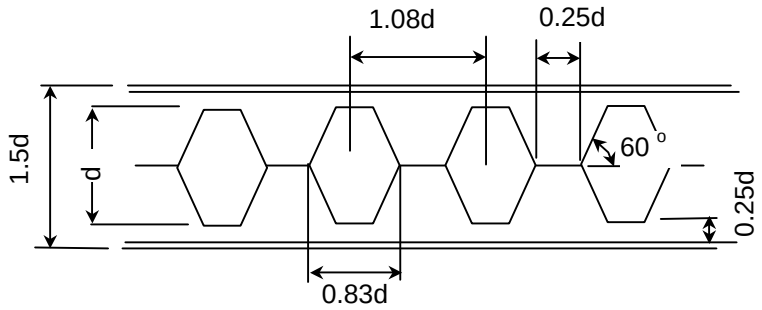
Comparison with Castellated Beams

Since the 1950's the high strength to weight ratio of castellated beams has been an asset to structural engineers in their efforts to design even lighter and more cost efficient steel structures. Cellular beams invariably produce a more efficient and economical solution than castellated beams, due to their greater flexibility.

The profile for any castellated section is standard or fixed, whereas the major dimensions of a **cellular beam are completely flexible**.



FIXED

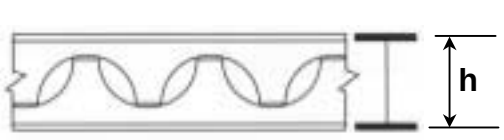
Standard Castellated Section

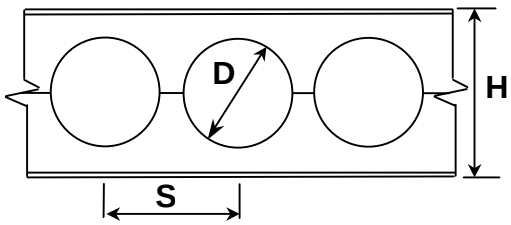
Flexible Geometry

The three flexible dimensions are:

FLEXIBLE

- Finished Depth **H**
- Cell Diameter **D**
- and Cell Spacing **S**





Thus, the geometry of a cellular beam can be chosen to match exact structural, aesthetic or service requirements. Economies are made by adjusting the geometry of a cellular beam to maximize its efficiency under specific loading conditions.

Example: 406x178x54 I-Section

Diameter (mm)	Spacing (mm)	H (mm)	I_{xx} $10^6 mm^4$	Z_{exx} $10^3 mm^3$	A_{net} $10^3 mm^2$
535	578	669	494.5	1478	4.7
490	735	615	410.5	1336	4.7
322	347	563	374.5	1330	5.5
306	459	535	333.5	1247	5.5

Cell Data Guidelines

The Limits of cellular beam geometry are as follows:

D min = 0.7h
Smin = 1.08 D

D max = 1.3h
S max = 1.6D

For more detailed information download the CELLBEAM Program design guide and section property tables. (http://www.macsteel.co.za/cellbeam)

With such a wide range of cell data arrangements, beams can be designed to suite exact requirements. For example a lightly loaded cellular roof beam would be designed with a maximum possible depth, and cell centers approaching the minimum permissible (1.08 x diameter) to create a beam with the largest moment of inertia.

A much heavier loaded cellular floor beam however would be designed with the greatest width of web-post (0.5 x diameter) as it is probable that the resistance of the web to shear will be the limiting factor.

This flexibility results in a cellular beam being lighter than the most efficient castellated section.

Given the client's maximum depth and minimum service opening size the optimum cellular beam can be designed:-

Eliminating infill Plates

In addition to the possibility using a lighter section, a cellular beam will invariably require fewer infill plates than a castellated beam. Castellated beams are economical because of their light weight. However it is easy to overlook the cost penalty associated with infilling a number of castellations, which can add up to 40% to their total cost. Castellations are usually infilled for one of two reasons.

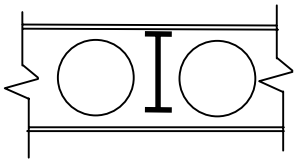
i) At positions of higher shear, eg: at the ends of a beam or beneath point loads

Unlike a castellated beam the geometry of a cellular beam can be chosen to create a beam with the highest resistance to shear. Furthermore, a cellular beam can be designed with a full web post at each end of the beam. Using the CELLBEAM computer program, the designer is fully aware of the beams behaviour at each cell position, and can keep the use of infill plates to the absolute minimum.

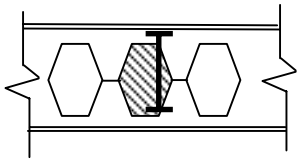
ii) At incoming connections of secondary beams

By adjusting the diameter and centers of cells most or all secondary beams can be connected on a web post, eliminating the need for infilling.

For maximum economy infills should be avoided where possible, even to the extent of increasing the section mass.



Cellular beam



Castellated beam with a full strength butt weld infill plate

For more information on eliminating infill plates download the Cellular Beam Design Guide or Avoiding Infills to Cells (http://www.macsteel.co.za/cellbeam)

Services

Although services can be passed through hexagonal openings of a castellated beam, cellular beams have distinct advantages over their traditional counterparts.

The circular openings possess on average 30 % more usable area than the openings of a castellated beam.