



Markup GTR9 vs. Amendment 3

Measuring Point Amendment 3 vs. 1PoC

Task Force „GTR9 Amendment 3“ Technical Working Subgroup

1st Meeting (Teams)

28 September 2021

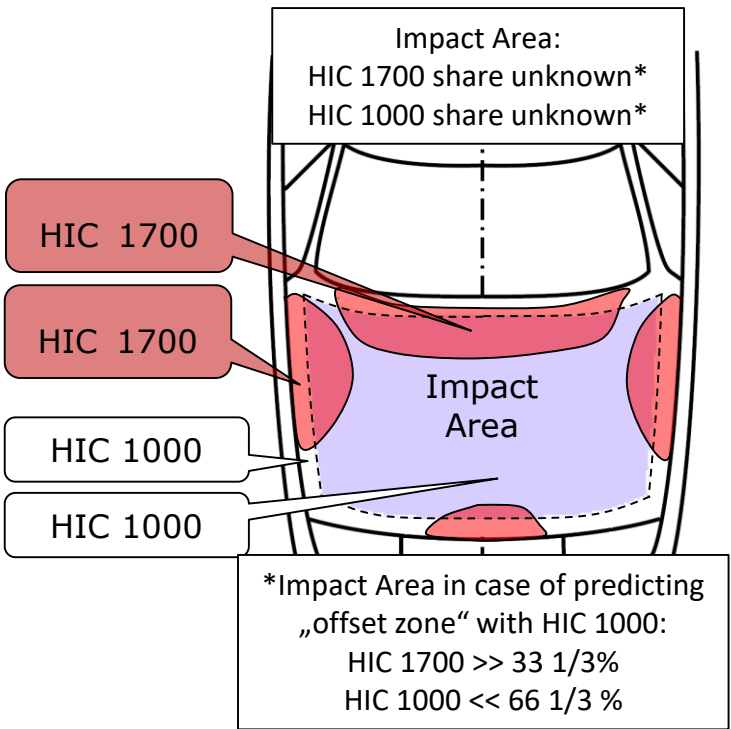


Markup Methods

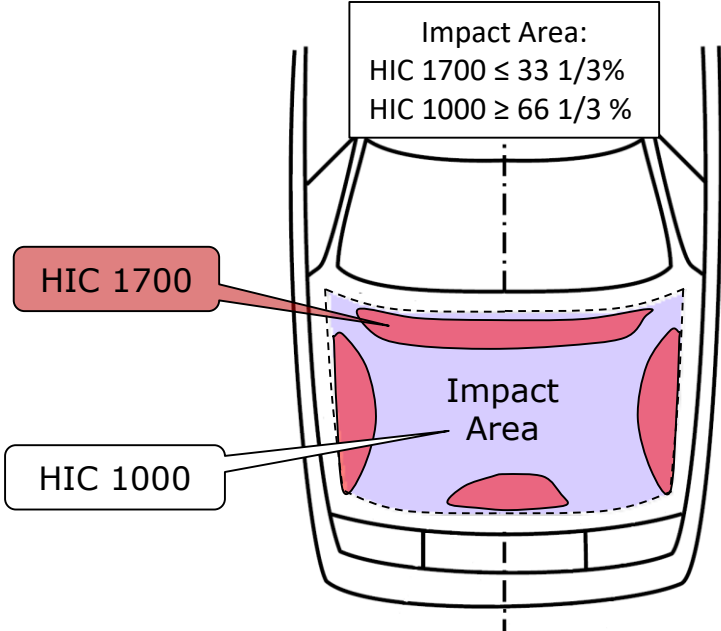
Test Point Methods

Actual Examples

Wrong interpretation of GTR9 in its original version:



Correct interpretation of GTR9 in its original version (as clarified by Amendment 3):



GTR9	Amendment 3	Remarks
<p>3.7. "<u>Bonnet top</u>" is the area which is bounded by (a), (b) and (c) as follows: (a) the bonnet leading edge reference line; (b) the bonnet rear reference line; (c) the side reference lines.</p>	<p>"3.8. "<i>Bonnet top test area</i>" is composed of the child headform test area and the adult headform test area as defined in paragraphs 3.14. and 3.1 respectively."</p>	
<p>3.1. "<u>Adult headform test area</u>" is an area on the outer surfaces of the front structure. The area is bounded, in the front, by a wrap around distance (WAD) of 1,700 mm and, at the rear, by the rear reference line for adult headform and, at each side, by the side reference line.</p>	<p>"3.1. "<i>Adult headform test area</i>" is an area on the outer surfaces of the front structure. The area is bounded: (a) In the front, by a wrap around distance (WAD) of 1,700 or a line 82.5 mm rearward of the bonnet leading edge reference line, whichever is most rearward at a given lateral position, (b) At the rear, by a WAD 2,100 or a line 82.5 mm forward of the bonnet rear reference line, whichever is most forward at a given lateral position; and (c) At each side, by a line 82.5 mm inside the side reference line. The distance of 82.5 mm is to be set with a flexible tape held tautly along the outer surface of the vehicle."</p>	<p>GTR9 here misses the 82.5mm offset which is introduced at a later stage (7.4.2). However, 5.2.3 and 5.2.4 of GTR9 show the idea: 1) Define impact areas 2) Define 1/3 2/3 zones 3) Test within impact areas</p>
<p>3.12. "<u>Child headform test area</u>" is an area on the outer surfaces of the front structure. The area is bounded, in the front, by the front reference line for child headform, and, at the rear, by the WAD1700 line, and by the side reference lines.</p>	<p>"3.14. "<i>Child headform test area</i>" is an area on the outer surfaces of the front structure. The area is bounded: (a) In the front, by a WAD 1,000 or a line 82.5 mm rearward of the bonnet leading edge reference line, whichever is most rearward at a given lateral position; (b) At the rear, by a WAD 1,700 or a line 82.5 mm forward of the bonnet rear reference line; whichever is most forward at a given lateral position, and (c) At each side, by a line 82.5 mm inside the side reference line. The distance of 82.5 mm is to be set with a flexible tape held tautly along the outer surface of the vehicle."</p>	<p>GTR9 here misses the 82.5mm offset which is introduced at a later stage (7.3.2). However, 5.2.3 and 5.2.4 of GTR9 show the idea: 1) Define impact areas 2) Define 1/3 2/3 zones 3) Test within impact areas</p>



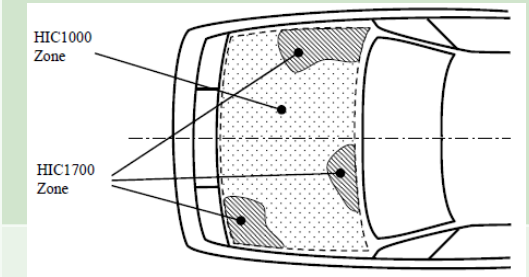
GTR9	Amendment 3	Remarks
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5.2.3. The HIC recorded shall not exceed 1,000 over a minimum of one half of the child headform test area and 1,000 over two thirds of the combined child and adult headform test areas. The HIC for the remaining areas shall not exceed 1,700 for both headforms.

In case there is only a child headform test area, the HIC recorded shall not exceed 1,000 over two thirds of the test area. For the remaining area the HIC shall not exceed 1,700.

5.2.4. Splitting of headform test zone

5.2.4.1. The manufacturer shall identify the zones of the bonnet top where the HIC must not exceed 1,000 (HIC1000 Zone) or 1,700 (HIC1700 Zone) (see Figure 11).



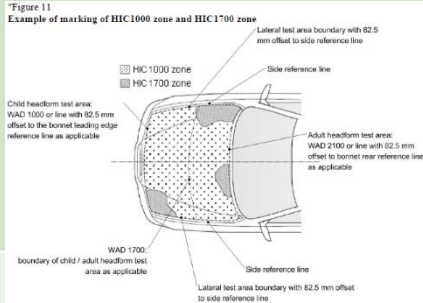
Paragraph 5.2.4.3., amend to read:

"5.2.4.3. The areas of "HIC1000 Zone" and "HIC1700 Zone" may consist of several parts, with the number of these parts not being limited. The determination of the impacted zone is done by the first contact point of the headform with the "bonnet top.""

"5.2.3. The HIC recorded shall not exceed 1,000 over a minimum of one half of the child headform test area and 1,000 over two thirds of the bonnet top test area. The HIC for the remaining areas shall not exceed 1,700 for both headforms.

In case there is only a child headform test area, the HIC recorded shall not exceed 1,000 over two thirds of the test area. For the remaining area the HIC shall not exceed 1,700."

"5.2.4.1. The manufacturer shall identify the zones of the bonnet top test area where the HIC must not exceed 1,000 (HIC1000 Zone) or 1,700 (HIC1700 Zone) (see Figure 11)."



"5.2.4.3. The areas of "HIC1000 zone" and "HIC1700 zone" may consist of several parts, with the number of these parts not being limited. The determination of the impacted zone is done by the measuring point."

A HIC value can only be calculated and assessed for areas in which a test has been performed. A HIC cannot exceed any value over any (test) area that cannot be tested. This leads to the conclusion that 5.2.3 and 5.2.4 exclusively refer to areas that can be tested. Thus, a zone prediction within the „offset zone“ (i.e. between the SLRs, the BRRL, the BLERLs and 82.5mm inboard) is not required and makes no sense.

The illustration in Amendment 3 is a clarification of the one in GTR9. In GTR9 it was missed to name the SRLs and the dashed line as the „offset line“.



GTR9	Amendment 3	Remarks
<p>7.3.1. Tests shall be made to the front structure within the boundaries as defined in paragraph 3.12. For tests on the rear area of the bonnet top, the headform impactor shall not contact the windscreen or A-pillar before impacting the bonnet top.</p>		
<p>7.3.2. No impact point shall be located so that the impactor will impact the test area with a glancing blow resulting in a more severe second impact outside the test area.</p> <p>Selected impact points on the bonnet for the child headform impactor shall be, at the time of first contact:</p> <ul style="list-style-type: none">(a) a minimum of 82.5 mm inside the defined side reference lines, and;(b) forward of the WAD1700 line, or, a minimum of 82.5 mm forwards of the bonnet rear reference line, - whichever is most forward at the point of measurement, and;(c) be rearward of the WAD1000 line, or, a minimum of 82.5 mm rearwards of the bonnet leading edge reference line, - whichever is most rearward at the point of measurement. <p>These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle.</p>	<p>"7.3.2. No measuring point shall be located so that the impactor will impact the test area with a glancing blow resulting in a more severe second impact outside the test area.</p> <p>The selected measuring points on the bonnet for the child headform impactor shall be within the child headform test area as defined in paragraph 3.14.</p>	<p>In conjunction with 3.14, 7.3.2 of Amendment 3 has identical content as 7.3.2 of GTR9.</p>
<p>7.4.1. Tests shall be made to the front structure within the boundaries as defined in paragraph 3.1. For tests at the rear of the bonnet top, the headform impactor shall not contact the windscreen or A-pillar before impacting the bonnet top.</p>		
<p>7.4.2. No impact point shall be located so that the impactor will impact the test area with a glancing blow resulting in a more severe second impact outside the test area.</p> <p>Selected impact points on the bonnet for the adult headform impactor shall be, at the time of first contact:</p> <ul style="list-style-type: none">(a) a minimum of 82.5 mm inside the defined side reference lines, and;(b) forward of the WAD2100 line, or, a minimum of 82.5 mm forward of the bonnet rear reference line, whichever is most forward at the point of measurement, and;(c) rearward of the WAD1700 line. <p>These minimum distances are to be set with a flexible tape held tautly along the outer surface of the vehicle.</p>	<p>"7.4.2. No measuring point shall be located so that the impactor will impact the test area with a glancing blow resulting in a more severe second impact outside the test area.</p> <p>The selected measuring points on the bonnet for the adult headform impactor shall be: within the adult headform test area as defined in paragraph 3.1."</p>	<p>In conjunction with 3.1, 7.4.2 of Amendment 3 has identical content as 7.4.2 of GTR9.</p>

Conclusions

GTR9 in its original version misses some important details:

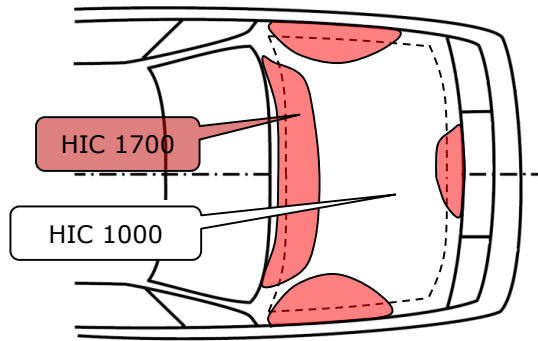
- the on-time introduction of the offset lines
- the initial contact is referred to the vertical longitudinal impactor centreplane.

This could lead to the wrong interpretation of adding the „offset zones“ to the „HIC determination zones“ (1/3 HIC 1700 and 2/3 HIC 1000).

An abuse of this wrong interpretation could result in an enlarged share of HIC 1700 zones in the impact area. A countermeasure would be banning a prediction of adjacent zones with an inferior performance.

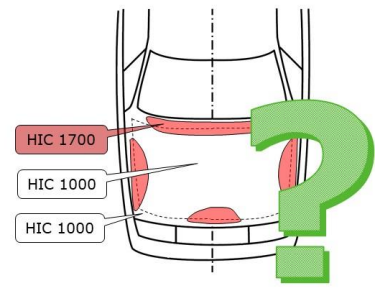
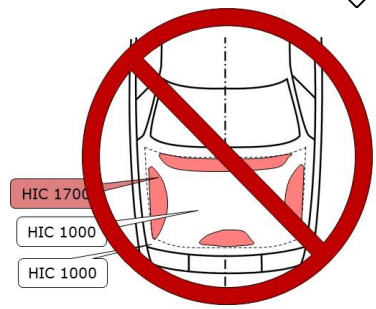
However, a better solution is clarifying that the HIC determination zones refer to the impact area (i.e. w/o the „offset zones“), only → Draft Amendment 3.

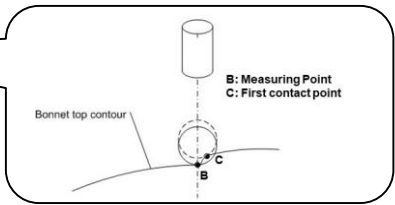
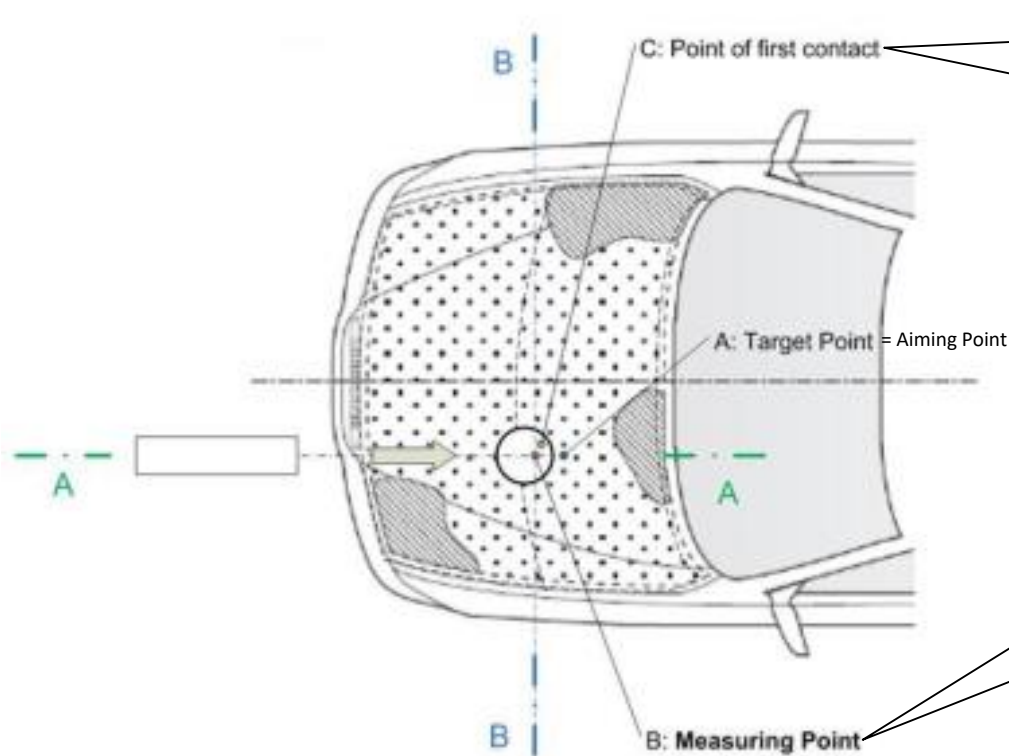
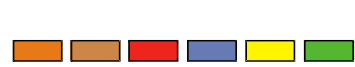
Wrong interpretation:



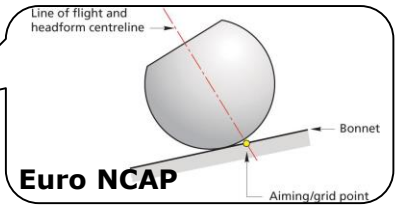
Enlarged share of HIC 1700 zones:

Possible countermeasure (but not favourite solution):

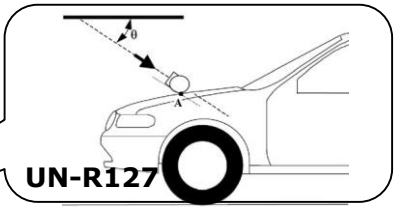




First point of contact for the headform test is where the headform first contacts the vehicle's outer surface.



The centreline of the headform impactor shall be directly in the line of flight toward the aiming point.

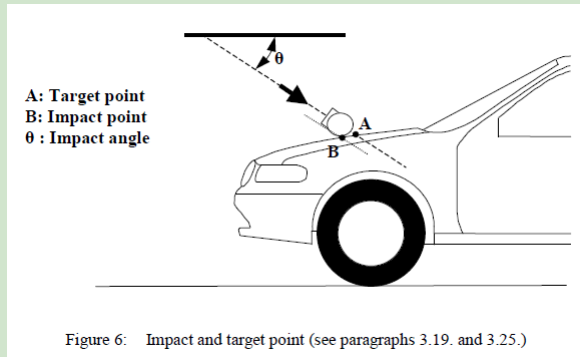


The **measuring point** is where the headform's profile contacts the vehicle's outer surface cross section in a vertical longitudinal plane through the center of gravity of the headform

GTR9

3.19. "**Impact point**" means the point on the vehicle where initial contact by the test impactor occurs. The proximity of this point to the target point is dependent upon both the angle of travel by the test impactor and the contour of the vehicle surface (see point B in Figure 6).

3.25. "**Target point**" means the intersection of the projection of the headform longitudinal axis with the front surface of the vehicle (see point A in Figure 6).

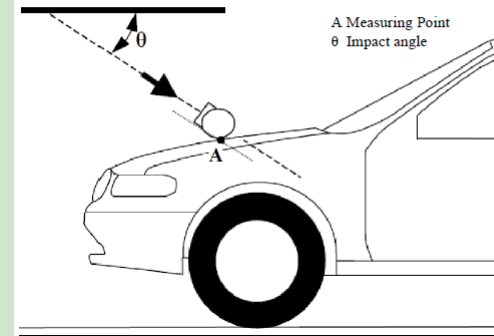


Amendment 3

"3.21. "**Measuring point**"
The measuring point may also be referred to as "test point" or "impact point". In all cases, the result of the test shall be attributed to this point, independent of where the first contact occurs.

3.21.1. "**Measuring point**" for the headform test means a point on the vehicle's outer surface selected for assessment. The measuring point is where the headform's profile contacts the vehicle's outer surface cross section in a vertical longitudinal plane through the center of gravity of the headform (see Figure 6A).

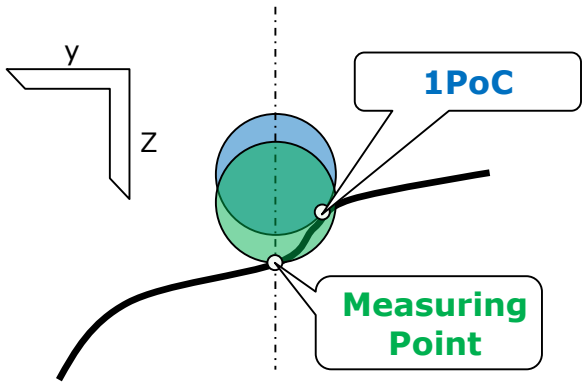
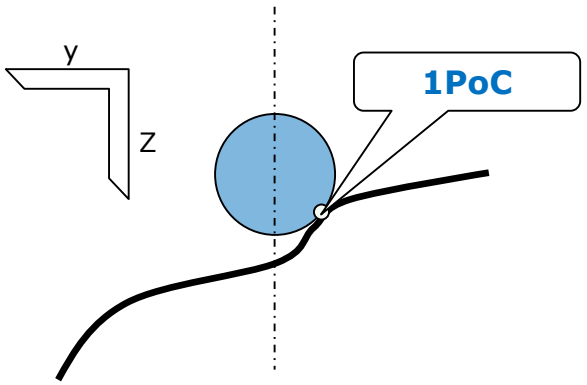
"Figure 6A
Measuring point in the vertical longitudinal plane through the centre of the headform impactor (see paragraph 3.21.1) ¹



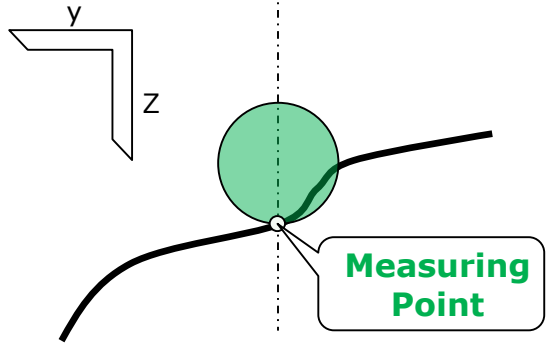
Remarks

3.19 in GTR9 states that the relation between GTR9 impact point to target point is described by angle of travel and vehicle contour in Figure 6. Figure 6 is a two-dimensional side view/sectional drawing, illustrating the angle and contour on the xz plane, only. This leads to the conclusion that with „angle of travel“ the velocity vector on the xz plane and with the „contour“ the contour projected to the xz plane is referred to. A lateral component is not taken into account for the velocity vector nor the vehicle contour.

Wrong interpretation of GTR9
in its original version:

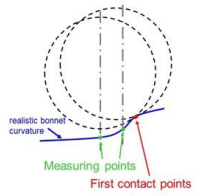


Correct interpretation of GTR9
in its original version
(as clarified by Amendment 3):



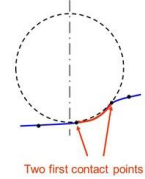
Problems occurring with wrong
interpretation of GTR9
in its original version:

One Po1C can have
different measuring
points



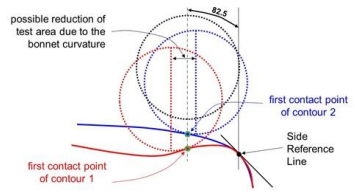
Source: GRSP-49-31

One measuring point
can have several
Po1C



Source: GRSP-49-31

Different bonnet shapes (same
width, same injury risk) tested
differently with Po1C method but
identically with measuring point
method



Source: GRSP-49-31

Conclusions

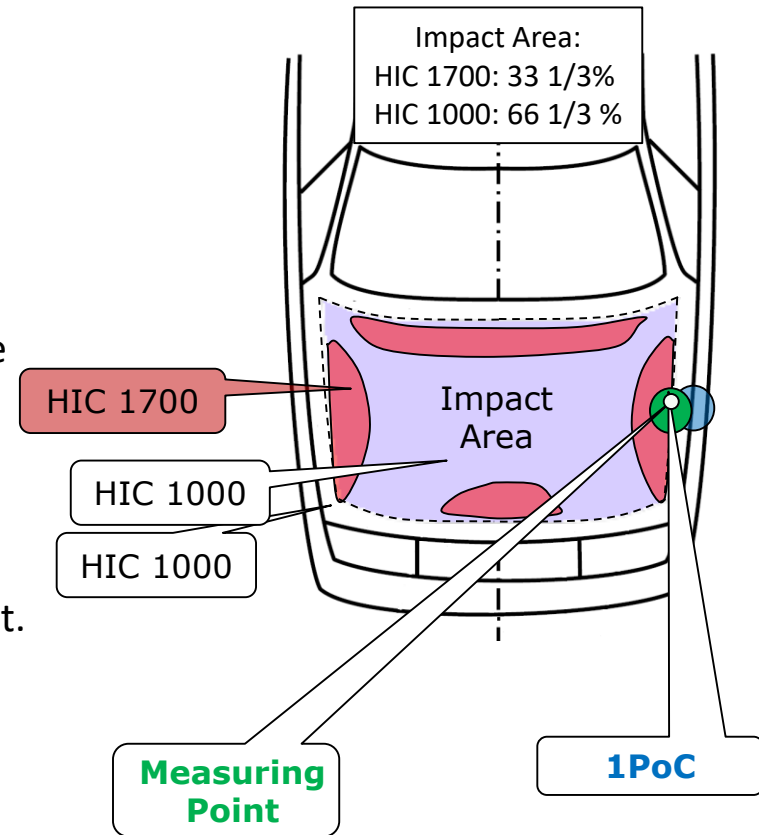
GTR9 in its original version misses the wording of an important detail: the initial contact is referred to the vertical longitudinal impactor centreplane. This however is described in Figure 6.

This could lead to the wrong interpretation of allocating the test result to a 1PoC located on a vertical longitudinal plane different to the vertical longitudinal impactor centreplane.

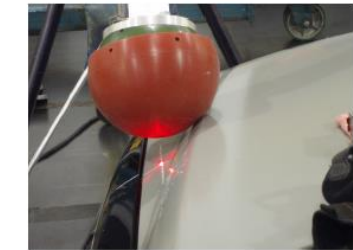
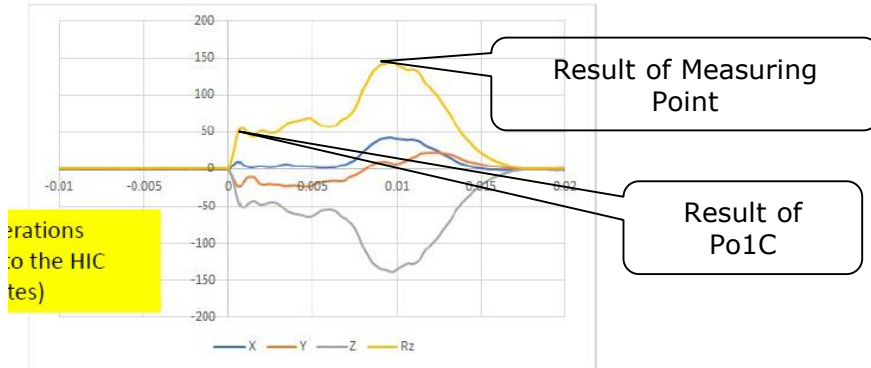
An abuse of this wrong interpretation could result in testing outside the impact area

Target and measuring points mainly contribute to the test result.

Since the target point is located on the vertical longitudinal impactor centreplane, the result must be allocated to a point located on the same vertical longitudinal plane.



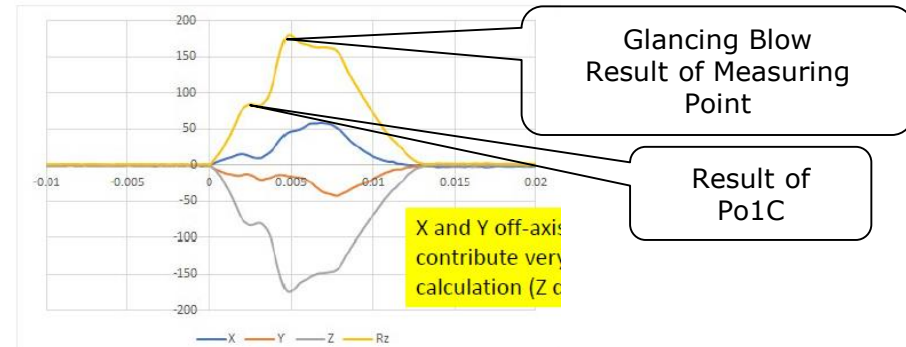
2010 Kia Forte:



Aiming Point Method

HIC15 = 927

2010 Buick LaCrosse:

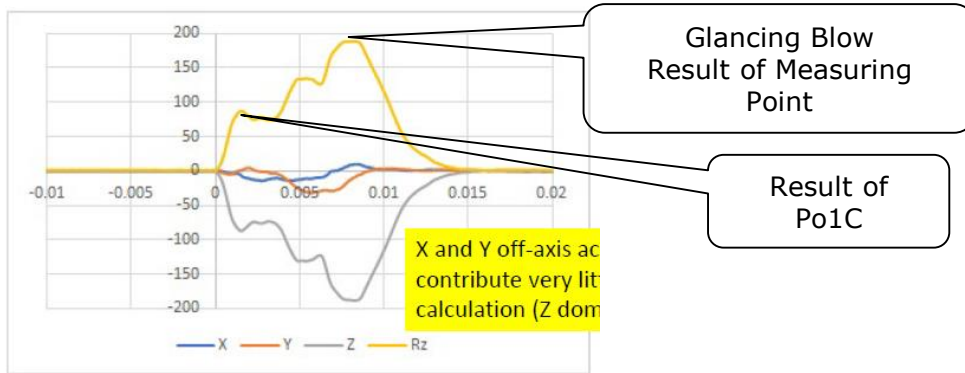


Point of First Contact Method

HIC15 = 1602

Target and measuring points mainly contribute to the test result.
Calculated HIC value not related to Po1C!

2010 Acura MXD:



Point of First Contact Method

HIC15 = 1100

Target and measuring points mainly contribute to the test result.

Since the target point is located on the vertical longitudinal impactor centreplane, the result must be allocated to a point located on the same vertical longitudinal plane.

Calculated HIC value not related to Po1C!



1) What contributes mostly to the accelerations for HIC calculation?

Is it more the structure close to any point located on the vertical longitudinal centreplane of the impactor (aiming/target point, measuring point),

or is it the structure close to the global first contact point?

2) Do we allow the CoG of the impactor aiming at any point laterally outboard of the test area (SRL minus 82.5mm), i.e. at points located within the „offset zone“?

Yes or no?



THANK YOU!