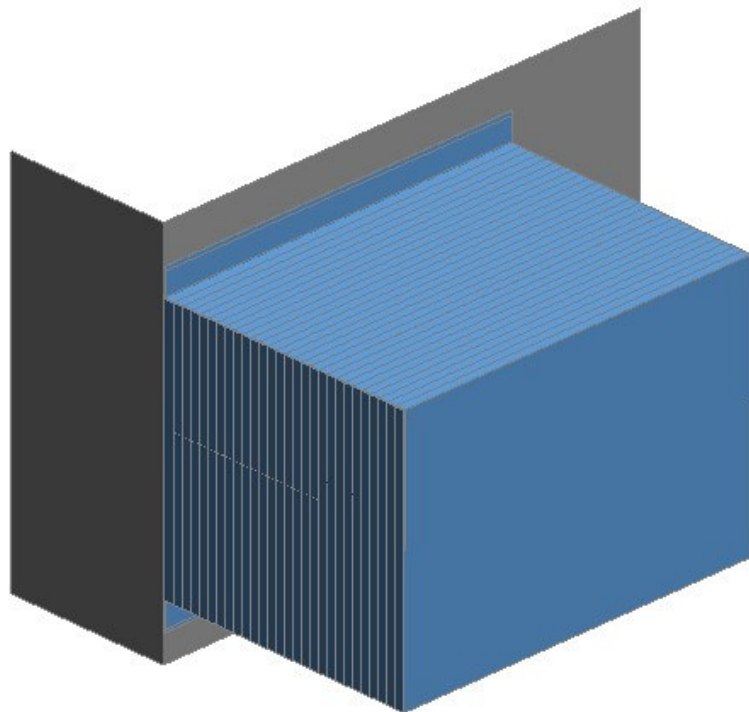


Progressive Deformable Barrier (PDB) Model Version 1.0



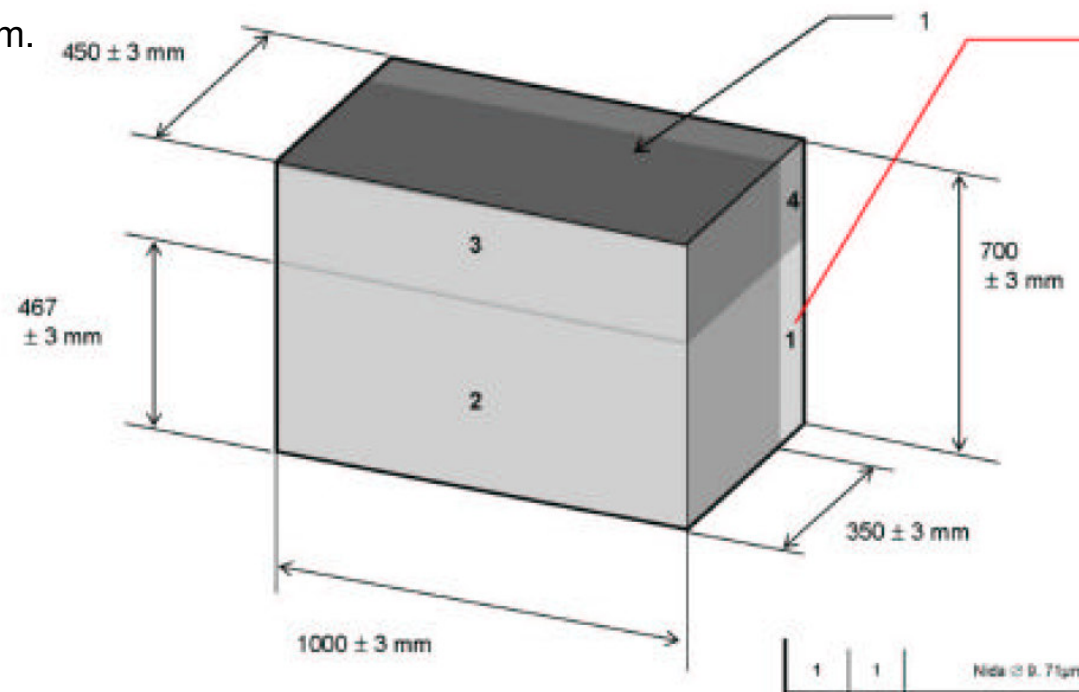
User Manual

August 2008

The specification used for the deformable frontal impact barrier in this documentation has been taken from Self & Partner Protection Test & Assessment Protocol by UTAC dated 28 April 2004

Barrier Characteristics

- The impactor consists of different strength aluminium honeycomb blocks covered in aluminium sheets
- The overall dimension of the block is 1000mm wide, 700mm high and 700mm deep
- The front 250mm of the block has a constant crush strength of 0.34MPa
- The rear 450mm is split into 4 zones as shown below
- The ground clearance should be 150 mm.



Material Characteristics

- Zone 1 has a constant crush strength of 1.02 MPa
- Zone 2 has a crush strength that increases progressively from 0.68MPa to 1.02MPa
- Zone 3 has a crush strength that increases progressively from 0.34MPa to 0.68MPa
- Zone 4 has a constant crush strength of 0.69MPa

Calibration Procedure

- No calibration test is specified for the deformable frontal 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 x-axis pointing forward, towards 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 is one Control Cards defined in the barrier model.

- Control Timestep - This control card has been added to the model to specify the mass scaling option and is set to the value we used in the barrier correlation.

Contact Surfaces

There are six contact definitions in the barrier model:

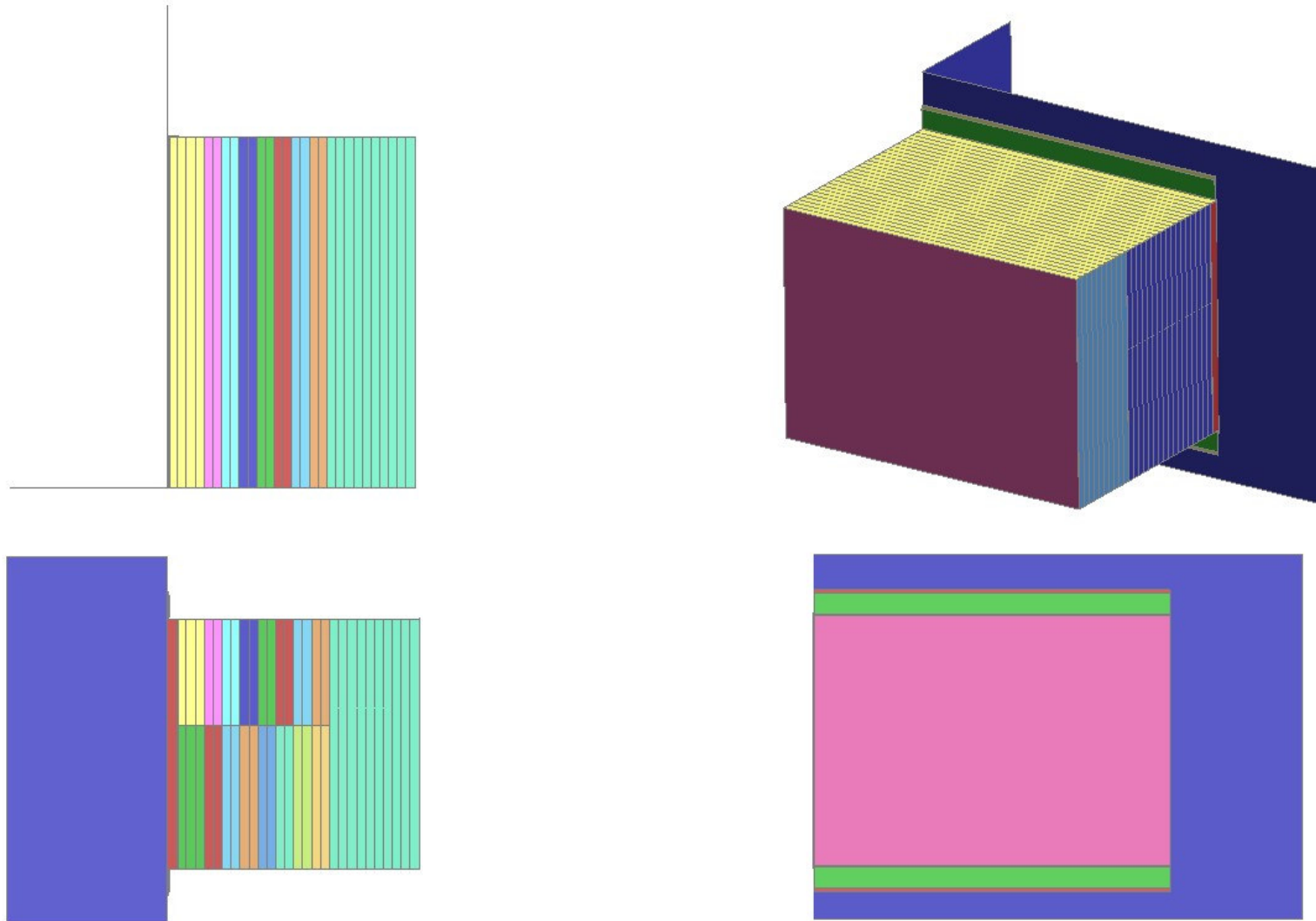
- The first five are internal contacts that relates to the barrier model.
- The sixth contact is an automatic surface-surface contact for setting up the contact with the vehicle. A part set with an id of 4 will need to be created containing the parts for the vehicle side of this contact.

Instrumentation

There is a Database Cross Section set up along the back face of the barrier to record the barrier force.

Figure 1.1 – PDB barrier model

Progressive Deformable Barrier Model



Model Description (cont.)

Progressive Deformable Barrier Model

List of parts

The following parts were used in this model:

Part Number	Part Description
101	Block 1 Honeycomb
102	Block 1 Null Shells
103	Block 1 Internal Null
201	Main Cladding
202	Front Plate
203	Intermediate Plate
205	Adv Plate - F core
206	Adv Plate – core
207	Adv Cladding - F Core
208	Adv Plate - Plate
300	Back Plate
301	Mounting Strip
302	Concrete Base
2001	Block 2 Upper Honeycomb 1
2002	Block 2 Upper Honeycomb 2
2003	Block 2 Upper Honeycomb 3

Part Number	Part Description
2004	Block 2 Upper Honeycomb 4
2005	Block 2 Upper Honeycomb 5
2006	Block 2 Upper Honeycomb 6
2007	Block 2 Upper Honeycomb 7
2008	Block 2 Upper Honeycomb 8
2101	Block 2 Lower Honeycomb 1
2102	Block 2 Lower Honeycomb 2
2103	Block 2 Lower Honeycomb 3
2104	Block 2 Lower Honeycomb 4
2105	Block 2 Lower Honeycomb 5
2106	Block 2 Lower Honeycomb 6
2107	Block 2 Lower Honeycomb 7
2108	Block 2 Lower Honeycomb 8
2200	Block 2 Null Shells
2201	Block 2 Internal Nulls

Model Size

The number of elements in the model is as follows:

Element Type	Number
Deformable solids	67440
Deformable shells	6376
Total deformable elements	73816
Null shells	37408
Rigid shells	1484

Adhesive Material Card

In LS-DYNA version 970 5434a and earlier the option to add a title to *MAT_ARUP_ADHESIVE was unavailable. As such the barrier model may need to be modified to remove the titles from this material card. The following example show how the barrier model needs to be changed.

LS-DYNA version 970 6763 and later

```
*MAT_ARUP_ADHESIVE_TITLE
Main Core - Plate Adhesive
      4      1.0E-9      900.0      0.0      0.8      0.1      0.0      0.0
      2.0      2.0      0.0      0.0      0.0      0.0      0      0.0
```

LS-DYNA version 970 5434a and earlier

```
*MAT_ARUP_ADHESIVE
      4      1.0E-9      900.0      0.0      0.8      0.1      0.0      0.0
      2.0      2.0      0.0      0.0      0.0      0.0      0      0.0
```

The Offset Deformable Barrier 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:

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