

Investigation of THOR-50M chest parts sensibility to maximum chest deflection(Rmax)

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In order to assess chest injury risk of car occupants in a frontal collision, THOR(Test Device for Human Occupant Restraint)-50M dummy is used around the world. Thorax response characteristic of THOR-50M is confirmed by chest impactor qualification test. However previous research shows that maximum chest deflection(Rmax) of THOR-50M has an individual difference because of dummy characteristic or dummy manufacturer. To address this issue, chest parts influence to Rmax was studied by simulation or component test. However, there are few studies which investigate THOR-50M chest parts sensibility in a quantitative way.

In this research, to clarify the THOR-50M chest parts sensibility to maximum chest deflection (Rmax), parameter studies which simulates frontal impact sled test(Fig.1) and chest upper impactor test(Fig.2) were conducted. The characteristic of rib #2~4, thoracic spine flex joint and bib were changed(Fig.3) and range of parameter(Table1) is decided from actual dummy measurement results.

The simulation results show that influence of chest parts has same tendency in both condition as described below.

- The thinner rib thickness is, the more Rmax increase.
- The harder thoracic spine flex joint stiffness is, the more Rmax increase.
- The softer bib stiffness is, the more Rmax increase.

The result of multiple linear regression analysis indicated that #3 chest rib has highest contribution to Rmax in both simulation conditions. From the simulation results, the mechanism of chest deflection change was considered in each case.



Fig.1 Sled FE model

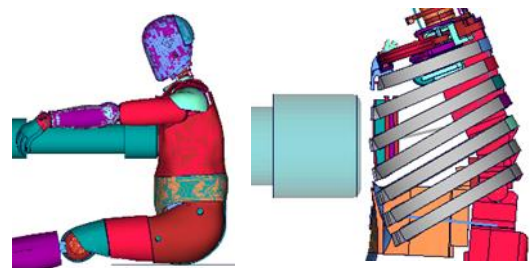


Fig.2 Chest upper impactor FE model

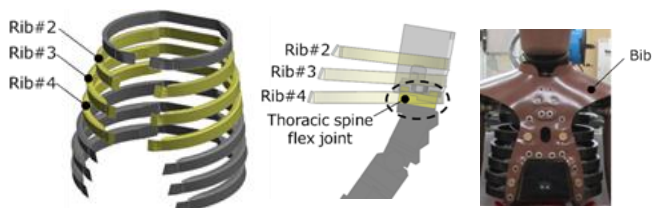


Fig.3 Chest parts of THOR-50M

(From the left, Rib#2~4, thoracic spine flex joint, bib)

Table1 Chest part parameter

Part	Parameter		
	Base -	Base	Base +
1 Rib#2(Thickness)	4.5mm	6.8mm	9.0mm
2 Rib#3(Thickness)	6.2mm	8.4mm	10.6mm
3 Rib#4(Thickness)	6.6mm	8.6mm	10.6mm
4 Thoracic spine flex joint (Stiffness)	44%	72%	100%
5 Bib(Stiffness)	75%	100%	141%