Clarification of Headform Test Procedure for GTR 9

Introduction

Definitions

Problems

History of Consumer Testing and Legislation

Proposal

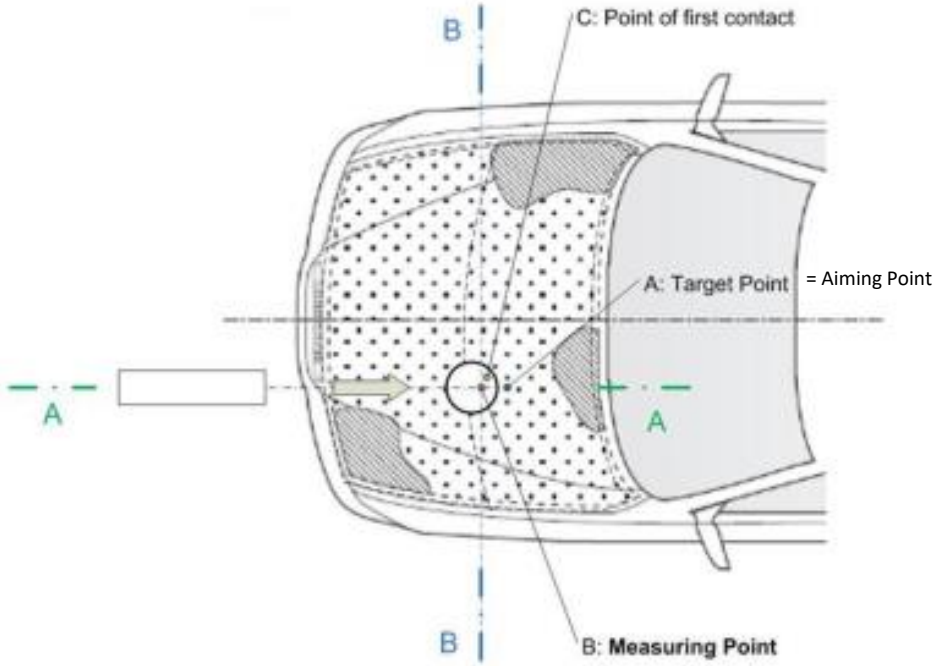
For more than two decades, headform test procedures have been developed and applied for the benefit of pedestrians suffering collisions with passenger cars.

These test methods are setting a standard towards vehicle type approval and certification regarding their passive pedestrian safety. Furthermore, consumer programmes established milestones in terms of vehicle safety, exceeding the regulatory requirements and giving detailed overviews to the consumers.

Full scale pedestrian tests that were already performed according to a standard proposed in the early 1980‘s identified the low repeatability of head impact kinematics as one major problem and were subsequently replaced by tests with impactors, improving repeatability and reproducibility of tests and their results.

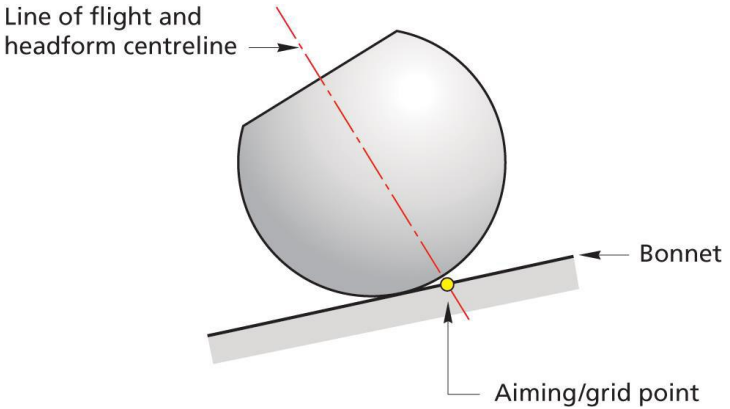
Working Groups 10 and 17 of the European Enhanced Vehicle-safety Commitee developed component tests with child and adult headform impactors that were later on implemented within consumer and regulatory testing.

While consumer programmes always defined the structure to be tested as the aiming or target point, legislation focused on the point of first contact located on the xz plane of the headform centre of gravity as the main point of interest.


B
C: Point of first contact
A: Target Point
= Aiming Point
A
A
B
B: Measuring Point

Euro NCAP:

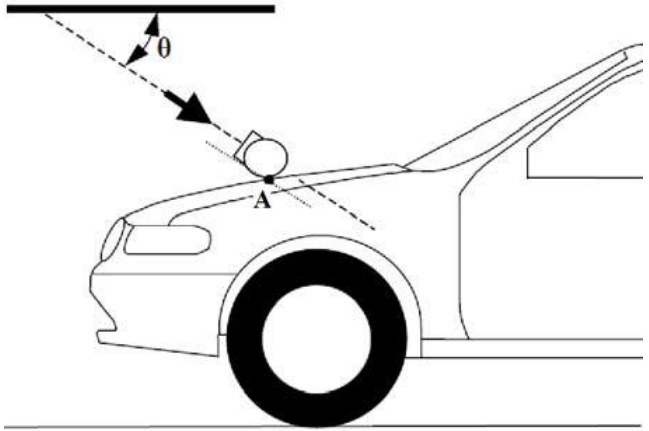
"The selected grid point shall be treated as the aiming point for the headform impactor, with deployable system in the undeployed position.
The centreline of the headform impactor shall be directly in the line of flight toward the aiming point."



Source: Euro NCAP Pedestrian Testing Protocol

UN-R 127 Suppl. 1 & UN-R 127.01:

"*"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."
[…]
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.
[…]
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."



Source: UN-R 127.01

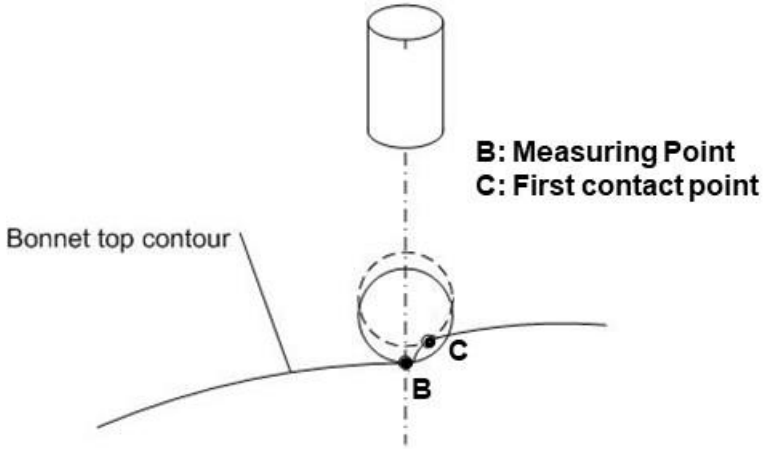
Remark: due to the spatial geometry of the bonnet top, the first contact may not occur in the same vertical longitudinal or transverse plane which contains measuring point A.

n.n.:

"First point of contact" for the headform test is where the headform first contacts the vehicle's outer surface. The location of the tested structure and the first point of contact can be located on different longitudinal vertical planes.

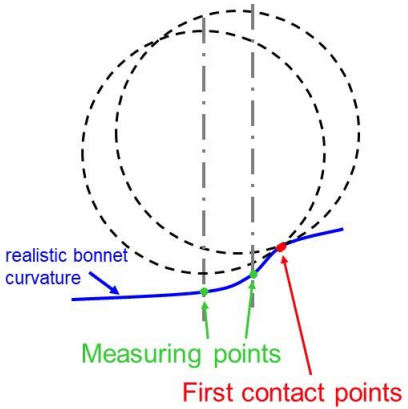
Photos / Source: BGS Boehme & Gehring GmbH

Front view:



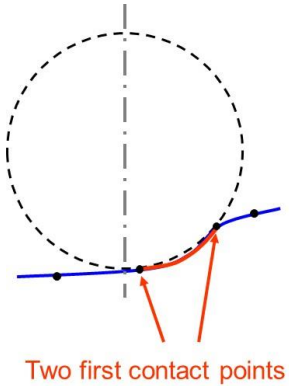
Source: GRSP-49-31

One Po1C can have different measuring points



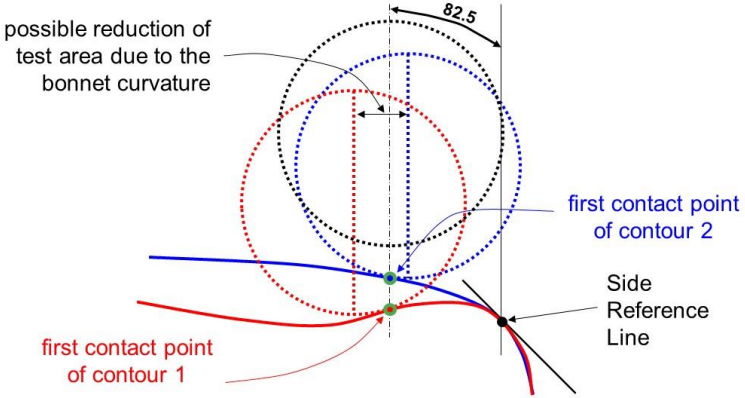
Source: GRSP-49-31

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



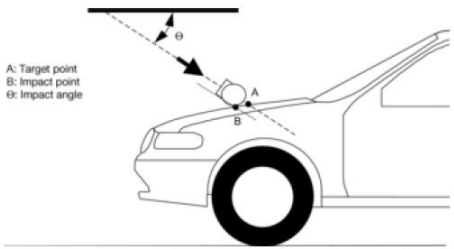
Source: GRSP-49-31

Reg (EC) 631/2009 (EIF 16/08/2009)

2.16. '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);

Figure 6

Impact and target points



GTR No. 9 (EIF 26/01/2009)

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.).

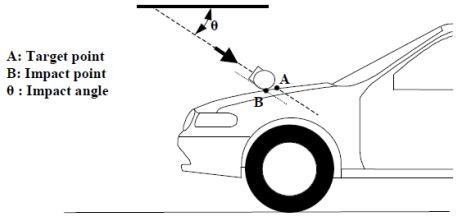
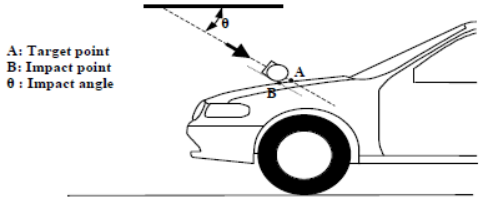


Figure 6: Impact and target point (see paragraphs 3.19. and 3.25.)

UN-R 127.00 (EIF 17/11/2012)

2.22. "*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 7).

Figure 7
Impact and target point

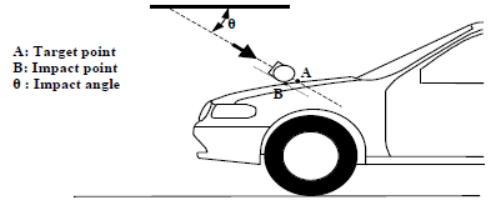


In all regulations, Regulation (EC) No. 631/2009, GTR No. 9 as well as UN-R 127.00, the impact point and aiming/target point are solely depending on impact angle and contour (xz plane, see drawing). I.e.: the xy plane is not considered!

UN-R 127.00 (EIF 17/11/2012)

2.22. "*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 7).

Figure 7
Impact and target point



Clarification (no change!)

ECE/TRANS/WP.29/ AC.3/31

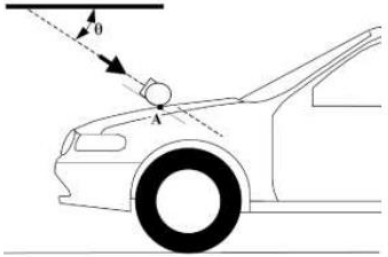
UN-R 127.01 (EIF 22/01/2015)
UN-R 127.00 Suppl. 1

2.27. "*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 first contact occurs.

2.27.1. "*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 8A).

Figure 8A
Measuring point in the vertical longitudinal plane through the center of the headform impactor (see paragraph 2.27.1.)[2]



UN-R 127.01 clarifies the impact point being a point located on the same vertical longitudinal plane as the centre of gravity of the headform. I.e. the xy plane is <u>not</u> considered! This has always been practice in regulatory use.

It had been noted that the first contact point may not be appropriate as the main reference point for testing.
There are points on the bonnet surface that may be identified as being of interest (due to underlying structures, hard points, etc.) but where a direct first contact of this point is impossible due to the bonnet design.
Assuming that the main impact energy is transferred in the centre-plane of the impactor that also contains the centre of gravity of the impactor it will nevertheless be possible to test such points, to achieve first contacts in the surrounding area and to allocate test results to such points.
This procedure is clearer since it can be used for every point within the borderlines of the test area on the bonnet surface, independent of whether a point can be contacted by the headform during a test or not.
Furthermore, the procedure allows a well defined positioning of the impactor while a first contact may be achieved with different points of the impactor's surface.
Finally, the procedure will guarantee that vehicles of the same width have an identical width of the test area.
In this spatial geometry, the measuring point as well as the target point are always in the centre-plane of the impactor that is aligned to the vertical longitudinal plane of the vehicle. The test result achieved (i.e. an Head Injury Criterion (HIC) value) shall always be allocated to the measuring point, independent of where the first contact occurred.

Consumer test programmes always referred to the aiming (target) point and regulations always to the measuring point (point of first contact on the xz plane of the headform CoG) as main point of interest when testing vehicle frontends with pedestrian headform impactors.

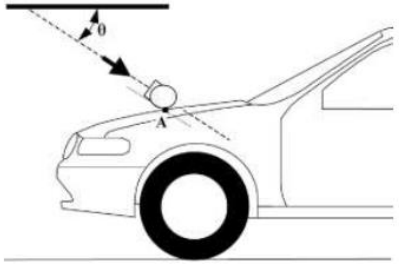
To avoid misleading interpretations of what is the point to be tested in regulations, UN-R 127 was supplemented in its 00 series and amended by its 01 series, clarifying the procedure that was already in place for many years.

UN-R 127.01 doesn‘t change or replace any test procedure that is or has been in place. It is meant as pure clarification of what has been done all the years before since the very beginning.

It is therefore suggested to clarify the procedure in GTR 9 by implementing the description of the current practice (applied in regulations world wide):

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 first contact occurs.

"*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



Thank you for your Attention!

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