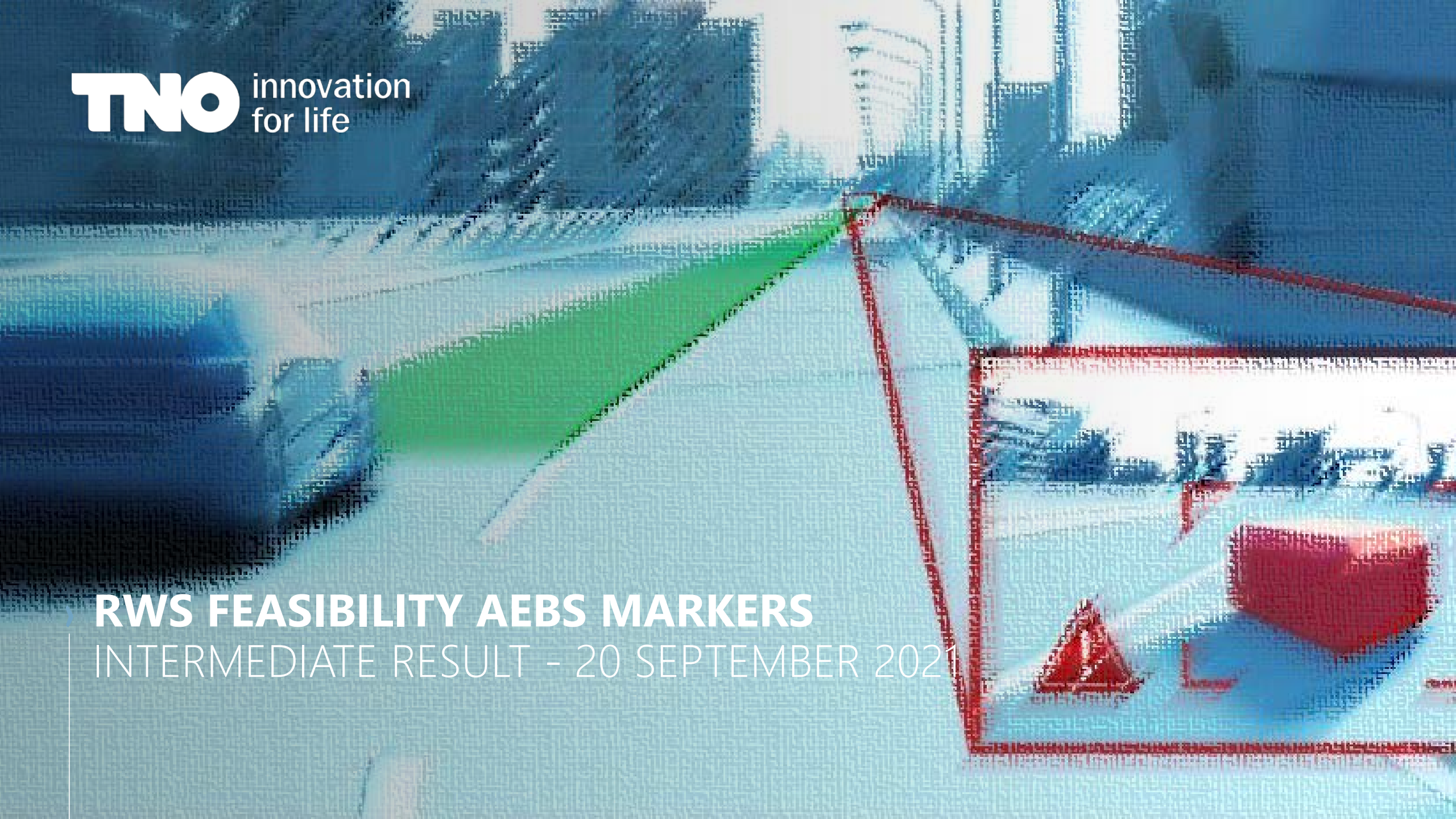


TNO innovation for life

RWS FEASIBILITY AEBS MARKERS

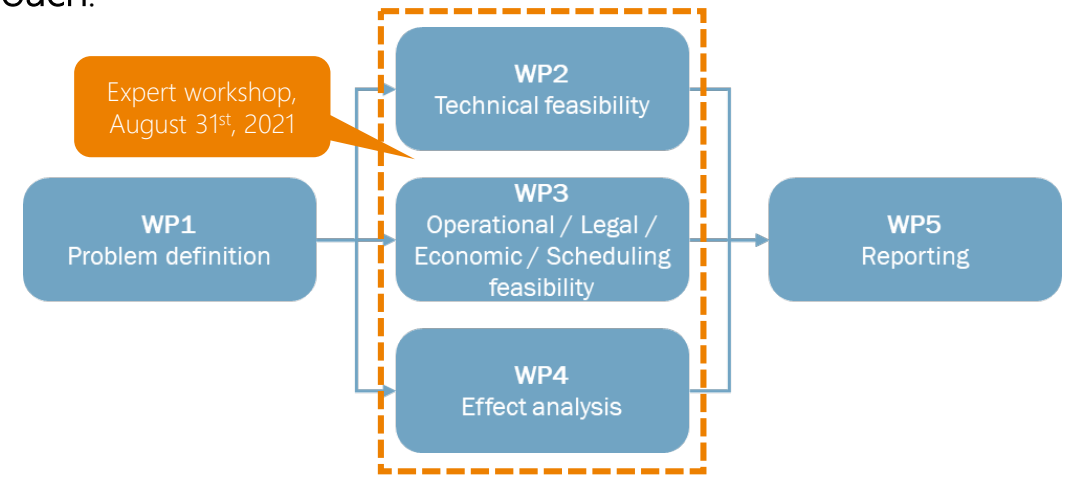
INTERMEDIATE RESULT - 20 SEPTEMBER 2021

AEBS MARKER PROJECT - RWS, RDW & TNO
INTERMEDIATE RESULT

- Goal document: This document summarizes the results obtained so far in the project "Feasibility study AEBS marker" by RWS, RDW and TNO

- Project goal: to evaluate the feasibility of a standardized marker, that can be detected and classified by a vehicle as unique distinctive entity, which is to be used to ensure AEB activation

- Project approach:



- This document:
  - WP 1: (almost) finished
  - WP 2/3/4: ongoing, expert workshop finished

WP1: PROBLEM DEFINITION
SERIOUS ISSUE FOR RWS, NL

- Problem
  - Regular accidents with injuries and casualties on highways due to trucks driving into road works
  - AEBS compulsory on trucks sold from November 2018, no traceable reduction of the number of these accidents [1]
  - Note: road works not specifically included in regulations for type approval (EU No. 347/2012 and EU 2015/562)

[1] PPT RWS + RDW, "Workshop Standardized Marker", Expert workshop 31-8-2021

WP1: PROBLEM DEFINITION
LARGE VARIETY SCENARIOS

- Large variety of accident scenario's → **Difficult to derive "common" scenario(s)** in which AEBS is was not deployed to its full potential
  - Even when looking just at highway scenario's, large variety is found in setting (vehicle type/build year, light/weather/road condition, crashed object type/position, …)
  - Exact scenario usually not known: position various vehicles / objects, driver state (attention), AEBS status (was it active?)and exact response of the AEBS (did it activate (on time)?), etc.

- AEBS implementation varies per brand + evolves over time → **Difficult to determine *why* AEBS did not activate** (in time)
  - **Sense**: various sensor types; mainly radar, camera or combination of two; less common: lidar
  - **Think**: various options to classify objects from sensor data; AI algorithms, model based, … (= usually confidential information); level (type of objects) and quality (confidence level) of classification
  - **Act**: decision making methods on if/when/how to start warning and/or activation of the brakes may vary (for example to balance true/false positives/negatives)
  - Development: industry is constantly improving their systems, hence all three steps mentioned above are changing over time

WP1: PROBLEM DEFINITION
RESEARCH DONE BY RWS SO FAR

RWS performed several tests to better understand AEBS response [2-5] (both trucks and passenger cars)

- Generally OK response test target (European Vehicle Target, slab foam target)
- AEBS response was inconsistent for road works vehicles, as well as for some other objects (among which a truck without container, the container itself, a tank truck and road works equipment (pylons, beacons, mobile road sign))
  - Note that these objects are not included in type approval regulation [6][7]
- No consistent AEBS behaviour over large variety of objects in these tests

Figure 10 - The slab foam targets in four different layouts: representing a car (upper left), a road inspector vehicle (upper right), a traffic arrow trailer (lower left) and a collision absorber (lower right).

[4]

Figure 14 – Mobile road sign (left) and collision absorber (right). [2]

Figure 1 Traffic control measures tested: traffic arrow trailer, WIS car fend-off, WIS jacket, WIS motorcycle. [3]

[2] Klem, "Practical test detection of trucks AEBS", Dec 2017
[3] Hattem, "Field test visibility AEBS", Dec 2017
[4] Gorter, "AEBS and Traffic Measures 2", Feb 2019
[5] Laarhoven, "AEBS marker testing", Jan 2020
[6] EG 347/2012
[7] EG 2015/562

WP2/3/4: EXPERT WORKSHOP
GENERAL FEEDBACK FROM WORKSHOP

- A standardized AEBS marker is believed to be a possible solution worth investigating (on a general level, not just technical) by the majority of the participants
  - Feedback OICA/CLEPA: *"the outcome of the study should in first place be an assessment of the advantages, drawbacks, limitations, associated constraints of the solution (in a kind of risk and benefit analysis), before to actually design a technical solution."*

- Other solution directions might also be interesting to look into, as they might be a more feasible and overall sustainable solution, e.g.
  - Improve AEBS such that it recognizes (standardized?) road works vehicles
  - Communication

- To define a technical solution for a standardized marker, more knowledge is required on why the system is not activated
  - Feedback OICA/CLEPA: *"The technical solution depends on the objective the group wants to reach. Hence the group should firstly define the objective, then the technical solution will follow."*

WP2/3/4: EXPERT WORKSHOP
GENERAL FEEDBACK FROM WORKSHOP

- Topics on which no consensus was found yet (will be further investigated)
  - Marker as temporary or long term solution?
  - Unique identifier or by mimicking existing properties?
  - Applicable to both current and future AEB systems?

- *NOTE: participants indicated several questions were difficult to answer since to little details was known about such marker* (feedback OICA/CLEPA)

WP 2/3/4: NEXT STEPS

- Investigate feasibility of several directions, not specifically focussing on technical feasibility

- Suggested directions to investigate

Not final

1. Marker attached to target vehicle
2. Stand alone marker (at distance from road works)
3. Include road works vehicles in AEBS development
4. Communication

- Topics to discuss for each of these directions
  - Technical feasibility (e.g. sensor specific abilities/limitations)
  - Operational feasibility (e.g. deployment implications)
  - Legal feasibility (e.g. introduction in regulations)
  - Economic feasibility (e.g. costs of solution direction, implementation, operational costs)
  - Scheduling feasibility (e.g. when could the solution be available in relation to alternatives)
  - Basic risk analysis (e.g. negative side effects, misuse)

Feasibility aspects might overlap