Dynamic criteria Biorid

Clepa has investigated the industrial feasability of proposed GTR 7 Phase 2 dynamic proposed criteria.

Proposed criteria and limits are :

	NIC	My+ up	My- up	My+ lo	My- lo	FX+ up	FX- up	FX+ lo	FX- lo
	[m^2/s^2]	[Nm]	[Nm]	[Nm]	[Nm]	[N]	[N]	[N]	[N]
Values proposed by Japan for GTR7 p2	23	34	34	34	34	640	640	640	640
Values proposed by Germany	23	30	30	30	30	360	360	360	360

Transmitted by the expert from CLEPA

Informal document GRSP-64-xx
(64th GRSP 11-14 December 2018,
agenda item xx)

Dynamic criteria Biorid

1st investigation : data from JNCAP 2010/12 results at 17.6 km/h.

- Clepa has analyzed :
  - If seats exceeded the Japanese Biomechanic proposed limits
  - If seats exceeded the German Biomechanic proposed limits
  - If seats can go into a serial production -> proposed limits – 20 %

  - 41 data sets were checked for 40 vehicles, 1 vehicle has had 2 seat variants

Dynamic criteria Biorid

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1st investigation : data from JNCAP 2010/12 results at 17.6 km/h.

Results:

Several vehicles do not meet GTR7 dynamic criteria or would be too borderline to allow an industrialization of such seats.

- Do not meet criteria proposed by Japan : 2 out of 40 cars
- Too borderline to be allowed in serial production for a regulatory use when Japan criteria are used in regulations : 7 out of 40 cars
- Do not meet criteria proposed by Germany : 8 out of 40 cars
- **Too borderline to be allowed in serial production for a regulatory use when German criteria are used in regulations : 18 out of 40 cars**
- We were not able to determine if such 18 cars fulfilled the backset requirement of GTR7.

Dynamic criteria Biorid

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Conclusion from data from JNCAP 2010/12 results at 17.6 km/h :

- Almost half of the vehicle seats will be eliminated from the market with the german proposal versus 2010/12 vehicles tested by JNCAP
- No injury curves are available on Fx- upper and Fx – lower and therefore those criteria shall not be included.
- The number of injury criteria can be reduced

Dynamic criteria Biorid

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2. Dynamic GTR7 phase 2 tests of GOOD EuroNcap seats by Clepa :

- Seats A, B, C, D and F have GOOD EuroNcap results, Seat E (1.46 out of 2 points) is near Good EuroNcap limit
- 3 seats were tested by changing pulse to GTR7 pulse, but maintaining Biorid setup of EuroNcap protocol with HRMD.(marked HRMD)
- 5 seats were tested by applying GTR7 pulse and GTR7 proposed Biorid set up (marked GTR7)

Torso angle of 25°

Orange : value exceed german proposal

Yellow : value near to regulatory limit (within 20% band)

Test-N°			Cartype	Test	NIC	My+ up [Nm]	My- up [Nm]	My+ lo [Nm]	My- lo [Nm]	FX+ up [N]	FX- up [N]	FX+ lo [N]	FX- lo [N]
8888	HRMD	17.6	A	BioRID II	18,7	8,4	-15,4	0,9	-6,2	36	-92	238	-31,5
8886	HRMD	17.6	B	BioRID II	18,5	9	-9,1	1,6	-6	14,6	-119,6	212	-47
8884	HRMD	17.6	C	BioRID II	16,7	20,8	-7,1	0,8	-10,3	63,6	-8,6	321	-18,2
5400	GTR7	17.6	D	BioRID II	18,6	23,8	-4,6	2	-8,1	72,6	-25	347	-35
5799	GTR7	17.6	A	BioRID II	20,8	9,67	-8,7	1,4	-6,2	25,6	-57,9	307	-56
5800	GTR7	17.6	E	BioRID II	error	31,9	-2,9	2,1	-12,1	150	-42,7	427	-36
5960	GTR7	17.6	F	BioRID II	14,5	7,5	-7,5	1,7	-8,9	33	-19,4	347	-41
5802	GTR7	17.6	B	BioRID II	17,2	9,1	-4,9	1,8	-6,8	56	-55	235	-33

Dynamic criteria Biorid

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2. Dynamic GTR7 phase 2 tests of GOOD EuroNcap seats by Clepa :

Results :

- 1 of 6 seats did not fulfill German proposal

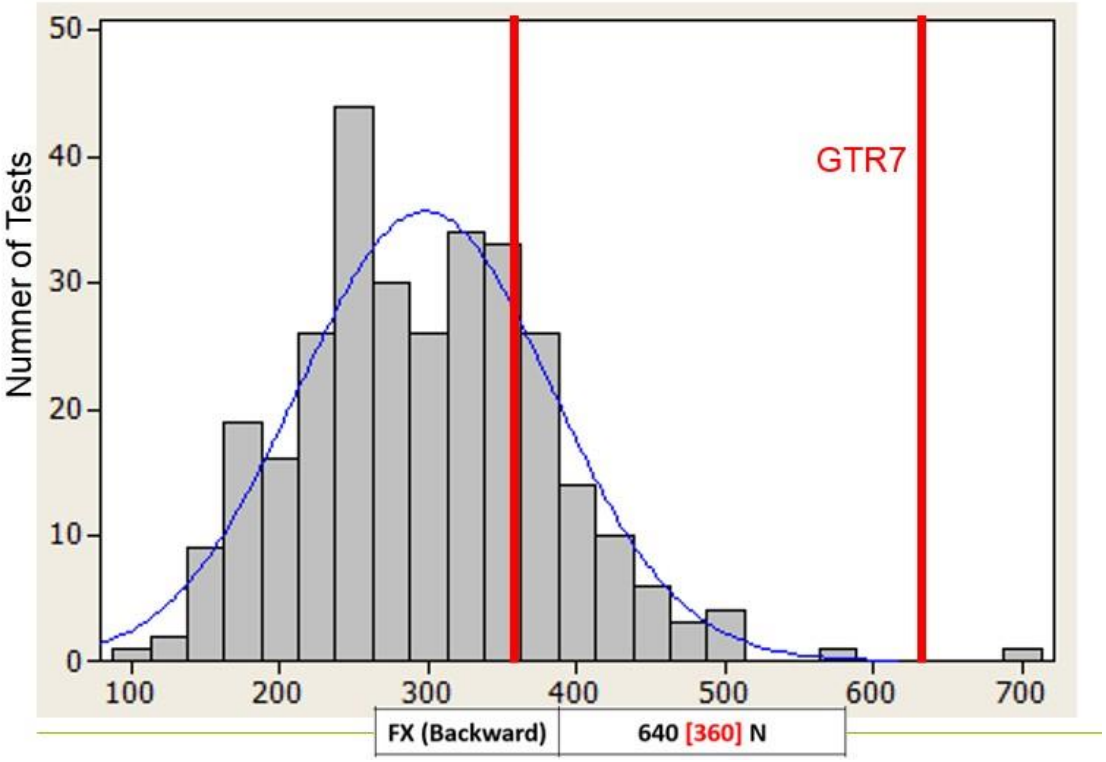
  the seat not fulfilling german proposal was limit for GOOD EuroNcap rating
- 5 of the 6 seats would be too borderline to allow serial production in respect to german proposal

80 % of tested GOOD EuroNcap seats will not fulfill the requirements for industrial production and GTR7 phase 2 german proposed injury limits.

Dynamic criteria Biorid

3. Results of more than 200 tests from seats released in serial production.

Fx+ lower.



A considerable amount of actual seats will not fulfill GTR7 dynamic proposed values of Germany.

Clepa does not understand the statement from Germany that 95% of actual EuroNcap tested head restraints fulfill the values.

Dynamic criteria Biorid

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2. Dynamic GTR7 phase 2 tests of GOOD EuroNcap seats by Clepa :

Results :

- 1 of 6 seats did not fulfill German proposal

  the seat not fulfilling german proposal was limit for GOOD EuroNcap rating
- 5 of the 6 seats would be too borderline to allow serial production in respect to german proposal

80 % of tested GOOD EuroNcap seats will not fulfill the requirements for industrial production and GTR7 phase 2 german proposed injury limits.

Repeatability and reproducibility of Biorid

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3. Clepa has done 6 repeatability tests of Biorid dummy in 2016 - 2018

- Before and after calibration of Biorid dummy according to latest calibration recommandations from Humanetics, 3 times before and 3 times after calibration.
- The 3 sets of data for 3 calibrations were realized on 6 seats with Good EuroNcap results produced the same day to minimize seat variations with 16 km/h IIWPG pulse.

- Results for cv values of the 6 tests and variation of results expressed in +/- 2 sigma :

	NIC	My+ up	My- up	My+ lo	My- lo	FX+ up	FX- up	FX+ lo	FX- lo
	[m²/s²]	[Nm]	[Nm]	[Nm]	[Nm]	[N]	[N]	[N]	[N]
Values proposed by Japan for GTR7 p2	23	34	34	34	34	640	640	640	640
Values proposed by Germany	23	30	30	30	30	360	360	360	360
6 repeatability tests (seats from same production date), Biorid before and after calibrations 3 times tests 2016 and 2018 16 km/h IIWPG - Test Faurecia, cv in %	13,9%	15,3%	28,6%	31,9%	12,8%	68,0%	17,2%	10,7%	64,9%
Value +/- 2 sigma (95 % repeatability) 16 km/h IIWPG pulse	+/- 3.8 m²/s²	+/- 3,8 Nm	+/- 3 Nm	+/- 1,1 Nm	+/- 1 Nm	+/- 22N	+/- 30N	+/- 47N	+/- 77N

Repeatability and reproducibility of Biorid

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Summary of repeatability and reproducibility studies of Humanetics :

- This data was already presented in the GTR7 group under GTR7-16-02-HIS.

	NIC [m²/s²]	My+ up [Nm]	My- up [Nm]	My+ lo [Nm]	My- lo [Nm]	FX+ up [N]	FX- up [N]	FX+ lo [N]	FX- lo [N]
Values proposed by Japan for GTR7 p2	23	34	34	34	34	640	640	640	640
Values proposed by Germany	23	30	30	30	30	360	360	360	360
Repeatability dummy 073 - VRTC tests GTR7 p2 - Biorid calibrated following GEN-X - presentation Humanetics GTR - entire test series pre - mid - post, cv in % - GTR7-16-02-HIS	9,94%	1,7		4,62	7,51	6,09	13,04	3.4	2,9
Absolute values 2 sigma - 1 dummy pre - mid - post - Gen-X tests	+/- 7 m²/s²	+/- 0.6 Nm						+/- 15 N	
Repeatability 3 dummies - VRTC tests GTR7 phase 2 - Biorid calibrated following GEN-X - presentation Humanetics GTR - entire test series pre - mid - post - All, cv in % GTR7-16-02-HIS	10,70%	5,29		4,2	10,76	17,8	22,7	10,51	
Absolute values 2 sigma - 3 dummies pre - mid - post - Gen-X tests	+/- 7.5 m²/s²	+/- 1.6 Nm						+/- 47 N	

Transmitted by the expert from CLEPA

Repeatability and reproducibility of Biorid

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Summary R&R for NIC and calibration corridor :

Humanetics : Repeatability : cv = 9.9% and +/- 2 sigma = +/- 7 m²/s²

Reproducibility : cv = 10.7% and +/- 2 sigma = +/- 7.5 m²/s²

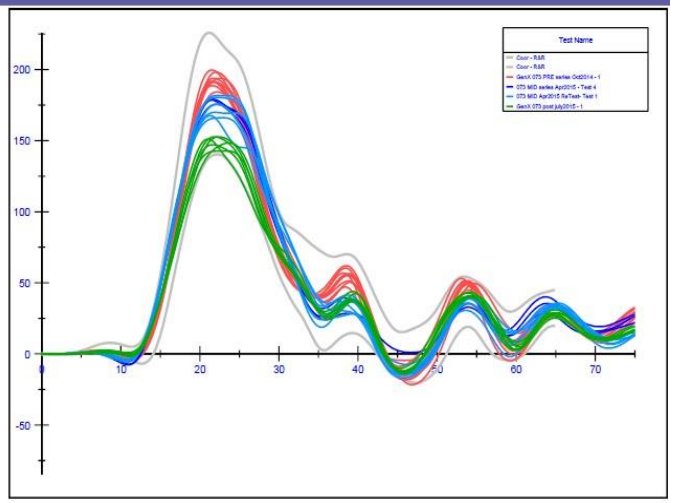
Clepa : Repeatability : : cv = 13.6% and +/- 2 sigma = +/- 3.8 m²/s²

Calibration corridor : none for NIC, but influence by T1 acceleration corridor:

Gen-X, VRTC Series:
0073 Pre, Mid, Post

28

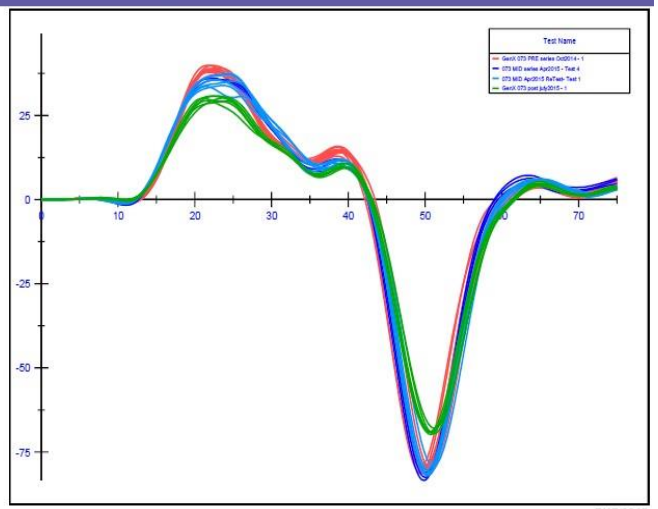
T1 X Accel.



Gen-X, VRTC Series:
0073 Pre, Mid, Post

36

NIC



Repeatability and reproducibility of Biorid

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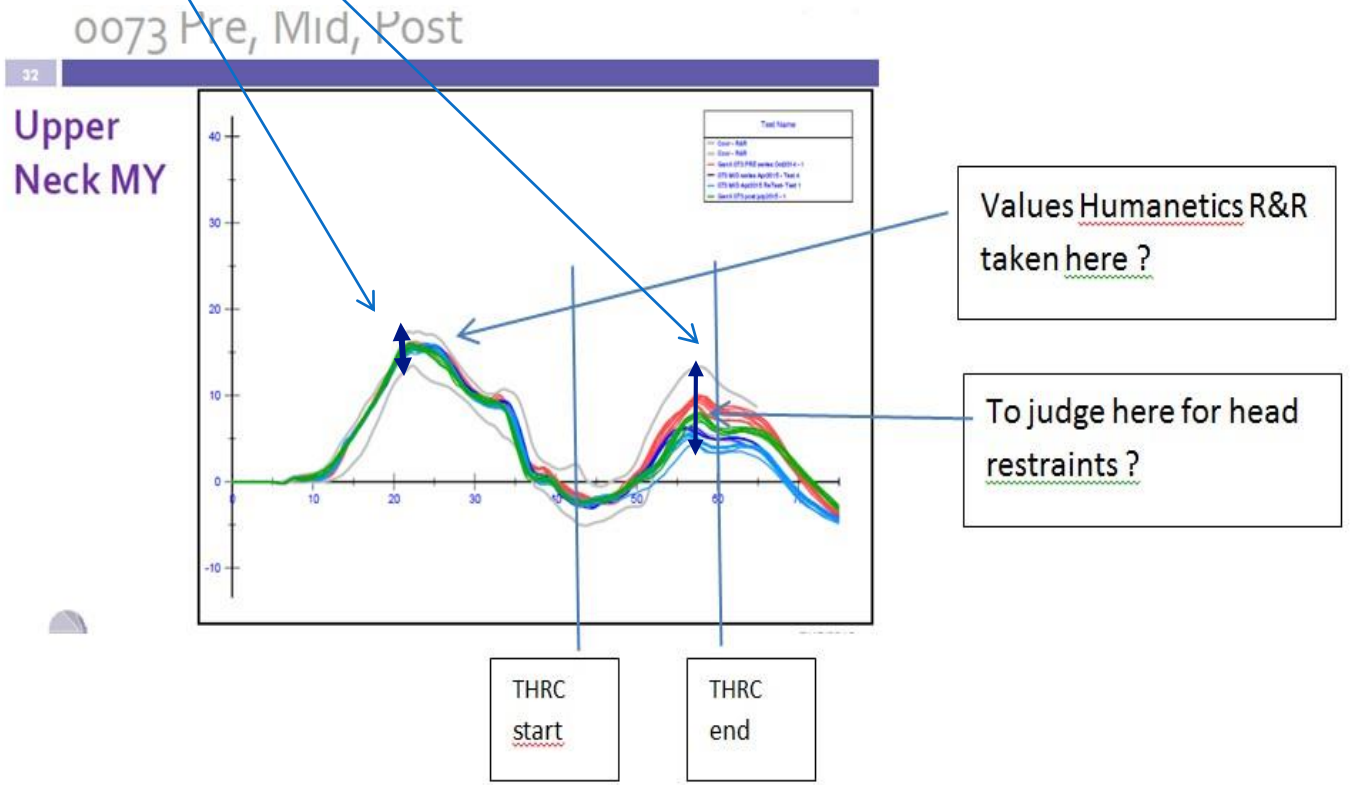
Summary R&R for My+ upper and calibration corridor :

Humanetics : Repeatability : cv = 1,7% and +/- 2 sigma = +/- 0.6 Nm

Reproducibility : cv = 5,3% and +/- 2 sigma = +/- 1.6 Nm

Clepa : Repeatability : cv = 15,3% and +/- 2 sigma = +/- 3.8 Nm

Calibration corridor : here or here ?



Repeatability and reproducibility of Biorid

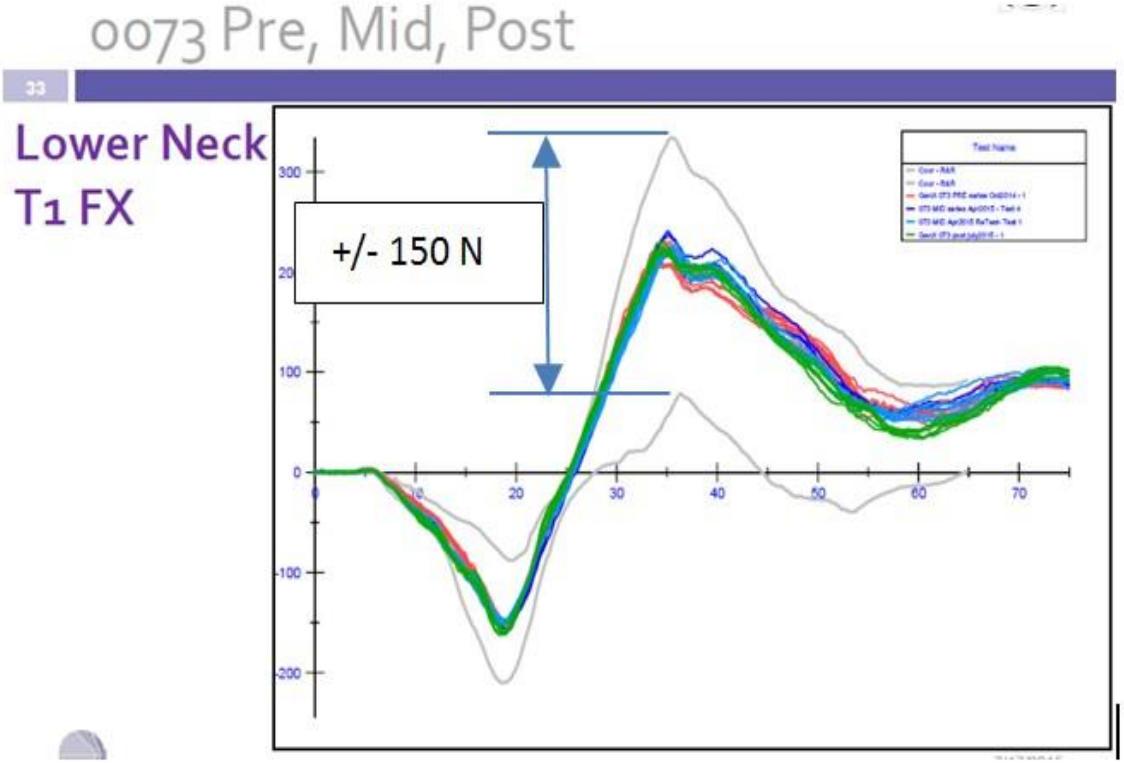
Summary R&R for Fx+ lower and calibration corridor :

Humanetics : Repeatability : cv = 3,4% and +/- 2 sigma = +/- 15 N

Reproducibility : cv = 10.5% and +/- 2 sigma = +/- 47 N

Clepa : Repeatability : : cv = 10.7% and +/- 2 sigma = +/- 47 N

Calibration corridor : +/- 150N



Dynamic criteria Biorid

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Conclusion Repeatability and Reproducibility

- Clepa is concerned by R&R issues and calibration corridors of Biorid in addition to needed margin for serial production of seats.
- Those variations must be taken into account for the allowed regulatory values.
- Allowed variations of the dummy must be added to the injury criteria.
  - NIC : 2 sigma of reproducibility of Biorid to be added.
  - My+ upper : it is not clear if the right area has been studied for R&R, therefore
    Clepa proposes to add repeatability values obtained by Clepa.
  - Fx+ lower : the corridor of GEN-X test is about +/- 150N and needs to be added.

Conclusion Repeatability and Reproducibility

Results :

- Clepa is concerned by R&R issues and calibration corridors of Biorid in addition to needed margin for serial production of seats.
- Those variations must be taken into account for the allowed regulatory values.
- Allowed variations of the dummy must be added to the injury criteria.
  - NIC : 2 sigma of reproducibility of Biorid to be added. 2 sigma = 2 x cv (10.7%) x 23 = 5m^2/s^2
  - My+ upper : it is not clear if the right area has been studied for R&R, therefore proposal to add repeatability values obtained by Clepa = 3.8 Nm
  - Fx+ lower : the corridor of GEN-X test is about +/- 150N and needs to be added.

Dynamic criteria Biorid

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Conclusion :

Clepa does not support the german proposal on injury criteria as not justified by injury risk curves.

Clepa supports the japanese proposal on injury criteria and values, with following changes :

- Supression of Fx- upper and Fx- lower as no injury curves have been shown
- There is a need for a review of all data for establishement of appropriate injury limits
- As example, Clepa believes following limits appropriate :
  - NIC : 23 m^2/s^2 + 5m^2/s^2 = **28 m^2/s^2**
  - My+ upper : 34 Nm + 3.8 Nm = **37.8 Nm**
  - Fx+ lower : 640 N + 150N = **790 N**