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Quiet Road Vehicles & Pedestrian Safety
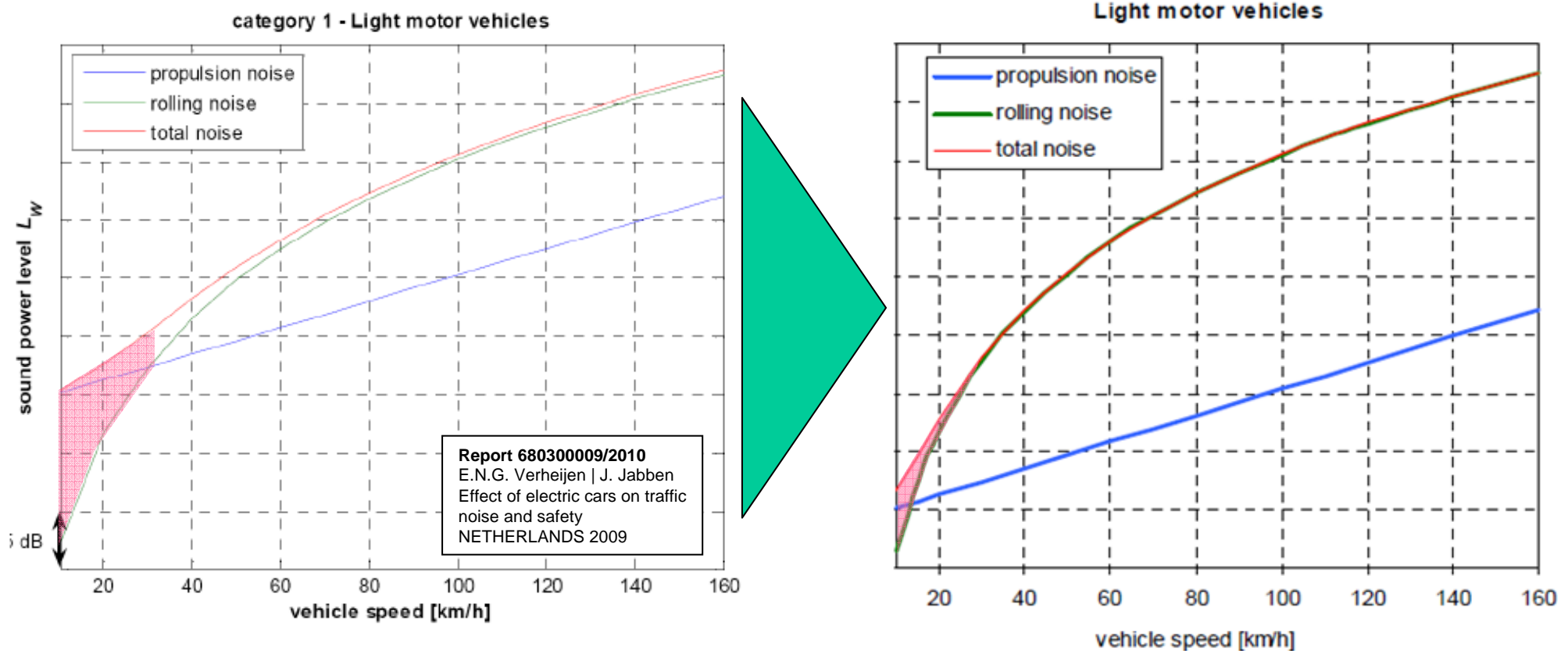
Activities in Germany (VDA)

Report to IG QRTV Washington 2010/05/04

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Dr. Ing. h.c. F. Porsche AG

Forecast of Effect of Future Noise Regulations in Real Traffic

category 1 - Light motor vehicles

Light motor vehicles

Report 680300009/2010
E.N.G. Verheijen | J. Jabben
Effect of electric cars on traffic noise and safety
NETHERLANDS 2009

Future technologies like Hybrids and EV will have nearly no propulsion sound emission.
What will be the consequences for detectability of vehicles in traffic?

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Reasons to start Investigations
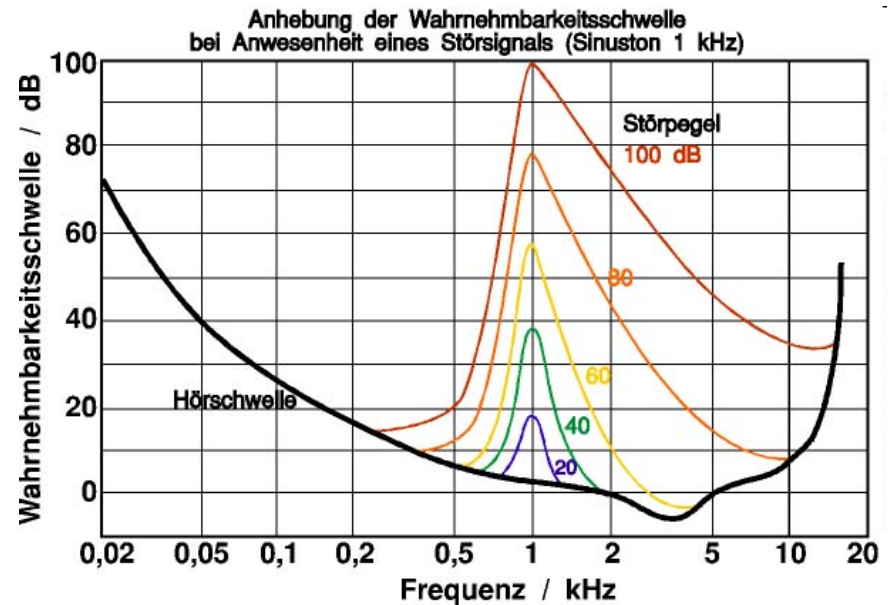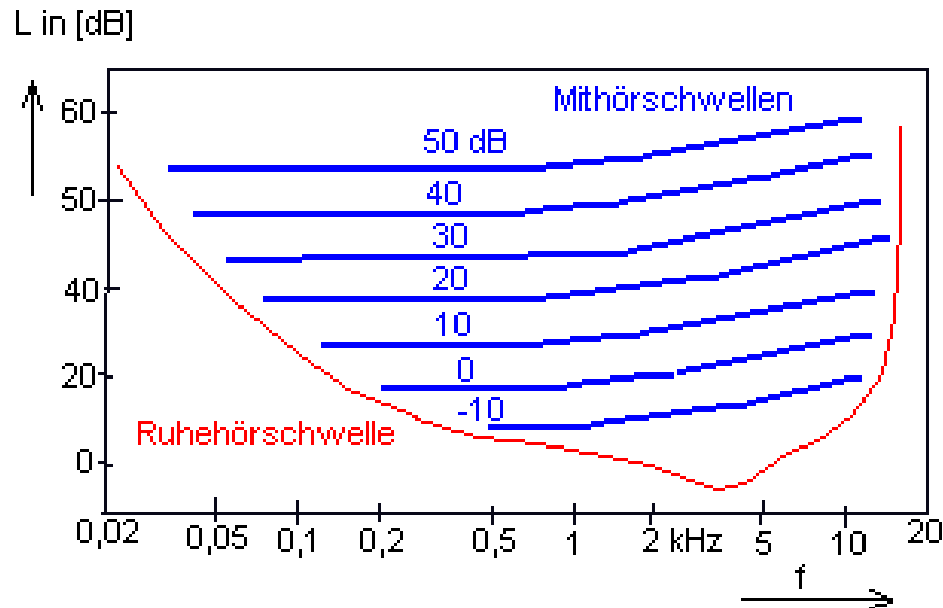
Typical traffic situation create a background noise that could mask the sound emitted by a particular vehicle such that observers will not be able to determine this vehicle properly. This could cause problems to pedestrians when traveling in that traffic.

Research of the Technical University Munich (2003-2006)

- Research on Accidents between pedestrians and vehicles.

- Assessment of the sound perception of vehicles in traffic.

- Find a descriptor to assess whether vehicles could be too quiet or not.

Cars in Traffic - Reasons for Pedestrian Accidents

Table 1: Typical lapses and locations of pedestrian accidents determined by the German police in 2003 [1].

Lack of road fitness	9.09 %
Wrong behaviour when crossing the street	77.92 %
No use of the sidewalk	1.68 %
No use of the correct road side	0.89 %
Playing on or next to the road	1.36 %
Other pedestrian errors	9.06 %
At controlled pedestrian crossings	8.92 %
At uncontrolled pedestrian crossings	0.76 %
Near intersections, pedestrian crossings, in dense traffic situations	7.37 %
In other places:	
- by sudden appearance behind obstacles	20.12 %
- by not paying attention to vehicle traffic	55.12 %
- by other misguided behaviour	7.70 %

Detectability of Cars in Traffic

Results of a Study of the Technical University Munich on the pedestrian safety (Germany 2003-2006)

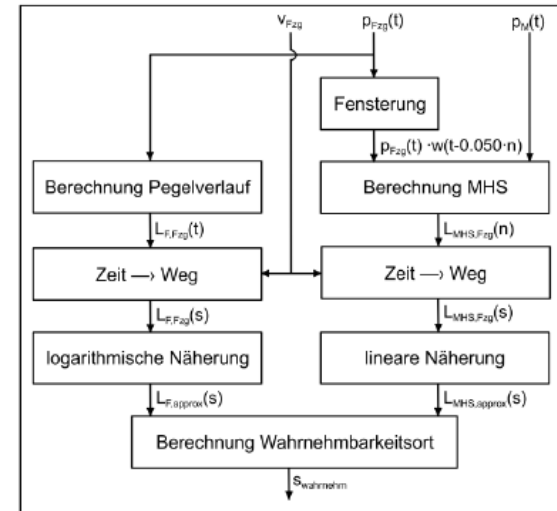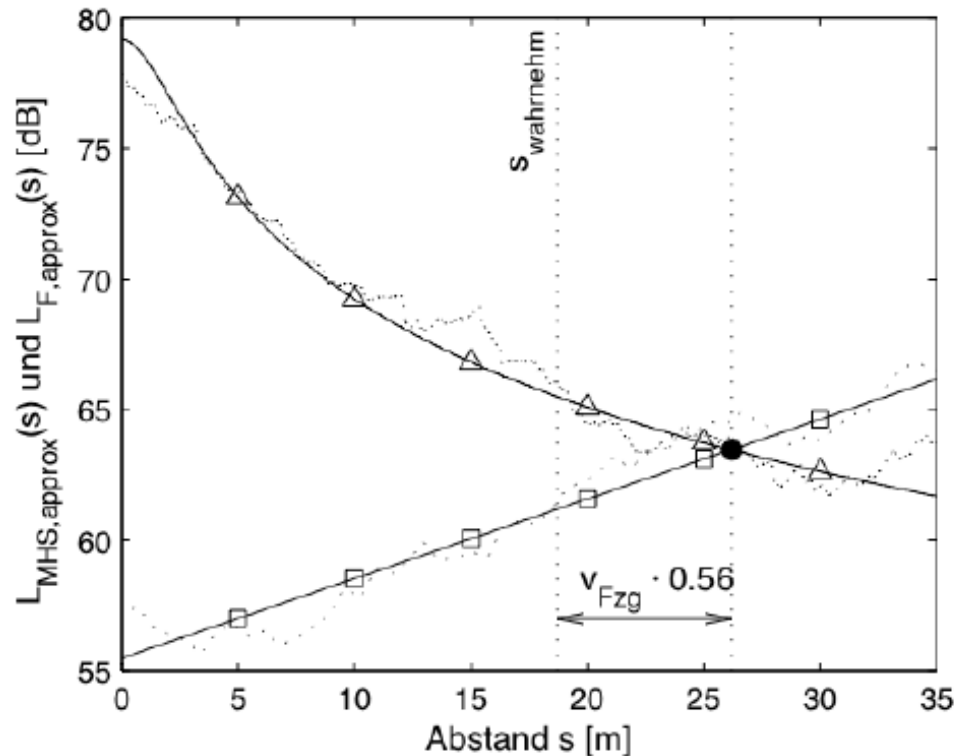high background noise   low background noise
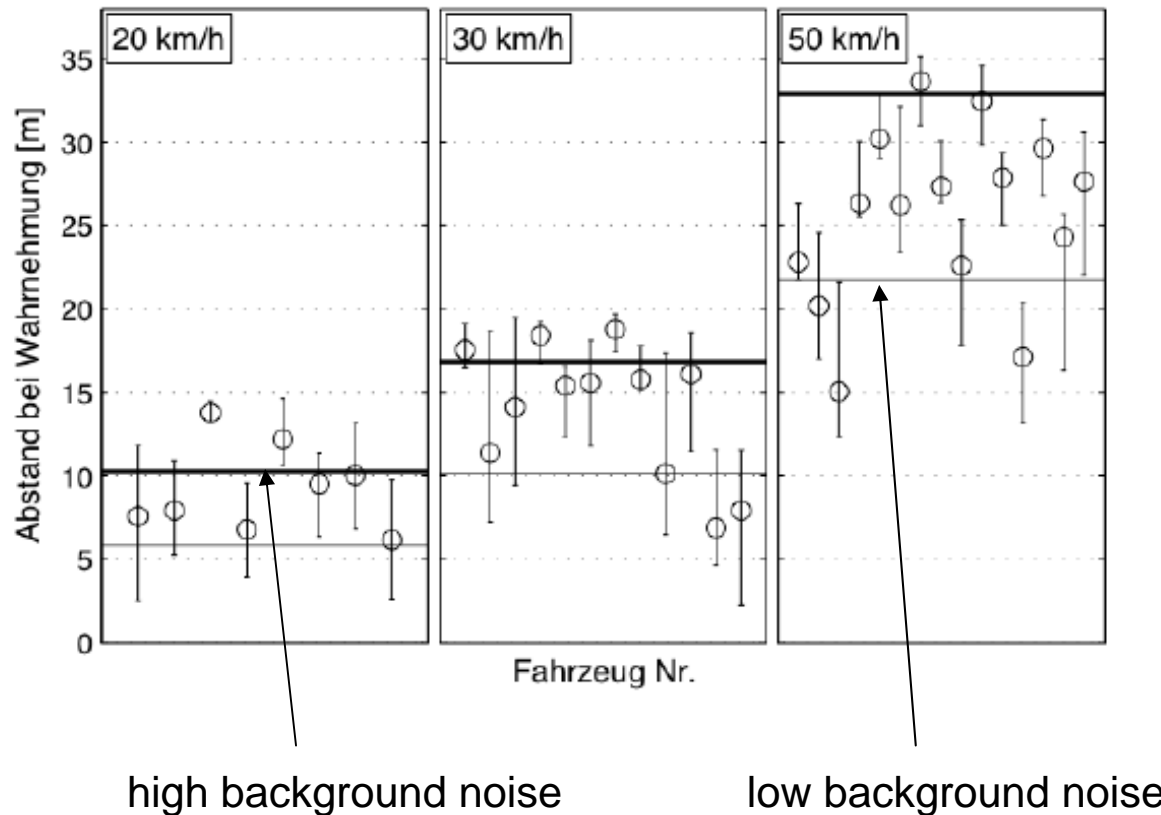
Result:

- Detectability of vehicles in traffic
  - is dependent on background noise (40 dB to 70 dB Leq)
  - is very different for individual vehicles

- Reaction time of observers (pedestrians) is very different.

- Vehicles with a clear signature are more easy to be detected.

Detectability of Cars in Traffic

Results of a Study of the Technical University Munich on the pedestrian safety (Germany 2003-2006)

Algorithmus

Kerber and Fastl: Prediciton of perceptibility of vehicle exterior noise in background noise
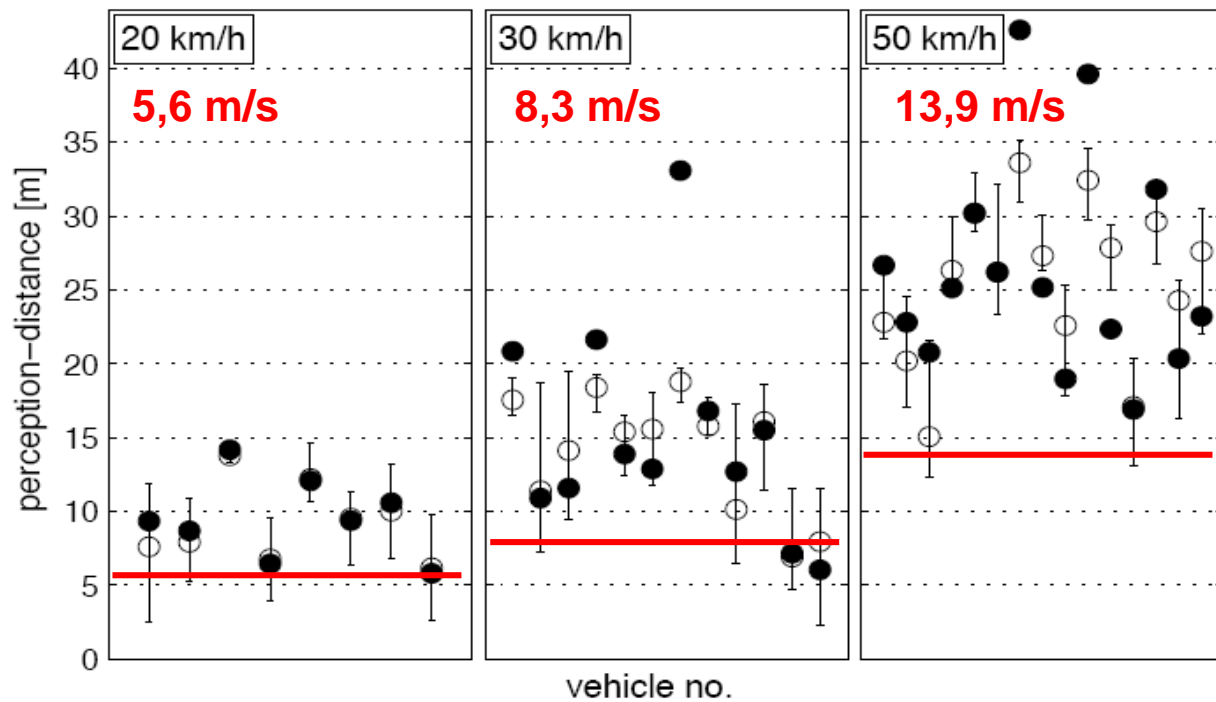
The TUM developed an algorithm to predict the detectability of a vehicle using passby measurements according to the actual ECE R51

Detectability of Cars in Traffic

Results of a Study of the Technical University Munich on the pedestrian safety (Germany 2003-2006)

black dots:
result of the prediction model of the TUM

figures in red:
mean driver reaction time of 1second

red line:
Stop distance in meter as a result of reaction time and braking time.

Difficulties to Balance Sound Requirements

- For Safety Purposes:

  - Sound shall have a clear signature and a sound level high enough to enable detection even at higher background noise condition.

- For Environment Purposes:

  - Sound shall have a decent character, be not annoying and shall have a sound level low as possible.

- Practically:

  - In most cases the warning device is not needed, because no pedestrians at all or no visual impaired persons are present, or a clear separation between road and sidewalk exists.

  - System should be disabled in such cases. But allowing the driver to do this manually seems to be unacceptable …

Research programs based on EU Regulations on SAFETY

- Europe is working on an "accident prevention" program for pedestrians with the goal to have no collisions between pedestrians and cars in the future.

- The EU-Directive 78/2009/EC is inviting vehicle manufacturers to come forward with proposals for collision prevention systems in general.

- The vehicle industry is working on active solutions, as

   - pedestrian recognition in traffic, specially for those who intend to cross roads

   - pedestrians <=> car communication to provide information to both.

- Traffic safety is on highest priority for vehicle manufacturers.

Actual activated Research Capacities in Germany (1)

- FAT (Research Body of the VDA) study about „Road/traffic-safety of pedestrians in the context with the low noise level of vehicles with alternative propulsion" - scheduled for 2009/2010

- Scope

  - Typical configurations of accidents with visually and hearing impaired pedestrians.

  - Examination and classification for warning systems - existing and possible in the future.

  - Beside acoustical warning signals other possibilities of warning shall be examined and compared.

  - Requirements on the perceptibility of possible warning signals based on vehicle, infrastructure or pedestrian.

  - Relations between other research activities with similar objectives.

Actual activated Research Capacities in Germany (2)

- **vFSS** – **Ad**v**anced F**orward-Looking **S**afety **S**ystems **(started 2009)**
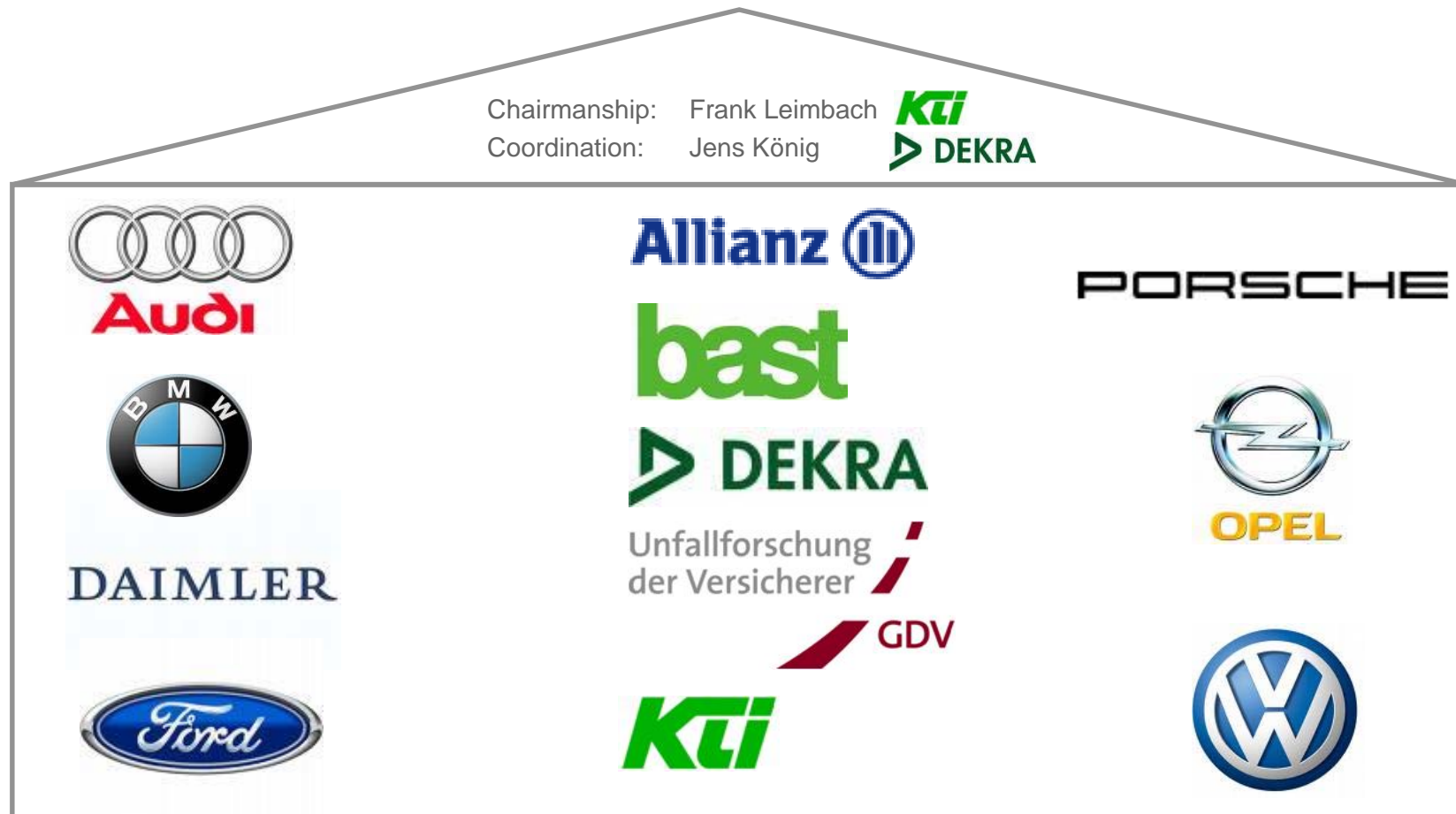
Chairmanship: Frank Leimbach **KTI**
Coordination: Jens König ▷ **DEKRA**

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Actual activated Research Capacities in Germany (2)

- **vFSS** – Ad**v**anced **F**orward-Looking **S**afety **S**ystems

- **Scope**

  - Development of ways for driver assistance systems (in particular advanced emergency braking systems).

  - Assessment of the technical feasibility (of the test procedure) and the definition of possible implementation strategies.

  - Consideration of test procedures with respect to other assessments for both primary and secondary safety.

  - Agreement on defined evaluation criteria (e.g. faulty activation rates, level of vehicle autonomous reaction,…).

Actual activated Research Capacities in Germany (2)

- **vFSS** – **Ad**v**anced** **F**orward-**L**ooking **S**afety **S**ystems

Radar detection of pedestrians.
Emergency braking when pedestrian do cross the road.

C2X Communication

- **Scope**

    - Increase the safety of pedestrians in traffic by means of micro system technical technologies.

    - Detect pedestrians even not visible to the driver, so that warning of the driver is possible to avoid a collision or at least reduce the severity of an accident.

- **Focus**

    - Pedestrian shows up between two cars.

    - Pedestrian are close to a vehicle that is maneuvering for parking (e.g. reverse driving) and driver cannot see pedestrian.

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Conclusions

- Sound as the warning signal seems to be the most appropriate approach.

  - Alternatives lack of general acceptance and experience, means people are used to have sound.

- However advanced forward looking safety features for pedestrian recognition will enable a satisfying compromise between safety requirements and environmental needs:

  - Recognition of pedestrians is done automatically.

  - Activation of warning sound only when needed.

  - Warning sound can be more loud and more penetrating.

  - Can be combined with other measures,
    e.g. braking or disabling of the acceleration control unit.