CUSTOMER SUPPORT NOTE

# Beam Fleshing - Defining the Cross Section

Note Number:

CSN/LUSAS/1015

This support note is issued as a guideline only.



Forge House, 66 High Street, Kingston upon Thames, Surrey, KT1 1HN, UK Tel: +44 (0)20 8541 1999 Fax: +44 (0)20 8549 9399 Email: info@lusas.com www.lusas.com

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#### 1. Introduction

Definition of beam cross section shape is only actually required for Cross Section Beam elements with guadrilateral cross section such as BMX3 (2D Kirchhoff Thin Beam), BSX4 (3D Kirchhoff Thin Beam) and BXL4 (3D Semiloof Thin Beam), but the cross section information is also used to visualise the beam's fleshing in V14. For other line mesh elements, it is necessary to enter the geometric properties, but specifying the cross-section is merely for fleshing visualisation and is therefore optional. The user can use the Section Library or Section Property Calculator to calculate the geometric properties, or calculate them outside of LUSAS and enter them manually. The cross section is automatically defined for existing sections that are extracted from the Section Library, and for those created by the Standard Section Property Calculator. When using the Arbitrary Section Property calculator, only the geometric properties are calculated and stored in the library. The fleshing visualisation of the section is, by default, a one by one square section. There is a development request to expand the Section Property Calculator so that it generates a visualisation of the arbitrary cross section as well as calculating the properties. Due to the arbitrary nature of the cross sections that the user can define, visualisation of these through fleshing is currently not automated for this tool.

### 2. Description

The section shape that is fleshed can be manually specified in the geometric properties by clicking on the **Cross section...** button as shown below in Figure 1.

lement type 3D Thick Beam (BMS3)	•	C Default C Specify Upper and lower sides 1		
Value		Left and right sides 5		
Cross sectional area (A) 4.35172E-3				
Second moment of area about y axis (lyy)	0.0230601E-3	Quadrilateral cross section properties	Local zy coordinates	
Second moment of area about z axis (Izz)	7.57854E-6	Lower Left Corner	(-0.1, -0.05)	
Forsion constant (Jxx)	0.0179505E-3	Upper Left Corner	(-0.1, 0.05)	
Effective shear area in y direction (Asy)	1.6E-3	Upper Right Corner	(-0.092, 0.042)	
Effective shear area in z direction (Asz)	3.2E-3	Lower Right Corner	(-0.092, -0.042)	
Offset in y direction (Ry)	0.0			
Offset in z direction (Rz)	0.0	1 🕂 Of 4 New Inse	rt Delete Visualise.	
Cross section Visualise Attribute RHS D=0.2 B=0.1 t=0.008 r=0	Plastic properties	OK	Cancel Help	



The cross section shape used for the fleshing is defined by specifying coordinates of quadrilaterals. A series of quadrilaterals can be specified to define more complex cross section shapes. The coordinates of each quadrilateral must be defined in local cross section coordinate pairs at each node y1, z1, y2, z2, y3, z3, y4, z4, working round the quadrilateral in a clockwise order. For example a rectangular hollow section is defined by 4 quadrilaterals. The coordinates of each quadrilateral are entered, clicking the **New** button to define additional quadrilaterals as required. The quadrilaterals defined can be checked by clicking the up and down buttons to the left of the **New** button.

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The **Visualise...** button will display the shape defined by the quadrilaterals that you have input as shown below in Figure 2.

Jement type 3D Thick Beam (BMS3)		
Cross sectional area (A) Second moment of area about y axis (Iyy) Second moment of area about z axis (Izz) forsion constant (Jxx) Iffective shear area in y direction (Asy) Iffective shear area in y direction (Asz) Offset in y direction (Rz) Cross section Visualise Attribute RHS D=0.2 B=0.1 t=0.008 r=0 OK Cancel	Value           4.35172E-3           0.0230601E-3           7.57854E-6           0.0179505E-3           1.6E-3           3.2E-3           0.0           1.01 (m) major              Apply           Help	

Figure 2

This cross section definition then controls the fleshing for the model as shown below in Figure 3.

