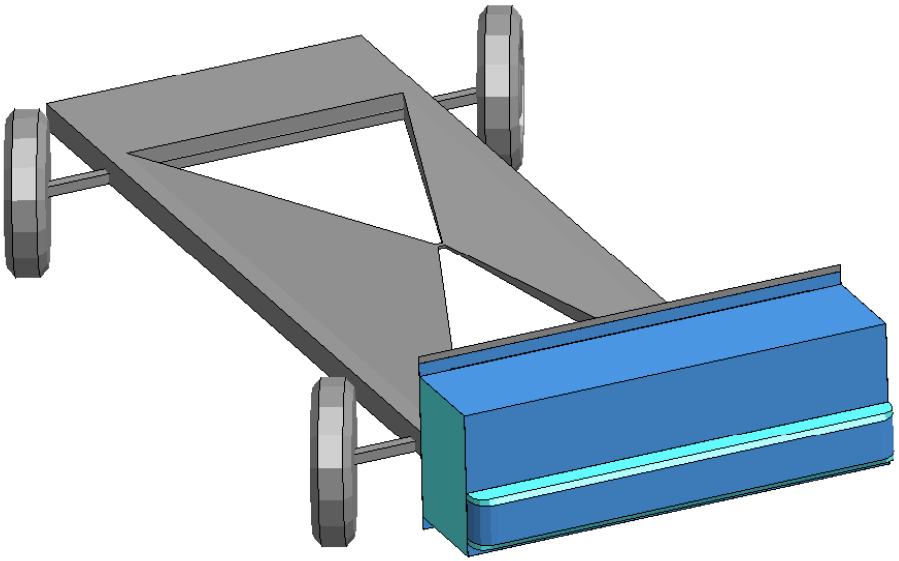
NHTSA (SINCAP) Side Impact Barrier Model
Version 1.0



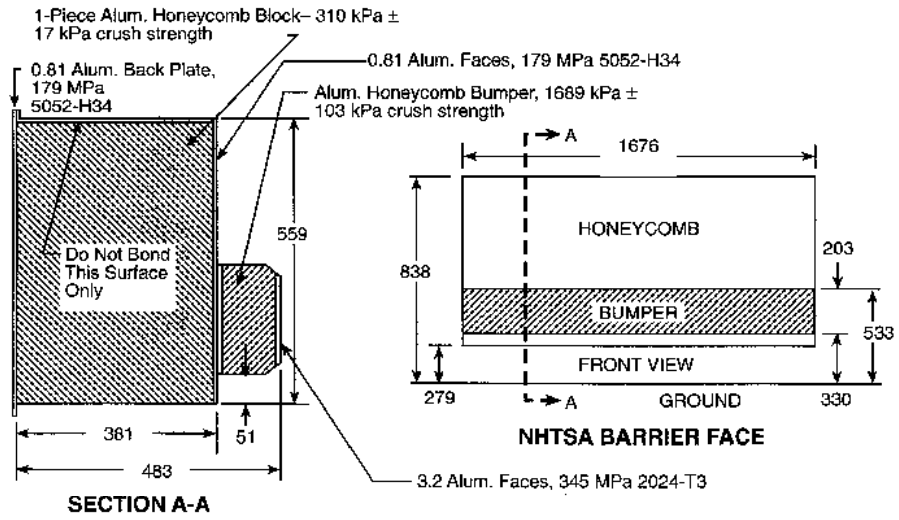
User Manual

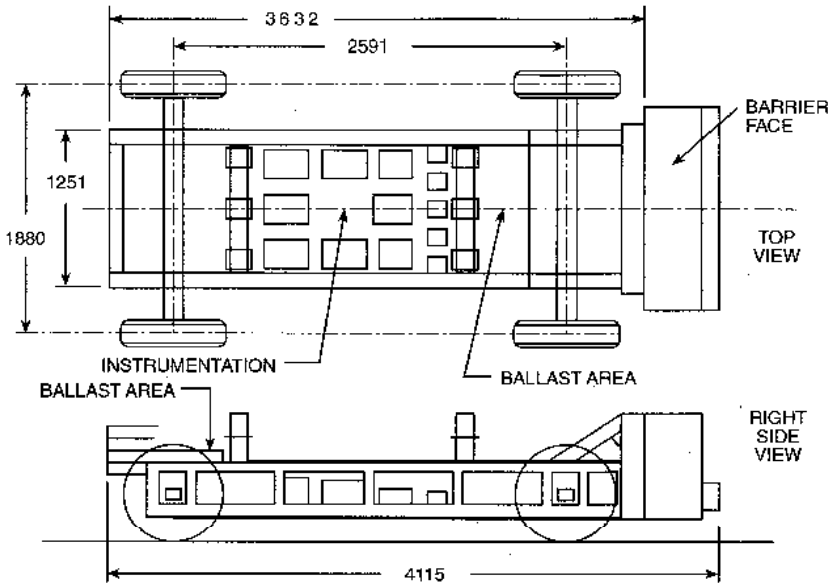
October 2006

The specification used for the deformable impact barrier in this documentation has been taken from the NHTSA documents ‘Federal Motor Vehicle Safety Standard, MVSS 214 - Side Impact Protection’ and ‘National Highway Traffic Safety Administration, PART 587 - Side Impact Moving Deformable Barrier’.

Barrier Characteristics

- The mass of the barrier including instrumentation should be 1367 kg (3015 lbs).
- The front and rear track width of the trolley should be 1880 mm (74 in).
- The trolley wheelbase should be 2590 mm (102 in).
- The centre of gravity should be situated 7.5 mm (0.3 in) left of the longitudinal centre line, 1123 mm (44.2 in) behind the front axle and 500 mm (19.7 in) above the ground.





Material Characteristics

- The main honeycomb block should have a crush strength of 0.31 N/mm2 ±0.017 N/mm2. The front and top faces of the main block should be covered with 0.8 mm aluminium sheet. The top aluminium sheet should not be bonded to the main block.
- The bumper honeycomb block should have a crush strength of 1.69 N/mm2 ±0.103 N/mm2. The front face of the bumper block should be covered with 3 mm aluminium sheet.

Calibration Procedure

No calibration test is specified for the deformable impact barrier as its crush performance is characterised by its material properties.

Model Description

- The units of the model are Newtons, Tonnes, seconds and millimeters. Versions of the model in other unit systems are available on request.
- The Barrier is oriented in standard vehicle coordinates, with the z-axis pointing upwards and the y-axis pointing forward, towards the side of the vehicle.
- The barrier will need to be translated so that it is correctly positioned relative to the vehicle.
- The model mesh is shown in fig 1.1.

Control Parameters

There are two Control Cards defined in the barrier model.

- Control Contact - In order to allow contact between the rigidwall ground and the rigid trolley, option RWPNAL in this card has been set to 0.1. The user will need to review this control card and add in any other Control Contact option they use as standard.
- Control Timestep - This control card has been added to the model to specify the mass scaling option (see following page for more details)

Contact Surfaces

There are two contact definitions in the barrier model:

- An automatic single-surface contact which contains all the contact parts of the barrier (null shells, cladding etc.)
- An automatic surface-surface contact for setting up the contact with the vehicle. A part set with an id of 3 will need to be created containing the parts for the vehicle side of the contact.

Instrumentation

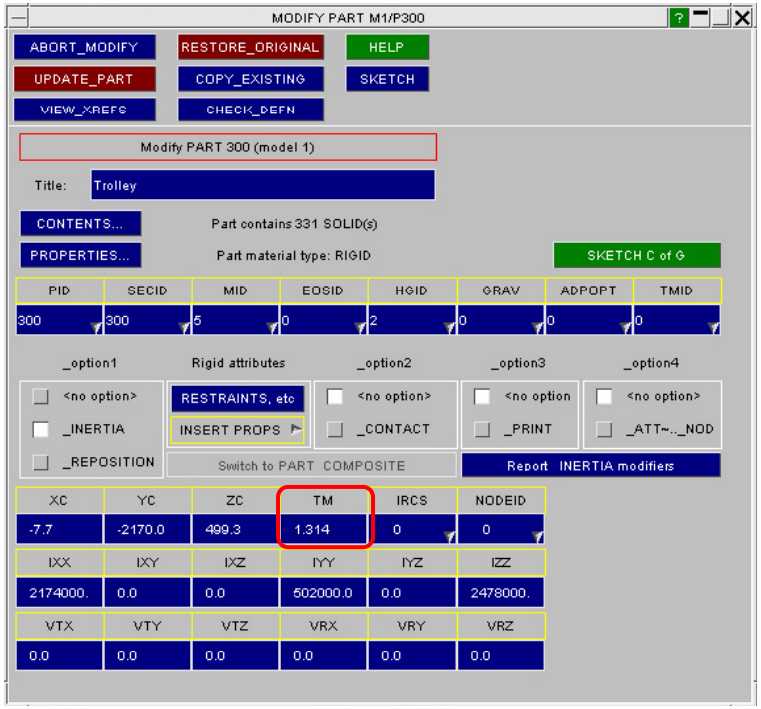
The model is equipped with an accelerometer at the COG of the vehicle (Node id 50000). This can be used to output nodal displacements/velocities/accelerations.

Mass Scaling

The Mass Scaling in this model is set such that the actual timestep will be 1.2E-6 sec. This can be modified but the trolley mass as defined on the *PART_INERTIA card for part no. 300 will also need to be adjusted to take into account the change in mass of the barrier.

The following table gives the required trolley mass for a selection of different timesteps.

Actual Timestep (sec)	DT2MS Value	Part 300 Mass (tonne)
1.2e-6	-1.333e-6	1.313
1.1e-6	-1.222e-6	1.320
1.0e-6	-1.111e-6	1.326
0.9e-6	-1.000e-6	1.332
0.8e-6	-0.888e-6	1.337
0.7e-6	-0.777e-6	1.341
0.6e-6	-0.666e-6	1.342
0.5e-6	-0.555e-6	1.343
0.44e-6	0.0 (No Mass Scaling)	1.344



NB: The timestep as specified in the DT2MS option of the *CONTROL_TIMESTEP card is multiplied by the timestep scale factor (TSSFAC) option also on the *CONTROL_TIMESTEP card to give the actual analysis timestep.

This scale factor defaults to 0.9 as such a value of -1.333e-6 sec entered in the DT2MS option will give an actual analysis timestep of 1.2e-6 sec

Model Description (cont.)

List of parts

The following parts were used in this model:

Part Number	Part Description
100	5.2 Core (Bumper)
101	Bumper Cladding
103	Bumper Backplate
104	Adhesive - 5.2 Core to Bumper Backplate
105	Adhesive - 5.2 Core to Bumper Cladding
106	Bumper Null
107	Bumper Internal Null
200	1.6 Core (Main)
201	Main Cladding
202	Mounting Plate
204	Adhesive - 1.6 Core to Cladding
205	Adhesive - 1.6 Core to Backplate
207	Adhesive - Cladding to Backplate
209	Core Null
210	Core Internal Null

Part Number	Part Description
300	Trolley
301	Trolley Contact Shells
400	Adhesive - Bumper Backplate to Main Cladding

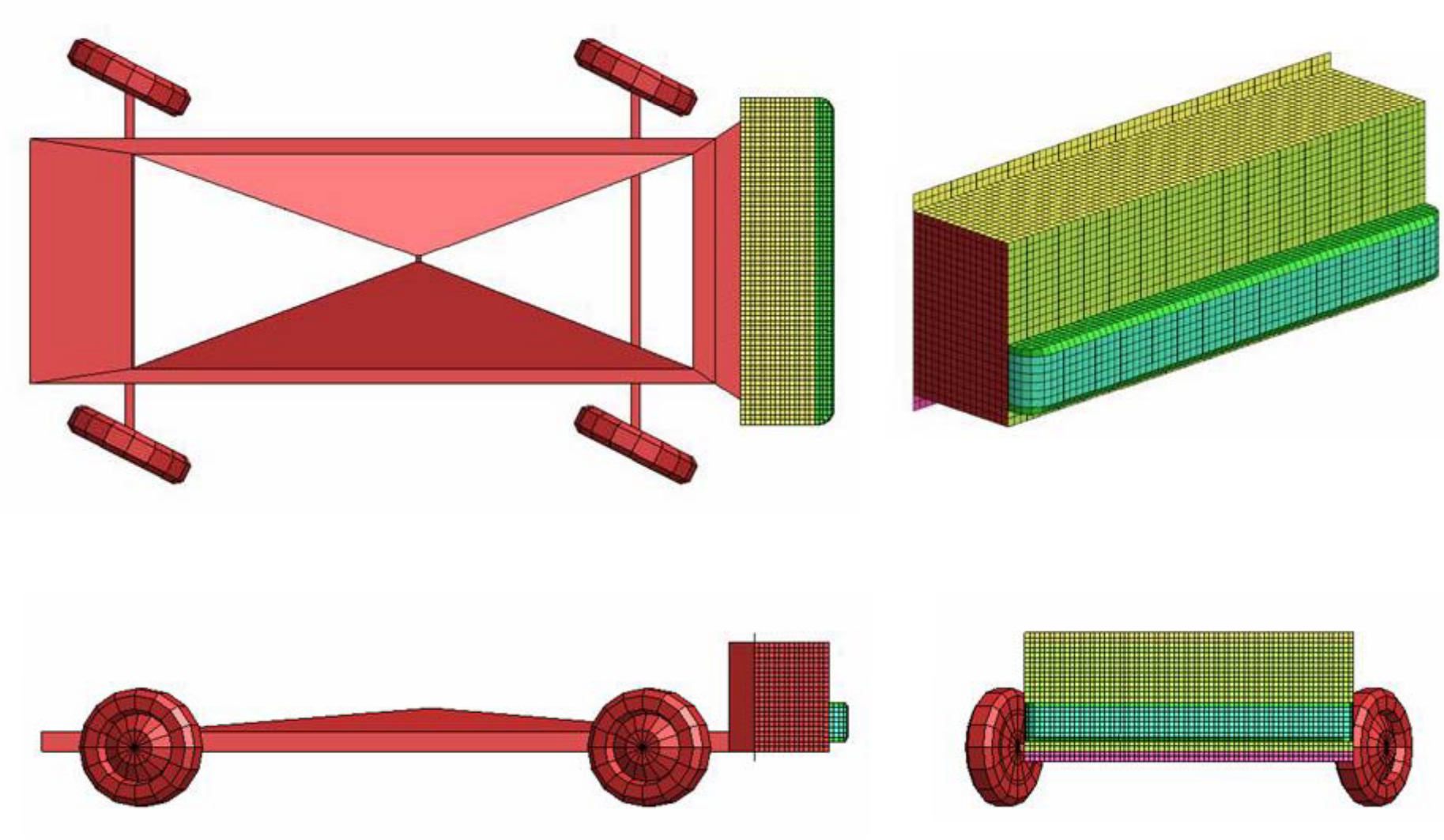
Model Description (cont.)

Model Size

The number of elements in the model is as follows:

Element Type	Number
Deformable solids	28388
Deformable shells	5238
Total deformable elements	33626
Null shells	29052
Rigid solids	331
Rigid shells	1250

Figure 1.1 – NHTSA barrier model



Company and Contact Information

The NHTSA model is developed by Cellbond Composites in association with Arup.

www.cellbond.com

www.arup.com

For more information on the model please contact the following:

UK:

Arup
The Arup Campus
Blythe Valley Park
Solihull, West Midlands
B90 8AE
UK
T +44 (0)121 213 3399
F +44 (0)121 213 3302
dyna.support@arup.com

China:

Arup
39/F-41/F Huai Hai Plaza
Huai Hai Road (M)
Shanghai
China 200031

T +86 21 6126 2875
F +86 21 6126 2882
china.support@arup.com

India:

nHance Engineering Solutions Pvt. Ltd (Arup)
Plot No. 39, Ananth Info Park
Opposite Oracle Campus
HiTec City-Phase II
Madhapur
Hyderabad - 500081
India
T +91 (0) 40 44369797 / 8
india.support@arup.com