UNITED STATES OF AMERICA

NATIONAL TRANSPORTATION SAFETY BOARD

OFFICE OF ADMINISTRATIVE LAW JUDGES

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In the matter of: *
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PUBLIC FORUM ON *
MOTORCYCLE SAFETY *
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NTSB Board Room and Conference Center
429 L'Enfant Plaza
Washington, D.C. 20024

Tuesday,
September 12, 2006

The above-entitled matter came on for hearing, pursuant to Notice, at 8:00 a.m.

BEFORE: DEBORAH A. P. HERSMAN, Chairwoman
DR. VERN S. ELLINGSTAD
BRUCE MAGLADRY
DR. JANA PRICE

APPEARANCES:

Technical Panel:

CAROL FLOYD
DR. MARGARET SWEENEY
DR. KRISTIN POLAND
DOUG BRAZY
DENNIS COLLINS
HENRY HUGHES
MICHELE BECKJORD
DANIELLE ROEBER

Panel: Trends and Safety Statistics

PAT MURPHY, Motorcycle Industry Council
UMESH SHANKAR, National Highway Traffic Safety Administration
RALPH GILLMANN, Federal Highway Administration
DR. CAROL TAN, Federal Highway Administration
DR. TED R. MILLER, Pacific Institute of Research and Evaluation

Panel: Vehicle Design

WAYNE CURTIN, Harley Davidson
TOM BALOGA, BMW
JAY JOSEPH, American Honda
JOHN ZELLNER, Dynamic Research Inc.

Panel: Rider Protective Equipment

RICHARD ALCORTA, MD, FACEP, Maryland Institute for Emergency Medical Service Systems
DAVID THOM, Collision and Injury Dynamics
LIZ de ROME, LdeR Consulting
ANDY GOLDFINE, Aerostich
PAUL VARNSVERRY, PVA Technical File Services Limited

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P R O C E E D I N G S

(8:00 a.m.)

CHAIRWOMAN HERSMAN: Welcome to the NTSB Conference Center.

I am Deborah Hersman, a member of the National Transportation Safety Board and Chairman of this Public Forum on Motorcycle Safety.

For nearly 40 years, the NTSB has served our nation's transportation community by investigating transportation accidents and making recommendations to insure that similar events don't reoccur. We provide safety oversight of the transportation industry and the regulatory agencies, and although we are best known for our investigation of aviation accidents, the National Transportation Safety Board is charged by Congress with investigating accidents in all modes of transportation and conducting safety studies of significant transportation problems. And while aviation and rail accidents receive significant media attention, over 95 percent of transportation fatalities occur on the nation's highways.

Recent data indicate that the increases in fatalities among motorcycle riders far exceeded any other form of transportation. Last year, 4,553 motorcyclists died in crashes. That's over 12 motorcyclists a day.

Motorcycle fatalities now account for over 10 percent of our nation's highway fatalities. The number of motorcycle

fatalities last year is more than double that of a decade ago, and we know that the increase in accident numbers is partly due to a steady increase in growth and in interest in riding motorcycles. However, the number of fatalities is outpacing the increase in ridership. This trend is very troubling.

To put it in perspective, motorcycle fatalities in any recent year has been almost double the number of fatalities that the Board sees in aviation, rail, marine and pipeline, in any year. It's only half of that number. Motorcycle fatalities are almost double of all of those modes of transportation put together.

Motorcycles are probably the American icon for freedom of the road, but right now too many lives are being lost.

In this forum, we hope to explore what can be done to reverse this accident trend and make motorcycles the symbol for both freedom and safety on the road.

Our goal over the next two days is to gather information about motorcycling, ongoing safety research and initiatives, and safety counter measures that may reduce the likelihood of motorcycle fatalities and accidents.

Once we have gathered this critical information, the NTSB may issue safety recommendations, geared to improving motorcycle safety. The NTSB has no authority to issue or enforce laws or regulations nor does it have the authority to

issue grants or fund research. Our main products are our safety recommendations.

When this forum is completed, we will review the information gathered, and if warranted, we may issue recommendations to the industry, to government agencies, to safety rider groups or any other entity that we believe can implement our recommendations and achieve appreciable improvement in motorcycle safety.

Motorcycle safety is not a new topic. For many of you here today, you've been working diligently to improve safety and motorcycling, and I see many people in the audience who have been involved in the NAMS in the late 1990s. The National Highway Traffic Safety Administration or NHTSA and the Motorcycle Safety Foundation formed a technical working group. They looked at ways to improve motorcycle safety.

At that time, motorcycle crashes and fatalities had increased for two years after a period of decline. The working group produced the National Agenda for Motorcycle Safety or the NAMS, which provided a comprehensive review of concerns in motorcycle safety and numerous suggestions on how to improve motorcycle safety. It has been six years since the NAMS, and there have been many efforts to improve motorcycle safety.

Rider training and education is at its highest levels. Manufacturers have introduced new safety features on motorcycles, and Congress has called for both a large scale

crash causation study as well as a Motorcycle Advisory Council to provide suggestions to the Federal Highway Administration about roadway and environmental issues affecting motorcyclists.

Before this year, the National Transportation Safety Board had not investigated accidents involving motorcycles or studied this issue. However, last June, the NTSB launched investigations into three motorcycle crashes.

The first accident occurred about noon on Sunday, June 11th, and it involved a collision between a 1995 Mercury Tracer and two motorcycles, a 2000 Harley Davidson and a 1999 Suzuki. This accident occurred on State Route 49, in Thornton, New Hampshire. As a result of the crash, the driver of the vehicle, the passenger vehicle and the Suzuki operator were serious injured. Both the operator and the passenger of the Harley Davidson and the Suzuki's passenger were fatally injured.

The second accident occurred about 3:15 on the same day. It involved a 2003 Kawasaki motorcycle and a 1993 Plymouth minivan. It occurred on State Route 220 in Linden, Pennsylvania. As the southbound van was in the process of making a left turn, it crossed the northbound lanes of the highway and was struck on the right side by the motorcycle. Following the impact, the motorcycle embedded in the van. The van rolled to the left, and a post-crash fire ensued. The motorcyclist and all four occupants of the minivan were killed.

The third is a well known crash that occurred the day after, on June 12th, and involved the Pittsburgh Steeler's quarterback, Ben Roethlisberger. In that crash, a 1996 Chrysler New Yorker was traveling westbound on Second Avenue in Pittsburgh. The driver was intending to make a left turn from Second Avenue onto the 10th Street Bridge. A 2005 Suzuki motorcycle was traveling in the opposite direction, also approaching the intersection of 10th Street. As the Chrysler started to turn left, it crossed in front of the motorcycle. The motorcycle collided with the right front fender of the car, and the rider was ejected and seriously injured.

It is not our intent to use this forum to further the NTSB's investigations of these three accidents. However, concerns raised by these investigations as well as issues noted from accident data, from motorcycle safety research and from riders we have spoken to, have all influenced the agenda for this public forum.

Before I get into the details of our agenda, I would like to acknowledge some of the rider experience that we have within our agency. Fifteen percent of NTSB employees have been motorcycle riders at some point in their life, and seven percent of those are current riders. Of those who currently ride, riding experience ranges from 1 to 40 years, and more than 2/3 of them have taken rider safety courses at least once.

For my own preparation, I took the basic rider course

and obtained a motorcycle endorsement from the State of Virginia. I learned a lot about motorcycling from my instructors and my classmates. I also learned though, that one motorcycle course and endorsement on my license don't a motorcyclist make. That's why I'm grateful that I've been able to rely on our staff to assemble a panel of experts who are volunteering their time to help us address motorcycle issues in an informed way.

Over the next two days, we have an ambitious agenda. We will have three technical panels on each day. Today we will discuss trends and safety statistics, vehicle design and rider protective equipment. Tomorrow we will discuss training and licensing, public education and awareness and rider impairment.

In each panel, experts from Government, research organizations, manufacturers and industry, will give brief introductory presentations. And then the NTSB staff will lead a round of questions for the panelists. I will then lead additional questioning by NTSB's Director of Research, Dr. Vern Ellingstad, Mr. Bruce Magladry, the Acting Director of our Office of Highway Safety, and our Forum Manager, Dr. Jana Price.

We will also present questions from the audience. I would encourage all of you to write down your questions and return those cards to our staff who will be collecting them from the audience. We will do our best to stay on schedule so

that there will be time for meaningful discussion after each set of panel presentations.

Our first panel today will discuss motorcycling trends and safety statistics. We will learn about factors associated with crashes, changes in motorcycle characteristics and in rider demographics as well as how motorcycle related data are calculated.

Our second panel today will focus on vehicle design, how vehicle design factors influence crashes and crash safety and the influence of new technologies on motorcycle safety.

Our final panel today will cover rider protective equipment. We hope to learn about what type of injuries result from motorcycle crashes and what research has been done on the effectiveness of various types of rider protective equipment.

Tomorrow, we will have three technical panels. In our first panel on training and licensing, we will learn about training programs, their effectiveness and efforts to increase the number of riders who receive training and obtain a motorcycle license.

The second panel on public education and awareness will highlight efforts to alert all road users about how to operate safely in the presence of motorcycles. We will look at what states, riders groups and the insurance industry is doing to educate both riders and all motorcyclists about motorcycle safety.

Our final technical panel tomorrow will discuss rider impairment. In 2004, 41 percent of motorcycle operators involved in a single vehicle accident had a blood alcohol concentration of .08 or higher. In this panel we hope to learn about how alcohol and other substances impair riders and find out about what efforts Government, law enforcement and rider groups are taking to reduce impairment related crashes.

At the end of tomorrow's technical panels, we will ask several leaders in the motorcycling community and Government to summarize what we have heard and give their opinions about what we need to do now and in the future to reverse the rising trend of motorcycle fatalities.

Because this forum has raised a great deal of interest in the motorcycling community, the NTSB has received a significant amount of correspondence, as well as a number of requests for participation in our technical panels. We're limited to two days for this forum, and as you can see, we have a very full agenda. The time constraints necessitated our making some difficult choices about who should be included on the panels. We believe we have assembled a group of panelists who are representative of the most important aspects of motorcycle safety.

The NTSB will carefully review any additional information already received through correspondence, as well as information we receive within the next 30 days.

There are a few more things I would like to mention before we get started.

First, there are a variety of interesting exhibits in our foyer and in the rooms adjacent to the conference center. These displays are pertinent to the discussions of the forum, and I encourage you to visit the exhibits when you have a moment.

Second, I want to note that all of the presentations you see today and tomorrow, provided by our presenters, will be available on our website, and the forum is also being webcast on www.ntsb.gov, for those of you who are not able to attend in person.

I would ask that all of you silence your cell phones and other electronic devices that you may have with you. Please also make a mental note of the exits in this room that you would need to use in the case of a fire. We have several exits.

I would like to end my remarks with a quote by Dr. Harry Hurt. Dr. Hurt, as many of you all know, led a pioneering crash causation study in the 1970s which continues to be referenced today. In an interview when Dr. Hurt was asked to summarize his advice regarding motorcycle safety in one sentence, he replied, "There is no magic bullet other than getting smart." I believe this simple statement captures the goal of this public forum. We want to take advantage of the

tremendous experience we have in this room to gather information about ongoing research and motorcycle safety, initiatives as well as counter measures that could reduce the number of motorcycle accidents and fatalities.

My thanks go out to all of our presenters for joining us today and tomorrow as well as many staff who have participated in putting this forum together. Thank you all for coming, for being in the audience, and I'm looking forward to the discussions that the public forum will generate and more importantly the ideas for improving motorcycle safety that will come from it.

Dr. Price, will you please introduce the first panel?

DR. PRICE: Thank you, Member Hersman. I'd like to begin by introducing the members of our first panel, the trends and safety statistics panel, as well as our technical panelists on our staff.

Our first speaker today will be Ms. Pat Murphy from the Motorcycle Industry Council, followed by Mr. Umesh Shankar, from the National Highway Traffic Safety Administration, Mr. Ralph Gillmann from the Federal Highway Administration, Dr. Carol Tan from the Federal Highway Administration, and Dr. Ted Miller from the Pacific Institute for Research and Evaluation.

Our staff technical panelists for this panel will be Ms. Carol Floyd, Dr. Meg Sweeney, and Dr. Kris Poland.

So when you're ready, Ms. Murphy, you can begin.

MS. MURPHY: I'd like to thank NTSB for the opportunity to speak today. I'm Pat Murphy with the Motorcycle Industry Council, and I've been directing motorcycle owner surveys for the last 25 years for the MIC.

My purpose here today is to provide trends and statistics as background to the presentations you'll hear over the next two days, and to help understand -- help you understand motorcyclists as people, not just statistics. I'll cover who they are, what they ride, and their basic characteristics.

The MIC is a not for profit national trade association with more than 300 members that works to preserve and promote motorcycling through government relations, statistics research, after market, and technical programs. The MIC owner's survey is considered by many to be the industry census and has been conducted at roughly five year intervals since 1975.

Over a 12 month period, in 2003, the motorcycle owner telephone survey used a stratified national probability sample of U.S. households. We completed in depth interviews with 2018 owners and 2007 non-owners. Basic model information was obtained for each vehicle in the household, and we consider the primary rider of the vehicle the owner.

The survey covers a wide array of topics ranging from

type, size, age and number of motorcycles owned, owner demographics and interest, vehicle after market purchases, and on highway and off highway motorcycle use.

So first things first. Who are the riders? Although motorcycle owners are represented in the entire spectrum of demographic categories, in 2003, the average owner was 42, a married, white male with some college education, with above medium U.S. income who carried health insurance. Here you see how that's changed over the last several years.

Who are the motorcyclists today? They're your neighbors. They're remarkably similar to the U.S. population, but just generally, a little bit older.

It'll be tempting as you hear some of the speakers to view motorcyclists as the stereotypes you've seen, but today all kinds of people ride motorcycles. In fact, in 2003, we estimated 16 million people rode motorcycles on highway.

Let's look at some of the other characteristics of the riders. The motorcycle survey indicated that slightly more than 1/3 of motorcycle owners had taken an organized motorcycle rider education course, and the vast majority reported having a valid motorcycle operator's license, almost 87 percent. Older motorcyclists are more likely to have a license than other groups.

Owners in 2003 rode an average of 3,019 miles annually. The most frequent types of riding were casual

pleasure riding and touring under 500 miles.

As far as knowledge of their motorcycles, somewhat unique to motorcyclists is that maintenance of their bikes was done by owners themselves or a friend or relative nearly 65 percent of the time.

There's been a tremendous interest in motorcycling over the past and there are multiple indicators showing increased ownership and vehicle miles traveled. 2006 is on track to be the 14th consecutive year of increases in year over year new unit sales. On average, there are one and a half bikes in motorcycle owning households with engine displacements ranging from 50 cc to over 2,000 cc.

Although not shown here, the average cost of a motorcycle including scooter, on highway and dual, was between 11 and $12,000 in 2005. The prices can range from about $1800 to nearly $100,000 for some of the custom bikes.

And motorcycle registrations have also increased, but they remain very small as a percent of total vehicle registrations. In the period between 1994 and 2004, motorcycle registrations increased over 55 percent where registrations of all vehicles increased less than 20 percent.

But the reality is, that not all motorcyclists register their bikes. The MIC estimated vehicles in use may be a more accurate picture of the number of motorcycles on public roads today. We estimate that there were nearly 7 million

motorcycles ridden on highway in 2003.

Motorcyclists regularly talk about the number of miles they ride, and the MIC owner survey is collected over 12 months to account for seasonal bias in self-reported annual miles ridden. In 1990, the NHTSA safety facts and MIC projections for VMT were very similar, but in both 1998 and 2003, they're significantly different.

Now let's take a look at how the fatality rates compare when using MIC's numbers and the federal and state numbers.

One fatality is one too many but to understand the trends and fatality rates, we need to be working from the same base numbers. For instance, in 2003, the MIC rate for 18 fatalities per 100 million vehicle miles traveled is less than half of what was reported by NHTSA. Using the MIC numbers, the rate does increase 18 percent, from 1998 to 2003. But over the same time period, NHTSA reports a 74 percent increase, more than 4 times higher. So, you know, I think we need to work together to look at those numbers.

This chart compares motorcycle ownership by age group to fatalities by age group. As you can see, fatalities for motorcyclists under 40 are over-represented. While only 15 percent of owners are 20 to 29 years old, they account for 26 percent of the fatalities.

And here we see the percent of vehicles in use by

engine size, compared to the engine size of the motorcycles involved in fatalities.

So comparisons in this presentation are meant to identify the need for more consistent and accurate statistics to help analyze trends and determine solutions that will minimize the fatalities each year, and now Dr. Sherry Williams of Motorcycle Safety Foundation who focuses on the human element of motorcycling will answer some of the additional questions from the Board.

DR. WILLIAMS: MSF is committed to research based education and training programs. That's why we've conducted two national surveys with national probability samples of motorcycle owners in order to understand the whys of motorcyclist decisions. Being a safe motorcyclist depends on more than just skill, because skills deteriorate over time. That's why all of our training courses incorporate both cognitive and mental and physical skills as well as safety strategies to help motorcyclists manage risks.

So what do we know about motorcyclists that choose to take a training course?

In a household panel study that is generalizable to the U.S. population, a study that MSF commissioned and directed, we found that 3 out of 10 motorcycle owners had taken some sort of training course. While we have observed anecdotal differences in gender and age in those who take training

courses, we found no such differences in this particular sample. We did, however, note differences in income, education, and location. For example, we found that people with higher incomes and higher education are more likely to have taken the training course, and we found that if you lived in the west, you were slightly more likely to have attended the course.

Those motorcycle owners who had never attended a training course, and indicated they had no interest in ever attending one, comprised 16 percent of the sample. When asked further why they wouldn't attend a course, they said, I'm an experienced motorcyclist. I don't need training.

When we looked at first time owners, this group was more likely to take training classes and were more aware that the training classes were available.

Another finding from this study was that 36 percent of the sample identified themselves as returning riders. This group had ridden for an average of 10 years and then stopped riding. The gap in their riding at the time of the survey was an average of 13 years, yet upon returning to riding only 2 out of 10 of this group said that they had taken a formal safety training class.

What other comparisons can we make? One question that often comes up is, are motorcyclists more likely to be risk takers when compared with automobile drivers? There isn't

a lot of research in this area, but one study we did find said that motorcyclist and non-motorcycling car owners do not different on risk taking measures.

When we asked motorcyclists if during the past year they had consumed two or more drinks of alcohol and then ridden, eight percent of the samples said yes. These yes responses were more prevalent among a couple of demographic groups. The tendency to report consuming alcohol and then ride was more prevalent among men, in fact, three times more likely than women. These men were also more likely to be higher income and older, up to age 60.

One of the most important issues is the validity of the data that's going to guide our policy and programmatic decisions. The relationship between rider demographics and rider cyclographics and rider training data and fatalities must be more clearly understood. Some portion of the spike in fatalities is related to increases in various rider demographics. As noted in the 2003 issue of the "Morbidity and Mortality Weekly Report" offered by the Centers for Disease Control, the increased number of motorcycles on the road probably contributed to the increase in the motorcycle mortality rate during 1993 and 2003.

A statement we all know to be true, yet for some reason we are still unable to fully quantify this or understand it. Why? Because the data integration for rider education,

rider demographics, rider licensing, crash reports, is all woefully inadequate.

We encourage the NTSB to advocate for development of new procedures to collect motorcycle miles traveled, and to require states to use equipment that counts motorcycles on local and two lane state roads in their average annual daily traffic reports.

Finally, we strive to serve our constituencies with valid research based on sound scientific methodology. Motorcyclists should expect nothing less.

MS. MURPHY: So to summarize, today's motorcyclist is likely to be the person next door, and we've had 14 consecutive years of growth with no sign of slowing down. So it's imperative that we get accurate data that's fully integrated to help identify our opportunities to address critical issues in motorcycle safety.

Thank you for your time, and we look forward to your questions. Thanks.

DR. PRICE: Thank you, Ms. Murphy. Our next speaker on the panel today will Mr. Umesh Shankar from NHTSA.

MR. SHANKAR: Thanks, Jana. As Ms. Hersman mentioned in the opening remarks, one of the concerns we have seen with respect to the fatality data is we have had eight years of increase in the motorcycle rider fatalities. And as Pat mentioned about some of the industry-side demographic data that

she presented, I'll go over some of the data that we have seen from the fatal crashes and how they kind of relate to some of the numbers or the data that the industry is seeing.

Once again, as Sherry Williams mentioned, the question is, yes, we are seeing a compliment of the same rider groups in terms of ages and the numbers. But why are we still seeing an increase which is beyond the number of registered motorcycles or the ridership that we have seen, and, and one of the things that probably we will be able to have some questions more than probably the answer is what do we need to do to get better data and see why these increases are going the way it's happening the last eight years?

When you look at the latest 2005 data, we have seen compared to 1997, and that was year when we saw the least number of motorcycle fatalities, it's more than doubled in the last eight years, reaching the level last seen in 1986.

This is just trend data that you are seeing going back to '75. And I've just shown there the lowest year when we reached the lowest total of fatalities but then you can see after that, it continued to increase in the past eight years of the motorcycle rate of fatalities that we have seen.

When we compare it to the proportion of the motorcycle rate of fatalities going back to '97, when compared to 2005, right now the rate of motorcycle fatalities in 2005 comprise of 10.5 percent of the overall motor vehicle

fatalities on the nation's roadways.

The data in here compares the change in the total fatalities to the motorcycle riders and as a percent of all fatalities. Except in 2002, going back to 1997, each year what we have seen is that most of the increases in the increase in total fatalities has been accounted by the increase in motorcycle rate of fatalities.

Overall fatalities have not declined in the past 10 years when you look at the trend. This kind of makes a comparison of the major components of the overall fatalities which compares with the passenger vehicle occupants, which are the passenger cars and light trucks, the non-occupants who are the pedestrians and the bicyclists and other people, the other occupants which includes the large truck occupants and occupants of other vehicles types and the motorcycle riders.

As you can see in here, when you compare the highest to the lowest in the past 10 years, it's the motorcycle riders who have really kind of taken off, doubling in number. Even the increased vehicle miles traveled that we have seen with the passenger vehicles, we have seen a decline in the total fatalities among passenger vehicle occupants. We have seen a decline in the total non-occupants and some slight increases in the fatalities among other occupants.

Just a comparison of the data that you saw in the previous slide, once again, as you can see in here, going back

to '97, we've had just over 2100 fatalities. In 2005, we have over 4500 fatalities in 2005. And as Pat mentioned, when you go back and look at the sales and what they are also predicting that's going to be made in the future years, the continued increase in ridership and the popularity of motorcycles, I think we are going to see an increase in the number of fatalities. But the question is just because the registrations or ridership has increased, do we really need to see an increase in the fatalities, is a question that we really need to get some handle and answers on.

The chart here shows the fatality rate, looked at three different measures. One is the motorcycle VMT, vehicle miles traveled, the registration, and I also put in the population in here. I know the resident population is not a real measure of the motorcycle ridership population, but just to show that even when you look at the overall population, there is an increasing trend in the rate. And you look at any three of the measures in here there has been an increase in the fatality rates when compared to 1997, which explains that there has been a higher level of increase in the fatalities, which is the numerator compared to when you look at any measure of exposure, either the VMT or the registration or the population.

Where are the increases? As Pat mentioned, when you look at the overall increases, the majority of the increases that we have seen in the last 10 years have been in the 40 plus

age group. But, of course, over 400 percent increase in the 50 plus age group which compliments to the data of that MIC just presented just before me.

When you look at the engine size, which is another part of the data that MIC presented, nearly 200 percent increase in the larger motorcycles. So this shows where the ridership is interested, in the kind of motorcycles that they're interested in, and that's what we are seeing in the fatalities. We don't have the actual number of motorcycles by these different engine size. So that may be one way of looking at whether it is an increase because of the number of motorcycles that have increased on the roads in these engine size groups.

Once again, looking at the age groups, as you can see in here, the 40 plus and, of course, the 50 plus are the two age groups that we have seen. There has been some increases in the 30 to 39 and the 20 to 29 also but most of the increases that I mentioned have been in the 40 plus age group that we have seen the past 10 years.

Showing another way of looking at the data in here, I just split them into three different age groups, the 30 to 39, the under 30 and the 40 and over. As you can see, the 40 and over has just taken off since '96, each year in terms of increases.

The only way I could look at the data and the way to

look at whether, you know, we are really seeing an increase in the rates to account for the exposure, was looking at the rates by the age group, looking at the population itself. And when we look at even the overall population, we do see an increase in the rates and some real large increases in the rates in the 40 to 49 and the 50 plus age groups, and also in the over 59 age group, and some slight increases in the 20 to 29 and the 30 to 39 population groups. Of course, we still see that the 20 to 29 has the highest rate compared to any other age group overall in 2005.

Looking at the rate of fatalities by the engine size, and once again what you're seeing here that there have been some increases in the middle engine size which is the 500 to 1,000 cc, but the real increases that we are seeing have been in the 1,000 to 1500 cc, and starting in '96, we started seeing some fatalities in the real large engine type motorcycles which are over 1500 cc.

Looking at the data of the age group on the larger engine size motorcycles, specifically looking at the 1,000 to 1500 cc where we have seen nearly doubling of the fatalities in here, and one of the significant things that we are seeing here is most of the fatalities on this larger engine size have been in the 40 plus age group, really showing the interest of this age group of riders to be using these large engine motorcycles. And as you can see in here, more than 300 percent increase in

the 40 plus age group, and over 500 percent increase in the 50 plus age group, and when you look at the data, 84 percent of the fatality increase in the large engine motorcycles were in the 40 and older riders, and 66 percent of the increase among the 40 and older riders were larger motorcycles. It really shows a combination of the, of the 40 plus riders on the larger engine size motorcycles.

Slicing with the data for 10 years, looking at trends by the same issues that I showed previously, it clearly shows the rider's interest in riding with larger motorcycles in the 40 plus. As you can see, over 600 fatalities in 2005 were in the age group of 40 to 49, and over 500 fatalities in the 50 to 59, and nearly 200 fatalities in the over 59 age group. And, of course, there are some smaller fatalities also in the 30 to 39 and the younger age group.

Just looking at the proportions, how do these age group kind of relate to the proportions of the fatalities on this larger motorcycles, if you go back 10 years in 1996, they comprised of about 47 percent of the total fatalities. When you look at that 2005, there are two-thirds of the fatalities on these larger motorcycles. And pretty much when you look at the data that I've showed previously, they really show an interest in riding these motorcycles at least when we look at the fatal crash data, and that pretty much compliments what the industry has shown the data in terms of the data itself.

When we look at the last 10 year data with respect to the fatal crashes, the mean age of the motorcycle rider is increasing. And the mean engine size of the motorcycle involved in the fatal crash is increasing, which once again compliments to the data that the Industry Council has seen from their survey. And looks like, looking at the data in here, the mean ages increase from about 33 years to close to 39 years in 2005, and the engine size has increased from about 866 cc to over 1,000 cc in 2005 which is the latest data we have.

Looking at some of the crash factors that are commonly cited with respect to motorcycle crashes, when you look at the speeding as a factor, typically the speeding is an issue with the younger age group. But even when you look at the 50 to 59, 1 in 5 riders in the 50 to 59 age group were cited with speeding as a factor in a motorcycle crash.

When you look at the alcohol involvement, I tried to compare some of the alcohol involvement with the passenger cars and the light trucks, and traditionally, the motorcycle riders have had a much higher alcohol involvement compared to the light truck drivers and passenger car drivers, and the 2005 data shows that about 34 percent, more than a 1/3 of the motorcycle operators had some level of alcohol when in the crash, and it clearly shows that the effects of alcohol and the consequences of riding a motorcycle with some alcohol on the rider impairment.

Looking at the alcohol data once again, slicing it down to the age group, the highest level of alcohol that we have seen among the riders of the age group of 30 to 39 and the 40 to 49 age group, more than almost -- more than 40 percent of the 40 to 49 age group riders had some level of alcohol, and when you look at that, a majority of those alcohol involved operators had alcohol levels of .08 plus, and that clearly shows that a majority of those that do drink and ride, they are impaired to the level of .08 plus. And our crash data has also shown that the median BSE for impairment is .16 which is twice the level of impairment levels in all the states and recently in Puerto Rico.

When you look at the alcohol level by engine size, once again when you look at the highest level of alcohol here, 40 percent of the operators on the 1,000 plus cc engine size had some level of alcohol in the fatal crash.

Licensing. As Industry Council put out some of the data, I tried to look at the licensing by the age group in fatal crashes. Licensing looks to be a big issue among the 40 -- under 40 age group, but even when you look at some level of the licensing issue, 10 percent of the riders in the 50 to 59 and the over 59 riders, didn't have either a license or they were not endorsed to ride a motorcycle, and almost 1 in 5 in the 40 to 49 didn't have the license to ride a motorcycle.

Looking at the weekday versus weekend. Once again,

Industry Council also looked at the data in terms of what the interests of the riders are in terms of their motorcycle riding. When you look at the fatalities sliced by the weekday and the weekend, and when you look at the number of hours, more than twice as many motorcycle fatalities occur during the weekends than during the weekdays -- 18 versus 8.

Comparing that to the age group, if you look at them here, as the age group increases, the fatalities during the weekends increases. So, for example, the 40 to 49, they are 2.5 times more likely to be killed in the weekend compared to in the weekday and when you look at the 30 to 39, it's more than 2.4 times. It shows that more riding is recreational riding during the weekends, compared to the traditional workday riding.

Looking at the similar rate of fatalities by engine size, the weekend rider fatalities is about 2.65 times on a weekday fatality when you look on the larger motorcycles on the 1,000 plus cc.

Just to summarize, the increasing rate of motorcycle riders which compliments with the fatal crash data with the Industry Council, with most of the increases in the 40 and over age group, increasing size of motorcycles involved in the later years shows that the mean engine sizes over 1,000 cc, the fatality rate shows overall increase in the rate of VMT and registered vehicles and large increases in the 40 and over age

group, when we look at the rate by the population.

Just look -- show some of the data sources that I've used in my presentation, and I'll be happy to answer the questions at the end of the session. Thank you.

DR. PRICE: Thank you, Mr. Shankar. Our next speaker on this panel will be Mr. Ralph Gillmann from the Federal Highway Administration.

MR. GILLMANN: Thank you. Good morning. I'm with the Federal Highway Administration's Office of Highway Policy Information, and we publish the annual publication, "Highway Statistics" among other things. I'm the Acting Chief of the Travel Monitoring and Surveys Division.

The Office of Highway Policy and Information has three data sources on motorcycles, motor vehicle registration data from the Form 561, vehicle miles of travel by vehicle type from the high performance monitoring system's summary data, and the number of motorcycles, motorcycle trips and vehicle miles of travel from the National Household Travel Survey. I'll present a brief overview of each data source.

Motorcycle registration data are collected annually from the states on Form 561, under instructions provided in the Federal Highway's Guide to Reporting Highway Statistics, Chapter 3. These data are published annually in our Highway Statistics MV1 table. Motorcycles, mopeds and motorbikes are combined in the published table. The software that is used by

the states to report the data and by our office to analyze the data is being upgraded in order to improve data quality. A new software will be released to the dates in 2007.

The highway performance monitoring system has a section called summary data, which asks for the travel activity by vehicle type. This is collected from the states annually and published in the Highway Statistics Table VM1. Motorcycles are defined as all two or three wheeled vehicles on the highways.

A couple of points about that. The reporting of motorcycles is optional. However, more than 43 states have been reporting them, and I want to make it very clear, that we do not simply aggregate all the state reported values. So if a state reports 0 motorcycles, that is understood as a missing value, and that we use the data from the states that do report motorcycles to estimate the national vehicle miles of travel for all motorcycles.

The highway performance monitoring system is undergoing a reassessment currently, which includes ways to improve reporting motorcycle vehicles miles of travel, and at this point it is expected that in the next few years, reporting of motorcycles VMT will become mandatory.

The third source of data is the National Household Travel Survey. The NHTS provides a rich source of detailed information on personal travel patterns in the United States.

The survey includes demographic characteristics of households, people, vehicles and detailed information on daily and longer distance travel for all purposes by all modes. The 2001 NHTS survey data included approximately 66,000 households of which about 26,000 households are in the national sample while the remaining 40,000 households are from nine so-called add on areas. The NHTS and its predecessor, the Nationwide Personal Transportation Survey, have been conducted every five to seven years since 1969. The website is listed on the slide.

The NHTS questionnaire asks for information on motorcycles and mopeds that are owned, leased and/or available for regular use by the people who currently live in the household. The number of motorcycles, motorcycle trips and motorcycle travel are covered along with many demographic variables.

For a more complete picture of motorcycle trips, it would be necessary to over sample for motorcycles. This could be done with an add-on sample to the National Survey. Since we are in the planning stage for the next NHTS, now would be a good time to initiate a motorcycles add on to the NHTS.

As a comparison, here's a graph or a table, I mean of the number of motorcycles from the registration data published in the MV1 table compared with the NHTS household survey, and we find that they are comparable for the year 2001. For motorcycle VMT similarly, comparing the HPMS figure with the

NHTS, again, they are in the same ballpark.

Here's a graph from the NHTS on the issue of motorcycle usage by age, and it shows a general trend that others have spoken about. The NHTS also indicates that 42 percent of motorcycle trips are taken during the evening and night, and that 34 percent of all motorcycle trips occur on weekends.

Our office website contains more information about highway statistics and traffic monitoring. I'll be glad to answer your questions afterwards.

DR. PRICE: Thank you, Mr. Gillmann. Our next speaker in today's panel, this morning's panel will be Dr. Carol Tan, who is also from Federal Highway Administration. Dr. Tan.

DR. TAN: Good morning. As Jana said, I'm Carol Tan. I work in the Federal Highway's Office of Safety Research and Development. I'm the team leader for the Safety Management Team.

This morning, I'll briefly cover three critical studies on the causes of motorcycle crashes.

DR. PRICE: Dr. Tan, could I ask you to speak up a little bit please. Thank you.

DR. TAN: Is this better? Okay. This morning I will cover three critical studies on the causes of motorcycle crashes, and after that review, I'll give a brief overview of

the Federal Highway's motorcycle crash causation study.

The three studies that I'll cover are the -- Hurt Study, the MAIDS Study, and the Thailand Study. The Hurt Study, that was mentioned earlier, was conducted about 30 years ago, and more recently we have the MAIDS Study and the Thailand Study.

The Hurt Study had three main objectives, to examine crash causes, to look at the effectiveness of protective equipment such as helmets, and to also identify countermeasures. This study was a case control design, meaning that data was acquired from crashes and also from matched controls. They used a multidisciplinary team to collect the data. As you can see, they collected 900 in-depth motorcycle crashes. They investigated these on site, and they also collected about 500 matched control sites.

Some key findings. The principal cause of motorcycle crashes was the failure of motorists to see the motorcyclists, to detect the motorcyclist. The two main reasons were lack of conspicuity on the motorcyclist's part and the lack of awareness and proper caution on the motor vehicle driver.

In terms of countermeasures, the Hurt Study recommended training, licensing and the use of helmets.

The MAIDS Study, MAIDS stands for Motorcycle Accident In Depth Study. This was sponsored by the Association of European Motorcycle Manufacturers, and this study focused on

powered two-wheeler crashes. This study included both motorcycles and mopeds. Their objectives, very similar to the Hurt Study, to look at the risk factors for these crashes and to develop countermeasures to reduce the severity and frequency of the crashes.

The used the methodology that was developed by the OECD, the Organization for Economic Cooperation and Development. This again was using a case controlled methodology. Again, about 900 in depth motorcycle crashes were investigated, looking at over about 2,000 variables and about 500 controls. They collected their control data at fueling stations or what they called petrol stations or gas stations as we call them.

The five countries that they collected data in were in France, Germany, The Netherlands, Spain and Italy, and all these were conducted independently of each other.

Some key findings. You can see in about half of the crashes, the primary contributor was human error on the part of the other vehicle driver, not the motorcyclist. In a third of the crashes, the primary contributing factor was human error on the part of the two-wheeler rider, and in 70 percent of the crashes, the crash occurred on a tangent section, otherwise in European terminology, straight roadway alignments. And half of the crashes occurred on minor arterials, 21 percent on major arterials and 4 percent on a motorway, what we call the

freeway. Unlike the Hurt Study, no one single accident configuration dominated.

The Thailand Study, there were actually two separate studies, one in Bangkok and one in what they call the up country. What I'll describe is only the Bangkok study. Again, you can see the objectives are very similar to the past studies. This was also a case controlled study, and control data were collected by two methods. They conducted driver interviews at fueling stations and also on the crash scene one week later.

In the Thailand Study, there are 723 in depth on scene motorcycle crashes, and they also looked at injury analyses as well.

You can see that rider error was the most frequent primary cause in both single and multiple vehicle crashes. There is 40 percent alcohol involvement, and riding and driving errors in about 50 percent of the cases.

In the Thailand Study, roadway design and maintenance contributed 12 1/2 percent to the crash. In the Hurt Study and the MAIDS Study, contribution of these environmental factors was much, much less. The most frequent accident type was a motorcycle rear ending another vehicle, and only one rider reported any training which leads us to infer that the absence of training is responsible for such a predominant role of rider errors in the Thailand Study.

And now I'll cover the current efforts within the Department of Transportation. There are actually two separate efforts that are being coordinated. One is the National Highway Traffic Administration's Pilot Study, and the other is the Federal Highway Administration's Main Study.

NHTSA started the Pilot Study before Congress mandated that Federal Highway conduct a Main Motorcycle Crash Causation Study, and the focus of the Pilot Study was to implement and test the OECD methodology in the U.S. This had never -- their methodology had not been conducted in the U.S., and it was thought that it would be better to pilot the effort first, rather than just jump straight into it. And it's hoped that the lessons learned from the Pilot Study can be used in the Main Federal Highway Study, and provide a foundation in the seamless transition.

You can see from the objectives, that NHTSA's Pilot Study is looking at determining the effectiveness of the OECD methodology, and also again as in the former studies, looking at the main factors contributing to crashes and motorcycles and also looking at crash outcomes with focus on countermeasures.

Here's some projected milestones. We hope that the data collection instruments and coding will be finalized in November, which is very soon, and we'll have the site selection in December of this year. It'll take quite a while to actually train the data collectors, and we hope that that will be

accomplished by April of next year, and we'll begin the data collection very soon after that. Again, we'll have to have the site selection coordinated, and the sites that we determine to collect data will have a lot of coordination with the local jurisdiction, the hospital and police there. And hopefully once we've gotten some of the data from the NHTSA Pilot Study, we can begin actually collecting data on the Federal Highway Study.

Some background on the Federal Highway Study. This was mandated in the legislation, SAFETEA-LU, in Section 5111. Federal Highway was to give grants to the Oklahoma Transportation Center to conduct an in depth motorcycle study, crash causation study, using the OECD methodology. There was no leeway in terms of determining another methodology. It was mandated that the OECD methodology be used. And furthermore, funding was to be provided, over $1.4 million for 2 fiscal years.

Also within SAFETEA-LU, there was, given the status of the Oklahoma Transportation Center, it was a required match on Oklahoma's part to provide 50 percent of the funding. So they must provide at least over $2.8 million in match, and that does not necessarily have to be in full dollar amount. It could be in in-kind services as well.

The status of the grant. We have signed a cooperative agreement with the Oklahoma Transportation Center.

The contract or cooperative agreement actually began September 1. It will last four years, and the actual funding is roughly about $5.6 million at this moment, when you combine both the federal match and Oklahoma's match.

The objectives should look very similar to what you've seen, except that we are specifically use the OECD methodology as I mentioned. Looking at motorcycle crash causation and also trying to determine countermeasures to reduce the frequency and severity of the crashes.

We'll be focusing on two main areas, risk factors and crash types. Under risk factors, we'll look at rider and driver characteristics for the motorcycle and the motor vehicle involved in crashes. And under that, we'll try and focus on other things that typically NHTSA would look at, training, age, gender, experience, and alcohol, vehicle characteristics and roadway characteristics. Federal Highway typically deals with the roadway and roadside, and hopefully the results of this study will lend itself to the Federal Highway perhaps in the future doing something to help reduce the severity and frequency of crashes.

The milestones. We've already had a project working group this past summer, and we plan to have this group meet annually. We hope to have a finalized work plan by November of this year. There will be a website up in March of next year, and as you can see, the parallel efforts with the pilot's study

in September to have the data collected and begin our data collection. And if you have more detailed questions that I can't answer today, you can contact me or Paul Tremont who is focusing on the NHTSA Pilot Study.

DR. PRICE: Thank you, Dr. Tan. Our final presentation for this morning's panel in Trends and Safety Statistics will be given by Dr. Ted Miller of Pacific Institute --

DR. MILLER: Thank you.

DR. PRICE: -- for Research and Evaluation.

DR. MILLER: Yeah, and PIRE actually is a subsidiary -- has as a subsidiary, National Public Services Research Institute which has been working in motorcycling for 30 years or more.

Today I'm going to talk about the cost of motorcycle crashes, the effect of helmets on costs, and motorcycle insurance.

We've run some estimates specifically for this presentation using NHTSA data sets in their 2005 numbers. We've also used NHTSA crash costs but at the 3 percent discount rate that health policy standards would suggest. I went too far. Can you take that back one? Thank you.

Overall, I estimate that in 2005, motorcycle crash injuries cost $17.5 billion. The largest share of that was for quality of life loss, that 30 percent of it was for work loss

and 15 for medical treatment.

There were 190,000 people in police reported motorcycle crashes in 2005, and 42 percent of those people were motor vehicle occupants or pedestrians. About 1 percent were pedestrians or less. But I have to tell you that the crashes that you've chosen to investigate are very atypical because 99 percent of the injury costs are in motorcycles. Only 1 percent are in the motor vehicles. So as you've gone to those ones where a motor vehicle occupant was killed much less injured, those are extremely unusual crashes. And most of the ones who were not motorcycle occupants were actually pedestrians, even when we break it further.

Overall, about 51 percent of the cost of motorcycle crashes don't even involve another motor vehicle. They're only motorcycle crashes, and 48 percent of the crashes are only motorcycle crashes. So they're slightly more severe than the ones that involve motor vehicles, and they're about equally common. About half the fatalities are also in motorcycle only crashes.

If we look at helmeted versus non-helmeted, about 40,000 of the 110,000 cases are non-helmeted, but the costs are primarily in the non-helmeted cases. And the reason for that is that the cost per crash involving motorcycles is more than four times as high, if you're not helmeted.

We've already mentioned the DWI deaths are about 9

percent of total deaths and are about 34 percent of motorcycle deaths from numbers I just looked up on the NHTSA website.

We've done a report for NHTSA, that I'm going to talk some about, that was a wet review on the cost of injuries resulting from motorcycle crashes. Wendy Max and Bruce Lawrence were the main people who did that report. And it was literature based. These are overall costs per 1,000 vehicle miles of travel per vehicle annually, per vehicle lifetime and per crash, and you can see that motorcycle crashes, according to two different studies, are much more severe by any exposure measure than average motor vehicle crashes. There's a much higher rate of crashes, and the crashes that do occur cost more.

As we look at hospital charges per case, they're very substantially higher no matter what setting you go into among those who are not wearing a helmet. So even if you just say here people who were hospital admitted, if they weren't wearing a helmet, their costs are going to be much higher. We also find that the costs of head injury motorcycle crash injuries are much higher than non-head injury cases. And the third thing that we found is that if you're not wearing a helmet, you're much, much more likely to have a head injury than if you were wearing a helmet. And that occurs no matter what setting we look in as a place of treatment.

A motorcycle helmet costs about $200 in the store,

maybe a little more. I've done some estimates of -- well, if motorcyclists are wearing their helmets, and many of them aren't, where they're not required to, and we look at their risk perception, we can make some estimates of how much discomfort and inconvenience they must be perceiving among those who aren't wearing a helmet. And what we estimate is that if you force people into a helmet between passing the law, enforcing it and the discomfort and inconvenience, the cost of that is going to be about $1,000 per new users.

Now that helmet would save $3900. So it actually pays for itself. The benefit cost ratio is still more than 3 to 1, and this is based on the effectiveness estimates from 10 years ago which were about 29 percent effective. NHTSA's latest estimates that are the helmet -- the current generation of helmets were about 37 percent effective which would raise this benefit cost ratio.

We also know the helmet was increased usage by about 40 percentage points, typically from about 50 percent to 90 percent.

The other report that we've done that I'm going to summarize today is on motorcycle insurance coverage and how it compares between motorcycles and autos. The first thing that we find when we look at that is that motorcycle coverage is narrower than auto coverage, because there are less mandates in motorcycle insurance coverage. The typical example is that

auto insurance, you must carry passenger liability. Motorcycle insurance, you don't. You are much less likely to be carrying some coverage for your own medical costs, and you in many cases are exempt from no-fault loss. You also tend to carry less collision insurance in motorcycles than in motor vehicles.

If we look at just crash related coverages and leave aside comprehensive coverage for theft and such, if you bought all covers on a motorcycle, you'd spend about $300. On a motor vehicle, you'd spend -- on a car, you'd spend about $700. In actuality, the costs are about 180 because they buy less coverage compared to 620, but if we look at cost for 5,000 vehicle miles of travel, the cost is actually higher on the motorcycle.

Overall, there are 316 million in motorcycle related claims for crashes in 1999. The largest part of that was for property damage, own injuries about 22 percent and others injuries about 15 percent. You recall how rare other injuries are in terms of the total costs of motorcycle injury. So it tells you a lot about what insurance covers. No insurance typically covers much of the cost of the insurance holder. That's just not motorcycle. It's any insurance. If we look at cost per claim by engine size, you can see that it goes up about $1,000 for every 250 cc's. If we look at claims paid for policy, you can see the sport bikes have a terrible record. The touring bikes which are the heavy bikes also cost almost

twice what the lighter bikes cost for policy and claims payments. And some of that is just higher property damage.

If we look at the costs of a motorcycle claim versus an auto claim, you can see that they look very different. The motorcycle are in red here. A typical bodily injury claim is almost twice as large. Even a collision claim just for property damage is larger typically on a motorcycle claim than on a motor vehicle claim, but conversely the medical insurance claims tend to be lower.

The crash related costs for 5,000 VMT actually are about identical on the two vehicles but if the motorcycle had been carrying all coverage, the costs on the motorcycle would be about one and a half times the cost in an auto.

In summary, motorcycle injuries cost almost $17.5 billion in 2005. Most of those costs were for motorcycle only crashes and were unhelmeted. Thirty-four percent of the fatals were DWI. The medical costs of motorcycle injuries are about twice as high if a head injury occurs. The total injury cost per motorcycle crash is about -- almost $180,000, and of that, medical costs is about $27,000. Yet, most of our research is only looked at medical costs, partially because that's most readily available. An average motorcycle insurance costs $180 a year, and it primarily pays for cyclist property losses. Prices and claims rise with engine size. Sport bikes, followed by touring bikes, have bad loss experience. Auto coverage is

broader than motorcycle coverage, and per VMT, claim costs are higher for motorcycles than autos if you consider all coverages being purchased. Thank you.

DR. PRICE: Thank you, Dr. Miller. Now what we're going to do is we're going to turn the questioning over to our Technical Panel, staff from NTSB. I'd also like to remind the audience that if you have questions, when you came through the door, you should have received some index cards with pencils or if you have pens. Feel free to write down your questions and hand them to the aisles. We'll have NTSB staff members ready to collect those and give them to this table, and we will be asking those questions.

So now I'd like to turn it over to Ms. Carol Floyd to begin the questions from the staff.

MS. FLOYD: Thank you, Dr. Price. Thank you. Thank you for your presentations.

Ms. Murphy, could you tell me what factors can be attributed to the increase of motorcycle sales?

MS. MURPHY: I think generally motorcycles have, have experienced an increase -- they're becoming very fashionable over the last several years, and there’s a lot of baby boomers that are getting back into motorcycling. They got out of it for a little while during the time that they had children and while the children are going out of the household, they're going back to the sport, and they -- I think there's more

discretionary income and generally motorcycle sales follow the economy and since the economy has been strong, sales usually follow along with that.

MS. FLOYD: Okay. As a follow up to this, the sale increases, are riders more or less knowledge about the bikes that they choose?

MS. MURPHY: Motorcycle riders, right now they have more access to find out about motorcycles that they're purchasing. There's more information available online. I know from the owners survey, riders said that they, that they did research on line or they visited a dealership before they purchased their vehicles. So they're getting information that way. If they take a training course, I know that they cover that area pretty extensively. They talk about riding your motorcycle. They talk about riding within your limits and selecting a vehicle that fits your capabilities.

MS. FLOYD: Why do you think the percentage of fatalities is high as among the 30 to 59 age group, either yourself of Mr. Shankar, anybody on the panel?

MS. MURPHY: I think part of that -- I think we can both answer that. Part of that is that there's more motorcyclists out there in that age group. Over the last 10 years, the average age of a motorcyclist went from 33 to 42. There's a higher percentage of the population that are older riders. So it would make sense that a higher percentage of the

total fatalities would be part of that age group. You may want to --

MR. SHANKAR: I think when you look at the data, alcohol is one of the significant factors that we find in that age group, and we also found that this is the age group that tends to ride the larger bikes. So when you look at the interaction of the rider with respect to the stability and how much of an interaction they need to have on riding a bike, and if they're going to have the presence of alcohol with riding, I think it really increases the risk in terms of the kind of consequences they're going to have, and that's one of the things we are seeing. And certainly some of the increases that we can see in this age group can be added to the demographics and the increase in the ridership of this age group.

DR. MILLER: If I could add, the other factors, that the largest growth in people who are riding motorcycles at least for the first time in a long time is in those age groups. So we also have this sort of new rider factors hitting us heavily in those age groups.

MS. FLOYD: My last question is, since you brought up about alcohol involvement, is there any data to show motorcycle accidents resulting in injuries of the 40 plus age group that involve prescription drugs?

MS. MURPHY: I don't have anything available related to the use of prescription drugs. I don't know if anybody else

does.

DR. POLAND: Mr. Shankar, we've heard several different discussions on crashes and why they may result. Do you feel that the fatality data shows that crashes occur as a result of the other driver most frequently?

MR. SHANKAR: When you look at the cross section of the motorcycle crashes, about 45 percent of the crashes are single vehicle crashes. So the involvement of the other vehicle is not there. And then when you take the other 55 percent of the motor vehicle crashes, where there's the interaction of a motorcycle with another vehicle, about 40 percent of those 55 percent involves some kind of -- I mean we can't really kind of get a blame from the crash data that we have in there, but it shows that the motorcycle was going straight when the other vehicle was trying to make a left turn. So if you look at the overall crash -- motorcycle crashes, it comes to about 20 percent of them are instances where the motorcycle was trying to go straight when the other vehicle was making a left turn.

So it's not a majority of the proportion but still there is something that probably they will have to look into as to what really went on in those kind of crashes to get some feel for what we need to look at.

DR. POLAND: And then we were also discussing between Ms. Murphy and yourself, some of the demographics and increases

in ridership, but you had mentioned in your presentation that there was also an increase in motor vehicle registrations as well. Do you think the increase in fatalities in the motorcyclists is a result of the increase in motorcycle ridership, and is that mirroring what you're seeing in the light trucks and passenger cars?

DR. SHANKAR: If you look at the rate either by VMT or registration for passenger cars and light trucks, we have actually seen a decline in the rate in spite of tremendous increase in the registration and the VMT. When we look at the VMT, I note that the motorcycle VMT has really not increased when compared to the registration, and I can't really say what's going on in there, but just looking at the fatalities and the registration, going back as a comparison between '97 and 2004, since we don't have the 2005 registration data yet. The registration increased by about 50 percent for motorcycles whereas fatalities increased by 90 percent. So there is a disproportionate increase in the, in the motorcycle rider fatalities when you look at the increase of the registrations of motorcycles. So there is something -- some phenomenon that is going on to look at the disproportionate increase in the fatalities.

DR. POLAND: Now we've talked a lot about how the lowest number of fatalities was in 1997. And, of course, one of the interesting points is what, what has changed to have

that increase from '98 and then continuing onward. There's a lot of different factors that can be contributing to that. Is there anything that you think of that is pointing directly towards that? Is that an increase in the, in the ridership or the demographics of the riders that Ms. Murphy was discussing or do you think that it's a lot of different factors that contribute to that?

MR. SHANKAR: I think we can certainly attribute some of the increases to the increase in ridership among this age group riders and probably in the larger motorcycles. But certainly the rate increases when we look at like event just mentioned, just now. The rate increases really kind of show that the fatalities have increased at a much higher pace than the increase in the ridership than the registration itself. Once again, motorcycle crashes are -- can happen with different types of scenarios and like I said, a single vehicle crash versus a two vehicle crash has different kind of factors in there. There's alcohol. There's speeding. There are some rider training and licensing issues that attributed, and there is also the fact that some of the people are mentioning, that I have heard is that whether these are returning riders who are riding 20 years back but then stop riding, but had the motorcycle license and came back into that. Unfortunately, our data doesn't really show what kind of training they had when they were riding 20 years ago.

So there are several questions that needs to be answered. What vehicle type, look at the data and what it can show in terms of who these riders are in fatal crashes, and what kind of motorcycles that are being used by these riders. That's pretty much what we are seeing right now.

DR. POLAND: Dr. Miller?

DR. MILLER: Yeah, another extremely important factor here has been the repeal of motorcycle helmet use laws in quite a number of states, and the subsequent rise in traumatic brain injury deaths, in crashes that if the riders had been helmeted, they would have survived. Our helmet usage is plummeting.

DR. POLAND: Thank you. And I think that's also a point that will come out in more detail in the rider protective equipment panel later on this afternoon. I think that's an interesting point.

Mr. Shankar, Dr. Miller had mentioned that NHTSA has published some statistics on helmet effectiveness. What is the current effectiveness that NHTSA assigns to helmets in preventing fatalities?

MR. SHANKAR: Our latest estimates show that helmets are 37 percent effective in preventing fatalities in a fatal crash.

DR. POLAND: And is that preventing any sort of fatalities or only fatalities resulting from head injury?

MR. SHANKAR: The fatal crash data, the FARS data

that we have, doesn't really prescribe the kind of injury itself. So these are just looking at the rider fatalities itself as a whole.

DR. POLAND: Okay. Mr. Shankar, one of the other points that we had talked about earlier was that you were able from the FARS data to break down the fatality information based on engine size. One of the other points of information that you could break down the data by is motorcycle types or models, but you don't typically do that. Can you give me some explanation to help me understand why it is that you look at engine size versus some of the other parameters that you could look at pertaining to the motorcycle itself?

MR. SHANKAR: One of the things, when we look at the actual fatality numbers, whether it's increases or declines, I think we are to be careful as we have heard over and again about increase in ridership. So if we start breaking down the fatalities either by models or makes or the types of vehicles and those types of things, we really need to make sure that we don't attribute either the increase or declines just to one factor itself but look at the exposure which is the denominator and one of the hard things for us to get is the exposure measure either by make or the model types and those kind of information. So without looking at the exposure, just looking at either increase or decline, doesn't really make any sense for us to get a real handle of what is going on in fatal

crashes data.

DR. POLAND: Thank you. Okay. Mr. Shankar, since you brought up some of the denominator questions, maybe we could move onto some questions for Mr. Gillmann since he was addressing some of these denominator data as well. You mentioned that some of the verification of the VMT and the registrations was done by the household survey. How effective do you think that verification is and is there a better way to verify the vehicle miles traveled or motorcycle registrations?

MR. GILLMANN: Well, we certainly try to work with the states to improve the data collection. Every state is different, and they have their own laws and ways of doing things, and it's just an ongoing process, quality control process. I think if motorcycles become more of an issue and people are looking at the data more, than the states will respond and work more closely with their data. Part of the problem we have with registration data, for example, is that we're working with agencies that are not necessarily the Department of Transportation which would be our counterpart, but the Department of Motor Vehicles or other agencies which have their own concerns. And, of course, states have their own ways of defining different vehicle types as well.

In terms of the vehicle miles of travel, I think the states can collect that data. They are collecting more data on the vehicle types and the travel by vehicle types is

particularly of interest because of the truck travel, but the equipment, if it's properly installed, can classify by motorcycles as well. So as more interest is put on motorcycles, I think we will see increased data quality.

The benefit of the National Household Travel Survey is that it's a very independent source of data. As I said, we could over sample for motorcycles specifically to get more information on the trip usage. We have a good sample of the trip of the motorcycle owners but to get specific data on the trips, we would need to increase the sample size to be more confident about that data.

DR. POLAND: Some of the statistics that were shown were that fatalities were highest on weekends. Is the VMT data typically collected Monday through Friday, 9:00 to 5:00 or is it a 24 hour, 7 day a week collection?

MR. GILLMANN: Well, it's a combination. There are the permanent traffic reporting devices, which gather data every day of the year. Some of the portable equipment will only gather data for a week or perhaps for a couple of days. And in those cases, it's true that the State Departments of Transportation are more interested in the Monday to Friday traffic typically. But all these short counts are factored using the permanent data to try to estimate an annual average daily traffic, which would cover the entire year. So procedures are in place to estimate all seasonal factors as

well.

DR. POLAND: So in exploring some of the changes that have happened over the 10 years, Mr. Shankar did a good job of breaking down the fatality rates by a variety of different denominators. Do you think that there have been changes in either registration or vehicle miles traveled and how that data's collected in the past 10 years, that may affect some of these rates that we're seeing for motorcycles?

MR. GILLMANN: I don't think there's anything substantial that would create the changes, the kind of changes we're talking about here. We're seeing more of automatic vehicle classifiers installed by the states. So I think we're seeing gradually that the quantity and the quality of data is improving. But it's not some kind of dramatic change from one year to the next.

DR. POLAND: When did the automated systems become -- start to be implemented?

MR. GILLMANN: Well, they've been around for at least 20 years, and over time, they've gradually improved.

DR. POLAND: And we had spoken on the phone. It appears as though there may be a couple of states that put special emphasis --

MR. GILLMANN: Uh-huh.

DR. POLAND: -- on collecting motorcycle data. Do you feel as those states that put special emphasis on

collecting this data match the trends that you see throughout the other states that may not put as much emphasis on that, on that data collection or are they significantly different in the trends and the numbers that you're seeing?

MR. GILLMANN: We are aware of a few states that have made some special efforts. Wyoming has been mentioned for example, but motorcycles traffic is such a small percent of the total traffic stream, that a slight increase -- it would actually have to be a major increase for it to make a significant difference. We haven't seen that in reported statistics coming from these states.

DR. POLAND: And I guess I have one other question before I pass it onto my colleagues and don't talk too long here, but I know North Carolina had specifically written into the FHWA docket about motorcycle registration data and had noted some discrepancies. I believe it was beginning in 1998, where they had noted that the motorcycle data was not being reported as what they had reported to the Government but was actually being estimated as only a 5 percent increase which was less than what the registration data they were saying was coming out of North Carolina. What steps have been taken to insure the accuracy of the data in terms of quality control and discrepancies such as North Carolina brought up for registrations?

MR. GILLMANN: Well, as I mentioned, we have new

software, and the idea is that as the states fill out this form through automated means, they would receive instant feedback and some quality control checks would be provided, and then we would also be using the software to analyze the data. In general, our policy is that if the state is reporting to the public a figure, we want to be using the same figure. We don't want to be inconsistent with the state, and that is, you know, what we have made known to them. So if there is a difference, we would be very concerned about that.

DR. POLAND: So you think that the new software will give better feedback to the states --

MR. GILLMANN: Yes.

DR. POLAND: -- than what is currently happening?

MR. GILLMANN: Yes.

DR. POLAND: Because it seemed as though North Carolina -- it took sometime for North Carolina to realize that the discrepancy was occurring.

MR. GILLMANN: Uh-huh.

DR. POLAND: And they had mentioned that the software wasn't -- wouldn't be the only cause or wouldn't be the only solution, but rather that it was the step of the quality control in between their reporting and FHWA's detail of what that data was. So you're hoping that that would increase their ability to understand what data you're reporting?

MR. GILLMANN: Yes.

DR. POLAND: Thank you.

DR. SWEENEY: As a follow up to that, what has been done with the North Carolina data specifically? Are you still reporting it as just the 5 percent increase or are you going back to look at the North Carolina numbers more closely?

MR. GILLMANN: Actually, I'm not aware exactly what was done with the motorcycle registration for North Carolina.

DR. SWEENEY: FHWA estimates about what? Five million motorcycle registrations. The Motorcycle Industry Council indicates about 7 million. I think you gave one explanation that perhaps they're not -- motorcycles may not be registered. Are there any other possible explanations for the discrepancy in your two numbers that's open to either?

MR. GILLMANN: You know, we hear anecdotal information about people having, you know, half built motorcycles out in the garage and so forth. But I don't know of any statistical information.

MS. MURPHY: Motorcycles in use from the -- I can't speak to the estimates on vehicle registrations, but on the MIC data, the motorcycle registrations are estimated with a random digit dialing to, I think we call about 300,000 households, to estimate the household -- the number of households in the U.S. that own motorcycles. We do -- we survey the motorcycle owner who we consider the primary rider as the owner, and ask them about each vehicle in the household. Then we go back and code

those vehicles to determine down to what model they are. From that, we estimate what -- we project what the total vehicle population is by type and engine size, and then ask about -- we also ask about their riding, what percent of the time they ride on highway and off highway, and if they ride more than 5 percent of the time either on or off highway, then we consider them to be an on highway rider, if at least more than 5 percent of their riding is done on public roads. So that's the methodology we're using. I'm not sure if we're close on that, but --

DR. SWEENEY: Mr. Gillmann, the National Household Travel Survey, you have indicated that if additional data were collected in an add on survey, we could start looking at the trip type data. Could you expand upon what might be included in that trip data?

MR. GILLMANN: Well, the NHTS survey does collect a fair amount of demographic information, and so that, as far as the motorcycles owners, we have a good data set, but the NHTS is trying to get a sample of the actual trips, and it does sample throughout the year. And so getting the sample of trips is a greater challenge, and to have cross tabulations of the motorcycle trips by the demographic information, we would need a larger sample of motorcycles -- motorcycle owners in order to be confident of those cross-tabulations. So in order to do that, we really need to have an additional sample of motorcycle

owners.

DR. SWEENEY: And what type of questions might you be able to answer with that data --

MR. GILLMANN: Well, whatever --

DR. SWEENEY: -- when you talk about demographics?

MR. GILLMANN: -- questions people think are important. Certainly questions about age and income and education and the standard variables like that but --

DR. SWEENEY: Trip purpose?

MR. GILLMANN: Yes. Trip purpose, time of day, day of week and so forth, you know, whatever people are willing to admit to I guess.

DR. SWEENEY: You said you were in the preparation stages for initiating another survey.

MR. GILLMANN: Yes.

DR. SWEENEY: Do you have any timeline for that when the next one may be started?

MR. GILLMANN: Well, I've been hoping to have the next survey in 2008. We don't have an exact timeline worked out though.

DR. SWEENEY: Ms. Murphy, in your introductory slide mentioned three surveys that your agency conducts, and that was the owner's survey, the retail sales system and then the rider characteristics survey. I think you did a fairly nice job in describing the owner survey in your presentation and indicated

that that's done approximately every five years as well. Do you have expectations of doing another one in the near future?

MS. MURPHY: Yes, we're actually in questionnaire development right now for the next survey, and it will begin right at the beginning of 2007.

DR. SWEENEY: And could you maybe give a brief overview of what your other two surveys would entail?

MS. MURPHY: The other two surveys I refer to in the presentation, well, the retail sales reporting system is not a survey. It's an ongoing collection of sales data from 15 manufacturers who provide sales every month by model. The Motorcycle Industry Council is kind of clearing house to collect that data, and then report for the industry, and the rider characteristics survey was actually a survey that was funded by the Motorcycle Safety Foundation, which is why Dr. Williams spoke to most of the data from that survey.

DR. SWEENEY: Uh-huh. Carol, I have a couple of questions for you. Will the FHWA study be a follow on to the pilot study? Will you be using the same data collection methods for the most part? Is that the plan?

DR. TAN: That's the plan. Hopefully all the kinks will be worked out with the pilot study so that as I mentioned earlier, there will be a seamless transition. We can use the same methodology or, you know, find out what went wrong and take corrective action and move on from there.

DR. SWEENEY: In the motorcycle safety agenda, there were several areas that were brought up and indicates that research needs to be done in these areas, all sorts of areas. The motorcycle attitudes, the design of the other vehicle. Will any of these issues be addressed adequately in the crash causation study?

DR. TAN: We will try to get some of that information but the focus will be more on external factors. If we look at the OECD methodology, there's about 2,000 variables that -- it's fairly comprehensive. We've actually added a few more on the roadway environment, on the driver -- on the rider characteristics. There's quite a bit of information there that will be collected. So we will be able to capture some of that.

DR. SWEENEY: And what sample size, the MAIDS and the Thailand studies had a pretty substantial size.

DR. TAN: Actually, it's our hope that we can pretty much duplicate what was done in the Hurt Study which was actually about 1200. There are some budgetary constraints. So I don't know for sure that we'll be able to actually reach that 1200 sample size. I think our goal right now is to probably get about half of that with the current budget.

DR. SWEENEY: And do you also intend to do a control group?

DR. TAN: Yes. We will be using pretty much the same methodology.

DR. SWEENEY: Dr. Miller, You have looked at the injury data. What are some of the challenges that you encounter in looking at injury, trying to estimate the cost based on these injury data?

DR. MILLER: One of the challenges is that the last time that NHTSA took a sample of injuries to people who were not in tow away crashes, was 1982 to '86. Now fortunately, that's not that big a limitation on motorcycles because motorcycles easily in a crash fair badly enough that they're not going to drive away from the scene but a bigger problem is police under reporting crashes, and we have no knowledge of how much under reporting of crashes occurs in motorcycling. We have some estimates for motor vehicle. We don't know about police under reporting motorcycle crashes. So that's a major difficulty.

The second major difficulty is you might have noticed that I didn't present property damage. I stuck with injury costs. That's because we don't have good estimates that are easily put together of the damage not to the motorcycles. We can get that from the insurance data, but the damage to other motor vehicles that occurs in motorcycle crashes is very difficult to estimate.

DR. SWEENEY: You also had an opportunity to work with the insurance data. Were there any obstacles or challenges in dealing with that data?

DR. MILLER: The obstacle to dealing with insurance data is getting it. You have to go contact individual insurance companies. You have to make a case, and you have to convince them that it's a meritorious case. The motorcycle insurers were pretty cooperative actually which helped. And some of those data we actually purchased as well.

DR. SWEENEY: Are you familiar with the National Electronic Injury Surveillance System?

DR. MILLER: Yes.

DR. SWEENEY: Would that be another alternative database to look at any sorts of these issues in terms of injuries?

DR. MILLER: The sample of motorcycle crash injuries in the NEISS All Injury Program database, which is the one you need to use, comes from 66 hospitals in the United States, which is a small number of hospitals, and so the sample itself would be a lot smaller than you get out of say the Crashworthiness Data System part of NEISS. And the GES System does give us for police reported as crashes a good estimate of the U.S. The other thing about the NEISS AIP System is that I don't believe their motorcycle coding distinguishes on road versus off road crash.

Now you can distinguish that in say hospital discharge data and for some states emergency discharge data, but even though it's coded, sometimes it's missing or unknown

as opposed to coded.

I do think that on fatalities, there's information -- from the National Vital Statistics System, about the nature of the injuries that cause the fatality, that we can't pick up from FARS. We can also try to pick that up from the CDS data though.

DR. SWEENEY: Mr. Shankar, just a clarification question. When you gave the fatalities of riders, that included drivers as well as passengers?

MR. SHANKAR: These are just motorcycle riders, the motorcycle operator and the passenger.

DR. SWEENEY: On the motorcycle, right. It could be a passenger on the motorcycle.

MR. SHANKAR: Right.

DR. SWEENEY: Do you have any idea of the breakdown for that?

MR. SHANKAR: It's about 90 percent of the fatalities are the motorcycle operators and about 10 percent are the passengers riding with the operators.

DR. SWEENEY: Okay. And has NHTSA taken and used the GES data to look at motorcycle injuries?

MR. SHANKAR: We do look at the overall national estimates of injuries from motorcycle crashes using the GES data, and, and that's where we limit it. As you know, GES data is a probability sample of police reported crashes, and trying

to decipher the data any further than that, we have to really look at the sample size especially for motorcycle crashes, knowing that motorcycles are about two percent of the total registrations in the U.S. So the sample is going to be very small, and thereby we are going to have -- which really may not be able to give us the kind of distinction or the trends that we're looking at if you try to break them any further than that.

DR. SWEENEY: Dr. Miller?

DR. MILLER: Like for trend data, you really can't use it for that, but if you want to look at characteristics of motorcycle crashes, what you can do is pull many years of data, and you'll notice in the costing, that we started with 1997 through 2003 data, just to try to get the costs, and you can do the same thing for other crash characteristics described in the CDS data in particular but also GES, but CDS is an investigated crash. GES is just what the police reported.

DR. SWEENEY: Thank you.

DR. PRICE: Is the Technical Panel finished question? Okay. Thanks very much. I'll turn it over to Member Hersman.

CHAIRWOMAN HERSMAN: Thank you very much for your presentations.

I'd like to introduce our Chairman of the National Transportation Safety Board, Mark Rosenker, just to say hello. We may also be joined by other Board Members throughout the

course of the -- I'm sorry. The Vice Chairman is also here, Robert Sumwalt. So we may be joined throughout the course of the forum by Board Members as well as a number of staff from the NTSB.

I'd like to begin my questions. Mr. Over, could you pull up the slide that Ms. Murphy used in her presentation on VMT. Yes.

I know there's been a little bit of discussion on this issue. Ms. Murphy, can you explain why you think there is such a discrepancy between your numbers that have been collected and the FHWA numbers?

MS. MURPHY: I don't know if I can explain the discrepancy. From the numbers that we produce, those come from the owners survey, and the methodology has been constant from 1975 up through the latest survey in 2003, and seems to track with the trends in new unit sales and number of vehicles in use based on scrappage rates and matched to new sales. So we feel pretty confident in those numbers that we have. I think we need to confirm with NHTSA if there are some discrepancies that we, you know, kind of look at where that's at. I don't know what the differences might be or what they might be caused from. We feel pretty confident though on the numbers that -- for VMT, the methodology stayed constant throughout.

CHAIRWOMAN HERSMAN: Would anybody else on the panel like to comment?

DR. MILLER: Yeah. As a user, all my denominator estimates are based on the MIC numbers. I think that the unregistered vehicles are an important factor here. Because motorcycling is not the predominant mode of transport, I think that there's -- and because as we mentioned, it's a weekend mode of transport, and it's a mode of transport that's used a lot on things other than the major roads where we concentration most on measuring our vehicle miles of travel for normal travel. I think that there's a greater potential to have uncertainty in the normal Federal Highway measurements, because I think the nature of the travel is different, and it's not the nature of the travel that they're most concerned with. They're most concerned with how clogged are our roads on the commute to work, not what's happening at 10:00 on Sunday night on a country road.

CHAIRWOMAN HERSMAN: Thank you. I appreciate that. While we're on FHWA issues, one of the things that we traditionally look at is the vehicle, the rider and the environment. And some of the issues concerning the environment have been raised, cable barriers, other issues. I know that you have an advisory panel that's going to be participating in the reauthorization, post-reauthorization era. Can you tell me what issues that FHWA and the advisory panel might be looking at to make improvements to highway design for motorcyclists?

DR. TAN: Well, you had mentioned one of them which

was the guardrail, cable barrier being one of them. Some other issues more in terms of operational, what we call congestion, would be the traffic loop detectors. Typically we hear that motorcyclists aren't picked up by the detectors. Another thing would be some of the treatments we put on pavements, some of the asphalt add mixtures that we use or to seal the pavement, we've heard some complaints about how that can cause problems. Also some of the pavement markers that we put down, thermoplastic can become slippery when wet. Some of the problems we have with raised payment markers that affect passenger cars also will affect motorcyclists as well.

So I think primarily also rumble strips would be an issue. Currently we install milled in rumble strips on shoulders, which help run off the road type crashes for a passenger cars, but they can cause problems for motorcyclists and bicyclists. And there's been some efforts looking into trying to find a compromise that would help the motor vehicles and not be so stressful for a motorcyclist. So some of those are being looked at.

CHAIRWOMAN HERSMAN: So FHWA is looking at these. What is the plan for how to address them? Is there some sort of report or anything that's going to be issued as a result of the Council, the Advisory Council?

DR. TAN: The Motorcycle Advisory Council is actually handled by our Office of Safety, and I'm in the Office of

Safety Research and Development. So that's a separate effort. So I'm not familiar with what their plan is.

CHAIRWOMAN HERSMAN: If you could get back to the Board --

DR. TAN: Sure.

CHAIRWOMAN HERSMAN: -- that would be helpful. One of the areas that you've all addressed is that increasing demographics, the older drivers, making up the population and a lot of them are novice drivers, one of the things that the Safety Board has looked at is medical issues in non-commercial drivers, things as people age, they get more effective cognitive skills, vision, increasing use of medications, prescription medications that Ms. Floyd asked you, if you'll know about. Has there been any effort to look at the effect of age, and when you look at the fatality numbers, the age numbers are increasing exponentially for the older riders. Has there been any effort to look at any of these potential age-related conditions that might present not just increased ridership but other things that might be affecting those older riders? Will you all look at that in the crash causation study, collect information about medical conditions and things like that?

DR. TAN: Well, we will be getting information on alcohol and other drugs. I don't know how specific we can get in terms of an actual prescription per se, but we will be collecting that information if possible.

DR. MILLER: If I might remark. I don't think that's going to be a big issue. This is not 70-year-old riders, and where we're seeing the problems with medical conditions is not in the 40 to 55 age group where there's been this -- the place where I work, bunches of people have been buying motorcycles, and they're very healthy people. They're very well off people. It's the new -- they are people that like a little bit of risk in their life. They've reached an age where they're not able to do the risky things that they used to do, and this is sort of the next step down to something a little less dangerous and a little less physically demanding. But the population doesn't seem to be one that's in poor health from my observation of the growth. And, yeah, there's medication in that population, but probably the issue would be more abusive medication and drugs, and we don't have a good handle on that in automobiles. We're probably going to get it in the next National Roadside Survey for the first time in autos but we're just learning the first steps there, and we haven't really gotten -- NHTSA has been piloting that, and it seems to be working. I'm not sure we're even ready to take it into motorcycling yet.

CHAIRWOMAN HERSMAN: Okay. Well, I just note the fatality numbers in '97 were 87 fatalities for the over 59 age group, and there were 363 last year, and so that age group clearly is riding and the fatality numbers are going up.

Has Oklahoma come up with the money, the matching

money required for the crash causation study?

DR. TAN: Not as yet.

CHAIRWOMAN HERSMAN: So you signed an agreement as of September but you don't have a match?

DR. TAN: They have about 60 days to come up with a plan for that match.

CHAIRWOMAN HERSMAN: What happens if they don't come up with it?

DR. TAN: We'll have to discuss that with our contracts office. We don't really have a plan as of yet what to do.

CHAIRWOMAN HERSMAN: And Oklahoma doesn't have any motorcycle experience. What -- how are they going to handle that issue in doing the crash causation study?

DR. TAN: They'll primarily contract it out. There will be some involvement in terms of the statistical analysis and some of the data collection, but the expertise will be subcontracted.

CHAIRWOMAN HERSMAN: Okay. And there's been a lot of discussion about the OECD common methodology which was also used in the Thailand and the MAIDS studies. Are you all going to be strictly adhering to all of the tenants and requirements of the OECD methodology?

DR. TAN: To the extent practicable. We've renamed some of the variables to be consistent with U.S. terminology.

Some of the variables we have to collect just because it's in the methodology, but as I mentioned earlier, we've added some roadway variables, roadside variables but pretty much we'll have to stick to the methodology.

We have not really decided how we'll collect the control data yet. That's still kind of up in the air. And that will rely on the results of the pilot study for that, to make that determination.

CHAIRWOMAN HERSMAN: And why has there been a decision to do two separate studies, the pilot study and the causation study? Why not combine forces and move forward on one?

DR. TAN: NHTSA had actually begun the pilot study before the legislation had mandated Federal Highway begin the motorcycle crash causation study. In essence, they're going to operate as one large study. Contractually they're two efforts but basically we are coordinated, and the pilot study feeds into ours. So once we've got some of the data initially collected under the pilot study, we can pretty much move forward more on the main study.

CHAIRWOMAN HERSMAN: And the NHTSA study that will also be adhering to OECD methodology as well?

DR. TAN: Yes.

CHAIRWOMAN HERSMAN: How about the training portion, the requirement for the 12 weeks of training for the examiners?

DR. TAN: That we may reduce to nine weeks. It's a matter of practicality. Again, we need to get moving on the data collection. We'd like to do the full training, but in terms of practicality, we may have to shorten it.

CHAIRWOMAN HERSMAN: Okay. Dr. Miller, one thing that I would like to follow up on with you, has to do with how we assess the value of fatalities versus injuries. When we have used data that's provided by NHTSA, the cost to society for a fatality is valued about $1 million, and an injury number is something less than that. Given your experience and the information that you've looked at, does it make sense to use the same type of data that we're using for car fatalities and injuries or should there be some different calculation made for motorcycles?

DR. MILLER: Actually, if you look closely at the NHTSA economic cost of crashes where you find an appendix, which are the numbers that they use in regulatory analysis, I personally think that NHTSA does a real disservice to the highway safety advocate because the numbers that are in that appendix are three to four times the numbers that are in the main report because they include the value of quality of life. The U.S. Office of Management and Budget since 1989 has said that if you put a dollar value on saving a life in regulatory analysis, you must use a method that includes the value of quality of life. NHTSA does that with a funky calculation that

the Institute of Medicine in their report last year very much said they didn't think was a very good calculation. But they do it in sort of a very closed form. They put the values in, they calculate the value of an injury relative to a fatality with the quality of life in the calculations, and then they just put fatality equivalence in their report and don't put a dollar value on them because they find it offensive to put a dollar value on a life.

The rest of the Highway safety literature has been putting a dollar value on a life since around 1986 or '87, and the Department of Transportation itself, in its regulatory analysis guidance, puts a dollar value on lives and on injuries that includes the quality of life and has done that for over 10 years.

CHAIRWOMAN HERSMAN: That's more of a general issue and I think it's a point well taken. Specifically though, should the calculation for injury, motorcycle injury use a different calculation than the injury number that they're using for passenger cars?

DR. MILLER: The calculation should be done the same. They should both be done with quality of life and all our numbers are published with quality of life, and if you look closely, you can find the numbers with quality of life in the NHTSA report as well. It's just the thing that they put out in their press releases doesn't have it.

CHAIRWOMAN HERSMAN: Okay. And those values are different when you compare motorcycles to cars?

DR. MILLER: The cost per crash, for fatal crash, is about the same. The cost for a fatality of somebody age 38 years old, it doesn't matter whether they were killed in a motorcycle crash or auto crash. The cost of injuries differ because the mix of injuries differ, and the average cost per injury in motorcycle crashes are a lot higher than the average in an auto crash.

CHAIRWOMAN HERSMAN: That's what I was looking for. Thank you. Thank you very much. Dr. Ellingstad and Mr. Magladry.

DR. ELLINGSTAD: We have a number of questions following up on estimates of vehicle miles traveled and let me just kind of sort these out, and I think some of them perhaps have been discussed but let's make sure they're clarified.

First of all, the differences between the MIC and the NHTSA fatality rates is due to differences in estimates for the denominator. Is that true? And the MIC is out of the owners survey estimates of miles traveled and the NHTSA is from the Federal Highway essentially traffic count data?

MR. SHANKAR: That's correct. The vehicle miles traveled and registration data is published by Federal Highway and that's what we use for all of our crash rates.

DR. ELLINGSTAD: Okay. And there have been some

others about variations and essentially the sensitivity of the Federal Highway estimating system. Mr. Gillmann, could you comment just a bit about how standard that methodology is from state to state. You say you're -- I believe that you had indicated that you have data from 43 plus states that goes into the -- that basically comes from traffic counts. Is that correct?

MR. GILLMANN: Yes. AS far as the total vehicle miles of travel, there is a very standardized methodology and the Federal Highway's traffic monitoring guide goes into detail about that, and the HPMS field manual also gives specifics.

For the vehicle miles traveled by vehicle type, the HPMS has a section called summary data, and there the states are asked to estimate the proportion of travel by vehicle type on I think it's six different roadway types. How each state does it is probably different, but it's based on their data from automatic traffic --

DR. ELLINGSTAD: Is there a technological issue with respect to being able to detect two-wheeled vehicles as opposed to vehicles with a lot more wheels?

MR. GILLMANN: Well, there are a number of issues in terms of the automatic vehicle classifiers. Let me just say right up front, the main thing is that there are fewer of them on the roads. So the data source is less.

DR. ELLINGSTAD: Fewer of?

MR. GILLMANN: Fewer of the automatic classifiers --

DR. ELLINGSTAD: Okay.

MR. GILLMANN: -- are out there. So the geographic spread is a lot less than your typical counters, whether they're permanent or portable. So in order to estimate the total VMT for a statewide system, they have to use whatever information they have plus their total vehicles miles traveled to break it up by vehicle type. So that's one reason we have emphasized getting more of the vehicle classification data. In fact, we have said we will waive the state match so that they can purchase and install automatic vehicle classifiers.

DR. ELLINGSTAD: Are these installed on your permanent stations or are these used in your portable temporary --

MR. GILLMANN: Both.

DR. ELLINGSTAD: Okay.

MR. GILLMANN: In terms of the devices themselves, there are certainly challenges in automatically classifying vehicle types. The greatest challenge is distinguishing between a light truck and a passenger car. There are challenges in terms of trucks, truck heights. Are motorcycles more challenging that than other types? I don't think they're more challenging. About average shall we say. Some things can happen, for example, a five axle tractor trailer can be picked up as a three axle truck and a two axle motorcycle, and that's

just a question of adjusting equipment, the sensitivity, the time out, and so forth.

DR. ELLINGSTAD: Is there a concern with respect to the differential sensitivity of these kinds of estimates as a function of roadway type, city streets as opposed to rural roads, et cetera?

MR. GILLMANN: Well, I mean there's a concern in general of data quality. It's true the states are more interested in the higher volume roads, and certainly that's where a greater amount of devices are placed. I guess I'm not quite sure what you're getting at.

DR. ELLINGSTAD: Well, we have a set of questions here that basically are concerned about the goodness of our estimation of the denominator of these terms for rates, and we seem to have something between a survey on the one hand, a self-report, and some mechanical methods of capturing that data, and there seems to be some concerns with respect to the validity of both.

MR. GILLMANN: Well, that's one reason I emphasize that the NHTS household data would be good not only as a check, but also to get a better handle on the trip characteristics of motorcycle trips.

DR. ELLINGSTAD: Okay. I'll hand it to Bruce.

MR. MAGLADRY: Good morning. As you might imagine with your short presentations, or relatively short

presentations, lots of information has been left out and, of course, the questions that I've gotten this morning are people interested in parsing that information a little bit tighter than you had to do this morning. So I'll jump around a little bit but there are a number of interesting questions.

One of them addressed to Mr. Shankar, to what extent can the increase in the over 40 crashes be attributed to a simple population demographics that there are more and more people over 40?

MR. SHANKAR: If you'd turn back to the slide 12 if you can get it on here. Since we don't have any registration or vehicle miles traveled by age group, I tried to use the U.S. population as one of the measures for the exposure itself. When you look at the 40 to 49 age group, and go back to the last 10 years, the rate has increased from just about 1.1 to over 2.2. It clearly shows that even after accounting for the increase in the population itself, there has been an increase in the fatalities because the rate obviously has gone up more than twice. So it clearly shows that there is a disproportionate number of fatalities in the age group, but when accounted for the exposure itself, and that's the only exposure measure that we could probably do by age group.

MR. MAGLADRY: I have some additional questions for you. How many of the fatalities, if we know, are from unlicensed riders?

MR. SHANKAR: Our data has shown that when you look at the combination of the licensing itself and also the fact that the motorcycle riders have to have an endorsement to ride a motorcycle, about one in four of fatal crash are improperly licensed, which is a combination of like I said, either they didn't have a license or they didn't have an endorsement. And if you try to slice between the two, it's about 15 percent of them didn't have the license and about 10 percent of them, 10 to 12 percent of them didn't have the endorsement to ride a motorcycle in a fatal crash.

MR. MAGLADRY: And along that same line, are there any numbers to indicate the prior experience of motorcyclists involved in fatal crashes?

MR. SHANKAR: Unfortunately our data doesn't collect the rider experience or, you know, what kind of further education they had. So we wouldn't be able to really look at that aspect of the fact that we would probably want to look at.

MR. MAGLADRY: I think this probably is directed to Dr. Miller but I'm available to answers from anyone. How does taking a motorcycle safety course improve accident rates?

DR. MILLER: We're still learning that. There's one study in California that says that it does improve accident rates but there are a number of reasons that that study is suspect from a technical viewpoint. I'm not familiar with the literature for the last three or four years and there may be

something new out there that has looked at it. But the answer, the last I looked at the literature, is we really aren't too sure. We do know that when the -- that some of the stuff that's rider skill stuff, was pretty well validated when it was originally developed, Jim McKnight at our organization developed that 25 years ago, when he developed both the first motorcycle course and the motorcycle licensing test. And some of that work at that time was shown to be quite effective. There's not been a lot of replication since, and the part that was effective was the training on specific riding skills is my recollection, but I might be wrong on that.

MR. MAGLADRY: For anyone on the panel, there are a number of questions that have to do with causation of motorcycle accidents. One is, what is the role of the rise of sport utility vehicles in motorcycle crashes? How's that impacted motorcycle accidents?

MR. SHANKAR: We have not looked at, like previously mentioned, we have not looked at the kind of bikes and rise in the fatalities in the different kinds of bikes like sports bikes, cruisers and those kind of things, and one of the reasons for that is we really need to get a handle on the exposure. Just because there's a decline or an increase in the fatalities in a certain model or certain type of bike, doesn't give us a good answer, a good handle on that because we don't know the exposure. There may be many more of the sports bikes

on the road, and that may be the reason why the numbers are going up on those, and without the exposure measure for us, to break it down by the kind of bikes, it really doesn't give us any kind of an answer. It basically leaves more questions to answer, and actually we've not looked at that.

MR. MAGLADRY: I understand.

DR. MILLER: If I could add on that?

MR. MAGLADRY: Yes, please.

DR. MILLER: Though there's not studies out there, if you think about what you know about all these left turning vehicles, straight motorcycles, a lot of the problem here is the drivers don't see motorcycles. They don't look in -- the way we look when we look over our shoulder, captures a car, but we don't see the smaller vehicle. A SUV being bigger, conceals the vehicles behind it more, and it also means that -- I know when I drive behind an SUV, it makes it much harder for me to anticipate when I'm going to have to stop suddenly. That has to affect a motorcyclist who is more vulnerable because they don't have a steel wall around them. What for me might be a small fender bender because of that for a motorcyclist might be catastrophic. So I think that the SUVs, just by sheer thinking about crash geometries, have to be a factor here.

MR. MAGLADRY: There are a couple of other questions along those same lines. Someone has asked the question about the statistics involving single vehicle accidents and animal.

Motorcycle accidents and animals.

MR. SHANKAR: In terms of fatal crashes, we did a report about five years back looking at single vehicle crashes, and I don't think we found any data to substantiate that animals were in any a major factor in, in single vehicle crashes.

MR. MAGLADRY: Dr. Ellingstad would like to go along the same lines.

DR. ELLINGSTAD: Yeah, we have a few others here that have to do with the, the accident data themselves. Now, first of all, let's clarify that the data, Mr. Shankar, that you're dealing with are principally FARS data. Is that correct?

MR. SHANKAR: That's correct.

DR. ELLINGSTAD: And are these data provides sufficient kind of a resolution to get at in any sort of a detail these issues of causation?

MR. SHANKAR: The FARS data is -- the information in the FARS data basically comes to us from the police accident reports, which is provided at the state level. All that we do is we collect the data and recorded it to one standard format. And I think the police accident reports in every state is different but to a large extent, they do give us at least some feel for what may be the cause of the crashes in there, without really assigning what was one factor in the crash. So they do give us some sense of, of what we need to look at when we look

at some of these fatal crashes.

DR. ELLINGSTAD: Mr. Miller, would you care to comment on the resolution those kinds of data for purposes that we're talking about?

DR. MILLER: If you think about it, whenever there's a fatal crash, you often find the road closed for a few hours while the police investigate. The fatal crash is probably the best police report. It does include both the first harmful event and the most harmful event for example, and then if you then go to CDS, you can often find even additional details that the police don't collect. And I think that we do have at the same time, you don't really get the ability to make a total determination of what happened in that crash, out of that level of investigation.

Now there have been some studies through the code system where they have gone -- Codes is the thing where the -- with the Sirens. Actually, it's with the CIREN System and the Code System combined, where they have gone and looked in depth at motorcycle crashes in a few states at times as well and particularly in fatal crashes. So there is a reasonable amount of stuff out there, if one sat down to do a focused analysis. I'm not sure that I know of anybody in the literature who's done that other than out of those focused studies with the CIREN Centers.

DR. ELLINGSTAD: Dr. Tan, relative to the Hurt Study

and the other studies as well as the ones that you're preparing, will you comment on the resolution of causative detail that you're --

DR. TAN: Well, these will be on site scene investigations. So there will be a lot more detailed data that are collected, not just from the police accident report forms. It will be much more detailed.

I wanted to comment on the police accident reports. You actually have the physical report, and then you have the computerized coded file, and a lot of times, in order to do more detailed investigation analysis, you can't just use the computerized files. You actually have to go look and read the narratives that are on the police accident report forms. So anyone who wants to actually do some type of research study, just looking at computerized, summarized data that comes off of FARS, is going to actually be missing a lot of data that just there's actually no way to code the narratives and illustrated drawings that are included on those police accident report forms.

But in our study, and in the past studies as I mentioned, these are in depth on scene investigations, a much more level of detail collected.

DR. ELLINGSTAD: Okay. Thank you. And finally, Mr. Shankar, along those same kinds of lines, you've provided us a lot of information about the age distribution of riders

and these kinds of factors. Have these studies shown much about the sort of roadway environments that these accidents are happening on and are particularly with respect to the kinds of relationships that you've been talking about with respect to the size of the motorcycle and the age of the drivers, are they, are they happening on different kinds of roadways or are these all out on mountain roads or are they city streets or --

MR. SHANKAR: We released an updated report in July this year looking at the motorcycle crashes, looking at various factors. Over 80 percent of these fatal crashes occur on two lane roads, and we have found that about half of the fatalities occur on rural roads. So we have looked at the types of roadways and where they occur within this report itself.

DR. ELLINGSTAD: And you had mentioned I think earlier that you had about 45 percent of these were single vehicle crashes. And is the proportion of those higher on these rural roads?

MR. SHANKAR: I think that the proportion of -- I don't remember the exact numbers on those, but when we did a report about five years back on single vehicle crashes, we did find that a higher proportion of the single vehicle crashes were on rural roads, but I don't remember the actual numbers off the top of my head, but we have looked at the single vehicle crashes itself and done a comprehensive report on that about five years back.

DR. ELLINGSTAD: Okay. Thank you. And one final one in my pile here to Dr. Miller. Could you just very quickly comment in some specificity about calculating the quality of life value?

DR. MILLER: Yeah. It's done separately for -- we start out by getting what people routinely pay for a small change in their chance of being killed or injured, and economists have done 67, 70 studies like that. And so what we might find is that each of 10,000 people pays $300 for an airbag that reduces their chance of being killed by 1 in 10,000. Overall, that implies that to save one's life on a statistical basis, we'll spend about $3 million. Actually in current dollars, probably about 4 million is what we'll spend. Some people would estimate it at more like 5.

Then we break that down with non-fatal injuries by using what are called quality adjusted life years, which are a measure that's used in clinical trials routinely in medicine, that look at sort of the percentage of your functioning that you've lost because of your health condition and the value you place on that functioning. And so we apply that to the other value.

Now that quality -- that value that I just gave you includes the work loss as well as the pain and suffering, loss of quality of life. So we subtract the work loss out as we do that calculation.

DR. ELLINGSTAD: Okay. Thank you.

MR. MAGLADRY: Let me finish up with a few more, and we're I think about at the end of our time here.

Dr. Tan, if you might, can you give me an idea of the education and training that's provided to law enforcement officers that investigate motorcycle accidents?

DR. TAN: I'm sorry. That investigate what?

MR. MAGLADRY: Motorcycle accidents.

DR. TAN: Okay. I'm not familiar with that. That's -- historically NHTSA has done those types of investigations and not Federal Highway. I would have to defer to Umesh to actually try and cover that.

MR. SHANKAR: We have another group of people who do the special crash investigations. I'm not familiar with what kind of training they're provided. So we may have to get back to you on this question.

MR. MAGLADRY: Is the proportion of the population of large displacement motorcycles involved in fatal crashes, is that proportional to their numbers in the general population of motorcycles?

MR. SHANKAR: It comes back to the exposure measurement. We really don't have a handle on the number of motorcycles of these engine size on the roadways. So without a real handle on that, we really don't know what's really going on and that's probably another part of the question that we

need to get some answers on.

MS. MURPHY: I think we could. I think it was slide 20 on the ownership. This is -- yeah. This shows engine cc size of the vehicle population. This is in 2003, and compares it to the percent of fatalities. So you can get some idea that it generally follows along with the vehicle population.

MR. MAGLADRY: Thank you. One of the questions I have has to do with helmet laws. Is it true that in every state that has repealed its helmet law there's been an increase in fatalities regardless of how you look at it, either motorcycle miles traveled or registered motorcycles, those sorts of things? Is there an increase in motorcycle fatalities when helmet laws don't exist?

DR. MILLER: There is the one exception to that, is that back when we passed the helmet laws, it was some of them passed at a moment when there was a lot of economic downturn, and there was a downturn in motorcycling. So you did find that per vehicle mile of travel, fatalities went down, but there were some analyses done that just looked to promote a motorcycle, people weren't riding their motorcycles because it was the middle of a recession, and so there were some very bad analyses that tried to claim that when the helmet was passed, it went up.

There are also some analyses that were circulated on Capitol Hill that had no basis in fact, that claimed that

fatalities had not gone down when the motorcycle helmet laws were passed, but it turned out that there was no study behind them. People had just made up the numbers and circulated them, and the series of Congressmen entered them into Congressional hearings. We tried to correct some of that, in some of those hearing records because we had actually looked at the data on all the states when the helmet laws passed.

MR. MAGLADRY: Is there an increase in fatalities in those states that had helmet laws and then repealed those helmet laws?

DR. MILLER: Yes, there is.

MR. MAGLADRY: Is there a corresponding injury data that's increased?

DR. MILLER: I don't know of anybody who has done those studies nationally, but in the individual states where we've looked, we have found a corresponding increase.

MR. MAGLADRY: And one last question that I'll ask, are there any states where the fatalities or injury rates have decreased rather than the national average that we've all discussed which is increasing? Is there any individual state where that's gone down?

MR. SHANKAR: When you look at the fatality rate within an individual state, when comparing it to year to year, there are always some spikes depending upon various factors, but we have looked at the trend for the fatalities by state,

and we are generally seeing an increasing trend in the states, when you go back to the last 10 years of the data in there. In fact, that was also presented in the report that was published in July of this year.

MR. MAGLADRY: Thank you.

CHAIRWOMAN HERSMAN: There were an awful lot of very good questions, and Dr. Ellingstad and Mr. Magladry tried to aggregate some of them. We probably are not going to be able to ask each question separately, but we will maintain all of the cards that the questions have been submitted on and include that as part of our work going forward.

I'd like to thank the panelists very much for their presentation. I hope you all will remain available in the future for us to follow up with you should we have additional questions.

We'll now take a 15-minute recess, and we'll come back at 10 'til.

(Off the record.)

(On the record.)

CHAIRWOMAN HERSMAN: If people would take their seats we're about ready to begin.

Dr. Price, will you please introduce the second panel?

DR. PRICE: Certainly. Our second panel today will be on vehicle design, and will be led by Mr. Wayne Curtin from

Harley Davidson, followed by Mr. Tom Baloga from BMW, Mr. Jay Joseph from American Honda, and Mr. John Zellner for Dynamic Research. I apologize that we do not have name tags for Mr. Curtin and Mr. Zellner. They will be arriving shortly.

I'd also like to introduce our Technical Panelists for this section, Mr. Doug Brazy, Mr. Dennis Collins and Dr. Kris Poland, and we'd like to start our presentations for this panel with Mr. Wayne Curtin from Harley-Davidson. Thank you.

MR. CURTIN: Thank you, Jana. Member Hersman, I appreciate your having this opportunity for us to come testify today. We're very happy to be here.

My name is Wayne Curtin. I'm Director of Government Affairs at Harley-Davidson Motor Company, and I'd like to talk a little bit about our concept, Harley-Davidson's concept in support of motorcycle safety.

Harley-Davidson has approached motorcycle safety as an integration of three factors. It's the vehicle, the environment and the human behavioral side, and you can't just focus on one of those areas is our belief. You have to take all three into consideration and in doing that, you'll come up with effective solutions and ones that will have acceptance in the marketplace.

The sources of data and input that Harley-Davidson as it uses as it looks at motorcycle safety are motorcycle safety

organizations, activities and road safety organizations, consumer input and feedback, internal R&D, internal test rider feedback, and then Government data and studies.

In regards to motorcycle safety activities, the safety organizations and activities, we have a number of leadership positions. We have a volunteer state safety coordinators program that's run through our Harley Owners Group. We donate helmets to rider education programs. We have the Harley Owners Group and also our BRAG which is our Buell owners group, do reimbursement and incentive programs to take rider education. We have Rider's Edge for the Harley-Davidson Academy of Motorcycling where we do rider education through our dealerships, and then we're also very active in the development of harmonized global technical regulations, mainly through Working Party 29 in the UN System.

We're a founding member of the Motorcycle Safety Foundation, a corporate member of the National Association of State Motorcycle Safety Administrators. We have a regular ongoing relationship with, with NHTSA and FHWA, in particular through their quarterly motorcycle safety network meetings. We've had representation on the Transportation Research Board's Committee on Motorcycles and Mopeds, very actively involved in the Society of Automotive Engineers on the Motorcycle Committee, and there's several other safety associations we're involved with.

Our volunteer safety coordinators are 15 people around the country. They're just that. They're volunteers. They cover several states each, who go out to different rallies and events. For instance, over the Labor Day Weekend, I was up at the Utah HOG Rally, and during that rally, the volunteer state coordinator that covers that area, ran four experienced rider courses. So it gives a chance to get out and do those types of activities at the rallies. They made hundreds of presentations to HOG chapters. They've had over 1100 contacts with HOG chapters, facilitated a lot of group riding courses and presentations on the Ride Straight module, and then also they go out and give presentations to civic organizations and other motorcycle organizations.

Since 1977, Harley-Davidson has donated helmets annually to rider education programs around the country, and we've donated over $300,000 worth of helmets in that program. Since its inception, our Harley Owners Group and Buell Riders Adventure Group have offered reimbursement incentive programs to encourage their customers -- their members, to take rider education courses on a regular basis. Although the program began in 1983, we didn't really start getting good recordkeeping on how much the reimbursements were every year until 1990, but since 1990, we've reimbursed and provided incentive things like pins and patches and those types of things, to about 74,000 members to get them to take rider

education on a regular basis.

Rider's Edge is the Harley-Davidson Academy of Motorcycling. This is a corporate and dealer funded program in which we offer rider education programs through our dealerships. We kicked off the Rider's Edge Program in 2002, and the core of that is the new rider course, which is comparable to the basic rider course in the MSF programs. In that, since we started that in 2000, we've actually now trained a little over 90,000 students in the program. We have 135 dealers around the country that offer the program, and we have about 800 people who are rider coach trainers, that teach in that program.

We also have the Rider's Edge MSF Guide to Group Riding, and we've had over 8500 participants in that program, and then in 2004, we launched the skilled rider's course which is our version of the experienced rider's course, and we've had about 750 students go through that last year, and we also are operational in the United Kingdom in exploring other international activities.

So in these areas that I've just covered, each of the aforementioned activities provides Harley-Davidson the opportunity to discuss safety matters with consumers and experts alike. It identifies the areas with the most potential for improvement, and this includes possible vehicle design changes that are likely to be accepted in the marketplace, as

we get that feedback from the customers.

For our internal R&D, we do a tremendous amount of product validation testing. We put approximately 3 million miles a year on road testing of motorcycles in testing the safety components of those motorcycles. That works out to roughly about 600,000 miles per platform. In other words, our Touring bikes, our Dyna line, our Sportster line, our V-Rod line and our Soft Tail line, and we also do a little over 2 million additional miles of tests on vehicle stands when we're testing those vehicles.

There's almost 450 full-time, salaried employees who are dedicated to this testing, and that includes 126 people in lab testing and 218 who are at our vehicle test sites on a full-time basis working on these motorcycles.

We also have what we call customer driven feedback from our test riders. Our test riders are trained to approach the motorcycles and respond to them and give us feedback as a very highly discriminating customer. And so as they come off of a shift of testing, they write very extensive reports and give us feedback on the operations of the motorcycles, and then we have 104 years of motorcycle development and experience that has allowed us to refine our motorcycles over a century.

Harley-Davidson emphasizes and seeks feedback from its own internal resources, and these include beginning and professional riders, subject matter experts and avid motorcycle

fans trained to be highly discriminating. Participation of these external groups and events is encouraged, and we have processes to capture and leverage their insights and we heavily utilize those.

The other source of information that's valuable to us as we look at motorcycle design is the Government data and studies. And the major crash causation studies that we've relied on, one has been the Hurt Report, which was concluded basically in '81, but there were a couple of follow up reports that came out of it through '83, that we used some of that as well. And then there's the European MAIDS project which you've heard about earlier today, and we'll hear more in later presentations that was concluded in 2004, that utilizes the OECD common methodology, was co-funded by the European Commission along with riders groups and manufacturers supported that as well, and it really expanded on the work pioneered by Professor Hurt.

The data that is provided by the Government is extremely valuable. For us, the Hurt Report led to many improvements in motorcycle safety, but it's now 30 years old. The MAIDS data, which is good data, but it reflects a little bit different environment. It's European roadways, European drivers, and a different vehicle mix.

And so we were hoping and would encourage that the new comprehensive U.S. crash causation study that FHWA is

working with, is MAIDS compatible, that is done on the OECD methodology, and we believe if that happens, it will provide us with some very critical information that will be valuable for motorcycle safety in the future.

So our approach is that we're data driven. It enables issues to be quantified objectively. In other words, is there really a problem or is it just a conjecture? What is the root cause or is it just a reoccurring symptom? It enables a more complete description of the situation, and allows powerful tools to be leveraged to evaluate proposals using representative conditions.

The obstacles to development are a lack of representative data, the low lack of funding of any study in the United States since the Hurt Report, the problems between compatibility and U.S. data with the MAIDS Report, and then the lack of some of the representative methods and systems to measure effectiveness.

We also have concerns about misinformation or I would say is not full information. You heard a lot of discussions today about the vehicle miles traveled equation. We have serious concerns about that, in particular how that has been reported consistently at a pretty flat or declining level over the last 10 years when motorcycle sales and the number of registered motorcycles has been expanding dramatically during that time period, that is counterintuitive as to how those two

could be mixed together in that light.

We also are concerned about the definition of motorcycle accidents. One of the things that came out of the MAIDS Report, and I'll talk about a little bit more, is that 62 percent of the accidents involving powered 2-wheelers had primary contributing factors other than the powered 2-wheeler or its rider. So 62 percent of the accidents were something other than the vehicle or the rider itself.

And we also have concerns about conflicting global regulations, which cause trouble, problems in the development of good effective measures, when you're having to do different things for different countries, and it makes it a little bit more challenging for manufacturers to develop products in that environment.

I'm going to talk a little bit of case in point in conspicuity and lighting. The motorcycle conspicuity has been identified by several countries and markets as an area of interest, including the U.S. and EU. Webster defines conspicuity as the quality or state of being, and being obvious to the eye or mind or attracting attention. A common model that's used in looking at conspicuity is the NASA Midas Model, where you have to move through a process of detection to the collision estimation, what's the speed distance, to decision making. Do you go, no go, to motor response, actually taking some of the actions and then the task performance to actually

avoid the collision.

The Hurt Report and the MAIDS data had a number of significant findings that were very common to each other. One is that 73 to 75 percent of the accidents happened in the daylight, 84 to 90 percent of them happened in clear weather, 75 to 80 percent of them were two vehicle collisions, and 71 to 77 percent of those happened in the 11:00 to 1:00 position at the front of the motorcycle.

NHTSA has a conspicuity study that's been ongoing. The final report is not out yet, but the preliminary findings do not identify any lighting treatment study as statistically significant improvements. Visibility and comfort treatments are inversely related. In other words, as you increase lighting, if that's the way you're going at it, it creates more glare for oncoming riders. And then also you have the behavioral study shows that cars make left turns in front of motorcycles with a 12 percent less gap than they do with other vehicles. And then another point of interest is that Canadian drivers seem to have accepted a larger gap in what is acceptable to turn in front of another vehicle than U.S. drivers have.

When it comes to lighting regulations, there's a number of areas in which we work. One is the Federal Motor Vehicle Standard 108 which specifies required lamps and installation requirements, but it does allow for optional

lighting, if it does not impair the effectiveness of the required lighting system. So we can have other lighting treatments that are added to the motorcycles beyond what is required by the standard. You have the U.S. regulations where nearly half the states require daytime running lights but all the manufacturers have had the headlamp on during the day since I think it's 1977. And then per the Motor Vehicle Standard 108 and SAE, dedicated daytime running lights must automatically turn off when the headlamps are on. So you have some kind of different treatments of the lighting there.

With the UN and the ECE regulations, we have a different environment there because they specify a minimum required amount of lights and the maximum allowable lamps but then we're not allowed to put or the customer is not allowed to put additional lamps or lighting on the vehicles, and then daytime running lights are not allowed on motorcycles at all.

Photometrics and color of the DOT SAE approved lights are not completely consistent with their ECE counterparts. So again, that's the challenges we have in the regulatory environment.

And then installation requirements are not completely consistent, and there's some ongoing rulemakings in that environment that are going to be a little problematic for us.

In conspicuity and technical challenges, the lighting treatment must provide effective road illumination, effective

single intent and actions to other road users, let them know you're going to stop or turn, must enhance the detection by the road users in all ambient conditions including daylight, while avoiding glare, and comply with relevant regulations in each market, and be able to be fitted to motorcycles and withstand the environment in which they'll be exposed. There's a lot more exposure for vibration and weather on some of the lighting on motorcycles than you might find in cars, and so it's a little tougher environment to develop some of that. And then it must meet the demands of the customer in durability, in styling and in cost.

Other considerations are that multiple conspicuity solutions may be required to address the perceived motorcycle vehicle design issue due to regulatory requirements. According to the MIC, there were 8.8 million motorcycles in use in the U.S. Now that was all motorcycles including off road motorcycles and as you heard Pat talk about earlier, their estimate there for on road motorcycles is right about the $7 million number, and again, the sales are climbing dramatically year after year.

Many motorcycles remain in service for a long period of time, and the impact of new technology, even if available today, may not be significant for years. Again, motorcycles are in use for a long time, and then other effective solutions such as training and education campaigns may be very helpful as

well.

This slide I just wanted to show because it's some of the information from the MAIDS data, and one, you'll see that 87 percent of the accidents were attributable to human behavior, either the operator of the powered 2-wheeler or of the other vehicle. It was less than 1 percent of the accidents were attributable to a vehicle defect or the vehicle itself.

The other thing that I think is interesting about this slide is when you look at the difference between the green and the blue bars on the -- especially the perception of the other vehicle driver, in which 264 of those accidents, the driver of the other vehicle did not have a motorcycle endorsement, whereas with only 43 of those cases, did the operator of the vehicle who violated the motorcyclist's right-of-way, have a motorcycle endorsement. And you notice that that line is consistent there when you have decision failures by the operator of the other vehicle in the other areas.

And so again, as we look at the conspicuity part of it, in noticing motorcycles, as part of the solution to that problem has to be how do we get at the drivers of the other vehicle to get them to look for the motorcycles because this data is pointing to the fact that people just -- they're not a motorcyclist and they're not looking for motorcycles when they're on the road. That's some of the things we'd like to get at in some of the other discussions here over the next two

days.

So in conclusion, Harley-Davidson is committed to promoting safety in the motorcycling experience. In order to accomplish this, vehicle design is a critical element but one that cannot be isolated from the environment in which the vehicles operate, or without consideration for the behavior of riders and those of the drivers around them. By relying on data, proper analysis of motorcycling experience can be performed and opportunities for the most effective and significant improvements identified, we are hopeful that the soon to be performed FHWA crash causation study will be properly executed and significantly add to the data available in the U.S. And that through our work activities, we will work to improve motorcycle vehicle designs that will be both accepted in the market as well as compliant with all applicable regulations.

I appreciate the opportunity to speak to you all today and look forward to your questions later in the day.

DR. PRICE: Thank you, Mr. Curtin. Our next panel presentation today will be from Mr. Tom Baloga, from BMW. Mr. Baloga.

MR. BALOGA: Thank you for the opportunity to make a presentation. My name is Tom Baloga. I'm the General Manager of Safety Engineering and ITS for BMW. BMW not only manufactures automobiles, but also motorcycles and we are very

happy to be able to have a chance to use the experience with vehicles and motorcycles to cross-pollinate so to speak, and to enhance the technical designs of both as a result of the experience.

Three very, very important issues for motorcycle safety involve crash avoidance, active safety as we call it, and the three factors that we consider to be most important, see and be seen, maintaining stability and proper training. I'm not going to touch on the proper training aspect, only to strongly endorse it. We at BMW feel it's very important that proper training is given to motorcycle riders. Driving a car does not necessarily quality a person to safety and skillfully ride a motorcycle. They're completely different tasks requiring different skill sets, and I'm sure there will be a lot of good presenters talking about that tomorrow on training.

In terms of seen and be seen, two factors obviously during the day, the conspicuity that Wayne mentioned is very, very important, to be recognized by other road users, and also so they can estimate the speed and the distance of the approaching motorcycle so that the driver of the car can make a decision not to pull out in front of a motorcycle.

At night, obviously good light distribution is very important to get the proper range, as optimum as possible, to get good resolution for risk identification. You can see in the picture on your right that there are things on the road

that you need to be able to recognize as a motorcycle rider, whether they are dangerous. They could be slippery leaves. They could be dry leaves. It could be particles of tire from a truck or something. So good resolution is very important.

And obviously, another thing that Wayne mentioned that is very important is minimizing glare. You don't want to affect the oncoming drivers or riders with too bright of lights.

Comparison of normal headlamps, Halogen versus Xenon is shown here. I don't know how well you can see it on the picture. Our monitor here doesn't show it very crisply, but the Xenon gives a longer and a more uniform distribution of light. It's a design called high intensity discharge. It's a more blue light. It has quite a bit of advantages over the typical Halogen. The color is more similar to daylight, so that you can perceive the dangers and the risks of the actual view much better as you would during the daylight. The power output of a Xenon light is much better than a typical Halogen. The bulb lasts for the lifetime of the vehicle or the motorcycles. The power consumption of Xenon is less. Therefore, there's an increase in fuel consumption, and there's less demand on the electrical system. In terms of the color, it is a more true color. Therefore, it's easier on the eyes for the rider. There is a more uniform illumination as I showed you in the previous slide.

In terms of -- the monitor here is getting very dark. In terms of maintaining stability, riding a motorcycle, the demands, a very high degree of skills to keep your stability. Tire pressure is crucial. BMW has developed a tire pressure monitoring system that provides reliable information to the driver or to the rider, I'm sorry, and also gives you a warning in a yellow or red manner if your tire pressure is below a specified requirement.

Top view of the motorcycle showing a schematic of the system. You have a display in front of where the typical instruments are. There's a connection of CANbus and a controller receiver in the back of the motorcycle, and this is very similar to automobiles where you have wireless transmitters in the wheels of the motorcycle that sends the pressure and the temperature, temperature being used to compensate for drops in temperature that would affect the tire pressure so that you don't get a false warning. The information that's displayed to the rider, you can see the white arrows in the middle. If there is a low tire pressure, the value is blinking. There's also a yellow warning at the top. If the tire pressure is too low, it becomes a red alert, and the value continues to blink so that the rider can take action.

In terms of continuing to maintain stability, anti-lock brakes, most everyone is familiar with ABS from the

automobile sector. There is quite a bit of difference in benefits for anti-lock brakes for four-wheeled vehicles compared to two-wheeled vehicles. In a car, anti-lock brakes allows steering during panic braking. On a motorcycle, anti-lock brakes by keeping the wheel turning allows for stability when even going straight. It also has benefits when you're turning, when you're cornering, but you can see here in this video how it has a huge benefit when you're even going straight.

The rider on the right has outriggers obviously so that the bike doesn't upset, but on this slippery surface of sand, you can see that even going straight when the wheel is locked on the right, the loss of the gyroscopic effect, even for a skilled rider causes the bike to fall over.

In terms of evolution of anti-lock brakes for motorcycles, we started back in 1988 with the first system. It was quite heavy, quite complex. It didn't have the benefits of the technology from the automotive sector, and it's evolved over the years to become very sophisticated, a really light weight system, quite capable and very user friendly.

In the development of integral ABS, obviously shorter stopping distances are very important, excellent response, simpler architecture, and optimum distribution of forces front and rear, taking account of the load conditions, if you have a rider on the back or not, is very important, improving the feel

for the riders so that they don't need to have a sharp learning curve for the motorcycle width, anti-lock brakes versus without. Reduction of weight is very important. Diagnosis of the system automatically in the event of a malfunction is very important and easy to operate.

Developments of anti-lock brakes for motorcycles benefited, of course, from the automotive sector and all of the advancements that came with the new technology. Valve systems were able to become more compact. Simplification happened in integrating the anti-lock brakes into the motorcycle as well as with vehicles so that you can add in different components to evolve into a stability control system which I'll talk about in coming.

In terms of integral ABS, you have sensors at the front and rear wheels. You have your levers to operate the system and also a pressure modulator that is the main controller electronically and hydraulically.

This is a rather busy schematic. The basic operation though is when the rider applies the front brake lever, there is a pressure that will be sent directly to the caliper and act directly. There is also a connection with the integral system to the real brakes, so that when you operate the lever, it will engage the motor to send pressure to the rear brakes so that you have a combination system. Applying the lever at the front also operates the rear brakes.

Applying the rear brake, you can have a system whereby it applies it individually or it can be integral and combined with the front brakes.

For anti-lock brake control, the system electronically senses imminent lockup just like in an automobile, and modulates the pressure so that you have a cycling back and forth so that the pressure is increased and decreased to prevent locking of the front wheel. The same thing happens on the rear wheel. You have the cycling and it's very important that in the evolution of the system to understand that the early systems operated less optimally in that you felt a pulse or a feedback into either the pedal or to the lever, and this was not very comfortable for the rider. It was an uncomfortable feeling that a person might have thought under those panic brake conditions, that there was something wrong. What's happened in the meantime is the evolution has produced systems that are really very transparent to the user. You actuate anti-lock brakes and it functions, and you know that it's working but it isn't very obvious. You don't have a discomfort level or something unusual to feel in the pedal or the lever.

In terms of the main features, obviously improving the brake feel as I just talked about, we don't have a brake loosed function that is dependent on anti-lock brakes so that in the event the anti-lock brake system has a malfunction and

doesn't work, you still have your normal braking performance. The weight has been reduced significantly. It's now about five pounds. There's a very low power output electrically to operate the system, and there's no special maintenance needed compared to normal brakes.

In terms of the function that's improved over the years, significantly improved traction, especially when you have changes -- sudden changes in the friction coefficient, optimized detection control of rear wheel liftoff, that is if you abruptly apply the front brake, the system senses that the rear of the bike is lifting up, and it will release the front brake correspondingly just enough to maintain maximum braking but not allow the back wheel to liftoff.

Adapting for the best distribution, based on the load, whether a rider is on the back or not, extended diagnosis, data provision as I mentioned for integrating anti-lock brakes with a stability control function and, of course, it still has the ability to be deactivated in the event of off road use.

I have a series of curves here to illustrate the point of maximum grip and how that affects the rider in the process of cornering and braking at the same time. If you look at this, I'll try to use the mouse here, this curve here is showing the maximum amount of grip that is permitted based on the tire and the road surface. This circle can get larger or

smaller depending on the conditions, but that's a constant value, that you have the maximum amount of grip that you can possibly get based on the circumstances.

When you have braking force, you're taking up some of that grip as a result of the braking. You're using up some of that grip. So you only have a certain amount of grip left for cornering. So if you want to corner harder, you may go outside of this curve. So with a front wheel under hard braking and under some cornering, you only have a little bit of cornering grip left to use up.

If you have an integral system that when you operate the front lever, it also operates the rear brakes, you have a point where the front wheel is not using up a high amount of that grip. So you have a larger amount of grip that's left that you can apply for cornering. It's actually giving you the ability to corner with a higher level of grip because you are distributing the load of braking back to the rear wheel. So the physics are allowing you to corner at a faster speed safely and not risk slipping.

If you don't have that distribution of force, and you exceed this level of grip, the result is the tire loses adhesion. You've overloaded the amount of grip available and you will slide the motorcycle out. This is called the low side where the bike slides out from under you.

So by having an integral system, you're able to

hopefully avoid this kind of scenario where you can better distribute the grip to the front and the rear and still allow some extra cornering force.

Another function that's available with an integral system, that is when you operate the front lever, it also operates the rear brake is when you're parked on a slope, as a result of the down force on the motorcycle and on the wheel, you will not have the maximum amount of grip on the road just by operating the front brake. By transferring brake force also to the rear wheel, you can take advantage of that, and you can hold the motorcycle steady and not slide down a slope by applying the front brake.

In terms of integrating electronics into the system, there is a system whereby you can avoid liftoff, that is this would be called a stoppie to motorcyclists where you apply abruptly the front wheel brake, and the back of the motorcycle wants to lift off. What the system will electronically do is detect the difference in speed between the front wheel that's heavily braking and the rear wheel that's not, and it will minimize the chance for this to happen, and it will come to a stop without lifting off the rear brake.

Self-diagnosis of the whole system obviously is important. You need to have continuous self-diagnosis when traveling, and constantly checking of the system for plausibility. That means, does the system report what makes

sense? Are you getting a signal that is telling you something that the electronics accept as being a condition of the road or is there something that is highly unusual that may indicate a malfunction in which case the system would revert back to its normal braking function.

In terms of going further, maintaining stability, stability control most everyone understands from an automobile perspective as ESC or electronic stability control. As a matter of fact, we believe that in a couple of days, the National Highway Traffic Safety Administration is going to introduce a new rule to require stability control on automobiles because the success has been so tremendous. But just to explain the difference between stability control for an automobile versus a motorcycle, for four wheel stability control, during hard steering, the brakes will alternately apply. That is under hard steering, all the driver needs to do is steer and the system will electronically brake a left front wheel and a right rear wheel or vice versa in order to maintain stability.

With a motorcycle obviously, you don't have a left and a right front wheel. So you could not alternately do that to gain stability. So stability control for a motorcycle means under hard acceleration before you reach excessive tire slip, the engine power would be reduced. Obviously you need that grip for acceleration if you're driving in an area --

motorcyclists are taught that you should brake before the corner and you should accelerate slightly, smoothly out of the corner, which is not something that drivers of automobiles would typically ever think about. It's very important to do that to maintain stability, and if you're accelerating out of a corner on a motorcycle and you hit a slippery condition, wet leaves, a wet road, gravel, sand, so forth, it could be very dangerous.

The system that BMW has developed allows for maximum transfer of the driving torque within physical limits. We can't defeat the laws of physics obviously. The transferring of forces are heavily dependent on the friction, and riding stability is negatively influenced obviously if the tire starts to spin. You lose that grip.

Development targets when we first set out to develop a stability control was obviously improving stability contributing to active safety, supporting the rider and acceleration on surfaces that are difficult to estimate. It could be at night. It could be that you're occupied with looking at something else. You can't look at the road surface to determine whether it's slippery or not, and to counteract the front right rising when rapidly accelerating to avoid wheelies.

Our stability control has not been developed to achieve maximum acceleration. It hasn't been developed for

race track type conditions so that the rider can feel empowered to useful throttle cornering and starts and so forth. That's not the purpose of our stability control.

In terms of the layout of the design, we have an on/off switch. We have an engine management system. We have a pressure modulator that's linked to the anti-lock brake system. We have the ABS sensors and we also integrate into the system the ignition and the injection of fuel so that the engine can be correspondingly cut back to reduce the power. What happens is that the sensors are detecting wheel speeds and comparing it to what is plausible front wheel versus rear wheel. If the slip is too great, the engine torque is reduced by reducing, by retarding the ignition timing. It is designed for public roads as I said, not for racing conditions. It can be turned off for off road use where the rider would need to spin the wheels under certain conditions to make certain corners.

What happens technically is the system will sense the imminent slip of the wheel, the rear wheel under acceleration, and it will start to reduce the ignition timing, retard the timing, the spark timing in stages. If it reaches about the third stage of retardation and it still senses that that slip will occur, then it will further reduce engine power while reducing the injected fuel into the engine.

There is a switch to turn it off obviously. There's a display in the instrument panel so that the rider knows when

it's working, when it has detected the slip, much like in an automobile, so that it gives an alert that there is a slippery condition to be aware of, and also obviously indicates if the system has been deactivated.

Thank you very much.

DR. PRICE: Thank you, Mr. Baloga. Our next presentation will be from Mr. Jay Joseph from Honda. After Mr. Joseph's presentation, we'll have a brief announcement, and then we will break for lunch. When we return from lunch, we'll have Mr. Zellner's presentation. Mr. Joseph.

MR. JOSEPH: Thank you, Dr. Price. Thank you for this opportunity to share with you a little bit of information about Honda's vision for motorcycle safety and specifically some information on the Honda motorcycle airbag.

First, I want to start by explaining our vision of motorcycle safety. If you look toward the lower left-hand side of the screen, we believe everything starts with the rider. This includes wearing helmets, protective clothing, training and retraining, education and other issues. Building on the rider safety, we move toward motorcycle safety, things that we can do to the motorcycle itself to enhance the rider's safety, and in this category, we fit things like braking systems, advanced braking systems, the improvements to tires over the years, improved lighting and conspicuity, and recently our motorcycle airbag.

Moving on beyond that, we think that the next stage would be environmental safety or factors in the environment in which the motorcycle operates that can actually improve rider safety. That would include roadway design, intelligent highway systems and inter-vehicle communication.

Our vision, if you look up along the upper left-hand side is first to try and mitigate the severity of an accident. Building on that, we would hope to take measures that would help avoid and even prevent accidents, all towards this overall goal we have of reducing injuries and fatalities.

Looking at a few of these areas more specifically, starting with the rider safety area, we have four riding training centers across the U.S., and you can see in the lower left-hand side of the screen, that we're now training more than 10,000 riders a year through these centers. We've also developed a riding simulator that's used in Japan, and you see here a riding traffic safety simulator which is designed to be used in conjunction with on-road training and classroom training. We also produce a number of safety materials, different safety materials to educate riders, both through advertising and educational handbooks.

Looking at things we can do through the motorcycle itself, of course, this area is a real broad area including advance braking systems, advances to tires going from bias ply to tubeless to radial and so on, but I'm just going to focus a

little bit on conspicuity here.

In recent years, we've published papers on our face concept which in short suggests that -- our research suggested that if the front of a motorcycle has lighting features that resemble a human face, that the driver of an opposing vehicle can recognize the motorcycle more quickly in an on road environment. And our long concept. The long concept, the research from the long concept suggests that spreading the light out along the front of the motorcycle can help the driver of an opposing vehicle determine the speed and the distance of the closing rate of the motorcycle and make better decisions about how to use that gap in between the motorcycle and themselves. You can find information on those and other papers we've produced on our global website as was indicated on that slide.

Finally moving on to environmental safety, we think the best examples of this that we've shown recently are through our ASV 3 or Advanced Safety Vehicle, concept vehicles, and the main focus here in addition to the long concept employed on this scooter is inter-vehicle communication, and we believe that future roadways can help share information between vehicles, and that that information, whether it be traffic or weather or other pertinent information, can help drivers and riders make better decisions as they go down the road, and we believe there's a lot of potential to enhanced safety.

Now moving on to specifically why we chose to develop a motorcycle airbag, the first step was looking at some of the research. The charts at the top of this slide show that between half and two-thirds of motorcycle collisions are frontal collisions, depending on which part of the world you're looking at. Looking at the bottom part of this slide, you can see the types of injuries incurred by the motorcycle rider in these collisions. Nearly all of the injuries were caused by the rider impacting the road, obstacles or automobile that was involved in the accident.

That research and that information and some in depth analysis led us to believe that we needed to focus on reducing and preventing rider injury somewhere toward the front of the bike. We developed a working concept, and this was a crucial step. We had to establish our concept for developing a motorcycle airbag before we could really undertake any work. The concept is that in front collisions, the airbag would absorb the rider's kinetic energy, reducing the speed at which the rider separates from the motorcycle, and thus mitigating the rider's injuries as they impact the imposing vehicle or fixed objects.

You see here a picture of a 1987 Acura Legend, and that was the first vehicle that we introduced a driver's airbag on in the United States. I mention this for a couple of reasons. One is that although we have more than 20 years of

experience with having automobile airbags on the road, we have almost 20 years of experience of researching it before we got to that point.

But I also mention it because the automobile airbag is a supplemental restraint system and works very differently from the motorcycle airbag. The automobile has many very important differences. For example, the safety structure of the car itself, the amount of steel surrounding the occupants, but we know a lot more about the environment that that automobile occupant is in than we do about a motorcycle. There are many less variables. Just the inherent stability of a four-wheeled vehicle compared to a single track vehicle.

So while we had a lot of experience in automobile airbags that did help us, as we sought to develop a motorcycle airbag, there are also a lot of unique technical challenges that had no benefit of technology transfer as we undertook the challenge of developing a motorcycle airbag.

You can see here a brief timeline of our development activities, research and development activity for the motorcycle airbag going back to about 1990. We developed our first working models which were crash tested in the mid nineties, and you can see how that timeline progressed until the completion of an airbag system that was applied to the 2006 Honda Goldwing as an optional feature.

If you look toward the right, however, you'll see

that throughout this process, we repeated presented papers in public seeking peer review and third party, third party review of all of our information, so that we could be sure that we weren't just proceeding with blinders. We wanted to get information from other researchers and safety officials as we went through this process.

You can see seven different crash geometries here. These are seven full-scale test geometries identified by the ISO 13232 Guideline, and I'll explain a little bit more about the Guideline in just a moment. I point these out to show you just a few examples of the testing that we had to do, and these full scale tests, using a live motorcycle and an automobile in these cases, had to be conducted with and without an airbag. So it's every one of these configurations times two, so we could get an assessment of risk versus benefit.

In addition to the seven full-scale test configurations, there are 200 simulations based on the 25 crash geometries that you see here, and again, those had to be conducted with and without airbags. So that's 400 different simulations at a minimum.

I want to talk a little bit about the ISO 13232 Standards on which those crash geometries are based, and I hate to read slides to people, but I'm going to make an exception because the text you see in red is the title of this ISO, and the title is Motorcycle Test and Analysis Procedures for

Research Evaluation of Rider Crash Protective Devices Fitted to Motorcycles. I love saying that sentence.

What that boils down to, what that really means is that this is an evaluation tool. This was developed for researchers to use to have some measurement of risk versus benefit. This is not developed to be used as a standard. This was not developed to be used as regulation. It's a very simple -- it's a very complicated tool, but it simplifies some even more complex concerns into manageable data. And just one example of the limitations of this are that it's really only looking at motorcycle to car crash geometries, and obviously a motorcycle incurs many other obstacles in the road. So while this is a critical tool, it is not the only guideline that you can use to assess this kind of safety feature.

I also want to mention a little bit about the dummy. I've heard this called the Frankendummy sometimes. It's roughly based on the Hybrid 3 dummy used for automobile crash testing but has a lot of unique features specifically to have the biofidelity and measurements unique for a motorcycle occupant -- motorcycle rider.

One of the obviously questions is why did we choose the Goldwing for this first application of a production motorcycle with an airbag, and there are a number of reasons for that. One of the first is the location of the fuel tank. As you can see, the fuel tank is actually located underneath

the rider and moving the fuel tank a little bit farther back, allowed us that space forward of the rider to use -- to locate the airbag, and that location is really important for a couple of reasons.

One, as it relates to the upright rider position, it allows both time and space for the airbag to deploy before the rider comes in contact with it. It's also a critical location because the combination of the structure of the motorcycle and the tethers that are used to help the airbag do its job, rely on a certain kind of geometry, and some motorcycles are much less suitable for that than others.

Other factors include the relatively long wheel base and low center of gravity, which result in result in less forward pitch rotation at a frontal collision meaning the airbag and the rider are in a more predictable position so the airbag can do its job of slowing that rider down in a frontal collision.

There are also a couple of non-technical factors that really can't be overlooked here. One is the typical Goldwing rider tends to be a little bit older. This is a very large, very comfortable motorcycle to ride, and we believe that the Goldwing rider is probably more amenable to considering a safety device than riders of some other bikes, a sport bike for example. And finally cost. The Goldwing starts off as a relatively expensive motorcycle and adding the cost of an

airbag doesn't have as much impact as it would on say a scooter, which it starts out at a much lower retail price.

Looking specifically at the system itself, it's comprised of the airbag module which is, as I mentioned, located forward of the rider. That airbag module is attached to a frame. Also attached to the same frame is the airbag electronic control unit or brain, if you will, and that is all connected to the crash sensors. There are two crash sensors in each front fork, one upper and one lower on each side, and that -- those four sensors send data back to the ECU, which uses them sort of for telemetry to determine the severity and direction of the crash, and then makes the airbag deployment decision.

I'm going to walk you through a crash scenario. This is based on a static opposing vehicle. In this case, it's a Honda Accord that you can see the crash timing sequence is on the left side of this slide. The column with pictures on the right is -- are from full scale tests and then the column with pictures on the far right are based on computer simulations, and we use those so we can see through some of the dust and powder that obscures some of what is going on with the dummy and the full scale test pictures.

We'll start off on the top at 0, and if you look at the -- both of the images on the right, time equals zero is the point when the front wheel of the motorcycle first makes

contact with the side of the automobile. Over the course of the next 15 milliseconds, that's 15/1000's of a second. The four crash sensors are sending accellerometer data back to the ECU which is comparing the information and confirming that this is the type of collision in which the airbag should be deployed. At 15 milliseconds, the inflation of the airbag begins. It takes approximately 45 milliseconds for the airbag to inflate, and we move down to the third column -- I'm sorry -- the third row of pictures there. So at approximately 60 milliseconds, the rider has started to move forward into the airbag, and then the rider essentially rides out the airbag. The airbag is fully inflated and begins to deflate through the vents as the rider -- the mass of the rider pushes the volume of air out of the airbag vents at about 150 milliseconds. So one and a half tenths of a second, the airbag is depleted and has done its job of slowing the rider down progressively as opposed to having the rider come into contact with that fixed object directly.

Here we'll see a couple of simulations and if you look to the images on the left, that will be simulation of a motorcycle without an airbag and the simulation on the right is a motorcycle with an airbag.

Pay particular attention to the motion of the body, kinematics of the dummy body, especially the head position as this video plays.

So you can see that the airbag is slowing the rider down -- the dummy's body down much more progressively and at a certain point, the dummy actually stops making forward progress and then it's carried forward again. I'll play that again just so you can compare the two.

So right about there, the dummy's forward progress stops on the airbag, and that progressive slowing of the dummy's body results in much lower, especially head injuries as you'll see in a few slides.

So based on these computer simulations, and this is based on one of the ISO simulations, we advanced to doing additional simulations.

Now this computer aided engineering analysis is much more detailed than the ISO required simulations, and this allowed us to get an even better understanding in depth of the interaction between the dummy, the airbag and the motorcycle as well as the car that was involved. And this is a slightly different scenario. You'll see that the car is moving forward in this crash. So the bike actually yaws a little or rotates about a vertical access, a little bit counterclockwise as the bike comes into contact with the car. But again you see the progress slowing of the dummy in this case even though this is a different configuration.

So if you sense a trend here, we're getting more detailed with our information as we develop, and finally

getting into the full-scale crash. This is a 50 kilometer full-scale crash test of a Goldwing with an airbag into a stationary opposing vehicle. And you'll see that this really confirmed what we understood through the simulation. Again, the dummy's body comes to almost a complete stop showing that the airbag is more progressively slowing him down and not causing the kind of injury that would be incurred without an airbag.

So one of the important issues is how effective was the system and looking at these examples of the ISO full-scale crash tests, in these four crash configurations, we judge that the airbag was effective, and we say that because all or most of the riders forward kinetic energy was absorbed in these crash configurations by the airbag.

There's a lot of information on this slide. So I need to go over this fairly carefully. The chart on the left is the abbreviated injury CL, and I think most of us in the U.S. are familiar with this. But an AIS injury of 0 is no injury, no measurable injury, and an AIS injury of 6 is considered fatal, and as you can see, this looks at three different areas of the body, the head region, neck region and chest. The effect of the airbag is to reduce the head injury criteria, the HIC from just over 2700 down to 800, and a crucial point on HIC is 1,000. So getting HIC below 1,000 is a big improvement, an important improvement.

Based on the ISO testing, this is a different scale. This is a normalized injury cost scale, 0 being no injury and 1 being a fatality. Again, you can see that the benefit of the airbag is considerable.

One of the things that I want to point out, I mentioned earlier the differences between a motorcycle and an automobile. You can see here that the Goldwing in the upper left-hand is sort of our baseline example of design of motorcycle that's well suited to an airbag, and you can see the other motorcycles here, other powered two-wheelers here, have different riding configurations, and one of the things I want to point out about that is that if we compare these riding positions, say the Cruiser and the Sport bike in particular, to occupant positions in an automobile, those would be considered out of position occupants in an automobile. And that's important because after 20 years of on road experience with automobile airbags, in cases of out of position occupants, the only thing we know how to do in many cases is turn the airbag off, disable it. So the point being that while this is promising technology in some ways, there's still a lot to learn. There's a lot of R&D required to get it to a level where it can, it can show even more promise.

Now that you've gotten a sense of how the motorcycle airbag works and how it fits into our overall vision for motorcycle rider safety, I just want to close with a few

comments.

We believe that the motorcycle airbag has a limited but important role, helping to reduce injury severity in some frontal collisions by absorbing the rider's energy and slowing the rider's philosophy. However, we do recognize that this collision data must be obtained and analyzed so we have a better understanding of the real, real benefits of the motorcycle airbag. The application of airbag systems to other types and models of motorcycles will require extensive R&D, and there are serious technical challenges to that at this point, but we'll have to see what can be done about them. And finally, after 20 years of experience with automobile airbags, automobile airbags are continuing to advance. So the concept of motorcycle airbags requires time and analysis for the industry to make further advances. Thank you.

CHAIRWOMAN HERSMAN: Thank you all for your presentations and, Mr. Zellner, we'll come back after lunch and have you lead off after lunch.

We're going to take a lunch break now, and Honda has volunteered to demonstrate their airbag technology, which we will do during lunch. We will break and return at 1:15 for Mr. Zellner's presentation.

At 1:00, the demonstration will take place here in the middle of the boardroom. There will be a brief description of what's going on. People will be asked to stand several rows

back. So if you would like to see the demonstration of the airbag, it's going to be a remote deployment of the airbag, not an actual crash demonstration. We will do that at 1:00. Otherwise, the forum will begin again at 1:15. Thank you.

(Whereupon, at 12:00 p.m., a luncheon recess was taken.)

A F T E R N O O N S E S S I O N

(1:15 p.m.)

CHAIRWOMAN HERSMAN: Good afternoon and welcome back. We're going to conclude our last panelist for the second panel, and then we will proceed to questions. Mr. Zellner.

MR. ZELLNER: Thank you, Dr. Hersman, and NTSB members and staff.

The topic I'd like to address today is the role of motorcycle design factors in safety performance, and I just want to mention a few words about our company, Dynamic Research. We do vehicle research and development for the U.S. Government and as well as manufacturers worldwide. This includes work in the areas of vehicle dynamics, human factors, occupant protection and accident investigation and analysis. We mostly work on things like ground vehicles, although we do do some work with aircraft and spacecraft. We do on and off road ground vehicles and in particular, today's topic is on road motorcycles.

In the motorcycle area, we've had the opportunity over the last 30 years to be involved in a number of things, some of which are included here. These include -- let's see if we have a pointer here -- NHTSA's early studies of motorcycle handling and stability back in the 1970s as well as motorcycle anti-lock brakes -- brakes and combined brake systems, in that same time period, and then most recently for NHTSA. NHTSA is

working in conjunction with the United Nations Working Group on a global technical regulation for motorcycle brakes, and we've been supporting NHTSA by doing motorcycle ABS and combined brake system test method development, and that work is continuing.

We've also done work for the motorcycle industry worldwide, in studies, motorcycle leg protectors from 1987 to the late '90s, motorcycle airbag feasibility from around 1992 to present, and more recently daytime lighting and conspicuity studies for the industry from around 2001 to present, and then other studies as well.

I've had a chance to be and serve as U.S. delegate to two international committees in particular which you should be aware of, of their activities. One is the ISO's Working Group 22 which was mentioned earlier this morning in terms of the standard 13232 for test and analysis methods for crash research. And the other is the OECD committee for a common methodology for motorcycle in depth accident investigations, and that committee has been active beginning around 1997.

Today I'd like to address specifically motorcycle design factors in accident involvement, and then secondly in design factors in injuries. And in terms of getting -- as a starting point, getting to a starting point for motorcycle accident data, I think it's widely acknowledged and recognized in the motorcycle research community that the best detailed

source for accident data is the in depth accident investigations using the OECD common methodology. This was developed with using Dr. Hurt's -- Professor Hurt's work from the 1970s as a starting point, and then developing and refining that on a worldwide basis with participants from 10 countries, all of whom had done work in accident investigation for motorcycles. Motorcycles because they are highly specialized involve specific kinds of accident and injury patterns which are very, very different from passenger cars and other types of vehicles, and so that is why this common methodology was developed. It was to define the methodology, the terminology, and the methods and training to be used by investigators in this field because it is so different.

It involves I think as mentioned before, and we'll just go quickly over this, on scene in depth follow up investigations. About 1800 variables per accident are collected. Samples include at least 100, typically 900 cases or more, and the sample of accidents is either a sample or a census of all police reported crashes in a sampling area, and one of the unique things about the OECD methodology is the collection of concurrent exposure data in the sampling region in the same period of time as the accident occurred, typically one week after the accident occurred, accounting and categorizing the different types of riders and vehicles involved in the traffic flow and at the accident site. And

this enables -- it's statistically based identification of over and under representative factors.

As discussed earlier, both NHTSA and Federal Highway are planning a large study in the near future which should update detailed knowledge of U.S. accidents and this will go beyond, I think, the other accident data bases in terms of providing detailed knowledge that does not exist with either the CDS or the GES accident basis which really do not include motorcycles and/or cars which is not represented. The FARS database, of course, is a very small subset of all motorcycle accidents involving I think very specific types of patterns and chains of events which are different from that which are observed in motorcycle accidents in general. Also, FARS, of course, is not exposure based.

Our staff and our consultants have participated in these in depth OECD studies in the five countries and Europe mentioned earlier, Thailand, in the United Kingdom, and actually one of our people in the original U.S. Hurt Study.

Then looking at -- first of all, I'd want to emphasize that these are accident involvement factors, in terms of accident causation and we're not looking at fatal accidents as we were this morning, but these are all motorcycle accidents in a sample, OECD type sample, and we're looking first at the accident factors and then later on at the injury factors.

This table discusses some of the differences between

car and motorcycle accidents in general, car versus car accidents, operator error occurs in half or more than half of the crashes. In motorcycle accidents, the rider is at fault or commits an error in a smaller number of cases, 25 to 30 percent of crashes. In terms of evasive action taken in car to car crashes, the driver tries to avoid the accident in about 30 percent of the cases whereas motorcycle accidents, it's almost, well, more than double that typically. So the rider is less at fault but more active in trying to avoid the crash as found by these in depth investigators. The traffic space taken by a motorcycle is much smaller which gives it another advantage. Its braking effectiveness is equal to that of cars and very high compared to other types of road users such as heavy trucks.

On the other hand, it does have some inherent disadvantages and one is, as already mentioned, the low conspicuity. The result of over braking a motorcycle -- sorry -- over braking a car is possible loss of steering ability, as mentioned by Tom Baloga this morning, whereas for a bike, it's possible loss of yaw, pitch or roll or capsize stability. So a bike can overturn just from over braking in these three different modes. That's a different aspect. In terms of steering method, cars and other road vehicles, are steer to turn. So if you want to steer to the right -- if you steer to the right, you'll turn to the right. Motorcycles

involve counter steering where if you want to move to the right, you will counter steer to the left. It will lean, it will bank the vehicle to the right, and then the vehicle will yaw and turn to the right. So it's a more involved control process.

In terms of primary contributing factors, there was some mention of that this morning. The opposing vehicle driver in the MAIDS accident database, this is the European accident database, was responsible for the majority of the accidents in terms of operator error, and in particular, this very large green area here, indicates that 37 percent of the accidents involved opposing vehicle driver perception failure. This is the so-called conspicuity type of accident. So this is a very large portion of the accidents which we'll talk more about.

In terms of the time available to complete the avoidance maneuver, for the motorcycle rider in MAIDS, in 32 percent of the cases the rider did not have sufficient time to complete the maneuver versus 20 percent for cars, and on the other hand, in 39 percent of the cases, the rider took no evasive action whereas 70 percent of the car drivers took no evasive action. So you can see this very different pattern of pre-crash actions and in actions.

This, this data is very consistent with the theory that the OV driver does not perceive and violates the motorcycle right-of-way in a large percentage of accidents,

thereby resulting in the rider not having sufficient time to take evasive action, but on the other hand, trying to take evasive action in a large percentage of cases which is shown in this next slide.

This shows for the original Hurt Study back in -- published in 1981, a breakdown, and I know it's very difficult to see, impossible to see, of the collision avoidance maneuvers and loss of control. The pink area here is no evasive action taken. The blue is braking action taken. And then green is brake and steer and dark brown is swerve or steer only. The main thing I wanted to point out here is that over braking of the front wheel resulting in capsize, overturn, occurred in a very small number of cases, about 1 percent of the accident sample. So this goes to the question of what effectiveness will ABS, would ABS potentially have on the overall accident picture. The blue box here indicates that for rear wheel which, if it locks up, can result in what's called either a slide out or a low slide accident or a high side, pitch rollover accident, was about 12 percent of the accidents. So that goes to the question of rear anti-lock brake system effectiveness. So front over braking is rare. Rear over braking is less rare.

If we go to the new European data, the latest data from a couple of years ago, we see a very, very similar picture in terms of the breakdown. If you'd just switch back for a

second to the previous slide. If you look at the Hurt data from 30 years ago in the U.S., and the MAIDS data from a couple of years ago in Europe, it's very, very similar in terms of the collision avoidance maneuvers. That does not mean that in all of the 1800 variables, the two databases are similar, but at least in the collision avoidance breakdown, the two databases are quite similar.

This indicates that front over braking is also rare in Europe, 1 percent of the cases. Rear braking is less rare, at about 8 percent of the cases. This will go to again the discussion of advance brake systems.

For loss of control mode, the MAIDS data indicate that about 68 percent, the large blue zone, is no loss of control prior to the crash, and then there's different types of loss of control illustrated on the left side, and the one I wanted to point out is this pink box which is impossible to read as well, which says high speed wobble. This is high speed instability, is about 1 percent of all the crashes in the MAIDS database. The rest of these crash or loss of control modes do not typically involve very high or extremely high speeds or high speeds, and the only high speed loss of stability is with this high speed wobble, and that would go to the question of stability systems which we'll talk about a little bit later, stability enhancement systems.

So high speed loss of stability is rare in motorcycle

accidents. Oh, back one slide. Sorry.

Next I'd like to go to a discussion of potential countermeasures that have been discussed or considered over the last 30 years for motorcycles. The first is in the area of speed and acceleration, the first two being here engine size limit and engine power limits. The first point is that larger engine capacities are -- were found to be under represented in the Hurt data 30 years ago, that is engines over 500 cc's were under represented in the accidents, and in the MAIDS data, those over 1000 cc's were under represented in the accidents.

Touring motorcycles in general have larger engines and fewer accidents. That's just a technical note. We wanted to add for the case of engine power limits, the analysis of the OECD data, of MAIDS, indicates that less than 7 percent of the accident involved bikes were accelerating and had increased their throttle input just prior to the crash. So a relatively small sample of the accidents involved acceleration, and of this, we could safely conclude that a very, very small fraction of the 7 percent were at full power setting. So these were at other power settings, probably a very small part of that was at full power settings. It's probably rare for accidents to occur at or near peak power but it is being studied currently by the industry.

For design speed limit, the question of design speed limit, as we indicated just perhaps a little while ago, less

than 0.1 percent of the MAIDS accidents were over 100 miles per hour, and I think the same conclusion can be said of the Hurt database. So this would not be a particularly effective countermeasure because so few of the accidents in a general sense are or occur above 100 miles per hour.

There are two other innovative ideas. One is external speed control. This actually is being researched in the UK by the UK Government currently. There's no existing systems in operation, and it would need a complex infrastructure. This is where the infrastructure would control the speed of vehicles in and around intersections, and there is a prototype study being done with motorcycles and cars in the UK. It's only in its very initial stages, and there could be risks, and I think the UK has found various risks, as you can imagine, mixing controlled and uncontrolled vehicles in an evaluation.

Another type of system is the speeding or onboard speeding sensor and warning system, and potentially control system. In the MAIDS database, 18 percent of the motorcycles were going faster than the other traffic. So speeding could be potentially a factor. However, this kind of speeding onboard warning device would also need a complex infrastructure in terms of sensing in the infrastructure and transmitting it, receiving it by the motorcycles, and the effectiveness of this kind of system in terms of rider response is unknown.

The next three involve control systems, anti-lock brake systems, combined brake systems and traction control. In the MAIDS Study, there were too few ABS systems to determine, basically less than 2 percent of these, the bikes in the market, in both Europe and the United States have ABS, and so statistically there's too few to determine the effectiveness of ABS from the accident data. However, as we noted before, for non-ABS bikes, front lock up is only 1 percent of the accidents. So potentially front ABS could eliminate 1 percent of the accidents. Rear might do a bit greater than that at 8 percent.

I think there's been a long standing belief of many researchers that effectiveness of ABS may be small. It's believed to be possibly not cost effective. The cost of ABS is quite high, ranging between 700 to $1,000 per unit, and the effectiveness may be small. I think we're all familiar with the car ABS effectiveness that was found over the last 10 years. Initially the car ABS effectiveness in the U.S. market where 50 percent of the vehicles had ABS, was about negative 1 percent, and then more recently about plus 1 percent. So we would not be surprised if similar results occurred for motorcycles.

Combined brake systems, same picture. There are fewer than 2 percent of bikes have CBS, in Europe and also the U.S. and with a combined brake system, front or rear lock up

and capsize can still occur. The combined brake system just links the two with proportioning valves and so lock up can still occur in principle, and the effectiveness of that in reducing accidents is unknown.

Traction control systems are one additional idea. Again there are two few traction control systems in the marketplace. Less than 1 percent. I think there was a Honda system about in 1987 introduced and BMW as discussed, introduced one recently. It could be used to prevent wheelies, wheel spins, on slippery surfaces, but these wheel spins and slippery service accidents are very small percentages of the accident population. Lost wheelies are less than 1 percent. Slippery surfaces are down in the very few percentage points of accidents which we'll talk about a little bit later.

The next category is stability control systems or electronic stability control. There is a terminology problem here with stability control, and the comparison between cars and bikes. There's four types of stability control systems that could be considered. The first is steer dampers. There's again less than 2 percent of the bikes in the market that have steer dampers, and high speed steer dampers are mainly aimed at high speed wobble instability and as we saw in the previous slide, those types of accidents are very rare, less than 1 percent. Passive stability dampers increase high speed stability but then they degrade the low speed stability in

handling. So that's a problem, partially solved with speed sensitive steering dampers which can adapt but again, there's very, very few high speed accidents that this category device could be aimed at reducing.

There are pitch control devices, as mentioned by BMW this morning, wheelies and these end-overs, the forward pitch, the wheelie, the backward pitch. Traction control systems that could be used and ABS systems that could be used are less than 1 or 2 percent of the market. So we cannot address their effectiveness or their risks by means of the accident data, and I stand corrected here. And -- control system actually may exist it sounds like from the BMW presentation, although again there's not enough of them in the accident data to assess their effectiveness.

An important point to mention here is that SCS, stability control systems, as they exist for cars, do not exist for motorcycles, roll and yaw systems. Roll and yaw systems are becoming more and more prevalent in cars and may be universally introduced over the next few years, but for motorcycles which are single track, it's unclear how to stabilize the vehicle in roll, and if you try to stabilize it in yaw, by increasing or decreasing the rear wheel side traction, side course, you will automatically with a single track vehicle induce a roll instability, either a so-called high side rollover or a low side slide out. So for a single

track vehicle, roll and yaw are coupled in a way that prevents really effective roll, yaw stability control.

Next. The next category, and the NTSB asked about suspension, the roll of suspension and advanced suspensions in accidents. In both the Hurt Study and the MAIDS Study, less than 1 percent of motorcycle accidents are suspension related, and virtually all of these are related to modified, worn or broken suspension units. So it's mainly seems to be a maintenance related factor. There are adjustable rate suspensions on the majority of street and touring motorcycles in the U.S. market. No one has studied the effect of adjustment or misadjustment of these types of suspensions. It could have some effects on stability, road disturbance, response and safety but their effect is generally unknown or unquantified.

There are automatic adaptive rate suspension systems, again very rare in the market, and both these and the adjustable -- primarily affect ride comfort, and they have unknown effects on safety.

And finally, there's active suspension systems which exist for military and other types of vehicles but these are extremely costly, and would probably have little or unknown effects on safety. So suspension overall seems to be probably not a highly cost effective way to address motorcycle safety.

DR. PRICE: Excuse me, Mr. Zellner.

MR. ZELLNER: Yes.

DR. PRICE: I don't know how much more you have in your presentation --

MR. ZELLNER: Oh, sorry.

DR. PRICE: -- but I'm going to ask you to --

MR. ZELLNER: Accelerate a bit.

DR. PRICE: -- speed up a little bit --

MR. ZELLNER: I'll try to summarize.

DR. PRICE: -- to make sure we have time for questions.

MR. ZELLNER: Okay.

DR. PRICE: Thank you.

MR. ZELLNER: Conspicuity seems to be one of the big areas and possibly one of the more effective areas to look at. Automatic headlamp on were found to be under represented or headlamp on under represented, and a very good way to reduce motorcycle accidents, and today 100 percent of U.S. motorcycles do have automatic headlamp on. Daytime running lamps are in U.S. regulations alternative to automatic headlamp on, and in Europe, there are no daytime running lamps allowed currently, and the industry, the worldwide industry is looking at trying to optimize the number, intensity, separation, the color, modulation of daytime running lamps in a series of research projects currently. I think this was shown by Mr. Curtin this morning. These are emphasizing that most of the accidents are

daylight, clear weather, so the lighting system needs to operate in that condition. I will not go into detail here. Again, it's not possible to read this on the screen, but basically the point is existing lighting systems do not meet the daytime running lamp requirements that's defined by the United Nations for good daytime conspicuity. This is an example of some simulator based research. This is a sensor that senses the driver's eye, a focal point. There's a little cross here and there, and what he's focusing on and by this means, you can study in a simulator whether the driver perceives motorcycle with different lighting treatments and the presence of different types of cars or other vehicles and their lighting standards. And, of course, on a worldwide basis, more and more cars are going to daytime running lamps or headlamp on requirements. So motorcycles are competing in a very difficult environment in that regard.

Vehicle to vehicle communication systems is another one, but that's sort of a future system. Adapted headlamp is a very rare type of accident. I think pressure monitoring was addressed earlier this morning.

The last topic is the injury factors. I just want to emphasize that the difference between cars and motorcycles, the majority of injury sources for cars are, of course, the vehicle interior whereas 76 percent of the injuries in motorcycles are environment or other vehicle sources and contracts, which are

very difficult to control obviously by motorcycle design but possibly highway design or other vehicle design could consider them.

Belt restraint systems, of course, are used for car occupants, but they've been found to be harmful for motorcycles. Yaw, pitch and roll is relatively small in car impacts and crashes but relatively large rotations and rapid rotations occur for motorcycles. For a car, the typical strategy is absorb energy, restrain the occupant inside the vehicle, and for motorcycles, it was found as early as the 1970s in measure, that the best strategy is removing external projections from the path of the rider and providing a helmet.

Again, this is just a slide that gives a source of the contact injuries to the rider. 76 percent are the environment and the other vehicle and the other 16 percent are the motorcycle itself. The majority of those are lower extremity, leg injuries, from contact with the motor and frame and wheels of the motorcycle. Very few are tank injuries as we'll see in just a second.

There has been work on motorcycle protection, research over the last 30 years, intensive work, and enormous -- relatively enormous sums of money spent on this by the U.S. Government and other governments including the UK as well as the motorcycle industry. Leg protectors were researched beginning in the 1970s up through the late '90s, and

it was found that they tend to transfer lower -- the injuries from the lower legs to the upper legs and the head as the forces between the leg and the leg protector were transmitted to the leg, the upper body pitched forward and worsening head injuries and upper leg and thigh, femur fractures.

Seatbelts as you might imagine result in increased injury because of the capsize or pitch over the motorcycle. Safety frames, BMW and others have introduced enclosed two-wheeled vehicles which are not considered to be motorcycles by the majority of regulators in different countries as well as riders. Airbags are introduced first this year by Honda, but no accident data exists, and the feasibility then for other types of motorcycles is not yet established. And the effectiveness and potential risk in real accident data is unknown.

NTSB staff asked me to comment on low yield strength handlebars. They do not exist in the current vehicle fleet but less than .6 percent of all rider injuries are between -- involve lower or leg fractures, I'm sorry, lower extremity fractures, possibly related to handlebar contacts. So it's an extremely rare type of injury in the accident data. And in addition, obviously handlebars must provide adequate strength so as not to yield to normal use.

External projections, it's difficult to define them in accident studies as well as in regulations, although I think

everyone agrees they should be minimized. There's no effective regulation or standard in that area.

Next is reduced fuel tank slope. NTSB staff asked me to comment on that. In the MAIDS data, less than 0.5 percent of rider injuries were pelvic fractures, possibly related to tank contact. So again, it's a very rare type of accident. The market is generally moving toward less steep tank slopes in general, and the other comment is that it's not just a matter of slope because most tanks have multiple slopes, but not a single slope, and the tank has to provide other functions, not the least of which is maintaining fuel system integrity. So in terms of its strength and energy absorption, the tank has multiple requirements on it but again, it's a rare type of injury.

Crash testing of motorcycles, energy absorption as has been mentioned as a factor that could be considered in motorcycle crash testing, but it really is not relevant as the motorcycle -- the rider is really not attached to the motorcycle. So energy absorption is not so important.

In summary, the accident data indicate that in terms of accident involvement, riders are committing fewer errors than drivers. They're more frequently taking evasive action. A large number of accidents are caused by driver perception failure on the part of the car driver. Riders have inadequate time to respond in general. Some of the design factors like

ABS, CBS, high speed stability and high speed accidents, are too rare in the accident data to evaluate whether they are over or under represented. And in terms of injury factors, the environment and other vehicle are the majority of injury factors in motorcycle accidents. The crash motions of the rider are much more complex and the contact surface is much more varied.

The protection strategy involves a helmet and smoothing the ejection path. One manufacturer has produced airbags, but its effectiveness and risks in real accidents needs to be better understood. Other strategies have been looked at, leg protectors and seatbelts, and have been found to be either harmful or infrequent sources of injuries such as the tank and the handlebars.

These findings tend to point toward research into the feasibility of improved conspicuity for motorcycles such as optimized daytime running lamps and vehicle to vehicle conflict warning systems, and possibly airbags pending evaluation of their in use effectiveness and risks in real accidents and for other motorcycle types, and in conjunction with agreed test methods for assessing their feasibility.

Honda has come up with their own test methods for airbags but the ISO methodology is still being discussed in terms of expanding it to airbag applicability -- deploying airbag applicability. Improved motorcycle accident reporting

systems, that is one of the major areas, in order to assess effectiveness of feasible countermeasures and in particular, the CDS system is not applied to motorcycles currently, and that's one area that probably should be upgraded, and the OECD methodology in my opinion should be adhered to and not translated into American terms, but should be closely adhered to because the research community, motorcycle research community is a worldwide community and causing or introducing new American terms to OECD will just I think cause a lot of confusion.

So I think that gives an overall summary of my recommendations and conclusions. Thank you.

DR. PRICE: Thank you, Mr. Zellner. The NTSB Technical Staff will now ask questions, and will be led by Mr. Doug Brazy.

MR. BRAZY: Thank you, Jana. My first question is for Mr. Curtin, and it has to do with the differences in international standards for lighting requirements, and in your presentation, you pointed out that there are a number of different requirements from different countries, and that presents some significant challenges to a manufacturer to address those different standards. Can you give us some examples of how Harley-Davidson has met those challenges for different standards for lighting?

MR. CURTIN: Well, Harley-Davidson has met the

standards because every motorcycle we produce meets the applicable regulations in the marketplace in which we sell the bike. But where it causes the difficulties is one is in the design side, because the engineers designing the motorcycles have to make sure they're putting the appropriate equipment for the bike's design to go to certain markets, and then when you get in the manufacturing process, it just creates an additional complexity in the manufacturing process. For instance, just a basic black Fatboy motorcycle which most people here are familiar with. It's one of our standard Soft Tail bikes, that motorcycle, we have to do eight different versions of just the black standard Fatboy in order to meet all the different country regulations in which we sell that motorcycle. So then you take that to the entire Soft Tail family of motorcycles, and we're having to produce about 2,000 different configurations when it comes down to the styles and colors and then the different safety regulations. So it just adds that level of complexity in both our design and in our manufacturing process.

MR. BRAZY: And are there any other -- aside from lighting, are there any other standards that differ from the United States to Europe or other countries for vehicle based safety standards like we have here in the United States? For example, consistent control position is something that's mentioned in the NHTSA regulations. Are there other

differences, with the exception of lighting, between international standards and how do you address those if they do exist?

MR. CURTIN: Well, there's different standards for instance in the braking arena. And so when we're doing the compliance, you know, in the United States, our, our compliance with our regulations, with the Federal Government, with NHTSA in particular, is a self-certification process, but for most of the international markets that we sell into, there's a testing process that has to be observed by testers or test facilities and in that, then we have a different complexity of having to comply with those different braking standards and tests in order to be able to move forward with entering that market. So that's just another example. It's the same thing again with, you know, the testing of the lighting has to be done with all these different testing agencies as well.

MR. BRAZY: And speaking of testing, you mentioned that Harley-Davidson does some extensive product validation testing in the presentation that you gave earlier. Can you give us some examples of some of the types of tests that Harley-Davidson does for safety based initiatives from a vehicle design standpoint, not necessarily airbags or ABS, but are there other safety aspects from a motorcycle manufacturer's perspective that, that Harley-Davidson tests for in that product validation testing.

MR. CURTIN: A couple of examples that I can give to you of testing and evaluation is, one is testing for stability in high speed wobbles and where our test riders will actually, you know, doing 100 miles an hour or so, induce a high speed wobble and have it straighten itself out. And then there's also similar type things that we will do with evaluating braking systems, especially if we're going to new components for a braking system, and then there's that extensive testing at our different test facilities to evaluate those products and make sure that they meet and comply with the standards.

MR. BRAZY: I think that's all I've got for Mr. Curtin. Mr. Collins I think has some questions for Mr. Baloga.

MR. COLLINS: Thank you for your presentation. First I just wanted to see, where is BMW with the deployment of the ABS. It's my understanding that it will be an option on the next model year. Is that correct?

MR. BALOGA: Anti-lock brakes has been an option for quite a few model years. It is still optional but is ordered in the U.S. about 96, 97 percent of the time. It's really a technical issue that it's optional and not standard, just giving the rider the opportunity -- the purchaser the opportunity to add that on. It's a marketing issue I would say more so.

MR. COLLINS: And does BMW believe that certain of

these features discussed today such as the ABS or the anti-slip should be mandatory?

MR. BALOGA: Well, I would say that we would use the word encourage. The technology is good. The technology has definite benefits. The anti-lock brake systems that came on heavy-duty trucks many years ago, back in the seventies, they were mandated. They were required and they weren't ready for commercialization and there were some difficulties and they actually went to the Supreme Court to rule that they were not allowed to be mandatory because of the technical limitations back then.

Anti-lock brakes on automobiles were considered to be mandatory years ago, and NHTSA considered that possibility and decided not to do it, and that turned out to be a good thing because there was an evolutionary process necessary for ABS on automobiles. The benefits on ABS on automobiles ended up evolving into stability control in cars that have turned out to be fantastic, and I would say that probably a good lesson to learn from that would be that the market evolved at a good rate and the, the pressure, the marketing pressure and the demand from the consumer helped the industry evolve at a good pace as opposed to forcing mandatory installation which could result in some problems. Passenger airbags being mandatory had some difficulties in the beginning and so forth. So I think the encouragement would be the word I would use.

MR. COLLINS: And just to go back to ABS for a moment, you said that it's in the high nineties for --

MR. BALOGA: The take rate, yes.

MR. COLLINS: And can you just give us an idea of what the incremental cost for that would be if I as a purchaser would select ABS? What would be my cost?

MR. BALOGA: 700 to $1,000.

MR. COLLINS: I'm going to turn it over to Kris.

MR. BRAZY: Can I follow up with a question about ABS real quick, Kris? Mr. Baloga, you mentioned that in the advancement of anti-lock braking systems, some of the initial problems with feel have been essentially engineered out in pulsing of the pedal or lever. I'm wondering, are there any -- and I'm imagining that in a straight line braking kind of panic situation, but you also mentioned that anti-lock brakes have an effect in braking while cornering which most motorcyclists knows is a very delicate maneuver to perform but it is quite often very necessary to do. Do you expect that riders would need any initial operating experience or training or guidance in using a motorcycle equipped with anti-lock brakes when braking in a corner when that need arises? Is there something special that they should know if their bike is equipped with ABS versus what they might know if it's not?

MR. BALOGA: I think just to take a step back. Our anti-lock systems are included only with systems that integral,

partial integral or fully integral systems, that is when you squeeze the lever for the front brake, it applies the rear brake and so forth. And when that's available in that technical configuration, it allows you to brake in corners, not typically by choice but being a rider yourself, you know that there are times when you come around a corner and you are going too fast because of a stopped car, an accident, halted traffic, some unexpected reason, you couldn't possibly have foreseen, and you're leaning the bike in the turn, and then you must brake hard. Well, the training tells you to upright the bike so you're going straight, then apply the brakes in a panic manner when you're going straight. Well, that's not always possible in a millisecond. And so the combination of the anti-lock brakes with the integral aspect allows you to use the capability of ABS without locking up, even with slippery leaves and so forth, so you can maximize the stable braking effect.

In terms of your other question regarding a learning curve, in the early systems on BMWs, there was a learning curve necessary. Riders needed to understand how the system was working in order to get the maximum benefit. We had that issue with automobiles where people feeling the pulse of the brake would induce some people to take their foot off the brake or other people were pumping them when they shouldn't and so forth. So there was a learning curve necessarily in the early technological development, but the state of the art today is

such that with our systems, there's really very little learning curve. They've evolved to the point where they are second nature, and there really isn't any specialized knowledge needed other than the typical skills necessary for stability.

MR. BRAZY: And if a motorcyclist was taught in a basic rider course, exactly what you had just mentioned, which is do the best to upright the bike, time and space permitting, the integral ABS system is now affording them to some degree another option --

MR. BALOGA: Right.

MR. BRAZY: -- besides that training. Does the motorcycle dealer or the owner's manual of the motorcycle -- motorcycle's owner's manual, where would a customer get that information that says, hey, you know, you've got a little bit more of a margin available to you. So don't discount that availability in an emergency, and how can they practice that? Is it all up to the rider himself, or is there a mechanism in place to, to educate them I guess about that.

MR. BALOGA: Yeah, that's a good question. It is also mentioned in the owner's manual, and the dealer personnel are trained. They're also riders themselves, and they do mention these different advantages of the systems to the riders when they make their first purchase, particularly if it's a first purchase of a BMW that they don't have the experience of this, they typically would be using their rear brake as opposed

to exploiting the benefits of the technology.

MR. BRAZY: Okay. Thank you. Sorry, Dr. Poland.

DR. POLAND: That's all right. Let me ask Mr. Joseph a couple of questions and then I have a couple of general questions for the panel as well.

I was hoping that you could briefly describe to me or explain to me what the threshold is for the airbag deployment?

MR. JOSEPH: I can, I can give you a non-answer answer to that. I don't want to give you a miles per hour threshold which is what most people like to have. The reason for that is it's much like a car system. We're looking at delta V, at the change in speed over a small amount of time, but we have to think of it in terms of how quickly the motorcycle is being decelerated, and we're also concerned with the direction of travel and other factors. The reason I'm being vague is because if a motorcycle going 5 miles an hour encountered a truck going 30 miles an hour, that would be the same as the delta V if the motorcycle was going at 33 miles an hour into a flat barrier. So I don't want to give a speed range for the threshold, but just let you know that it's similar to an automobile.

DR. POLAND: Is it purely a longitudinal deceleration?

MR. JOSEPH: It's -- nothing is pure, especially in a motorcycle accident, but --

DR. POLAND: Do you have a triaxial sensor? Or is it purely a longitudinal accelerometer?

MR. JOSEPH: Comparing the telemetry between the four accelerometers, so it -- and part of the reason for that is so that it can sense longitudinal as opposed to vertical, and tune out things like a really severe pothole as an indication of a collision.

DR. POLAND: Do you know what the velocity is of the bag as it deploys?

MR. JOSEPH: I don't know off the top of my head. I'm sorry.

DR. POLAND: Okay.

MR. JOSEPH: It's similar -- it's comparable to an automobile passenger airbag, not the driver, but the front passenger's airbag.

DR. POLAND: For the passenger.

MR. JOSEPH: Yeah, very similar.

DR. POLAND: Okay. You mentioned that the airbag in the motorcycle is different than the airbag on a motor vehicle, on a passenger car because in the passenger car it's a supplemental restraint device supplementing the restraint systems, the seatbelts on the passenger car. Do you see the airbag as any sort of supplement to rider protective care?

MR. JOSEPH: Thank you for asking that question. Yes. The rider's helmet -- we consider the rider's helmet to

be the primary protective gear, and as I mentioned just before, the static deployment, the airbag is designed to work with the helmet, not independently of the helmet. So, yeah, we do think that a rider should be wearing a helmet to protect their head and airbag is supposed to compliment that. But I really made the comparison to an automobile because for that reason and because there's so many variables in a motorcycle crash that are unique to that vehicle as opposed to an automobile where you've got a lot of information about where the occupant was located, where they're likely to move to, their direction of travel, their rate of travel. There's so many fewer variables that help you protect the occupant of a car that just don't apply to a motorcycle.

DR. POLAND: If I am participating in a motorcycle accident investigation, and an airbag has deployed, is there any opportunity for me to examine the acceleration information that was fed to the airbag for its decision for deployment like in some passenger cars?

MR. JOSEPH: Yeah. Just like in our passenger cars, we do have an electronic data recorder, and in the Goldwing with the airbag, and only in the Goldwing with the airbag for just -- well, for the same reasons we have them in cars really. We do consider that information the property of the owner, just like we do in our automobiles. So we treat it as their -- part of their vehicle, what is has captured as part of their

vehicle. So it would obviously require their cooperation.

DR. POLAND: And do you have a good method in place to monitor the deployments of the airbags on these Goldwing bikes?

MR. JOSEPH: We expect the first one to get our attention pretty quickly. We expect initially that, especially with so few in the market, that we'll hear about it through our dealer network and other means. I think it will probably be a pretty newsworthy event.

DR. POLAND: And if my other members don't mind me asking a couple of general questions here, and then I'll open up to the panel in general. This morning, I believe Ms. Murphy had mentioned that in their surveys that 65 percent of the motorcycle owners do maintenance themselves. Is that something that you would expect and is that something that you're comfortable with?

UNIDENTIFIED SPEAKER: Who's going first?

MR. CURTIN: Well, I think a large part of motorcycling and especially for our customers, but I think for all customers, is personalizing and customizing their motorcycles, and I think in a lot of ways that is considered by them maintenance of their own motorcycles. And also when it comes to maintenance issues, I think when it's things like oil changes and tune-ups and those kinds of things, that's perfectly normal for somebody who enjoys machinery. Now I

think you'll find that a little of the 35 percent that was referred to there, it is probably when there is something more major going on with the motorcycle, especially if it's a safety related item, and then it gets taken to the dealers and dealt with in that way. I think it's a customer's understanding of their own vehicles and their own capabilities and working responsibly with their dealers to address those issues.

MR. JOSEPH: If I could just build on Mr. Curtin's comments a little bit. I think there's an important distinction, and I think it's been alluded to a few times, but just to state it more specifically, motorcycling is very different from driving a car. Most of us drive a car out of necessity, and motorcycling is -- a lot of the miles we see ridden, I think we saw it in the MIC data this morning, that motorcycling is a leisure activity. It's something people do for fun, to escape from what they have to do, and I think as a result of that, it's really more of a lifestyle decision to be a motorcyclist, and because it's something you do on your own time, as Mr. Curtin said, maintaining a motorcycle is part of the lifestyle, part of enjoying it. Motorcycles are typically more accessible to repair on your own than an automobile is. So there are a lot of differences technically but also in demographics and cyclographics that make motorcycling and owning a motorcycle very different from owning and operating a car.

DR. POLAND: In one of the earlier presentations before lunch, the NHTSA study on conspicuity was mentioned, and it was noted that there weren't significant differences in lighting found during that NHTSA study, and yet we've talked a lot about conspicuity and different lighting designs. Do you have any thoughts on why there wouldn't have been significant differences found in the NHTSA study?

MR. ZELLNER: Well, I haven't read, I don't think it's available yet, the detailed methodology or the report, but from what I understand in talking with NHTSA staff and hearing their presentations, the methodology probably in our view at least lacks sufficient experimental controls.

DR. POLAND: And, of course, we don't have NHTSA to --

MR. ZELLNER: To defend themselves.

DR. POLAND: -- defend themselves.

MR. ZELLNER: Or discuss it.

DR. POLAND: We'll take that with NHTSA's ability to explain it later.

MR. ZELLNER: A lot of the work was done in track or over the road and with not very many, if any, experimental controls, to control all of the other hundreds or thousands of other variables that occur in traffic or in hour-to-hour daytime ambient lighting variations.

DR. POLAND: Now is it recognition of the bike itself

in terms of conspicuity or is it perception of the bike's speed that could be the problem?

MR. ZELLNER: I think this goes back to Mr. Curtin's block diagram, the NASA Midas Model, for collision avoidance in that the first step is really detection, simply the detection or the movement of the eye to a moving object or target or high contrast target. The second then is collision estimation, and that gets into speed distance estimation and for that, really I think the research and NASA's research as well as some of the motorcycle industry's research indicates that you need a separation of light sources or separation of light contrast elements in order to have good speed distance perception. And then the third is sort of the threat perception in terms of collision avoidance, and that again is one of the evolving research questions as to how the motoring public perceives motorcycles in terms of needing or wanting to avoid a collision.

DR. POLAND: So any of those points.

MR. ZELLNER: It could be any of those. I think at least the published research so far from the motorcycle industry is at least the second block, the speed distance estimation is probably quite important, in distinguishing and improving collision detection capabilities of car drivers.

DR. POLAND: Well, I have many more questions and I find this fascinating, but I think my other members are giving

me looks saying, that they have additional questions as well, and that I should let them ask.

MR. COLLINS: I just have one for Mr. Joseph. I'm intrigued by the idea of a simulator in Japan, and I wonder if there are any plans to bring that to the U.S., and if so, do you foresee any barriers to bringing it to the U.S.?

MR. JOSEPH: Yes. As I mentioned, the traffic simulator that I briefly showed, there are barriers. First, it is being deployed in Japan as an aid to training. By itself, it will not teach anybody how to ride a motorcycle, and it will not teach anyone how to ride a motorcycle safely. It's a very simple low cost training aid, and as Mr. Zellner mentioned, riding a motorcycle requires a slightly more complex steering maneuver than an automobile. You don't steer to turn. You steer to bank -- your counter steer to bank to turn, and the traffic simulator doesn't -- isn't capable of simulating that motion. The seat is static. You sit in the seat and you steer, brake and use the controls. So there are limitations. It's really intended as an addition to in the saddle training and classroom training. It kind of bridges that gap. It's purpose is to make riders, especially someone who is new to riding, more aware of traffic threats. So it has a very limited role in training a motorcyclist. We have considered it for this market but we're terribly concerned that someone would get the wrong idea that they can spend some time in this and

learn how to ride a motorcycle. So we have to address some of those issues. It has some potential, but in a very limited scope.

MR. BRAZY: Dennis stole my question about the simulator. I imagine that it's at least somewhat useful in, in helping newer riders with the decision making challenges faced in traffic and it's sort of working in Japan at least so far?

MR. JOSEPH: Well, as I said, it fits into a bigger scope of training. So it has a role in between classroom training which has a certain effect and in the saddle training which has other limitations. It's tough to communicate with somebody once they're in the saddle, and it's tough to simulate other things. So it bridges that gap to a certain degree and it has some effect there. But we're very concerned about the other issues and the potential for someone to misinterpret that they now know how to ride a bike.

MR. BRAZY: Thank you very much. Maybe all of the presenters meant, there's a common theme about what is most likely a technology that's a bit off in the future and it's vehicle-to-vehicle communications, and I guess my bigger question is have the manufacturers thought of what role intelligent transportation systems will play on the motorcyclists and on the other drivers awareness of motorcyclists near them and this comes from -- the question comes from an Internet article that we had found about a BMW

system that is -- I don't think it's under development. I think it's still in the testing phase of notification to the automobile driver of the presence of a motorcycle. And are motorcycles being thought of in the development of intelligent transportation systems and can any one of you answer that question?

MR. BALOGA: Yeah. There's an awful lot of work going on right now for vehicle-to-vehicle and vehicle-to-infrastructure communication, VII as it's known or DSRC, which is dedicated short range communication car to car. There are a lot of technical issues to be resolved. Frequencies have been allotted by the FCC. The radios to communicate have been proven to function, to work properly to communicate from a BMW to a Jaguar to a Mercedes to a Chevy and so forth. So there is intercompany and intracompany discussions, coordination, cooperation, to make that happen. There is a lot of effort going on with the Federal Highway Administration with NHTSA to make that happen, to make cars talk to each other and understand for the purpose of advising initially and then warning, of course, is the next step, and ultimately at some point, there will be intervention which would mean that in the case of a motorcycle approaching an intersection where a vehicle, a truck, a car, some bigger vehicle is going to run the red light or is going to run the stop sign, the motorcycle would get a warning early, in advance of the intersection,

either through the car directly to the motorcycle or through the intersection of being alerted with radar and so forth, that this vehicle can't possibly stop in time. And this message will be sent to the motorcyclist who will have an opportunity to take evasive action, and then ultimately and I don't see this happening in the next 5 years, but perhaps 10 years or so, there will be intervention where the vehicle will take some action to cut back on the throttle perhaps or to start applying some brake, to apply drags so that the rider notices it. So this, this sophistication that's coming, vehicle-to-vehicle interaction communication is really now progressing very, very well, with the microprocessors having gotten smaller and faster, there's an awful lot of data that can be exchanged right now. So I would say from the auto industry and the development that's going on, motorcycles are prime candidates for this because they are so vulnerable in the population with the bigger vehicles.

MR. BRAZY: Excellent. Thank you.

MR. JOSEPH: If I could just add real briefly to that. As Mr. Baloga mentioned, there's a lot of research going on here with vehicle integrated infrastructure and DSRC. The example that I showed, the ASV 3 vehicles which was a scooter and a Honda Accord, the ASV program is a program that the Japanese Government organizes and includes many manufacturers. There are only a handful of companies that make automobiles

and motorcycles. Obviously BMW and Suzuki among them, along with Honda, and those manufacturers have been involved in many of these different efforts and are very supportive of including bikes.

DR. POLAND: I think we have a number of other questions here but I'm also told that our Board of Inquiry has some questions, too, and we don't want to limit their question. So we can pass it to Member Hersman and she could begin questioning please.

CHAIRWOMAN HERSMAN: The demographics are showing that a large number of woman and older riders are taking up motorcycling. Is there any vehicle design effort to try to address different needs, sizes, height, upper body strength?

MR. CURTIN: I think if you go back and look at our product introductions over the last few years, you'll see there's been a number of motorcycles where we've tried to lower the seat height, is one way. We've done that with the Sportster. We've done that with some of the other models in the Dyna line and the Soft Tail line, and so by doing that, we're addressing some of that concern about folks being able to feel comfortable getting both feet on the ground, and that's one of the areas in which we've tried to address some of that.

CHAIRWOMAN HERSMAN: Okay. Dr. Poland mentioned the issue of maintenance, that 65 percent of motorcyclists are doing their own maintenance. I had a number of conversations

with people who have been long time motorcyclists and they had a number of concerns about work being done on their bikes. One motorcyclist relayed that a brake issue wasn't caught except for he had an inspection, and it was done at a dealership where something was misaligned. Another one told me a story about a oil change and the filter not being put in correctly and then the bike seized up, the engine seized up while he was riding. And finally another talked about a wheel, front wheel that was put on backwards, and was a directional issue. Are there any standards, any requirements as manufacturers that you have for your dealerships for the maintenance that's done there? Are there any training requirements? Are there any -- I know on the vehicle side, on the automobile side, there's certifications that mechanics get. Anything like that on the motorcycle side or any concerns from you all about work being done on your motorcycles that are under warranty?

MR. BALOGA: We at BMW have training programs that are as sophisticated as for the automobile sector. With the incoming electronics that have been introduced and being more and more introduced, the sophistication -- we don't call them mechanics. We call them technicians, just like the auto industry for cars and so forth refer to them because it's no longer sufficient to be able to just pick up a wrench and unscrew a bolt or tighten a nut to repair these vehicles. They're more and more sophisticated, and I think with that

level of sophistication, there are more -- it's more attractive to certain types of people to become technicians. So I think for us, the field is evolving into one where if you want to repair our motorcycles, you need to be trained. You need to come to our facilities and take the training courses to become certified to be master technicians, and if you don't, when someone brings one of our motorcycles into you and says the diagnostic lamp says something is wrong, you won't even be able to start. You won't have the special tools, the specialized knowledge. So I think the level of sophistication is forcing the industry to go in a direction of more educated technicians. So I think that's encouragement for smarter people, more conscientious people to be working on motorcycles.

CHAIRWOMAN HERSMAN: Is this industrywide or just for BMW?

MR. BALOGA: I know for sure it is for us. I can't speak for the others.

MR. JOSEPH: Wayne and I just nodded to each other that, yeah, it is industrywide, and I think, you know, as I mentioned earlier, motorcycling is an inherently emotional topic. It's something that people choose to do. It's not something they have to do generally, and you cited several examples of situations you had heard about. Did I understand correctly that those were dealership repairs that had gone wrong?

CHAIRWOMAN HERSMAN: Yes, and they were from Safety Board staff who, you know, obviously accidents were avoided but they recognized what was going on, either avoided something or, you know, had a situation that was an incident and not an accident.

MR. JOSEPH: I think part of motorcycling being so emotional is that you will have -- I think everybody has -- everybody in this room probably has some anecdotal information but if you look back at the MAIDS Study, I remember specifically the suspension failures represented less than one percent. So I think the -- when things go wrong, it's very apparent, and the consequences are obviously much higher than in a four-wheeled vehicle, but I'd like to believe that that is not the norm, that most of these collisions are not a result of vehicle failure.

MR. CURTIN: And then with regards to the training and asking if it's industrywide, from Harley-Davidson's perspective, we have a very extensive technical training program for the technicians that work at the dealerships, and there's a core certification course in motorcycle mechanics that they have to go through and graduate from in order to even get a job at a dealership as a technician, and then once they've done that, there's all kinds of different opportunities for them to take training to upgrade their skills to be able to do more and more extensive work, and that training includes, we

have -- at Harley-Davidson, we have Harley-Davidson University which is geared towards training our dealership's staff and so they can come on site at Harley-Davidson and take training there. There's also online classes that they can take. There's also some video up link courses where like there's some kind of technical notice on something, that they'll get the information. There's very extensive training programs and steps that they have to go through in order to move up the line of the complexity of the work that they do at the dealerships.

CHAIRWOMAN HERSMAN: Okay. Are there any conditions where linked brakes would not be optimal? I know that riders face a variety of conditions on the road, and --

MR. ZELLNER: That's difficult to answer because there's such a wide variety of link brake systems. There are some that are hand operated, some that are foot operated. There's just many, many different designs with different types of proportions. So as a generality, it's very difficult. There are some that, for example, on extremely slippery uphill or downhill surfaces, on gravel, say like a gravel road would lock up and fall over without the expectation of the rider in that direction or steep, yeah, slippery surfaces I guess are the first ones that come to mind.

CHAIRWOMAN HERSMAN: Okay.

MR. BALOGA: We have some combination on road/off road motorcycles that allow the rider to select whether they're

linked or not. That helps for certain kinds of cornering under slippery conditions to actually be able to lock up the rear wheel and slide around a corner. That's the safest method actually to make a sharp corner in dirt, gravel and slippery surfaces as you said.

CHAIRWOMAN HERSMAN: Okay. And kind of going back to the issue of maintenance and, I've heard of some customer lounges that serve alcohol at dealerships while people are getting their vehicles worked on. Is this anything that any of you all are familiar with?

(No response.)

CHAIRWOMAN HERSMAN: Okay. Let the record note there was no comment from the panelists.

The role of the industry in implementing the scores of recommendations from NAMS, looking at the National Agenda which the industry was involved in, there have been so many recommendations that came out of NAMS. Are there any that or strategy that the industry has as far as implementing those recommendations? Is there a coordinated strategy to get those recommendations implemented? It's been six years trying to do a check of where we are.

MR. CURTIN: That subject has been discussed a lot at some of the recent NHTSA quarterly network meetings on motorcycle safety, and recently there's been an implementation guide that's been put together to try to help move that

forward, and I think there's some -- will be more ongoing discussion at the future NHTSA meetings on -- I think it's actually one of the subjects of our next meeting, is for people to come back and talk about what activities they think their companies, organizations, interest groups can pick up on and work with coming out of this implementation guide.

CHAIRWOMAN HERSMAN: Okay. And my last question has to do with the crash causation study that NHTSA's planning. I know all of you have mentioned in your presentations information from past studies and that you all participated in funding some of those, MAIDS and others. What is the industry's position on the crash causation study and the matching funding that's required in order to proceed ahead with this study? Is it something you all expect to be involved in? Is it appropriate for you all to be involved in the funding of that?

MR. CURTIN: I think there may be some other opportunities for you to talk about that question in a little bit with some of the other panels coming later, but it is something that I think most of the industry has an interest in, and there are ongoing discussions within associations like the Motorcycle Safety Foundation, Motorcycle Industry Council, about what role that the, that the industry can play in that, and ongoing discussions between them and Oklahoma State and FHWA and NHTSA.

CHAIRWOMAN HERSMAN: But you all have participated in funding the other studies that have been done in the past. I think in your presentation --

MR. CURTIN: Yeah, we had some participation in helping to fund the study.

CHAIRWOMAN HERSMAN: The MAIDS.

MR. CURTIN: The MAIDS study in Europe, yes.

CHAIRWOMAN HERSMAN: Okay. Thank you all very much. Dr. Ellingstad.

DR. ELLINGSTAD: Thank you. We are running a little long. Bruce and I will try to hurry here and ask the panel also to be expeditious in their answers.

First of all, to Mr. Baloga, with respect to the tire monitoring system, how much does it cost on the BMW?

MR. BALOGA: I'll have to get back to you with that. I'm sorry. I don't know the answer. [Mr. Baloga later responded that the cost was $260.]

DR. ELLINGSTAD: Okay. Do Honda or Harley-Davidson have any such systems under development?

MR. JOSEPH: We don't have anything available right now, and I'm not really prepared to talk about future product.

DR. ELLINGSTAD: Okay. That's fine.

MR. CURTIN: And from Harley-Davidson's perspective, we don't have anything on the market now, and I can't talk about future product offerings.

DR. ELLINGSTAD: Okay. Thank you. With respect to, to the Honda Goldwing airbag situation, how many Goldwings with airbags have been sold to date?

MR. JOSEPH: I checked last week, and the number I had was 21.

DR. ELLINGSTAD: Okay. So hopefully we'll wait a while before we see one of those in action.

MR. JOSEPH: I think so.

DR. ELLINGSTAD: I had a question here from someone who had inquired as to whether seatbelts ought to be added with the Goldwing, but in the more general case of a position, you had mentioned there are many situations where the motorcycle rider would be out of position. Are there any other kinds of design modifications that have been made or being contemplated for the Goldwing or other bikes to make sure that the operator is in position to be helped by the airbag?

MR. JOSEPH: I think I may have not stated that very well. We don't consider those positions out of position for a motorcycle rider. I was trying to draw a comparison to --

DR. ELLINGSTAD: Relative to a car.

MR. JOSEPH: In an automobile, they would be considered out of position but for those bikes, that is the riding position which poses a technical challenge for placing an airbag that would have benefit to the rider but we, we look at rider position, and obviously different configurations of

bike require a different rider position. So I'm not sure if I'm answering your question very well.

DR. ELLINGSTAD: Yeah, I guess the question basically was are there other design considerations that, that can put it in a better position to be affected by the airbag?

MR. JOSEPH: We have looked at that but certainly a seatbelt has a huge disbenefit or maybe disbenefits by likely putting a rider in harms way. So that specific example is not a good technical direction. There are other things we can and have looked at but ultimately it has to be something that has market appeal, too. You know, a sports bike with a lean back seating position may not have any appeal, and if nobody rides it, it doesn't help anyone.

DR. ELLINGSTAD: Okay. Thank you. Another question, the BMW produced the Boxer since 1923 with an east/west I assume transverse mounted engine, that provided protection for the rider's feet in a side impact. The question was why are these designs not used more widely?

MR. BALOGA: In terms of the Boxer engine, we still offer the Boxer engine on some of our models. We have three different engine configurations. I'm not, I'm not so sure from what I know about side impacts and automobiles that I would feel comfortable with that cylinder head protruding five or six inches providing much in the way of protection from an impacting automobile. I think, I think that may be more false

perception on the part of the people who would consider that. I think when the motorcycle would be impacted, if it hit on the valve cover or the cylinder head, it would push the motorcycle forward and the occupant would still be impacting the vehicle. So I wouldn't consider that to be a serious protective device.

DR. ELLINGSTAD: Okay. Thank you. Another question with respect to the injury mechanisms. Hurt reported on serious groin injuries to riders back 30 years ago due to the design of fuel tanks. There appears to be a resurgence of these types of injuries on sports bikes due to the collapse of the tanks. Is that something that you have encountered and could any of you comment on that?

MR. ZELLNER: I'm not sure exactly what you mean by collapse of the tanks, but at least in terms of contacting the tank, we tried to address that in the one slide. In the MAIDS accidents, less than 1 percent, actually less than .5 percent were involved pelvis fractures associated with tank contact. And again the technical challenge there is that the tank has to meet fuel integrity requirements in addition to interacting with the rider during a potential crash in a particular potential direction. So there are competing requirements there for fuel tanks, but as I understand it, in looking at the market, my understanding is that fuel tank slopes probably over the last 10 years have generally decreased in the market. So I think it's true -- it is accurate that those groin injuries

that occurred in the Hurt Study and a similar percentage, a small percentage occurred in the MAIDS Study, but I think it's a very small part of the accident and injury picture.

DR. ELLINGSTAD: Thank you.

MR. MAGLADRY: I'll try and finish up in six minutes here. Mr. Curtin, you talked a little bit about the complexity of the different lighting configurations or lighting standards for Harley-Davidson motorcycles. Is Harley-Davidson or the other manufacturers making an effort to get standardized lighting across the markets, U.S. and Europe?

MR. CURTIN: Harley-Davidson and most of the other manufacturers are involved in efforts to develop global technical regulations that could be applied across the board in areas. So, yeah, we do work a lot on the harmonization issue, and we have been active in that effort for many years. It's just a very slow process.

MR. MAGLADRY: We've talked a little bit about different braking systems here, ABS or CBS. Are these things that can be added to existing motorcycles? Is ABS an after market potential?

MR. JOSEPH: No, I would say not.

MR. MAGLADRY: Are they of value to novice riders more than they are to experienced riders?

MR. JOSEPH: I think you're getting into a complex issue of perception. An experienced rider, many experienced

riders believe that they are better off without these types of systems. I don't know that any studies have been done showing which is more effective or not.

MR. ZELLNER: I would agree with that. There have been no studies on the effect of skill level on ABS or CBS interaction.

MR. MAGLADRY: Mr. Baloga, somebody's written here about BMW C1 model which was not introduced in the United States I gather. Can you talk a little bit about what that is and how it's configured?

MR. BALOGA: I will be very brief. The C1 was a motorcycle that we produced up until a few years ago, and it was a motorcycle with a roll cage that was designed to pass all types of crash tests. It was a roll cage that passed the ECE funnel and side impact requirements. It had a harness system integrated into the motorcycle such that you could not start the engine without wearing the harness. It was a -- what's the English word for it, harness, racing harness type, H harness type, and it did have an interlock that you couldn't start the engine as I said. And you were strongly cautioned against -- by BMW against wearing a helmet because being belted into this motorcycle, the helmet would add extra weight to your neck that would cause -- expected to cause injury as a result of the inertia of the helmet.

What could have been done at the time, it wasn't

invented then, would be the Hans system to hold the helmet to the structure so that the helmet wouldn't overload the neck. So that was the basic design.

It was allowed to be ridden in Germany, the ECE, without a helmet, which was very unique. It was a very long process to convince the authorities that that was the safer alternative. The motorcycle could be -- you could roll the motorcycle over and so forth, and you were cocooned with this roll cage so to speak.

We thought about introducing it in the United States to try to convince certain states that this motorcycle did not need a helmet or was actually safer without a helmet, was a formidable task, and it was never introduced to the United States. It also was considered to be perhaps sending the wrong message. Why is this motorcycle exempt from helmet laws when every other motorcycle is not, and so as a result of the costs and it wasn't particularly popular -- there were high costs involved because of this complicated, fully developed tested roll cage, and we stopped production a couple of years ago.

MR. MAGLADRY: Mr. Joseph, with respect to your airbag, if a driver is, if a rider is not wearing a helmet, and the airbag deploys, what effect does that have on the HIC value?

MR. JOSEPH: Obviously we did tests with and without and they're still considerable benefit in the primary collision

but our concern about an unhelmeted rider is what happens after the airbag has done its job. Any secondary or later impact or contact with the road and so on. There's still a potential for head injury. And you bring up kind of an interesting point. I know we need to keep it brief but when we introduced automobile airbags, we had a very interesting condition. It was a real conundrum for us, in that the airbags were preventing fatalities, and we suddenly became aware of lower extremity injuries and other things that were irrelevant prior to that because the occupants were dying, and it was a revelation that when you get rid of the fatality, when you prevent the fatality, you become aware of so many other factors and the same could be the case here.

DR. PRICE: If I could just ask one additional airbag question that's slightly different, but what about if the airbag deploys with the passenger. Have you looked into that at all? Would everybody better or worse off if there were a passenger involved?

MR. JOSEPH: Yeah, we have looked into that. Our testing did include that. Again, we used the ISO 13232 Guideline for baseline analysis, risk versus benefit, and that tool was very helpful. In that regard, we did our own testing for many other conditions including with and without helmet, with and without passenger, and the effect -- there was a negligible effect on the passenger. It really didn't make any

difference. The passenger was still moving forward into the rider, and it really didn't change the kinematics or the injuries for the passenger.

MR. MAGLADRY: I'll just ask one last question for anybody on the panel that wants to take a shot at it. We've talked about a number of technologies here this morning that have some benefit for the safety of the vehicle. It's also my impression that maybe safety doesn't necessarily sell motorcycles. So that's my question. Does safety sell motorcycles? And how does the industry go about encouraging the sale of safety?

MR. BALOGA: I think there's a fine line between promoting safe riding, safe equipment, safe motorcycles, and having the rider of the motorcycle, purchaser of the motorcycle branded as afraid. There has to be a balance. You certainly -- those of us who ride and it's probably not understood by people who don't ride motorcycles, obviously it's completely different and you're not riding a motorcycle necessarily because you want to take risks. You're riding for the feel, the smell, the temperature change, the visibility of the road. It is a complete experience that you're riding a motorcycle for, and you're not, and I certainly don't have details or data to support this necessarily, but I don't believe that motorcycle riders are riding to be dangerous. And therefore what I started to say in the beginning is there is a

fine line between offering equipment to motorcycle riders who want this experience, that you can show them that the systems are for their benefit. They are rider assistance systems. They're for their benefit when they need it, with the Honda airbag for example, with protective gear which is very important, with the helmet, with the boots, with the gloves, and so I think we would be doing our industry a disservice if we were to embark on a direction of admitting that motorcycles are inherently dangerous and now we need to make them safe. There will never be a safe airplane, motorcycle, automobile, anything, anything that involves such tasks, and therefore, I think, I don't want to go on too much longer, but I think the philosophy should be give the rider the most assist and advantage and benefit that we in the industry can possibly do and then, of course, the good training from Motorcycle Safety Foundation and others can add to that and join. I don't think we want to go off on the deep end, but we can't neglect these people and their safety.

MR. MAGLADRY: Thank you.

MR. CURTIN: As I said during my presentation, Harley-Davidson is committed to promoting motorcycle safety. Of course, we look at it in the holistic view that I talked about earlier with the three factors, the vehicle, the environment and behavioral, and if you -- all through our promotional materials, we talk about safety. We talk about

protective gear. We encourage people to take rider education programs, whether that's going to the state program and getting rider education there or doing it through our Rider's Edge Program at the dealerships where it's available. And also as we continue to look at vehicle improvements, and I think it goes to part of where Tom was going with this, is that there has to be a level of market acceptance by the consumers in order for them to use the safety devices.

So you just can't go loading up a vehicle with a bunch of safety devices. If it's not accepted by the marketplace, they won't be used, and therefore you won't see the benefits of those, of those devices. So sometimes it just takes a while to -- again, I think Honda's approach with the airbag, of trying to go down that route and seeing what the marketing acceptance is, is one example of how that is done in the motorcycle industry if we try to move into new areas.

MR. MAGLADRY: Thank you. I'm done.

CHAIRWOMAN HERSMAN: We're running a little bit behind schedule. So we're going to have a very quick break. We're coming back at 3:00, but during the break, we are actually going to have another demonstration, hit air airbag jackets and vests, is going to be doing a demo, and I think they're on their way down. You're welcome to stay to watch that, but we will have a quick break and start at 3:00. Thank you very much for your presentations, Panel 2.

(Off the record.)

(On the record.)

CHAIRWOMAN HERSMAN: Welcome back. We're falling a little bit behind schedule. So we expect that we will probably be here a little bit longer than expected today. We hope to adjourn by 5:30.

Dr. Price, will you please introduce the third panel?

DR. PRICE: Our third panel this afternoon is rider protective equipment. It will be started by Dr. Richard Alcorta of the Maryland Institute for Emergency Medical Services Systems, followed by Mr. David Thom from Collision and Injury Dynamics, Ms. Liz de Rome from LdeR Consulting, Mr. Andy Goldfine for Aerostich, and finally Mr. Paul Varnsverry from PVA Technical File Services Limited.

Our NHTSA staff Technical Panelists for this panel are Mr. Hank Hughes, Dr. Kris Poland, Ms. Michelle Beckjord, Ms. Daniel Roeber and Mr. Doug Brazy, and we will begin with Dr. Alcorta's presentation. Dr. Alcorta.

DR. ALCORTA: Thank you very much. Greetings. My focus today is going to be presenting you with injury information that will give you an idea about frequency of injuries associated with motorcycle crashes as seen in a trauma system, and that is that of Maryland's trauma system.

I'm going to touch momentarily on severity score which gives us an idea about the magnitude or severity of

motorcycle related crashes, injury types by body areas, probably the best way to look at it because we're looking at prevention and engineering designs on how we can reduce injury to the rider and their passenger.

But I'm going to try and match up showing a video with some mechanisms of injury so that we can clearly focus on areas where we have some interventions and where we can make more in the future. And then clearly an example of a mandatory implementation of a single rider device in the State of Maryland and how the helmet law has made a different in implementation. And again, this is based on a year's worth of data from the State of Maryland with a population of 5,700,000.

Injury severity scores, basically means by which statisticians and physicians can analyze an injury pattern and determine whether this person has a good chance of survival or not a good chance of survival. So the easiest way to look at it is if you've got injury severity score of 1, you're going to do great. You're going to survive. If you have an injury pattern of greater than 15, you're going to have a potential of death. If you have an injury pattern of 30 or more, it's unlikely you're going to survive your injuries. It's a basic way to look at it, but it's really an in-hospital design and it's not something that's used from a pre-hospital triage process. And as you notice, some of the data comes from autopsies which means we failed both preventing the injury and

from saving them from their injury. Can you advance my slide please?

So when we look at the Maryland trauma registry data, what we clearly see is the vast majority of motorcycle crashes are under 12 which is good news. That means that whatever we're doing, those injuries are lower in mortality rate, but regrettably as you noticed, we have some between 13 and 19, and we have some as high as 75. Those people that are in that 75 category do not survive even under the best of circumstances. Next slide please.

This gives us an idea as a surrogate of severity. This is the length of stay in a hospital based setting. So when we talk about injuries as a whole, what we want to see is a short length of stay, and if you take a look at that 4.5 days, that's actually a dramatic improvement within the State of Maryland because it used to be an average of 6 days for the helmeted and 9.1 days for the unhelmeted rider. So on a whole, we're doing something right in the system, and we're seeing shorter lengths of stay and hopefully, as a surrogate of severity, lower severity scores. Next please.

Now mechanism of injury. Probably the biggest thing, anyone of us who has ever ridden, myself included, is you get road rashes when you go down, abrasions, contusions, bruises. Those you don't enter the trauma system for. You go to a local emergency department if at all.

Well, then we start moving into those that are more frequent, and that is head and brain injury. Probably the most delicate organ we have is our brain. Next are the things that we really worry about, are flexion extension or axial loading injuries to our spine, particularly our neck, but any part of our spine, thoracic or lumbar can have serious consequences, paralysis. No one wants that.

And then one of the things we've heard a little bit of talk about are straddle related injuries and pelvic fractures, high mortality, high likelihood of having a disabling injury. So I wanted to highlight those in this presentation. Next please.

This happens to be a videotape that I downloaded off the Internet, and it basically talks to airbags. What I want to try and stress for you actually is the mechanisms you're going to see evolve in the video because they actually do a crash test, and they have a crash test without the airbag and a crash test with the airbag.

As you look through the crash, what you're going to see is the head becomes the lead projectile. Therefore, it has the first right of impact if you will. Then we have to worry about neck, hyperextension and flexion and here's the video. So I'm not going to talk over it too much other than -- actually, can you pause that? Oh, we stopped it. Okay. Can't do it. We did it earlier, but we can't do it now. So would

you run it one more time for me. Back up. There we go. I'm going to continue to talk.

What you're going to see is a head first, hyperextension injury of neck, then the chest, torso impacting the vehicle. So what we're looking at is head, neck, chest is being the primary sources of injury which makes sense from this type of impact, and this is strictly a frontal motorcycle into secondary vehicle, not the motorcycle being the target as you will or the motorcycle being laid down.

Then you're going to see actually the airbag deploy, and it actually makes a huge difference in what becomes the projectile. Here you can see, and there's a potential straddling and/or pelvic fracture injury, and when you impact the handlebars, and then there are the extremity injuries as they proceed on into the vehicle and become part of the entrapped vehicle.

And here's where an airbag deploys, very clearly minimizing that forward impact and hitting the outside environment if you will. Next slide please.

So, looking at Maryland's trauma data, we have about 1,064 motorcycle crash victims that actually enter the trauma system. We have 9 trauma centers out of 41 hospitals and this is the data that we have. So those that went to a local emergency department are not part of this data set. You'll notice that 745 of them, about 70 percent were wearing some

type of head protection. Now I want to emphasize that because many of them were not DOT credentialed or DOT authorized, therefore did not absorb much of the energy and were more cosmetic to fool the law enforcement officer than provide any real protection.

The next thing that's probably most important is look how few had any form of protective padding or other protective device that they wore period. So on the whole, motorcycle victims that entered the trauma system and needed trauma care, were unprotected to all other parts of their body except their head, and only 70 percent of them were protecting things -- had some form of protective device for their head, and in Maryland, it's a law. Next please.

Now this is actual real time data from 2005. Now you notice, head injuries of all types is huge, and I've got to caveat this. The reason that it's huge is that anybody that sustained a loss of consciousness and based on the mechanism went to a trauma center, was put in as a head trauma. That's part of our system design. We want to over triage and get people to the right destination the first time which is a trauma center for assessment. Motorcycles do have significant mechanisms of injury.

So when we look at this caveat or at this category, you know, 4 out of 10 people having a head injury when they crash, this has the condition of all head injury types,

including just loss of consciousness, and then going to a trauma center as I'll highlight in a little bit.

We've heard a little bit about the rib fractures but clearly the lower extremity fractures are a biggy. The tib fib is actually your lower leg and that is one of the highest areas of clear trauma. The next is that of the thoracic organs. We're including in here lung contusions, cardiac contusions, great vessel contusions. Next please.

This is what we're trying to prevent. This is head injury with a skull fracture on the lower aspect, and then those nice kind of white areas, that's hemorrhage inside the brain. And what you want to have is a helmet that absorbs the energy rather than transmits it to the brain, because once your head starts rattling around, your brain starts rattling around inside of a closed cage, bad boogie. You start to bleed. You get edema. You have a good chance of having permanent brain damage, if not death. Next please.

Next we look at is pneumothorax and hemothorax. It's actually blood in the chest or air in the chest. That usually means the lung has been damaged in one way or another, and it's starting to leak air between the chest wall or blood between the chest wall and the lung.

Next is the abdominal compartment. We're looking at all of the organs of the abdominal compartment, intestine, liver, spleen. That's about -- you've got about a 1 in 10

chance, if you end up with a serious motorcycle crash, you're going to have one of those injured. These are not additive. These are taken as individual items, and some patients had multiple things. They could have had a head injury. They could have had a pneumothorax, and they could have had an abdominal injury. So please, when you look at the percentage that is based on all 1,064 people and they had a 1 in 10 chance of having just this injury, and some people have multiples.

Facial fractures are clearly important, realizing that most helmets are not designed with some form of facial visor or protection, and then the pelvic fracture or hip fractures are a high probability. And as you saw in that video clip, the handlebars and/or the area in which you straddle, especially if your bike is laid down and impacted into a wall, is designed to split you in half, and you get what's called axial loading and we'll touch on that in a moment.

Next are forearms and then femurs. So we're looking at extremity type injuries, both upper and lower. Next please. There we go.

Here's the straddle injury we were talking about. If you take a look at a pelvis, it's basically a nice round circular intact process. You like to keep it that way. The problem is if you hit pelvis first, it will book you. It will open you like a book and essentially end up with significant fracture, hemorrhage and anything in between, what gets hit,

may be crushed, and you may not what that to happen. Now -- you don't. You want to keep them. Trust me. Okay. All right.

Now this is part of the inclusion criteria that we were talking about earlier. Head injuries, we've isolated out hemorrhages in the brain or in the head is the way it's classified. You have a significant motor vehicle crash, going to a trauma center, you've got an 8 percent chance of having hemorrhage in your head, and a higher percentage of these are associated with not wearing a helmet or wearing a Mickey Mouse helmet.

Next is skull fractures, same criteria.

Hand and extremity fractures are relatively common. Why? Because our arms are falling about when we go down.

The last big category is actually the spine. We touch on it, if you look, lumbar and thoracic spine fractures are actually higher than cervical spine fractures, even though we wouldn't think that, part of it I think has to do with the fact that it's relatively flexible and we've got some protective devices that are working there, and we heard earlier that there are good devices that are out there. The problem is they're uncomfortable to wear. Hans device, unless you're doing, you know, stock car races or something like that, where you don't mind having extra gear on, it's uncomfortable but it has some benefit. Next please.

This is what you want to avoid. If you take a look on the left-hand side, your left-hand side, you'll notice that, if you count from the bottom, one, two, three, four, five, there's a vertebral body that's squished and split in half. You can see the crack right down the middle of it. That's related to axial loading. This is where you lay your bike down, your bike is doing the main part of the work and then you stop suddenly when the bike stops suddenly. You're entire body weight comes down on the thorax, comes down on the lumbar spine, and blows that vertebral body apart.

The other one you see on the right-hand side is actually a cervical fracture. This is actually a hyperflexion in this case, but hyperextension is the other etiology as you saw when that first motorcyclist hit his head and his started going back. That's extension. Neither of those is good and cervical fractures are a very real risk. Next please.

And here's where we have now. About 1 or about 5 percent of motorcycle related crashes have some form of cervical injury. I'm going to move on please for the sake of time. Oh, run please. No, skip it.

I had one -- basically that was a video that shows a well protected individual going down on a curb at high speed, and basically they become a sliding projectile, okay, and as long as you've got protective gear, that's a good thing. If you don't, as you noticed in our trauma data, less than 1

percent had protective gear. All of that basically rips off your skin and then starts to eat down into the bone and ends up with, you know, whatever else is under there going away.

In the Maryland system, we are very lucky, that previous to the law, we actually had 25 percent of the folks thought it was the right thing to do to wear a helmet, and they did. After the passage of the law, 80 percent believe it. Still about 20 percent don't, and we've clearly reduced fatalities. Well, you're going to die -- some of us think we're going to die. No question. But I want to talk to you about a head injury. Next.

Previous in 1992, this is from the head trauma center in Maryland, it's called the R. Adams Cowley Shock Trauma Center. We have a protocol that drives people from the EMS system directly to this center so they can get the best possible head injury care. That's where I want to go when I have my fall, and I need someone to take care of my head.

Now you notice in 1992, only 2 percent of those with a helmet had significant brain injury but 19 percent of the unhelmeted had significant brain injury. Why is the 2 percent so low? Those that were wearing helmets were wearing quality helmets. I want to reiterate that. Quality helmets.

Now clearly we've had more crashes, increased rider participation within the system, and more patients going to the trauma center, and we have an improved compliance with helmet

use, very dramatically, but we still have brain injuries. Why is that? A helmet only absorbs about 25 percent or excuse me, reduces head injury by about 25 percent. So you're still going to have a risk. It just improves your survival rate. Next please.

Regrettably, this is the kind of helmet we all too often see at a trauma center. It's actually one that says it is not for motorcycle or highway use. It's a novelty helmet, and as you notice, that's just a little sponge pad that's in there that wouldn't absorb a grapefruit dropping from this table as far as much energy. So the person ended up receiving all the injury to the head. Last slide please. And I don't think -- oh, it's running. Good.

Now if you notice everybody has protective gear on. That's why this video was put together. They slide, they fall, they burn, and they fly you're about to see -- and they fly, crash and then they stop when they hit something. The good news is they get up, and that's what I think much of what we're trying to talk about today is how can we do this without impacting rider enjoyability. Thank you.

DR. PRICE: Thank you, Dr. Alcorta. Our next presentation in this panel will be by Mr. David Thom from Collision and Injury Dynamics. Mr. Thom.

MR. THOM: Thank you very much, Jana. My name is David Thom. I'm going to be talking about some more details

about protective headgear but before we -- where am I supposed to point this thing. Here we go. Okay.

While we read that, I've been riding motorcycles and wearing helmets since 1971, and I work with Harry Hurt, Jim Ouellet and the rest of the team on the USC motorcycle accident study called the Hurt Report that we've heard quite a bit about today. And as a part of doing that work and some follow up studies that we did at USC, I got a chance to see what helmets do and what they don't do firsthand by spending time on the streets and in autopsy rooms and so on and so forth.

I'm also going to talk about helmet standards and going to talk in a little bit more detail about the novelty helmets or I'm going to add the new term, because I've never heard Mickey Mouse helmet before. So I'll add that to my also known as for the novelty helmets.

The comic here from Gary Larson is that, okay, you guys have had your chance, the horse just wanted another shot at it. All the king's horses and all the king's men couldn't put Humpty's head together again. And unlike other parts of the body, heads don't heal very well.

To talk a little bit about helmet effectiveness, just using some, what I think is very simplistic data, we've heard some more things today that I think were more detailed, but looking at the biggest study ever done in the U.S. to date, the Hurt Study, we found that at the time we had about 50 percent

helmet use under a voluntary condition back prior to the 1992 helmet law in California. And we found an under representation, about 40 percent of the riders that were involved in crashes had helmets on. So that was the first cut, that there was an under representation of guys with helmets on. But even then more importantly, when we started looking at the people that actually got killed, we found that only 20 percent of them had helmets on.

So at every level you go, you find that people get hurt less and killed less when they have helmets on.

Unhelmeted riders are three times more likely to suffer a brain injury. That ties into that 37 percent effective number which to me that's a hard number to understand. I think this states it in a more simple way.

Neck injuries are a very interesting topic, one that comes up a lot in discussions of helmets, and we looked at neck injuries. There are of great interest to everybody in the research community and the trauma community, and we've found overall, and there has been numerous studies done since that time, that confirm this basic finding, is that helmets just don't have anything to do with neck injuries and motorcycle accidents.

Now in a BMW C1 enclosed car/powered two-wheeler vehicle, that's a totally different situation, and that ain't a motorcycle. Those of you that are familiar with it, I as a

motorcyclist have no interest in that vehicle and that's kind of the way it worked out, the sales fell flat, and they don't make it anymore.

But that's a unique situation because motorcyclists as we have seen today are generally free floating through the air when they're involved in a crash. They're hitting cars. They're hitting obstacles in the road. They're hitting the road mostly, and in all of those situations, helmets just don't do anything one way about neck injuries. In other words, helmeted riders still get neck injuries but so do guys without helmets on, and they get them at approximately the same rate.

There are a lot of myths that I think are worth mentioning because one of the things that we pointed out in the National Agenda for Motorcycle Safety that I worked on five, six years ago, was that there's a lot of bad information out there, and that information gets passed around from person to person, and it's hard to find good information.

So some of the myths that are floating around out there, that you will still hear repeated, yesterday and today and tomorrow, is that helmets break necks, that you can't see when you're wearing a helmet, and therefore you're more likely to crash. You can't hear and there's somehow some association with this hearing and not crashing or with crashing. Inertia injury, meaning sort of like the question I just mentioned about neck injury, if you're restrained, like in a car, in a

race car or the BMW C1, that the extra weight of the helmet can put some extra force on your head and your neck, but that's not the case in motorcycle accidents, and that's why auto races use HANS devices that tie their helmeted heads to their shoulders literally so that the head can't move too far.

There's a paper that I'm sure we'll run across, I know I did when I was doing some just see what's up, what's new and exciting on the Internet, there was a paper by Jonathan Goldstein back in 1986, who did a reanalysis of the USC Hurt data and came to the conclusion that helmets were breaking necks and all sort of bad things. Goldstein was very wrong. His work has been highly, highly criticized and completely refuted in the econometric and other analysis literature for the last 10 odd years, yet you'll still see that paper trotted out as being meaningful.

There are some drawbacks to helmets. They can be expensive. People can steal them if you leave them hanging on your motorcycle because once you get there, what do you do with it? It's the same with all protective gear. It's much easier to get in your car, start it up, put on your seatbelt and drive where you're going and then you get out of your car, lock it and walk away.

You do the same thing on a motorcycle. You've got a jacket. You've got gloves. You've got boots. You might have a big riding suit. You've got a helmet, all of which you've

got to do something with, and if you leave it on your motorcycle, somebody might walk away with it.

Helmets do cause helmet hair. There's no question about it. That's one of those things that you just have to live with. You can't say much about it.

They can be very hot depending on the coverage and the weather. If you're in a very hot, humid place, wearing a full facial coverage helmet, it's not going to be comfortable, and that's when helmets with lesser coverage that leave the face and the sides of the head so you're not re-breathing your own hot sweaty air, can be very, very good alternatives for motorcycle riders.

Okay. Let me talk a little bit about helmet standards here. The law of the land, Federal Motor Vehicle Standard Number 218, everybody calls it the DOT standard, it's what manufacturers must meet in order to sell a helmet for motorcycle use, and as we've heard a little bit about earlier, it is currently, in current time, very -- it's well enforced for those helmets that are sold as motorcycle helmets. I don't want to suggest that DOT doesn't back up their standard because they do quite well. They test numerous helmets every year, and when there's a problem, they can force recalls and do on a regular basis.

However, there are a lot of helmets that don't fall into that category because they're sold with the label on it,

that Dr. Alcorta pointed out, this is not a helmet. This is a novelty device. Don't use it on your motorcycle but somehow they wind up on motorcycles. So when I say weakly enforced in the slide here, I mean not weakly enforced by manufacturers making legitimate helmets but on the fleet of helmets that's available to motorcyclists out there as a whole, there's a lot of helmets that don't meet the standard, and it's really a loophole that should be addressed.

Other standards that we see on helmets here in the country are from the Snell Memorial Foundation which is a United States organization founded back in 1957. It's a private organization, non-profit. They sell serialized stickers to helmet manufacturers and they have different testing requirements, and you'll see a lot of Snell stickers and a lot of good helmets on the street.

In just the last three or four years, we've started to see more European helmets coming into the U.S. meeting European standards as well as DOT. Those two specifically that we see a lot of now are the BSI standard, 6658 Type A, which is the higher performance standard from Great Britain, and then more commonly now is the ECE 2205 standard which is used in, oh, I think it's 50 countries nationwide. It's a very widely accepted standard within the entire European community and other nations as well.

There is no standard obviously for novelty helmets.

They don't do anything other than sit on your head and perhaps keep you from getting a ticket.

Some details about the DOT standard, because I think it's very important. There are a lot of questions that were presented to me beforehand by members of the Board, so I wanted to address those because if the Board thinks they're important, I think that they must be. The standard actually came out in 1974, and it's been updated twice, 1980 and 1988. And back when it was about 10 years old, there was a lot of interest within DOT and the safety community of updating the standard, bringing it more into parallel with some of the other international standards that were out there, and there was a lot of work done on that back in the nineties, including a large feasibility study that we did at the USC head protection research laboratory. And then several follow up studies looking into engineering costs and so on, over the several years in the late nineties.

That work has been stalled now for several years. There's currently no one assigned to that standard within the standards development team at DOT, and that's something that it's not creating a problem in that the standard is as good as it was back in 1988, but there are certainly many things that have been addressed that would improve the standard. Specifically labeling requirements are a big issue because of that huge loophole that allows novelty helmets to be sold and

worn and not be cited on the street. That is a loophole that could potentially be plugged by changes to the standard, which at this point is unscheduled.

To talk about the specifics of helmets here for a minute. On the left, you see a partial coverage helmet or a shortie helmet, and that's very distinct from a beanie or novelty or Mickey Mouse or fake helmet, in that it does stop about the ears but you'll see in a minute, that it's much bigger than the beanie helmet.

The one on the right is a pretty old fashioned styled. It's called the jet style with full coverage and the open face, and they're not that popular anymore. You don't see that many of them out there, compared to the full facial style which is on the left that covers the entire head with the exception of the eye part where one has to look out so you know where you're going.

And then a fourth style that's become available, relatively recently in the market, is the modular style or flip helmet in which it looks like a full face helmet, but the whole front end of it can tilt up to allow you to put the helmet on with glasses on, to smoke a cigarette with your helmet on, although smoking isn't good for you, various reasons that people like that helmet.

Here's a comparison between a shortie helmet, partial coverage, meeting DOT standard and on the right is a little

beanie helmet that you can see is much smaller. This particular one has, you might call it a political statement, helmet laws suck, on the back of it, and then it's got an actually manufactured supplied DOT sticker. So this is one of the helmets that the manufacturer was foolish enough to label their helmet as meeting the 218 standard, and so therefore the folks at the standard compliance were able to go out and test it, showed that it truly didn't meet any of the requirements of the standard and forced a recall. But that hasn't happened in years because the manufacturers of the novelty helmets got smart and started putting the labels in saying this isn't a helmet, don't wear it on a motorcycle, wink, wink.

Legislation, we've seen several statistics about what happens when you have a helmet law, when you don't. Depending on the weather and time of year, you get somewhere between 50 and 60 percent of people voluntarily wearing helmets in a non-helmet law state, in a free state. That goes up to somewhere around 100 percent typically in a mandatory helmet use law state. However, that doesn't mean, and Dr. Alcorta I think pointed that out very nicely in his presentation from very recent data here in the State of Maryland, is that the fact that there's a universal helmet law does not mean -- could you step back one slide for me. You went a little too fast there. The fact that there's a universal helmet law in the state does not mean everybody's wearing -- getting any head protection.

There have been some occupant studies done over several years, going back about 10 years in various different parts of the country, and up to 40 percent in some locales are wearing fake helmets, which really confuses, if nothing else, to say nothing of the tremendous human cost, it confuses the heck out of the statistics because if you have to check the box that says helmet, yes or no, which is what is typically done at the police report level which then filters up through the system and ends up in the FARS system with Mr. Shankar, you don't know if it's a real helmet or fake helmet. So one could presume that an on scene in depth study where we really looked at the details of helmets and knew exactly what standard they met or didn't meet, and what sort of damage they had to them, would shed tremendous light on what's happening with helmets.

The difference between a real helmet and a fake helmet, this is a real helmet. It's a shortie, only it stops at the ears. So it's a minimal coverage underneath the requirements of the DOT standard, but it has all the components that you need. It's got a shell which is a hard, in this case fiberglass, but it could be a thermoplastic, outer surface which prevents penetration and provides load spreading of impacts to a wider area.

The critical thing is that it's got an expanded polystyrene or EPS liner material that crushes and cracks and crushes and absorbs energy, that otherwise goes on to hurt you

head. It's got thick padding to make it comfortable. It's got a strap retention system on it to keep it on your head.

Now that's contrasted with a novelty helmet or Mickey Mouse helmet, I like that term, thank you, sir.

DR. ALCORTA: You're welcome. If it only had the ears.

MR. THOM: The ears would finish it off, right. In a novelty helmet, you've got an outer shell and you've got padding to make it comfortable. You've got some kind of strap, although they're typically not very good, but the real critical ingredient that's missing is an energy absorbing liner. There is nothing in this helmet, in this style of helmet, to absorb the energy of an impact to the head, and that's why they don't work. It's really very simple. The patent was issued for that basic design -- for the proper design of helmet but meaning a helmet that has energy absorption. That patent was issued to a USC professor named Red Lombard (ph.) who Harry Hurt studied under, in 1953. That was before I was born. So this is taking a step in technology back into the 1940s.

I had an interview in Time Magazine a couple of years ago, and I used this quote which I think I actually came up with it, it's like a fake fire extinguisher. It looks okay, it hangs on the wall, the fire inspector, if he doesn't look too closely, will pass you but if you have a fire, it's empty and it doesn't do anything. So any of you that would care to use

that, feel free to use that quote, because it's really quite a good analogy. They're very similar in their expectations and the disappointment that follows when they're actually called into action.

These are numbers from the last 10 years where there were helmet laws in place for sometime, and then they were repealed. The fatalities went up significantly. Obviously there are huge, huge questions there. It's not just a simple number of more died, more people got hurt. There's a lot of research that's needed. That's why we're here. I'm delighted to be here, to be part of this process.

I'm also delighted that there's the pilot study and the crash causation study going on with Oklahoma State and Federal Highway folks, because back in 2000, when we did the National Agenda for Motorcycle Safety, we recognized that there were a huge number of things that have changed between say the time that we did the Hurt Study back in 1981 and today, or actually in 2000 when we did NAMS, and it's just gotten nothing but worse.

We have twice as many motorcyclists dying on the highways, and as we said at one of the meetings for the National Agenda for Motorcycle Safety, when we were drafting it and went out to the public to get public comments in Phoenix in 1999, Steve Zimmer who is sitting in the audience today, very eloquently said, we're here today because we don't want to go

to any more of our friends' funerals, and I remember that every time I talk about this stuff, Steve.

So there's a lot of things that need to be looked at, helmets themselves, of course. There are questions about helmets. Motorcycles have changed dramatically. Cars have changed dramatically. Think about what you're driving today versus what you were 20 years ago. We've seen a lot about age, baby boomer returning motorcyclists, a lot of rider and driver demographics that have changed, driver distractions, cell phones, PDAs, navigation systems.

Many things are part of the picture but helmets are extremely important in that as Harry Hurt said in the Hurt Report, in the conclusions, there's really no good reason for a motorcycle rider to be without a helmet. Thank you very much.

DR. PRICE: Thank you, Mr. Thom. Our next presenter on this panel will be Ms. Liz de Rome from LdeR Consulting. Ms. de Rome.

MS. de ROME: Thank you. Can you hear me and understand me? I've come from Australia. So I have a funny accent.

I'm a consultant road safety planner in Australia, and I wrote something a little bit like NAMS for the State of New South Wales, which is where I live in Australia, and one of the issues that came up for us when we wrote that, was protective clothing, and I've been working on that issue for

the last three years, and that's why I'm here today, to share with you what I've found out.

So coming up -- there we go. Okay. So when we talk about protective clothing, the first thing we need to get clear is what are we protecting from. And I looked through, and this is the oldest photograph of a motorcycle protective clothing that I could find. This is from 1910, and in those days, protective clothing was about protecting people from the weather. And that is a valid issue. When a rider is too cold or too hot or gets wet or is uncomfortable, that's a safety issue. So protection from the elements is a relevant issue in protective clothing.

This suit was made from -- canvas. I don't think it was very comfortable. We also look at motorcycle clothing being made of bright colors or contrasts and that's to help make the rider more visible, and to draw the attention of other drivers and protect them from other motorists, and that's also obviously a relevant safety feature. But it's also just clothing and people choose to wear what they do as a fashion statement. And it's often related to sort of the machine that they ride, and that's quite relevant again with protective clothing as I'll show you later.

But our concern about protection from injury, and there is substantial evidence that good protective gear can prevent or reduce injuries in a crash.

Now how it works is you need materials that will last when you're being dragged against the road surface, and crash research suggests that you need between four and seven seconds. Just for an example, normal denim jeans will give you about .6 of 1 second. That's a little over half a second. You need 4 to 7 seconds. You also need materials that can't be cut or penetrated or torn by sharp objects during the course of the crash. You need seems and fastenings and material that won't split open on impact.

And you also need impact protectors, over the bony bits, the elbows, the shoulders, the bits that stick out. What the impact protectors do is they spread the force of the impact over a wider area so it's less damaging.

Now there are limits. Protective clothing is not going to protect you from a high energy impact. It's not going to protect you from being bent or crushed but most crashes aren't high impact. Most crashes in the MAIDS Study, 75 percent of the crashes were at 50 K per hour or less. That's about 30 miles an hour. Forty percent of riders tumbled and slid along the road surface without hitting any other solid object. Forty-nine percent of all injuries were at level one. A level one is a minor injury that Richard was mentioning earlier, a very survivable injury. And 49 percent of all the injuries were at that level. Now those are the sorts of crashes, those are the sorts of injuries where protective

clothing can play a role.

The sorts of injuries that protective clothing can help you with are cuts, gravel rash and friction burns, exhaust pipe burns, the stripping of muscle and skin. This is a very nasty injury called the degloving injury. I won't go on.

Protective clothing, by reducing the amount of abrasion or cutting to the surface of your skin, the soft tissue injuries, means reduction in loss of blood and also a loss of -- a reduction in the risk of infections and other complications from road dirt and open wounds. Impact protectors can also reduce fractures or the severity of fractures by again spreading the loading from the force of the impact.

So what I'm saying is that protective clothing can prevent some or reduce some injuries in a crash.

Richard talked about the injury scale. I use the abbreviated injury scale which goes from 0 to 6. Zero is no injuries. Six is not survivable. MAIDS refers to the most serious injury suffered by a rider in these crashes. So in the MAIDS studies, they had 921 riders and this is the writing of the most serious injuries suffered by each of those riders. So you can see that two percent suffered no injuries at all. Thirty-nine percent had AIS level one injuries. Now those are all superficial soft tissue injuries that would have been reduced or prevented by protective clothing. Another 33

percent have AIS level two injuries. They're more -- injuries but certainly a proportion of those could have been reduced by the impact protectors and by the protective clothing.

Now the MAIDS investigators tried to establish the extent to which the clothing that the riders were wearing had an impact on the injury prevention. Now what they've done here, this slide is a little bit complicated. So bear with me.

This starter set refers only to riders who were wearing protective clothing. So people who weren't wearing it, they're not included in this data. And what we are looking at is where they sustained an impact to that part of the body. So, for example, in relation to the third bar, lower torso, for people who were wearing clothing, who sustained an impact to their lower torso, 15 percent, it prevented minor injury to those people. Sixty-nine percent, the MAIDS investigators considered it reduced the proportion of them that suffered minor injuries. Only 16 percent of those riders suffered injuries to that part of the body as a result of the crash. So that's just in relation to the lower torso. The purple line all the way through is the proportion that was reduced. So you can see that it is really quite a significant benefit.

Now there's a very consistent pattern to the sorts of injuries that riders suffer. What I've done here is I've taken the pattern of injury that was tracked by Faughti (ph.) in 1987, these are both European studies. So I'm comparing like

with like, and I'm also comparing countries where motorcycle helmets were mandatory because it gets more complicated here. So these are two European studies, one in 1987 and one in 2004, and this is the pattern of injuries suffered by the riders. You can see that it's very, very similar. Little's changed in almost 20 years. The two areas most likely to be impacted is the head and the limbs, the arms and the most frequent source of injury as everybody's been saying is the legs. Faughti, it was 81 percent and in MAIDS it was 74 percent of riders suffered leg injuries.

Now this is a study that I recently did of Australian riders. It was done this year, 2006, and what we did was we wanted to know, given what we know that the pattern of injury is, what sort of protective clothing do riders wear, and we asked them what they were wearing the last time they went on a recreational ride, the last time they rode to work or school, and the last time they went out to the shops.

So the first part is the recreational riders. Ninety-eight percent wore a helmet with a visor. Ninety-five percent wore a motorcycle jacket, and that's the motorcycle jacket with the impact protectors. Ninety-four percent were wearing motorcycle gloves. Sixty-eight percent wore motorcycle pants. Eighty-two percent wore motorcycle boots.

When they went to work, they wore fewer protective clothing. They're slightly less likely to wear a jacket. They

all wear helmets. It's mandatory in Australia. But going to work, only 46 percent wore motorcycle pants and going to the shops only 35 percent. So I find it interesting to see the sorts -- people obviously have this clothing but they don't wear it for all types of riding that they do, and they're all least likely to wear protective clothing on their legs and the legs is the area that they're most likely to be injured.

Now the research have known for many years that this is the part of the body that's most likely to be injured. So the line here that I've drawn is the line of the injury risk, and then you can compare it against what the riders were wearing. So it seems to me that riders, Australian riders, they know about helmets, but they don't now about the need to protect their lower limbs and their feet.

Now we've broken this data down. I won't show it because I know I've got to be brief. I have broken this down by class of motorcycle, and it's quite clear that the different, you know, people who ride sports bikes, people who ride cruisers, there's a different pattern of protective clothing that people wear, and it seems to me that, certainly in Australia, the road rider clothing market is highly segmented, so that protective clothing, injury reduction clothing, is styled for the race track, and it's marketed to sports bike riders.

Protective clothing that gives protection from the

weather is styled for tourists. It's targeted to the touring market.

And there's relatively little injury protection clothing that is marketed for scooter riders or cruiser riders and that we call them naked or commuter bikes.

Now if you can see this one, I've used Faughti's figures again because they're really quite useful. Each part of the body, I haven't got a -- yes, there we go. Here, I'm looking at the legs again, and here you see the 81 percent get injuries to their legs. Now 76 percent of those injuries are soft tissue injuries and 32 percent are fractures. So that gives you an idea of the sort of protective clothing that you can use. We've got a website that gives you the numbers for every part of the body and tells you what proportion of soft tissue, what portion of fractures, and it gives you -- just to guide riders on their purchasing of protecting clothing.

Now in Europe, by law, protective clothing cannot be sold as protective unless it does provide protection from injury. It can't be sold as weather protection.

In Australia, we don't have that law, but we do have trade practices which require that any product must be sold that is fit for the purpose. So if it's sold as protective clothing, it has to provide a level of protection, though that's not defined as to what that is.

Now in the UK, where they do have this law about

providing protection from injury, consumer groups have put the protective gear that's on the market through the tests that are available under the European standard. Now I just want to draw this to your attention. This is just one test that I've pulled out to show you. This was a test of 18 sets of leather, one piece leathers, and the score is what they got out of 10 for the European test. So there was an abrasion test which is the 4 to 7 seconds. Now only seven of those suits scored five or less. In my book, they failed the abrasion test. Ten failed the burst test. Nine failed the impact test. Eight failed the tear test, and two of them had zip failure.

Now this is gear that is available in the open market. All of this stuff passed the open road tests that the motorcycle magazine put them through, and they're well known brands. The two brands that came 17th and 18th in the overall score, are very well known brands, and the brand that came second to last, 17th, was the most expensive one in the list and the one that came third best was the cheapest. So price and brand name mean nothing. The only way a rider can tell what they're buying is if it has been tested. Paul's going to talk more about that later.

Now the sad thing that comes also out of these tests, I don't want to discourage people from wearing protective clothing. The sad thing that comes out of these tests is that none of the reasons this gear failed were major problems. The

burst test, it just means that the seams were sewn properly. They're very easy to fix in the manufacturing process, if the manufacturers will pay attention to the requirements of the standards.

So just in summary, the injury risk patterns are very well know, and we've known them for more than 20 years. A significant proportion, at least half of all the injuries suffered by riders, can be reduced or prevented by wearing protective clothing. We know what the requirements are to make effective clothing, and we can test objectively to see if it does perform.

The motorcycle industry is generally not applying these standards, this information, and riders don't seem to be aware of it. And just on that comment, the motorcycle magazines that I work with in Australia, say they really don't feel like they can publish much of this because they earn their living out of that advertising. So that's an issue to be thought about.

Okay. So thank you for listening to me.

DR. PRICE: Thank you, Ms. de Rome. Our next presentation will be given by Mr. Andy Goldfine from Aerostich. Mr. Goldfine.

MR. GOLDFINE: Thank you. Before I begin, to the members of the public, there are standards in Europe covering the design and performance of rider's clothing, and the

committee that organized this event asked me a number of questions about those standards. So what I'm going to talk about to the best of my ability will be those standards.

We began making textile rider's clothing 25 years ago. At that time, except for the standards set by the race sanctioned bodies, there were no formal benchmark standards for motorcycle rider's clothing other than a de facto norm for leather protective suits, and added rubber or quilted felt padding materials at the elbows, hips and knees. So we developed our own benchmarks, designed and built a test sled for dragging sandbags of various materials, leathers and textiles, down little used country roads and carefully measured back to back material wear results.

For other equally important areas, including versatility, ergonomics, comfort, impact energy absorption, quality and style, we used other kinds of self-developed benchmarks. We also directly gathered as many riding experiences as possible and studied as much related information as we could find. Our goal is to make sure a customer's new Aerostich suit would be superior to whatever they had been wearing.

Our mission was, and still is, to profitably provide better products to help increase the adoption of motorcycles.

Those are some of the reason we never use the European CE standards for personal protective equipment for

developing and benchmarking our products, and why we have never marketed our products as meeting those standards.

In 1992, when the CE standards were first adopted, we added the following disclaimer to our catalog and to all of our marketing materials, and it just says that these garments are not considered to be protective equipment and names the directive and the standard number and no liability will be -- it's sort of a legal disclaimer. And, it's available on our website and also in the document that will be produced after this forum, of the full text of what I'm talking today contains that.

I studied the CE standards at the time of their development and questioned several things. Despite their allowable purpose, it almost seemed like the standards were partly some form of non-tariff trade restraint. Inexpensive Asian sports rider's gear was flooding into Europe, and it appeared to be threatening many established manufacturers there. I also remember reading about someone who was writing the standards while he was also an active stakeholder in a for-profit UK company developing a proprietary impact protective armor. This apparent conflict of interest was not reassuring.

Despite those concerns, the new CE standards had value. They contained useful guidelines and test methodologies which provided empirically comparative metrics. We sent our Aerostich TF2 systems to the CE lab in England for testing in

2001, and at the same time, built an exact duplicate of the CE test apparatus ourselves. And then I've got a couple of pages here that's attached to the document that will be part of the written papers, about the results of our testing.

Essentially -- and they compare the force of our armor padding systems with four or five other companies' armor padding systems. Essentially, we were producing and selling a version -- let me read I guess a couple of the notes.

The test showed that our pads were in the ballpark compared to the other CE approved pads. In the hard shell areas, our pads are a composite of several materials, and in certain areas they were among the best of the pads that the CE had tested, and in the areas around the perimeter of our pads which are a little more flexible and softer, they were not good enough, that only two pads that we were aware of that they tested actually produced better energy absorbing numbers than ours out of many. So we were very close to the top of the spectrum. Both of those had other kinds of problems in my judgment. One was rigid EPS or Styrofoam material similar to what's in the helmet, that had some comfort issues I felt. And the other material that beat us was quite a bit heavier than either the Styrofoam pad or our material.

So we were producing and selling a version of the TF2 pad 10 years before the CE standards were written. TF2 pads have always combined excellent energy absorption performance,

acceptably lightweight and versatile wearing comfort.

But despite those synergistic qualities, the TF2 pad systems never complied with the European CE standards, and there's an explanation in our catalog and also available on our company website, that says the CE standards involved -- basically I'm going to paraphrase that again and skip out of the prepared remarks. It is available on the full document.

Basically our pads are slightly the wrong shape and designed to fit the contours, the cut of our suits and benchmarking always involves making assumptions that influence the process. For example, the CE standards require impact pad shapes that are a little more closely fitted to the body than our Aerostich TF2 pads. I misspoke there. I shouldn't have used the word require. They generate shapes that fit the body closer than ours. I believe that the reason for this is partly because of the underlying European research involved more race type leather suits and sports racing motorcycles than what is common here in the United States. Their standards resulted in impact designs that are notably less insulation layering, versatile and comfortably fitted, yet are not more effective at protecting riders from impacts than our larger and more loosely fitted TF2 systems.

It's unlikely that any American rider clothing designer, manufacturer, distributor, retailer or consumer, would welcome the adoption of CE type standards here in the

United States. All regulations and certifications exist within larger societal environments. There are significant differences between Europe and the United States, not only in most motorcycle culture and motorcycle safety related areas, but in many directly related social, legal and political areas. America's approaches to increasing motorcycle safety must recognize these differences.

We can benefit from European experiences, but our solutions should be uniquely American. Regulating the exact size and shape of an elbow pad or how it may respond to slightly more or less impact energy on a test apparatus is not as important as knowing what effect the establishment of such regulations would have on the overall risks of riding a motorcycle in the United States. Establishing CE standards for rider's protective clothing transfers control of these products from entrepreneurial designers, manufacturers, distributors, marketers and sellers to lawyers, consultants and certification administrators. That would seriously undermine America's unique abilities to innovate and compete. The market for personal protective equipment is worldwide. Having a business environment here that remains free from regulatory interference is a crucial key to retaining one of America's most important competitive advantages. European CE standards should serve us well as guidelines and allow Americans to have the best of both world, useful comparative metrics for those who are interested,

and the freedom to out innovate and out compete with ever better and possibly non-compliant products. This is vital because with the exception of helmets, motorcycle rider's gear is an unregulated area. A significant consequence of this is that thus far there have been almost no liability lawsuits involving this type of protective equipment, and that's the exact opposite of what everyone making, distributing and selling motorcycle helmets has experienced.

In the U.S., motorcycle helmets are designed and produced and sold within a complex framework of certifications and standards. Layers of costly insurance litigation surround that structure. Because of this closely regulated and –highly litigious environment, it would be impossible for anyone to pioneer, for example, a new type of helmet, positioned between a bicycle and a motorcycle helmet, intended for use by the riders of smaller or displacement scooters.

At the other extreme, there are some indications that many models of certified helmets may actually be too stiff to provide riders with optimal levels of energy absorption for the majority of head impacts experienced in typical accidents. More than anything else, it is the highly competitive, free marketplace that exists in the United States, not in Europe or in any other areas were CE standards regulate innovation, that is responsible for the rapid advances in both motorcycle rider's gear designs and underlying materials technology.

The best gear is steadily becoming lighter, better functioning and easier to wear. Newer items are often more visible, versatile, durable, affordable, fashionable and protective, and similar products that were only recently considered benchmarks. Such advancements would be harder to develop and would arrive more slowly if CE type standards were to be implemented in our country. Future advances will offer motorcyclists even greater levels of comfort and style and can be instant protection. Beyond acknowledging generally improved functionality of value, it is easy to take informal guesses about a few desirable specifics. The abrasion resistant and kinetic energy absorbing properties of new materials will continue to exceed the performance levels of the materials available today.

There are also some entirely new design and engineering ideas that have considerable potential. Asian made C02 inflating airbag type vests and jackets have recently become available, and a larger company in Europe has independently developed a sophisticated sodium azide version of this idea. Also in development are several promising range of motion limiting cervical collars. Unfortunately, these advantages will all probably face increased difficulty becoming accepted within any CE regulated markets.

After an accident, many Aerostich riders will excitedly remark, this suit saved my life. The truth is that

most of the time a protective suit merely reduced injury severity which is wonderful in itself but not the same as truly lifesaving benefits. In most accidents, riders fall vertically a few feet to the ground. Unless there's an impact with another vehicle or a piece of roadside furniture, most of the post accident kinetic energy will be dissipated by road surface friction. Personal protective equipment usually provides less than an inch of space to mitigate all possible impacts and abrasions. Gear must be lightweight and flexible enough to be comfortable and remain easy to wear in conditions that range from tropical heat to arctic cold.

Until about 25 years ago, there was a very loose crash injury equivalence between cars and motorcycles. During an accident, a vehicle's occupants would hit the inside hard surfaces of their automobiles with forces similar to those that a crashing motorcycle rider experiences. Both cars and motorcycles have since become much safer, but the playing field is no longer nearly as level, passive safety systems in automobiles became many times more effective than the advances in personal protective equipment available to motorcyclists. An encapsulated driver is now far better protected from collision caused injuries than a well dressed motorcyclist.

Adopting CE regulations on personal protective equipment would help further lock in the imbalance. Except for populist repeals of mandatory helmet laws in many states, none

of the reasons for the increasing motorcycle injury rates are closely related to personal protective equipment. The type of injury most greatly reduced by wearing protective clothing are broken bones and skin abrasions. These can sometimes be quite serious but neither are normally life threatening. The likelihood of severe life threatening head injuries is usually reduced by wearing helmets and similarly, severe life threatening internal injuries can be reduced by wearing fairly bulky back and torso pads.

Unfortunately, these articles of personal protective equipment are not very popular. People who chose to ride motorcycles understand, though they sometimes deny it, the risks involved. Riders freely accept risk benefit ratios based on their individual needs and circumstances. Motorcycling is partly about riders reconciling nature, culture and technology. Those who wish to wear denim and leather are going to continue to do so, and those who do not want to wear boots, impact padding, thick gloves, helmets or other forms of personal protective equipment won't.

Motorcycle related injuries and deaths have increased mainly because there are now so many more motorcycles and motorcycle riders and because the motorcycles themselves are being designed and marketed as ever narrower forms of entertainment. As a result of being consumed largely as toys, motorcycles have become more specialized in ways that in my

opinion may have been contributing to some of the increasing accident rates.

Let me skip ahead for reasons of time here. Let's see. Changes in the driving population, the density mix of the surrounding vehicles and other environmental factors also account for some of the recent increases in motorcycle accident rates. Roads are becoming increasingly crowded as automobiles have been more widely adopted by a broader range of people. As a result, the makeup of the driving population may have changed slightly. Demographic and economic shifts maybe causing there to be slightly higher numbers of less capable drivers than there were 20 years ago.

Cars are also changing in ways that continue to provide their occupants with safer and more isolating inside environments. Streets and highways are changing, too. There are now more miles of straighter, wider roads. All of the changes may be producing a less engaged and less attentive driving population.

Somewhat more narrowly, there are now more light trucks and SUVs in traffic. This increases the risk of riding the motorcycle because of their bulk and height. A conventional car/motorcycle collision, the rider may bounce or arc over the car, landing on the roadway beyond, and the result is usually a non-fatal injury. However, when a motorcycle collides with a taller vehicle, the rider is less likely to be

ejected to a comparatively safe landing on the far side, frequently slamming into the vehicle itself. So there's less opportunity for kinetic energy to be slowly dissipated which is what happens when a rider tumbles on the ground.

Finally, of course, the threat environments surrounding the contemporary American motorcyclist has been made worse by today's longer commute distances which promote driver distractions such as cellular telephone use, eating, personal grooming and other multitasking behaviors that make it less likely that a driver will be able to see and avoid a motorcyclist, no matter what the motorcyclist is wearing or riding.

One recently encouraging safety advance is motorcycle airbag technologies. These handlebar level systems provide -- and I want to note here parenthetically, that in Japan, Yamaha has just introduced an airbag system for one of their scooters, to join Honda -- provide both controlled rider deceleration and possibly an enhanced upward ejection vector both very desirable frontal impacts. I wish this technology were available as a compact tank bag mountable accessory. I'd have the first one. Again, regulatory and litigation concerns in the United States can discourage such innovations.

For better or worse, America has the world's most effective and efficient product effectiveness feedback system already in place.

DR. PRICE: Mr. Goldfine, I hate to interrupt you, but are you just about finished with your presentation?

MR. GOLDFINE: Yes.

DR. PRICE: I think we're running out of time.

MR. GOLDFINE: Okay. I'll skip ahead again. We have repaired crash damaged Aerostich gear for more than 20 years because textile rider's clothing is inherently lighter and more sacrificial than leathers. The availability of good efficient repair services is important. Since 2001, we've repaired over 500 crash damaged textile rider's jackets, pants and suits. And we've basically found that the speeds are low and that some of our earlier products were actually overbuilt for the types of accidents that people were experiencing.

Let's see. What else do I have? I'll read the last paragraph.

Many riders choose motorcycling because it's fun, but on another level, they may also be responding to the seemingly increasing compartmentalization, sterilization and capsulization of modern living. Perhaps some riders need to experience the affirmation that comes so easily and directly from riding–‘s kinesthetic outdoor realities. For some, the helmet/no helmet choice might be more about celebrating their connections with the world in the sense that we all belong to this planet and it to us. Motorcycles from folk art, cruisers, to the most efficient sports models help their riders feel

good, and everyone appreciates the natural experience of apprehending the universality of interdependence. Motorcycles and scooters are an extraordinary form of public automobility. Riding them embodies a kind of innate and natural –parsimony, which is inseparable from the human magic which connects us all. Thank you.

DR. PRICE: Thank you, Mr. Goldfine. Our final presentation today in the rider protective equipment panel will be by Mr. Paul Varnsverry. After that, we will have questions from our NTSB staff Technical Panel and questions from the audience. Again, if you'd like to ask questions, I encourage you to jot those down and there will be staff members collecting those.

MR. VARNSVERRY: Thank you, Dr. Price. I'd also like to thank Member Hersman and all the NTSB staff for inviting me here today to present this information to you. Can you forward the PowerPoint please? It's a good job I didn't buy a lottery ticket, isn't it?

Okay. I'll just briefly start, so we're making some progress. This is a very in depth subject. There's an awful lot of ground I could cover but time is scant today. So I'm just going to have to skim the surface, but I'm sure you'll have lots of questions arising from the presentation.

There are two distinct categories of motorcyclist apparel in the world, and one of them is the CE marked clothing

which Andy's provided his view on a few moments ago. This is clothing that is tested in accordance with the requirements of the EU legislation, the personal protective equipment directive.

And the second type, I'd like to refer to it as the unmarked CE or the lower case ce, caveat emptor, buyer beware. Now that's not a slur on all products that don't meet the CE standards, and I'll explain why in a couple of slides.

What we know from press product reviews that Liz touched on briefly earlier, from anecdotal evidence, from 11 years of experience, since the first CE marked motorcycle clothing hit the UK marketplace, is these products function in an accident, and they function very well. In impressed product reviews, they consistently achieved top marks for durability and also value for money.

An observation is that a lot of caveat emptor products doesn't function too well at all, and the consumer can't really tell until the put the garment to the actual test, but on balance, there are also caveat emptor products that are very good, but again, unfortunately, you can't always tell. You can't even always go on reputation with the nomadic purchasing policies of some of the major brands. Dealing with companies who are nationally based, you're on a far firmer footing.

What we're looking at though, and this is the reason

why I have to be fairly brief today, is a 20 year odyssey, between the first work on the standard for race wear in the UK which was cancelled because of legal concerns, and I –share a number of Andy's views here on litigation, through the development of European standards through the PP directive program, and the publication finally in 2004, the last part, which was the back protector standard, EN1621, Part 2.

Now personal protective equipment according to the European legislation, is any device designed to be worn or held by an individual for protection against one or more health and safety hazards. What does this mean where motorcycle clothing is concerned?

I'm just going to summarize this guidance from the European Commission, and this is the very latest copy of the guidance. Motorcycle clothing, if it's not claimed to be protective, if it's simply outerwear for protection from heat, rain, wind and cold, not accident protection, then it doesn't have to comply with the legislation. If impact protector components, if it's shoulder pads, elbow pads, back pads, knee pads, these can only be protective devices and therefore they have to comply with the legislation and be CE marked, tested against the standard, if, however, the manufacturer claims that the product offers protection in an accident, the garment is abrasion resistant, then the whole garment has to be tested. What this means is you can have caveat emptor clothing fitted

with CE protectors but only the protectors are protective devices within the meaning of the legislation.

Let's have a look at the technical development of the same standards. Well, firstly, they were developed from two independent technical specifications which were produced by UK test facilities, Cambridge University, the protective clothing research facility, and SATRA which is a established test house which first opened in the 1920s and is a very expensive testing facility today for all types of protective clothing and footwear which is where it has its origins.

Now a lot of research actually underwent peer review here in the United States in 1994 with the America Society for Testing of Materials. An analysis of damage to suits which had been worn in motorcycle accidents was performed and the, the extent and severity of the damage was plotted, and this, no surprises to those of us who observed damaged clothing over many years, established that there were four risk category zones within a garment. Those at high risk of impact which, if I can get this to function, are like shoulders, elbows, hips, knees and shins. Those are considered zone 1. Zone 2 is the area of high risk of impact and abrasion and these generally surround zone 1 and extend further. Zone 3 forms the majority of the garment where there is moderate risk of impact and abrasion, and finally, zone 4, things like front of the chest, the front of the abdomen, areas inside the boots and inside of

the forearms, that can touch the ground in an accident but it's infrequent.

What happened was that the testing of a number of damaged suits, those that are protected in the crash and those that haven't established a number of data, correction values were added for aging effects over a period of several years, and three performance categories, low, normal and high were established.

A number of test methods were investigated in relation to abrasion performance. The Taber machine, the Martindale, the revolving drum and the domstaten (ph.) machine, all were considered unsuitable for a variety of technical reasons. The domstaten machine was further considered as part of the European standards program after this initial research and once again was rejected. What was needed was a new machine which could test some of the complicated multilayered structures which were becoming normal, common, in motorcycle clothing.

Here's a schematic of what is known as the Cambridge type device, and again, if I can get the mouse working, there will be a photograph in a moment as well, there's a revolving belt of known grit value which turns at a specified speed and the test specimen, which is mounted here, is dropped onto the revolving belt and maintained under a pressure and it's a test to destruction. There is a start wire which is cut when the

test specimen hits the track and behind it, there is a stop wire which is cut when the specimen is abraded to a hole. And I have a number of specimens here which you're free to look at after the presentations and questions.

Now this background research, you can actually obtain a copy of this ASTM publication. There are still about 90 copies available. It's a very old publication, and you can read in depth into all of the background research and development of the standards.

So let's have a close look at the content of the standards, and again I have to skim over things here. There are nine standards in total, and I'm just going to really focus on clothing where most of the core test methodology is based.

EN 13595, Parts 1 to 4, this is the clothing standard. Liz mentioned earlier the 4 and 7 second requirements for abrasion and if I can get this mouse to work again, there you go, level 1 clothing, level 2 clothing, and I'll explain the significant of level 1, level 2 in the next slide.

Level 1 clothing, in the standard, the clothing is designed to give some protection while having the lowest possible weight and ergonomic penalties associated with its use. If you want to put a speed on it, urban environment.

Level 2 clothing provides a moderate level of protection, higher than that provided by level 1, but there are

weight and restriction penalties in providing this level of protection.

There are only two levels of protection in the European standard. In the original Cambridge and SATRA standards there were three. If you recall, I said low, normal and high. The high performance class, the multi-crash suit that was deleted at the request of certain Italian manufacturers who occupied the last two places in the press review that Liz mentioned earlier.

Since all testing takes place in the laboratory, there's also a handheld device which can be used in the field which I've used to good effect all over the world for testing tensile strength of leather and other materials. It's just a quality check really to make sure that you're putting something together with the correct material before submitting it for testing. No one likes to pay for testing and getting a failed result if you can avoid it.

Other tests, well, dye fastness is one, making sure that the fabrics, leather from which the product is manufacturer, won't leech, dye onto your skin, and the other one is restraint, and I don't hesitate to say, that this is not the approved standardized test method that you see on the screen.

The other things that needs to be checked is the fit and ergonomics. Does the garment fit the person it's claimed

to fit, similar to the size on the size label, and can they perform a number of prescribed movements? And again, one of the slides, one of the images on the slide is not a prescribed movement. Don't try this at home.

Now we move onto the test methodology. I briefly touched on the abrasive belts, impact abrasion device earlier, and there you see a test specimen in the top right corner which has been abraded to a hole in this test, and that's the Cambridge type machine.

Strength of seams and fastenings. Liz touched on this earlier. It's no good having the best fabrics in the world if they're poorly stitched together and the thing flies apart if you sneeze in it or have a heavy lunch. So seams and fastenings are all tested. It's a modified milling type apparatus, which if any of you have been involved in testing for a number of years, you'll be familiar with the milling. This particular device uses a segmented rather than a solid locking ring so that it can take into account multilayered constructions and work its way around them and lock them in place.

An impact cut test, dealing with those sharp shards of aggregates in the road surface. That's EN 13595, Part 4.

Now if you want further detailed information on the standards and also some more slides of the apparatus, far more in depth information, check out my website please, pva-

ppe.org.uk, and you'll find a lot of information on there. Send me an e-mail or give me a call if you have any questions in addition.

Now the important thing is what are the costs going to be to industry because if you're a consumer, this is going to impact on you. So let's have a look at impact protectors. The cost for assessment and approval of a full range of impact protectors on a right first time basis, so the right size, the right performance, $300, and the manufacturer can market those products in perpetuity after that initial front end cost. Most manufacturers go also to the batch testing voluntarily.

For a back protector, EN 1621, Part 2, a -- protector, you're starting to see a lot of these products here in the USA. Well, the cost of testing a back protector, or a family of back protectors is about $600.

Moving onto garments, to test garments against the garment standard, all those tests I described earlier, about $2,000. Again this is on a right first time basis, and there are no on costs. Once you've paid this, there is no legal requirement in Europe to actually continue testing it again. Most manufacturers have ongoing verification and surveillance testing.

Now gloves. These are a little bit more complicated because of the limited -- from which to harvest test specimens. So the price is $3,000, but that can be the price of one model

of glove through approval which wouldn't be very cost effective, or 30 models of gloves and amortize the cost across massive production runs of tens of thousands of gloves.

And finally footwear, the cost here works out to about $3,500 and there are a number of boots on the market. BMW, for example, they started marketing boots to the C standards in the last couple of years, and there are at least six or seven other companies, including some major brands on this occasion, who are offering product.

Now an often overlooked benefit of the standards is they stimulate innovation and that has happened here. One of the earliest criticisms of these standards were that they were written for leathers. Well, that's now being comprehensively disproved.

What we have is three different technological approaches -- market. The first one is the single heavyweight layered textile garment. Now in the UK, Pizza Huts, UK delivery riders, they are equipped with these under their health and safety legislation, and I think a product like Andy's is internationally respected will probably set somewhere between this and the next product in terms of performance. Andy will tell me later, I'm sure, if I'm wrong.

The next product is a multilayered system, and this is used by the metropolitan police in London. They've been using it now for a couple of years. I was proud to be

associated with assisting them in developing the product and getting it approved, and other manufacturers are now using the same technology because there's no intellectual property attached to it.

The third product, which is a fairly recent innovation into the marketplace, but it's an old idea, is what's called the Tritector system which originated in the early to mid nineties, and it's a system of terry knit fiber backed with a high tenacity mesh. The terry knit has excellent abrasion and cut resistance, but poor tensile strength because of the nature of the knit. That's provided by the backing high tenacity mesh, and this is the first multiclimate motorcycling suit because you can wear it when the temperature is 32 Fahrenheit or less and will keep you warm. You can wear it when the temperature if 100 plus and it will keep you cool, and I can verify that because I've done both. It's also as protective as leather.

The first type of textile technology meets the level 1 performance requirements of the European Standard. The second and third meet with or in some cases exceed the level 2 performance requirements of the standard. So leather doesn't have its own way anymore.

And another often overlooked benefit from manufacturers who become engaged and in some ways engrossed in these standards and testing process, they start to introduce

some of the findings, some of the new innovations even into the caveat emptor ranges to improve them.

Now further information on these textile innovations can be found in this reference book, Textiles for Protection. There's a chapter in there which goes in depth into the development of these new textile garments.

So what do I think are the benefits of producing motorcycle apparel to a standard?

Well, firstly an independent mark, fitness and purpose. Apples for apples. Single technical benchmark, same rule applies and you aren't all over the place using different test methods and unable to sort out the data and find out where the comparisons can be made.

Improved consumer choice. The consumer has a product that they know what its capabilities are. At the moment they can rely on reputation but they don't really have an independent guideline.

A safeguard against litigation we hope. Certainly in the UK, if you manufacture a product to a British standard, European standards are produced as British standards, then if your product conforms, you have a legal umbrella from prosecution. If you prove your product meets the standard, you've done all you can, all that was reasonable and practicable to meet your obligations.

Prospect of insurance discount incentives. I think

this would be a useful one. I'm also going to perhaps cause a little bit more controversy here by saying I think manufacturers who engage in testing programs should be given tax breaks, and consumers who buy an accredited product should perhaps be offered a sales tax moratorium, so for perhaps two or three years, there should be no sales tax on accredited products. We've heard of the hundreds, thousands, tens of thousands, hundreds of thousands, and millions and billions of dollars that motorcycle injuries cost. Well, that's perhaps money on paper, but let's see some of that money poured back into making improvements, controversial perhaps, but my contribution I hope to proceedings.

A motivational force for further development, the textile technology I just touched on, a perfect example. Positive press test reports will assist sales, going back to what Liz said earlier, about the press articles, manufacturers receive press award, their sales go up, guarantee.

And key one where this forum is concerned, prevention or reduction of slight injuries. Fifty percent of motorcycling injuries reduced or prevented, that's a stroke. How can the legislators criticize us for that.

So perhaps controversial again but a quick catch phrase, better products, safer motorcyclists, where to next?

But as I said earlier, these standards, the background research was peer reviewed here in the USA. So it's

not new information on this side of the Atlantic, but a lot of motorcycle clothing, particularly that marketed by the majors, isn't made here in the USA. It's imported here like it is all over Europe. It's manufactured in China. It's manufactured in Indonesia. It's manufactured in Korea, in Vietnam. Some of it's manufactured still in India and Pakistan. A lot is also manufactured in Eastern Europe. Wouldn't international standards be a good move?

I'd like to thank you for giving me this opportunity once again. Thank you.

DR. PRICE: Thank you, Mr. Varnsverry. Now I'm going to turn it over to the NTSB technical staff, and we're going to start with Mr. Hank Hughes.

MR. HUGHES: Good afternoon, Dr. Alcorta. I listened with great interest on all of the panelists, and I know the four colleagues that are sitting there with you provided a great deal of useful information about protective equipment. You have a unique perspective as a former paramedic, physician and also a motorcycle rider. I'd be interested in your assessment of the adequacy of currently available equipment, what might be mandated in the future, and any suggestions or thoughts you may have along those lines.

DR. ALCORTA: I think the key principle we need to look at from motorcycle equipment safety standards are what works, what's cost effect and what will people use, from a use

perspective. From an emergency physician receiving side, clearly I think that the downside that I'm seeing is people aren't using personal protective equipment, and even if we're using just level 1 protection, I think we're going to see a dramatic reduction in many of these minor type injuries. So I think the utilization of any of these will be a great step forward.

One of the things I've had an opportunity to see at this conference is the use of the airbag. I think it's made a significant difference in vehicular, all vehicles included, four wheeled vehicles that is, improvement and reduction in fatal injuries and significant injuries. I think that it's going to make potentially positive strides, but we need to look at it because it only addresses one type of impact if you will. It certainly does not protect the driver or the passenger from side or rear impact at this point. But clearly from the head on impact as demonstrated in the video, I think it has positive benefits.

MR. HUGHES: Thank you. I have another follow up question to that. With regard to the types of injuries that you've seen as a physician, as they relate to motorcycle accidents compared to other types of vehicle accidents, could you elaborate on any difference if there is one?

DR. ALCORTA: There actually are some very significant differences. I think the most common in motor

vehicles we contribute them to what are called blunt trauma, where it's essentially rapid deceleration, but it's within a protected or confined space. Motorcycle injuries tend to be more of a sheering and projectile, if you will, type injury, where you are the projectile, and it's what you come up against that stops you that really changes and/or accounts for your injuries. So I think there are different mechanisms at work here, and the injury types as both you've seen in my presentation and heard from the previous presentations, there are significant injuries.

It was not that long ago that the motorcyclists had a very legitimate argument. Why didn't we put helmets on people in four wheeled vehicles? Because we had a significant head injury population there. That's being addressed to some extent by safety belts, the harness type, and with airbags. So I think those are the two distinct different categories that we see in the emergency and trauma settings when it comes to motorcycle versus vehicular accidents or crashes, excuse me, not accidents.

MR. HUGHES: What cost do you see that might be associated with a driver's failure to utilize protective equipment in terms of a life, injury, cost factor, as far as the financial aspect?

DR. ALCORTA: That's a great question. I can only go back to some data that we did and this actually goes back to

1990. When we look at motorcyclists that entered the shock trauma center, we looked at them basically on helmeted versus unhelmeted alone, and we saw that there was a significant difference in admission rates. The admission rate for the unhelmeted driver was around 21 percent. For the helmeted motorcyclist involved in a similar crash, it was around 8 percent admission. The other piece was there was a significantly greater length of stay for the unhelmeted driver of the motorcycle or passenger for that matter that was unhelmeted, and it was actually about 9.1 days and for the helmeted, it was an average of about 6 days. So clearly if you translate that into a cost, there's clearly a significantly higher cost for managing "the unhelmeted" and many of these folks ended up in long term rehabilitative care due to their head injury which we did not include in this. It was just acute care medicine.

And if we go back to the San Diego Study, their average cost for a helmeted motorcyclist was about 15,000 to $16,000 and the unhelmeted was almost $42,000, and that's actually a study that's well over 18 -- 15 to 18 years ago.

MR. HUGHES: Thank you, Doctor. I'd like to defer to my colleagues for follow up questions.

DR. POLAND: Thank you, Mr. Hughes. Mr. Thom, you mentioned that some motorcyclists choose to use a half helmet instead of the full helmet. Is there any decreased

effectiveness for the half helmet as opposed to a full faced helmet?

MR. THOM: Yes, there is. There's a direct correlation between what the helmet covers and what the helmet protects. However, the partial coverage helmet covers most of your brain, and that's the important part. It clearly provides no protection for your face which is equally important to some of us, but it's not going to cause necessarily the brain injuries. You can break your face without hurting your brain. So, yes, there is definitely a correlation in coverage and protection.

DR. POLAND: You talked extensively about the novelty helmets versus those that are certified to the DOT standards. Are some people accidentally buying novelty helmets when they intend to buy something that would provide the full standard coverage?

MR. THOM: That's a very interesting and good question. Because they look so different, my tendency, and I can't back this up with any research, but I think most people that buy a fake helmet know they're buying a fake helmet. In the olden days, say 10 years ago, when there were a couple of fake helmets that were labeled with DOT type labeling, that may not have been the case but virtually all of the fake helmets that you can find today have got a disclaimer in it. So you'd have to be illiterate to not be able to tell. Read the label

in the helmet that says this is not a helmet, don't wear it on a motorcycle. So I don't think that's an issue anymore although it may have been in the past.

DR. POLAND: I know it's going to be difficult to answer this question for the reasons you mentioned with FARS data not parsing out between DOT standard helmets and novelty helmets, but do you have any feeling for whether the NHTSA reported effectiveness of 37 percent for helmets reducing fatalities might be greater if we could parse out the data between novelty helmets and those that meet the 218 standard?

MR. THOM: I think that falls underneath the category that I mentioned of the statistics are confounded and confused by the fact that there are essentially unhelmeted conditions being thrown into the group of helmeted riders. So, yes, I'm sure that effectiveness number would go up. How much, I don't have a clue.

DR. POLAND: Is there any opportunity to somehow mark or identify the novelty helmet with either its own label or the lack of a chin strap or something along those lines to make it less accessible to be used as a helmet for motorcycle use?

MR. THOM: I don't follow the question. You mean beyond the label that says this isn't a helmet and don't use it on a motorcycle, what else would you do?

DR. POLAND: Is that helmet actually -- that label actually on the helmet and larger than the DOT label?

MR. THOM: Most new novelty helmets have that label stitched right on the inside. So it's, it's definitely an operator choice to use one.

DR. POLAND: But nothing on the outside to make it obvious to --

MR. THOM: No, nothing on the outside, and some of those labels aren't very well stuck in. They come out kind of easy.

DR. POLAND: Okay. Mr. Thom, I know there's many more questions about helmets, but due to our limited time, I'm going to pass my questions onto Ms. Beckjord.

MR. THOM: Thank you, Kris.

MS. BECKJORD: Thank you, Dr. Poland. My questions are to Liz. First, what are some of the other benefits that you could talk about for protective clothing aside from just protecting injury? I mean are they developing clothing to do other things for riders so that there's more incentive on top of protection?

MS. de ROME: Well, there's the issue with style and people not wearing them when they go to work because they want to wear clothing that looks appropriate for where they, you know, when you get there, what David was saying about the whole problem of what do you do with your protective equipment when you get to wherever you're going. So there are developments there in terms of making it more accessible, the development of

textile products that are more like daywear rather than leathers which are difficult to walk in unless you're upright.

The other thing I guess with protective clothing that I didn't mention is that there are studies to show that people who are wearing leathers spend a lot less time in hospitals, on the average, 7 days less in the hospital and were able to return to work 20 days earlier. So that's a marked benefit.

MS. BECKJORD: I guess what I was alluding to is there's also some information out there that talks about how this protective clothing can also reduce dehydration in certain weather.

MS. de ROME: Oh, I beg your pardon. Yes.

MS. BECKJORD: And maybe fatigue and some of those other items.

MS. de ROME: Yes, yes, certainly. The whole of the comfort issue is really important. Riders who get cold, their feet and their hands can become numb and then make operating errors or they can't handle the motorcycle correctly, and they also, there's some research that suggests that people who are affected by either cold or fatigue become irrational and make poor decisions and choices while they're riding. So there's a whole lot of issues to do with fatigue, as you said, dehydration, just to do with discomfort. So it's physiological stress as well as the impact if you do have a crash. So it enhances the chance that you will have a crash if you're

uncomfortable.

MS. BECKJORD: If you're uncomfortable in non-quality protective clothing?

MS. de ROME: Yes, yes. And also -- I mean it also goes to things being too tight or if clothing doesn't fit well, you can cut off circulation, things like that. So it's the design construction and the composition of the clothing, all contributes to making the rider safer. Ventilation. They can be designed to have ventilation so that in hot weather -- it's either ventilation or insulation to manage heat and cold. They're all essential parts of it.

MS. BECKJORD: Okay. And then I guess in terms of time briefly, can you say, is there a lot of information in Australia for riders about the benefits? Is there an education program that's going on?

MS. de ROME: Yes, that's quite interesting. Since we started this, at the time we started it, there wasn't, and we actually did a survey of riders in 2001, and then I did another survey this year, and the usage rates seems to have increased particularly in relation to impact protectors and also I think our state governments have run some very eye catchers, you saw the cow on the motorcycle, riders like that. There's been a lot of behavioral programs to encourage riders to wear protective clothing, and in our survey, we asked riders about safety messages they had heard that had made an impact on

them, and the protective clothing ones were mentioned by quite a high proportion of the riders. So I think the message is getting through, and it's showing up in the wearing rates. Yeah, it seems to be working.

MS. BECKJORD: Great, and my final question is, in Australia, are manufacturers and importers, I guess I got the impression that they're not currently subject to mandatory standards as they might be in Europe. Do you see it coming anytime soon?

MS. de ROME: Well, it is an international market so that whichever country you're in, you're buying gear from other countries, so that there's always the -- around 30 percent of the products sold in Australia come from Europe. So the local manufacturers have recognized that they're going to be competing with CE marked products as that system filters through. So they have to respond to that.

What we're looking at is whether we can establish a five star -- sort of a star rating system in Australia rather than mandating standards, using a consumer based structure, so that gear has a label that says how it complies or what its rating is against the standards and then promoting the benefits to riders so that it becomes a market push rather than a legislative push. That's the way we're going.

MS. BECKJORD: Thank you very much, Ms. de Rome. My next questions are for Mr. Varnsverry. What do riders normally

wear in Europe while you still have the standards? Can you say what is a generalized thing that you see selling the most and conforming?

MR. VARNSVERRY: Riders wear whatever they want to wear. Some will wear T-shirts and shorts and flip flops as I'm sure they do over here. Some will wear normal day clothing. Some will wear clothing specifically designed for motorcycling, some of the leading brands. They will exercise their choice depending on the type of journey they're making. And their budget, I think that's supported by the data we heard earlier on.

MS. BECKJORD: How much would you say some of these items that are in Europe now selling with the certification, how much would they generally cost in the U.S. for U.S. riders if those do come to the States so they could buy them in U.S. dollars?

MR. VARNSVERRY: If you do a direct currency conversion, then from $700, but we have this unfortunate situation in the UK, what you pay in dollars, we pay in pounds. So you could probably reduce that figure by a few percent. How much I can't say. So a lot of it would depend on the marketing strategies of the clothing distributors, but as a direct currency conversion, from $700 and some of the top featured CE clothing will perhaps be around the $1300 area and maybe even higher for the custom made products, maybe even as high as

$2,000, about the same price as you would be paying in many respects for the –caveat emptor product.

MS. BECKJORD: And one last question. You know, talking about how you've got manufacturers who could pay the money for the testing, do you think that that might eliminate some smaller manufacturers from being able to meet that testing or have you seen smaller companies be able to market their products that are standardized and tested the same as large companies?

MR. VARNSVERRY: The first companies, and there were a number of them, the first companies to go through the testing and accreditation process, were the small owner/operator run businesses in the UK, companies who annual turnover probably wouldn't -- to the average Italian Bronze monthly cappuccino budget. We're talking about very small companies, and they went through it.

MS. BECKJORD: Thank you very much.

MS. ROEBER: Mr. Goldfine, I want to start with a question that's actually having you put on a slightly different hat. I know that you're a rider. I know we actually have a few other riders up there, and I wanted to ask, you know, there are a lot of education programs out there to encourage riders to use this rider protective equipment, and from a rider's perspective, can you tell me what strategies do seem to work to encourage use and could we ever approach anywhere close to

universal use with these strategies rather than, you know, alternatively mandating their use?

MR. GOLDFINE: Thank you. I can't speak for all riders. It's interesting the effect that the Internet has had on riders' ability to communicate with one another about their experiences. When you go on the internet and you join groups of people widely separated by distance, but held together by a common interest, in riding on a forum, a tremendous amount of information is available now encouraging people to adopt protective clothing by testament of motorcyclists who have had crash experiences. I'm not sure -- that's been the most powerful change that I've seen since I've been making clothing. Riders now could be all over the world telling stories about their equipment and their experiences, and there's a lot of things to be filtered, but despite that, there's still some real truths there that help riders and encourage riders.

For some groups, I'm not a psychologist obviously, but there's some people who if they're told to wear something or that the Government wants something to be done, that it will have a counterproductive effect to some groups.

MS. ROEBER: Mr. Thom, didn't you say you're also a rider. Did you want to add anything to that?

MR. THOM: I often wear an Aerostich suit made by Mr. Goldfine's company when it's coolish, but when it's warmish, I don't wear that suit because it's too warmish. And

I think that having the -- once you made the step to own something like that, as we found out from the Australian experience, a lot of us, I often don't wear heavy pants even though I've known for 20 years that leg injuries are the most common thing to occur in accidents, but I also will never ride without boots after I ground an ankle down to the bone one time. So there's a lot of personal experience there and it's one thing to read in a MSF book or a rider training book that says, wear heavy clothing, wear long sleeves, cover your ankles, that's information that is there but I think most of us need to be pushed a little bit to believe it, to take that advice as being meaningful and worthwhile. So it's a definite problem but when two people talk, that I think is as meaningful as many other forms of communication. If I tell somebody about grinding my ankle down to the bone, oh, wow, maybe I won't wear sneakers anymore. But I don't know. I'm not a marketing person. So that's a little out of my field.

MS. de ROME: Can I just say something? One of the things that I've observed is that there's a certain set of presentation of protective clothing in relation to injury reduction that's aimed at the racing market. The protective clothing is styled for the race track, aimed at sports bikes, and so if you look at my data before from when did riders wear their protective clothing, they wore it on recreational rides, where the suggestion is that maybe they were going to take more

risks, maybe they were going to ride faster on those days. But, in fact, protective clothing is most helpful. It will do the best for you in a low speed crash and so probably when you are or maybe not going to the shops, but certainly riding to work, is the time when they should be wearing it. I mean I'm not saying they shouldn't wear it on the other rides, but it's as if they ride it when they're going to take risks and that's not really the most appropriate time.

MS. ROEBER: My second question for Mr. Goldfine, I understand all of your concerns that you've voiced about adopting European standards, but are there areas in which rider protective equipment that you think standards in the U.S. would be helpful, you know, get all the stakeholders, American stakeholders in a room, and have them hammer out some standards for certain items?

MR. GOLDFINE: I don't honestly know the answer to that. We have such a strong legal system here, that doesn't exist in Europe, and it's had such an impact on every area that's regulated. I get very nervous about this sort of thing. What's driving the increased adoption of protective rider's clothing right now and the technological advances I think are marketplace pressures, not regulatory. The air jacket that was demonstrated earlier today isn't a piece of CE approved equipment. I'm not sure whether it's good or bad equipment because I'm not an expert on that particular product, but I

guess -- is that enough?

MS. ROEBER: Yes. My last question, first, do you make any protective gear for European customers?

MR. GOLDFINE: Yes. What I was trying to say in the thing that I read is that 10 years before there were CE standards, we had a product that was better than the CE standards, and I don't feel we passed for technical nuance reasons, and we have a lot of experience with a lot of people falling off motorcycles and banging into stuff, with better than I expected results frankly than when I started the business 23 years ago. The experience of most riders when they get done with a crash, if they're not injured, is my God, this worked better than I thought, and it's -- and that's what made the lighter, more comfortable textile clothing become adopted and that's what made a lot of other companies decide to start making it. It's lighter and it's more comfortable and it's more convenient, and it works for most of the type of experiences and so now I'm competing with 100 other companies, most of which have Asian sourced production, and they're all saying mine's better for this reason or that, the zipper's over here or the lightening bolt is over there, whatever.

MS. ROEBER: What I was wondering is from a manufacturer's perspective, and if you don't know specifically maybe some of your other manufacturer friends have told you, what type of difficulties they run into having to design and

produce gear specifically for Europe which has a standard in place versus building gear for the U.S. which doesn't have a standard or for other countries, and Mr. Varnsverry touched on that a little bit saying, you know, stuff's manufactured all over the world. Are there any problems or barriers that you run into when you have to meet standards for one but you don't have to meet them for others?

MR. GOLDFINE: I'm sure for some consumers not having our garments approved is a disincentive to buy our garment, but it is what it is. I like not representing -- in our country where my business exists, I don't like telling people that this will save their X, Y or Z. I'm afraid to tell people that. I build it as good as I can and I try to describe its performance characteristics accurately in our marketing materials. I'm not sure the level 1, 2 and the -- I'm not sure the standards are very comprehendible to the consumer. There is a lot of complexity here today. There's a very wide range between what the pizza delivery driver that he's talking about and a motorcycle race guy is wearing, and a lot of nuance in between there. We have a ventilator zipper on the underarm area of our garments which is a low area unlikely to be in a -- but whether having the zipper there which opens your open underarm area directly to the outside would disqualify our garment on a technicality or not, I'm not well enough versed in the standards' details to tell you that, but I like that zipper

there because when it's hot, it makes me more likely to use the garment.

MS. ROEBER: Thank you. Any other questions?

DR. POLAND: Mr. Brazy, do you have a question?

MR. BRAZY: I just have one question, and I believe it's going to be addressed to Mr. Thom, but if others have input, I'd like to hear it. Helmets sold in the United States are not necessarily built to a single standard. They're required to be built to FMVSS 218, but often they carry other certifications such as the Snell Memorial Foundation stickers and you also mentioned standards that are for use in other countries. Is there anyone that's better than another? Are there any significant differences from one set of standards to another? Would the consumer have any benefit to buying a helmet that's manufactured to different ones that are still legal in the United States?

MR. THOM: Within the spectrum of qualified helmets, meaning helmets that have been tested to a standard or two standards or even three standards, yes, there are some subtle differences. That difference is not nearly as great as the difference between the most minimal, barely meets DOT partial coverage helmet and a fake helmet. We did a series of tests that was published in -- well, it's been a couple of places now, including Motorcyclist Magazine, which was probably the most visible one about, let's see, a year ago, June, and tested

a bunch of helmets meeting different -- all the different standards that I mentioned. And the group that met DOT and the group that met DOT and the ECE standard did best in that particular series of tests which was designed to be a pretty real world set of tests.

So, yeah, there are some differences. They're fairly subtle and they're not nearly as critical for motorcycle safety as the difference between helmets meeting no standard and meeting any standard, if that makes sense.

DR. POLAND: Member Hersman, we'd like to pass the questioning to you.

CHAIRWOMAN HERSMAN: And given the late hour, I'll defer to the audience questions that Mr. Magladry and Dr. Ellingstad have.

DR. ELLINGSTAD: Thank you. We have a number of questions here I think principally for Mr. Thom having to do with what you've just been talking about, with respect to FMVSS 218, but also then in relation to performance. There's a number of questions that basically say something to the effect that they encounter labels that say not good for over 15 miles and hour and throw it away if you drop it kind of thing. Could you comment about the performance level that FMVSS 218 protects to and what is the significance of this 15 mile an hour reference?

MR. THOM: Okay. I'd be happy to. That's a common

area of confusion for folks, talking about helmets, and we saw some video footage on some of the presentations today about guys falling off road race motorcycles going 70, 80, 100, 120, I don't know how fast they were going, but clearly far above 15 miles an hour. And in almost all cases, motorcycle road racers who crash their motorcycles let's just say at 120 miles an hour, they get up and walk away from those crashes. They don't have head injuries even if they've abraded their helmet down to nothing. And that's because the threth (ph.), and this is where the 13 or the 14 or the 15 miles an hour comes from. The question is the impact, the perpendicular impact. In science, we call it vector analysis where you're dividing up the forward speed from the vertical speed and looking at how much of that impact comes from one of those different vectors. So the rider who falls off of his motorcycle going 10 miles an hour going around the corner and hits some wet leaves will fall from riding height. His head goes from let's say 5 feet above the ground and that's the same height that the motorcycle road racer going 100 miles an hour falls from. He still falls from 5 feet. He hits his head with the same impact velocity which is vertically say 13 miles an hour or 15 or whatever it is, somewhere in that range, depending on the details of that fall.

So the idea that a helmet is limited to performance at 15 miles an hour is really simply just comes from a misunderstanding of how the vectors of impact work, and every

road racer who has ever fallen off or anybody who has ever fallen off a motorcycle at greater than 15 miles an hour, myself included, can attest that that is a false number. It's not a meaningful number when it comes to the speed of your motorcycle.

In other words, the speedometer speed on your bike has almost no relation to the impact speed that your head might incur or might be subjected to.

DR. ELLINGSTAD: Okay. Thank you. That I think clarifies some confusion there.

Another thing, with respect to the -- both for you and for Dr. Alcorta perhaps, with respect to those states that have helmet laws, is there an expectation that helmet law requires an FMVSS 218 certified helmet or some similar other helmet, and it relates to this novelty helmet kind of a thing? Would you care to, both of you, speak to that?

DR. ALCORTA: From a Maryland State perspective, I can speak directly to our law. It actually specifically cites the Department of Transportation standards themselves as being the minimum requirement for an approved helmet. That's the challenge. From an enforcement issue that the challenge runs into, is law enforcement officers have to rely on sign, symbols and many of them rely on a DOT sticker. Well, many of us are aware that the novelty helmets are sold in one place, and the DOT stickers are sold somewhere else, and they stick them

together. Then the challenge becomes how does an officer determine what is or what is not? And they're trained on what is an appropriate helmet, and when they honestly see the 1/2 inch helmet, there's no way that's DOT standard. The challenge is there are some helmets that are gray zone, in between, that start to approach a standard but still don't meet that standard, and how do you justify that.

The reality is the laws are written to the DOT standard, and that's what should be used.

DR. ELLINGSTAD: Mr. Thom, is that consistent with the other states that have laws?

MR. THOM: Yeah, virtually all states that have a helmet law currently, whether it be universal for all riders or a partial for some subcategory such as minors under 18 or 21, do refer to the FMVSS 218 standard as part of the law, you must wear a helmet meeting this standard. There are a couple of states who missed that little detail which takes us back into the late sixties right after the Highway Safety Act, and the first passage of helmet laws when they said must wear a helmet. And that was back in the days of Tupperware and Revere Ware hats and people would put anything on their head, call it a helmet and they would be technically correct, that they were wearing a helmet on their head.

But the simple answer is most standards -- excuse me -- most helmet laws do refer to the 218 standard, and then

we get right back into that loophole of purchasing helmets, sticking the sticker on them or not, the sticker seems to be less important in California than just having something on your head, and then the enforcement issue, enforcement problems that come with that. Or, more importantly from the forum here is the head injury problem that comes from that rather than writing tickets. I mean it's people getting hurt is the real problem.

DR. ELLINGSTAD: Thank you. And one final question along the same lines. Is there an official publicly available source for information about which helmets meet FMVSS 218?

MR. THOM: There is not. You do have to rely on the manufacturer's labeling. So you walk into a motorcycle shop and you look and see if it says it meets DOT, and you really do have to rely on that because there is no single place where you can go find a list of everything that legitimately meets the standard or purports to meet the standard. Now DOT does have a testing program where they test 40 models every year, and one could sort of by default look in that direction, but that is only telling you that the ones that they tested, and whether they met or didn't meet the standard, and they can only test a small percentage of those that are out there because there are so many different brands and models that are available.

So it does become somewhat of a caveat emptor process in that you have to trust the manufacturer that you're buying

it from. And if you buy a helmet and it looks like a helmet, it's got some size to it, and you look inside and it's got an EPS liner that's about an inch thick, you can bet that it's a real helmet, as opposed to if it's got a sticker in it that says this is not a helmet, don't wear it on your motorcycle, that's a pretty good clue it's not approved.

DR. ELLINGSTAD: Thank you.

MR. MAGLADRY: I get I get to clean up again. Let me touch on an area that I don't really think we've talked much about this afternoon. You've spoken, Ms. de Rome and others, a little bit about the carrot I think of getting people to use protective clothing, that it's comfortable, that it will protect me against the lesser injuries, those kinds of things. Is there a role for the stick, and both in law enforcement -- well, laws, regulations, law enforcement of those laws and regulations or perhaps insurance changes? Are there other avenues to induce riders to wear protective equipment or helmets?

MS. de ROME: I think so. I would prefer to go with the carrot rather than the stick. I think if you start -- I mean just from the practicalities of it, the difficulties you've been talking about with helmets, if you start mandating protective clothing for riders to wear it, then you're having to get into very distinctive statements of what is and isn't approved, like with the helmets. But the way the Europeans

have gone is that the onus is on the manufacturers. You can't sell products claiming to be protective unless they meet these standards. So that puts the -- on retailer or the manufacturer rather, at a legislative level rather than onto the rider.

But with riders, with the way we're going with it is, strong on the education, promoting the benefits to riders, working with insurance industry to give incentives. Some of our medical insurers will give a rebate if you go and buy like gym shoes or go to a gym course, to improve your health. They'll give you a rebate on that, and so we're working with them to give a rebate on motorcycle clothing. The same with other sorts of incentives, if you have a crash, and you were wearing protective clothing, then your insurance cover is this, but if you weren't wearing protective clothing, then your insurance cover is that. So it will affect the purchase of policies, things like that. That's the way I suggest going.

MR. MAGLADRY: Mr. Varnsverry.

MR. VARNSVERRY: Yeah, I'd echo those sentiments. To clarify a point, the compliance with the PP directive on the part of the manufacturer is not mandatory unless they claim the product has a protective function at which point the manufacturer has to comply with the legislation. It's not compulsory for motorcyclists to wear CE marked clothing in Europe. I'm also very much in favor of the carrot rather than the stick, and as I said earlier, I think there's room here for

Government to do their part, to incentivize manufacturers and consumers to take this up, to give manufacturers tax breaks and grant funding to develop new products, and to remove sales tax from conforming products to offer motivation for the consumers. And that's really, I think legislature, that's the best step you can take.

MR. MAGLADRY: One quick question about type 2 CE garments. How easy are they to put on and take off?

MR. VARNSVERRY: I don't have any problem at all putting any of my CE approved clothing on or taking it off, no more than I do some of the non-CE approved garments that I also own.

MR. MAGLADRY: One last question I think for Mr. Goldfine. Do you also do repairs of clothing?

MR. GOLDFINE: Yes. Since 2001, we've repaired over 500 garments from crashes. We get about two or three a week now, and if I can sideways segue to the previous question just for a moment, the minute we would claim in our advertising that the garments we make have a protective aspect to them, in our country we would have some legal problems I think, maybe not in Europe or Australia, but here the environment is different, the business environment and the legal environment.

MR. MAGLADRY: I'm done. Thank you.

MR. VARNSVERRY: I'll just come back on Andy's comments if I can. I mean the same situation exists in Europe.

We're perhaps not as litigious as I understand the situation may be here, but people are using -- consumers are using the standards to evaluate products which have failed them in wear. Not one case yet has gone to court because generally the manufacturers of the deficient substandard products take one look at the expert's opinion report, and they yield, and they just settle out of court, and so the legal system is being used to sort out substandard clothing certainly in the UK.

DR. PRICE: I'd like to -- one of the questions that Mr. Magladry just asked about repairs to the -- Mr. Goldfine, to your gear. When you repair gear, number one, after it's repaired, does it go back into service and, you know, do you feel that it's as good once it's repaired as it is originally? And then also does your company use information about the kinds of repairs that you see and the kinds of information you get from that to make changes to future lines of clothing?

MR. GOLDFINE: Well, to answer the second part of your question first, yes, we definitely -- I definitely use the experiences of our customers both from just having nothing to do with accidents as one benchmark that we don't like it because it's too hot or too cold or this or that needs to be changed, as well as the people who have experienced a crash on a motorcycle. So we definitely use feedback.

The first -- can you ask me the first part again please?

DR. PRICE: I wanted to know if they go back into service once they've been repaired --

MR. GOLDFINE: Oh, yes. Thank you. I'm sorry.

DR. PRICE: -- and how you feel about their quality at that state?

MR. GOLDFINE: We internally use a procedure similar -- most people have an experience of having a fender bender in an automobile accident, and they take their car to a body shop, and the guy comes out with a clipboard, with a diagram of the side of the car, and that helps figure out the estimate of the price of their repairs for the fender bender. We use a very similar internal system for pricing and scheduling the repairs that are needed. The garments that come back range in age from 20 plus years old, and we try to return them to full functionality and in 90 percent of the cases or more, that is the result. Everything that needs to be replaced is replaced. In a few cases, the customer will want the garment back for sentimental reasons and we don't feel that it is good, because it's either very old or the repairs would be too extensive. So we inform the customer of the options that they have, and if they want some repairs that we don't feel we want to have -- you know, we tag the garment with a little tag that we wrote that this is repaired to your requirements, not what we would like or what we -- we don't think this meets our internal standards for what this garment should perform in

terms of the weather and crashing and a lot of times it's an old worn out thing that people get emotional about. We all invest ourselves in our things I guess. So we have to deal with that sometimes.

DR. PRICE: Thank you. Are there any other questions from the NTSB technical staff or from our Board panelists?

(No response.)

DR. PRICE: Then I'll turn it over to Member Hersman.

CHAIRWOMAN HERSMAN: I'd like to thank this panel. We certainly have been in the touring variety of the forum today, long distance here. Thank you very much for your presentations, and thank you to all of the presenters who came today.

Thanks to the audience for sticking it out with us, and we look forward to starting tomorrow at 8:00 a.m.

(Whereupon, the hearing was adjourned to reconvene on Wednesday, September 13, 2006, at 8:00 a.m.)

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CERTIFICATE

This is to certify that the attached proceeding before the

NATIONAL TRANSPORTATION SAFETY BOARD

IN THE MATTER OF: PUBLIC FORUM ON MOTORCYCLE SAFETY

PLACE: Washington, D.C.

DATE: September 12, 2006

was held according to the record, and that this is the original, complete, true and accurate transcript which has been compared to the recording accomplished at the hearing.

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Nicholas Guarino
Official Reporter