

Submitted by the Chair of the
GRB informal group on QRTV

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(52nd GRB, 6-8 September 2010,
Agenda item 10.)

***QRTV REPORT
TO
GRB***

SEPTEMBER 7, 2010

UNINTENDED CONSEQUENCE

Thirty years of hard work has produced new families of road transport vehicles that produce nearly zero air and noise pollution –

Eureka! Success!

Well, not really. The unintended consequence was the evolution of a potential safety threat to blind, low vision, elderly and very young pedestrian.

FACT 1

- **Most individuals rely *principally* on their sight, supported by their sense of hearing, to assess vehicle traffic operations.**
- **In contrast, blind or low vision persons rely almost *exclusively* on their sense of hearing to make navigational decisions in the presence of vehicle traffic.**

FACT 2

- **Blind persons are able to listen to the sound of traffic and determine how many vehicles are near them, how fast they are moving, whether vehicles are accelerating or decelerating and if the vehicles are traveling toward, away, or parallel to them.**

FACT 3

- **Years of extensive hard and creative work that has produced the environmentally clean and very low noise electric and hybrid automobiles has,**
- **Unintentionally, deprived the blind and low vision population of one of their most valuable navigational tools – noise!**

OBJECTIVE OF QRTV

First, review and assess the research activities that are underway throughout the world.

Second, determine role, if any, of the international community (WP-29) in the development of acoustic warning devices for electric vehicles and hybrid electric vehicles.

Third, identify to WP-29 those acoustic alerting systems that may be candidates for a global harmonized technical regulation.

QRTV PROGRAM PLAN

Phase I - Identify, review and assess the status of research being carried out by various governments, universities and non-governmental organizations regarding audible signaling technologies for quiet vehicles and their respective mandated time frames. Complete by September, 2010 GRB meeting.

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. Complete by September, 2010 GRB meeting.

PHASE 1 STATUS

- Japan, United States and the United Kingdom have confirmed research programs underway.
- Several other countries and the European Community have indicated activities that are complimentary to the research efforts or will undertake work as needed.
- A number of private companies are also conducting studies aimed at the design of acoustic alerting signals.

PHASE 2 STATUS

- Japan and the U.S. have completed extensive investigations of quiet vehicle test protocols, minimum noise emissions and performance to establish baseline data essential to the design and operation of acoustic alerting devices
- To date, Japan and the U.S. have carried out signal detection studies with blind and low vision persons to better understand those human factors believed necessary to decision making in vehicular traffic situations.

2ND QRTV MEETING

➤ HUMAN FACTORS

□ Psychoacoustics:

- human response to sound pressure vs. loudness,
- human response to sound frequency spectrum,
- human ability to recognize differing sounds based on tone, time separation and combinations of the two,
- human response to unwanted sound (noise)

2ND QRTV MEETING

➤ ACOUSTIC SIGNAL

□ Detection

- Signal Masking
- Role of Sound Frequency
- Role of Time Domain
- Role of Continuous vs. Intermittent Sound

2ND QRTV MEETING

➤ **BLIND NAVIGATION**

□ **Useful Tools**

- **Memorization**
- **Acoustic sound generation**
 - **Mouth generated**
 - **Cane generated**
 - **Foot generated**
- **Proximity sensing**
- **External sound recognition**

3RD QRTV MEETING

- **Explanation of Basis for Japanese Quiet Vehicle Guideline**
- **Explanation of Development of Japanese Guideline**
- **Presentation of Acoustic Signal Development by Private Company**
- **Vehicle Demonstrations**
- **Post Mortem of Demonstration**

3RD QRTV MEETING

➤ Pedestrian Needs:

☐ Navigational Information

- Vehicle approach
- Vehicle presence
- Vehicle departure
- Vehicle speed
- Vehicle direction of travel
- Traffic configuration
- Traffic flow

3RD QRTV MEETING

➤ ALERTING SIGNAL

- Detectability
- Environmental Noise Masking
- Alerting Signal Characteristics
- Psychoacoustic Considerations
- Adverse Noise Impacts on Third Parties
- Driver Acceptance and Control

3RD QRTV MEETING

➤ Further Work

- ❑ Recognition aspects: Research needs – What characteristics of the sound convey the information? Human factors research experiments to answer questions.
- ❑ Spectral components: what amount of sound energy is needed within certain frequency bands to produce detectable signal in noise environment (this type of test is better carried out in a laboratory)
- ❑ Frequency shift with speed (pattern recognition)
- ❑ Amplitude shift with speed (volume)
- ❑ Other patterns (modulation, fluctuation)

3RD QRTV MEETING

➤ Further Work

- Correlation to detection distance; what is necessary detection distance
- Detection in various ambient environments (55, 65 dB Leq ?); detection distance (time)
- Is sound necessary when vehicle is stationary but in operation?
- Is different sound necessary when vehicle is backing?
- Other? (values, test method, TBD from Japan)

4th QRTV MEETING

- 27 thru 29 September 2010**
- Berlin, Germany**
- VDA Facility**
- Logistic Information (see QRTV Secretariat)**