be reacting correctly to this airbag crisis. Many people are seeing gruesome news coverage's of airbags killing drivers. Many scared drivers have had their airbags disengaged. That is fine, but the person who buys the car from them might not be told that the airbag has been unhooked. Certain cars are coming out with an on/off switch for the passenger side airbag. This would allow the people at risk to turn off the airbag to reduce the chance of sever injury during a crash. This idea was accepted by the federal government, which passed a law that mandated ON/OFF switches in all passenger vehicles, beginning in 1998. This is a good idea, but it does not solve the problem if the driver is either elderly or a woman of small stature. Due to this problem scientists and engineers are trying to come up with the answer that will solve all of the problems.

Scientists and engineers are split on this subject. Some think that airbags are not the answer and that other options should be looked at. While others say that "smart

airbags" or depowered airbags are the answer. A combination of the two may be where the answer really lies.

Many of the luxury cars such as BMW, Mercedes, Lexus, and Cadillac, are spending a lot of money on coming up with an alternative answer or solution to the airbag crisis. Lexus has a Vehicle Skid Control system or VSC for short. The VSC works with the anti-lock brakes and the traction control sensors to control and self correct skids. The way the system works is, the VSC decelerates the car and activates and outside front brake that slows the car down until the rear end is back and under control. Mercedes has a similar system that is called the Electronic Stability Program (ESP) and Cadillac has one called the StabiliTrak system. All of these different types of traction control either come standard with the car, or it is an option costing from $250 to $1950. This is not a lot of money when there are lives on the line.

Volvo is taking a totally different approach to the problem. They believe that part of the problem is in the amount of reaction time there is to avoid accidents. The new rear mounted brake light, lights up 1 millisecond after the brake is pushed. This is compared to the 250 milliseconds that it takes the average brake light to illuminate. This is due to the high tech light emitting diodes that are used instead of bulbs. This time saving of 249 milliseconds may not seem like a long time, but if you are traveling at a rate of speed of 55 mph, that additional 249 milliseconds or 1 quarter of a second allows the person behind you an extra car lengths notice to slow down. (Cathy, 97, 96)

The other possible solution is the use of "smart airbags." A gentleman by the name of Tony Corrado is heading up the research into the smart airbags. You may have heard his name before, as he was the one designing "Smart Bombs" for the US Military

five years ago. He has come up with basic systems with sensors that detect whether or not a seatbelt is being worn. If the sensor is tripped saying that the seatbelt is not being used then the airbag will not deploy. The ultimate goal is to be able to have sensors detect the height and weight of the person along with the seatbelt sensor to determine the rate of speed at which the airbag will deploy at, if at all. Some of these sensors detect the amount of water in the body, the amount of heat given off or simply the weight of what is in the seat. The problems with these are, it does not know if the person is holding a pizza, a gallon of water or a simple bag of groceries. These are the problems that scientists and engineers like Corrado face. By March 1, 2000 NHTSA is forcing auto companies to ensure that airbags are safe not only for the average size man, but for all occupants. It has been estimated that by the year 2005 these occupant-detection systems will be a $500 million business. (Underwood, 97)

Other companies such as General Motors, Chrysler, Ford, Nissan, Toyota and Mazda have disengaged airbags in the new 1998 models. The only difference to the original airbag design is, that they deploy at 35% less speed than standard airbags. The downside to this is that a slower, less powerful airbag would reduce the "window of effectiveness" from 25-50 mph to 25-45 mph. At these speeds, it can be argued that the airbag is not even needed and that a seat belt would provide ample protection to the occupants of the vehicle.

Scientists and engineers hope that by the year 2002 they can combine their ideas and start implementing them. Some people who have already lost their loved ones to airbag deployment feel that they should leave the "Star Wars technology" out of it. Their answer is to disengage the airbags and not only tell the consumer about the importance of

wearing seatbelts and keeping smaller people and all children in the back seat, but educate them as well.

4.0 Survey Results

This section contains case studies of actual accidents along with interviews and statistics from questionnaires. These surveys were performed in order to verify the many facts published by associations such as NHTSA, and perhaps help form a much more educated opinion about airbag safety.

4.1 Case Studies

These studies were carried out with the help of local car lots. The cases include many different vehicle models and degrees of damage. These variations show a variety of intriguing results. Here are some examples.

4.1.1 1994 Nissan Sentra

The First case study was done on a vehicle without airbags. This set a model of comparison for the rest of the studies. The vehicle is a 1994 Nissan Sentra. Although there was a fair amount of front end damage done to the car there was damage done to the windshield. In comparison, the Sentra has an equivalent amount of front-end damage as the Cavalier in case study 2. The Cavalier however, has windshield damage caused by the top-mounted airbag. see appendix A & B

4.1.2 1996 Chevy Cavalier

The next study was done on a 1996 Chevy Cavalier. The damage done to this vehicle shows possible excess damage caused by the deployment of the airbags. As mentioned above the top-mounted airbag cracked the passenger side of the front

windshield. This case study also shows how the drivers side airbag breaks through the steering wheel. see appendix B

4.1.3 1997 Saturn

The third vehicle that was studied was a 1997 Saturn. This vehicle endured heavy front-end damage. The car was equipped with dual airbags. Both airbags were deployed. The amount of damaged done to the vehicle was definitely enough to account for the airbag deployment. If seatbelts were worn in this crash the airbags would have helped the driver and passenger from obtaining serious injury. This case is a good example of airbags doing their job. see appendix C

4.1.4 1994 Toyota Tercel

Another study was conducted on a 1994 Toyota Tercel. The vehicle received minor frontal damage. The front bumper appeared slightly scratched and offset. However, the amount of damage was definitely not enough to justify the deployment of the driver side airbag. The impact is estimated to be around five-mph. This model of car does not come with a passenger side airbag. The photos of the Tercel can be seen in the appendix although a large number of parts have been stripped from the vehicle.

see appendix D

A number of other photos can be seen in the appendix. They show some interesting things that were encountered while performing the case studies, although no conclusions could be made from these findings.

4.2 Questionnaires

Two questionnaires were made in order to survey both accident victims and the general public. 100 questionnaires were given out. Accident victims answered fifty of them and the other half were answered by the general public. These questionnaires were handed out in a variety of different settings to try and offer the best representation of society. Although a large variety of people answered these questionnaires, there were no questionnaires answered from sources outside of New England. It is most likely that results from a survey of this type would vary depending upon the region of the country.

4.3 Interviews

The interviews that follow were either taken from published articles or performed in person. Some of the interviewees chose to remain anonymous. Both sides of the airbag issue are supported by the interviews that follow.

Interview I:

On Thursday 2/25/99 I was returning home from teaching an evening class when a deer suddenly entered the road and struck the front of my car, a 318i BMW. The impact of the deer didn't kill me, but the airbags nearly did. When the airbags deployed, they knocked my hands off of the steering wheel and totally blocked my view of the road. Rather than deflating, the airbags continued to obscure the windshield and prevented my grip of the wheel. Still travelling around 50 miles per hour, I couldn't control the car or see where I was going. After the horrifying episode, I ended up in a ditch on the other side of the road. I still have no idea how I managed to stop the car without hitting an oncoming car, a tree, a light pole, or flipping the car. Yes, hitting the deer was frightening, but the airbags placed my life in far greater jeopardy.

George Teston
Compute Teacher & Technology Specialist, OCMS
Ph.D. student, The University of Georgia
http://www.airbag.net/articles

Interview II:

On January 17, a Ford F1-50 pickup truck traveling 50 mph broadsided a 1998 740il BMW in Plano, Texas. Inside the car was mother Linda Rasmussen and her 12-year-old daughter, Jennifer. Linda's comment to the crash was "It scares me to think what would have happened without them", referring to the airbags that her high priced vehicle was equipped with.

Linda Rasmussen
Mother
Plano, Texas

Interview III:

Robert Sanders had just spent a Sunday afternoon watching a movie with his sons, David,9, and Mathew,10, and his daughter, Alison. Robert was on the way back to drop off his children at his ex-wife's home on October 15, 1995 when his life was changed forever. Only ½ mile from the house Alison took off her safety belt to adjust the radio so her brothers could listen to the Redskins football game. Robert remembers saying "sit back. Put your strap on . I'll find the game." As Robert adjusted the radio, a traffic light turned red he was unable to stop the minivan in time. It skidded into a van that was waiting to turn left. With the impact both of the front airbags deployed. Robert first thought, "I would need to have some bodywork done to the van." However, when the dust from the airbags settled Robert found Alison lying across the seat unconscious. The impact of the airbag had left Alison brain dead. Both parents were left very angry with this tragedy. They felt that "they should have been warned that the front seat was not a safe place for a child.

Robert Sanders, 45
Baltimore, MD
Good Housekeeping

Interview IV:

Terri Vaccher was eight months pregnant when a semi jackknifed in front of her Ford Explorer. The explorer ended up underneath the semi. The only injuries that Teri suffered were a broken ankle femur and kneecap. Terri comment was "the airbag in my Ford Explorer definitely saved my life and my baby's life, no question."

Terri Vaccher,32
Irvine,CA
Good Housekeeping

Interview V:

Linda John was returning home one day when she was forced to stop short by another vehicle in front of her. She was not able to stop in time and the front of her 1993 Honda Accord slammed into the vehicle in front of her. The Accord was equipped with airbags but they were not deployed. Luckily Mrs. John did not sustain any injuries from the 20 mph crash. Mrs. John's comment was " neither I or the mechanic who work on the car could figure why the airbag did not deploy" in addition "the complete front end of the car had to be replaced."

Linda John, 48
Barre, Vermont

Interview VI:

Late on March, 99 Jeremy Salvatori was returning from a friend's house. It was a short 20 minute drive from his house. However, half way home on a dark and winding Vermont road he lost control of his 1996 Nissan Altima and skidded into a telephone pole. He hit the pole at approximately 45 mph. It all happened so fast that he did not even realize what had happened until after everything had settled. In Jeremy's words "I escaped with no major injuries, just an abrasion on my noise." "The seatbelt cause about as much injury to my neck as the airbag did to my face."

Jeremy Salvatori, 22
Student at VTC
Barre, Vermont

Interview VII:

Working as a EMT I have seen a lot of accidents says Kevin Grebinar. "Many times it appears that the airbags do save the occupants of the vehicles". However, "I do see a lot of burns and abrasions on the faces of the drivers and passengers". The airbags are pretty rough. I have not seen any cases were "any shorter people have been hurt by airbags, no deaths".

Kevin Grebinar 21
EMT, Firefighter
Holden, MA

Interview VIII:

At sixteen years old, I was involved in a head on collision at an intersection. I drove a 1994 Ford Probe. I collided with a car going about 40mph. I was going about 20mph. I was in my seat belt and both airbags were activated when the collision occurred. I am only 5'1" and therefore I sit extremely close to the wheel. My neck was slightly burned from the seatbelt and the airbag. If I did not have the airbag I know my

face would have been extremely damaged or I could have gotten brain damage. To me, that little burn is nothing compared to what could have happened without that airbag.

Anonymous
11 Nov 1997

Interview IX:

The Associated Press reported that an airbag deployed in a fender-bender accident in Boise, Idaho, decapitating a one-year old girl. Police said the girl, Alexandra Greer, was riding with her mother, Rebecca Blackman, in the front seat of a Volkswagen Jetta when the accident occurred. The child was sitting in a forward facing child safety seat when her mother rear-ended a car that had just entered a mall parking lot. The Jetta's passenger side air bag deployed at full force, decapitating the child and threw her head through a broken door window and into the parking lot. Referring to the airbag, Police Lieutenant Tim Rosenvall said, "it otherwise would have been a minor traffic accident."
Paul Denver
The Auto Channel

5.0 Conclusions

In this section the authors will compose all of the data collected from research on airbags and formulate an opinion. Possible future solutions and a evaluation of them will be given. At the end of this section safety tips to avoid injury from airbags are given.

5.1 Interpretation of Survey Results

From the data collected from the General Airbag survey, 95% of all surveyed wear their seatbelt regularly. This is much greater than a study carried out by NHTSA, which estimated 60% of all people regularly wear safety belts. However, 99% of the people who stated that they buckle-up said they buckle up under any circumstances. The remaining 1% stated that if the vehicle is equipped with airbags they will tend not to wear their safety belt. This goes to show that there are people who believe an airbag can protect them in a crash without a seatbelt. It was shown that many other people were also not aware of the small dangers that could be involved in a crash where an airbag deploys. Out of the 50 people surveyed 78% thought that airbags should be an option. In relation

to this, 96% of the people thought that the passenger side airbag should be installed with an on/off option switch. The number of people who thought that airbags should be an option is much higher than expected. This percentage may be due to the great amount of trust that many people instill in airbags. The survey did show that just over half of the people were aware of the general speed range in which airbags are effective. 60% answered between 25-50 mph.

The results from the crash victim survey leaned towards the general disliking of airbags. Out of the 50 people survey who were in a crash, 99% said that their airbag deployed. Out of this, 99% of the people who did not have airbags and wish that they had totaled 15%. Challenging this, 50% of the people who had airbags, which were deployed, wished that their vehicle did not have airbags. 85% of the people involved in the accidents stated that they were wearing a seatbelt. 80% of the victims also said that they received minor injuries such as abrasions, burns and whiplash.

see following pages for results of survey

RESULTS FROM GENERAL SURVEY ON AIRBAGS

Questions asked	Responses from 50 people surveyed
Does your car have air bags?	75% of survey people's cars had dual air bags
Are you aware of the dangers of air bags?	90% knew of at least some dangers that air bags pose
Do you regularly wear a seatbelt?	95% said that they always buckle up
Do you wear a seatbelt if the car has air bags?	Out of the 95% that said they regularly wear their safety belt 99% wear their safety belt even if the car has air bags
Would you like the option of turning off your air bags?	78% of people thought airbags should be mandatory However, 96% of people though the passenger side air bags should be an option.
Up to what speed do you feel air bags could save you?	60% of the people answered between 30-40 mph
Did you know it was unsafe to wear glasses or place a small child in the front seat of a car with air bags?	99% did not realize that it could be unsafe to wear glasses while driving in a car with airbags 95%of people did know that it was unsafe to place small children in the front seat of a car with air bags

RESULTS FROM CRASH VICTIM SURVEY ON AIRBAGS

Questions Asked	Results from 50 people surveyed
Were you wearing your seatbelt	85% said they were
If your vehicle had airbags did they deploy?	99% that had airbags deployed
Were you and/or passengers injured	80% received Minor injury (abrasions, burns, whiplash)
Do you feel that the airbags helped protect you	15% of people that didn't have airbags wish that they did 50% that had airbags wish that they did not have them

5.2 Future Solution

Smart airbags appear as the best solution to automobile safety if airbags are used. Smart airbags offer optimal safety because of the ability to adjust to the characteristics of the driver and passengers. For example, if the driver of the vehicle is a small female traveling at a low speed, the airbag would inflate at a lower force than the original airbags that were designed to cushion an average sized male. The only problem with smart airbags in the future is affordability. Most people cannot afford to make their commute safer by purchasing a Volvo or Mercedes-Benz. This will then raise the question should people in a higher tax bracket be able to make their lives safer with new advanced technology? Are we really making things safer for everyone, or just those who can afford it? For now, before these smart airbags become standard in all vehicles, it is best to take caution and regard all safety tips for driving with airbags.

Another possible safety solution is a improved design of a seatbelt. Have you ever seen a race car driver crash into the wall going an excess of 200 miles per hour and his airbag go off? Could a shoulder harness like the ones these high-speed drivers use be the answer? One of the first steps in changing your ordinary car into a racecar is taking out the airbags. They are considered a safety hazard on the raceways. An over the shoulder seatbelt is a very safe solution but far too impractical for the average American.

5.3 What Can Be Done In The Meantime

Although the seatbelt may seem a bit outdated compared to all of the safety features that car companies rant and rave about today the best way to prevent injury from a car crash is wearing your seatbelt and to remain in a good position while driving. It is

also very important to make sure that all children are properly fastened and not in the way of an airbag.

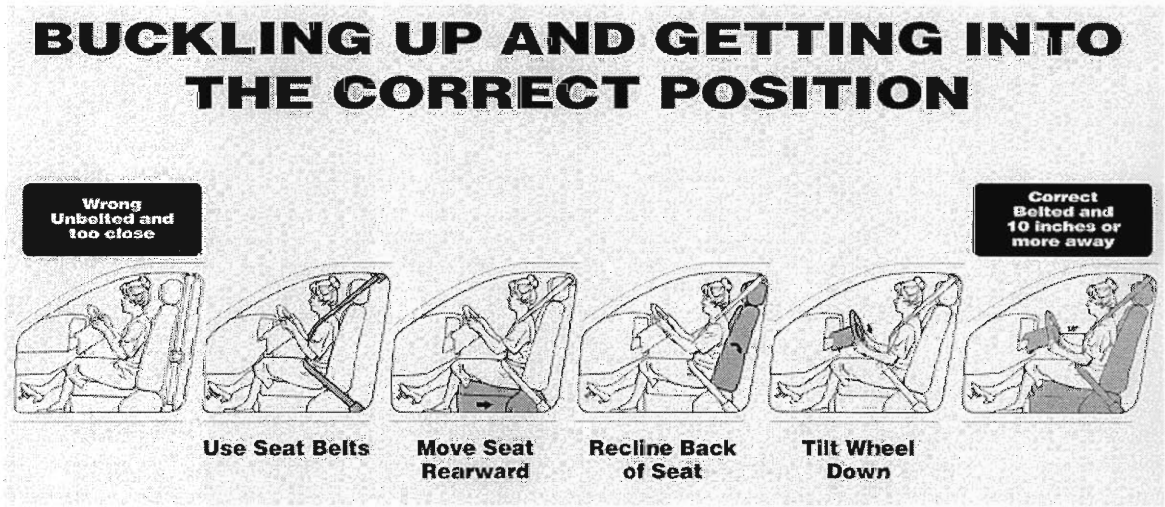
5.3.1 Proper Use

There are far too many people who still do not wear their safety belts, or do not wear them properly. The lap belt should be as low as possible over the hips - not over the abdomen. There should be no slack in the belt and it should cross over the chest and shoulder.

Small children and infants should never be placed in the passenger side of a vehicle if it is equipped with a passenger side airbag. Small bodies simply can not withstand the force from the airbags. There have even been cases of decapitation among small children. Placing a child seat facing backwards in the passenger side of the car does not help. Below is a picture showing the damage done when an airbag is deployed into car seat.

5.3.2 Positioning

Remaining in good position can definitely save injury when an airbag is involved. Do not bend down to change a CD, pick up a cell phone or reach for something in the glove box. The driver should be at least 10 inches away from the steering wheel and the wheel should not be tilted upward. If the wheel is tilted upward, when deployed the airbag will be thrust toward the face of the driver and possibly causing injury. To avoid possible fracture of wrists and fingers the hands of the driver should be placed on the lower half of the steering wheel. The original positioning of 10:00 and 2:00 that was taught in driver education courses is not acceptable. In this type of positioning upon deployment the arms of the driver will be pushed in themselves or into a the interior of the car causing injury. The current recommended hand positioning is 7:00 and 4:00. see diagram below for guide to correct positioning



5.3.3 Dismantling Your Airbag

As far as preventing airbags from going off, you may either apply for NHTSA approval to have an on/off switch installed or dismantle the airbag yourself.

Airbag dismantle Instructions are available through such organizations as the "Airbag Disconnection Group". They offer instructional kits free of charge. They are very simple to obtain and the procedures are laid in a very simple manner. Information about this organization may be found at autostream.com. The only stipulation to this is that the owner of the car must dismantle the airbag him or herself. It is against the law to bring the instructions to a mechanic to have them disconnected. Even with written approval from NHTSA, 95% of all dealers will not disconnect airbags because of liability.

Since January 19,1998 on/off switches have been available to those drivers who fall under the four risk profiles set by NHTSA. These include the following:

- Those who cannot avoid placing rear-facing infant seats in the front passenger seat
- Those who have a medical condition that place them at specific risk.
- Those who cannot adjust their driver's position to keep back 10 inches from the steering wheel
- Those who cannot avoid situations, such as a car pool, that require a child 12 or under to ride in the front seat.

In order to be approved by NHTSA a application must be filled out. These forms may be filled out and sent electronically over the web. Applications are found on NHSTA'S web sight. Once approved, the vehicle must be taken to one of the 400 approved installation shops located around the US.

If a shorter driver is looking for a quick solution from the threat of an airbag, pedal extenders may be purchased. They run from $90- $120 per installation. Some car

companies may even pay for the installation of on/off switches or reimburse the cost of pedal extenders. AAA has started to reimburse their customers for these expenses.

5.4 Summation

After evaluating all of the collected information it has been concluded that airbags do pose a threat in many automobiles today. Not only have there been many cases of airbag malfunctions but also instances were unnecessary injury has occurred. If used properly airbags can and do save lives. In order for this to occur proper positioning must be maintained while in the vehicle and it is imperative that seatbelts be worn. If the driver is too short and can not remain a minimum of 10 inches from the steering wheel than addition action needs to take place. They should have the airbag disconnected or pedal extenders added to their car. In addition to this, all passengers must also be 10 inches from the dash and small children or car seats can not be placed in the passenger side. Although there are many smaller injuries involved with airbags, such as hearing loss, burns and skin irritation from the by products of sodium azide, the propulsion of inflation, airbags are protective when used properly.

It is also concluded that top safety technology should be a standard in all automobiles. Although the best in airbag technology should be offered in any make or model of automobile it should also be a choice. If a consumer feels threatened by an airbag they should have the choice to shut the airbag off, or not have it installed in their vehicle at all.

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7.0 Appendices

7.1 General Survey on Airbags

1. *Does your vehicle have driver side or dual airbags? If so have they ever deployed?*

2. *Are you aware of the dangers of airbags? What have you heard?*

3. *Do you regularly wear a seat belt?*

4. *If the car has airbags do you not wear your seatbelt*

5. *Do you have a small child that rides in the passenger seat?*

6. *Would you like the option of turning of your airbags? Or do you think they should be mandatory?*

7. *In buying a new car would airbags be a major concern?*

8. *Up to what speed do you feel that an airbag could save you?*

9. *What are your thoughts on side airbags?*

10. *Did you know it is unsafe to wear glasses if the car has airbags*?

7.2 Airbag Survey for Crash Victims

1. *How fast were you going when you were in an accident?*

2. *Did you have on your seatbelt?*

3. *Did the car have driver or dual airbags? Did they deploy?*

4. *Where you and/or your passenger(s) injured?*

5. *Do you think that the airbag helped you or add to your injury?*

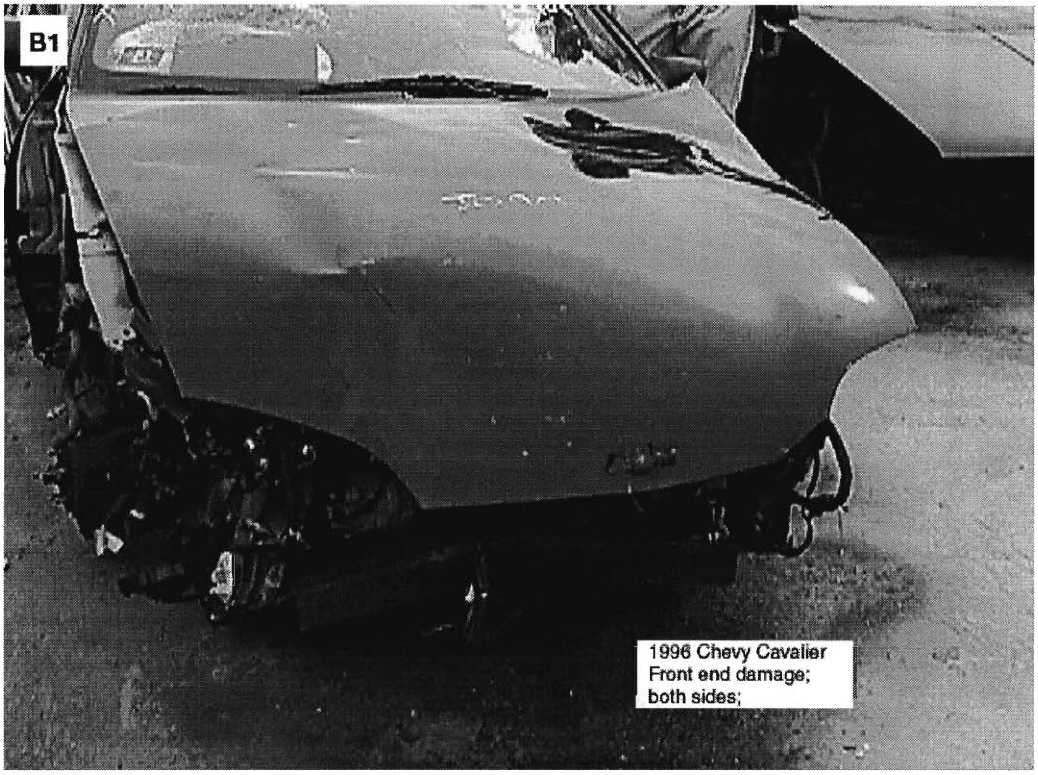
6. *What injures did your passengers suffer from?*

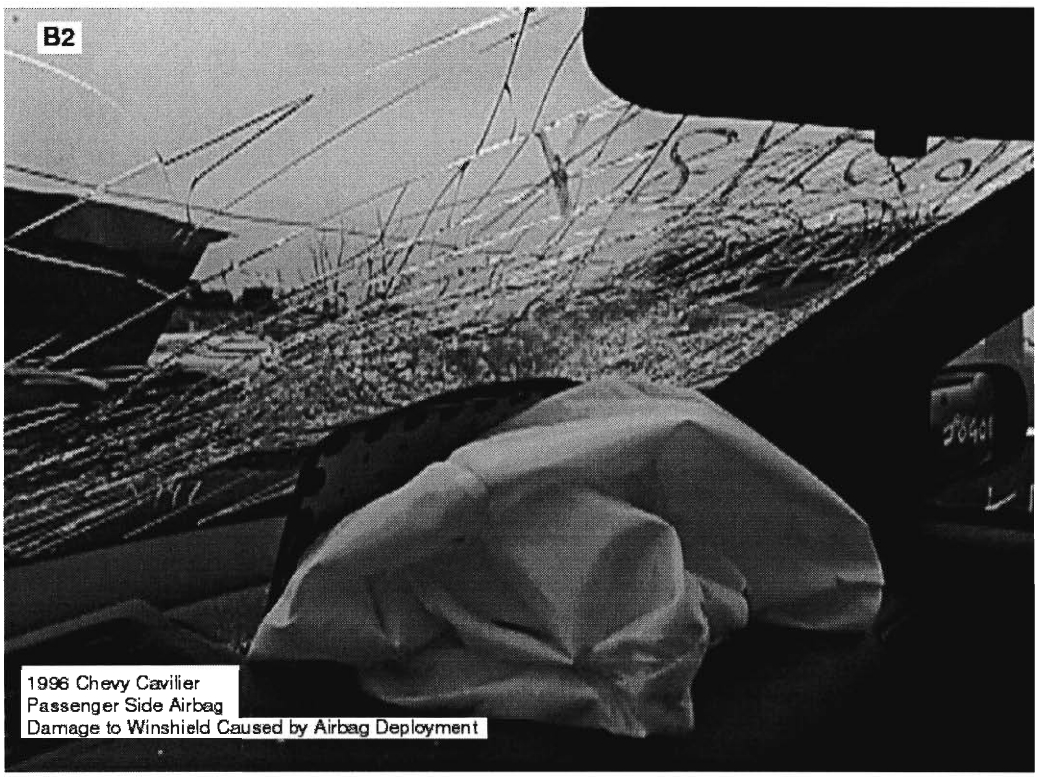
7. *Do you believe that airbags are in general for the better?*

7.3 Nissan Sentra


A1
1994 Nissan Sentra
Severe front end damage. No airbags installed in car.
No damage to windshield or windows.

7.4 1996 Chevy Cavalier

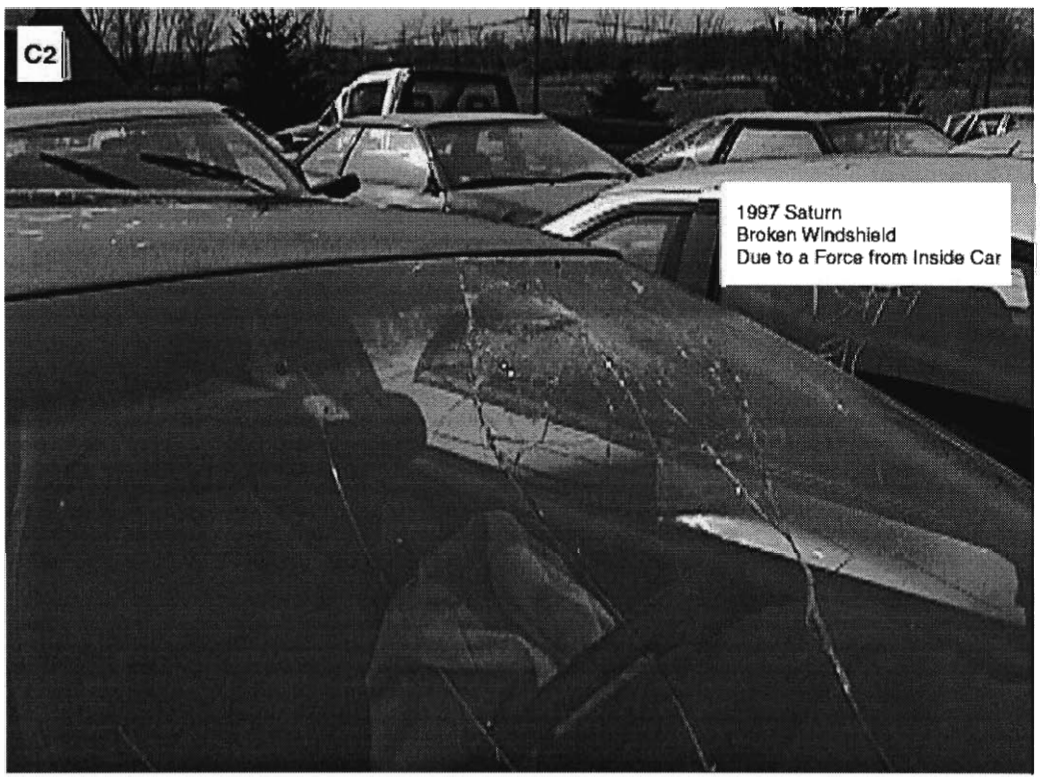

B1
1996 Chevy Cavalier
Front end damage;
both sides;

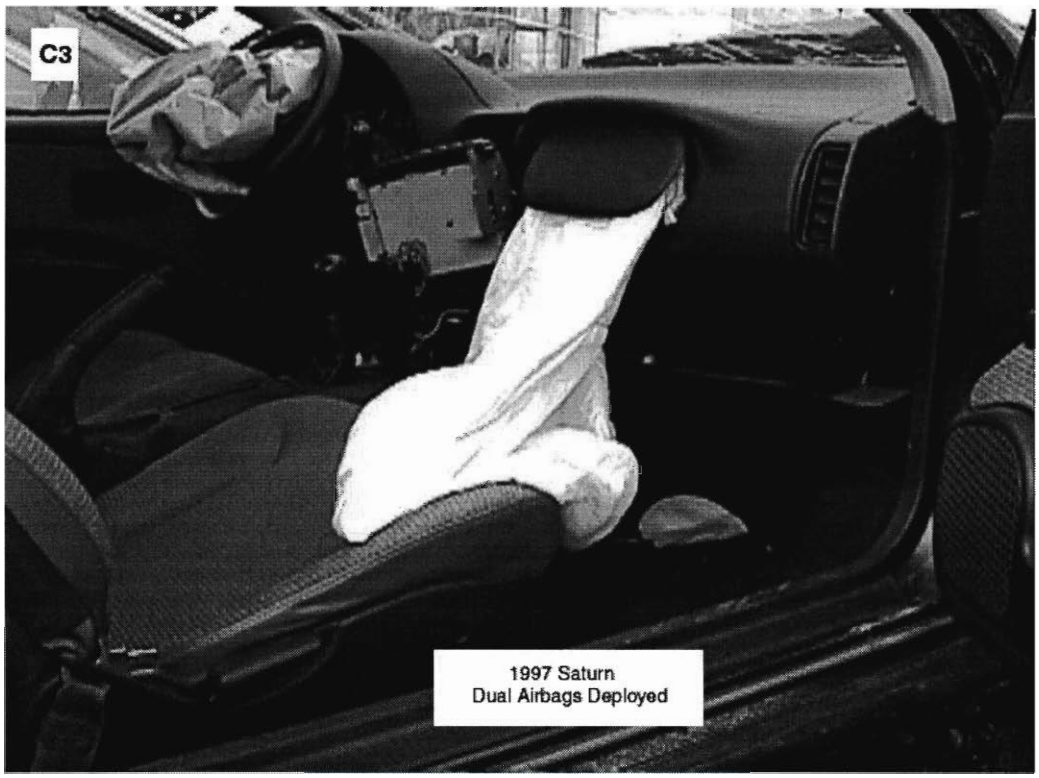

B2
1996 Chevy Cavilier
Passenger Side Airbag
Damage to Winshield Caused by Airbag Deployment


B3
1996 Chevy Cavalier
Driver's Side Airbag
Electrical Sensor/Circuit Showing

7.5 1997 Saturn

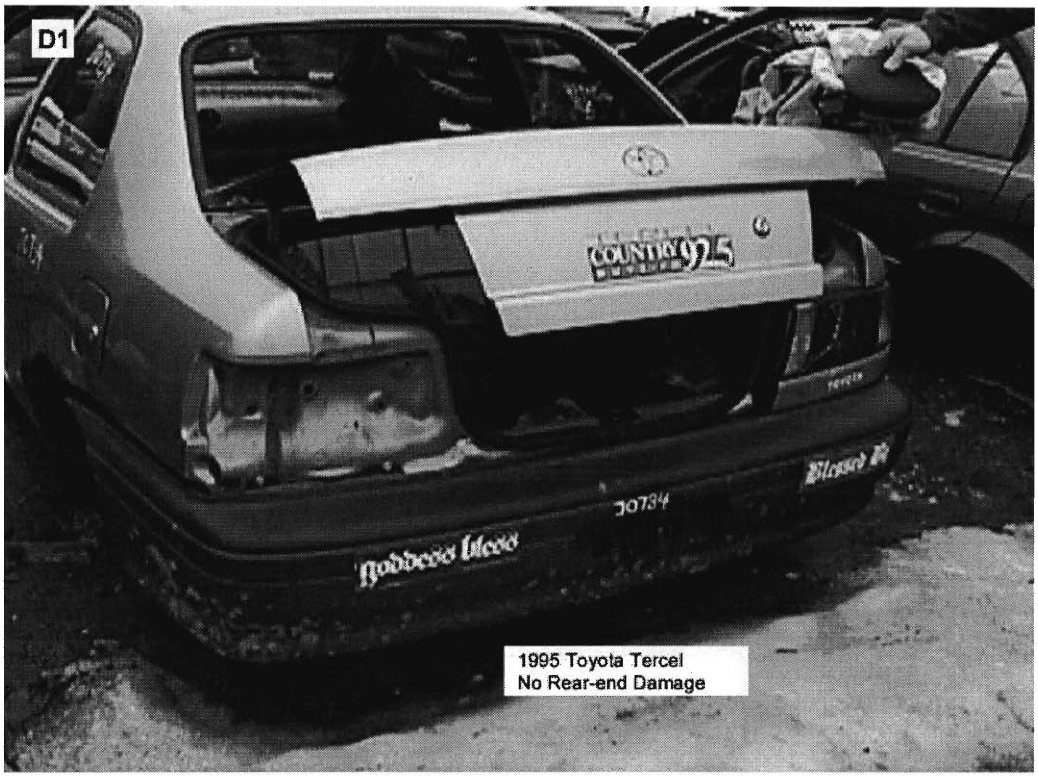

C1
1997 Saturn
Front-end Collision

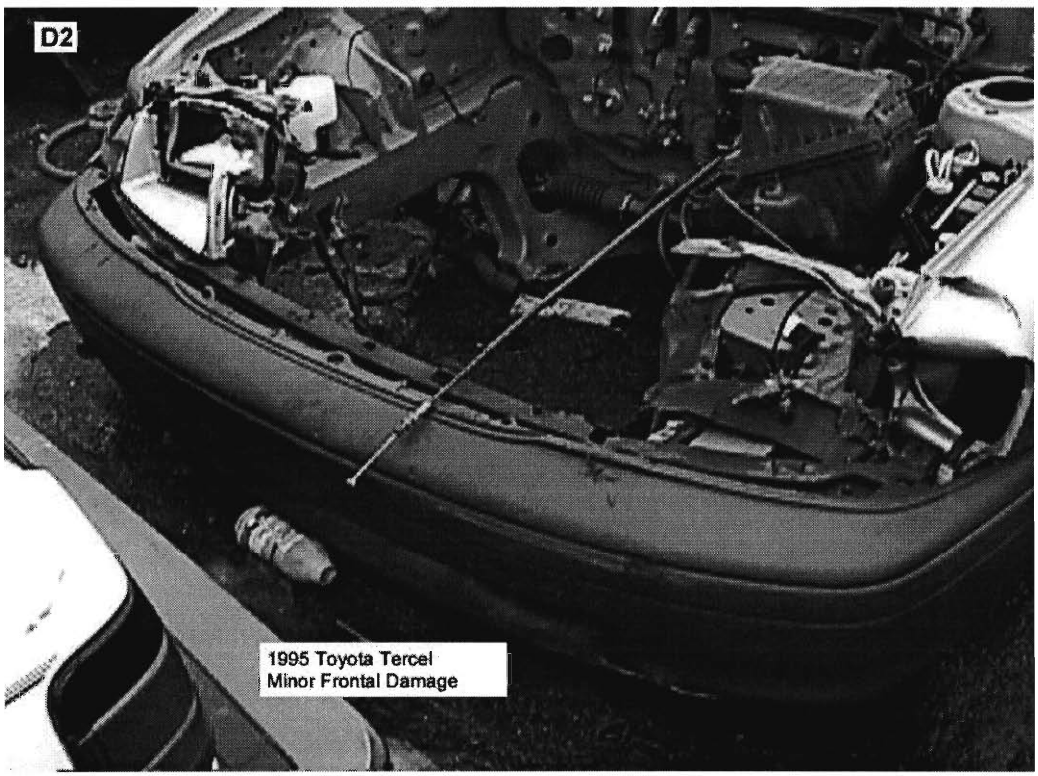

C2
1997 Saturn
Broken Windshield
Due to a Force from Inside Car


C3
1997 Saturn
Dual Airbags Deployed


C4
1997 Saturn
Driver's Side Airbag

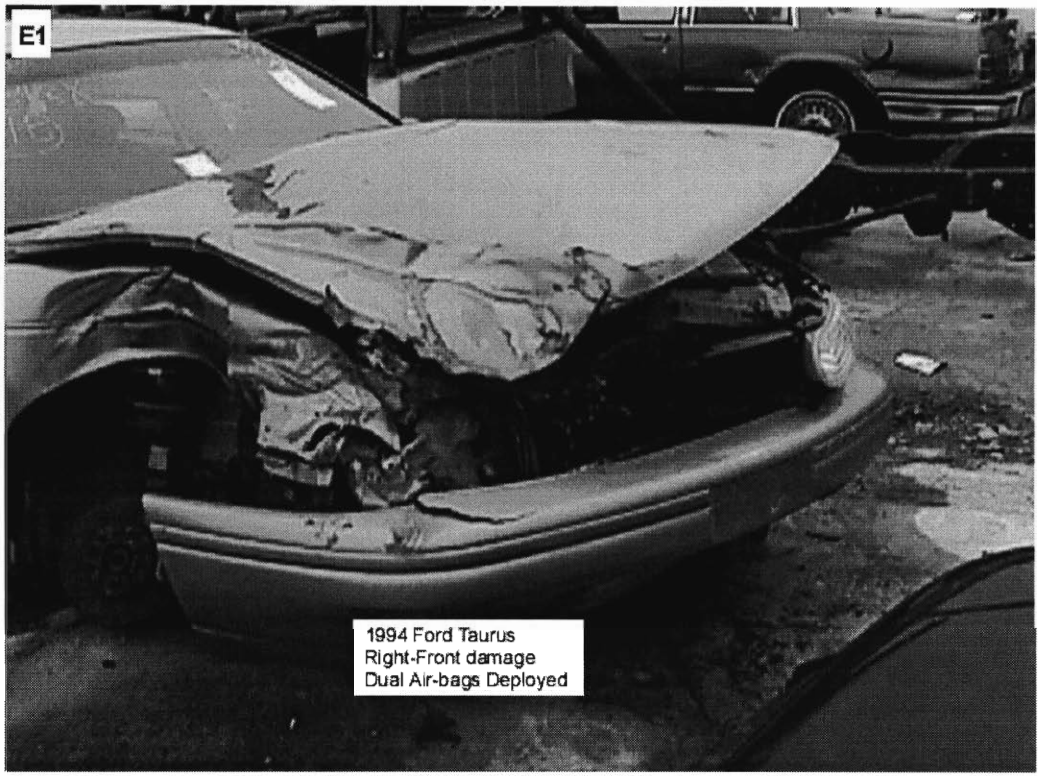
7.6 Toyota Tercel

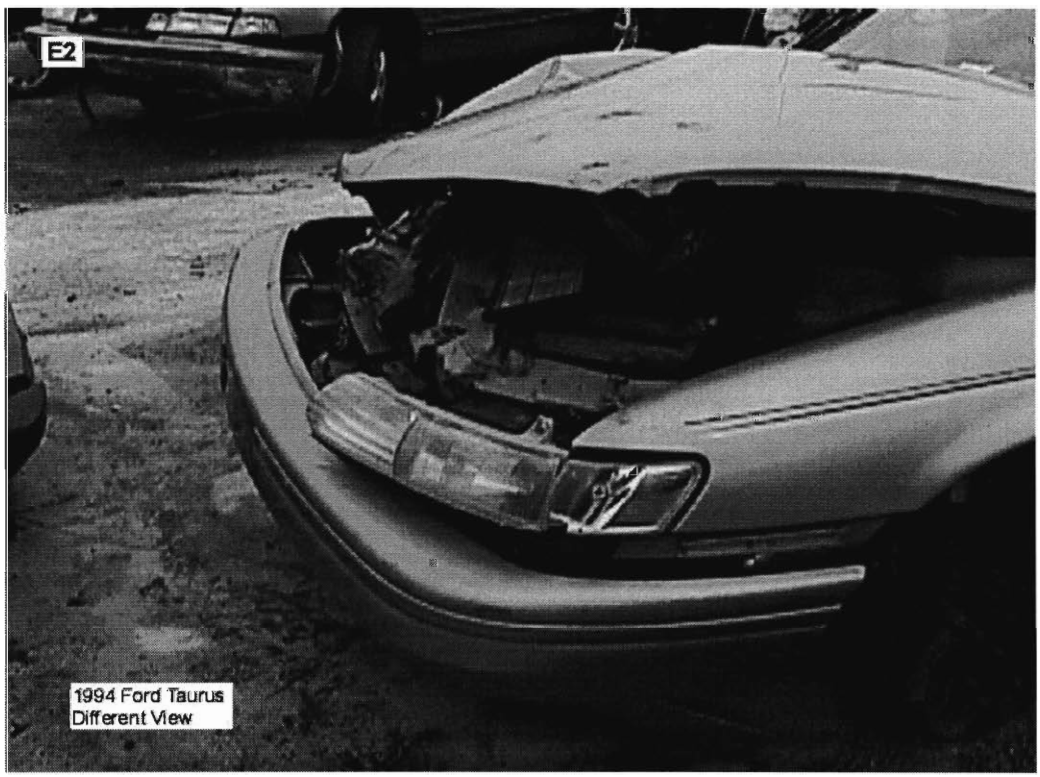

D1
1995 Toyota Tercel
No Rear-end Damage

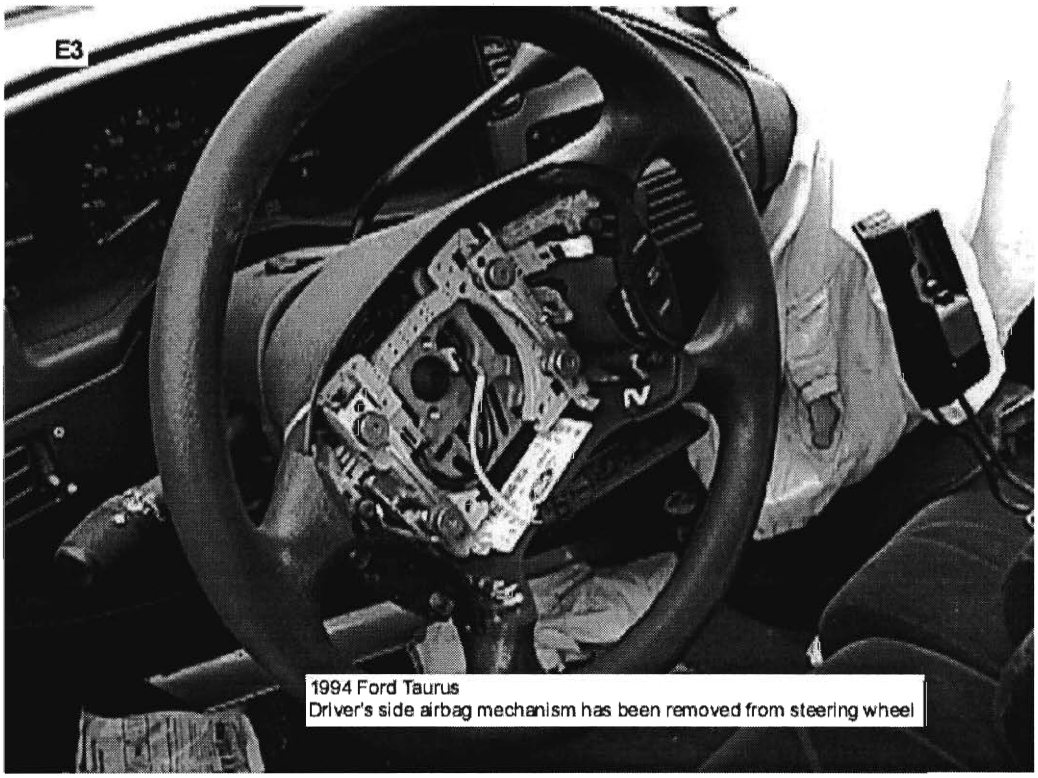

D2
1995 Toyota Tercel
Minor Frontal Damage


D3
1995 Toyota Tercel
Driver's Side Deployment
No Passenger Side Airbag

7.7 Additional Photos


E1
1994 Ford Taurus
Right-Front damage
Dual Air-bags Deployed


E2
1994 Ford Taurus
Different View


E3
1994 Ford Taurus
Driver's side airbag mechanism has been removed from steering wheel


E4
1994 Ford Taurus
Dual Airbags Deployed

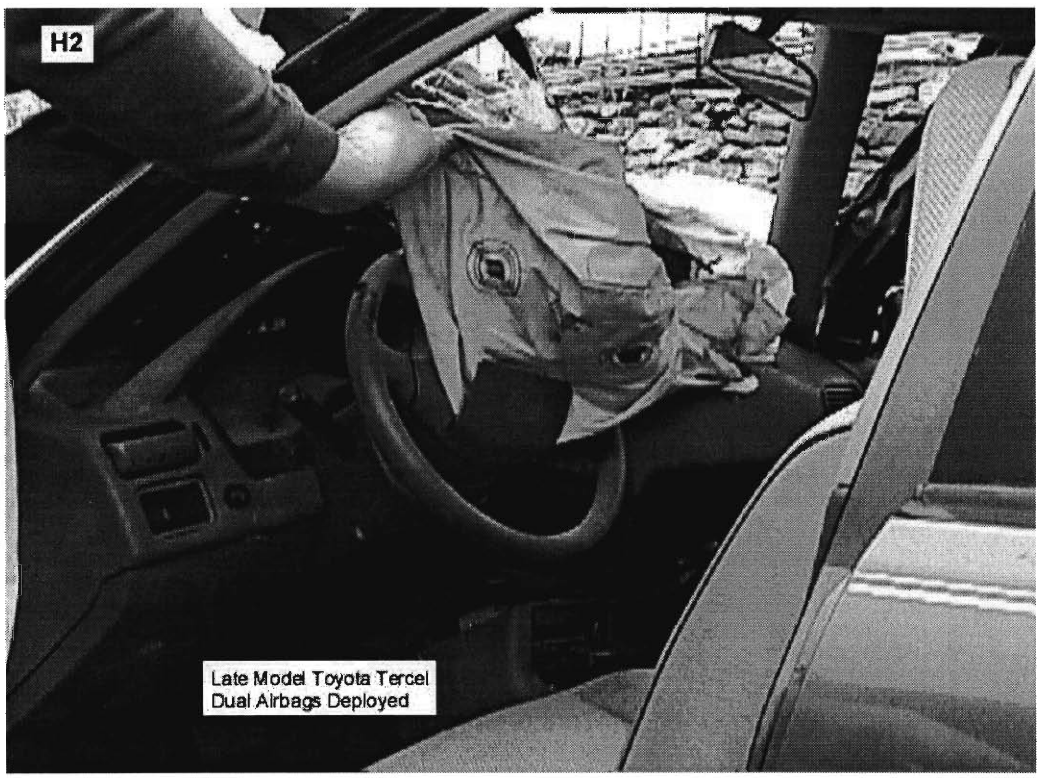

F1
1992Ford Tempo
Severe Right Front Damage

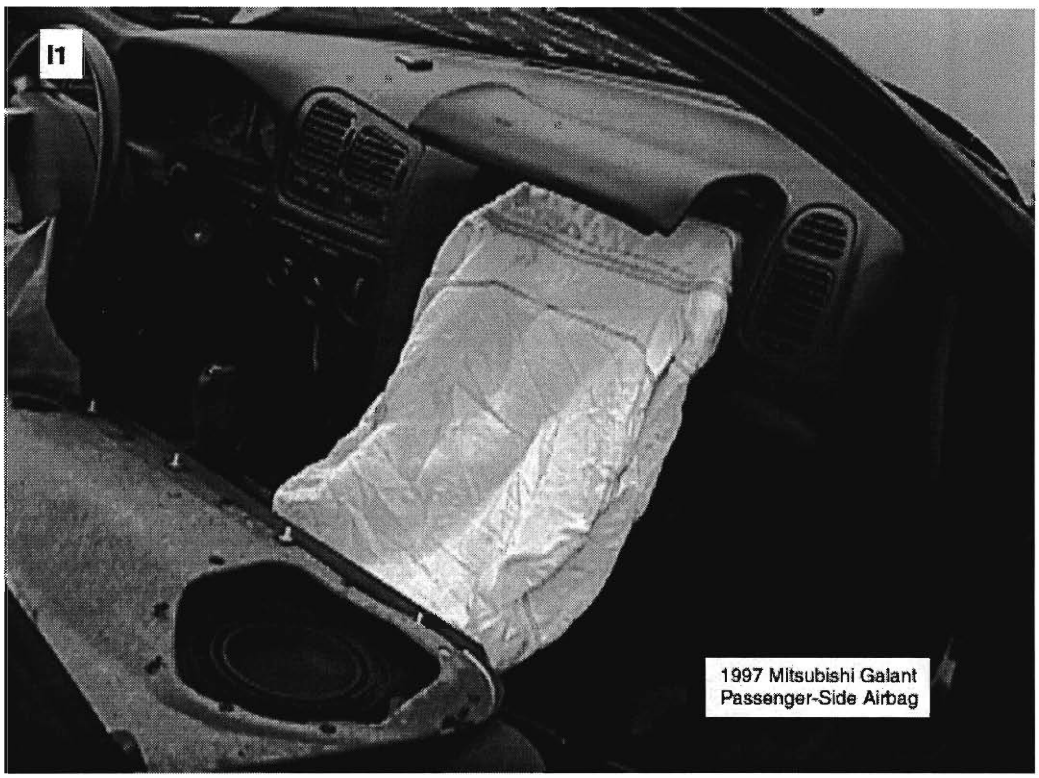

F2
1992 Ford Tempo
Dual Airbags Deployed


G1
1996 Hyundai Elantra
Front Impact Damage
Roll-over Damage


G2
1996 Hyundai Elantra
Dual Airbags Deployed

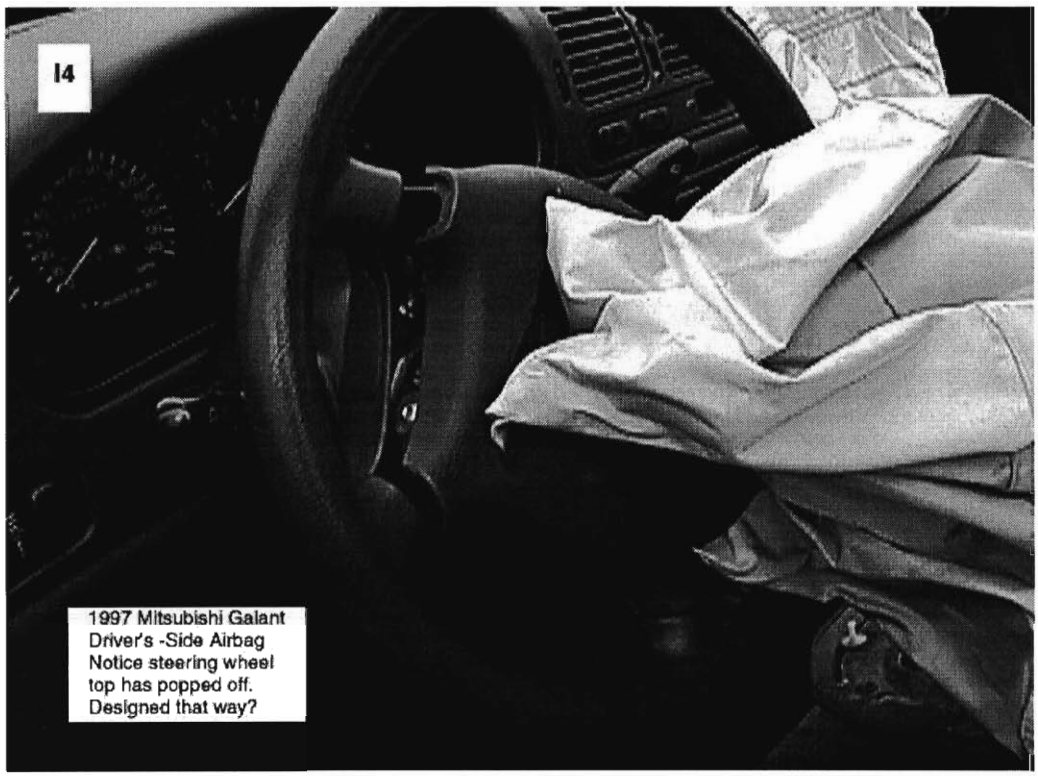

H1
Late Model Toyota Tercel
Severe Damage


H2
Late Model Toyota Tercel
Dual Airbags Deployed


I1
1997 Mitsubishi Galant
Passenger-Side Airbag


I2
1997 Mitsubishi Galant
Windshield damage due to
rearview mirror getting hit by something,
either occupant of vehicle, or airbag upon
deployment.


I3
1997 Mitsubishi Galant
Front-End Collision


I4
1997 Mitsubishi Galant
Driver's -Side Airbag
Notice steering wheel
top has popped off.
Designed that way?

7.8 Resent Recalls

- Honda Accord: 164, 139 cars made in 1995: Airbag can deploy at any time due to faulty electronic control unit.

- Toyota Corolla and Geo Prizm, 1993-1995: If liquid is spilled around center console, airbag could deploy.

- BMWs, 318i, 318is, 325i, 325is, 525iT, 535i, 735i, 750iL, 850i, and M5, 1991-1992: Due to defective locking tab, airbag may or may not deploy in crash.

- Buick Skylark and Oldsmobile Achieva: During deployment, airbag could snag inside dash and cause undesired results.

- Audi has 32 reports in the USA (so far) or inadvertent deployments. When the driver enters or leaves the car in low humidity conditions that promote static electricity, by touching parts of the steering column with either their body or a key in their hand – and the ground, set off the airbag.

- Porsche 1996: a to-be-determined number of cars. Airbag may deploy at any time.

- Jeep Wrangler: airbag may deploy when ignition switch is turned to the off position.

- GM: almost 1,000,000 cars made from 1994-1997. Specifically Cadillac Eldorados, DeVilles, and Sevilles: 103,000 cars made in 1995. Airbags can deploy inadvertently if the electronic sensors under the seat become wet.