

## NICIAMT FSUE "NAMI"

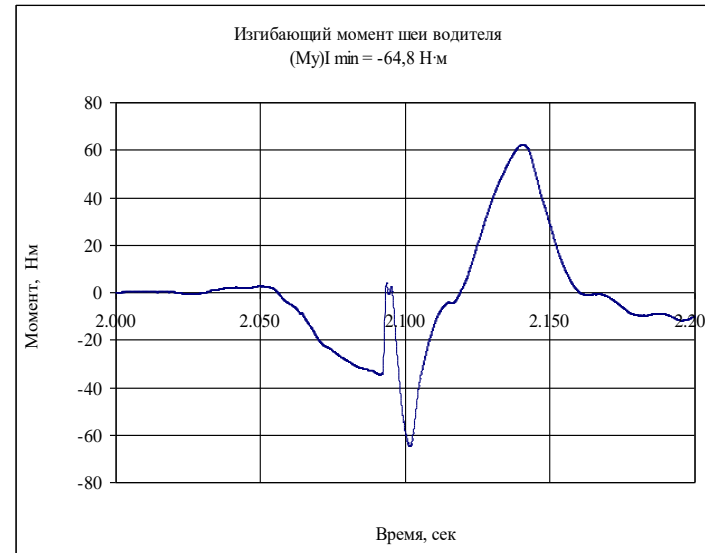
Study of the passengers' level of protection in a frontal collision  
for buses equipped with the seats with lap belts and lap-shoulder  
belts



The interaction of the dummy with the front seat backrest, lap belts, distance between the seats is **680** mm



Graph of the bending moment of the neck along the lateral axis y



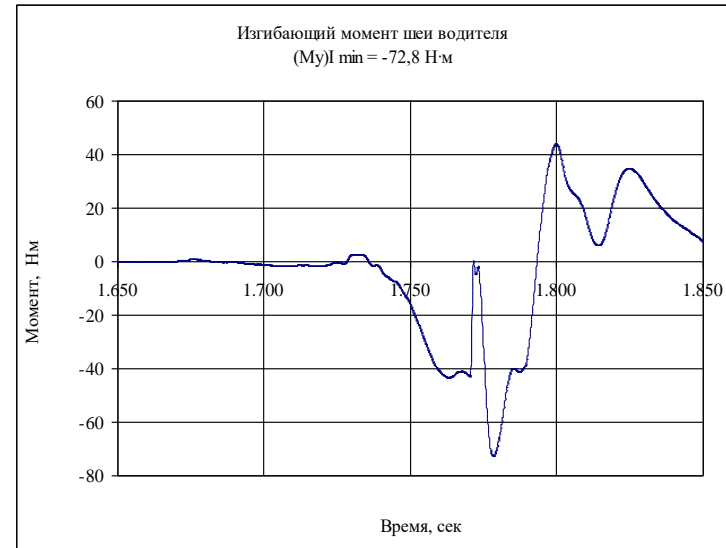
## Dummy injury criteria results

Name of parameters	Standardized value	Actual value
Head Injury Criterion (HIC) value, units	<1000	217
Resulting head acceleration for the duration T=3 ms, g	<80	45.5
Neck Injury Criterion (NIC) value		
Stretching force Fz, kN	<3.3	0.83
Shear force Fx, kN	<3.1	0.23
Bending moment My, Nm	>57	<b>-64.8</b>
Thoracic Compression Criterion (ThCC)	<50	12.4
Soft Tissue Criterion (V*C), m/s	<1	0.07
Rib Deflection Criterion FFC, kN	<9.07	
- left hip	<9.07	3.0
- right hip	<9.07	2.4

The interaction of the dummy with the front seat backrest, lap belts, distance between the seats is **780 mm**



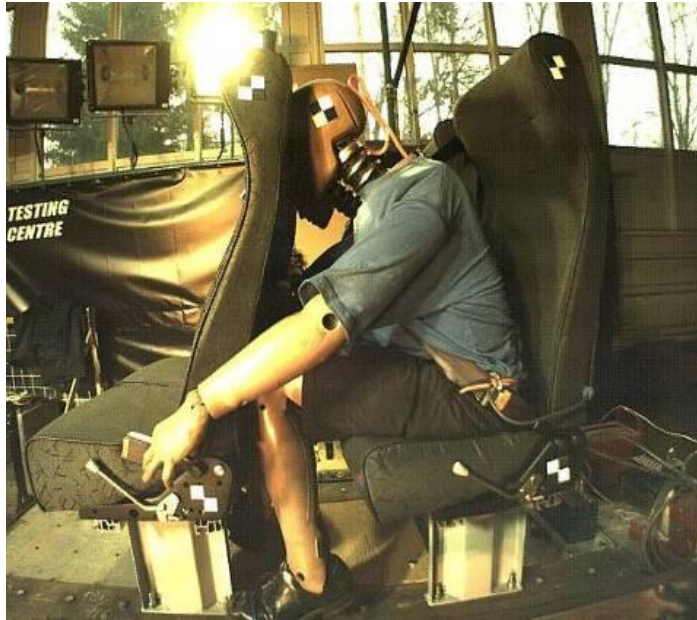
Graph of the bending moment of the neck along the lateral axis y



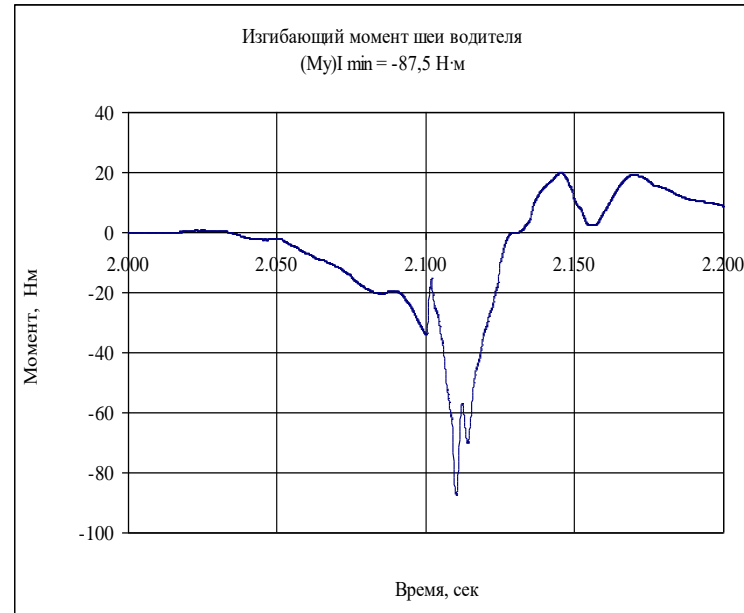
## Dummy injury criteria results

Name of parameters	Standardized value	Actual value
Head Injury Criterion (HIC) value, units	<1000	424.7
Resulting head acceleration for the duration T=3 ms, g	<80	69.4
Neck Injury Criterion (NIC) value		
Stretching force Fz, kN	<3.3	0.75
Shear force Fx, kN	<3.1	2.9
Bending moment My, Nm	>-57	<b>-72.8</b>
Thoracic Compression Criterion (ThCC)	<50	8.4
Soft Tissue Criterion (V*C), m/s	<1	0.02
Rib Deflection Criterion FFC, kN	<9.07	
- left hip	<9.07	2.2
- right hip	<9.07	2.1

The interaction of the dummy with the front seat backrest, lap-shoulder belts, distance between the seats is **680** mm



Graph of the bending moment of the neck along the lateral axis y



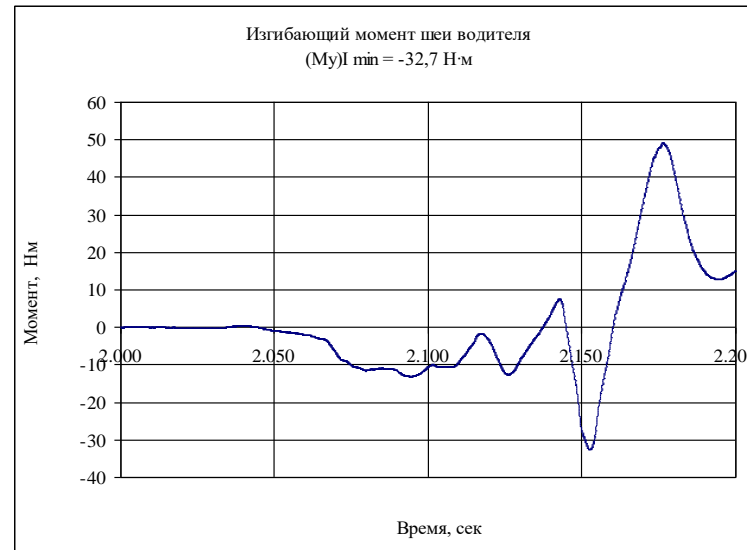
## Dummy injury criteria results

Name of parameters	Standardized value	Actual value
Head Injury Criterion (HIC) value, units	<1000	261.6
Resulting head acceleration for the duration T=3 ms, g	<80	53.5
Neck Injury Criterion (NIC) value		
Stretching force Fz, kN	<3.3	1.8
Shear force Fx, kN	<3.1	0.93
Bending moment My, Nm	>-57	<b>-87.5</b>
Thoracic Compression Criterion (ThCC)	<50	17.2
Soft Tissue Criterion (V*C), m/s	<1	0.09
Rib Deflection Criterion FFC, kN	<9.07	
- left hip	<9.07	1.1
- right hip	<9.07	1.7

The interaction of the dummy with the front seat backrest, lap-shoulder belts, distance between the seats is **680 mm**



Graph of the bending moment of the neck along the lateral axis y



## Dummy injury criteria results

Name of parameters	Standardized value	Actual value
Head Injury Criterion (HIC) value, units	<1000	115.4
Resulting head acceleration for the duration T=3 ms, g	<80	43.8
Neck Injury Criterion (NIC) value		
Stretching force Fz, kN	<3.3	0.46
Shear force Fx, kN	<3.1	0.42
Bending moment My, Nm	>-57	<b>-32.7</b>
Thoracic Compression Criterion (ThCC)	<50	12.1
Soft Tissue Criterion (V*C), m/s	<1	0.04
Rib Deflection Criterion FFC, kN	<9.07	
- left hip	<9.07	1.7
- right hip	<9.07	2.1

## Conclusion:

In the course of testing of the seats installed in 680 mm and 780 mm increments and equipped with lap belts, as a result of a frontal collision, the Dummy neck injury criterion increased to 64.8 Nm and 72.8 Nm, which exceeds the allowable standard (57 Nm) and can lead to neck injuries incompatible with tolerable values. Also, in the course of testing with the shoulder-lap belts with a distance between the seats equal to 680 mm, an increase in the Dummy neck injury criterion to 87.5 Nm was revealed, which also exceeds the allowable standard. At a distance of 730 mm with the use of shoulder-lap belts, the Dummy neck injury criterion remained within the tolerance of the standard and amounted to 32.7 Nm.

The analysis of results indicates that in result of the frontal collision the injury of the Dummy's neck occurs, therefore it is necessary to include a new paragraph in UN Regulation No. 80 concerning assessment of the Dummy neck injury criteria.

# Thank you for attention!

**Please send your questions to: Mr. Gleb Nevskiy**  
**E-mail: [g.nevskiy@autorc.ru](mailto:g.nevskiy@autorc.ru)**

