Martin O'Malley, *Governor*
Anthony G. Brown, *Lt. Governor*

SHA
State Highway Administration
Maryland Department of Transportation

Beverley K. Swaim-Staley, *Secretary*
Neil J. Pedersen, *Administrator*

December 7, 2010

The Honorable Thomas V. "Mike" Miller, Jr.
President of the Senate and
Chairman, Legislative Policy Committee
State House
Annapolis MD 21401-1991

The Honorable Michael E. Busch
Speaker of the House and
Chairman, Legislative Policy Committee
State House
Annapolis MD 21401-1991

Dear President Miller and Speaker Busch:

The Maryland Quiet Vehicle and Pedestrian Safety Task Force (Task Force) was established by Senate Bill 276/House Bill 1160, Chapters 384 and 385, Acts 2008 and expired December 31, 2008. A final report on its findings was submitted to the General Assembly in December, 2008. One of the findings called for reconstituting the task force as the issues surrounding quiet vehicle technology needed further study and analysis.

The reconstituted Task Force has completed its findings, conclusions, and recommendations as required in Senate Bill 370/House Bill 367, Chapters 249 and 250, Acts of 2009. We thank you for your support of this study and recommend our findings for your consideration as you decide what measures Maryland should move forward with to assist the blind community with this increasingly serious dilemma.

The legislation that reconstituted this Task Force directed that:

> *"(f) The Task Force shall:*
> *(1) study:*
> *(i) the effects of vehicle sound on pedestrian safety; and*
> *(ii) all available technology that may enhance the safety of blind pedestrians;*
> *(2) review all available research regarding the effects of vehicle sound on pedestrian safety;*

(3) consult with:
(i) consumer groups representing individuals who are blind, other pedestrians, and cyclists; and
(ii) advocates for the safety of children;
(4) as appropriate, contract for additional research and studies to be conducted;
(5) conduct hearings to accept testimony from:
(i) experts on acoustics, automobile design, environmental quality, orientation and mobility for blind people, pedestrian safety, and other relevant fields; and
(ii) interested members of the public; and
(6) make recommendations concerning:
(i) a minimum sound level and the nature and characteristics of the minimum sound to be required for all new vehicles sold and registered in the State; and
(ii) the use of technology to enhance the safety of blind pedestrians.

(g) The Task Force is not required to specify the method or technology through which automobile manufacturers must implement the recommended sound standard.

(h) On or before December 31, 2010, the Task Force shall report its final findings and recommendations to the Governor and, in accordance with § 2–1246 of the State Government Article, the General Assembly.

SECTION 2. AND BE IT FURTHER ENACTED, That it is the intent of the General Assembly that the Governor appoint to the Maryland Quiet Vehicles and Pedestrian Safety Task Force those individuals who formerly were appointed to the predecessor Task Force established under Chapter 384 of the Acts of the General Assembly of 2008 and who were serving on the Task Force as of December 31, 2009.

SECTION 3. AND BE IT FURTHER ENACTED, That this Act is an emergency measure, is necessary for the immediate preservation of the public health or safety, has been passed by a yea and nay vote supported by three–fifths of all the members elected to each of the two Houses of the General Assembly, and shall take effect from the date it is enacted. It shall remain effective through December 31, 2010, and, at the end of December 31, 2010, with no further action required by the General Assembly, this Act shall be abrogated and of no further force and effect.

The Task Force has met on several occasions since its last report in December 2008. Meetings and discussions have occurred with others working with and concerned about the impact that hybrid electric vehicles (HEVs) have on pedestrians, particularly those who are blind or visually impaired. This report discusses the current state of quiet vehicle safety efforts, provides a statement of findings and conclusions, and makes recommendations for future action.

Since the release of the Task Force's 2008 report, studies by the National Highway Traffic Safety Administration (NHTSA) have shown that the incidence rate for crashes involving HEVs and pedestrians is significantly higher than the incidence involving internal combustion engine (ICE) vehicles. Similar results were found for accidents involving bicyclists. Substantial research and progress has been made during the last two years in addressing detectability of vehicles at ambient sound levels by the visually impaired and other pedestrians. This information is being used to develop countermeasures to improve pedestrian safety.

Consistent with the recommendations in the 2008 report and recognizing that the ultimate goal is having vehicles that are detectable by all pedestrians and bicyclists, the Task Force and its members have participated in activities at the national and international levels to ensure progress toward adopting minimum sound levels and characteristics for all newly manufactured vehicles. However, one of the recommendations requests reauthorization of this Task Force to continue to oversee, coordinate, and evaluate the continuing progress by the federal government and the automotive industry on the issue of quiet vehicles.

The report contains eleven findings/conclusions and three recommendations for next steps on the issue of quiet vehicles. The substance of the report is separated into the following sections:

- Scope of Quiet Car Concern
- Society of Automotive Engineers (SAE) Vehicle Sound for Pedestrians (VSP) Subcommittee
- Legislative and Regulatory Activity
- Investigation of Existing and Anticipated Technology
- Actions being Taken by Vehicle Manufacturers
- Findings Conclusions
- Recommendations

If you have additional questions or concerns regarding this report, please do not hesitate to contact me at (410) 787-4092.

Sincerely,

Mr. Edward T. Paulis, Jr.
Office of Traffic Safety,
State Highway Administration and
Chairman of the Maryland Quiet Vehicles
and Pedestrian Safety Task Force

Attachment

cc: Secretary Beverley K. Swaim-Staley, Maryland Department of Transportation
Mr. Neil Pedersen, Administrator, State Highway Administration
Members of the Maryland Quiet Vehicles and Pedestrian Safety Task Force

A Report to the Maryland General Assembly

Regarding

Findings, Conclusions, and Recommendations of the

Maryland Quiet Vehicle and Pedestrian Safety Task Force

(Reconstituted in Senate Bill 370/House Bill 367,
Chapters 249 and 250, Acts of 2009)

The State Highway Administration

The Maryland Department of Transportation

December 2010

Quiet Vehicles and Pedestrian Safety Task Force Membership

Chosen by Governor

Edward T. Paulis, Jr., Chair	Maryland Department of Transportation, Maryland State Highway Administration

Appointed by Governor in consultation with Secretary of Transportation

Marco Carranza	Blind Industries and Services of Maryland
Carol Silldorff	One Less Car
Michael Gosse	National Federation of the Blind
Patrick Sheehan	American Council of the Blind and the Maryland Bicycle and Pedestrian Advisory Committee
Robert Strassburger	Alliance of Automobile Manufacturers
Marcia Ways	Maryland Department of the Environment, Air Radiation and Management Administration
John Wetmore	Perils for Pedestrians

Appointed by Senate President

The Honorable Norman R. Stone, Jr.	Senator 6th District – Baltimore County

Appointed by House Speaker

The Honorable Alfred C. Carr, Jr.	Delegate 16th District – Montgomery County

Findings, Conclusions, and Recommendations of the

Maryland Quiet Vehicles and Pedestrian Safety Task Force

(Reconstituted in Senate Bill 370/House Bill 367,
Chapters 249 and 250, Acts of 2009)

Findings, Conclusions, and Recommendations of the

Maryland Quiet Vehicles and Pedestrian Safety Task Force

(Reconstituted in Senate Bill 370/House Bill 367,
Chapters 249 and 250, Acts of 2009)

EXECUTIVE SUMMARY

The 2008 session of the Maryland General Assembly created the Maryland Quiet Vehicle and Pedestrian Safety Task Force (Task Force). During the 2009 session, the Task Force's term was extended through December 2010. As a result, the Task Force met on several occasions since its last report in December 2008. Meetings and discussions occurred with others working with and concerned about the impact that hybrid electric vehicles (HEVs) have on pedestrians, particularly those who are blind or visually impaired. This report discusses the current state of quiet vehicle safety efforts, provides a statement of findings and conclusions, and makes recommendations for future action.

Traditionally, travel by blind and visually impaired pedestrians has been based on a variety of travel techniques. Using these specialized techniques, which include taking in sound cues from the surrounding environment, the blind can judge the presence, location, speed, direction of nearby vehicles, and make decisions to take appropriate actions while navigating street and highway environments. However, many HEVs do not make sufficient sound to provide these cues, particularly when stopped or when moving at low speeds, making travel extremely difficult in such cases.

For several years, concerns about dependence on foreign oil, rising energy prices and the environment have encouraged the development and marketing of vehicles depending fully or partially on electric power. This movement towards the electrification of vehicles has intensified to meet the requirements produced through legislation, regulation and judicial activities. The result is an increasing number of vehicles using systems without the traditional sound produced by internal combustion engines (ICEs).

During the past decade, the safety issue of quiet vehicles has grown significantly, and is likely to continue to grow as the production of HEV vehicles increases. Compounding the issue further is the fact that even some vehicles with ICEs are now difficult for pedestrians to hear.

Since the release of the Task Force's 2008 report, studies by the National Highway Traffic Safety Administration (NHTSA) have shown that the incidence rates for crashes involving HEVs and pedestrians is significantly higher than the incidence involving ICE vehicles. Similar results were found for accidents involving bicyclists. Substantial research and progress was made during the last two years in addressing detectability of vehicles at ambient sound levels by the visually impaired and other pedestrians. This information is being used to develop countermeasures to improve pedestrian safety.

Research currently being pursued involves developing specifications resulting in rulemaking for synthetic vehicle sounds. This will result in vehicles that will be recognized and detected by pedestrians under a variety of conditions. Concurrent with these efforts is recognizing and addressing noise levels so as not to conflict with existing standards.

Consistent with the recommendations in the 2008 report and recognizing that the ultimate goal is having vehicles that are detectable by all pedestrians and bicyclists, the Task Force and its members have participated in activities at the national and international levels to ensure progress toward adopting minimum sound levels and characteristics for all newly manufactured vehicles.

Significant and substantial progress has been made on many levels. To summarize a few accomplishments:

- The U.S. Congress is considering legislation requiring the U.S. Department of Transportation to study the problem and issue regulations.

- The state of New Mexico has created a Task Force addressing the issue of quiet vehicles.

- The Japanese government has issued guidelines for hybrid and other "near-silent" vehicles, allowing voluntary installation of sound making devices meeting specified requirements.

- The United Nations Economic Commission for Europe (ECE), World Forum for Harmonization of Vehicle Regulations (WP.29) has determined that there is a safety issue with quiet vehicles.

The Task Force recognized in 2008 that substantial efforts by various parties were being made or planned towards addressing the issue of quiet vehicles. Not wanting to duplicate current efforts already underway, one of the Task Force recommendations was to review existing and anticipated technologies and determine the appropriateness of adopting an after-market system for testing on existing HEVs in the state fleet. Several potential products have been considered and the Task Force has determined that, at this time, a system for further evaluation does not exist. The current focus of industry is on new vehicles and the market. Interest in producing an after-market system is not sufficiently developed at this time. However, the Task Force expects such systems to be developed and made available within the foreseeable future.

Indicating that vehicle manufacturers have recognized the problem with quiet vehicles, several manufacturers, beginning this year with Nissan's LEAF, will include sound-making features on some of their models. Other manufacturers planning to actively address the issue are: General Motors (GM), Toyota, Fiskar, Hyundai and Lotus Engineering/Harman International.

FORWARD

Rising oil prices, increased societal concern about climate change, and many new regulations focusing on fuel/energy efficiency and greenhouse gas emissions are helping to drive the reinvention of the automobile to make it safer, cleaner, and more fuel efficient. As a result, there currently is an enormous amount of activity leading toward the electrification of the automobile.

During the last several years, the automotive industry has witnessed the issuance of numerous state and federal directives aimed at reducing greenhouse gas emissions and enhancing the energy security of the nation. These include:

- The enactment of the **Maryland Clean Cars Act** in 2007. This state legislation required Maryland to adopt the California Low Emissions Vehicle Program to help reduce greenhouse gas emissions as well as reduce tailpipe emissions that contribute to the formation of ground-level ozone. Section 177 of the Clean Air Act Amendments of 1990 provides states the ability to adopt the California program. Maryland's program started with model year 2011 vehicles.

- A U.S. Supreme Court ruling issued in April 2007 [***Massachusetts v. EPA***, 549 U.S. 497 (2007)] found that greenhouse gases are air pollutants covered by the Clean Air Act. The Court held that the Administrator of the U.S. Environmental Protection Agency (EPA) must determine whether emissions of greenhouse gases from new motor vehicles cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision.

- The **Energy Independence and Security Act of 2007** (P.L. 110-14), also known as EISA 2007, was enacted in December 2007. EISA 2007 is comprehensive legislation covering issues ranging from fuel economy standards for cars and trucks, to renewable fuel and electricity, to training programs for a "green collar" workforce. It also sets the first federal mandatory efficiency standards for appliances and lighting.

- Two distinct findings signed by the EPA Administrator in December 2009 regarding greenhouse gases under Section 202(a) of the Clean Air Act:
  - **Endangerment Finding**: The Administrator finds that the current and projected concentrations of the six-key well-mixed greenhouse gases—carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6)—in the atmosphere threaten the public health and welfare of current and future generations.
  - **Cause or Contribute Finding**: The Administrator finds that the combined emissions of these well-mixed greenhouse gases from new motor vehicles and new motor vehicle

engines contribute to the greenhouse gas pollution, which threatens public health and welfare (74 *Fed. Reg*. 66496; December 15, 2009).

- The **2012–2016 National Program** consisting of new standards established in May 2010 by a joint rule from the EPA and NHTSA. These standards will reduce greenhouse gas emissions and improve fuel economy, and they are the first ever national greenhouse gas emissions standards under the Clean Air Act (75 *Fed. Reg*. 25324; May 7, 2010).

- EPA and NHTSA jointly proposed changes in September 2010 to the fuel economy labels that consumers see on the window of every new vehicle in dealer showrooms (75 *Fed. Reg.* 58078; September 23, 2010). The goal of the **new fuel economy labels** is to provide consumers with simple, straightforward energy and environmental comparisons across all types of vehicles, including electric vehicles, plug-in HEVs, and conventional gasoline-powered vehicles. The agencies are proposing two new label designs for comment. One label design prominently features a letter grade to communicate the vehicle's overall fuel economy and greenhouse gas emissions performance. Under this proposal, only electric vehicles, HEVs, and plug-in HEVs would earn the top letter grades of A-, A, or A+.

- EPA and NHTSA issued a Notice of Intent (NOI) in October 2010 to begin developing new standards for greenhouse gases and fuel economy for light-duty vehicles for the 2017–2025 model years. This action responds to President Obama's request in his May 21, 2010, Presidential Memorandum to continue the national program in model year 2017 and beyond (75 *Fed. Reg.* 62739; October 13, 2010). The NOI describes EPA and NHTSA's initial assessment of potential scenarios for a **2017–2025 National Program**, and outlines next steps for continued work that the agencies will be conducting in developing a rulemaking. In addition, at the President's request, EPA and NHTSA worked closely with the California Air Resources Board (CARB) to develop an Interim Joint Technical Assessment Report of potential 2017–2025 scenarios. The implementation scenario preferred by EPA, NHTSA, and CARB—if implemented as proposed—would likely result in a near 50-50 mix of advanced internal combustion engine vehicles and hybrid and electric vehicles being sold in 2025.

It is also worth noting that consumers have seen gasoline prices fluctuate in recent years from $1.50 per gallon to more than $5.00 per gallon.

The shift toward electrification of the automobile can be separated into four distinct types of technology: hybrid electric vehicles, plug-in hybrid electric vehicles (PHEV), extended-range electric vehicles (EREV), and battery electric vehicles (BEV). These technologies present (in order) an increasing reliance on electricity. The last three can be classified as plug-in electric vehicles (PEVs). The plug-in electric vehicle can, in its most simple form, be described as an HEV with the ability to plug into an electrical outlet.

The hybrid electric vehicle combines an ICE with an electric motor. There are three basic variations: (1) belt alternator starter (or mild hybrid), (2) integrated generator assist, and (3) series parallel. The three are presented from least expensive to most, and least efficiency gain to most. The Toyota Prius was the first high-volume, series-parallel hybrid vehicle and has been on sale in the United States since 2000. Currently, most major manufacturers offer at least one, if not several, hybrid models, suggesting that this technology is becoming more mainstream. Indeed, today, the U.S. is home to numerous federal, state, and local incentive programs intended to overcome the initial cost of HEVs and PEVs. The Maryland Clean Cars Program, in combination with other federal directives described previously, is expected to result in more electric and hybrid vehicles on Maryland's roads. Because HEVs and PEVs operate with less sound than vehicles with gasoline internal combustion engines, in June 2008 the Maryland Quiet Vehicles and Pedestrian Safety Task Force was formed (Chapters 384 and 385, Acts of 2008). In May 2009, the Task Force was re-established by statute (Chapters 249 and 250, Acts of 2009).

Since its inception, the Task Force has studied ways to ensure that pedestrians, especially blind pedestrians, are not at risk from quieter vehicles. The study included a survey of available technologies that increase the safety of blind pedestrians. The Task Force conducted public hearings, reviewed research on the subject, and consulted with consumer groups representing blind individuals, pedestrians, cyclists, and child safety advocates. The Task Force evaluated minimum noise levels and types of sounds to be required for new vehicles registered and sold in Maryland, as well as how technology that can be used to protect blind pedestrians.

On December 19, 2008, the first Task Force submitted its final report to the General Assembly. Because that task force found that the increase in quieter vehicles posed a potential safety hazard to the population as a whole and not just to blind individuals, it recommended that the Task Force be reconstituted to continue its work. (See Appendix A for a copy of the 2008 Task Force's Final Report to the General Assembly.)

Authorization for the Task Force currently extends through December 31, 2010.

SCOPE OF QUIET VEHICLE CONCERN

Organizations of and for persons who are blind or have low vision have expressed concerns that some motor vehicles, such as HEVs, may not be audibly detectable by the blind when the vehicle's internal combustion engine is not operating. Blind pedestrians make decisions about crossing streets when they can hear vehicles in their environment. The blind use the sounds of passing vehicles in a number of ways to help them travel.

Mobility depends in large part on perceiving the characteristics of the immediate surroundings. The information gathering and decision-making processes include several tasks, such as detecting a street and crossing location, identifying the type of traffic control device or traffic patterns, establishing a heading toward the opposite corner (alignment), determining a time to cross, and maintaining a straight path while crossing. People gather, interpret, and act on information about the environment by using multiple cues and more than one source of perceptual input. Pedestrians who are blind detect their arrival at an intersection by using raised curb, slope of the curb ramp, detectable warnings, and traffic sounds among other way-finding cues. Traffic sounds help the blind to orient themselves toward crosswalks, to identify a time to cross, and to travel straight across the street[1,2]. The sound of traffic provides cues that help pedestrians identify vehicle operation (i.e., idling, accelerating, and slowing) and vehicle maneuvering (going straight, turning right or left). Vehicle operations provide information to assess the state of the traffic flow and to judge how much time one has to cross the street.

Until recently, the magnitude and detail of the impact of quiet cars on the safety of pedestrians has not been well known. However, since the release of the Task Force's 2008 report, NHTSA's National Center for Statistics and Analysis (NCSA) examined the incidence rates for crashes involving pedestrians and HEVs, compared to ICE vehicles, under different circumstances. NHTSA has also now studied the overall sound levels and general spectral content for a selection of HEVs and ICE vehicles in different operating conditions to evaluate detectability and possible countermeasures. A brief overview of the agency's findings follows.

[1] J.M. Barlow, B.L. Bentzen, and T. Bond, "Blind Pedestrians and the Changing Technology and Geometry of Signalized Intersections: Safety, Orientation, and Independence." *Journal of Visual Impairment & Blindness*. American Foundation for the Blind. Vol. 99, No. 10 (2005).
[2] B.B. Blash, W.R. Weiner, and R. L. Welsh. *Foundations of Orientation and Mobility*. 2nd ed. (Sewickley, PA: American Foundation for the Blind Press, 1997).

Incidence of Pedestrian and Bicyclist Crashes by Hybrid Electric Passenger Vehicles[3]

NHTSA has examined the incidence rates of pedestrian and bicyclist crashes that involved HEVs and compared the results to ICE vehicles under similar circumstances. Crash data was extracted from a sample of state crash files that contained vehicle identification numbers (twelve in all[4]) so that vehicle type could be established. State crash files contain a record of all police-reported crashes in any given state. Two groups of comparable vehicles were selected for analysis[5] and analysis was limited to 2000 model year and newer vehicles. Incidence rates were calculated to be the number of vehicles involved in crashes with pedestrians or bicyclists in similar scenarios (e.g., vehicle speed, light conditions, crash location, weather conditions etc.) divided by the total number of that type of vehicle that was in any crashes in those same scenarios. Speed limit was used as a proxy for vehicle speed, which is not available in state files (speed limits at or below 35 mph, or speed limits greater than 35 mph).

NHTSA reported a number of significant differences among the vehicle types in crashes involving pedestrians and bicyclists as follows:

- Pedestrian crash rates were significantly higher for HEVs compared to ICE vehicles in situations where the vehicle was slowing, stopping, backing up, or entering or leaving a parking space (all types combined). These are considered lower speed crashes.
- Pedestrian crash rates were significantly higher among HEVs compared to ICE vehicles when vehicles were turning. No difference was found when vehicles were going straight.
- Similar findings were reported when examining bicycle crash rates under different scenarios. Among crashes that likely occurred at slow speeds (such as turning, slowing or stopping, backing up, or entering or leaving a parking space), the rate of bicycle crashes involving HEVs was significantly higher than the rate for ICE vehicles.
- Bicycle crash rates at intersections or interchanges were significantly higher among HEVs compared to ICE vehicles.

[3] "Incidence of Pedestrian and Bicyclist Crashes by Hybrid Electric Passenger Vehicles," National Highway Traffic Safety Administration, U.S. Department of Transportation, DOT HS 811 204, September 2009.
[4] AL, FL, GA, IL, KS, MD, MI, NM, NC, PA, WA, WI.
[5] The HEVs included the Toyota Prius, Corolla, Camry; Honda Civic and Accord. The ICE vehicles included the same make models with ICE vehicles except for the Toyota Prius, which is only available as a hybrid.

Incidence Rate of Pedestrian/Bicyclist Crashes at Potentially Very Low Speed Maneuvers				
Vehicle Maneuver	**Pedestrian Crashes**		**Bicyclist Crashes**	
	HEV/Pedestrian Crashes	**ICE Vehicle/ Pedestrian Crashes**	**HEV/Bicyclist Crashes**	**ICE Vehicle/ Bicyclist Crashes**
Making a turn	--	--	0.6%	0.4%
Slowing/stopping	0.4%	0.2%	0.1%	0.1%
Backing	0.5%	0.3%	0.0%	0.01%
Entering/leaving parking space/ driveway	0.1%	0.06%	0.1%	0.01%
Starting in traffic	0.2%	0.06%	0.0%	0.02%
Total	**1.2%**	**0.6%**	**0.8%**	**0.5%**

Thus, NHTSA found that HEVs have a higher incidence rate of pedestrian and bicyclist crashes than ICE vehicles do in certain low-speed vehicle maneuvers. When a vehicle is slowing or stopping, backing up, or entering or leaving a parking space, the HEV was two times more likely to be involved in a pedestrian crash than was an ICE vehicle.

Sound Levels, General Spectral Content, and Detectability of Hybrid Electric Passenger Vehicles[6]

In this study, NHTSA documents the overall sound levels and general spectral content for a selection of HEVs and ICE vehicles in different operating conditions, evaluates vehicle detectability at two ambient sound levels, and considers countermeasure concepts that are categorized as vehicle-based, infrastructure-based, and systems requiring vehicle-pedestrian communications. Overall sound levels for the HEVs tested are lower at low speeds than for the ICE vehicles tested. There were significant differences in human subjects' response time, depending on whether electric or internal combustion propulsion was used at both lower and higher levels of ambient sound.

[6] "Quieter Cars and the Safety of Blind Pedestrians: Phase I," National Highway Traffic Safety Administration, U.S. Department of Transportation, DOT HS 811 304, April 2010.

Human Subject Studies: Average Times to Vehicle Arrivals (seconds)				
Vehicle Maneuver	Ambient Sound Level			
	Low†		High‡	
	HEVs§	ICE VehiclesΔ	HEVs§	ICE VehiclesΔ
Backing out at 5 mph	3.7	5.2	2.0	3.5
Slowing from 20 to 10 mph	2.5	1.3	2.3	1.1
Approaching at 6 mph	4.8	6.2	3.3	5.5

† Relatively quiet rural environment [31.2 dB(A)]
‡ Moderate noisy suburban environment [49.8 dB(A)]
§ Toyota Prius and Toyota Highlander
Δ Toyota Matrix and Toyota Highlander

The results of the human subject studies show that response time for each vehicle maneuver depends on ambient sound level and vehicle type. Overall, vehicles are detected sooner in the low ambient condition. ICE vehicles tested are detected sooner than their HEV twins, except for the vehicle slowing scenario where HEVs were detected sooner. The trend observed in the vehicle slowing scenario (i.e., HEVs are detected sooner than their ICE vehicle twins) may be explained by the noticeable peak in the 5000 Hz one-third octave band, emanating from the regenerative braking system, for the Toyotas during this operation.

Ongoing NHTSA Research

The goal of the research currently being pursued by NHTSA is to develop objective sound specifications for synthetic vehicle sounds that are:

- detectable by pedestrians in critical operating scenarios;
- recognizable to pedestrians as a motor vehicle in operation;
- able to provide sound content to convey vehicle operation information such as startup, presence/"idle," speed, acceleration/deceleration;
- not in conflict with established community noise standards; and
- not likely to result in driver annoyance, or be easily tampered with or "defeated" by vehicle operators or service technicians.

In order to achieve the research objectives described above, the agency is working to:

1. acquire acoustic measures of some existing ICE vehicles and typical urban ambient noise levels;
2. analyze data from Task 1 to develop detectability requirements;

3. obtain sample countermeasures from industry and other sources;
4. conduct human subject testing to measure the detectability of synthetic vehicle sounds developed by various manufacturers and the Volpe Center; and
5. determine feasibility of an objective specification test (or develop an alternative evaluation procedure).

The work described above will assist the agency in making a rulemaking decision in the late 2010/early 2011 timeframe.

SAE VEHICLE SOUND FOR PEDESTRIANS (VSP) SUBCOMMITTEE

In the spring of 2007, the Society of Automotive Engineers (SAE) International was approached by the National Federation of the Blind (NFB) regarding a concern about blind pedestrians being involved in traffic incidents with hybrid vehicles. The concern focused on the quiet operation of hybrid vehicles at low speeds. Based on the NFB's request, SAE International Motor Vehicle Council asked the Hybrid Electric Vehicle Technical Committee to study this concern. The HEV Technical Committee concluded that this concern did merit more study, but recognized that it required different expertise from what the members of that committee could provide. The responsibility for this issue was then transferred to the SAE Safety & Human Factors Committee, which formed the Vehicle Sound for Pedestrians (VSP) subcommittee at its November 2007 meeting. The VSP subcommittee was formed and has met monthly since that date. This subcommittee is made up of stakeholders from several different backgrounds and organizations, including representatives of the blind community and government agencies as well as academics and automakers.

The VSP subcommittee created three task forces to gather technical information to assist in determining the technical issues:

- audience for the specification (which is the targeted beneficiary);
- target sound level and type of sound (what types of sounds are necessary to achieve the desired effect, and what type of sound will achieve the desired effect with the least undesirable and unintended consequences); and
- driving conditions for the sound (what combination of vehicle conditions, vehicle status, and ambient conditions are required).

These task forces meet independently and report back at the monthly subcommittee meetings. The VSP subcommittee worked first to accurately define this issue. During the process, the subcommittee also worked to understand the conditions where these types of incidents are likely to occur (e.g., at alley and street intersections, at stop lights, etc.). The subcommittee will propose and evaluate different methods and/or countermeasures to address the issues as these factors are better understood. Even though the subcommittee's initial focus is only on hybrid vehicles, any data collected or generated in understanding the issue could eventually include vehicle types other than hybrids. The VSP subcommittee plans to issue a technical report on recommended practice by the end of 2010 based on its analysis of pedestrian safety issues related to the quiet operation of hybrid vehicles and its identification and evaluation of potential countermeasures to address these issues.

LEGISLATIVE AND REGULATORY ACTIVITY

Domestic:

U.S. Congress

On January 28, 2009, Congressmen Ed Towns of New York and Cliff Stearns of Florida reintroduced the Pedestrian Safety Enhancement Act, H.R. 734. This legislation would direct the Secretary of Transportation to study the dangers posed to blind and other pedestrians by silent cars, and at the conclusion of that study to issue regulations setting forth a motor vehicle safety standard to protect pedestrians. The Senate companion legislation, S. 841, was introduced on April 21, 2009, by Senators John Kerry of Massachusetts and Arlen Specter of Pennsylvania. Both of these bills have received strong cosponsor support during the 111th Congress.

In early 2010, Congress began to hold hearings on vehicle safety in response to several stories related to sticky floor pedals and rapid, unintended acceleration in several types of vehicles produced by Toyota. These hearings prompted Congress to introduce legislation known as the Motor Vehicle Safety Act of 2010, H.R. 5381 and S. 3302. On May 26, 2010, the House Committee on Energy and Commerce convened to mark up its version of the Motor Vehicle Safety Act of 2010. At that meeting, an amendment was offered to incorporate provisions of the Pedestrian Safety Enhancement Act. The language added to the Motor Vehicle Safety Act was agreed to and supported by the National Federation of the Blind, the Alliance of Automobile Manufacturers, the Association of International Automobile Manufacturers, and the American Council of the Blind (language included in Appendix B). On June 9, 2010, the Senate Committee on Commerce, Science, and Transportation included similar provisions in the Senate version of the Motor Vehicle Safety Act.

These provisions would direct the Secretary of Transportation to initiate rulemaking within eighteen months of enactment in order to develop a motor vehicle safety standard, to establish performance requirements for an alert sound that will allow blind and other pedestrians to detect hybrid and electric vehicles and require new electric and hybrid vehicles to be equipped with an alert sound that conforms to the motor vehicle safety standard. The motor vehicle safety standard would require neither driver activation nor pedestrian activation of the alert sound and would allow the pedestrian to reasonably detect a nearby electric or hybrid vehicle in critical operating scenarios including, but not limited to, constant speed, acceleration, or deceleration. The Secretary will allow manufacturers to provide each vehicle with one or more sounds that comply with the motor vehicle safety standard at the time of manufacture. Further, the Secretary will require manufacturers to provide, within reasonable manufacturing tolerances, the same sound or set of sounds for all vehicles of the same make and model, and shall prohibit manufacturers from providing any mechanism for anyone other than the manufacturer or the dealer to disable, alter, replace, or modify the sound or set of sounds, except that the manufacturer or dealer may alter, replace, or modify the sound or set of sounds in order to

remedy a defect or noncompliance with the motor vehicle safety standard. The Secretary will promulgate the motor vehicle safety standard no later than thirty-six months after the date of enactment. The motor vehicle safety standard would also establish a phase-in period for compliance, as determined by the Secretary, and will require full compliance with the required motor vehicle safety standard for motor vehicles manufactured on or after September 1 of the calendar year that begins three years after the date on which the final rule is issued.

State of New Mexico

New Mexico's 49th Legislature passed House Joint Memorial 77, which created a Task Force to study the issue of hybrid and "quiet" cars and the risk they pose to blind and other pedestrians. The Task Force recommended that the state legislature consider enacting requirements for rental car companies and car dealers to inform persons renting or purchasing HEVs and PEVs about the "quiet nature" of these vehicles. The Task Force also made recommendations to state agencies to inform drivers of state-owned HEVs and PEVs about the "quiet nature" of these vehicles, and to revise drivers education curriculum and defensive driving materials to include information about the "quiet nature" of HEVs and PEVs.[7]

International:

Ministry of Land, Infrastructure, Transport and Tourism (Japan)

After receiving concerns from drivers and other people about gasoline-electric hybrids and electric vehicles operating in near silence, beginning in July 2009, the Japanese government began assessing possible countermeasures through the Committee for the Consideration of Countermeasures Regarding Quiet Hybrid and Other Vehicles. The Committee's efforts culminated in the issuance of guidelines for hybrid and other "near-silent" vehicles in January 2010 by the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT). Based on the Committee's findings, MLIT has established a *Guideline on Low-noise Measures for HEV,* allowing voluntary installations of Approaching Vehicle Alert devices meeting specified requirements below (translated from Japanese).

I. Requirements of the Devices for Approaching Vehicle Alert

1. Definition

"Devices for Approaching Vehicle Alert" shall refer to those devices designed to be equipped in motor vehicles that meet certain requirements described in sections 2 and 3 below in order to let pedestrians, etc. beware of approaching vehicles, etc.

[7] See www.cfb.state.nm.us for more information.

2. Activation Conditions

   (1) Method of sound generation

   Devices for Approaching Vehicle Alert shall automatically generate sound at least in a speed range from the start of a vehicle until reaching 20km/h (12.4 mph) (see figure that follows) and when moving rearward; provided, however, that sound generation shall not be required for those vehicles equipped with internal combustion engines while such engines are activated.

   Further, for those vehicles equipped with devices for alerting rearward move, sound generation by the Devices for Approaching Vehicle Alert shall not be required when moving rearward.

   (2) Pause Switch

   Devices for Approaching Vehicle Alert may be equipped with a mechanism to temporarily halt the operation of the device (hereinafter, the "Pause Switch").

   However, when a Pause Switch is installed, an indicator showing to the driver that the Device for Approaching Vehicle Alert is suspended shall be installed.

   Furthermore, even when a Device for Approaching Vehicle Alert is suspended by the Pause Switch, a setup shall be provided so that the Device will not remain suspended.

   Further, the Pause Switch shall be easily recognized and operated by the driver in a normal position.

3. Types and Volume of Sound Generation

   (1) The sound generated shall be constant sound that reminds people of motor vehicles that are running. In such case, the kinds of sound listed below or similar sounds shall be deemed inappropriate:

      (i) Siren, chime, bells or melody

      (ii) Horn sound

      (iv) Sound generated by animals and/or insects such as birdsongs, etc.

      (v) Sound of natural phenomenon such as wave, wind, river current, etc.

      (vi) Any other sound that cannot be conceived as being generated by motor vehicles based on a common sense

   (2) The sound generated shall be automatically altered in volume or tone depending on the vehicle speed for easier recognition of the move of the vehicle.

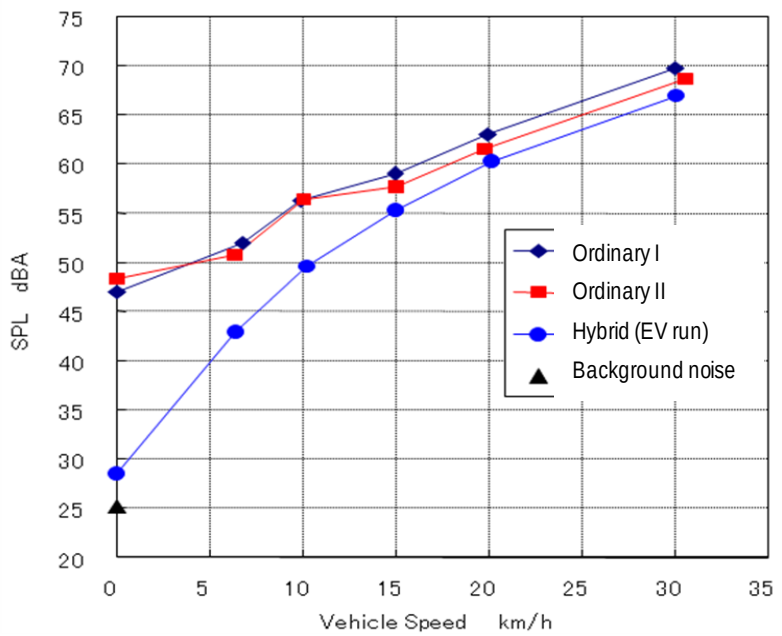
   (3) Sound volume shall not exceed a level of the sound generated when vehicles driven by internal combustion only run at speed of 20km/h for respective usage of a passenger car, truck, etc.

II. Means for Penetration Among Vehicles in Use, etc.

In light of quick penetration among vehicles in use, a sound generation device which does not meet every requirement for Devices for Approaching Vehicle Alert but at least meets requirements of 3.(1) and (3) [for devices that generate sound by an operating switch, limited to those with which the sound of 3.(1) is generated continuously for five seconds or longer by a single operation and the operating switch is easily recognized and operated by the driver in a normal position] may be installed as simplified devices that alert approaching vehicles even when such device does not meet other requirements, and sound volume and other details shall be issued separately following more elaborate studies.

III. Handling of the Guideline

This guideline shall be reviewed as necessary based on the status of technological development, etc.



Comparison of sound volume※: EV run-capable HEV vs. ordinary vehicles with engines

※ Microphone was placed at 2 meters (6.56 feet) to the left from the centerline of running vehicles and 1.2 meters (3.94 feet) from the ground. When stopped, it was placed at a position immediately next to the front edge of the vehicle.

United Nations World Forum for Harmonization of Vehicle Regulations

The United Nations Economic Commission for Europe, World Forum for Harmonization of Vehicle Regulations, has determined that road transport vehicles (propelled in whole or in part by electric means) present a danger to pedestrians. Further, the WP.29 has directed the Working Party on Noise (GRB) to assess and determine what, if any, steps might be taken by WP.29 to mitigate potential pedestrian hazards through the use of acoustic means.

The GRB has established an informal working group to carry out the following activities that are considered essential to determine the viability of "quiet vehicle" audible acoustic signaling techniques and the potential need for their global harmonization[8]:

> Phase I: Identify, review, and assess the status of various research being carried out by various governments, universities, and nongovernmental organizations regarding audible signaling technologies for quiet vehicles and their respective mandated time frames.
>
> Phase II: Determine, based on survey and experimental investigation with blind and low vision people, those human factors believed necessary to decision making in vehicular traffic situations. Studies shall include both learned and intuitive information processing.
>
> Phase III: Transform human-factor needs into technical performance parameters for road vehicles, including the types of vehicle movement and position information required by the blind, low-vision, and other persons to facilitate their safe passage, navigation, and orientation in the presence of vehicular traffic.
>
> Phase IV: Determine potential audible sound characteristics and mechanisms that convey desired vehicle performance information to the human receiver.
>
> Phase V: Determine technical and economic feasibility of those audible warning techniques deemed appropriate for "quiet vehicle" operations.
>
> Phase VI: Determine potential adverse impact on the public at large or existing vehicle noise emission standards and regulations.
>
> Phase VII: Present conclusions and recommendations to the GRB.

The Informal Group on Quiet Road Transport Vehicles (QRTV) is currently in Phase III of their work. The work group is considering adoption of the Japanese guidelines on this issue as an overall worldwide guideline on this subject.

[8] See http://www.unece.org/trans/main/wp29/wp29wgs/wp29grb/QRTV_2.html .

While adoption of these guidelines is intended primarily as a temporary measure, the Task Force has four major concerns with the Japanese guidelines.

First, the Japanese guidelines require that a sound only needs to be made when a hybrid or electric vehicle is traveling under 20 kilometers per hour (approximately 12.4 miles per hour). This requirement is based on the MLIT's study that indicates that at 20 kilometers per hour, hybrid and electric vehicles should approach the same noise level as internal combustion vehicles. What the Japanese guidelines presuppose is that cars make a safe level of sound at 20 kilometers per hour; however, this is not supported by any scientific evidence. Research needs to be done to determine the optimal level of vehicle sound to ensure the safety of all pedestrians.

Second, the Japanese guidelines do not set any minimum volume or sound requirement. The concern with this approach, of course, lies in the fact that the danger facing pedestrians is that some vehicles are too quiet to hear. Again, any standards mandating vehicle sound should be based on scientific study of the volume and characteristics of the sound needed to alert pedestrians to the presence, location, speed, and direction of vehicles.

Third, the guidelines do not require the vehicle to emit any sound when it is operating but stationary. Blind pedestrians listen for the sound of stationary vehicles in order to determine patterns of traffic at an intersection. Idling internal combustion engines tell blind pedestrians when vehicles are waiting for a traffic signal to change. A once-stationary vehicle moving forward indicates to a blind pedestrian that the signal has just changed, thereby allowing the pedestrian to enter the crosswalk quickly and cross the intersection with time to spare. And when crossing many lanes of traffic, the sound from stationary vehicles provides the information needed to walk straight across the street.

Finally, the Japanese guidelines allow the driver to deactivate the sound at any time. This option seemingly defeats the purpose of the safety feature itself, as the feature can be used at the driver's discretion, but it is when a driver does *not* see a pedestrian or bicyclist that an alert sound is most needed.

INVESTIGATION OF EXISTING AND ANTICIPATED TECHNOLOGY

In the December 2008 report, the Task Force recommended the evaluation of existing and anticipated technology to determine the appropriateness of adopting a system to be installed on state and local government-purchased vehicles.

Beginning in 2008, with a public meeting held by NHTSA, several potential developers and manufacturers of devices to increase pedestrian safety by producing sounds on quiet vehicles have been identified. HEVs have been noted as quiet vehicles, although some concern has been expressed that even ICE vehicles are being manufactured to be quieter than in the past and may present some difficulty to portions of the visually impaired community.

Part of the focus of the Task Force was to evaluate the after-manufacture market and to address those quiet vehicles currently on the market that were produced before the availability of sound-making devices. In November 2009, the Task Force invited the following groups to present their product or potential product:

- Brigade Electronics, PLC
- Creative Performance Products, Inc.
- Enhanced Vehicle Acoustics, Inc. (EVA) (See http://www.youtube.com/watch?v=Sol2MpIy5Rg&feature=fvw)
- Fisker
- Nissan
- Harmon Becker Automotive Services, Inc./Lotus Engineering

Brigade Electronics and Creative Performance attended the November 2009 meeting.

The Brigade system combines or would combine existing ICE noise with a synthesized broadband system that they believe addresses the needs of the pedestrian. The Task Force believes that an effective sound system needs to have a sound that is generally recognized by a pedestrian as that of an automotive vehicle. Brigade indicated that research is needed to determine the proper balance of broadband and ICE noise. This system has potential, but it was apparent that Brigade was relying on the participation and resources of others in the research and development of a future product.

Creative Performance Products, Inc., has a system called the Proximity Alarm Sounder System (PASS). PASS requires the pedestrian to carry a device that activates an alarm located on the quiet vehicle (see http://www.youtube.com/watch?v=ovCMu5CI4Nc). In addition to some

concern from the visually impaired community about carrying a device for effectiveness, there is concern that the sound produced is not consistent with the travel environment.

Two manufactures were not able to attend the meeting but were willing to discuss their product through a conference call. These were Nissan and Harman Becker Automotive Services, Inc. This call was made at the December 2009 meeting of the Task Force. Nissan indicated that they were not working on the after-market manufacture of a product, but were focusing on a proprietary sound system as a functioning part of their own vehicles. Since that time, Nissan has announced their electric vehicle—the LEAF. Further discussion regarding the LEAF can be found in the following section entitled ACTIONS BEING TAKEN BY VEHICLE MANUFACTURERS.

Harmon Becker is capable of producing a wide range of sounds for quiet vehicles. At this time, they have not developed a product available for the after-manufacture market but have offered their product to automobile manufacturers. An example of their capabilities can be found at http://www.pistonheads.com/news/default.asp?storyId=21103.

With few exceptions, the sounds currently being used are consistent with the sounds produced by ICE vehicles. Producing these sounds requires some customization for each vehicle, thereby limiting the use of generic devices. However, a major question concerning after-market vehicles is: How much will an owner of a quiet vehicle be willing to spend on a device to produce sound? Until this and other questions are answered, there appears to be little impetus to produce a satisfactory after-market device.

ACTIONS BEING TAKEN BY VEHICLE MANUFACTURERS

Concerns that quiet HEVs may pose a hazard for pedestrians have previously been recognized by vehicle manufacturers and means to generate synthetic sounds that could accurately mimic the sounds of ICE vehicles have previously been investigated. In 1994, Honda Motor Company applied for a U.S. patent for a "Simulated Sound Generator for Electric Vehicles." As a result, patent number 5,635,903 was awarded to Honda on June 3, 1997.

General Motors' EV1 electric car (offered for lease on a limited basis in the late 1990s) came equipped with a "pedestrian alert alarm." At low speeds, drivers could, as needed, engage an electronic chirp/headlight flash to warn pedestrians that the car was approaching—loud enough to get attention, but not nearly as startling as the regular horn.

Some makers developing HEVs and electric vehicles are understood to be considering equipping them with a pedestrian alert system. The following vehicle manufacturers have already made announcements publicly of their intentions.

Nissan LEAF

The Nissan LEAF plug-in electric vehicle is slated for release in late 2010 as the 2011 model year vehicle. In June 2010, Nissan announced that the LEAF would be fitted with an "Approaching Vehicle Sound for Pedestrians" system. According to Nissan, in developing the sound system, the company studied behavioral research of the visually impaired and worked with cognitive and acoustic psychologists.

The sine-wave sound system sweeps from 2.5kHz at the high end to a low of 600Hz, an easily audible range across age groups. Nissan worked to avoid a sound range that would add unnecessary noise to the environment (around 1,000Hz).

Depending on the speed and status (accelerating or decelerating) of Nissan LEAF, the sound system will make sweeping, high-low sounds. For instance, when Nissan LEAF is started, the sound will be louder, so a visually impaired person would be aware that a nearby car was beginning operations. And when a car is in reverse, the system will generate an intermittent sound. The sound system ceases operation when Nissan LEAF tops 30km/hr and enters a sound range where regular road noise is high. It engages again as Nissan LEAF slows to under 25km/hr.

The system is controlled through a computer and synthesizer in the dash panel, and the sound is delivered through a speaker in the engine compartment. A switch inside the vehicle can turn off sounds temporarily. The system automatically resets to "On" at the next ignition cycle. (See http://www.youtube.com/watch?v=DwPwx-YxIZM&feature=related.)

Chevrolet Volt

The 2011 Chevrolet Volt plug-in HEV is expected to go on sale at the end of 2010. The first-generation Volt will be equipped with a driver-activated or "active" pedestrian alert system similar to the one installed on the EV1. See http://www.youtube.com/watch?v=_-v-pMxmHLE. Passive systems produce a sound at all times. The Volt pedestrian alert sound is a light-volume, horn-like sound similar to the chirp of the keyless entry indicators of some cars.

GM is looking at the possibility of passive alert for future Volt generations. The company has formed a partnership with the National Federation of the Blind to identify what will be a "safe level of sound" for alerting visually impaired and other pedestrians to the approach of a silent running EV.

In January 2010, GM announced it will invest approximately $246 million in electric motor and electric drive manufacturing for HEVs and PEVs, including construction of a high volume electric drive production facility at its Baltimore transmission plant in White Marsh, Maryland. This will double the number of jobs at the Maryland plant, which opened in 2000. The plant will be the first electric motor manufacturing facility in the U.S. operated by a major automaker. The announcement signals that electric motors are driving the next wave of automotive growth. Until recently, most of the focus on HEVs and PEVs has been on the battery—how to make it lighter and cheaper. Comparatively, electric motors have received little attention. GM hopes to change that in Maryland, improving the design of its electric motors so that they use the power from the battery more efficiently.

The manufacture of electric motors at the Baltimore transmission plant is scheduled to begin in 2013.

Toyota Prius

In August 2010, Toyota Motor Corporation (TMC) announced that it was beginning sales in Japan of an onboard device designed to alert pedestrians and others audibly to the presence of a quiet vehicle, such as a gasoline-electric hybrid. The device will be available nationwide through authorized Toyota dealers and Toyota genuine parts and accessories distributors for retrofitting on the third-generation Prius gasoline-electric hybrid vehicle.

For the equivalent of $150, Prius owners are able to add a speaker system that goes under the hood. The onboard device automatically emits a synthesized sound of an electric motor when the Prius is operating as an electric vehicle at speeds up to approximately 25 km/hr. The sound—aimed to alert but not annoy—rises and falls in pitch relative to the vehicle's speed, thus helping indicate the vehicle's proximity and movement.

The device is designed to meet new Ministry of Land, Infrastructure, Transport and Tourism guidelines for hybrid and other near-silent vehicles.[9]

Toyota is considering whether it will offer the system in the U.S. at a later date. TMC says that it plans other versions of the device for use in gasoline-electric hybrids, plug-in hybrids, electric vehicles, as well as fuel-cell hybrid vehicles planned for launch in the future.

(See http://www.youtube.com/profile?user=priuschatdotcom&annotation_id=annotation_689712&feature=iv.)

[9] *"Measures Against the Quietness of Hybrid and Other Vehicles (DRAFT),"* Ministry of Land, Infrastructure and Transport (Japan), January 2010. (Translated from Japanese.)

Fisker Karma

The Fisker Karma is a luxury plug-in HEV to be assembled at a former General Motors assembly plant in Wilmington, Delaware. Start-up Fisker Automotive is headquartered in Irvine, California. The Karma is anticipated to go on sale in March 2011 and it is to be equipped with an exterior sound system to warn approaching pedestrians.

See http://www.fiskerautomotive.com/#!/karma/audio/exterior-sound .

Hyundai BlueOn Electric Vehicle

Recently, Hyundai Motor Company unveiled at Korea's Blue House the company's—and Korea's—first Full Speed Electric Vehicle named the "BlueOn." The name BlueOn derives from Hyundai's Blue Drive strategy, which encompasses the company's eco-friendly products and technologies. The word "On" symbolizes "switch on." The BlueOn features Hyundai's Virtual Engine Sound System, which creates synthetic audio feedback for the safety of pedestrians. The BlueOn reportedly will begin series production in late 2012 and will be sold in Korea shortly thereafter.

Lotus Evora 414E Plug-in Hybrid Concept

The Evora 414E Hybrid uses the Lotus Engineering and Harman International developed HALOsonic suite of noise solutions. The first of which is Electronic Sound Synthesis. This generates engine sounds inside the vehicle through the audio system where it provides an exciting sports sound in line with the brand and nature of the vehicle together with a high level of driver feedback in an intuitive manner. In addition, it generates sound on the outside of the vehicle through speakers mounted at the front and rear to provide a warning to increase

pedestrian safety, which is especially important for electric and hybrid vehicles that can be difficult to hear at slower speeds.

There are four driver-selectable engine sounds currently on the vehicle, two of which have been designed to have characteristics of a multi-cylinder conventional V6 and V12 engine. There is also a futuristic sound and a combination of a conventional engine and a futuristic sound, enhancing the brand identity of the vehicle as a step forward in electric vehicle design.

FINDINGS AND CONCLUSIONS

1. Most internal combustion vehicles provide sound cues from which vehicle position, speed, and direction can be determined.

2. All pedestrians and bicyclists use the sound of traffic in combination with other techniques to travel safely.

3. Blind pedestrians depend on and are able to listen to the sound of automobiles to determine the direction, speed, and pattern of traffic. The sound of traffic is essential to allowing the blind to travel safely, independently, and confidently.

4. The Maryland Clean Cars Act of 2007 and national efforts aimed at (a) improving environmental conditions, (b) reducing greenhouse emissions, and (c) gaining energy independence will continue to drive demand for hybrid electric vehicles and advanced technology vehicles. This will lead to hybrid and other low-emission vehicles being prevalent on roadways in Maryland.

5. Without adequate sound cues, blind pedestrians have more difficulty detecting and predicting the movement of vehicles and are at added risk on roadways. Research evidence, in addition to significant anecdotal evidence, exists to warrant action being taken on the issue of quiet vehicles.

6. While significant efforts are under way by the federal government and the automotive industry, as well as internationally, to solve this problem, it is clear that these efforts will not result in a complete or total solution by the time the Maryland Clean Cars Act goes into full effect in 2011.

7. Any minimum sound standard should balance the need for safety with not significantly raising ambient noise levels.

8. Maryland is the first state to enact legislation to study the effects of vehicle sound on pedestrian safety and technology available to enhance safety of blind and other pedestrians and is demonstrating leadership in this area, and therefore has contributed significantly to furthering pedestrian and bicycle safety.

9. Acceptable sound-generating devices for use on existing vehicles are not currently available.

10. The Japan Automobile Manufacturers Association has prepared a report establishing requirements for devices to be installed on hybrid, electric, and fuel-cell vehicles.

11. Any sound generated should be recognized as a motor vehicle in operation.

RECOMMENDATIONS

1. The Task Force supports passage of the federal legislation that incorporates the agreed-to language by the National Federation of the Blind, the Alliance of Automobile Manufacturers, the Association of International Automobile Manufacturers, and the American Council of the Blind based on the provisions of the Pedestrian Safety Enhancement Act.

2. The state should take action to provide notice and warning to drivers of HEVs and EVs of the increased potential for conflict with pedestrians and bicyclists. The Task Force will work with the appropriate State agencies to address this issue both for state-owned vehicles and vehicles owned by the general public. Note, the Task Force is aware of action by the New Mexico Task Force to provide such notice and warning and in general, agrees.

3. The Task Force should be extended until June 30, 2013:
   a. to oversee and coordinate with government (federal and state) and industry efforts to ensure satisfactory progress toward adopting a minimum sound level and the nature and characteristics of that sound level for all new vehicles sold;
   b. to conduct an evaluation of existing and anticipated technology to determine the appropriateness of adopting a system to be installed on state and local government purchased vehicles; and
   c. to identify potential technologies for evaluation, install those technologies on an appropriate number of state-owned vehicles, and evaluate the efficacy of these technologies.

STAFF PARTICIPATION

Linda Singer, Maryland State Highway Administration

Matthew Garbark, Maryland State Highway Administration

ACKNOWLEDGEMENTS

In addition to the efforts and contributions of the Task Force, John Paré of the NFB has been a significant contributor to the Task Force. John's position within the NFB, and his National and International work on the quiet vehicle issue has made him a valuable member of the team in putting together this report. We also acknowledge the efforts of Jesse Hartle and Christopher Danielsen of the NFB in preparing parts of the report.

Kristian Kuhnke has been invaluable in putting together the final document. She exhibited the ability to take material prepared by several contributors and form them into a cohesive final document.

APPENDICES

Appendix C:
Approximate Timeline for work conducted by NHTSA and SAE

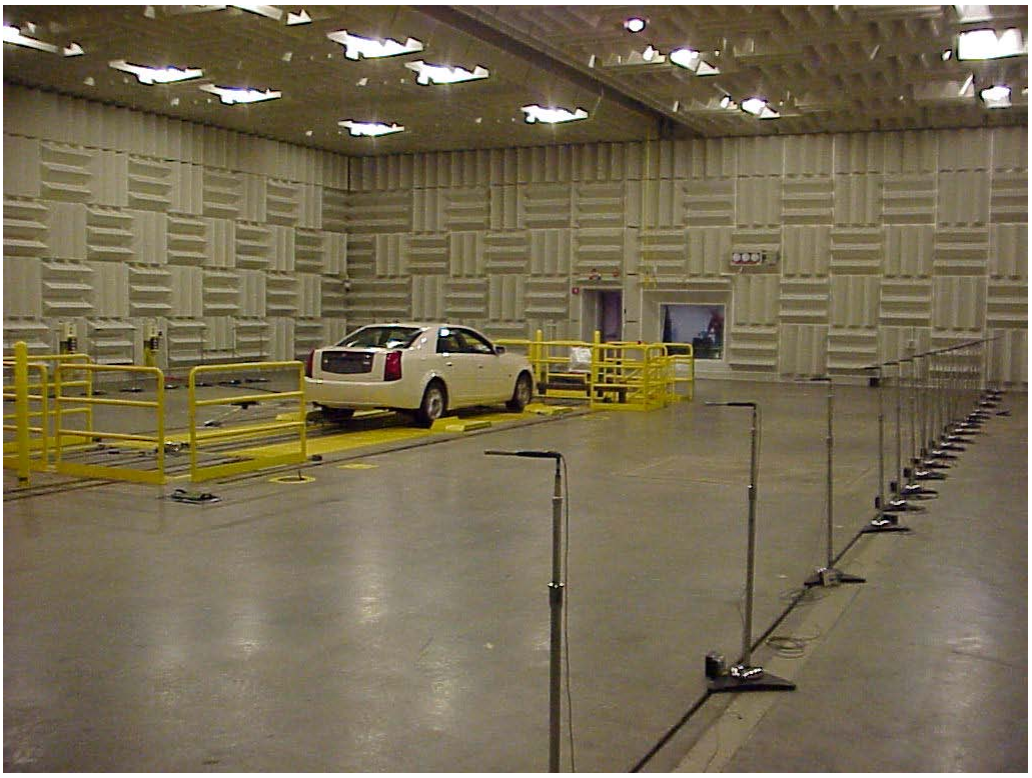
Appendix A:
2008 Task Force's Final Report to the General Assembly

A Report to the Maryland General Assembly

regarding

Findings, Conclusions, and Recommendations of the Maryland Quiet Vehicle and Pedestrian Safety Task Force

(Senate Bill 276 / House Bill 1160, Chapters 384 and 385, Acts 2008)



The State Highway Administration
The Maryland Department of Transportation

December 2008

Appendix C:
Approximate Timeline for work conducted by NHTSA and SAE

*COVER PHOTO: A Cadillac CTS undergoes low-speed sound emissions testing in an anechoic chamber at the General Motors Proving Grounds located in Milford, MI.

Quiet Vehicles and Pedestrian Safety Task Force Membership

Edward T. Paulis, Jr., Chair	Maryland Department of Transportation, Maryland State Highway Administration
Marco Carranza	Blind Industries and Services of Maryland
Richard Chambers	One Less Car
Glenn DiChiera	Maryland School for the Blind
Michael Gosse	National Federation of the Blind
Patrick Sheehan	American Council of the Blind and the Maryland Bicycle and Pedestrian Advisory Committee
Rob Strassburger	Alliance of Automobile Manufacturers
Marcia Ways	Maryland Department of the Environment, Air Radiation and Management Administration
John Wetmore	Perils for Pedestrians

Findings, Conclusions, and Recommendations of the Maryland Quiet Vehicles and Pedestrian Safety Task Force

(Senate Bill 276 / House Bill 1160, Chapters 384 and 385, Acts 2008)

Findings, Conclusions, and Recommendations of the Maryland Quiet Vehicles and Pedestrian Safety Task Force

(Senate Bill 276 / House Bill 1160, Chapters 384 and 385, Acts 2008)

FOREWORD

Organizations of and for persons who are blind or have low vision have expressed concerns that some motor vehicles, such as hybrid electric vehicles, may not be audibly detectable by the blind when the vehicle's internal combustion engine is not operating. Blind pedestrians make decisions about crossing streets when they can hear vehicles in their environment. The blind use the sounds of passing vehicles in a number of ways to help them travel. In response to this concern, in 2008, the General Assembly adopted and Governor Martin O'Malley signed into law Senate Bill 276, which established the Maryland Quiet Vehicles and Pedestrian Safety Task Force. The Task Force is charged with:

- studying the effects of vehicle sound on pedestrian safety;
- studying all available technology that may enhance the safety of blind pedestrians;
- reviewing all available research on the effects of vehicle sound on pedestrian safety and consult with consumer groups and safety advocates;
- conducting research, as appropriate;
- conducting hearings to accept testimony from experts and the public; and
- making recommendations concerning:
    - a minimum sound level and the nature and characteristics of the minimum sound standard to be required for all new vehicles sold and licensed in the State; and
    - the use of technology to enhance the safety of blind pedestrians.

Senate Bill 276 took effect June 1, 2008 and terminates December 31, 2008. The Task Force must submit a report by December 31, 2008 to the General Assembly. This is that report.

Minimum Sound Requirements for Motor Vehicles

To date, no state or municipality or the federal government have adopted minimum sound level requirements applicable to motor vehicles but some of these jurisdictions have enacted maximum sound emission requirements applicable to some motor vehicles.

Federal Law

Under authority of the Noise Control Act of 1972 (P.L. 92-574), the U.S. Environmental Protection Agency (EPA) has promulgated maximum sound emission standards for vehicles with a Gross Vehicle Weight Rating (GVWR) in excess of 10,000 pounds. The EPA standard sets a maximum sound emission level of 80 dB(A) for these vehicles. See 40 CFR § 205.52. EPA has not established maximum sound emission standards for vehicles under 10,000 pounds GVWR, i.e., passenger cars, SUVs, or light trucks. Some states and municipalities have enacted a variety of noise control laws and regulations which apply to motor vehicles sold or offered for sale in and/or operating within their jurisdictions.

Maryland Law

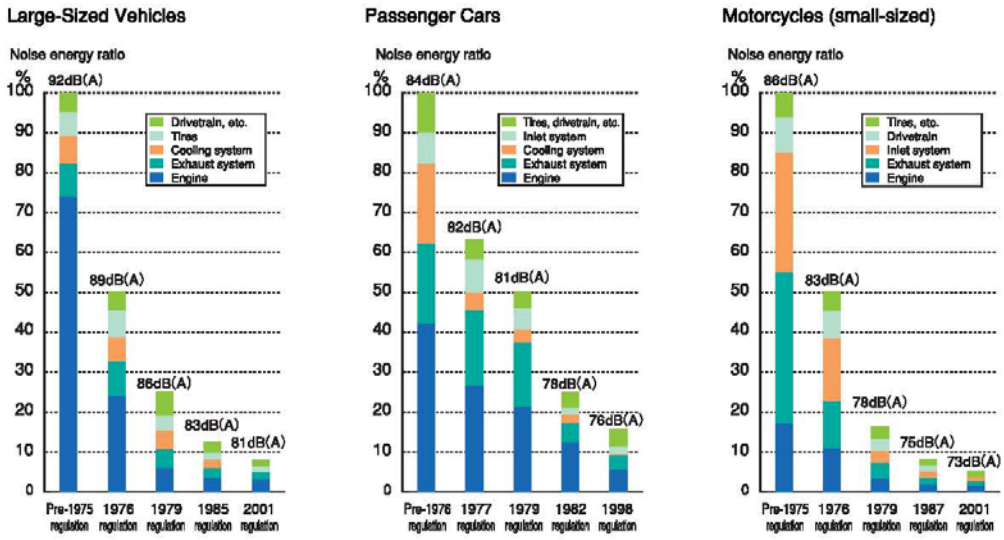
Maryland Vehicle Law contains provisions establishing maximum limits for vehicle sound. See Transportation Article, §22-601, Annotated Code of Maryland. As implemented, a new motor vehicle, including motorcycles, may not produce a sound level greater than 80 dB(A)[10] when measured under the moving vehicle test site procedures established by regulation. See 11.14.07.13 Code of Maryland Regulations. Except for specific items of motor vehicle equipment such as a horn, minimum sound levels are generally not addressed in Maryland's statutes and regulations. Motor vehicles offered for sale in the state must be equipped with a horn, *"capable of emitting sound audible under normal conditions from a distance of not less than 200 feet."* See Transportation Article, §22-401, Annotated Code of Maryland.

Trends in Vehicle Sound Emissions

Road traffic sound comprises a number of factors: vehicle-emitted sound and driving practices; road structure; road surface quality and conditions; the status of traffic flow; and factors pertaining to the roadside environment, such as roadside terrain characteristics and the extent of development. Reductions in road traffic sound may be achieved through upgraded road infrastructure and road surface quality (e.g., the use of rubberized asphalt or better roadway drainage), changes in the environment and changes to the vehicle. Societal concerns about the adverse effects of noise, in addition to the policy directives described above, have caused automakers to steadily

[10] The **decibel** (abbreviated **dB**) is the unit used to measure the intensity of a sound. On the **decibel scale**, the smallest audible sound (near total silence) is 0 dB. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. A sound 1,000 times more powerful than near total silence is 30 dB. See http://science.howstuffworks.com/question124.htm , accessed on November 6, 2008.

reduce automobile-emitted sound. As a result of these efforts, motor vehicles manufactured today are significantly quieter as illustrated on the next page.



The figure above illustrates that sound emissions of modern motor vehicles are in the sub-80 dB(A) range. This figure also illustrates that sound is emitted from several areas of the vehicle. These are: tires, drive train, inlet system, exhaust system, and engine. It is important to note that the sound emitted by the engine no longer dominates. To aid readers' understanding of the magnitude of the noise emitted from modern motor vehicles, the noise levels of some common sounds are given in the table below[11].

150	Firecracker
120	Ambulance siren
110	Chain saw, Rock concert
105	Personal stereo system at maximum level
100	Wood shop, Snowmobile
95	Motorcycle
90	Power mower
85	Heavy city traffic
60	Normal conversation
40	Refrigerator humming
30	Whispered voice

[11] See http://www.nidcd.nih.gov/health/hearing/ruler.asp

Until recently, independent travel for the blind has been a relatively straight forward matter, once a blind person has been trained in travel techniques and has learned to use a white cane or to travel with a guide dog. Blind persons are able to listen to the sound of automobiles to determine the direction, speed, and pattern of traffic. Sound from traffic tells blind pedestrians how many vehicles are near them and how fast they are moving; whether the vehicles are accelerating or decelerating; and if the vehicles are traveling toward, away from, or parallel to them. With all of this information, blind persons can accurately determine when it is safe for them to proceed into an intersection or across a driveway or parking lot. The information obtained from listening to traffic sounds allows blind persons to travel with complete confidence and without assistance.

Over the past few years, however, vehicles that are virtually silent when in certain modes of operation have come on the market, and more such vehicles are expected to be produced in the near future. These vehicles are designed to produce lower emissions in order to protect the environment from harmful pollutants but the vehicles do not necessarily need to be silent in order to achieve the intended positive environmental affects. Currently the most popular of these vehicles is the gasoline-electric hybrid (which alternates between running on a gasoline engine and on battery power), although there have been a few electric automobiles on America's roads and new all-electric models are planned. In addition to these new vehicle technologies, the engines and power trains of traditional motor vehicles have also grown quieter, meaning that even some vehicles with internal combustion engines cannot be heard by pedestrians.

The environmental benefits of new vehicle technologies have prompted municipalities, states, and the federal government to establish incentives in order to increase the sale and purchase of vehicles that employ them. The Maryland General Assembly passed legislation in 2008 creating this task force to study the dangers posed to pedestrians by vehicles which produce insufficient sound cues and recommend solutions. This report sets forth the findings and recommendations of the task force.

Background

A Brief History and Overview of Travel by the Blind

In order for blind people to live independent, productive lives, they must master certain skills. One of the most important is the ability to travel safely and independently using a white cane or a guide dog. The blind have used canes to detect obstacles in their path for centuries, but the modern white cane and the techniques for its use began to take shape when blinded veterans returned from the battlefields of World War I. Accounts differ as to when the first white cane was created, but by the early 1930s, Lions Clubs International was promoting the white cane as a symbol identifying a blind person and some municipalities had ordinances recognizing it as such and providing that blind

pedestrians carrying a white cane had specific rights. The white cane was considered advantageous to blind people because it could be easily seen by motorists and other pedestrians, thereby alerting them to the presence of a blind person on the street or sidewalk. After World War II, Dr. Richard Hoover and others began to develop and refine techniques to make the white cane more effective as a travel aid. By the time Congress passed a joint resolution on October 6, 1964, authorizing the President of the United States to issue an annual proclamation declaring October 15 as "White Cane Safety Day," the white cane was recognized both as a symbol identifying blind people and as a tool for allowing them to travel independently. Early orientation and mobility courses for the blind emphasized memorizing and traveling fixed routes from one place to another. In the late 1950s, however, a new approach began to take shape that emphasized learning to use information provided by the white cane and other cues in the environment to travel anywhere safely and independently, whether a blind individual had previously visited the place or not. This model is now known as the "structured discovery" method of teaching cane travel. It is currently taught to orientation and mobility teacher candidates studying at the Professional Development and Research Institute on Blindness at Louisiana Tech University, and other training programs for teachers of orientation and mobility for the blind are increasingly recognizing its effectiveness and adopting all or part of the approach.

Guide dog schools began to appear in the United States in the 1920s; today there are thirteen such schools training guide dogs and handlers. Most of these schools require blind applicants for guide dogs to have at least some skill in traveling with a long white cane, since the basic techniques for using a white cane and a guide dog are similar in many respects. Contrary to popular mythology, a guide dog's job is not to "lead" a blind person but simply to guide him or her around obstacles; the blind handler is still responsible for navigation.

Whether a blind person uses a white cane or guide dog, the primary purpose of both travel tools is to help the blind traveler identify and/or avoid obstacles in his or her path using the sense of touch. In the case of the white cane, the cane acts as an extension of the hand and arm; when it comes into contact with obstacles, the blind traveler can take evasive measures. The cane is also kept close to the ground to warn of curbs, steps, and other variations in the walking surface. With a guide dog, the dog watches out for obstacles, curbs, steps, and so forth, and alerts the blind person to their presence through the harness. The remaining information needed by a blind person to travel safely and independently is provided through the other three senses, primarily the sense of hearing. This is particularly true with regard to the safe navigation of intersections. By listening to the traffic, a blind traveler can determine the way it flows at a given intersection and, by moving when the traffic flow is parallel to him or her, safely cross the street. The sound of vehicles also alerts blind travelers to the location, speed, and direction of individual vehicles even in situations where the traffic flow is not high. For example, a blind person moving through a parking lot can hear and avoid vehicles entering or exiting the lot or looking for parking spaces; a blind person walking through a

neighborhood can hear when a neighbor is backing out of a driveway. For all of these reasons, the ability to hear vehicle sounds is critical to the ability of a blind person to travel to work, to school, to church, or to any other location.

Effect of Silent Vehicle Technology

As hybrid gas-electric vehicles began to appear on America's roadways, the blind noticed that these vehicles are inaudible when operating at low speeds. The National Federation of the Blind conducted informal tests with volunteers at its national convention in 2006, and these tests established that the blind participants could not hear these vehicles even in a quiet parking lot. The National Federation of the Blind also organized a day-long conference where similar tests were conducted, and through its Committee on Automobile and Pedestrian Safety, began to reach out to automobile manufacturers, regulators, pedestrian groups, electric vehicle advocates, and others to try to find a solution to the problem.

Meanwhile, independent research began to verify what the blind community had been saying about new silent vehicle technology, affirming that pedestrians cannot hear hybrid vehicles and that they therefore pose a danger not only to the blind but to others. The Society of Automotive Engineers and the Alliance of Automobile Manufacturers began to work with blind advocates to find solutions to the problem (see later sections of this report for additional information). Anecdotal information has begun to emerge about accidents and near-accidents involving the blind and others. Most recently, in Minnesota an eight-year-old boy on his bicycle collided with a Toyota Prius that he did not hear. [12] While it is difficult to confirm whether any serious injury or fatality has been directly attributable to the inability of the blind or others to hear a hybrid vehicle, the fact that these vehicles cannot be audibly detected is undisputed even by their manufacturers. As the number of silent vehicles on the roadways of Maryland increases, it is reasonable to assume that there will be a corresponding increase in the number of pedestrian injuries and fatalities.

Scope of Quiet Car Concern

Federal Government Crash Databases

The federal government, through the National Highway Traffic Safety Administration (NHTSA) National Center for Statistics and Analysis (NCSA), is currently involved with a number of major data collection efforts. Notable among these are the Fatality Analysis Reporting System (FARS) and the National Automotive Sampling System (NASS). FARS provides police-reported information augmented by data gathered from other sources for the fatal crash situation. The NASS program, which has been active since 1979, involves the statistical sampling of traffic crashes, and documents a considerable

[12] Retrieved 24 November 2008, from http://kare11.com/news/news_article...aspx?storyid=510106

amount of vehicle information. In the current implementation, the collection program has been modified to yield the General Estimates System (GES), which collects information to provide a national sample of important crash measures.

FARS contains data derived from a census of fatal traffic crashes within the fifty states, the District of Columbia, and Puerto Rico. To be included in FARS, a crash must involve a motor vehicle traveling on a traffic way customarily open to the public and result in the death of a person (occupant of a vehicle or a non-motorist) within thirty days of the crash. FARS was conceived, designed, and developed by the National Center for Statistics and Analysis (NCSA) of the National Highway Traffic Safety Administration (NHTSA) in 1975 to provide an overall measure of highway safety, to help identify traffic safety problems, to suggest solutions, and to help provide an objective basis to evaluate the effectiveness of motor vehicle safety standards and highway safety programs.

Data for the NASS-GES come from a nationally representative sample of police reported motor vehicle crashes of all types, from minor to fatal. The system began operation in 1988, and was created to identify traffic safety problem areas, provide a basis for regulatory and consumer initiatives, and form the basis for cost and benefit analyses of traffic safety initiatives. The information is used to estimate how many motor vehicle crashes of different kinds take place, and what happens when they occur. Although various sources suggest that about half the motor vehicle crashes in the country are not reported to the police, the majority of these unreported crashes involve only minor property damage and no significant personal injury. By restricting attention to police-reported crashes, the NASS-GES concentrates on those crashes of greatest concern to the highway safety community and the general public.

These accident reports are chosen from sixty areas that reflect the geography, roadway mileage, population, and traffic density of the U.S. NASS-GES data collectors make weekly visits to approximately four hundred police jurisdictions in the sixty areas across

the United States, where they randomly sample about fifty thousand police accident reports (PARs) each year. The collectors obtain copies of the PARs and send them to a central contractor for coding. No other data are collected beyond the selected PARs.

Pedestrian Fatalities and Injuries Overall

According to federal government data, in 2007, 4,654 pedestrians were killed in traffic crashes in the United States and 70,000 pedestrians were injured. Most pedestrian fatalities in 2007 occurred in urban areas (73%), at non-intersection locations (77%), in normal weather conditions (90%), and at night (67%). More than two-thirds (70%) of the pedestrians killed in 2007 were males. Pedestrians (age 70+) account for 16 percent (721) of all pedestrian fatalities and an estimated 6 percent (4,000) of all pedestrians injured in 2007. In 2007, one-fifth (20%) of all children between the ages of 5 and 9 who were killed in traffic crashes were pedestrians. Children age 15 and younger accounted for 8 percent of the pedestrian fatalities in 2007 and 23 percent of all pedestrians injured in traffic crashes. 36 percent of the 354 young (under age 16) pedestrian fatalities occurred in crashes between 3 p.m. and 7 p.m. Nearly one-half (48%) of all pedestrian fatalities occurred on Friday, Saturday, and Sunday (16%, 17%, and 15%, respectively). Alcohol involvement–either for the driver or for the pedestrian–was reported in 49 percent of the traffic crashes that resulted in fatalities. Of the pedestrians involved, 35 percent had a blood alcohol concentration (BAC) of 0.08 grams per deciliter (g/dL) or higher. Of the drivers involved in fatal crashes, 14 percent had a BAC of 0.08 g/dL or higher. In 6 percent of the crashes, both the driver and the pedestrian had a BAC of 0.08 g/dL or higher. The number of pedestrian fatalities, the percentage of the total and the fatality rate per 100,000 population for select states is given in the table below[13].

STATE	PEDESTRIAN FATALITIES	PERCENT OF TOTAL	PEDESTRIAN FATALITIES PER 100,000 POPULATION
Arizona	154	14.4	2.43
California	640	16.1	1.75
Hawaii	27	19.6	2.10
Kentucky	44	5.1	1.04
Maryland	**116**	**18.9**	**2.06**
New York	278	20.9	1.44
Virginia	88	8.6	1.14
U.S. Total	4,654	11.3	1.54

[13] "Pedestrians: Traffic Safety Facts, 2007 Data," National Center for Statistics and Analysis, National Highway Traffic Safety Administration, DOT HS 810 994.

Pedestrian Fatalities and Injuries Attributable to "Quiet" Cars

Limitations in the data collected by NASS-GES and FARS which are structured to look at all crashes not just those involving certain vehicles such as hybrid and blind pedestrians suggests that the use of these crash databases to quantify the potential scope of the blind pedestrian safety problem is not likely. Quantification of the scope of the problem may be limited to anecdotal data or incidents. This will complicate the task of both identifying potential countermeasures in traditional terms (e.g., number of fatalities or injuries) as well as evaluating the potential effectiveness of those countermeasures.

Other Indicators of the Exposure to Risk That May Suggest Action is Needed

The Blind in the U.S.[14]

There are an estimated 1.3 million legally blind adults ages 18 and older living in the United States. Legal blindness is defined as corrected eyesight no better than 20/200 for either eye or restricted field of vision less than 20 degrees wide. Most blind adults are older than the general population; their average age is 62 and one out of three is over the age of 75. Half of the blind adults are male and half are female. Most blind adults–78 percent–live in an urban area. More blind adults –35 percent–live in the South. The rest are almost evenly distributed in the other three regions: Northeast, Midwest, and West. Rural and urban adults do not differ in terms of age or sex. Approximately one in four blind adults–28 percent–use visual "equipment." The most common choices are white canes (12 percent), telescopic lenses (9 percent), and Braille (5 percent). Less than 1 percent (7,000) use a guide dog. Annually, 1,500 individuals graduate from a dog-guide user program. According to the National Federation of the Blind (NFB), every year approximately 75,000 Americans become blind.

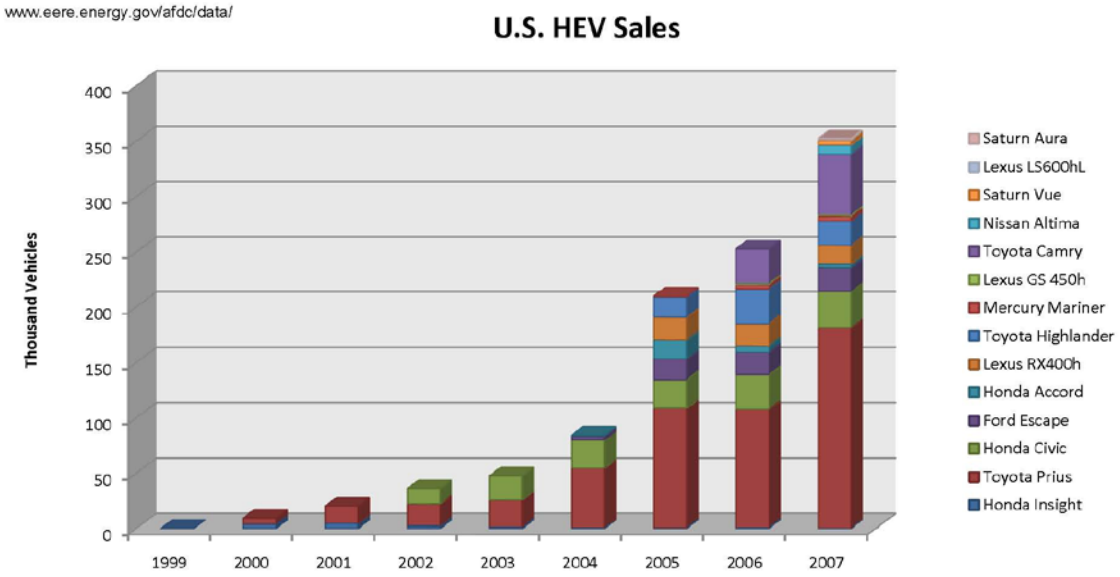
Hybrid Electric Vehicle & Advanced Technology Vehicle Trends in the U.S.

The desire to reduce greenhouse gas emissions and the need to reduce U.S. dependence on foreign oil will continue to drive demand for hybrid electric vehicles (HEVs) and advanced technology vehicles. Nationwide registrations of HEVs totaled nearly one million (997,604) at the end of 2007[15]; compared to total light vehicle registrations of 257,708,000. In a year when total light vehicle sales declined by 2.5 percent, HEV sales grew by 38 percent to 350,000 units compared with 250,000 in

[14] Zuckerman, D M, "Blind Adults in America: Their Lives and Challenges," National Center for Policy Research for Women & Families, Washington, DC, February 2004.

[15] See http://www.hybridcars.com/market-dashboard/dec07-overview.html, accessed November 14, 2008.

2006. Ninety-seven percent of the increase came from two vehicles: The Toyota Prius and the Toyota Camry. In 2007, the Toyota Prius accounted for over half of the HEVs sales in the U.S. See figure below[16].



California leads the nation in HEV registrations, followed by Florida, New York, Texas, and Illinois. Hybrid sales in 2007 and the number of new hybrids per 1,000 residents for select states are given in the table on the next page[17].

State	2007 Sales		New Hybrids per 1,000 Residents	
	Number	Rank	Number	Rank
Arizona	7,852	10	1.322	10
California	74,737	1	2.068	1
Hawaii	na	na	na	na
Kentucky	na	na	na	na
Maryland	**7,345**	**12**	**1.312**	**11**
New York	14,580	3	na	na
Virginia	10,037	7	1.326	9
U.S. Total	414,396	--	1.37	--

The top five global hybrid markets are the U.S., followed by Japan, the United Kingdom, Canada, and Germany. In 2007, 75 percent of the hybrids sold globally were in the U.S.

[16] See http://www.eere.energy.gov/afdc/data/index.html, accessed November 14, 2008.
[17] See http://www.hybridcars.com/market-dashboard/dec07-overview.html, accessed November 14, 2008.

Advanced technology that is intended to improve fuel economy and reduce greenhouse gas emissions from vehicles fueled by conventional fuels such as gasoline may also have an impact on blind pedestrian safety. Start-stop technology shuts a car's engine down when stopped at a red light or sitting in gridlock, but automatically restarts the engine when the vehicle operator lifts their foot from the brake pedal. Some automotive technology analysts believe that one in five cars (20 percent) will use start-stop technology by 2015[18]. Start-stop technology would eliminate one sound cue used by the blind who use the sound of idling vehicles lined up in front of a crosswalk to identify where that crosswalk is located.

Research

University of California at Riverside

Dr. Lawrence Rosenblum, professor of psychology at the University of California–Riverside, is conducting an ongoing research project on hybrid cars and the ability of the blind and other pedestrians to hear them.

Initial findings released in March 2008 found that even in the absence of ambient sounds, a hybrid car needed to be about 40 percent closer than a combustion-engine car before the subjects could determine whether it was approaching from the left or right.

Dr. Rosenblum made audio recordings of hybrid and combustion-engine cars in a quiet parking lot. The vehicles moved no faster than five miles per hour to assure that the hybrid car operated only with its electric motor. Subjects in a lab listened to the recordings and indicated when they could hear from which direction the car approached. Subjects could make these judgments sooner when listening to the combustion-engine car than when listening to the hybrid car.

In another study by Dr. Rosenblum, the background sounds of two quietly idling combustion-engine cars were added to simulate the noise of a parking lot. With these stimuli, the hybrid needed to be 74 percent closer than the combustion-engine car before the subjects could hear from which direction the cars approached.

[18] *"Start-Stop Technology Gets Another Boost – and Some Efficiency as Well,"* Wired, April 29, 2008.

"Subjects could correctly judge the approach of the combustion car when it was about 28 feet away," Dr. Rosenblum said in a statement about his findings. "But they could only judge the hybrid's approach direction when it was seven feet away." This means that a pedestrian would not be able to correctly determine the hybrid's approach until it was one second away, he said. Those findings have implications for pedestrians who are blind, small children, the elderly, runners, cyclists, and others, he said.

At speeds above 20 to 25 miles per hour hybrid cars likely generate enough tire and aerodynamic noise to make them sufficiently audible, Dr. Rosenblum said.

Society of Automotive Engineers, Inc.

The Society of Automotive Engineers (SAE) is an independent organization made up of members from most of the major automotive manufacturing companies. Its purpose is to develop and recommend standards for the automotive industry. SAE operates through more than six hundred committees and a host of subcommittees.

After careful deliberation SAE established the Subcommittee on Vehicle Sound for Pedestrians (VSP) under the Safety and Human Factors Committee. The subcommittee is composed of automotive engineers, academicians, and members of blindness organizations, as well as a government liaison. It has formed three task forces to examine various facets of the issue. Task Force 1 on audience identification is working to determine which segments of the population will be most negatively affected by quiet cars. Task Force 2 is studying crash problem definition and scenarios, using data collected by the National Highway Traffic Safety Administration (NHTSA) and analyzing anecdotal accounts of accidents and close calls. The third task force is focused on countermeasure performance evaluation and test procedure. By the close of calendar year 2008 the VSP subcommittee plans to complete a report on its findings. This report will include recommendations for a testing standard for determining whether a vehicle meets a specified minimum sound standard. Completion of this phase of work by the SAE will facilitate follow-on research to proceed as preliminarily illustrated in the figure on the following page.

International Activities

In November 2008, the United Nations World Forum for Harmonization of Vehicle Regulations agreed to address the concern that some vehicles may not emit sufficient sound cues to allow the blind to travel safely and independently.

LEGISLATIVE AND REGULATORY ACTIVITY

In 2003 blind advocates first expressed alarm regarding the danger that hybrid and other silent vehicle technologies would pose to blind people. The two reasons for this concern were that people who cannot see must use hearing when traveling and that hybrid and other automotive technologies are quieter than traditional internal combustion engines. Initially only blind people expressed any concern about the effect of reduced sound from automobiles on pedestrians. Neither the automotive industry nor federal and state governments took steps to address these concerns. Meanwhile, governments at all levels actively developed a vast array of incentives to encourage the manufacture and purchase of hybrid and other low-emission or zero-emission vehicles. These include tax credits for manufacturers and purchasers of such vehicles, permitting drivers of these vehicles to use high occupancy vehicle lanes (even with one occupant) for more rapid commutes during periods of high traffic, and most recently allowing manufacturers to borrow up to $25 billion for factory upgrades to facilitate more rapid manufacture of alternative energy vehicles including hybrid and electric automobiles. The growing popularity of these automobiles, which is the result of these incentives in combination with aggressive marketing by the automotive industry, has led the blind community to seek the enactment of legislation and regulations to assure the safety of blind pedestrians.

Federal Legislation

The Pedestrian Safety Enhancement Act of 2008 (H.R. 5734) was introduced by Democrat Edolphus Towns of New York and Republican Clifford Stearns of Florida on April 9, 2008. During the 110th Congress, over eighty Democrats and Republicans joined the original sponsors. The legislation was not enacted before the session adjourned; however, it is extremely likely that the bill will be promptly introduced again in the 111th Congress and that it will receive substantial bipartisan support.

The Pedestrian Safety Enhancement Act would require the U.S. Secretary of Transportation to:

- Commence a study, within ninety days of its enactment, to determine the most practical means of assuring that blind and other pedestrians receive essentially similar information to that which they now receive from sound emitted by internal combustion engines;
- Determine the minimum amount of sound necessary to offer sufficient information for blind pedestrians to make safe travel judgments;
- Determine whether a minimum sound standard or some other solution would best provide the needed information;

- Review available research, conduct additional research as needed, receive consultation from groups representing the blind, other pedestrians, cyclists, children, and the automotive industry or its representatives;
- Take no more than two years to conduct the study and provide a report of the findings to Congress;
- Promulgate a motor vehicle safety standard to address the needs of blind and other pedestrians either requiring a minimum level of sound or an equally effective means of providing essential information for the blind to travel safely and independently within ninety days after conclusion of the study; and
- Apply the standard to all motor vehicles manufactured or sold in the United States beginning no later than two years after the date it is promulgated.

Legislative Activity in Maryland

In the legislative session of 2007, the General Assembly enacted the Maryland Clean Cars Act of 2007. This legislation was a high priority of the newly elected Governor Martin O'Malley and the culmination of several years of intense effort.

The legislation as originally introduced did not take account of the concerns of blind Marylanders that to comply with this legislation, hybrid and other silent vehicles would become increasingly more prevalent in this state, thus increasing the danger to blind pedestrians. Blind Marylanders were also keenly aware that none of the other states that enacted similar legislation demonstrated any knowledge of these concerns. Maryland's blind community contacted Delegate James Malone and Senator Norman Stone, both avid supporters of the legislation, to seek the addition of language acknowledging its concerns. The enacted legislation requires state administrative agencies, when developing implementing regulations, to "consider the needs of individuals with visual impairments."

The Maryland Department of the Environment (MDE) was the primary agency responsible for the regulations for the Maryland Clean Cars Program. In adopting the regulations, MDE considered this issue internally and determined that it falls in the safety arena rather than emissions regulation, the primary focus of the Clean Cars Program, and that this important safety concern must be addressed at the national level and independent of the Clean Cars Program. Additionally, MDE had no authority to enact safety standards for automobiles. Notwithstanding this determination, MDE supports the objective of providing safe vehicles and did take steps outside the regulatory process to address this important concern. MDE contacted the major automobile manufacturers and asked them to provide information on whether a solution was being sought within the industry. The industry response cited the SAE and NHTSA

efforts that are now underway. For these reasons, MDE believed it acted in accordance with the directive and did not include a minimum sound standard in the final regulations.

The National Federation of the Blind did not agree with MDE and did not believe the Department fulfilled the directive of the Maryland Clean Cars Act to consider the needs of the individuals with visual impairments. As a result, blind advocates contacted Delegate Malone and Senator Stone, and each introduced new legislation in their respective chambers. The intent of this legislation was to establish a task force to study the concerns expressed by blind people. The Maryland Quiet Vehicles and Pedestrian Safety Task Force and this report are the result of that effort..

Legislative Activity in Other States

In 2008, six other states, in addition to Maryland, considered legislation to address the concerns of the blind. These were: Arizona, California, Hawaii, Kentucky, New York, and Virginia. A brief summary of the actions by each of these states is given in the table below.

State	Legislation		Action		Current Status/ Disposition
	Bill Number	Summary	Last	Next	
Arizona	HB 2780	Establish Minimum Sound Standard	2/14: Referred to House Committees of jurisdiction	6/23: Failed on adjournment	Failed
California	SB 1174	Establish Task Force	9/18: Presented to Governor	9/30: Vetoed	Vetoed
Hawaii	SB 2550	Establish Minimum Sound Standard	1/23: Referred to Senate Committee of jurisdiction	5/1: Failed on adjournment	Failed
Kentucky	HB 732	Establish Minimum Sound Standard	3/5: Referred to House Committee of jurisdiction 3/11: Hearing held	4/15: Failed on adjournment 10/7: Legislative Research Commission hearing	Failed/Referred to Legislative Research Commission
Maryland	SB 276 HB 1160	Establish Task Force	5/13: Enacted into law	10/28: First Task Force meeting 11/18: Second Task Force meeting	Passed/ Enacted
New York	SB 7151 AB 10248	Establish Minimum Sound Standard	3/12: Referred to Senate Committee of jurisdiction 6/10: Hearing in House	11/18: Special Session on budget	Pending
Virginia	SB 739	Establish Minimum Sound Standard	1/24: Referred to Joint Commission on Technology and Science (JCOTS)	3/13: Failed on adjournment 8/14: First JCOTS meeting	Failed/Referred to JCOTS

Governor Schwarzenegger, in his veto message, indicated that he, *"recognize(d) the challenges that the blind and visually impaired must overcome when interacting with the motor public."* He further expressed his belief that, *"there is value in creating conforming standards throughout the nation <and> this issue should be handled at the federal level."* Finally, Governor Schwarzenegger observed that the NHTSA, SAE, and the automotive industry are collaborating on research to address this problem. The Virginia Joint Commission on Technology and Science (JCOTS), recognizing the need for a national solution, has recommended that a letter be sent to the National Conference of State Legislatures and the American Legislative Exchange Council (both organizations are comprised of state legislators from all 50 states) to study this issue.

Federal Regulatory Activity

Experts agree that the National Highway Traffic Safety Administration (NHTSA) is empowered to establish a safety standard relating to silent vehicles and that no legislative grant of authority is required. However, without legislation mandating NHTSA action, that agency has complete discretion regarding whether or not to act. Blind activists first met with NHTSA officials in December 2007 and those officials stated that there was no clear statistical evidence that quieter vehicles were responsible for any death or injury among blind pedestrians. In fact only a statistically insignificant number of blind people were killed or injured in auto pedestrian crashes.

The blind community, influential members of Congress, and others called upon NHTSA to take a more active role in addressing concerns of the blind and other pedestrians. Therefore, the agency scheduled a listening session in June 2008. Testimony was provided by blind people, individuals researching possible sonic solutions, automotive representatives, and others. NHTSA claimed following that meeting that it would propose a research strategy in the *Federal Register* and seek comments regarding a timeline of steps NHTSA would take to conduct and facilitate needed research. To date there has been no such activity.

Currently Available or Expected After-Market Technology

Enhanced Vehicle Acoustics

Enhanced Vehicle Acoustics (EVA) is a start-up company founded by a group of Stanford University graduate students in 2007 to develop an add-on sound-emitting device for hybrid vehicles. The device consists of four small speakers mounted in the vehicle's wheel wells. The speakers emit a computer-generated sound when the vehicle operates silently on battery power. EVA is working closely with Dr. Lawrence Rosenblum, a perceptual psychologist at the University of California–Riverside, to determine a sound that will be effective in alerting pedestrians and cyclists to the presence of silent vehicles and at the same time will be inoffensive to the general public. The EVA device will soon be available for purchase by car owners.

Lotus Engineering

Lotus Engineering, the automotive consultancy division of sports car manufacturer Lotus, has developed technologies to synthesize external sound on electric and hybrid vehicles. A simulation of a real engine sound is used on the "Safe & Sound" Hybrid technology demonstrator vehicle, making it possible for a pedestrian to recognize instantly that the vehicle is in motion.

The Lotus "Safe & Sound" Hybrid technology demonstrator uses a standard Toyota Prius, one of the most popular and most advanced hybrid vehicles, to demonstrate the sound synthesis application and compensate for the lack of engine sound emitted by the vehicle when running on its electric motor.

To synthesize the engine sound, a road speed signal is taken from the vehicle and a corresponding sound is emitted through a waterproof loudspeaker system positioned adjacent to the radiator, allowing the sound to emanate from the front of the vehicle. When the car is operating on the electric motor only, throttle- and speed-dependent synthesized sound projects a realistic engine sound in front of the vehicle. The technology was designed around the behavior of a conventional engine, using an existing engine sound that makes it instantly recognizable. As with a traditional vehicle, the pitch and frequency help to identify vehicle distance and speed. If the hybrid's combustion engine starts operating, as it does at higher speeds or throttle demands or lower battery levels, the control system automatically stops the external synthesis. When the power train control system switches the car back to running on the electric motor only, the synthesis controller instantaneously sets the system running again. The system is completely automatic and the driver hears almost none of the additional sound.

The Enhanced Vehicle Acoustics and Lotus Safe & Sound devices are just two examples of after-market technologies being developed to solve the problem of silent vehicles. While after-market solutions have been designed in the face of concerns about hybrid vehicles, which are currently the most popular low-emission vehicles on the roadways of Maryland and the United States, these solutions are technology-neutral and could be applied to other silent vehicle technologies, such as electric vehicles, or to traditional vehicles with extremely quiet engines and power trains. Furthermore, these devices can be adjusted to accommodate any sound level standard once such a standard has been determined by appropriate research and study.

Conclusions

11. Most internal-combustion vehicles provide sound cues from which vehicle position, speed, and direction can be determined.

12. All pedestrians use the sound of traffic in combination with other techniques to travel safely.

13. Blind people depend on the sound of traffic to travel independently and safely.

14. The Maryland Clean Cars Act of 2007 provides regulatory oversight, which may lead to hybrid and other low-emission vehicles being prevalent on roadways in Maryland.

15. Blind persons are able to listen to the sound of automobiles to determine the direction, speed, and pattern of traffic, making the sound of traffic essential to allowing the blind to travel safely, independently, and confidently.

16. The desire to reduce greenhouse gas emissions and the need to reduce U.S. dependence on foreign oil will continue to drive demand for hybrid electric vehicles (HEVs) and advanced technology vehicles.

17. Without adequate sound cues, blind persons have more difficulty detecting and predicting the movement of vehicles and are at added risk as pedestrians with quieter vehicles on the roadways.

18. Federal crash databases are not currently structured to allow for the quantification of the scope of the problem posed by vehicles that do not provide sufficient sound cues.

19. Sufficient anecdotal evidence exists to warrant action being taken on this issue.

20. While efforts are underway by the federal government and by the automotive industry as well as internationally to solve this problem, it is not clear whether these efforts will result in a solution by the time the Maryland Clean Cars Act goes into full effect in 2011.

11. Any minimum sound standard should not raise ambient noise levels.

12. Unless immediate action is taken, blind Marylanders and other pedestrians will be at increased risk of being struck by vehicles that do not provide sufficient sound cues.

13. Maryland is the first state to enact legislation to study the effects of vehicle sound on pedestrian safety and technology available to enhance safety of the blind and other pedestrians and is therefore demonstrating leadership in this area.

14. Therefore it is imperative that the state of Maryland act.

Recommendations

The Maryland Quiet Vehicles and Pedestrian Safety Task Force recommends that:

2. The Maryland General Assembly adopt a resolution encouraging this state's congressional delegation to support federal legislation directing the Secretary of the United States Department of Transportation to study and establish a motor vehicle safety standard that provides for a means of alerting blind and other pedestrians of motor vehicle operation.

3. The Governor of Maryland write a letter to the United States Secretary of Transportation requesting that National Highway Traffic Safety Administration study and prescribe a motor vehicle safety standard that provides for a means of alerting blind and other pedestrians of motor vehicle operation.

4. The National Federation of the Blind, American Council of the Blind, and other interested organizations representing all pedestrians continue to support the adoption of regulations at the federal level to ensure that quiet cars make sufficient sound to allow detectability by pedestrians.

5. The Maryland General Assembly extend the term of the Maryland Quiet Vehicles and Pedestrian Safety Task Force as authorized by SB 276 and HB 1160 (2008 session) to December 31, 2010:

    a. To oversee and coordinate with government (federal and state) and industry efforts to ensure satisfactory progress towards adopting a minimum sound level and the nature and characteristics of that sound level for all new vehicles sold;
    b. To conduct an evaluation of existing and anticipated technology to determine the appropriateness of adopting a system to be installed on state and local government purchased vehicles; and

    c. To identify potential technologies for evaluation, install those technologies on an appropriate number of state-owned vehicles, and to evaluate the efficacy of these technologies.

6. The President of the Maryland Senate and the Speaker of the Maryland House of Delegates each choose one member from their respective chambers to serve on this task force.

Appendix B: Endorsed Amendment to the Motor Vehicle Safety Act

The following language is endorsed by the National Federation of the Blind, the American Council of the Blind, the Alliance of Automobile Manufacturers, and the Association of International Automobile Manufacturers.

A BILL

To direct the Secretary of Transportation to establish a motor vehicle safety standard that provides for a means of alerting blind and other pedestrians of hybrid and electric motor vehicle operation.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the 'Pedestrian Safety Enhancement Act of 2009'.

SEC. 2. DEFINITIONS.

As used in this Act--

(1) the term 'Secretary' means the Secretary of Transportation;
(2) the term 'alert sound' (herein referred to as the 'sound') means a vehicle-emitted sound to enable pedestrians to discern vehicle presence, direction, location, and operation;
(3) the term 'cross-over speed' means the speed at which tire noise, wind resistance, and/or other factors eliminate the need for a separate alert sound as determined by the Secretary;
(4) the term 'motor vehicle' has the meaning given such term in Section 30102(a)(6) of title 49, United States Code, except that such term shall not include a trailer (as such term is defined in section 571.3 of title 49, Code of Federal Regulations);
(5) the term 'conventional motor vehicle' means a motor vehicle powered by a gasoline, diesel, or alternative fueled internal combustion engine as its sole means of propulsion;
(6) the term 'manufacturer' has the meaning given such term in Section 30102(a)(5) of title 49, United States Code;
(7) the term 'dealer' has the meaning given such term in Section 30102(a)(1) of title 49, United States Code;

(8) the term 'defect' has the meaning given such term in Section 30102(a)(2) of title 49, United States Code;
(9) the term 'hybrid vehicle' means a motor vehicle which has more than one means of propulsion; and
(10) the term 'electric vehicle' means a motor vehicle with an electric motor as its sole means of propulsion.

SEC. 3. FINDINGS.

Congress finds that--

(1) motor vehicles designed to provide the desirable benefits of reducing harmful pollutants and operating with greater fuel efficiency include hybrid and electric vehicles, and in the foreseeable future may include vehicles powered by other propulsion technologies;
(2) these vehicle propulsion designs operate or are likely to operate with significantly less sound being produced by the vehicle;
(3) the total number of hybrid and electric vehicles sold per year in the United States is growing dramatically, and may someday equal or exceed the number of internal combustion engine motor vehicles on the nation's roads;
(4) blind pedestrians cannot locate and evaluate traffic by sight and instead must listen to traffic to discern its speed, direction, and other attributes in order to travel safely and independently;
(5) other people, including pedestrians who are not blind, bicyclists, runners, and small children, benefit from multi-sensory information available from vehicle traffic, including the sound of vehicle engines;
(6) hybrid and electric vehicles, especially when traveling at low speeds, cannot be audibly detected by blind people and others, rendering such vehicles difficult or impossible to perceive in situations where pedestrians and vehicles come into proximity with each other, leading to crashes;
(7) failure to take action assuring that pedestrians can hear vehicles when operating in a purely electric mode in situations where vehicles and pedestrians come into proximity with each other will likely lead to pedestrian injuries and fatalities; and
(8) such accidents can be mitigated through vehicle designs that take into account the multi-sensory nature of traffic detection and avoidance, and require that vehicles emit a minimum level of sound designed to alert all pedestrians, especially blind pedestrians, to the presence of such vehicles.

SEC. 4. MINIMUM SOUND REQUIREMENT FOR MOTOR VEHICLES.

(a) RULEMAKING REQUIRED.-- Not later than 18 months following the date of enactment of this Act the Secretary shall initiate rulemaking, under section 30111 of title 49, United States Code, to promulgate a motor vehicle safety standard--

(1) establishing performance requirements for an alert sound that allows blind and other pedestrians to reasonably detect a nearby electric or hybrid vehicle operating below the cross-over speed, if any; and

(2) requiring new electric or hybrid vehicles to provide an alert sound conforming to the requirements of the motor vehicle safety standard established under this subsection.

The motor vehicle safety standard established under this subsection shall not require either driver or pedestrian activation of the alert sound and shall allow the pedestrian to reasonably detect a nearby electric or hybrid vehicle in critical operating scenarios including, but not limited to, constant speed, accelerating, or decelerating. The Secretary shall allow manufacturers to provide each vehicle with one or more sounds that comply with the motor vehicle safety standard at the time of manufacture. Further, the Secretary shall require manufacturers to provide, within reasonable manufacturing tolerances, the same sound or set of sounds for all vehicles of the same make and model and shall prohibit manufacturers from providing any mechanism for anyone other than the manufacturer or the dealer to disable, alter, replace, or modify the sound or set of sounds, except that the manufacturer or dealer may alter, replace, or modify the sound or set of sounds in order to remedy a defect or non-compliance with the motor vehicle safety standard. The Secretary shall promulgate the required motor vehicle safety standard pursuant to this subsection not later than 36 months after the date of enactment of this Act.

(b) CONSIDERATION.-- When conducting the required rulemaking, the Secretary shall:

(1) Determine the minimum level of sound emitted from a motor vehicle that is necessary to provide blind and other pedestrians with the information needed to reasonably detect a nearby electric or hybrid vehicle operating at or below the cross-over speed, if any;

(2) determine the performance requirements for an alert sound that is recognizable to a pedestrian as a motor vehicle in operation; and

(3) consider the overall community noise impact.

(c) PHASE-IN REQUIRED.-- The motor vehicle safety standard prescribed pursuant to subsection (a) of this section shall establish a phase-in period for compliance, as determined by the Secretary, and shall require full compliance with the required motor vehicle safety standard for motor vehicles manufactured on or after September 1 of the calendar year that begins 3 years after the date on which the final rule is issued.

(d) REQUIRED CONSULTATION.-- When conducting the required study and rulemaking, the Secretary shall:

(1) consult with the U.S. Environmental Protection Agency (EPA) to assure that the motor vehicle safety standard is consistent with existing noise requirements overseen by EPA;

(2) consult consumer groups representing individuals who are blind;

(3) consult with automobile manufacturers and professional organizations representing them;

(4) consult technical standardization organizations responsible for measurement methods such as the Society of Automotive Engineers (SAE), the International Organization for Standardization (ISO),and the United Nations Economic Commission for Europe, World Forum for Harmonization of Vehicle Regulations.

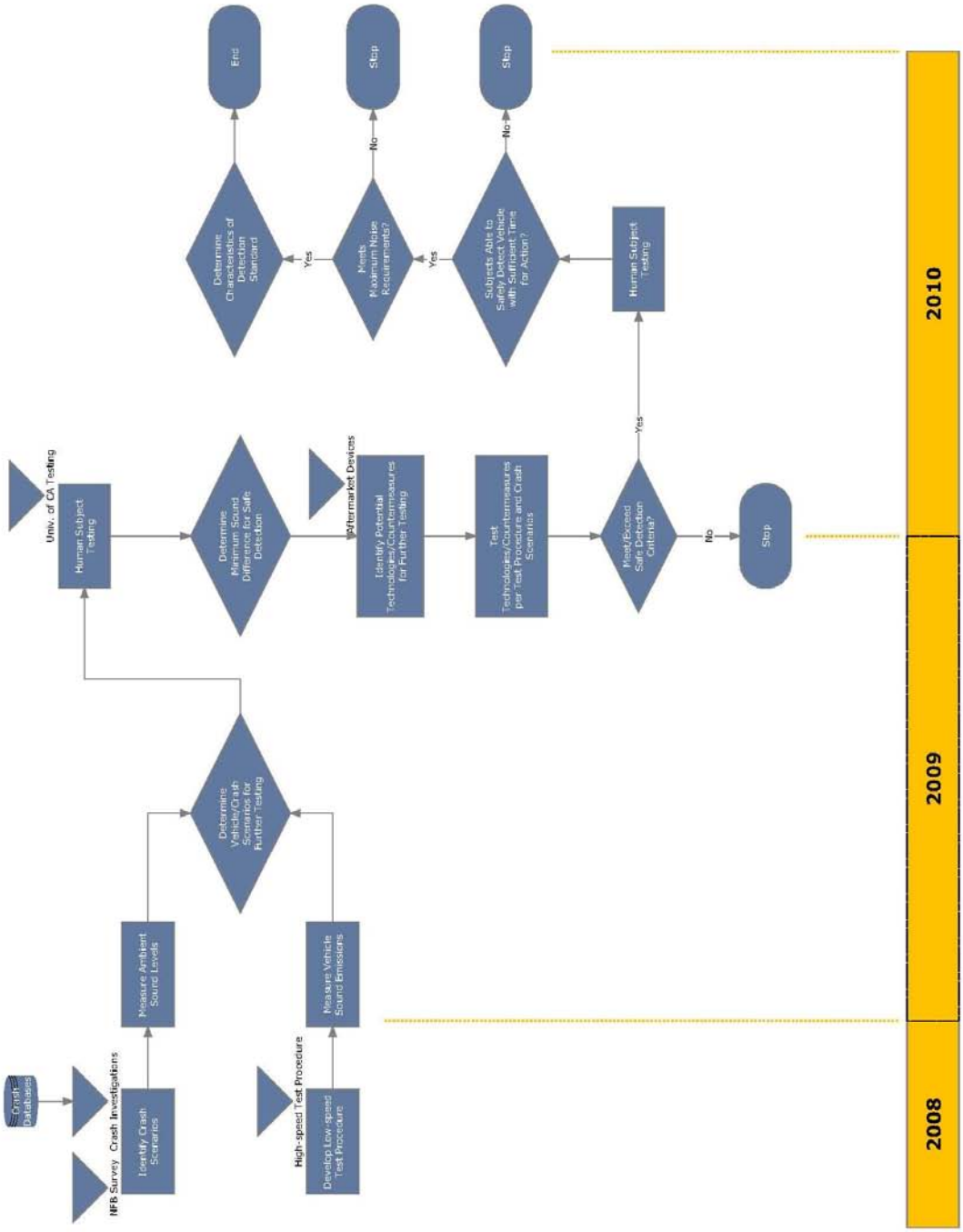
(e) REQUIRED STUDY AND REPORT TO CONGRESS.-- Not later than 48 months after the date of enactment of this Act, the Secretary shall complete a study and report to Congress as to whether there exists a safety need to apply the motor vehicle safety standard required by subsection (a) to conventional motor vehicles. In the event that the Secretary determines there exists a safety need, the Secretary shall initiate rulemaking under section 30111 of title 49, United States Code to extend the standard to conventional motor vehicles.

SEC. 5. AUTHORIZATION OF APPROPRIATIONS.

There are authorized to be appropriated to the Secretary of Transportation such sums as may be necessary to carry out this Act.

END

Appendix B:
Approximate Timeline for work conducted by NHTSA and SAE



Appendix C:
Endorsed Amendment to the Motor Vehicle Safety Act

AMENDMENT TO THE COMMITTEE PRINT OFFERED BY MR. TOWNS AND MR. STEARNS

At the end of title I, insert the following:

SEC. 109. MINIMUM SOUND REQUIREMENT.

(a) RULEMAKING. --Not later than 18 months following the date of enactment of this Act the Secretary shall initiate a rulemaking proceeding under section 30111 of title 49, United States Code, to promulgate a motor vehicle safety standard to establish performance requirements for an alert sound that allows blind and other pedestrians to reasonably detect a nearby electric or hybrid vehicle operating below the cross-over speed, if any. Such standard--

(1) shall require new electric or hybrid vehicles to provide an alert sound conforming to the requirements of the motor vehicle safety standard established under this subsection;

(2) shall not require either driver or pedestrian activation of the alert sound;

(3) shall allow the pedestrian to reasonably detect a nearby electric or hybrid vehicle in critical operating scenarios, including but not limited to constant speed, accelerating, and decelerating;

(4) shall allow manufacturers to provide each vehicle with 1 or more alert sounds that comply with the motor vehicle safety standard at the time of manufacture; and

(5) shall require manufacturers to provide, within reasonable manufacturing tolerances, the same alert sound or set of alert sounds for all vehicles of the same make and model and shall prohibit manufacturers from providing any mechanism for anyone other than the manufacturer or the dealer to disable, alter, replace, or modify the alert sound or set of alert sounds, except that the manufacturer or dealer may alter, replace, or modify the alert sound or set of alert sounds in order to remedy a defect or non-compliance with the motor vehicle safety standard.

(b) CONSIDERATION. --When conducting the required rulemaking, the Secretary shall--

(1) determine the minimum level of an alert sound emitted from a motor vehicle that is necessary to provide blind and other pedestrians with the

information needed to reasonably detect a nearby electric or hybrid vehicle operating at or below the cross-over speed, if any;

(2) determine the performance requirements for an alert sound that is recognizable to a pedestrian as a motor vehicle in operation; and

(3) consider the overall noise impact to streets and communities.

(c) PHASE-IN REQUIRED. --The motor vehicle safety standard prescribed pursuant to subsection (a) shall establish a phase-in period for compliance, as determined by the Secretary, and shall require full compliance with the required motor vehicle safety standard for motor vehicles manufactured on or after September 1 of the calendar year that begins 3 years after the date on which the final rule is issued.

(d) CONSULTATION.--When conducting the required study and rulemaking, the Secretary shall consult with--

(1) the Environmental Protection Agency to assure that the motor vehicle safety standard is consistent with existing noise requirements overseen by the Agency;

(2) consumer groups representing individuals who are blind;

(3) automobile manufacturers and professional organizations representing them; and

(4) technical standardization organizations responsible for measurement methods such as the Society of Automotive Engineers, the International Organization for Standardization, and the United Nations Economic Commission for Europe, World Forum for Harmonization of Vehicle Regulations.

(e) DEADLINE. --The Secretary shall issue a final rule under subsection (a) not later than 36 months after the date of enactment of this Act.

(f) STUDY AND REPORT. --Not later than 4 years after the date of enactment of this Act, the Secretary shall complete a study and report to Congress as to whether there exists a safety need to apply the motor vehicle safety standard required by subsection (a) to conventional motor vehicles. In the event that the Secretary determines there exists a safety need, the Secretary shall initiate rulemaking under section 30111 of title 49, United States Code to extend the standard to conventional motor vehicles.

(g) DEFINITIONS. --For purposes of the motor vehicle safety standard required under this section--

(1) the term "alert sound" means a vehicle-emitted sound that enables pedestrians to discern vehicle presence, direction, location, and operation;

(2) the term "cross-over speed" means the speed at which tire noise, wind resistance, or other factors eliminate the need for a separate alert sound, as determined by the Secretary;

(3) the term "conventional motor vehicle" means a motor vehicle powered by a gasoline, diesel, or alternative fueled internal combustion engine as its sole means of propulsion;

(4) the term "electric vehicle" means a motor vehicle with an electric motor as its sole means of propulsion; and

(5) the term "hybrid vehicle" means a motor vehicle which has more than one means of propulsion

In the table of contents in section 1 (b), insert after the items relating to section 108 the following: