TO: The George Washington University - National Crash Analysis Center
Aortic Injury Project Support

FROM: Pradeep Mohan, National Crash Analysis Center

DATE: Sept 9, 2005

SUB: Y-damage car-to-car test

OBJECTIVE:

Conduct a full scale crash test to obtain crush measures and acceleration data for a Y-damage crush pattern.

DISCUSSION:

A full scale crash test was conducted at the Federal Highway Administration (FHWA) Federal Outdoor Impact Laboratory (FOIL). The bullet vehicle was a 1994 Chevy S10 pick up truck and the target vehicle was a 1996 Ford Taurus. The impact speed was 48 km/h. The bullet vehicle was pulled into the target vehicle using the FOIL track rail towing system, and it was released to be freewheeling and unrestrained just before impact. The centerline of the bullet vehicle was aligned to impact the A-pillar of the target vehicle. Appendix A provides additional details about the test article, camera views and instrumentation. The pictures taken during impact are shown in Appendix B.

Appendix A

GENERAL	
TEST NO.	03003
DATE	5/8/03
TIME	3:00 pm
WEATHER	Partly Cloudy
TEST CONFIGURATION	S-10 to A-pillar of Taurus
SPEED (KM/H)	48 km/h
PURPOSE	

COMMENTS

Front driver seat set at mid track position with a 22 degrees inclination angle for the seat back

Digital Speed Trap: 29.69 mph (47.782 km/h)

VEHICLE 1 TEST PARAMETERS

Veh No: 1 **Test No:** 03003 **Date:** 05/08/03

Make:	Chevrolet
Model:	S-10
Year:	1994
Color:	White
Engine:	2.2 L I4
Vin No.:	1GCCS1445R8102788

Measured Curb mass (Kg)

LF:	367.50
RF:	361.00
LR:	288.50
RR:	276.50

Location of Vehicle CG (cm)

X-Axis (from LF to LR):	120.10
Y-Axis (From LF to RF):	68.20
Z-Axis (From Ground):	35.00

Measured Test Inertial Mass (Kg)

LF:	426.00
RF:	390.00
LR:	431.50
RR:	443.00

Location of CG Accelerometer (cm)

X-Axis (from LF to LR):	119.50
Y-Axis (From LF to RF):	77.50
Z-Axis (From Ground):	35.00

	Items Removed	Mass (Kg)	Added	Mass (Kg)
1	Shifter	2.50	Ballast plates	225.00
2	Fluids	13.00	Instrumentation tray	25.50
3	Jack Case and Jack	6.50	Data Acquisition	6.50
4			Battery box	21.00
5			Brake system	14.00
6			Camera tripod	46.00
7			Camera bracket	2.50
8			Camera	5.00
9			H-II Dummy	73.50
10				
11				
12				
	Total Mass Removed (Kg) =	22.00	**Total Mass Added (Kg) =**	419.00

Measured Curb Mass =	1,293.50
Removed Total =	22.00
Stripped Vehicle Mass =	1,271.50
Added Mass =	419.00
Calculated Test Inertial Mass =	1,690.50
Measured Test Inertial Mass =	1,690.50

All weights are in Kg

VEHICLE 1 TEST PARAMETERS

Date: 5/8/03 **Test No.:** 03003 **VIN No.:** 1GCCS1445R8102788

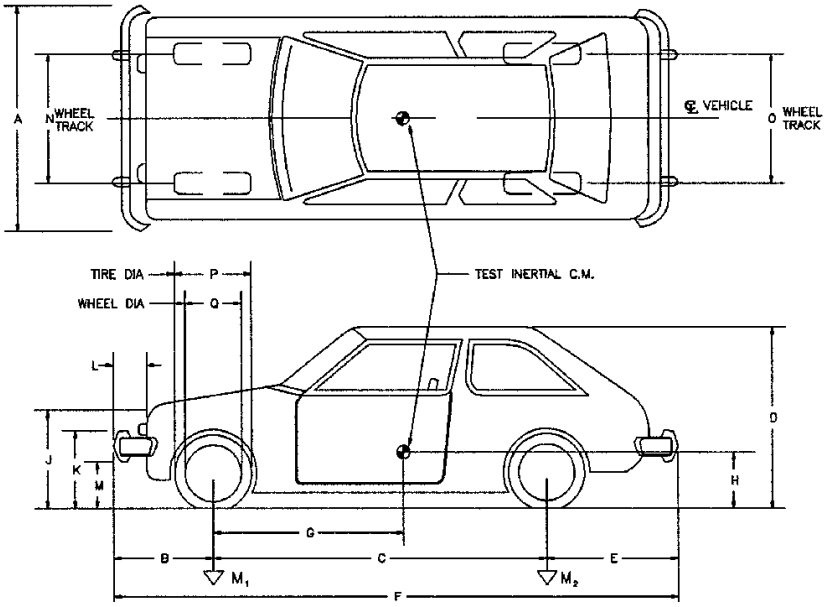
Make: Chevrolet **Year**: 1994 **Model**: S-10

Tire Inflation Pressure: 35 psi **Odometer:** 107207 **Tire Size:** P20570R15

Mass Distribution (kg) **LF:** 367.5 **RF:** 361.0

RR: 276.5 **LR:** 288.5

Describe any damage to vehicle prior to test:



Engine Type: 4 Cylinder

Engine CID: 2.2

Transmission Type:

☐ **Auto**

X **Manual**

Optional Equipment:

Dummy Data:

Type: Hybrid II

Mass: 73.5 Kg

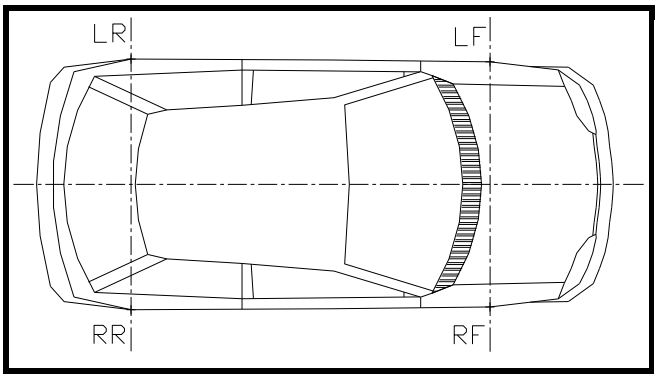
Seat Position: Driver side

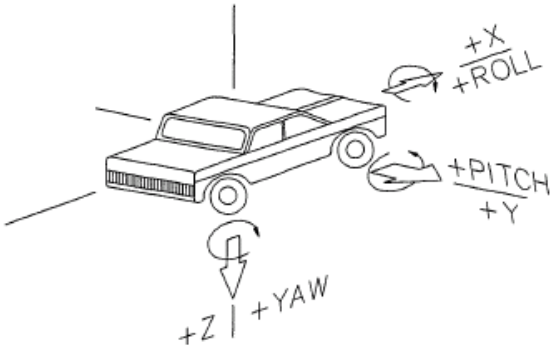
Geometry - (cm):

A: 160.5	**D:** 149	**G:** 119.5	**K:** 58.7	**N:** 159.5	**Q:** 41.5
B: 85.7	**E:** 115.5	**H:** 38.5	**L:** 7.0	**O:** 158.5	**R:**
C: 275.0	**F:** 477.0	**J:** 84.5	**M:** 32.0	**P:** 66.0	

Mass – (kg)	**Curb**	**Test Inertial**	**Gross Static**
M_1	728.50	816.00	816.00
M_2	565.00	874.50	874.50
M_T	1293.50	1690.50	1690.50

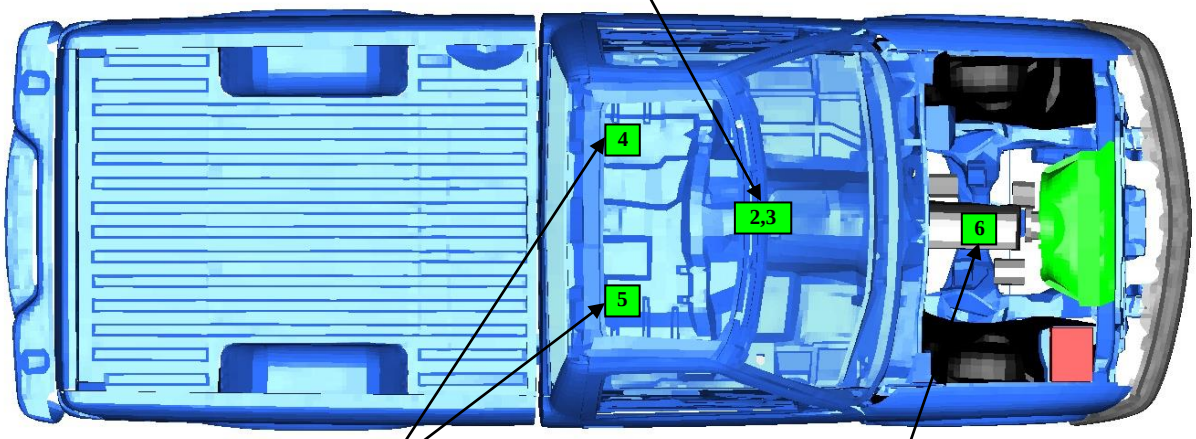
VEHICLE 1 SENSORS LOCATION





CH.	LOCATION	X (cm) From frt. axle	Y (cm) From centerline	Z (cm) From ground	SERIAL NO.	AXIS
1	Engine Cradle	+8.0	0	-	98D17-B09	+X
2	C.G.	-88.0	-76.0	39.1	Entran 98D27-B07	+X
3	C.G.	-88.0	-76.0	39.1	Entran 98D27-B08	+Y
4	Under Driver Seat	-137.0	-34.0	37.1	D12654	+X
5	Under Passenger Seat	-145	32.0	37.1	D12820	+X
6	Engine Top	-9.5	5.2	-	B187906	+X
7	Left Front Rail	-27.0	-24.0	-	J14364	+X
8	Right Front Rail	-19.0	37.0		J14381	+X
9	Engine Bottom (Oil Pan)	-23.0	0		98D27-B03	+X
10						
11						
12						
13						
15						
16						
17						
18						

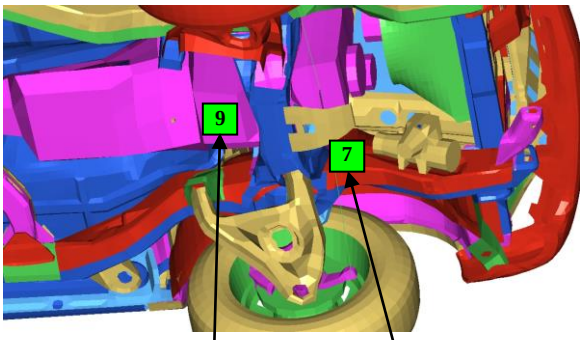
VEHICLE 1 SENSORS LOCATION

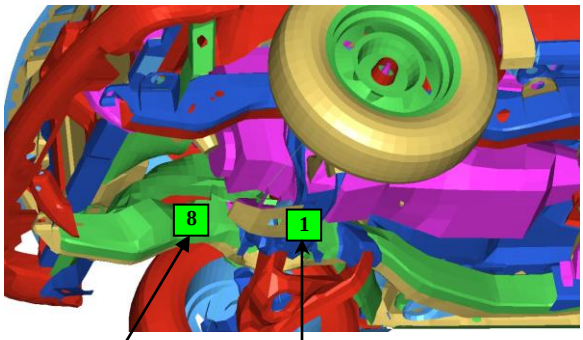


7264B accelerometer block in the x and y directions at vehicle center of gravity (c.g.)

7264B accelerometer block in the x direction under the seat

7264B accelerometer block in the x direction on the top of the engine block





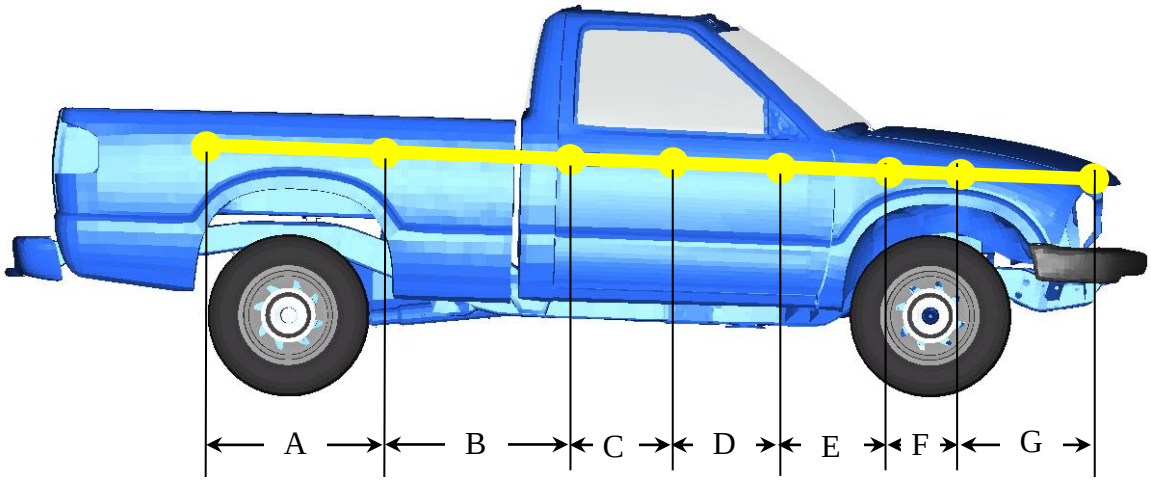
7265AM3 accelerometer block in the x direction at driver side front rail.

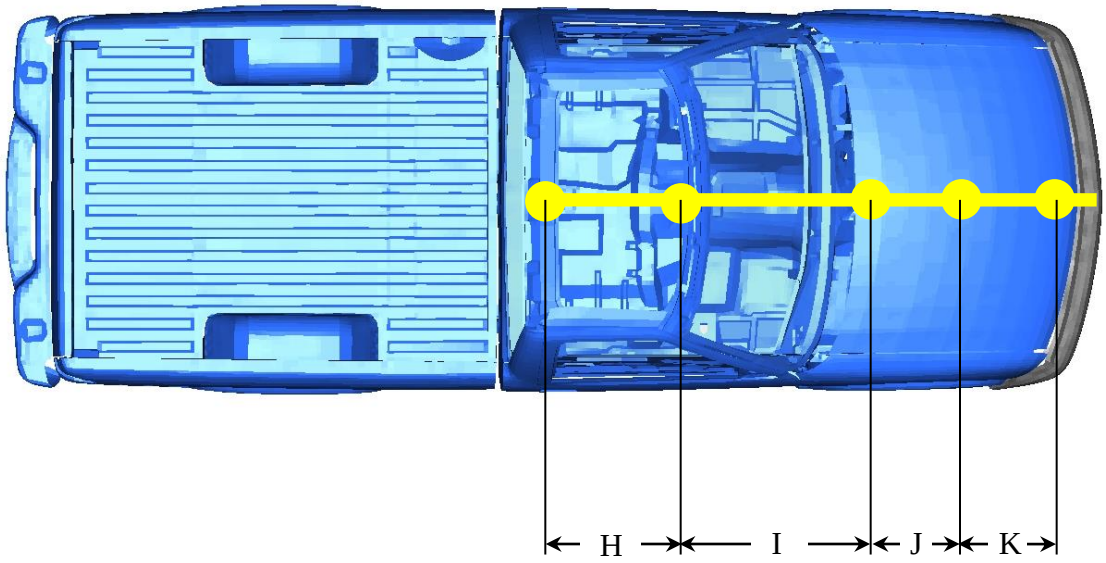
7265AM3 accelerometer block in the x direction at driver side front rail.

7264B accelerometer block in the x direction at the bottom of the engine (oil pan)

7264B accelerometer block at the center of the engine cradle

VEHICLE 1 TARGETS LOCATION





Geometry (cm)

A: 89.5	**D:** 61.0	**G:** 45.5	**J:** 46.2
B: 89.0	**E:** 11.0	**H:** 65.0	**K:** 46.2
C: 60.5	**F:** 45.0	**I:** 75.8	**L:**

VEHICLE 2 TEST PARAMETERS

Veh No: 2 **Test No:** 03003 **Date:** 05/08/03

Make:	Ford
Model:	Taurus
Year:	1996
Color:	Burgendy
Engine:	3.0L V6
Vin No.:	1FALP5359TA121424

Measured Curb mass (Kg)

LF:	507.50
RF:	481.00
LR:	264.50
RR:	265.50

Location of Vehicle CG (cm)

X-Axis (from LF to LR):	97.70
Y-Axis (From LF to RF):	74.80
Z-Axis (From Ground):	

Measured Test Inertial Mass (Kg)

LF:	485.00
RF:	485.00
LR:	258.00
RR:	282.00

Location of CG Accelerometer (cm)

X-Axis (from LF to LR):	88.30
Y-Axis (From LF to RF):	67.50
Z-Axis (From Ground):	43.60

	Items Removed	Mass (Kg)	Added	Mass (Kg)
1	Seat	21.00	Instrumentation tray	11.50
2	Spare tire	13.50	Battery box	21.00
3	Trim and carpet	6.50	Camera	5.00
4	Fluids	7.00	Camera bracket	2.50
5	Center console	12.50	Camera door mount	8.00
6	Window	3.00	Data Acquisition	6.50
7	Door panels L and R	8.00	String pots mount	17.00
8				
9				
10				
11				
12				
	Total Mass Removed (Kg) =	71.50	**Total Mass Added (Kg) =**	71.50

Measured Curb Mass =	1,518.50
Removed Total =	71.50
Stripped Vehicle Mass =	1,447.00
Added Mass =	71.50
Calculated Test Inertial Mass =	1,518.50
Measured Test Inertial Mass =	1,510.00

All weights are in Kg

VEHICLE 2 TEST PARAMETERS

Date: 5/8/03 **Test No.:** 03-003 **VIN No.:** 1FALP5359TA121424

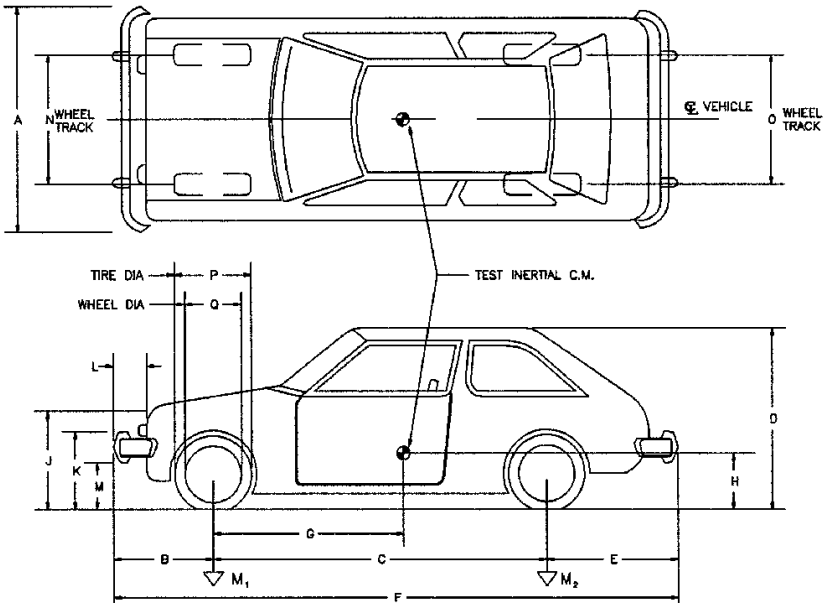
Make: Ford **Year**: 1996 **Model**: Taurus

Tire Inflation Pressure: 44 psi **Odometer:** 61526 **Tire Size:** P20565R15

Mass Distribution (kg) **LF:** 507.5 **RF:** 485.0

RR: 258.0 **LR:** 282.0

Describe any damage to vehicle prior to test:



Engine Type: V6

Engine CID: 3.0 L

Transmission Type:

X Auto

☐ Manual

Optional Equipment:

Dummy Data:

Type:

Mass:

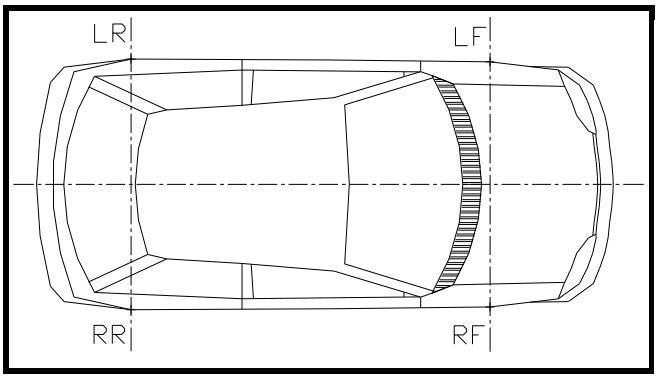
Seat Position:

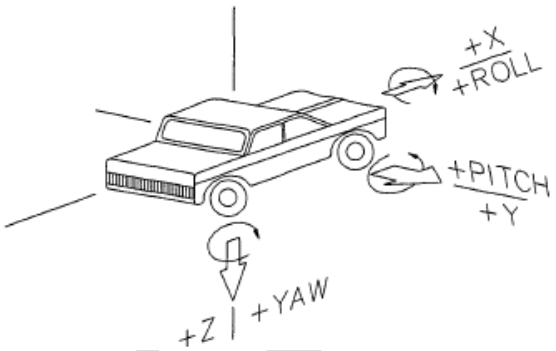
Geometry (cm)

A: 167.0	**D:** 139.0	**G:**	**K:** 53.0	**N:** 178.0	**Q:** 42.0
B: 103.0	**E:** 113.0	**H:**	**L:** 65.0	**O:** 174.0	**R:**
C: 276.0	**F:** 486.0	**J: 66.0**	**M:** 25.0	**P:** 64.5	

Mass – (kg)	**Curb**	**Test Inertial**	**Gross Static**
M_1	988.50	970.00	970.00
M_2	530.00	540.00	540.00
M_T	1518.50	1510.00	1510.00

VEHICLE 2 SENSORS LOCATION

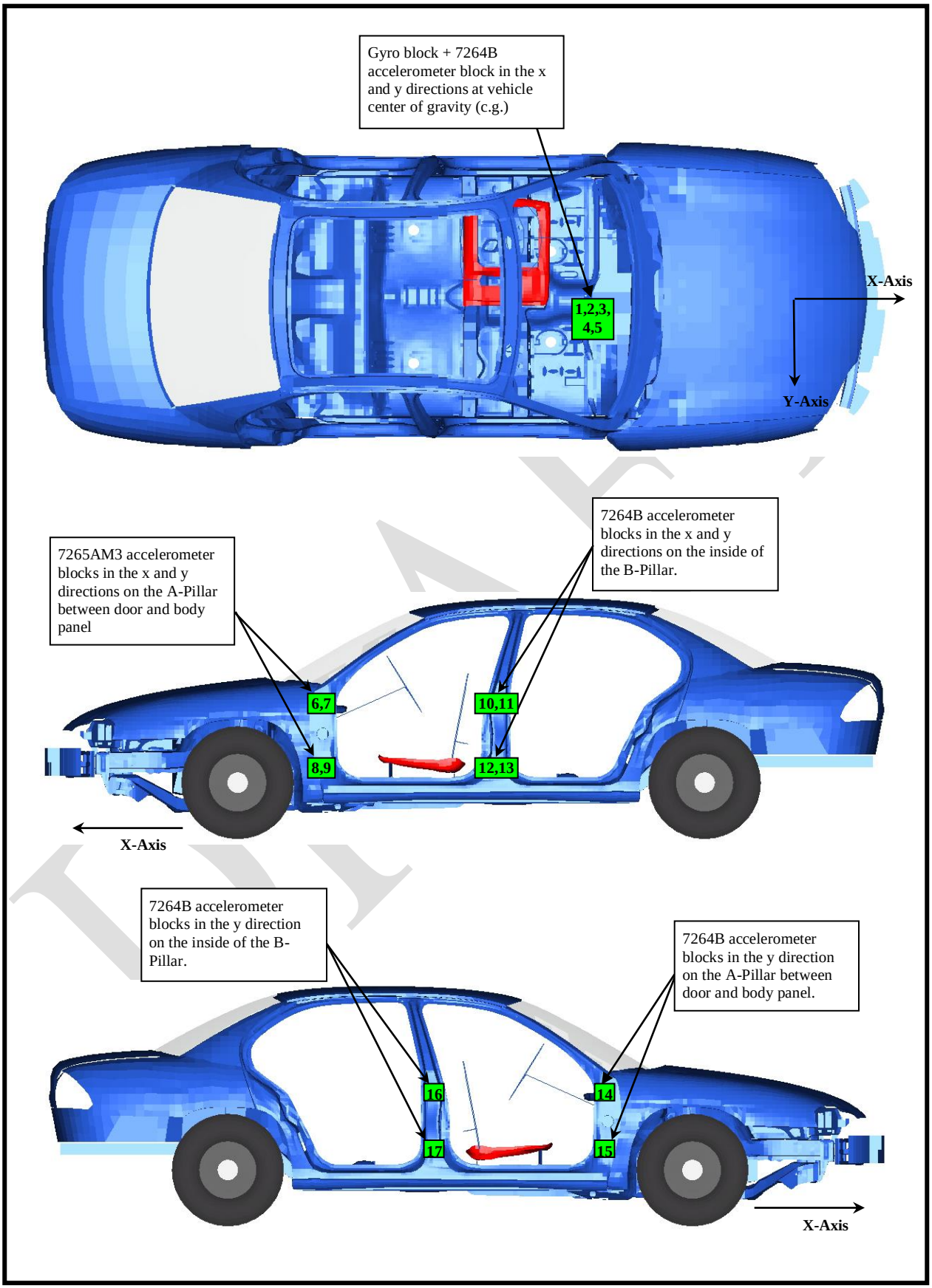




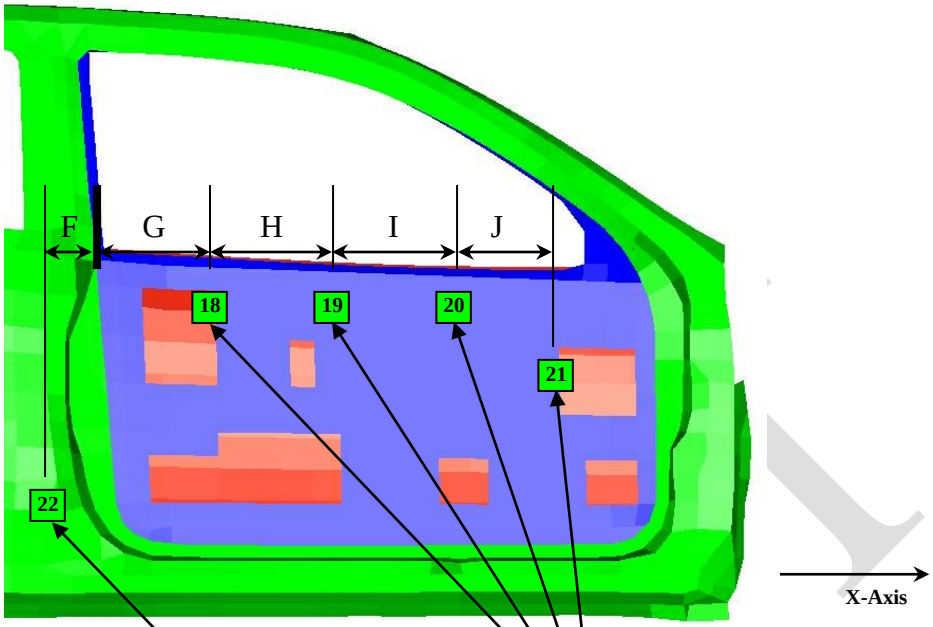
CH.	LOCATION	X (cm) From frt. axle	Y (cm) From centerline	Z (cm) From ground	SERIAL NO.	AXIS
1	C.G	81	+1	44	RT02-0251-1_SN_101	Roll
2	C.G	81	+1	44	RT02-0251-1_SN_101	Pitch
3	C.G	81	+1	44	RT02-0251-1_SN_101	Yaw
4	C.G	81	+1	44	7264B-B27929	+X
5	C.G	81	+1	44	7264B-B27929	+Y
6	Driver side, A-pillar at beltline	50	-81	72	7265AM3-D12899	+X
7	Driver side, A-pillar at beltline	50	-81	72	7265AM3-D12844	+Y
8	Driver side, A-pillar at rocker pnl	54	-83	31	7265AM3-D12766	+X
9	Driver side, A-pillar at rocker pnl	54	-83	31	7265AM3-D12748	+Y
10	Driver side, B-pillar at beltline	163	-73	72	7264B-B27863	+X
11	Driver side, B-pillar at beltline	163	-73	72	7264B-B27930	+Y
12	Driver side, B-pillar at rocker pnl	149	-71	31	7264B-B27928	+X
13	Driver side, B-pillar at rocker pnl	149	-71	31	7264B-B27866	+Y
14	Passenger side, A-pillar at beltline	51	81.5	73	7264B-B27023	+Y
15	Passenger side, A-pillar at rocker pnl	54	83	34	7264B-B26984	+Y

16	Passenger side, B-pillar at beltline	163	+74	73	7264B-B27867	+Y
17	Passenger side, B-pillar at rocker pnl	149	+71	34	7264B-B32874	+Y
18	String pot, driver door, location 1	135	-3	93	025811	+Y
19	String pot, driver door, location 2	123	-2.4	93	025812	+Y
20	String pot, driver door, location 3	112	-2.4	93	025810	+Y
21	String pot, driver door, location 4	98	-3.75	80	025809	+Y
22	String pot, driver door, location 5	161	-2.8	64	025813	+Y

VEHICLE 2 SENSORS LOCATION

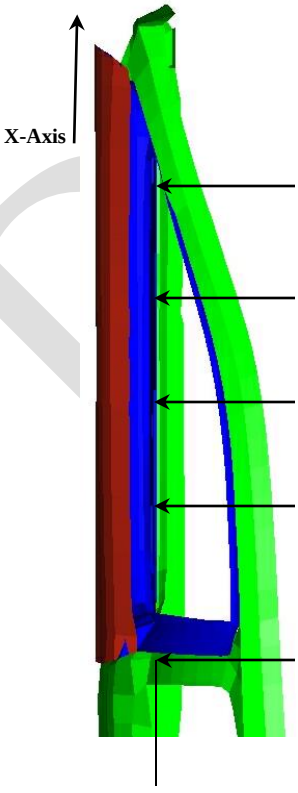


VEHICLE 2 SENSORS LOCATION



Position transducer located on the lower B-Pillar-

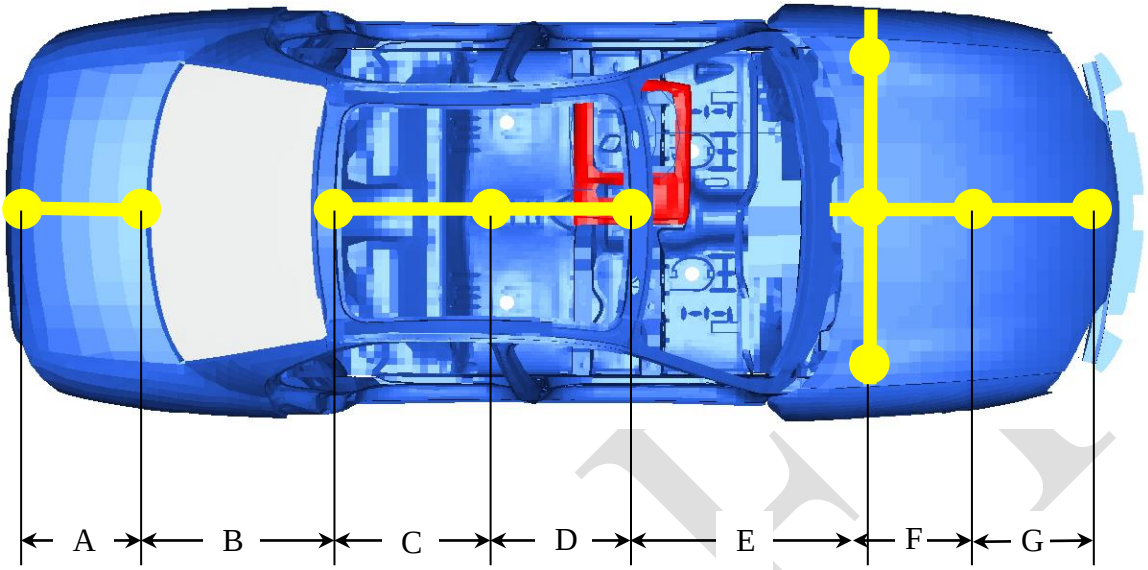
Position transducers located at the top of the inner driver side door

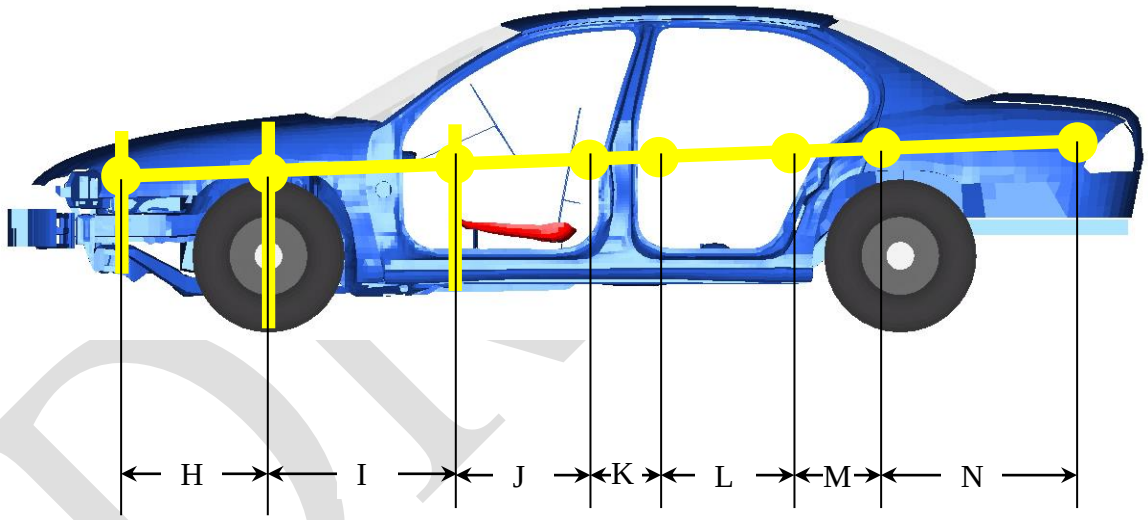


Geometry (cm)

A: 73.0	**F:** 15.0
B: 73.0	**G:** 16.5
C: 73.1	**H:** 13.0
D: 72.7	**I:** 13.5
E: 68.8	**J:** 13.7

VEHICLE 2 TARGETS LOCATION

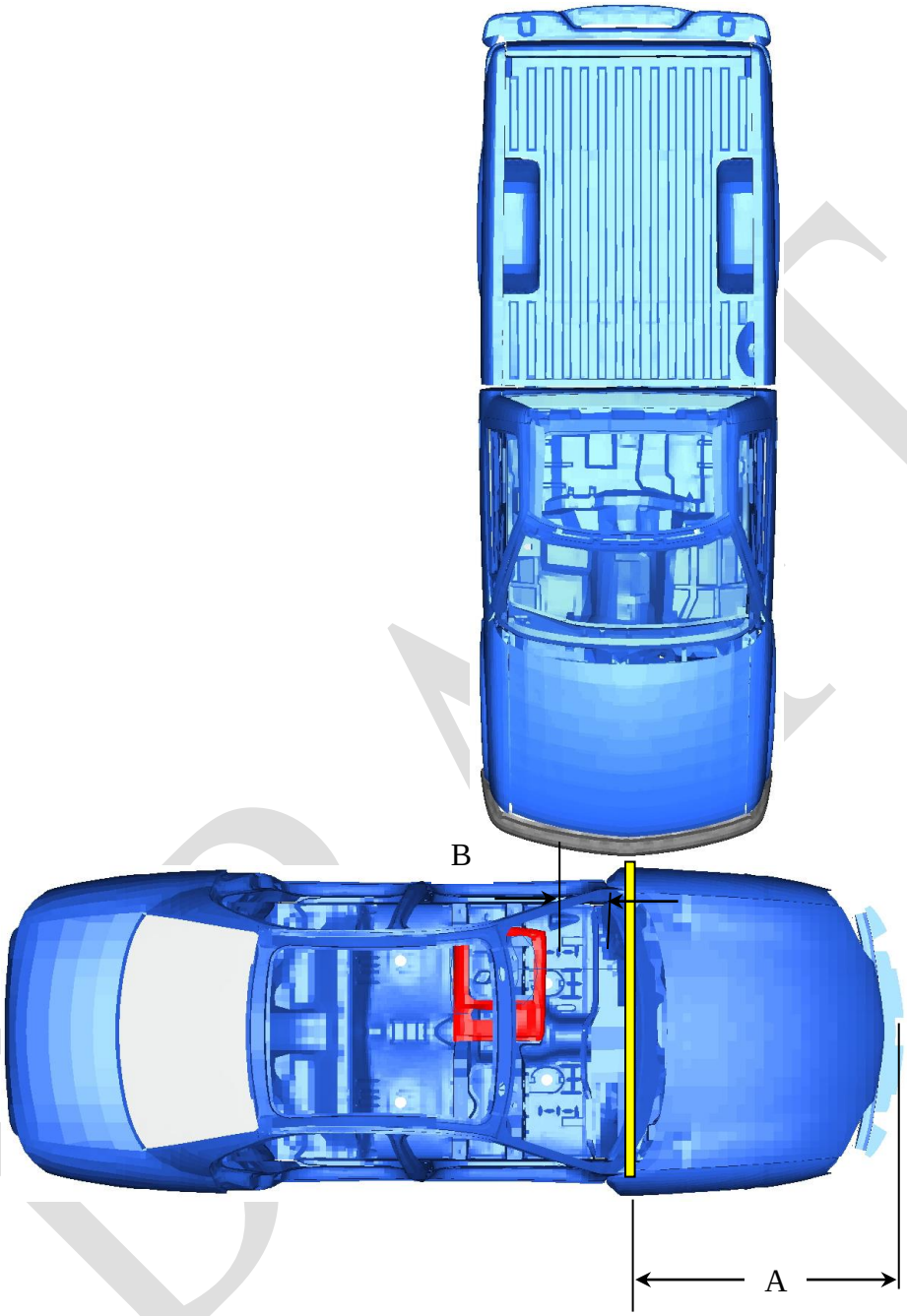




Geometry (cm)

A: 43.6	**D:** 64.1	**G:** 43.0	**K:** 11.1	**N:** 86.9	**Q:**
B: 101.0	**E:** 111.2	**H:** 73.5	**L:** 93.2	**I:** 84.6	**R:**
C: 62.7	**F:** 40.5	**J:** 65.4	**M:** 11.2	**P:**	

TEST SETUP



Geometry (cm)

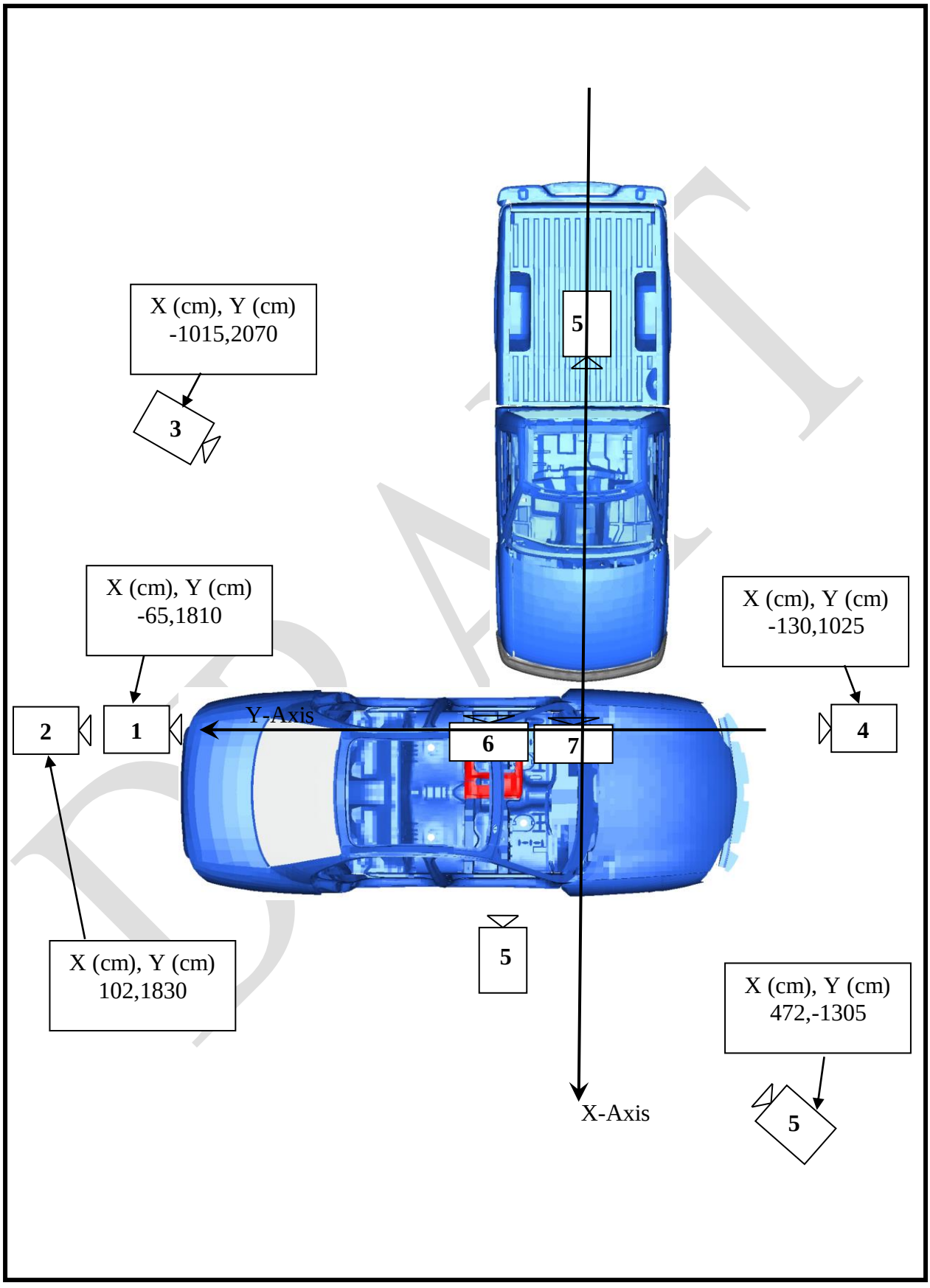
A: 109.0

B: 35.5

CAMERA PARAMETERS

NO.	CAMERA	LENS	LENS (MM)	RESOLUTION (PIXELS)	SPEED (FPS)	LOCATION
1	K3			1280X1024	500	Right Side 90 degrees Did not work, used NAC rental
2	Locam 001018	Cosmicar		Film	500	Right Side 90 degrees
3	K3 001040	Nikon 135629	85	1280X1024	500	Right Front 45 degrees
4	K3 001042			1280X1024	500	Left Side 90 degrees
5	Locam 001016	Zoom 001017	16	Film	500	Left Rear 45 degrees
6	K3R			1280X1024	500	Overhead
7	Locam 115061	Zoom 001024	18	Film	500	Overhead
8	Locam 2072	Super Cinetar		Film	500	DID NOT WORK

CAMERA PARAMETERS



Appendix B