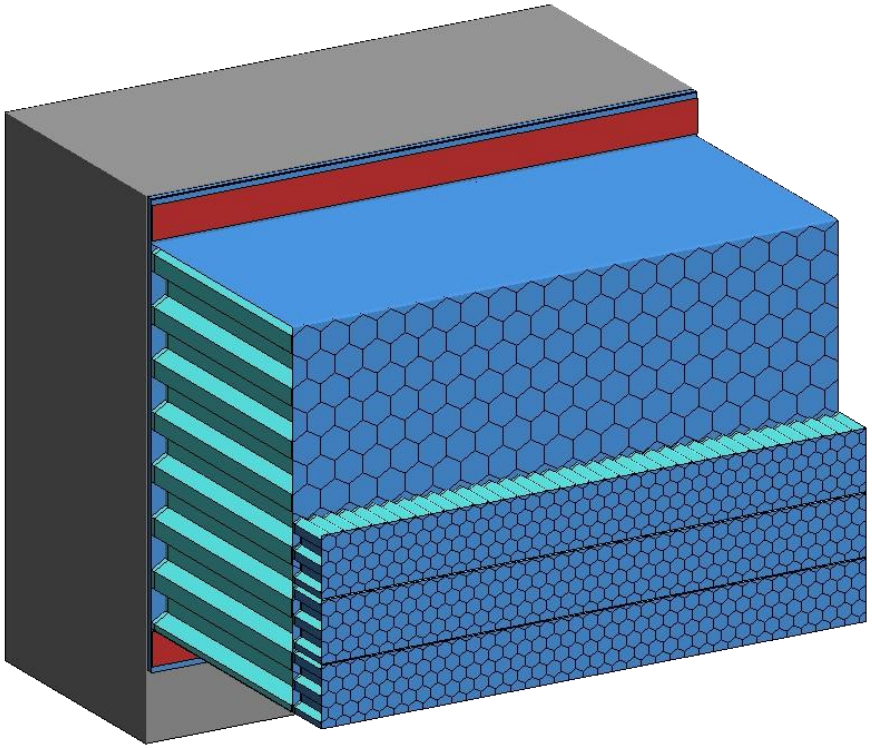
European (EEVC)
Offset Deformable Barrier (ODB)
Shell Element Model
Version 1.1



User Manual

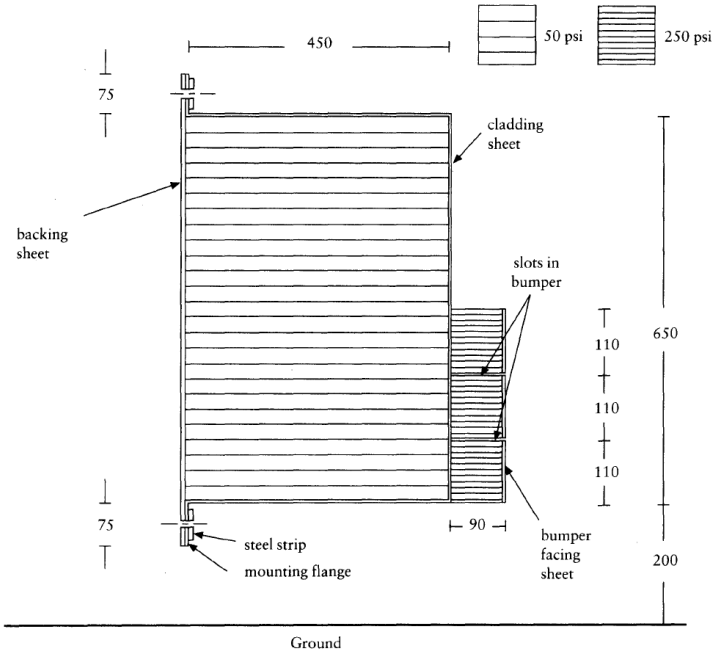
September 2010

General Information

The specification used for the deformable frontal impact barrier in this documentation has been taken ECE R94 Revision 1 - Frontal Impact Protection dated May 2007

Barrier Characteristics

- The impactor consists of two different sized aluminium honeycomb blocks partially covered in aluminium sheets
- The main aluminium block should be 1000 mm wide, 650 mm high and 450 mm deep.
- The second 'bumper' block should be 1000 mm wide, 330 mm high and 90 mm deep.
- The ground clearance should be 200 mm.



General Information

Material Characteristics

- The main honeycomb block should have a crush strength of 0.342 N/mm2 (50 psi) +0 -10%.
- The bumper honeycomb block should have a crush strength of 1.71 N/mm2 (250 psi) +0 -10%.

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

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 three Control Cards defined in the barrier model.

- Control Bulk Viscosity – The TYPE option is set equal to -2 to include the type 16 shell elements
- Control Shell – The NFAIL4 option is set equal to 1 to allow distorted full integrated shell elements to be deleted.
- Control Timestep - This control card has been added to the model to specify the mass scaling option and is set to the value that was used in the barrier correlation.

Contact Surfaces

There are ten contact definitions in the barrier model:

- The first nine are internal contacts that relate to the barrier model.
- The tenth contact is an automatic surface-surface contact for setting up the contact with the vehicle. A part set with an id of 10 will need to be created containing the parts for the vehicle side of this contact.

Instrumentation

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

Model Description

Model Encryption

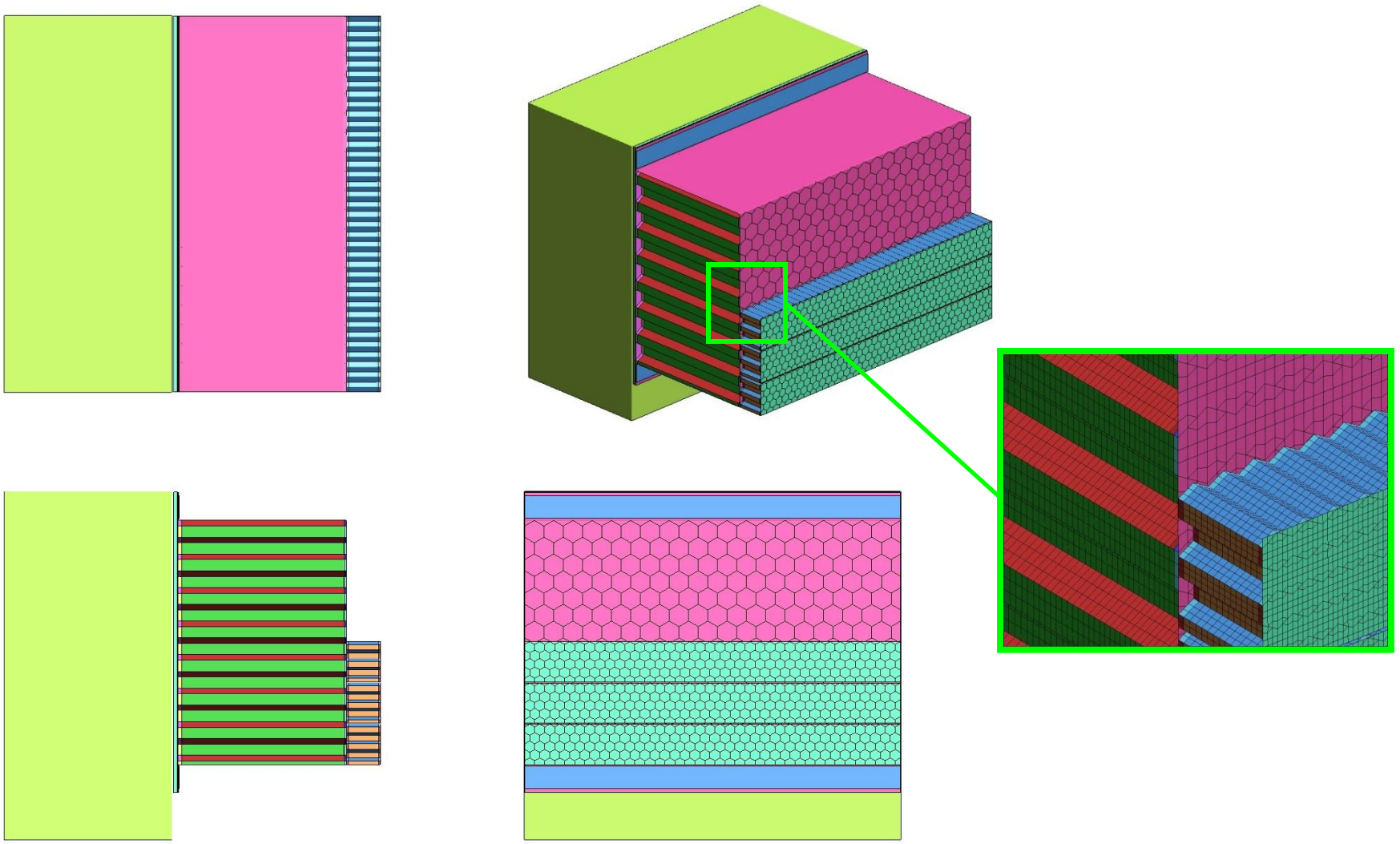
The material data in this model has been encrypted.

If the model needs to be renumbered then the id offset options on the *INCLUDE_TRANSFORM card can be used to included the barrier model in the analysis and also renumber it.

```
*INCLUDE_TRANSFORM
filename
   IDNOFF    IDEOFF    IDPOFF    IDMOFF    IDSOFF    IDFOFF    IDDOFF
   IDROFF
   FCTMAS    FCTTIM    FCTLEN    FCTTEM    INCOUT1
   TRANID
```

```
*INCLUDE_TRANSFORM
odb_shell_model_v1-0_S2.key
   1000000   1000000   1000000   1000000   1000000   1000000   1000000
   1000000
       1.0       1.0       1.0none               0
         0
```

Figure 1.1 – ODB barrier model



Model Description (cont.)

List of parts

The following parts were used in this model:

Part Number	Part Description
100	Concrete Base
101	Loadcell
102	Mounting Strip
200	Backplate
201	Adhesive – Cladding to Backplate
202	Main Cladding
300	Honeycomb (thin)
301	Honeycomb (thick)
302	Honeycomb (thin) Adhesive front
303	Honeycomb (thick) Adhesive front
304	Honeycomb (thin) Adhesive rear
305	Honeycomb (thick) Adhesive rear
400	Bumper Cladding
401	Bumper Honeycomb (thin)
402	Bumper Honeycomb (thick)
403	Bumper Honeycomb (thin) Adhesive
404	Bumper Honeycomb (thick) Adhesive

Model Description (cont.)

Model Size

The number of elements in the model is as follows:

Element Type	Number
Deformable solids	3,072
Deformable shells	293,279
Total deformable elements	296,351
Rigid shells	1,752

Version Data

Model Version	Date	Modifications	Created by	Approved by
1.0	July 2010	New Model	I Bruce 	B Walker 
1.1	Sept 2010	Honeycomb orientation adjusted	I Bruce 	B Walker 

Company and Contact Information

The Offset Deformable Barrier model is developed by Arup in association with Cellbond Composites.

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)
Ananth Info Park
HiTec
Hyderabad - 500081
India

T +91 (0) 40 44369797 / 8
india.support@arup.com