Proposal for a
Modification of the Bumper Test Area for Lower and Upper Legform to Bumper Tests

2nd Meeting of Informal Group GTR9 Phase 2
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Background

- **At the 1st meeting of the Informal Group GTR9 Phase 2 a request of the European Commission to amend the terms of reference of the IG was discussed.**

- **It was requested that this amendment containing a re-assessment of the legform test zone to counteract manufacturer‘s practice of making the bumper test area as narrow as possible by using different design means.**

- **There was consensus within the IG that no amendment of the terms of reference was needed as those already cover the general possibility of modifying the pedestrian test procedures for the legform impact.**

- **BASt commited to detail a proposal on how possibly modifying the legform test area, e.g. according to the Euro NCAP test and assessment procedure.**

History of Bumper Test Area

- **Draft test procedure (1985): Bumper corner definition by the vehicle‘s point of contact with a straight edge which makes an angle of 45° with the vertical longitudinal plane of the vehicle and is tangential to the outer bumper surface. *1)**
- **By 1991: Change to 60° *1); implemented within a draft proposal for a Council Directive *2)**
- **2002: TRL proposal to EEVC WG 17 that the angle being changed back to 45° (reason: actual vehicle with very small bumper test width, just between the inner ends of the headlights)*3)**
- **However, WG 17 found that further research would be necessary and for the time being decided to keep 60° *4)**

*1): Personal correspondence between B. Hardy (TRL) and O. Zander (BASt), July 2009.
*2): Commission of the European Communities: Draft proposal for a Council Directive adapting to technical progress Cpuncil Directive 74/483/EEC relating to the external projections of motor vehicles including their effect on pedestrians. Document III/4025-92, Brusselss, April 1992.
*3): Suggestions for EEVC WG 17 test procedures and for EC draft directive. EEVC WG 17 Doc 186, May 2002.
*4): EEVC WG 17 11th meeting minutes. EEVC WG 17 Doc 197R1, May 2002.

Current GTR9

7. TEST PROCEDURES

7.1. Legform to bumper test procedures

7.1.1. Lower legform to bumper test procedure:

Each test shall be completed within two hours of when the impactor to be used is removed from the controlled storage area.

7.1.1.1. The selected target points shall be in the bumper test area.

[...]

7.1.2. Upper legform to bumper test procedure:

Each test shall be completed within two hours of when the impactor to be used is removed from the controlled storage area.

7.1.2.1. The selected target points shall be in the bumper test area as defined in paragraph 3.10.

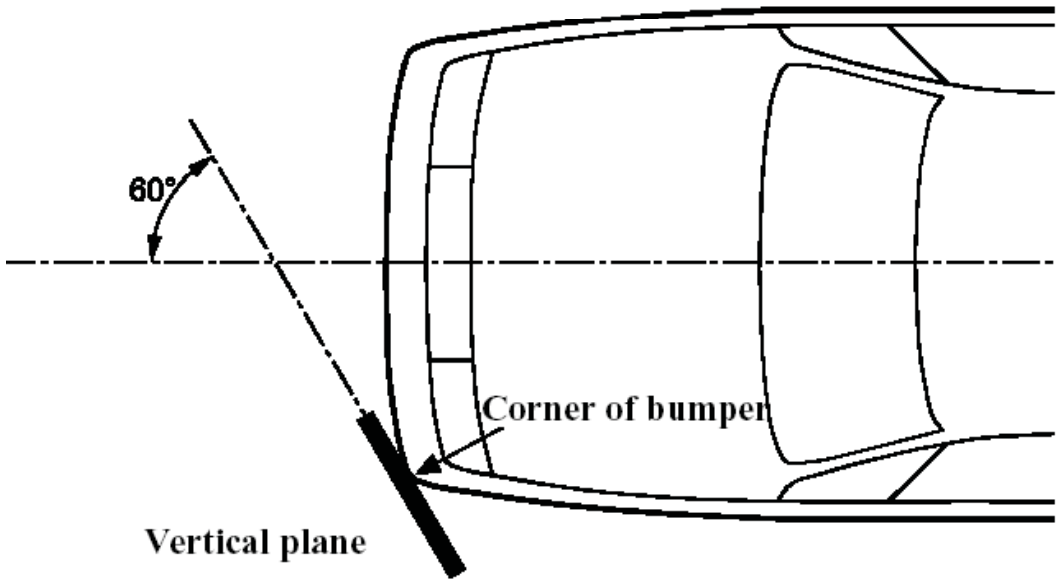
Current GTR9

3.10. "Bumper test area" means the frontal surface of the bumper limited by two longitudinal vertical planes intersecting the corners of the bumper and moved 66 mm parallel and inboard of the corners of the bumpers.

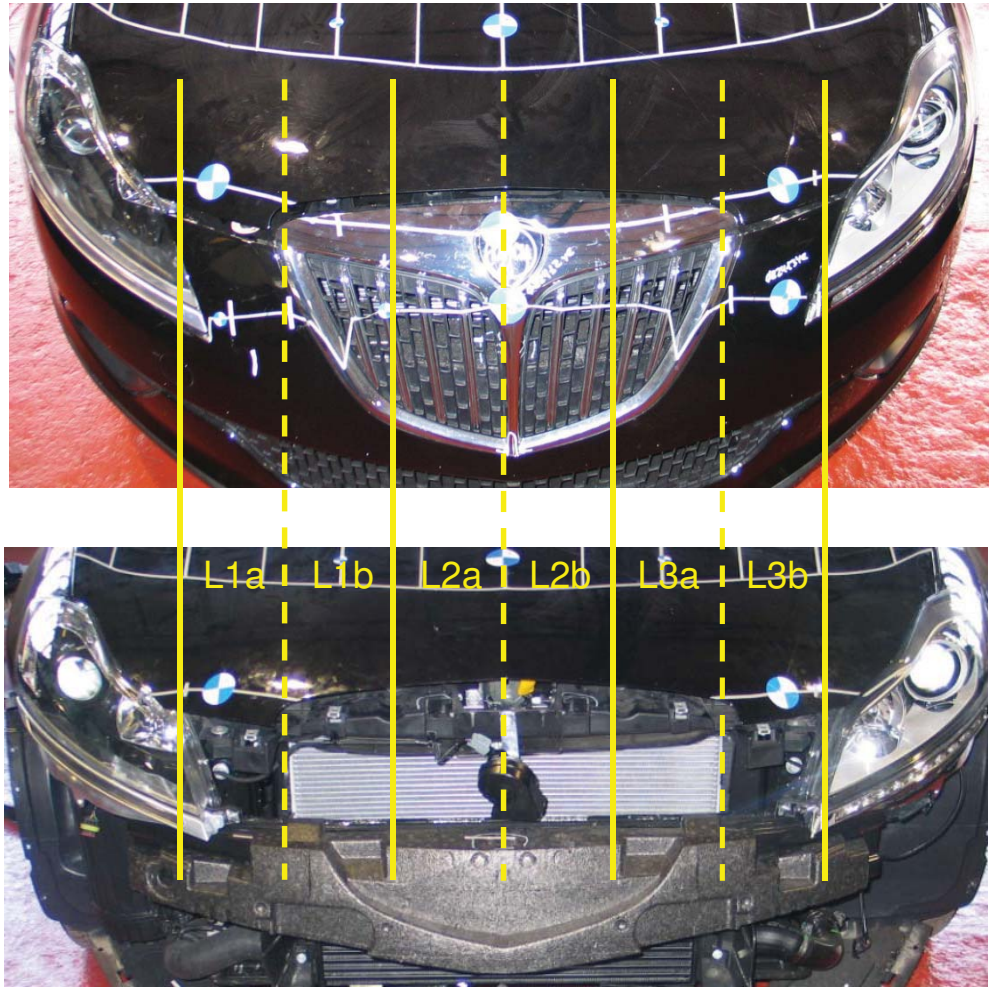
[...]

3.13. "Corner of bumper" means the vehicle's point of contact with a vertical plane which makes an angle of 60° with the vertical longitudinal plane of the car and is tangential to the outer surface of the bumper (see Figure 5).

[...]



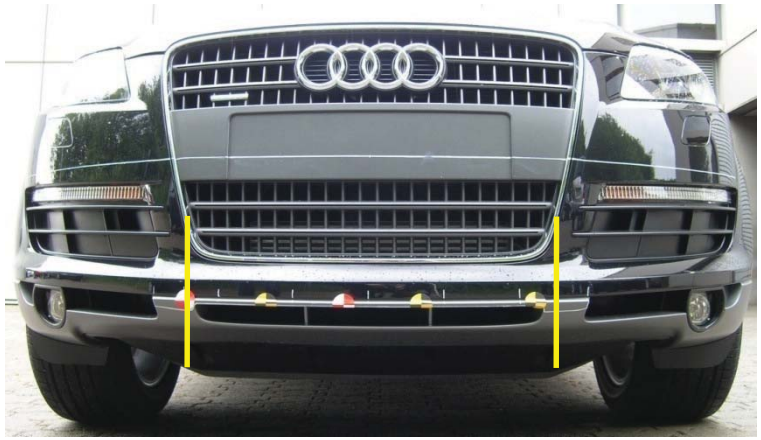
Current GTR9 / Former Euro NCAP



Bumper test area according to current GTR9 and former Euro NCAP Protocol (limitation by bumper corners)

Current GTR9 / Former Euro NCAP

Examples for narrow bumper test areas:



Euro NCAP Ped Pro Protocol V 5.3

4 DETERMINATION OF IMPACT POINTS

4.1 Legform to Bumper Test

[…]

4.1.2.4 The impact points shall normally be between the Bumper Corners.

4.1.2.5 However, where there are structures outboard of the bumper corners, which are deemed to be more injurious than locations in the adjacent third, Euro NCAP will perform a test to those structures for use in the final vehicle assessment. These tests will be limited to locations between the two outermost ends of the bumper beam/lower rails/cross beam structures. This area is termed the bumper test zone.

4.1.2.6 Points selected outside of the bumper corner will be applied to the outermost areas L1A and/or L3B in the vehicle rating. The remaining areas, L1B & L3A will remain free for nomination.

4.2 Upper Legform to Bumper Test

[…]

4.2.3 The upper legform to bumper tests must be carried out at the same lateral position as the points selected in Section 4.1, with the intersection of the longitudinal and lateral planes, at the centre of the impactor, aimed mid way between the Upper Bumper Reference Line and the Lower Bumper Reference Line.

Euro NCAP Ped Pro Protocol V 5.3

3.3 Bumper Corners

The Corner of Bumper is the point of contact of the vehicle with a vertical plane which makes an angle of 60° with the vertical longitudinal plane of the car and is tangential to the outer surface of the bumper, see Figure 4. Where multiple or continuous contacts occur the most outboard contact shall form the bumper corner.

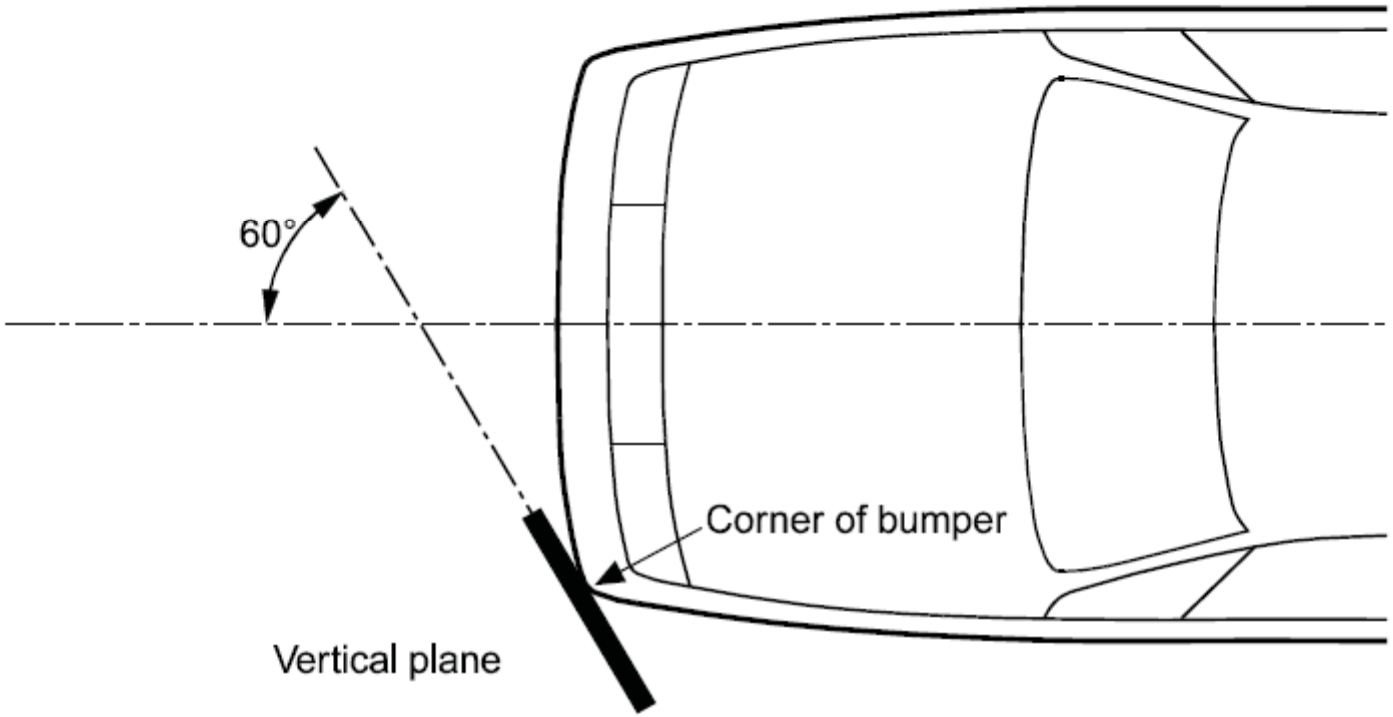
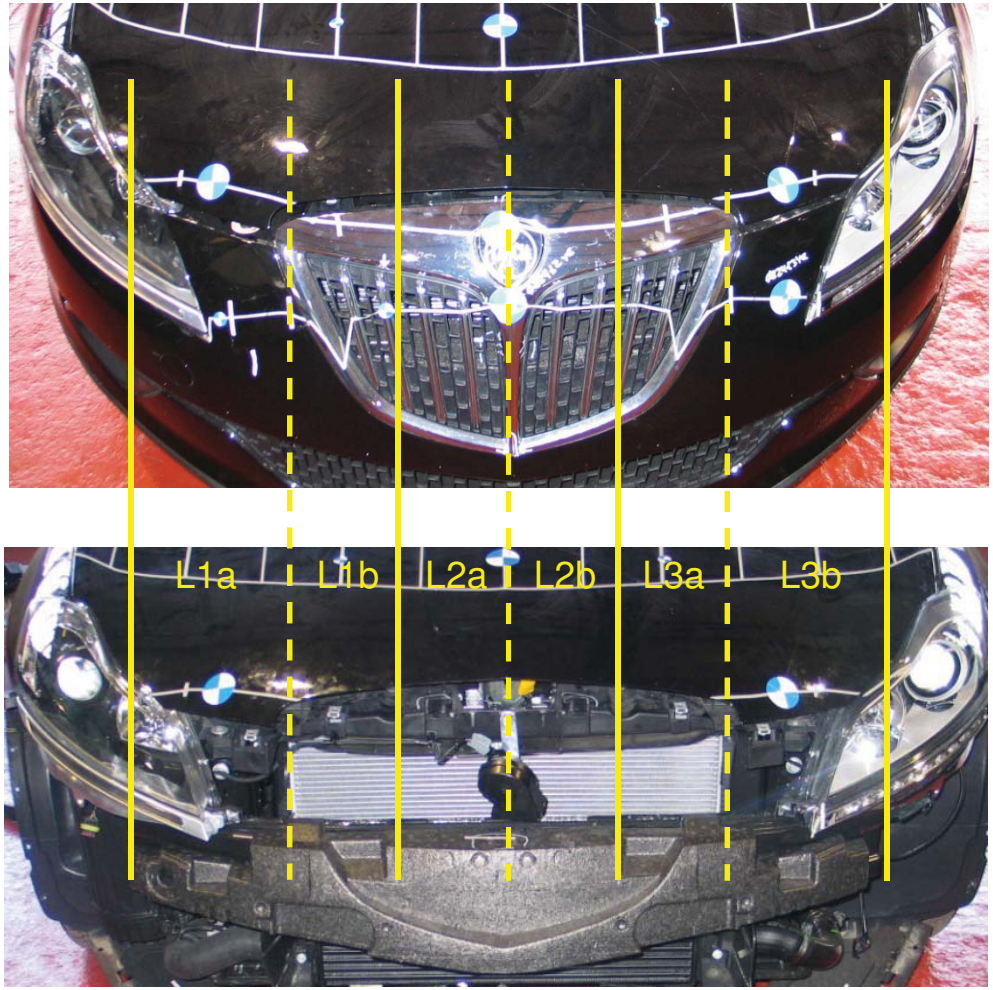


Figure 4: Determination of Bumper Corner

Euro NCAP Ped Pro Protocol V 5.3

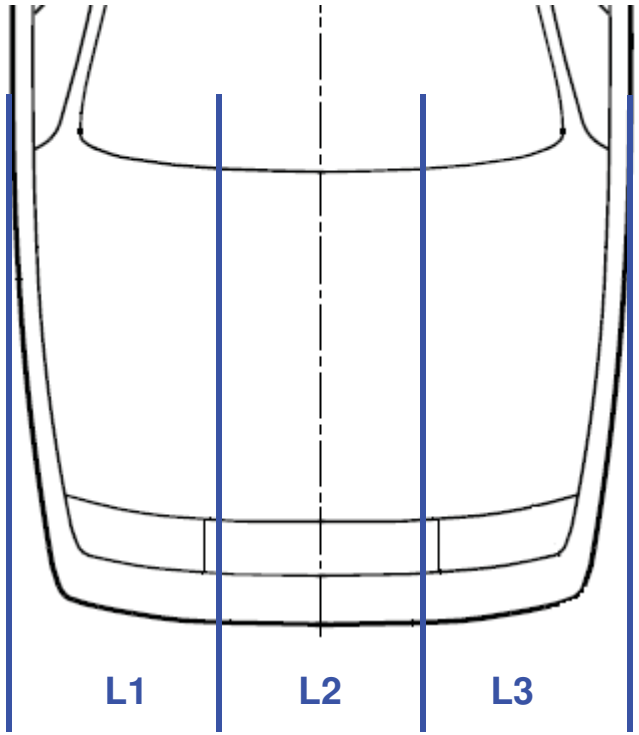


Bumper test area according to current Euro NCAP Protocol:

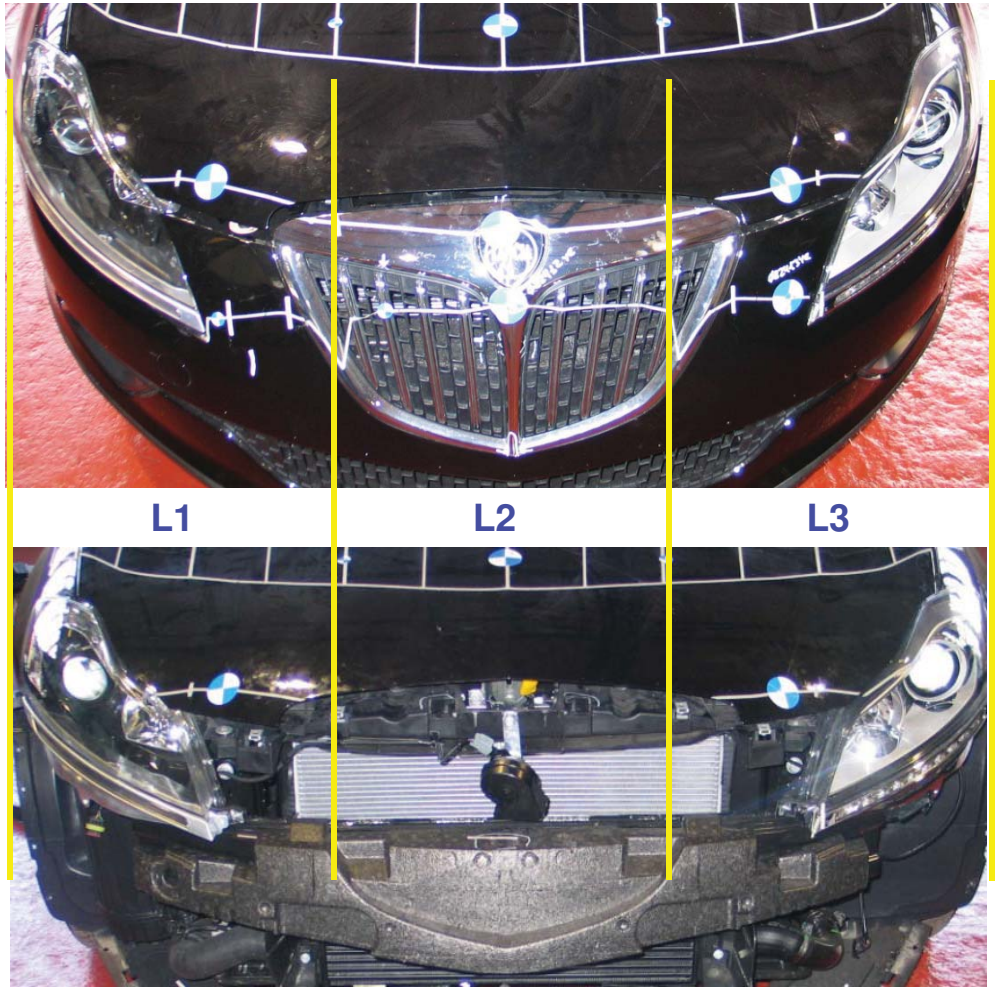
- **limitation by bumper beam**
- **areas L1 and L3 not limited to bumper corners and therefore possibly wider than area L2)**

Proposal for GTR9 amendment

- **Test area: Whole width of the vehicle**
  i.e. nominal width of the vehicle without mirrors
  (from technical datasheet)
- **Test area divided into three equal parts (for EU Regulation)**



Proposal for GTR9 amendment



Bumper test area according to BASt proposal

Discussion

Discussion of possible concerns regarding BASt proposal and corresponding countermeasures:

Discussion point #1:

A concern has been expressed that high impactor rotation outside the current GTR test area could occur in case of the bumper being impacted at an impact angle < 60°.

On the other hand, up to now there is no indication for testing outside the current GTR test area necessarily providing high impactor rotation. Tests even outside the bumper corners can provide higher or at least equal test results:

Test point 1: Towing eye
Peak accel.: 100%
Max SD: 100 %
Max bending: 100 %

Test point 2: End of bumper beam
Peak accel.: 99,4%
Max SD: 92,5 %
Max bending: 100 %

➔Injurious points outside the current GTR test area

Discussion

Discussion of possible concerns regading BASt proposal and corresponding countermeasures:

Discussion point #2:

Concern has been raised that the (at least EEVC WG 17) legform impactor is likely to be an inappropriate test tool for application outside the bumper corners.

1. ***The bumper corners limiting the GTR9 legform test area are described in the EEVC WG 10 report already; no indications with respect to impactor validation for selected impact angles are given. Therefore, there is no evidence for the inappropriateness.***

2. ***The bumper corners are defined using the outer bumper surface which is not relevant for the feasibility of tests.***

Discussion

Discussion of possible concerns regading BASt proposal and corresponding countermeasures:

Discussion point #3:

With the introduction of the BASt proposal problems related to testing in "angled surfaced areas" are suspected.

1. ***The proposal will not cause any more problems than the current GTR9 procedure because the proposal foresees tests to be performed on potentially injurious test points only.***

2. ***The BASt proposal foresees no test where testing is not feasible e.g. due to expected very high impactor rotation.***

3. ***Even if to some extent spin of the impactor could occur, the test result will still be able to indicate particularly dangerous front structures.***

4. ***The test lab is supposed to check always (also nowadays) the structures behind the bumper cover / surface and therefore to remove the bumper cover in order to decide whether a test makes sense or not.***

Conclusions

- **The aim of performing tests within the legform test zone should be enabling the test lab to always test the most injurious impact locations.**
- **A premature limitation of the width of the test area is equal to limit the test lab on test points inside the current GTR test area. Even testing according to Euro NCAP only allows for testing outside (maximum up to the width of the bumper cross beam) in exceptional cases.**
- **Without in depth accident investigations an assumption has to be made that pedestrian to car accidents adressed by the EEVC WG 17 procedures are equally distributed over the whole vehicle width; therefore the vehicle should be assessed accordingly.**
- **If IG GTR9-PH2 aims at the limitation of the legform test zone (that then should be defined by structural elements like cross beams, longitudinal beams etc.), detailed information on impactor validation would be needed.**
- **For the time being, BASt is recommending an assessment of the whole vehicle width with respect to the pedestrian leg protection potential.**

Thank you !