

Evaluation of WS & ES2 dummy in Pole Side Impact

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Korea Automobile Testing & Research Institute

Younghan Youn (Professor, KUT)

Objectives

- **Side impact type traffic accidents in Korea:**
 - Major source of fatality in car-to-car accidents
 - Head, thoracic injuries are the most cause of fatality
- **PSI type accident is small portion from total accidents**
 - Fatality is very high
- **Application of PSI ??**
 - Suitable for regulation ?
Any benefit ? (← reduction of head injury fatality)
 - Currently only industry select as an optional test in KNCAP
(But, most of KNCAP program cars were tested)

Overview

- **Pole Side Impact Tests according to PSI GTR draft.**
 - **Test conditions**
 - **32km/h oblique pole side impact tests (using WS 50th & ES2 for PSI GTR draft)**
 - **29km/h perpendicular pole side impact test (using ES2 for KNCAP protocol)**
 - **Injury Responses of WorldSID 50th and ES2 dummies**

Note : Test was conducted by a part of KATRI & HMC WorldSID & PSI Joint Research program

Test #1

Test data : 10 May 2012

Test speed : 29km/h

Test angular : 90 °

Test dummy : ES2



Test #1 (ES-2 with 29 kph 90 degree)

		Unit	Injury value	IARV's	Ratio
Head	HIC36		318	1,000	32%
Thorax Ribs	Deflection	mm	26.5	44	60%
	Viscous Criterion	m/s	0.19	1.0	19%
Backplate	Force (Fy)	kN	0.3	4.0	8%
T12	Force (Fy)	kN	1.21	2.0	61%
	Moment (Mx)	Nm	16	200	8%
Abdomen	Force	kN	1.23	2.5	49%
Pubic	Force	kN	5.56	6.0	93%

Test #2

Test data : 6 September 2012

Test speed : 32km/h

Test angular : 75 °

Test dummy : WorldSID 50th

Comments : Driver-side windows was opened



Test #2 (WorldSID 50 with 32 kph 75 degree)

		Unit	Injury value	Injury Criteria *	Ration
Head	HIC36		1,745	1,000	175%
Shoulder	Force (Fy) Deflection	kN mm	??? 48.0	[2.556] ???	
Thorax Ribs	deflection	mm	U. 20.0 M. 21.3 L. 24.7	[58.1] [55.4]	42% 46%
Abdomen	deflection	mm	U. 25.3 L. 33.5	[79.8]	42%
Pelvis	Pubic Force	kN	0.95	[3.365]	28%

Test #3

Test data : 14 June 2011

Test speed : 32km/h

Test angular : 75 °

Test dummy : ES2



Test #3 (ES-2 with 32 kph 75 degree)

		Unit	Injury value	IARV's	Ratio
Head	HIC36		363.7	1,000	36%
Thorax Ribs	Deflection	mm	36.9	44	84%
	Viscous Criterion	m/s	0.19	1.0	19%
Backplate	Force(Fy)	kN	0.6	4.0	15%
T12	Force(Fy)	kN	1.46	2.0	73%
	Moment(Mx)	Nm	109.5	200	55%
Abdomen	Force	kN	1.25	2.5	50%
Pubic	Force	kN	1.83	6.0	31%

Test result Analysis (ES-2)

(90 vs. 75 degree impact)

		Injury value	Ratio	Injury value	Ratio
		29 km/h with 90 degree		32 km/h with 75 degree	
Head	HIC36	318	32%	363.7	36%
Thorax Ribs	Deflection	26.5	60%	36.9	84%
	Viscous Criterion	0.19	19%	0.19	19%
Backplate	Force(Fy)	0.3	8%	0.6	15%
T12	Force(Fy)	1.21	61%	1.46	73%
	Moment(Mx)	16	8%	109.5	55%
Abdomen	Force	1.23	49%	1.25	50%
Pubic	Force	5.56	93%	1.83	31%

Test result Analysis (75 degree Impact) (ES-2 vs. WorldSID)

		Injury value	Ratio	Injury value	Ratio
		32 km/h with ES-2		32 km/h with WorldSID	
Head	HIC36	363.7	36%	1,745	175%
Thorax Ribs	Deflection (mm)	36.9	84%	24.7	42%
Abdomen	Force (kN)	1.25	50%	33.5mm (def.)	42%
Pubic	Force (kN)	1.83	31%	0.95	28%

Summary

- **With ES-2, Injury outcome from 32km/h oblique pole side impact test is more severe than 29km/h perpendicular test except pubic forces**
- **In oblique pole test, Injuries of WorldSID are lower than ES2 except HIC. A very high HIC is seem to be unusual with a curtain airbag.**
- **Level of injury (%) in terms of 50% injury risk in two dummies are similar in abdomen and pelvis injuries in oblique tests**
- **In oblique test, % of ES-2 rib deflection injury in terms of 50% injury risk is up to 84%, but WorldSID was 42 [46]%.**

**Thank you
for your attention!**

kimdeaup@ts2020.kr

