



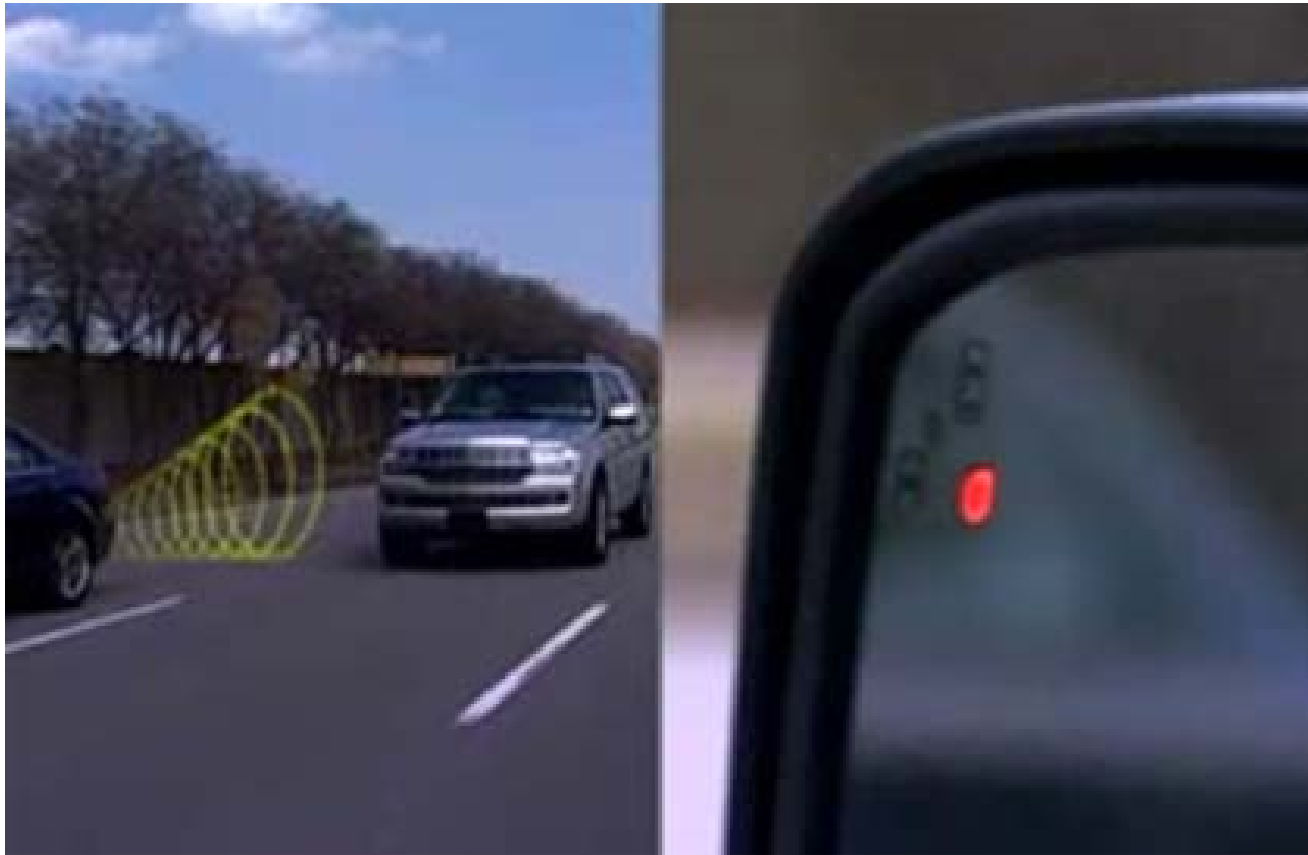
Statement of Principles on the Design of High-Priority Warning Signals

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An amber visual icon in the mirrors (Delphi)



Blind Spot Detection (Ford)



Mercedes Blind Spot Assist



Audi's Side Assist



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An amber light in the A-pillar (Volvo)



Side sensor display unit

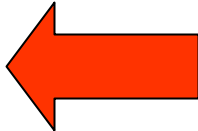
Introduction



- Warnings are intended to promote driver awareness and timely and appropriate responses in critical situations.
- Standard warnings will improve system performance with:
 - Better understanding and attention from drivers
 - Reduced confusion
 - More accurate and consistent expectations
- The purpose of this document is to provide some basic recommendations for the design of warnings.



Integrated Safety Chain

1. Normal driving
2. Deviation from normal driving
3. Emerging situation
4. Critical situation 
5. Crash unavoidable

(Tingvall, 2007)



High-Level Warnings

A signal informing the driver of a hazardous situation, which if not corrected by an immediate action (0 to 2 seconds), will result in equipment damage and/or personal injury.



System performance is limited by the driver's response to the warning



HAZARD

WARNING SYSTEM

WARNING!

TIMELY & APPROPRIATE RESPONSE

WARNING FAILURE

- No response
- Inappropriate response
- Slow response

WARNING FUNCTION

- Senses road traffic environment
- Filters & processes information for hazard
- Calculates severity & urgency
- Issues warning

WARNING PERFORMANCE

- Sensor coverage
- Sensor reliability
- Sensor accuracy
- Warning decision logic
- Warning itself

FAILURE DUE TO:

- Not noticed**
- Confusion**
- Misunderstood**
- Ignored it...**



Factors mediating warning effectiveness

- Conspicuity
- Comprehension
- Driver frustration and annoyance
- Expectancy
- Frequency of warnings
- Individual differences and condition
- Response options/ uncertainty
- Trust
- Willingness and/or ability to comply



Crash avoidance response options

1. Immediate hard braking.
2. Immediate steering manoeuvre.
3. Immediate termination of initiated or initiating action.
4. Seek awareness of situation and perform one of the above responses.
5. Immediate decision to retake control by the driver.



Status and Scope

- Some good generic warning guidelines are available, but these need to be consolidated, promoted & applied.
- IHRA-ITS working group has developed these principles to support the UN-ECE WP.29 ITS informal group.
- These principles are based on a consolidation of published guidelines, research and expert opinion.
- Scope – high-priority warnings on passenger vehicles.
- These principles are for the people who design and evaluate high-priority warning systems for vehicles.



Design Principles

1. Warnings should be noticeable in the driving environment
2. Warnings should be distinguishable from other messages in the vehicle
3. Warnings should provide spatial cues to the hazard location
4. Warnings should inform the driver of the hazard
5. Warnings should elicit timely responses or decisions
6. Multiple warnings should be prioritized
7. False/ nuisance warning rates should be low
8. Non-operational system status should be displayed



Other considerations

- No evidence of significant problems with current ITS – limited data exists on the performance of these systems in the field
- No “one right way” to design warning systems – but there are wrong ways
- Generic principles and/or guidelines and best practices for specific systems
- Care should be taken so as not to constrain new safety technologies because vehicle design and ITS are changing rapidly
- Drivers and the road traffic environment are not changing



Summary

- Warning signals are a key component of advanced driver assistance systems.
- This IHRA-ITS document provides some basic recommendations for the design of warnings based on current practice, research and expert opinion.



Thank you
