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Bundesanstalt für Straßenwesen

Short Background to UNECE R17 and GTR 7

IWG EqOP TF2 Workshop

Stockholm, 9th September 2024

Bernd Lorenz

Content

- History of GTR 7 Phase 1
- History of GTR 7 Phase 2 and M.R.1 (BioRID II UN) and influence on
- UN-R17

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 1

- **In March 2002** during the 126th session of WP.29 the Executive Committee AC.3 adopted a program of work, which includes the development of a Global Technical Regulation (GTR) to "address neck injuries in crashes".
- The United States of America volunteered to lead the group's efforts and develop a document detailing the recommended requirements for the GTR. The USA presented an informal document (WP.29-134-12) in **November 2004 proposing the work and highlighting the relevant issues to be addressed in the GTRr**.
- This **proposal was adopted at the March 2005** session of WP.29 (TRANS/WP.29/AC.3/13).
- At the **November 2004 WP.29 session, AC.3 charged the Working Party on Passive Safety (GRSP)** to form an **Informal Group on Head Restraints** to discuss and evaluate relevant issues concerning requirements for head restraints to make recommendations regarding a potential GTR.
- **First meeting of the IWG Head Restraints** on 1-2 February **2005** in Paris, France

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 1

Regulations and standards taken into account during development of the GTR 7 phase 1 regarding head restraints:

- **UNECE Regulation No. 17** - Uniform Provisions concerning the Approval of Vehicles with regard to the Seats, their Anchorages, and any Head Restraints
- **UNECE Regulation No. 25** - Uniform Provisions Concerning the Approval of Head Restraints (Head Rests), whether or not Incorporated in Vehicle Seats
- **EU Directive 74/**408, concerning interior fittings of motor vehicles
- **EU Directive 96/037**, adapting to technical progress Council Directive 74/408/EEC relating to the interior fittings of motor vehicles (strength of seats and of their anchorages)
- **EU Directive 78/932/EE**C, concerning head restraints of seats of motor vehicles
- **United States of America Code of Federal Regulations (CFR) Title 49: Transportation; Part 571.202: Head Restraints**
- **Australian Design Rule 3/00, Seats and Seat Anchorages**
- **Australian Design Rule 22/00, Head Restraints**
- **Japan Safety Regulation for Road Vehicles Article 22 – Seat**
- **Japan Safety Regulation for Road Vehicles Article 22-4 – Head Restraints, etc.**
- **Canada Motor Vehicle Safety Regulation No. 202 – Head Restraints**
- **International Voluntary Standards --SAE J211/1** revised March 1995 – Instrumentation for Impact Test – Part 1 – Electronic

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GTR No. 7 Phase 1

Additionally, research and activities conducted by

- European Enhanced Vehicle Safety Committee (**EEVC**) Working Group 12, EEVC WG 20
- **Euro NCAP**
- **Japan NCAP** and
- **Korea NCAP**

were considered.

Note: Some of the involved CPs (e.g. France, Germany, Netherlands, UK, Sweden) were members of **Euro NCAP** and **EEVC!**

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 1

Main issues under discussion during development of GTR 7 Phase 1:

- Head restraint height
  - Front outboard (different data/views)
  - Rear ourboard
  - Front centre/rear centre

- Seat set-up and measuring procedure for static measurement (use of **R-point or H-point**, use of head restraint measurment device (**HRMD**))

- Dynamic test procedure (pulses, Dummy **Hybrid III or BioRIDII**)

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 1

- IWG had proposed a final draft of the GTR phase 1 based on 202a, R17, R25
- many points found no agreement by all members of the IWG
- in December 2006 the GTR was close “to be killed”
- dynamic test on the basis of FMVSS 202a using Hybrid III was not acceptable for several CPs
- head restraint height under discussion again
- doubts about NHTSA’s Cost-Benefit-Studies
- no agreement on the use of H- or R-point (due to self certification or type approval system)
- Use of design-angle

- USA did enter FMVSS 202a into force (regardless of GTR process)
- -> In March 2007 GRSP recommended to put the GTR on ice
- -> In June 2007 WP29 decided on a compromise proposal

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 1

EC, Japan, and US Proposal Regarding Next Steps on Head Restraint GTR - Decision of WP.29 (June 2007)

Backset

Allow in the GTR backset measurements from either R-point with backset limit at 45 mm or H-point with backset limit at 55 mm. Contracting Parties decide which of these two options to require in their domestic regulation.

All other static measurements

Use R-point as the initial reference point for all other measurements including height, energy absorption test, rearward displacement tests, and strength tests.

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 1

EC, Japan, and US Proposal Regarding Next Steps on Head Restraint GTR - Decision of WP.29 (June 2007)

Dynamic Test

Hold an additional informal working group meeting at the end of October or early November 2007 to discuss the results of the EEVC study and work on other outstanding bracketed issues.

Based on the discussion of the EEVC study results, the informal working group had to recommend whether to hold one more meeting before Dec 2007 GRSP.

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GTR No. 7 Phase 1

Three possible outcomes are to be explored and decided by the December 2007 GRSP Meeting.

(1) Accept the dynamic test with the Hybrid III dummy in phase 1 and put language in the preamble committing to address the BioRID dummy under phase 2; or

(2) Allow the BioRID dummy as an alternative dummy to Hybrid III in the dynamic test option in phase 1. State in the preamble that Contracting Parties will decide whether to require the Hybrid III or BioRID dummy in their domestic regulations while awaiting the development of injury criteria and associated corridors for BioRID under phase 2; the preamble will also address initiation of work for phase 2; or

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 1

(3) Stop work on the GTR if data is introduced to the informal working group that strongly indicate that the use of the Hybrid III dummy will lead to the introduction of designs that will not produce expected overall benefits.

If either (1) and (2) are recommended, conclude the GTR text at the December 2007 GRSP session and hold the final vote at the March 2008 Session of WP.29.

If (3) is recommended, withdraw the GTR. Contracting Parties will decide what to do at the national level based on their own data and assessment.

At the November 2007 WP.29 session, AC.3 had to be appraised of the status of the EEVC research and the timing of the informal working group meetings.

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 1

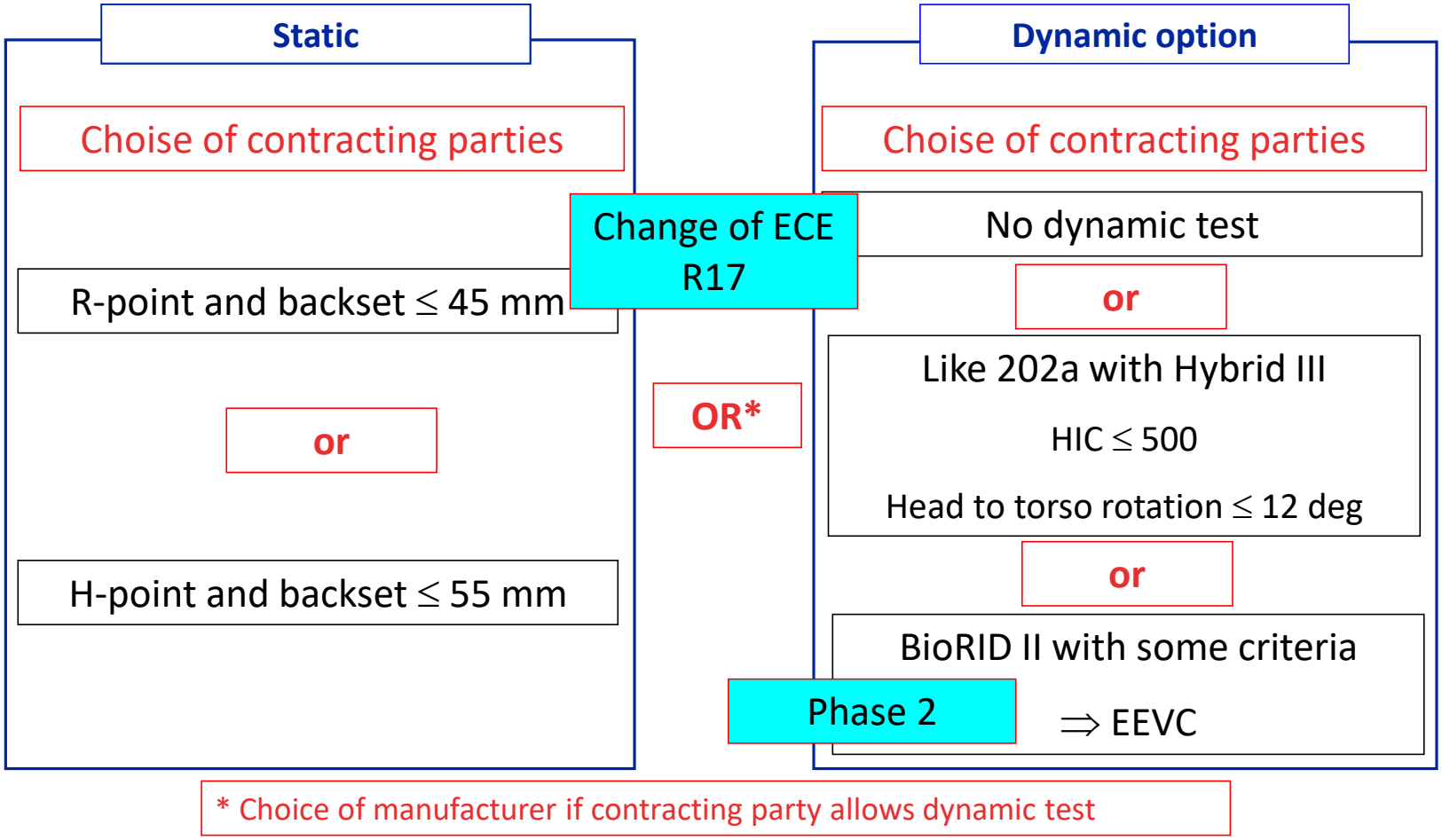
In the November 2007 IWG meeting the three options have been discussed partially very emotional. In the end the group went to a combination of option 1 and 2.

At the November 2007 WP.29 session, AC.3 tasked GRSP to finalise the GTR during its December session. A lot of comments and discussions and emotional statements have been made on the GRSP session. **Finally, a GTR was drafted with a lot of options**.

At the March 2008 Session of WP.29 the contracting parties adopted the GTR with minor changes.

A (new) IWG was be tasked to develop a proposal for **phase 2** of the GTR. **Japan volunteered as a sponsor.**

Status of GTR as after WP.29 March 2008 ⇒ a GTR full of options !



* Choice of manufacturer if contracting party allows dynamic test

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Status of GTR as after WP.29 March 2008 ⇒ Next steps

- EC drafted a proposal for the change of Regulation 17 for the GRSP meeting on 19-23 May 2008 in Geneva
- This proposal to change Reg 17 was on the agenda of December 2008 GRSP
- IWG on GTR HR shall now work on Phase 2 - Japan volunteers as a technical sponsor
  - **Address all open issues**
  - **Min. head restraint height!**
  - **Dynamic test using BioRID II**
  - **Performance criteria**

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

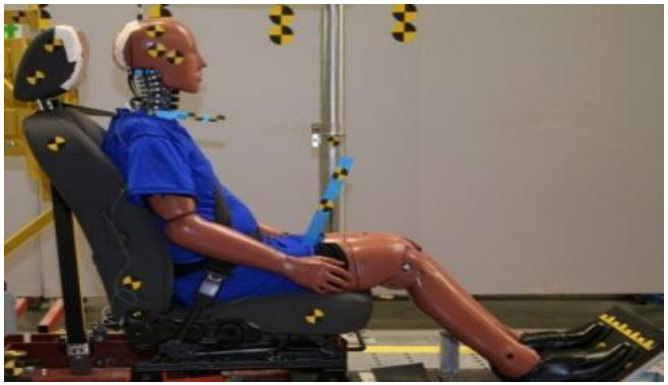
Status of GTR as after WP.29 March 2008 ⇒ Next steps

- 1st "informal" informal working group meeting **("meeting of interested experts")** was before GRSP in December 2008 (Chair: Bernie Frost (UK DFT), Secretary: Kris van der Plas (Honda/OICA))
- In this meeting **many issues especially dealing with the BioRID** have been discussed
- In **February 2009 a joint research meeting of IWG with EEVC WG 20 and an additional joint meeting of governmental representatives with Denton was held at BASt**
- Intention of the joint meetings:
  - Status of research activities world wide with regard to whiplash
  - Outstanding issues with regard to BioRID (R&R, design changes, certification etc.)
  - Denton presented possible modifications of the BioRID

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

- On its March 2008 meeting WP.29 contracting parties adopted GTR No. 7.
- The use of Hybrid III for the dynamic test is part of GTR No. 7, but it is at the choice of each member state to use an alternative dynamic test procedure with BioRID Dummy.
- In June 2009 a proposal for the development of a phase 2 of GTR No. 7 was accepted by AC.3 (Executive Committee of 98 Agreement).
- Chairman of the new IWG: B. Frost (DfT / UK)
- Main topics of the IWG:
  - (minimum) head restraints height of 850 mm
  - dynamic test procedure with BioRID II
  - Injury criteria and certification corridors for the BioRID II



GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

- **Two step approach:**
  - **Low speed dynamic test for minor neck injuries including long term consequences (up to WAD 2, "ECE"-approach)**
  - **Mid or high speed test for other injuries (AIS 2+, NHTSA approach)**
- **1st official meeting of the IG phase 2 in December 2009: review of current activities in Europe, Korea, USA and Japan**
- **In total 18 meetings – last meeting 24th / 25th April 2019 in Bergisch Gladbach**
- **WP.29 agrees to skip the high severity test (Proposal USA)**
- **For GTR then a mid severity pulse shall be applied (~~either Euro NCAP style or~~ JNCAP style)**
- **In parallel a technical evaluation group to assess BioRID II (BioRID TEG) was established (chaired by Bernd Lorenz BASt)**
- **A smaller GTR No 7 so called review group is consolidating the draft GTR in principal via WebEx meetings**

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Harmonization of Drawings (Humanetics)


Procedures for Assembly, Disassembly, and Inspection (PADI) of the BioRID II Rear Impact Crash Test Dummy

November 2010

- ✓ Draft drawing package available on UNECE website http://www.unece.org/trans/main/wp29/wp29wgs/wp29grsp/gtr7phase2_3_drawing_package.html
- ➓ Draft PADI available on UNECE website (TEGID-23)
- ➓ Check list included in PADI to check for correct build level


Appendix E – BioRID II Design Checklist

BioRID II Design Checklist	✓
VERIFY THE SKULL CAP IS FOR BIORID, AND THAT IT HAS THE CORRECT SIZE CABLE CLEARANCE SLOT.	
VERIFY SKULL AND CAP CONTAINS ERROR PROOFING PIN-HOLE COMBINATION.	
VERIFY THE CORRECT SIZE HOLES IN THE HEAD TO CLEAR THE FRONT CABLE ADJUSTERS (12.7 MM).	
VERIFY THE CORRECT HEAD IS INSTALLED (NON-SKULL CAP LOAD CELL VERSION).	

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All dummy specifications need to be transferred into UN Mutual Resolution No. 1 (M.R.1):

M.R.1: „Concerning the description and performance of test tools and devices necessary for the assessment of compliance of wheeled vehicles, equipment and parts according to the technical prescriptions specified in UN Regulations and UN Global Technical Regulations"

New way for definition of test tools!

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GTR No. 7 Phase 2

Improved certification procedure and corridors (Humanetics et al.)

- New certification sled(s) in use
- Tests with and without head restraint
- Pelvis and Jacket test added
- First draft certification corridors proposed by Humanetics on the basis of data from different BioRIDs
- All BioRIDs used in test programs for TEG activities shall be of built level according PADI and certified according to the new procedure.
- Certification data (with head restraint and jacket, also) shall be provided to Humanetics for tightening corridors.

Based on new test results (EC/TRL test series):

- Pelvis certification test is added (stiffness and geometry check)
- Quasi-static spine stiffness test proposed
- Better control of bumper stiffness

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

- EC/TRL–test series (2012)
- 6 BioRID (no. 006, 007, 028, 068, 077, 100)
- Swapping of parts between dummies (e.g. spine, pelvis)
- Acceleration sled, lab seat, draft GTR 7-pulse (JNCAP style)

GRSP IWG GTR Head Restraints - History

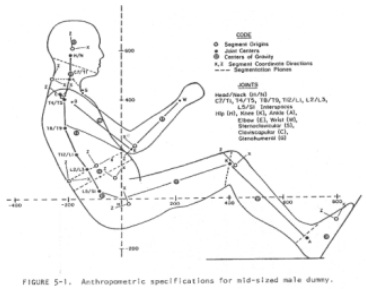
GTR No. 7 Phase 2

Dec 2013 GRSP - Common proposal from NL, UK and D:

Effective head restraint height in highest front (outboard) position changed from not less than 800 mm to not less than 830 mm

Reason: changed anthropometry of nowadays population

Automotive posture

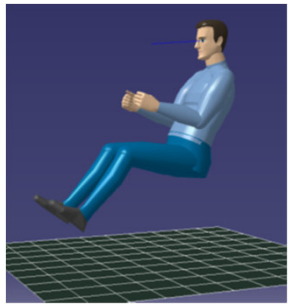


Source: GRSP-53-17

UMTRI study (1983): Merging H-Points

Source: GRSP-53-17

NL 2004 male positioning in UMTRI automotive posture

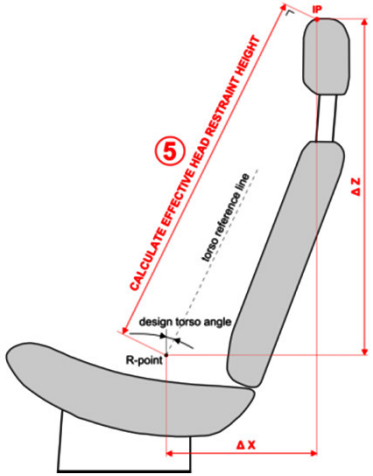


Source: GRSP-53-17

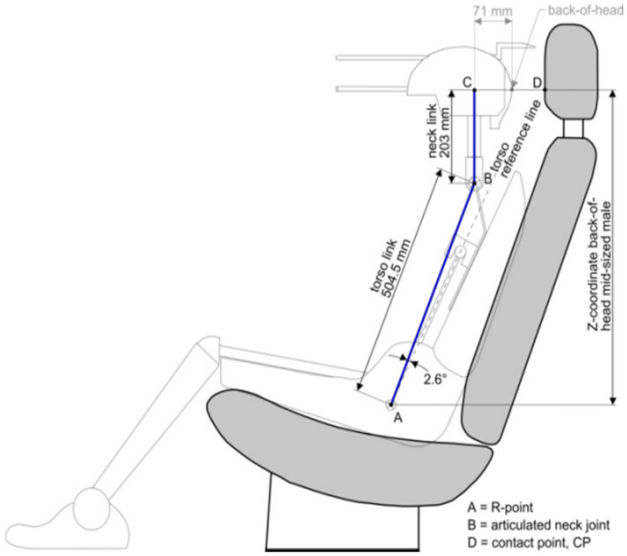
➔ **Calculation of needed effective head restraint height**

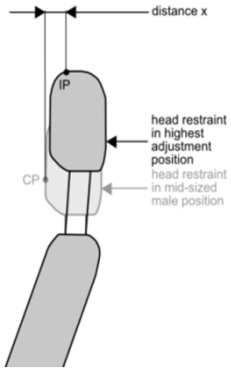
$H_{hr,\,eff}$ =
Δ X * SIN(design torso angle) +
Δ Z * COS(design torso angle)

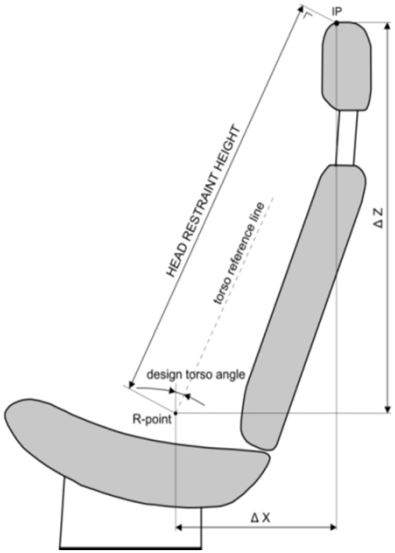
With design torso angle of 25°:
$H_{hr,\,eff}$ = 831 mm



New static measurement procedures for head restraint height and backset (no HRMD needed any more!):







CP: contact point
IP: intersection point
Distance x: function of design torso angle

New static measurement procedures for head restraint height and backset (no HRMD needed any more!):

With head restraint set in mid-sized position, the measuring of Contact Point CP:

Available are:

- the coordinates of the R-point,
- A design torso angle, and
- dimensions of a mid-sized Torso & Neck Link.

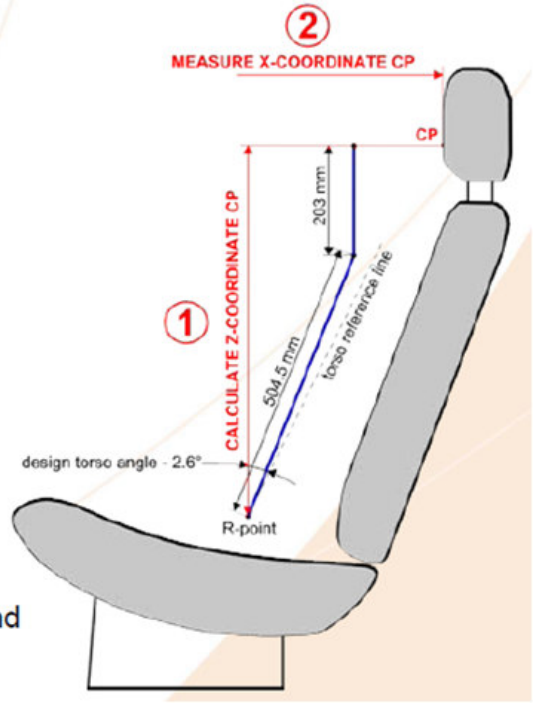
Needed actions:

1) calculate Z-coordinate CP =

504.5 * COS(design torso angle – 2.6°) + 203

(instead of calculation, a table will be provided),

2) mark this point on the head restraint surface and measure X-coordinate CP.



Source: Working Document GTR7-08-03e

New static measurement procedures for head restraint height and backset (no HRMD needed any more!):

With head restraint set in its highest position, the measuring of Intersection Point IP:

Available are:

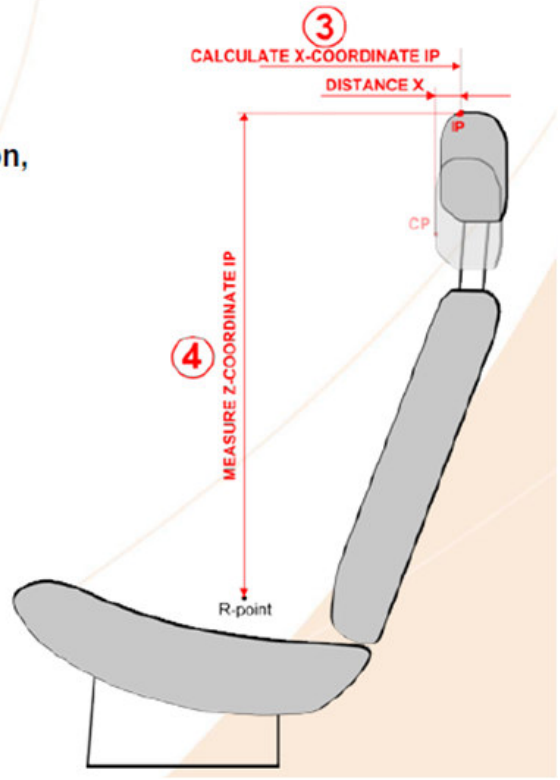
➢The table providing also “distance X”

Needed actions:

3) calculate X-coordinate IP =

Measured X-coordinate CP + “distance x”,

4) mark this point on the HR and measure Z-coordinate IP.



Source: Working Document GTR7-08-03e

GTR Nr. 7 Workshop on 26th March 2013 at BASt

- Concept agrred
- New text proposed for GTR7
- Concept works for backset, too.

-> HRMD no longer needed!
-> further investigation for positioning of BioRID!

Fotos: B. Lorenz

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

GTR No. 7 Workshop on 16th of July 2013 @BASt, Bergisch Gladbach

- Difference between the static measurements and the dynamic test is the position of the seat.
- A new „reference point“ is needed as basis for a similar procedure as agreed for the static one

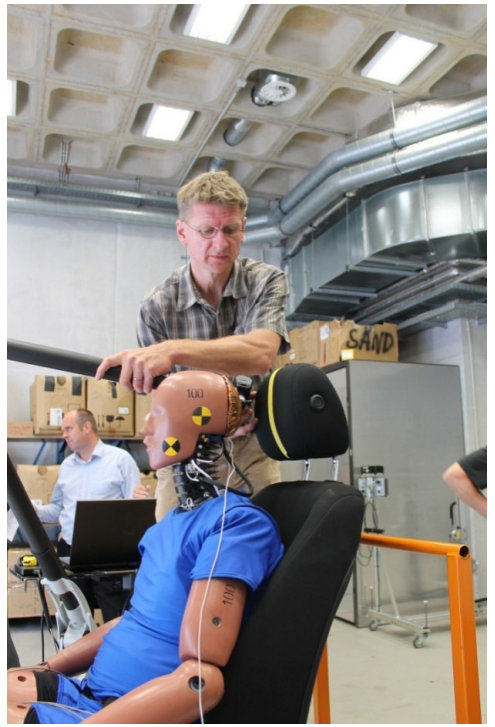
-> Introduction of the „R_{50} point“

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

GTR No. 7 Workshop on 16th of July 2013 @BASt, Bergisch Gladbach

Impressions I



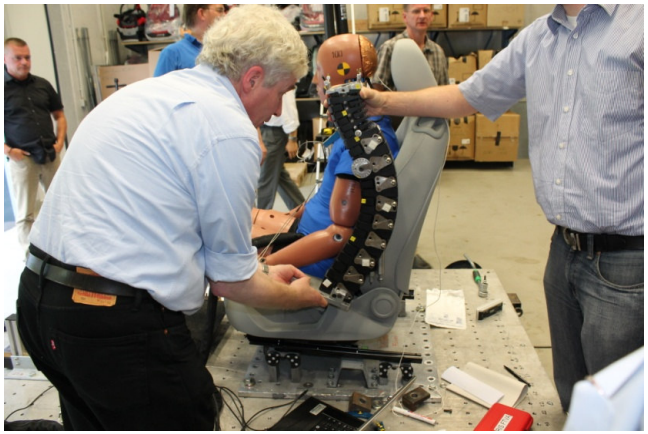
Fotos: B. Lorenz

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

GTR No. 7 Workshop on 16th of July 2013 @BASt, Bergisch Gladbach

Impressions II

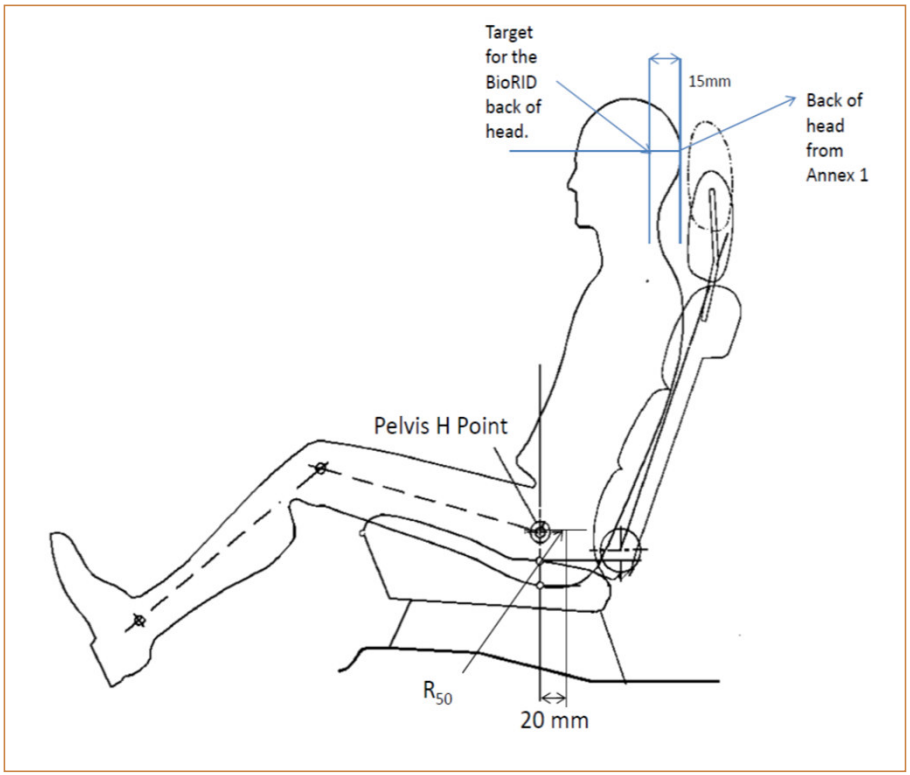


Fotos: B. Lorenz

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Introduction of the „R_{50} point“



- Introduction of a new “designated H-point” for mid-size male seating position “R_{50}”.
- This data is provided by the manufacturer, allowing the seat to be adjusted to this point.
- Note: static measurement is made in a different seat set-up than for the dynamic test.
- “R_{50}“tolerance is checked by the H-point machine. If it lies within the 50 mm box it is this is the designated design point.

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Introduction of the „R_{50} point“

- The BioRID H-point is located 20 mm forward of the “R_{50} point”
- Based on the “R_{50} point” Annex 1 table shall be applied which provides the target back of the head.
- Based on the experience from the BioRID user group and current practice in NCAP subtract 15 mm from figure given for the backset taken from the Annex 1 table.

Note: The group was well aware that most experience with the BioRID in dynamic testing is based on 25 degrees design angle as used at IIHS and Euro NCAP.
However, JNCAP uses the BioRID for a range of design torso angles. Based on the available expert knowledge the group recommends to limit the use of the BioRID to torso angles between 20-30 degrees.

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

17h Meeting of the GTR 7 (Phase II) Informal Group 7/8 September 2015

Injury Criteria		AIS1+: 50% Value <Equivalence> WAD2+: 82.9% Value
		IV-NIC=1.1
NIC Max		23 [23]
Upper Neck	FX (Backward)	640 [360] N
	MY(Flx/Ext)	34 [30] Nm
Lower Neck	FX (Backward)	640 [360] N
	MY(Flx/Ext)	34 [30] Nm

Japanese proposal in black, Bernd Lorenz proposal is in red.

Notes:

- **Does not include rebound phase(excluded)**
- **Measures both negative and positive FX figures.**

2 Group of Experts Meetings

As there had been discussion without results for many meetings it was decided to set-up a "Group of Experts" with the aim to make a consolidated proposal to the IWG/GRSP (chair Bernd Lorenz (BASt))

Participants from Chalmers, EEVC, VRTC/NHTSA, JARI, TRL, LAB, PDB …

- **8th/9th September 2014: 1st Group of Experts Whiplash Injury Criteria Meeting – Berlin after IRCOBI conference**
- **27th August 2015: 2nd Group of Experts Whiplash Injury Criteria Meeting - WebEx**

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

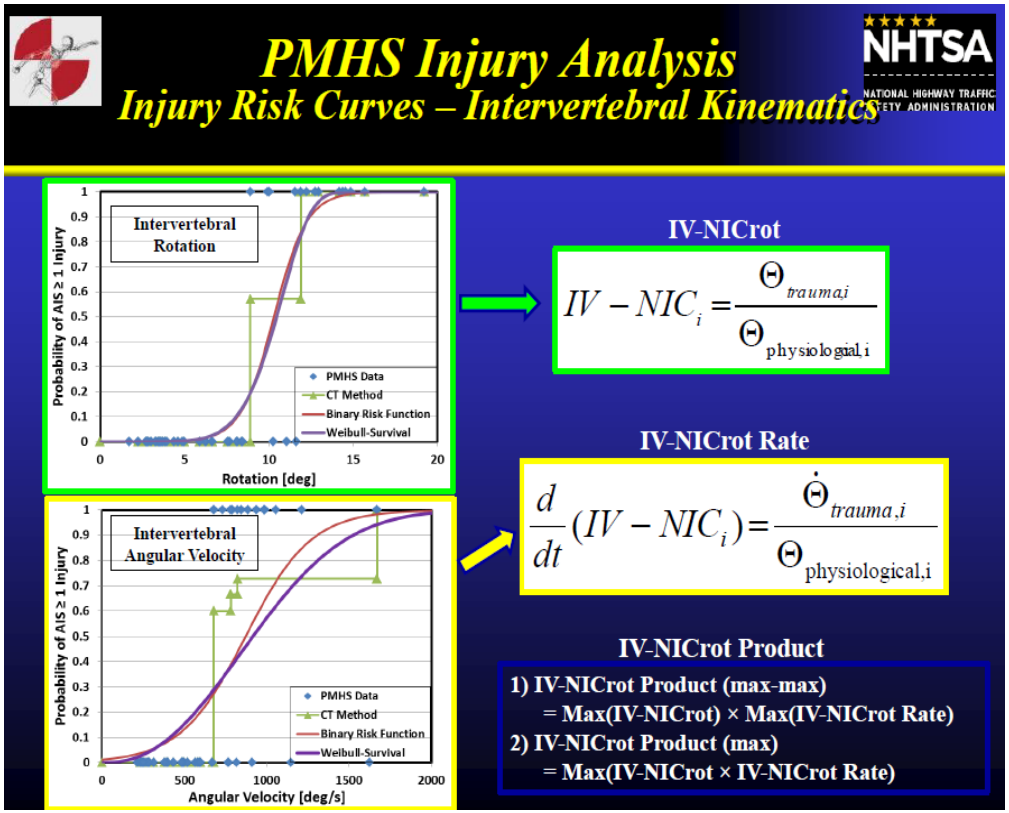
Candidate seat performance criteria
(as of doc GTR7-06-10 and proposed by Japan, 6th Meeting „8th February/1st March, Brussels):

- **Neck Injury Criterion (NIC): NICmax shall not exceed [23.4].**
- **Upper Neck Fx, flexion and extension: Fxmax shall not exceed [61.3].**
- **Lower Neck Fx, flexion and extension: Fxmax shall not exceed [61.3].**
- **Upper Neck Fz: Fzmax shall not exceed [933.5].**
- **Lower Neck Fz: Fzmax shall not exceed [1113.1].**
- **Upper Neck My: My^{oc}max shall not exceed [31.6].**
- **Lower Neck My: Mymax shall not exceed [31.6].**

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

GRSP IWG GTR Head Restraints - History

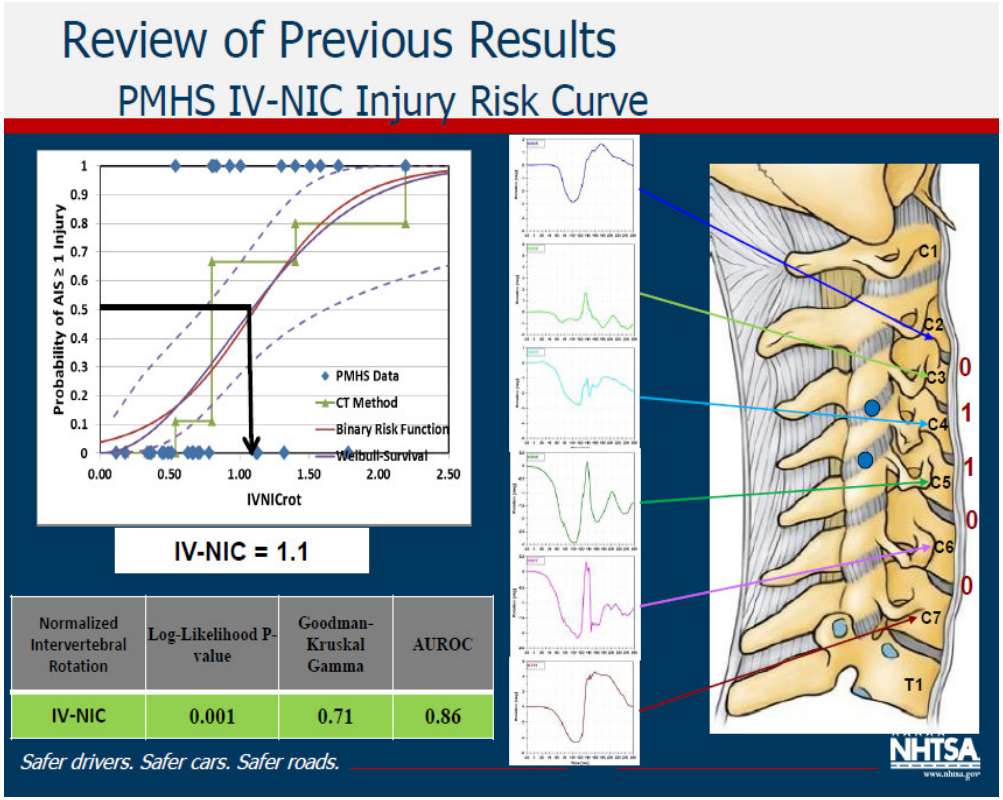
GTR No. 7 Phase 2



Based on PMHS tests and simulations of volunteers tests as well as accident reconstructions the IV-NIC criterion was developped. (IV: InterVertebral)

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

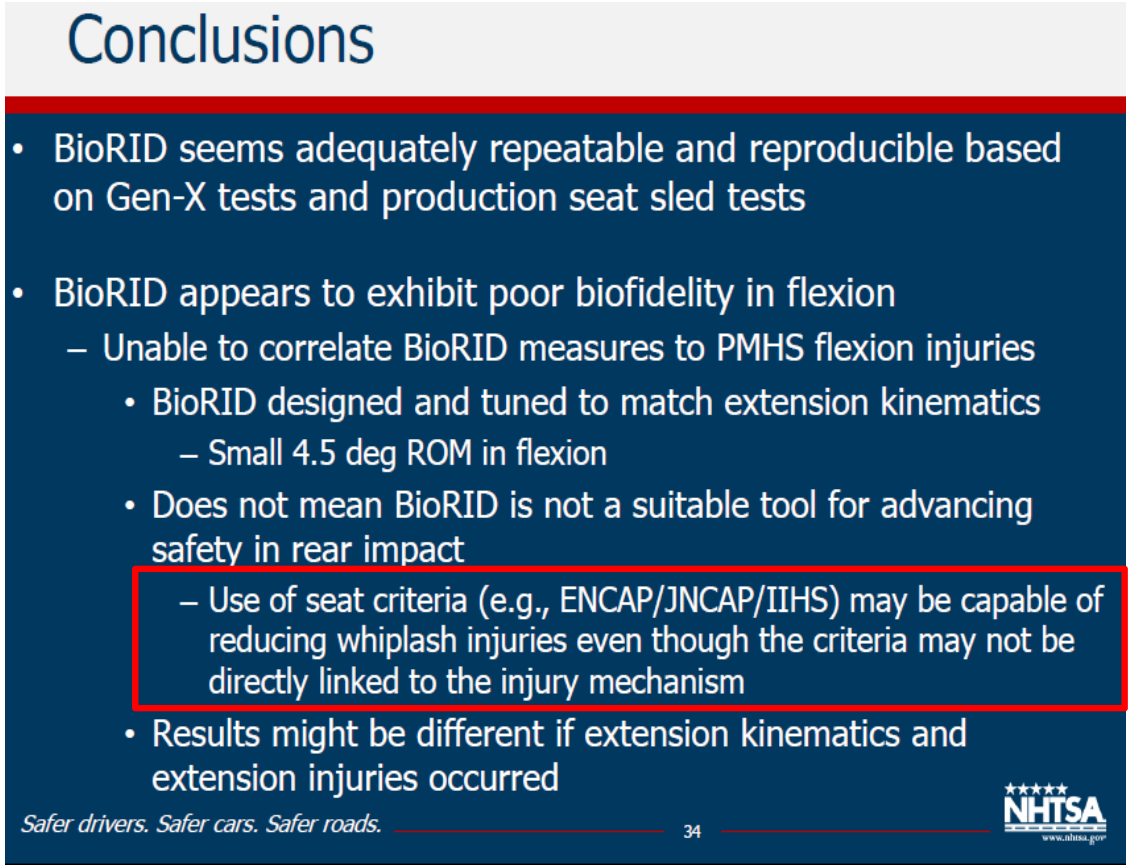


Doc GTR7-16-03 RR-IC-Correlation

IV-NIC of 1.1 represents 50% probability of AIS1+ injury risk

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2



Doc GTR7-16-03 RR-IC-Correlation

Further research from VRTC/NHTSA leads to the assumption thaT mainly flexion is causing injury:
BioRID shows bad biofidelity for flexion!

=> Pragmatic approach favoured!

Seat Performance Criteria Problems / discussion

"The IWG recognised the **absence of an absolute medical definition for whiplash associated disorder** and had the ambition to develop this understanding as part of its work.
Innovative cadaver based studies were undertaken by VRTC guided by an extensive work of simulation studies by Japan and this programme of work has been significant in the timeline for the delivery of a proposal.

However, **while the work has helped to evaluate the repeatability and reproducibility of the tool it has not been successful in producing correlation between the tool and the cadaver performance**. It has become clear that more cadaver studies are required in order to deliver a sufficiently large statistical sample."

from: GRSP-58-18 Introduction to Revision of GTR 7

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

“The IWG believes that it is now necessary to proceed with a more empirical approach and to recommend that the cadaver work be reported in a later amendment.

The BioRID tool is already used extensively in consumer information programmes where empirical criteria are in use. “

from: GRSP-58-18 Introduction to Revision of GTR 7

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Candidate seat performance criteria
After 1st Group of Expert Meeting September 2014:

- **Neck Injury Criterion (NIC)**
- **Fx upper and lower neck (flexion and extension?)**
- **NDCrot for both flexion and extension**

My upper and lower neck was deleted provided that NDCrot has requirements for both flexion and extension.

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

Euro NCAP Seat performance criteria

Seven criteria are assessed during the dynamic test related to dummy response

NIC	**Relative horizontal acceleration and velocity of the occipital joint relative to T1**
Nkm	**Combination of moment and shear forces**
HRV	**Head rebound velocity**
$F_{x\ upper}$	**Upper neck shear force**
$F_{z\ upper}$	**Upper neck tension force**
T1g	**Acceleration on 1^{rst} thoracic vertebra (T1)**
HRC	**Time to head restraint first contact**

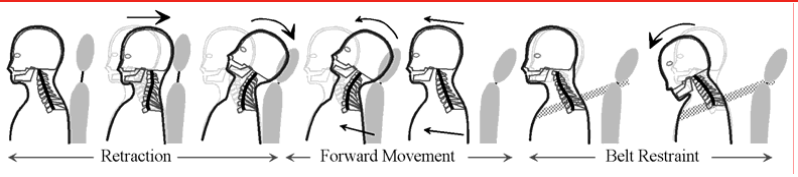


Figure from Trauma-Biomechanik by Schmitt, Muser

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

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Rating System
Sliding scales and capping limits

- For the dynamic test, sliding scales are used for all criteria.
- For each test severity different limits for the criteria have been generated following the “best practise” approach.
- The sliding scales appropriate to each pulse have been generated from an Assessment Protocol Prove Out (APPO) test programme in 2006 with 30 seat models (90 tests).
- Sliding scale limits are based on the 5th and 70th percentile figures of the APPO data.
- Capping applied if one of the criteria is above the 95th percentile (-> 0 points for test)

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

Euro NCAP (GRSP IWG GTR Head Restraints – History)

Experience from Euro NCAP seat performance assessment since 2008

- Out of **88 seat models** tested between 2008 and 2010:
  - High pulse was capped for 8 models.
  - Mid pulse was capped for 4 models.
  - Low pulse was capped for 4 models.

- Out of **152 models tested** between 2011 and 2014 **only 4** vehicles had a whiplash pulse score capped
  - 2011 one car, low pulse, rebound velocity
  - 2011 one car, high pulse, rebound velocity
  - 2012 one car, high pulse, most criteria (very bad seat)
  - 2013 one car, high pulse, rebound velocity.
  - 2014 no capping!

No capping applied for candidate injury criteria NIC, Upper Neck Fx

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

Euro NCAP (GRSP IWG GTR Head Restraints – History)

Experience from Euro NCAP seat performance assessment since 2008

- Tests are performed in 7 European labs which received „Euro NCAP accreditation“:
  - ADAC, BASt, CSI, IDIADA, Thatcham, TNO, UTAC

- Different BioRIDs are used

- Dummies are certified according to the „old“ procedure

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Japan Proposal
Injury Evaluation Parameters and Injury Criteria for GTR7

Injury Criteria		AIS1+: 50% Value <Equivalence> WAD2+: 82.9% Value
		IV-NIC=1.1
NIC Max		23
Upper Neck	FX (Backward)	640
	MY(Flx/Ext)	34
Lower Neck	FX (Backward)	640
	MY(Flx/Ext)	34

Units: Force (N)
Moment (Nm)

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

Discussion

NIC

NICmax 23 (Japan)
NICmax 25 (EEVC for long term injuries)
NICmax15 (Literature)
No rating capped due to NIC since 2011 at Euro NCAP

Recommendation for GTR 7: NICmax 23 ?

Upper and Lower Neck Fx

Fxmax (backwards) 640 N (Japan)
Fxmax 210 N (EEVC, tentative)
Upper Neck Fx Capping Limit 364 N (Euro NCAP high severity pulse)
No rating capped due to Upper neck Fx since 2011 at Euro NCAP

Recommendation for GTR 7: Upper and Lower Neck Fx 360 N?

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Discussion

Upper and Lower Neck My

Mymax (flex/ext) 34 Nm (Japan)

Recommendation for GTR 7: Mymax 30 Nm?

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Summary of recommendations for GTR 7	
NIC	23 ?
Upper and Lower Neck Fx	360 N ?
Upper and Lower Neck My	30 Nm ?

Lorenz, B.: On Candidate Seat Performance / Injury Criteria for Regulatory Purposes. 17th GTR 7 Meeting, 7th / 8th September 2015, London

Proposal from Germany (for April 2019 IWG meeting)

Summary of recommendations for GTR 7

NIC	**23**	
Upper and Lower Neck My	**30 Nm**	
Upper Neck Fx	**360 N**	
Lower Neck Fx	**360 N** ?	

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Latest proposal for injury criteria as agreed during 18th IWG meeting

Summary of recommendations for GTR 7

NIC	**25**	✅
Upper and Lower Neck My	**l30l Nm**	✅
Upper Neck Fx	**l360l N**	✅
Lower Neck Fx	**as care point / monitoring, language in preamble! (§147 in GRSP-65-24)**	

My and Fx for flexion and extension!

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

Recommendations of the BioRID TEG as of 12th September 2019:

1. keep all corridors as they are with the exception of
   - Pot A and
   - Adjust Pot A at mean and keep the same corridor width
   - keep jacket and pelvis compression for monitoring purposes only
2. bumper compression to be added to drawings
3. Review all certification criteria after 3 years
4. Remove C4 mount
5. Shoe weight confirmed to be: 0.57 +/- 0.1 kg (check PADI)

Mutual Resolution M.R.1 (GRSP IWG GTR Head Restraints – History)

BioRID specifications described in Mutual Resolution No. 1 (M.R.1)

„Addendum 1: BioRID UN“

M.R.1: „Concerning the description and performance of test tools and devices necessary for the assessment of compliance of wheeled vehicles, equipment and parts according to the technical prescriptions specified in UN Regulations and UN Global Technical Regulations”

„New“ way of test tool definition for regulatory use!

Addendum 1: Specifications for the Construction, Preparation and Certification of the 50th percentile male Biofidelic Rear Impact Dummy, anthropomorphic test Device (BioRID-II UN)

(Text of Addendum 1 “BioRID UN” M.R.1: ECE/TRANS/WP.29/2021/146)

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

66. GRSP December 2019:

The expert from Germany, by way of GRSP-66-41 presented Amendment 1 (ECE/TRANS/WP.29/GRSP/2019/26) to UN GTR No. 7 (Phase 2 of the UN GTR on head restraints) that had been prepared by the expert from Japan as technical sponsor of the informal working group (IWG).

He explained that the proposal had resolved all the main issues, i.e., in square brackets:

- text of the preamble,
- text of the Regulation and
- injury criteria.

He added that the proposal to include the Biomechanical Rear Impact Dummy (BioRID) UN test tool in Mutual Resolution No. 1 (M.R.1) was still in final review, and that an agreement was in progress with the dummy manufacturer on disclaiming any copyright infringements.

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

66th GRSP recommended that (a) Amendment 1 to UN GTR No. 7 (ECE/TRANS/WP.29/GRSP/2019/26), as amended below, (b) the final progress report (ECE/TRANS/WP.29/GRSP/2019/21), not amended and (c) the authorization to develop the work ECE/TRANS/WP.29/AC.3/25/Rev.1 be established in the global registry.

The secretariat was requested **to submit the Amendment, report and authorization to WP.29 and to the Executive Committee of the 1998 Agreement (AC.3) for consideration and vote at their June 2020 session as Amendment 1 to UN GTR No. 7.** GRSP also agreed to suspend discussion on ECE/TRANS/WP.29/GRSP/2019/20 since the subject was considered to not be in the IWG mandate, though future consideration would follow a new authorization to develop the work.

Annex 3, paragraph 2.1.1., shall be deleted.

! COVID-19 !

WP.29 in March 2020 reached no Quorum

WP.29 in Juni 2020 did not discuss GTR 7!

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

GRSP, agreed to resume consideration on this subject at its May 2020 session on the basis of a proposal of Addendum to M.R.1. to incorporate drawings, specifications and manual of the BioRID test tool. GRSP also agreed that consideration on this subject would have as a prerequisite that the dummy manufacturer provide the set of drawings for the test tool and agree to have the disclaimer on intellectual property rights removed from the drawings.

! COVID-19 !

67. GRSP did not take place in May 2020 due to COVID-19 but was moved to a virtual meeting in July 2020

M.R.1 was not discussed due to time contraints!

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

67. GRSP virtual July 2020:

UN Regulation No. 17 (Strength of seats) (agenda item 6)

The expert from Japan introduced ECE/TRANS/WP.29/GRSP/2020/8 in a presentation (GRSP-67-17) on behalf of the Task Force on aligning UN Regulation No. 17 with UN GTR No. 7, Phase 2 provisions. The expert from Italy requested a delay on transitional provision for all new vehicles (paragraphs. 13.13.2 and 13.13.3). Finally, GRSP adopted ECE/TRANS/WP.29/GRSP/2020/8, as amended by Annex IV to this report. The secretariat was requested to submit the proposal as the draft 10 series of amendment to UN Regulation No. 17, for consideration and vote at the November 2020 sessions of WP.29 and AC.1. At the same time, the expert from CLEPA withdrew ECE/TRANS/WP.29/GRSP/2019/9.

WP.29 November 2020 adopted GRT 7 amendment 1 (= GTR 7 Phase 2)! (ECE/TRANS/180/Add.7/Amend.1)

UN Regulation No. 17 Revision 6 - Amendment 2 -> 10 Series of Amendments enterd into force in June 2021

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

68th GRSP December 2020 (virtual)

The expert from United Kingdom introduced **GRSP-68-23**, representing the development of **Mutual Resolution No. 1, Addendum 1** and concerning the Biomechanical Rear Impact Dummy-II (BIORID-II) UN dummy as part of test tools in UN GTR No. 7 and UN Regulation No. 17 (10 series of amendments) for use in rear impact assessment.

He recommended that consideration on this proposal would be made together with GRSP-54-05 (Draft addendum 1 to M.R.1), introduced at the fifty-fourth session of GRSP (see ECE/TRANS/WP.29/GRSP/54, para. 4).

He recommended GRSP to provide comments on GRSP-68-23 and GRSP-54-05 before 31 January 2021 for consideration in the final document to be submitted **to the May 2021 session of GRSP**.

It was noted that **copyrights were expected to be removed from drawings when the proposal would be finally adopted by WP.29 and AC.3**. GRSP agreed with the recommendation of the expert from the United Kingdom and agreed to resume discussion at its May 2021 session.

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

69. GRSP May 2021:

The expert from United Kingdom of Great Britain and Northern Ireland introduced ECE/TRANS/WP.29/GRSP/2021/2 and GRSP-69-39 (this last correcting typo errors) through GRSP-69-01 as proposal for Addendum 1 to Mutual Resolution No. 1 …

He explained that the structure of the proposal was stemming from GRSP-54-05 (Draft addendum 1 to M.R.1), introduced at the fifty-fourth session of GRSP (see ECE/TRANS/WP.29/GRSP/54, para. 4) and that the body of the proposal introduced the general design of the dummy, including the essential dimensions and how they are checked.

He added that the text associated with the procedures for dismantling, assembling and adjusting the dummy had received editorial review and that proprietary names had been removed. It was noted that copyrights were expected to be removed from drawings when the proposal would be finally adopted by WP.29 and AC.3.

He finally urged GRSP to recommend the proposal to allow a thorough implementation of UN Regulation No. 17 and UN GTR No. 7 by Contracting Parties of both Agreements.

GRSP IWG GTR Head Restraints - History

GTR No. 7 Phase 2

69. GRSP May 2021:

The experts from the Netherlands, Germany, Japan, France agreed with the recommendation of the expert from the United Kingdom of Great Britain and Northern Ireland.

The expert from the United States of America endorsed in principle the proposal, however, she explained that a full technical review of the document was not completed by her Administration and requested a time reservation. It was noted that time for possible revision was still available prior the November sessions of WP.29 and AC.3 and being integrated even on informal basis if they would not be relevant.

Finally, GRSP recommended ECE/TRANS/WP.29/GRSP/2021/2, as amended by Annex VII to the report, and requested the secretariat to submit it as draft Amendment 3 to M.R.1 to the **November 2021** sessions of WP.29 and AC.3.

-> was adopted by WP.29 for 23.-25 November 2021 (ECE/TRANS/WP.29/2021/146)

Sex and Size Neutral Crash Safety

GRSP-69-42 (Schweden)
Result from the study presented in Dec -2020

People of different sizes and gender where studied and the conclusion were:

- **Female occupants have greater risk of crash related injuries than male occupants**
  - *Females:* *Greater risk of spine, thorax and extremity injuries*
    (Welsh & Lenard 2001; Bose et al. 2011; Parenteau et al. 2013; Kahane 2013)
  - *Males:* *Greater risk of head injuries*
    (Parenteau et al. 2013; Welsh & Lenard 2001)

- **Risk is also affected by size**

”Gender is the factor that effects the risk the most!”

Sex and Size Neutral Crash Safety

70. GRSP December 2021: Proposal for an new Informal Working Group from Canada, France, Germany, Japan, Netherlands, Spain and Sweden

„Informal working group on sex and size neutral crash safety“

The objective for the informal working group is to analyze the following ECE- regulations under the 1958 agreement:

- ECE R 16, safety belt/restraint system test
- **ECE R17, strength of seats**
- ECE 94 and 137 frontal test
- ECE R95 and 135 side impact tests

The informal working group might also wish to review existing passive safety dummies and their capability to reflect the different injury patterns from field data analysis. As well as investigate whether the current safety related regulations are sufficiently flexible to allow the development of advanced adaptive systems where higher safety for different occupants can be achieved.

(Dokument: GRSP-70-01e)

Summary / Outlook

- GTR No. 7 (Phase 1) was adopted with a variety of options by entry in the Global Registry in March 2008.
- The Informal Working Group on GTR No. 7 worked together with BioRID TEG on a Phase 2, Technical Sponsor Japan.
- Through some measures on the dummies, good R&R could be achieved.
- Drawing sets and certification corridors have been transferred to M.R.1
- GTR No. 7 Phase 2 was finally approved by GRSP in December 2019.
- At the same time, a draft of the 10th series of amendments to UN-R 17 was developed
- Delay due to COVID-19! WP.29 adopts GTR 7 Phase 2 in November 2020
- 10th series of amendments to UN-R 17 entered into force on 9 June 2021

Summary / Outlook

- Final draft M.R.1 Addendum 1 BioRID UN was on the agenda of WP.29 for 23-25 November 2021 for approval by the Contracting States, despite NHTSA's reservations.
- M.R.1 necessary for the proper implementation of both the GTR / UN-R17
- In the medium/long term, further research is needed with regard to injury indicators (cadaver examinations by the NHTSA).
- International activities on "Sex and Size Neutral Crash Safety“
- -> Informal Working Group on Equitable Occupant Protection (IWG EqOP)

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Questions?

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EEVC Activities (GRSP IWG GTR Head Restraints – History)

Why not Hybrid III?

Spine (esp. cervical spine) is not human-like

Human skeleton

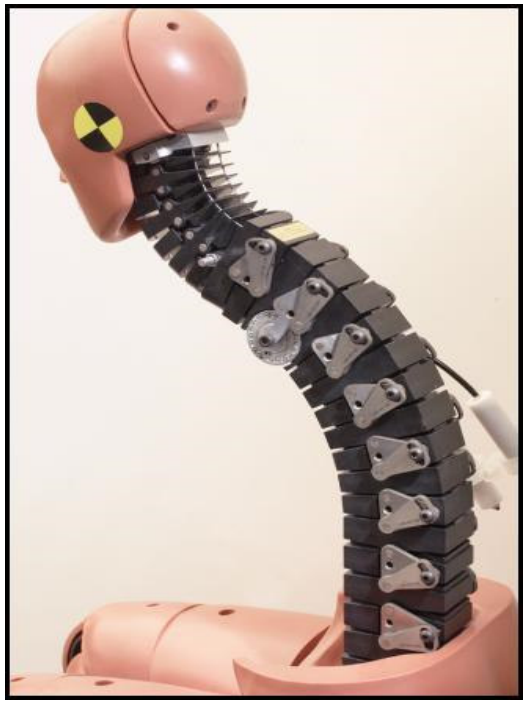
Hybrid III

BioRID ATD Part of a Presentation from Matthew Avery/Thacham for an EEVC WG12/20 joint meeting. Doc. HR-2-9, IWG on Head Restraint Phase 1 https://unece.org/DAM/trans/doc/2005/wp29grsp/HR-02-09e.pdf

EEVC Activities (GRSP IWG GTR Head Restraints – History)

BioRID has more humanlike spine than Hybrid III

Human skeleton

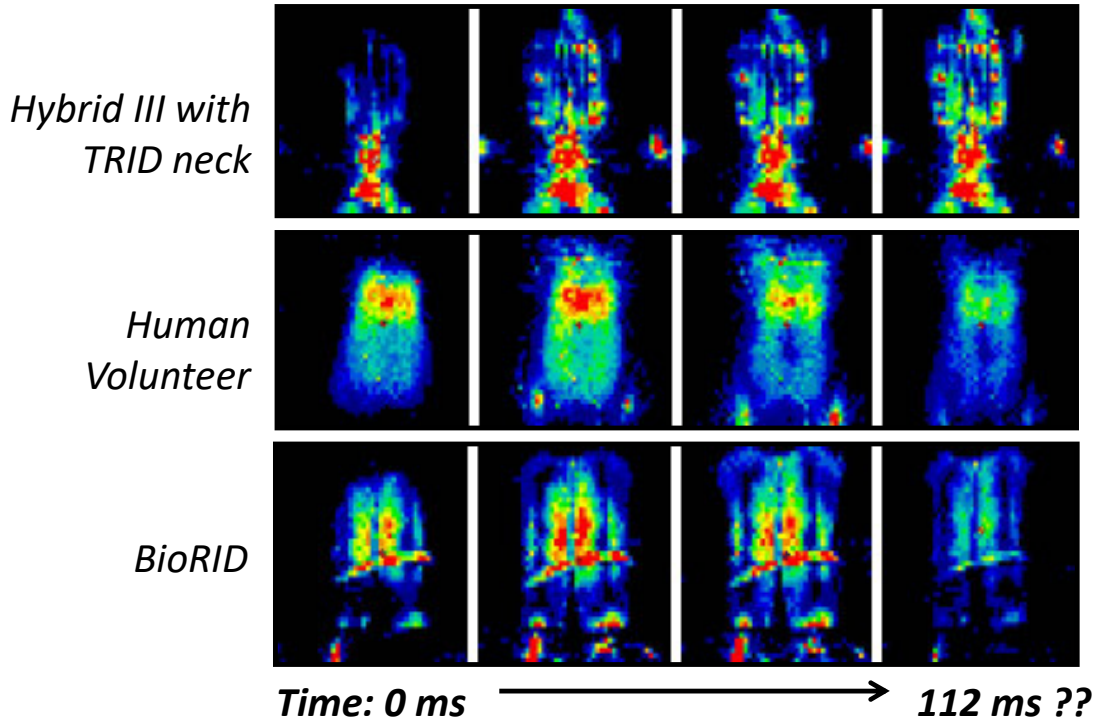


BioRID 2

BioRID ATD Part of a Presentation from Matthew Avery/Thacham for an EEVC WG12/20 joint meeting. Doc. HR-2-9, IWG on Head Restraint Phase 1
https://unece.org/DAM/trans/doc/2005/wp29grsp/HR-02-09e.pdf

EEVC Activities (GRSP IWG GTR Head Restraints – History)

BioRID exhibits more humanlike pressure distribution on seatback than Hybrid III



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