



# TEST REPORT

Issuing No : CC-07-01

## APPLICANT

COMPANY : Shindo Industry Co. Ltd.

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Pajusi Kyunggido Korea (☎82-1588-0490)

PRESIDENT : Whang, Y.S.

## TEST ARTICLE

1. Name : Crash Cushion-CCS80
2. Dimensions : 800(W) × 1,000(H) × 4,500(L) mm
3. Facility Type / Test Level : Redirective Type / CC2 Class
4. Test Method : Head-on center(900kg, 1300kg) / Head-on, 1/4 vehicle offset / Nose (center) at 15° / Side Impact at 15° / Side Impact at 165°

## EVALUATION CRITERIA

"Installation and Maintenance Guidelines for Roadside Safety Appurtenance ; Vehicle Restraint System", Ministry of Construction and Transportation, Korea.

We issue this test report which contains the results of experiments by upper evaluation criteria.

- Attachment :
1. Evaluation Tables for Crash Cushion Test Results.
  2. Test Photographs
  3. Drawings

Issuing Date : 13 February 2007

President of KOTSA



<Attachment 1>

## Evaluation Tables for Crash Cushion Test Results

- Head-on Center (Test① 900Kg)

PRODUCT NAME	Crash Cushion-CCS80	COMPANY	Shindo Industry Co. Ltd.		
<b>PRODUCT INFORMATION</b>					
TYPE	<input checked="" type="checkbox"/> Redirective <input type="checkbox"/> Non-Redirective	LEVEL	CC2		
DIMENSTIONS	800(W) × 1,000(H) × 4,500(L) mm				
MATERIAL	Interior Filling Material, Cable, Support Tank/Frame etc.				
FOUNDATION TYPE	Concrete Foundation				
REMARK	The product needs to be installed at least 50cm apart from the structure				
<b>TEST AUTHORITY</b>					
NAME	KOTSA	FACILITY NAME	Crash Cushion		
TEST DATE	18 January 2007	TEST NO.	070118F900		
<b>TEST CONDITION</b>					
IMPACT METHOD	<input checked="" type="checkbox"/> Head-on center <input type="checkbox"/> Head-on, 1/4 vehicle offset <input type="checkbox"/> Nose(center) at 15° <input type="checkbox"/> Side Impact at 15° <input type="checkbox"/> Side Impact at 165°				
TEST CRITERIA	VEHICLE WEIGHT(kg)	900	TEST CONDITION	VEHICLE WEIGHT(kg)	902
	VELOCITY (km/h)	80		VELOCITY (km/h)	81.0
<b>TEST RESULTS</b>					
<b>A. OCCUPANTS SAFETY</b>					
	CRITERIA		RESULTS		
THIV	≤12m/s (44km/h)		43.0 km/h		
PHD	≤20g (g=9.8m/s <sup>2</sup> )		11.0 g		

Note)  : Indication of applied type or test



## - Head-on Center (Test① 900Kg)

TEST RESULTS	
<b>B. CRASH CUSHION BEHAVIOR</b>	
EVALUATION CRITERIA	TEST RESULTS
(1) Elements of the crash cushion shall not penetrate the passenger compartment of the vehicle.	No penetrations
(2) Deformations of, or intrusions into, the passenger compartment, that could cause serious injuries to the occupant, are not permitted.	No intrusions or deformations
(3) No major element of the crash cushion shall become totally detached. <Grades according to deformation and scattering or the crash cushion> (D1 : 0.5m, D2 : 1.0m, D3 : 2.0m, D4 : 3.0m)	No detachments or scatters Grade : D1(0.03m)
(4) The deformed crash cushion shall not encroach into the front surface of the obstacle.	No encroachment
<b>C. TEST VEHICLE BEHAVIOR AFTER COLLISION</b>	
(1) The vehicle shall remain upright during and after collision.	Be upright
(2) The vehicle shall not encroach into the front surface of the obstacle.	No encroachment
(3) The tires of the vehicle shall not encroach the lines of the exit box unless the velocity of the vehicle center of gravity at the instant of encroachment is less than 10% of the prescribed impact speed. (Front : 6m, Left/Right : 4m or 6m Back : extended line of the end of the test facility)	No encroachment The vehicle stopped at a distance of 5.22m from the front end of the crash cushion.
(4) The grades of crash cushions shall be raked according to the distances from the left and right boundaries of test facility. (Z1 : 4m, Z2 : 6m)	Grade : Z2
ASSESSMENT	<b>PASS</b> (Standard Satisfied)



## Evaluation Tables for Crash Cushion Test Results

- Head-on Center (Test① 1300Kg)

PRODUCT NAME	Crash Cushion-CCS80	COMPANY	Shindo Industry Co. Ltd.		
<b>PRODUCT INFORMATION</b>					
TYPE	<input checked="" type="checkbox"/> Redirective <input type="checkbox"/> Non-Redirective	LEVEL	CC2		
DIMENSTIONS	800(W) × 1,000(H) × 4,500(L) mm				
MATERIAL	Interior Filling Material, Cable, Support Tank/Frame etc.				
FOUNDATION TYPE	Concrete Foundation				
REMARK	The product needs to be installed at least 50cm apart from the structure				
<b>TEST AUTHORITY</b>					
NAME	KOTSA	FACILITY NAME	Crash Cushion		
TEST DATE	16 January 2007	TEST NO.	070116F1300		
<b>TEST CONDITION</b>					
IMPACT METHOD	<input checked="" type="checkbox"/> Head-on center <input type="checkbox"/> Head-on, 1/4 vehicle offset <input type="checkbox"/> Nose(center) at 15° <input type="checkbox"/> Side Impact at 15° <input type="checkbox"/> Side Impact at 165°				
TEST CRITERIA	VEHICLE WEIGHT(kg)	1300	TEST CONDITION	VEHICLE WEIGHT(kg)	1302
	VELOCITY (km/h)	80		VELOCITY (km/h)	81.3
<b>TEST RESULTS</b>					
<b>A. OCCUPANTS SAFETY</b>					
		CRITERIA	RESULTS		
THIV		≤12m/s (44km/h)	41.6 km/h		
PHD		≤20g (g=9.8m/s <sup>2</sup> )	15.4 g		

Note)  : Indication of applied type or test





- Head-on Center (Test① 1300Kg)

TEST RESULTS	
<b>B. CRASH CUSHION BEHAVIOR</b>	
EVALUATION CRITERIA	TEST RESULTS
(1) Elements of the crash cushion shall not penetrate the passenger compartment of the vehicle.	No penetrations
(2) Deformations of, or intrusions into, the passenger compartment, that could cause serious injuries to the occupant, are not permitted.	No intrusions or deformations
(3) No major element of the crash cushion shall become totally detached. <Grades according to deformation and scattering or the crash cushion> (D1 : 0.5m, D2 : 1.0m, D3 : 2.0m, D4 : 3.0m)	No detachments or scatters Grade : D1(0.03m)
(4) The deformed crash cushion shall not encroach into the front surface of the obstacle.	No encroachment
<b>C. TEST VEHICLE BEHAVIOR AFTER COLLISION</b>	
(1) The vehicle shall remain upright during and after collision.	Be upright
(2) The vehicle shall not encroach into the front surface of the obstacle.	No encroachment
(3) The tires of the vehicle shall not encroach the lines of the exit box unless the velocity of the vehicle center of gravity at the instant of encroachment is less than 10% of the prescribed impact speed. (Front : 6m, Left/Right : 4m or 6m Back : extended line of the end of the test facility)	No encroachment The vehicle stopped at a distance of 5.76m from the front end of the crash cushion.
(4) The grades of crash cushions shall be raked according to the distances from the left and right boundaries of test facility. (Z1 : 4m, Z2 : 6m)	Grade : Z2
<b>ASSESSMENT</b>	<b>PASS (Standard Satisfied)</b>



## Evaluation Tables for Crash Cushion Test Results

- Head-on, 1/4 vehicle offset (Test② 900Kg)

PRODUCT NAME	Crash Cushion-CCS80	COMPANY	Shindo Industry Co. Ltd.		
<b>PRODUCT INFORMATION</b>					
TYPE	<input checked="" type="checkbox"/> Redirective <input type="checkbox"/> Non-Redirective	LEVEL	CC2		
DIMENSTIONS	800(W) × 1,000(H) × 4,500(L) mm				
MATERIAL	Interior Filling Material, Cable, Support Tank/Frame etc.				
FOUNDATION TYPE	Concrete Foundation				
REMARK	The product needs to be installed at least 50cm apart from the structure				
<b>TEST AUTHORITY</b>					
NAME	KOTSA	FACILITY NAME	Crash Cushion		
TEST DATE	31 January 2007	TEST NO.	070131F900		
<b>TEST CONDITION</b>					
IMPACT METHOD	<input type="checkbox"/> Head-on center <input checked="" type="checkbox"/> Head-on, 1/4 vehicle offset <input type="checkbox"/> Nose(center) at 15° <input type="checkbox"/> Side Impact at 15° <input type="checkbox"/> Side Impact at 165°				
TEST CRITERIA	VEHICLE WEIGHT(kg)	900	TEST CONDITION	VEHICLE WEIGHT(kg)	903
	VELOCITY (km/h)	80		VELOCITY (km/h)	81.0
<b>TEST RESULTS</b>					
<b>A. OCCUPANTS SAFETY</b>					
		CRITERIA		RESULTS	
	THIV		≤12m/s (44km/h)		42.5 km/h
	PHD		≤20g (g=9.8m/s <sup>2</sup> )		8.4 g

Note)  : Indication of applied type or test





- Head-on, 1/4 vehicle offset (Test② 900Kg)

TEST RESULTS	
<b>B. CRASH CUSHION BEHAVIOR</b>	
EVALUATION CRITERIA	TEST RESULTS
(1) Elements of the crash cushion shall not penetrate the passenger compartment of the vehicle.	No penetrations
(2) Deformations of, or intrusions into, the passenger compartment, that could cause serious injuries to the occupant, are not permitted.	No intrusions or deformations
(3) No major element of the crash cushion shall become totally detached. <Grades according to deformation and scattering or the crash cushion> (D1 : 0.5m, D2 : 1.0m, D3 : 2.0m, D4 : 3.0m)	No detachments or scatters Grade : D1(0.18m)
(4) The deformed crash cushion shall not encroach into the front surface of the obstacle.	No encroachment
<b>C. TEST VEHICLE BEHAVIOR AFTER COLLISION</b>	
(1) The vehicle shall remain upright during and after collision.	Be upright
(2) The vehicle shall not encroach into the front surface of the obstacle.	No encroachment
(3) The tires of the vehicle shall not encroach the lines of the exit box unless the velocity of the vehicle center of gravity at the instant of encroachment is less than 10% of the prescribed impact speed. (Front : 6m, Left/Right : 4m or 6m Back : extended line of the end of the test facility)	The rear tires crossed the lines. The vehicle stopped at a distance of 6m from the front end of the crash cushion. The encroaching velocity / was 5km/h
(4) The grades of crash cushions shall be raked according to the distances from the left and right boundaries of test facility. (Z1 : 4m, Z2 : 6m)	Grade : Z2
ASSESSMENT	<b>PASS</b> (Standard Satisfied)



## Evaluation Tables for Crash Cushion Test Results

- Nose (center) at 15° (Test③ 1300Kg)

PRODUCT NAME	Crash Cushion-CCS80	COMPANY	Shindo Industry Co. Ltd.		
<b>PRODUCT INFORMATION</b>					
TYPE	<input checked="" type="checkbox"/> Redirective <input type="checkbox"/> Non-Redirective	LEVEL	CC2		
DIMENSTIONS	800(W) × 1,000(H) × 4,500(L) mm				
MATERIAL	Interior Filling Material, Cable, Support Tank/Frame etc.				
FOUNDATION TYPE	Concrete Foundation				
REMARK	The product needs to be installed at least 50cm apart from the structure				
<b>TEST AUTHORITY</b>					
NAME	KOTSA	FACILITY NAME	Crash Cushion		
TEST DATE	22 January 2007	TEST NO.	070122F1300		
<b>TEST CONDITION</b>					
IMPACT METHOD	<input type="checkbox"/> Head-on center <input type="checkbox"/> Head-on, 1/4 vehicle offset <input checked="" type="checkbox"/> Nose(center) at 15° <input type="checkbox"/> Side Impact at 15° <input type="checkbox"/> Side Impact at 165°				
TEST CRITERIA	VEHICLE WEIGHT(kg)	1300	TEST CONDITION	VEHICLE WEIGHT(kg)	1303
	VELOCITY (km/h)	80		VELOCITY (km/h)	81.1
<b>TEST RESULTS</b>					
<b>A. OCCUPANTS SAFETY</b>					
		CRITERIA		RESULTS	
	THIV		≤12m/s (44km/h)		39.2 km/h
	PHD		≤20g (g=9.8m/s <sup>2</sup> )		10.9 g

Note)  : Indication of applied type or test





- Nose (center) at 15° (Test③ 1300Kg)

TEST RESULTS	
<b>B. CRASH CUSHION BEHAVIOR</b>	
EVALUATION CRITERIA	TEST RESULTS
(1) Elements of the crash cushion shall not penetrate the passenger compartment of the vehicle.	No penetrations
(2) Deformations of, or intrusions into, the passenger compartment, that could cause serious injuries to the occupant, are not permitted.	No intrusions or deformations
(3) No major element of the crash cushion shall become totally detached. <Grades according to deformation and scattering or the crash cushion> (D1 : 0.5m, D2 : 1.0m, D3 : 2.0m, D4 : 3.0m)	No detachments or scatters Grade : D1(0.29m)
(4) The deformed crash cushion shall not encroach into the front surface of the obstacle.	No encroachment
<b>C. TEST VEHICLE BEHAVIOR AFTER COLLISION</b>	
(1) The vehicle shall remain upright during and after collision.	Be upright
(2) The vehicle shall not encroach into the front surface of the obstacle.	No encroachment
(3) The tires of the vehicle shall not encroach the lines of the exit box unless the velocity of the vehicle center of gravity at the instant of encroachment is less than 10% of the prescribed impact speed. (Front : 6m, Left/Right : 4m or 6m Back : extended line of the end of the test facility)	The rear tires crossed the lines. The vehicle stopped at a distance of 16.6m from the front end of the crash cushion. The encroaching velocity was 5km/h
(4) The grades of crash cushions shall be raked according to the distances from the left and right boundaries of test facility. (Z1 : 4m, Z2 : 6m)	Grade : Z2
ASSESSMENT	<b>PASS</b> (Standard Satisfied)

## Evaluation Tables for Crash Cushion Test Results

- Side Impact at 15° (Test④ 1300Kg)

PRODUCT NAME	Crash Cushion-CCS80	COMPANY	Shindo Industry Co. Ltd.		
<b>PRODUCT INFORMATION</b>					
TYPE	<input checked="" type="checkbox"/> Redirective <input type="checkbox"/> Non-Redirective	LEVEL	CC2		
DIMENSTIONS	800(W) × 1,000(H) × 4,500(L) mm				
MATERIAL	Interior Filling Material, Cable, Support Tank/Frame etc.				
FOUNDATION TYPE	Concrete Foundation				
REMARK	The product needs to be installed at least 50cm apart from the structure				
<b>TEST AUTHORITY</b>					
NAME	KOTSA	FACILITY NAME	Crash Cushion		
TEST DATE	02 February 2007	TEST NO.	070202S1300		
<b>TEST CONDITION</b>					
IMPACT METHOD	<input type="checkbox"/> Head-on center <input type="checkbox"/> Head-on, 1/4 vehicle offset <input type="checkbox"/> Nose(center) at 15° <input checked="" type="checkbox"/> Side Impact at 15° <input type="checkbox"/> Side Impact at 165°				
TEST CRITERIA	VEHICLE WEIGHT(kg)	1300	TEST CONDITION	VEHICLE WEIGHT(kg)	1304
	VELOCITY (km/h)	80		VELOCITY (km/h)	81.2
<b>TEST RESULTS</b>					
<b>A. OCCUPANTS SAFETY</b>					
		CRITERIA		RESULTS	
	THIV		≤9m/s (33km/h)		23.5 km/h
	PHD		≤20g (g=9.8m/s <sup>2</sup> )		5.5 g

Note)  : Indication of applied type or test





- Side Impact at 15° (Test④ 1300Kg)

TEST RESULTS	
<b>B. CRASH CUSHION BEHAVIOR</b>	
EVALUATION CRITERIA	TEST RESULTS
(1) Elements of the crash cushion shall not penetrate the passenger compartment of the vehicle.	No penetrations
(2) Deformations of, or intrusions into, the passenger compartment, that could cause serious injuries to the occupant, are not permitted.	No intrusions or deformations
(3) No major element of the crash cushion shall become totally detached. <Grades according to deformation and scattering or the crash cushion> (D1 : 0.5m, D2 : 1.0m, D3 : 2.0m, D4 : 3.0m)	No detachments or scatters Grade : D1(0.02m)
(4) The deformed crash cushion shall not encroach into the front surface of the obstacle.	No encroachment
<b>C. TEST VEHICLE BEHAVIOR AFTER COLLISION</b>	
(1) The vehicle shall remain upright during and after collision.	Be upright
(2) The vehicle shall not encroach into the front surface of the obstacle.	No encroachment
(3) The tires of the vehicle shall not encroach the lines of the exit box unless the velocity of the vehicle center of gravity at the instant of encroachment is less than 10% of the prescribed impact speed. (Front : 6m, Left/Right : 4m or 6m Back : extended line of the end of the test facility)	No encroachment (0.3m)
(4) The grades of crash cushions shall be raked according to the distances from the left and right boundaries of test facility. (Z1 : 4m, Z2 : 6m)	Grade : Z1
<b>ASSESSMENT</b>	<b>PASS (Standard Satisfied)</b>





## Evaluation Tables for Crash Cushion Test Results

- Side Impact at 165° (Test⑤ 1300Kg)

PRODUCT NAME	Crash Cushion-CCS80	COMPANY	Shindo Industry Co. Ltd.		
<b>PRODUCT INFORMATION</b>					
TYPE	<input checked="" type="checkbox"/> Redirective <input type="checkbox"/> Non-Redirective	LEVEL	CC2		
DIMENSTIONS	800(W) × 1,000(H) × 4,500(L) mm				
MATERIAL	Interior Filling Material, Cable, Support Tank/Frame etc.				
FOUNDATION TYPE	Concrete Foundation				
REMARK	The product needs to be installed at least 50cm apart from the structure				
<b>TEST AUTHORITY</b>					
NAME	KOTSA	FACILITY NAME	Crash Cushion		
TEST DATE	05 February 2007	TEST NO.	070205S1300		
<b>TEST CONDITION</b>					
IMPACT METHOD	<input type="checkbox"/> Head-on center <input type="checkbox"/> Head-on, 1/4 vehicle offset <input type="checkbox"/> Nose(center) at 15° <input type="checkbox"/> Side Impact at 15° <input checked="" type="checkbox"/> Side Impact at 165°				
TEST CRITERIA	VEHICLE WEIGHT(kg)	1300	TEST CONDITION	VEHICLE WEIGHT(kg)	1303
	VELOCITY (km/h)	80		VELOCITY (km/h)	81.2
<b>TEST RESULTS</b>					
<b>A. OCCUPANTS SAFETY</b>					
		CRITERIA		RESULTS	
	THIV	≤9m/s (33km/h)		16.2 km/h	
	PHD	≤20g (g=9.8m/s <sup>2</sup> )		3.8 g	

Note)  : Indication of applied type or test





- Side Impact at 165° (Test⑤ 1300Kg)

TEST RESULTS	
<b>B. CRASH CUSHION BEHAVIOR</b>	
EVALUATION CRITERIA	TEST RESULTS
(1) Elements of the crash cushion shall not penetrate the passenger compartment of the vehicle.	No penetrations
(2) Deformations of, or intrusions into, the passenger compartment, that could cause serious injuries to the occupant, are not permitted.	No intrusions or deformations
(3) No major element of the crash cushion shall become totally detached. <Grades according to deformation and scattering or the crash cushion> (D1 : 0.5m, D2 : 1.0m, D3 : 2.0m, D4 : 3.0m)	No detachments or scatters Grade : D1(0.06m)
(4) The deformed crash cushion shall not encroach into the front surface of the obstacle.	No encroachment
<b>C. TEST VEHICLE BEHAVIOR AFTER COLLISION</b>	
(1) The vehicle shall remain upright during and after collision.	Be upright
(2) The vehicle shall not encroach into the front surface of the obstacle.	No encroachment
(3) The tires of the vehicle shall not encroach the lines of the exit box unless the velocity of the vehicle center of gravity at the instant of encroachment is less than 10% of the prescribed impact speed. (Front : 6m, Left/Right : 4m or 6m Back : extended line of the end of the test facility)	No encroachment (0.3m)
(4) The grades of crash cushions shall be raked according to the distances from the left and right boundaries of test facility. (Z1 : 4m, Z2 : 6m)	Grade : Z1
<b>ASSESSMENT</b>	<b>PASS</b> (Standard Satisfied)



<Attachment 2>

- Head-on Center (Test① 900Kg)



- Head-on Center (Test① 1300Kg)



- Head-on, 1/4 vehicle offset (Test②) 900Kg





- Nose (center) at 15° (Test③ 1300Kg)



- Side Impact at 15° (Test④ 1300Kg)



- Side Impact at 165° (Test⑤ 1300Kg)



<Attachment 1>

