The best opportunities for improving materials resource efficiency in construction projects occur during the design stage. Implementing these opportunities can provide significant cost savings, reductions in waste disposed to landfill, and carbon reductions.

This sheet is part of a series highlighting alternative design details which use less materials or result in less waste being created than ‘standard’ details used in construction. The benefits provided by the alternative design detail are quantified, and technical considerations presented.

Potential benefits:
- Up to 35% lighter than solid slab.
- Fast construction.
- Design flexibility.
- 41% embodied carbon reduction (slab only).
- 20% concrete reduction in other structural elements.
Voided biaxial slabs (VBS) are a resource efficient design for concrete slabs by incorporating voids which significantly reduce overall materials use.

Several VBS technologies have been introduced over the last few decades, primarily to reduce the weight of buildings, and designs now have comparable strength to solid slabs.

Typical systems use hollow plastic spheres placed in a precise modular grid; these can be fixed in place using only reinforcement mesh. Solid concrete above and below the voids ensures greater strength at the points of highest stress. Semi precast systems offer faster, straightforward construction.

VBS systems offer excellent freedom in architectural design, by allowing a variety of building shapes, large spans and with few supporting points. As a result they allow the construction of flexible and easily changeable buildings.

The light, strong slabs can also allow materials savings throughout the building structure, including in beams, columns and foundations.

Further information

- The effect of post-tensioned cables in VBS is enhanced; spans of up to 50 times deck thickness can be achieved.
- Semi-precast VBS systems do not require formwork, and offer a flat, smooth soffit finish which can be left exposed.
- Risk during construction is reduced due to lower weight and fewer crane lifts.
- VBS technology is well established across Europe and North America.

WRAP has produced a range of guidance and tools to help design teams with designing for resource efficiency in construction projects. These resources are freely available at www.wrap.org.uk/construction
## Potential benefits*

| Materials/waste | 30 – 50% concrete reduction in slab.  
|                | Biaxial design allows weight reductions in reinforcement.  
|                | Further reductions from reduced columns, beams, foundations and load bearing walls.  
| Cost           | Potential cost savings of 4% for the slab.  
|                | Further cost savings for supporting structure.  
|                | Reduced weight can result in lower transport costs.  
|                | Cheaper lifting equipment.  
| Time           | Up to 40% time savings have been achieved.  
|                | Few columns and beams = faster construction.  
|                | Fast installation of services.  
|                | Some fully finished VBS elements are available.  
| Carbon         | Potential embodied carbon reductions of 41% for the slab.  
|                | Further embodied carbon reductions for supporting structure.  
|                | It is possible to incorporate heating/cooling within the slab to reduce operational energy consumption.  
| Recycling      | Recycled HDPE spheres can be used.  
|                | Consider specifying concrete with recycled content.  
|                | Specifying VBS has no impact on recyclability.  
| Constructability | Varying degrees of prefabrication are available.  
|                | Long spans between columns are possible.  
|                | Downstand beams can be eliminated.  
| Replicability  | Can be used in the construction of most buildings. Examples include apartments, hotels, schools, car parks, hospitals, factories etc.  

*All stated benefits are provided as guidance only and may vary from project to project.
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