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Quieter Cars and the Safety of Blind Pedestrians

United States of America

National Highway Transportation Safety Administration

In Collaboration With

The Environmental Protection Agency

And

The Society of Automotive Engineers

Problem

- The advent of hybrid and electric vehicles is serving to significantly reduce air pollution and traffic noise.
- The positive environmental benefits have produced the unintended consequence of removing a source of audible signal that is used by blind and low vision people to inform them of the approach, presence, direction, and/or departure of road vehicles.

Objectives

- Examine the blind pedestrian safety risk associated with quieter cars,
- Identify information needed by blind pedestrians to effect their safe mobility,
- Assess the potential effectiveness & acceptability of information sources.

Key Tasks

- Identify critical safety scenarios where pedestrian vehicle-conflicts are likely to occur
- Identify blind pedestrian mobility needs and the acoustic cues presently needed for safe pedestrian travel
- Review Society of Automotive Engineers (SAE) new acoustic test procedure and adapt as appropriate
- Measure acoustic parameters for a sample set of vehicles and ambient sound conditions for critical safety scenarios.
- Determine pedestrian response to vehicle acoustic information sources under various ambient sound conditions
- Identify potential information sources in addition to acoustic options
- Review potential information sources to identify strengths and limitations

Identify Critical Safety Scenarios

- Type of facility (e.g., parking lot, driveway, mid-block crosswalk, stop-controlled intersections),
- Vehicle maneuver (e.g., backing, turning, traveling in a straight line),
- Vehicle speed and operating condition (e.g., approaching at a constant speed, acceleration from stop),
- Pedestrian characteristics (e.g., age, experience, mobility aid used),
- Weather, and background noise (e.g., urban, residential, single versus multiple vehicles), among others.

Identify Blind Pedestrian Mobility Needs

- What information do blind pedestrians need for safe mobility?
- What strategies do blind pedestrians use for various walking situations?
- How is the decision-making process of blind pedestrians affected by a reduction or elimination of perceptible auditory cues from vehicular traffic?

Testing Criteria

- What are typical acoustic characteristics (signatures) for quieter cars in various critical scenarios?
  - Identify candidate vehicles for testing
  - Specify vehicle operating conditions for acoustical measurements
  - Specify environments for acoustical measurements
  - Measure acoustical characteristics of vehicles under specified operating conditions with minimal noise contamination from external sound sources to quantify the A-weighted sound level and spectral shape.
  - Measure ambient sound levels in specified environments to quantify A-weighted sound level and spectral shape.

New SAE Test for Minimum Noise Level

- Test procedure is needed to assure that vehicle acoustic parameters are evaluated consistently.
- Test procedure should be practical and accurately measure low level sound emissions.
- The test procedure must specify measurement location relative to the vehicle.
- The test procedure must specify operating conditions that mimic sound emissions associated with critical scenarios in a consistent manner.

Pedestrian Response to Vehicle Acoustic Parameters Under Various Ambient Conditions

- Measure blind pedestrians' response to acoustic parameters of ICE vehicles under ambient sound conditions of safety critical scenarios. For example, measure the ability of blind pedestrians to detect, recognize, and localize a nearby vehicle.
- Measure blind pedestrians' response to acoustic parameters of quieter cars under similar ambient sound conditions as above.
- Examine how different sound levels and spectral content (considering ambient sound and critical scenario) affect vehicle detection, recognition, and localization.
- Develop a quantitative estimate of sound level and spectral content that is needed to ensure vehicles will be detected and localized by a blind pedestrian in critical scenarios.

Identify Potential Countermeasures

- What are the expected safety improvements to be attained by the target population?
- What is the level of acceptance of each countermeasure by the blind community, car manufacturers, and the public?
- What are the unintended consequences associated with countermeasure use in an unexpected or incorrect manner; what are the impacts on safety?

Assessment of Potential Countermeasures

- Identify countermeasures that have the potential to provide the anticipated safety benefits.
- This countermeasure research will include both national and international resources.
- The work conducted by the World Forum for Harmonization of Vehicle Regulation (WP.29), Working Party on Noise.
- Countermeasures suggested by orientation and mobility training professionals, blind pedestrians, car manufacturers, and other interested parties.

Status to Date

- Identify critical safety scenarios: 100%
- Blind pedestrian mobility needs: 100%
- SAE test procedure: 100%
- Acoustic signatures of vehicles: 80%
- Representative ambient sounds: 80%
- Blind response to vehicle/ambient sounds: 20%
- Document potential countermeasures: 75%
- Countermeasure advantage / disadvantage: 10%

For More Information

www.dot/nhtsa.gov

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A Research Plan

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