Panel Guide

ANNEX 2B

OSB (oriented strand board)

Description

Compared with many other types of panel products, OSB is a relative newcomer, first developed about twenty-five years ago. Over the last decade a phenomenal increase in capacity has occurred and in 2000 world capacity was approximately 22 million m^3 produced from nearly 60 mills; European capacity in 2002 was about 3 million m^3.

OSB is an engineered wood-based sheet material in which rather long strands of wood are bonded together with a synthetic resin adhesive. Sometimes in all three layers, but usually in only the outer layers of these three-layer panels, the strands are orientated in a particular direction. However, there is quite a large degree of variability in this orientation among adjacent strands in the panels from any one production line as well as between panels from different producers.

Composition

The timbers used in OSB manufacture include both softwoods (spruce, pine) and hardwood (aspen). Wood strands are cut tangentially from debarked logs which are held longitudinally against rotating knives. The ribbon of flakes produced is usually about 75mm wide and this breaks up on handling to produce individual flakes which are 75mm along the grain and from 5 to 50mm across the grain.

After drying, these flakes are generally sprayed with a synthetic resin, though one or two mills employ powdered resins. One of the important points in OSB manufacture is the removal of fines prior to resin application: this results in the use of lower amounts of resin in OSB (2-3%) compared with other resin bonded panel products.

In the majority of mills, phenol formaldehyde (PF) resin is used, but in one or two mills a melamine fortified urea (MUF) resin or isocyanate (PMDI) resin is employed.

All these resins confer a measure of moisture resistance to the composite.

In the formation of the mat the strands are aligned either in each of the three layers of the panel, or, more frequently, in only the outer two layers. The degree of orientation varies widely within any one panel, and also in panels from different manufacturers; thus, in panels from different manufacturers it is possible to obtain ratios of property levels in the machine- to cross-direction of 1.25:1 to 2.5:1, thereby emulating the ratios found in plywood.

Appearance

OSB is readily identified by its larger and longer wood strands. The orientation of the surface strands is not always visually apparent, especially in small pieces of panel. The panel tends to have a number of holes on the surface due to the overlap of strands: a smoother surface can be obtained by sanding. However, OSB will never possess the smoothness of surface found in fibreboards and particleboards: rather its merits lie in the field of mechanical performance which is directly related to the use of longer and larger strands of wood.

OSB varies in colour from a light straw colour to a medium brown depending on species used, resin system adopted and pressing conditions employed.

Density, mass and sheet size

Panel density (and thus panel mass) varies depending upon the product, being affected by the timber species and the process used in manufacture. Typical densities are 600-680kg/m^3. Thus, for example, a 2400 x 1200 x 12mm panel will weigh approximately 20 kg.

Panel sizes commonly available are 2440mm x 1200mm, 2440mm x 1220mm, 3660mm x 1220mm in thicknesses of 6mm, 8mm, 9mm, 11mm, 15mm, 18mm, 22mm, 25mm 38mm.

Other sizes are available or can be produced to order. Panels are produced with either square or T&G edges.

Applications

Because of its lay-up and composition, OSB is primarily a panel for construction and is widely used for flooring, flat roof decking and wall sheathing. Different grades of the product are available for different levels of loading and different environmental conditions. Guidance on the use of OSB in these load-bearing applications is given in DD ENV 12872. Generally, for the same loading conditions, a thinner board of OSB can be used than a load-bearing particleboard.

It should be noted that BS 7916: 1998 has now been withdrawn and the prescriptive specification linking panel thickness to joist/batten spacing in Table 4 of BS 7916 is no longer valid and must not be used. If the manufacturer is unable to provide this information on panel thickness and joist/batten thickness, then recourse to testing according to EN 12871 must be adopted.

Large quantities of OSB are also used for sarking and industrial packaging and in the construction of site hoardings and pallet tops.

Specification

OSB manufactured in Europe for construction purposes must now be specified in accordance with the European standard BS EN 300(Oriented Strand Boards (OSB) – Definitions, classification and specifications): the UK version of this is BS EN 300. As explained in Section 2 of PanelGuide, OSB that is used in construction must comply (by law) with the Harmonised Standard for wood-based panels (BS EN 13986); this standard calls up BS EN 300 which contains the requirements for the following four grades (technical classes)-

OSB/1- General purpose boards, and boards for interior fitments (including furniture) for use in dry conditions.
OSB/2 - Load-bearing boards for use in dry conditions.
OSB/3 - Load-bearing boards for use in humid conditions
OSB/4 - Heavy-duty load-bearing boards for use in humid conditions.

Selection of a grade of load-bearing panel is dependent upon the ambient climatic conditions together with the level of loading that is anticipated.

Guidance on the selection of the different grades of OSB is given in tabular format in Sections 2.3 to 2.14 of PanelGuide.

Physical properties

a) Climate

Like other wood-based panel products, OSB is hygroscopic and its dimensions change in response to a change in humidity. A 1% change in moisture content increases or decreases the length, width and thickness of the different grades of OSB by the amounts set out in the table below.

Dimensional change for a 1% change in panel moisture content (DD ENV 12872)

Type of panel	Specification	Dimensional change at 1% change in panel moisture content		
		Length %	Width %	Thickness %
OSB	BS EN 300, OSB/2	0,03	0,04	0,7
	BS EN 300, OSB/3	0,02	0,03	0,5
	BS EN 300, OSB/4	0,02	0,03	0,5

As a guide, OSB can be expected to attain the following moisture content under the following specified conditions.

Relative humidity at 20°C	***Approximate equilibrium moisture content***
30%	5%
65%	10%
85%	15%

When it leaves the factory, OSB generally has a moisture content about 2%. Therefore, it must be conditioned to bring it into equilibrium with its environment before it is fixed. This is usually achieved by loose stacking the panels in the room where they will be used prior to fixing them. The time required for the panels to achieve equilibrium moisture content will vary depending upon the temperature and relative humidity in the building. The likely equilibrium moisture content of OSB in various conditions are as follows:

In a building with continuous central heating: 5-7%
In a building with intermittent central heating: 8-10%
In an unheated building: up to 15%

When components are factory produced for installation on site, it is essential that the site conditions are suitable to receive the components with wet trades completed and the building dried out.

OSB with enhanced moisture resistance (OSB/3; OSB/4) is not waterproof; the term 'moisture resistant' applies to the adhesive binder which (within limits defined by BS EN 300) will not break down in the presence of moisture. Physical wetting of all grades of OSB should be avoided. When wet, OSB will increase appreciably in thickness.

b) Biological attack

OSB will not normally be attacked by wood-boring insects common in temperate climates, but panels made using aspen and spruce are susceptible to fungal attack under prolonged wet conditions; panels made from pine have moderate resistant to attack.

c) Water vapour 'permeability'

The value of the water vapour resistance factor (μ) for OSB varies with the method of determination (BS EN ISO 12572) as set out in the table below which is an extract from BS EN 12524 and BS EN 13986.

	Mean density	Vapour resistance factor	
	Kg/m^3	Wet cup *μ*	Dry cup *μ*
OSB	650	30	50

d) Thermal conductivity

The thermal conductivity (λ) of OSB as determined according to BS EN 12664 is 0.13 W/m.K for a mean density of 650 kg/m^3 as set out in BS EN 13986

e) Reaction to Fire

Under the new Euroclass system for characterising the reaction to fire performance of materials, an untreated OSB may be assumed to achieve a class D-s2, d0 (excepting floorings) or class D_{FL}-s1 (when used as a flooring) without need for testing, provided that it has a minimum density of 600 kg/m^3, a minimum thickness of 9mm and is used in real applications where it is fixed without an air gap behind, against class A1 or A2-s1, d0 products with minimum density 10 kg/m^3, or at least class D-s2, d0 products with minimum density 400 kg/m^3**. If the manufactured product does not satisfy any of these minimum requirements or is used with an air gap behind, then it must be tested and classified according to BS EN 13501-1.**

Further information on the reaction to fire of the various panels products in both the BS and EN systems is provided in Section 2.2.3.

Storage and handling

Careful storage and handling is important to maintain panels in their correct condition for use; thus, OSB must be protected from rain and accidental soaking. During transport, it is particularly important to keep edges well covered. Panels should be stored flat in an enclosed, dry building. When handling boards, the edges and corners should be protected against damage.

Detailed guidance on the storage and handling of wood-based panel materials is given in DD ENV 12872 and Section 4 of PanelGuide.

Working with OSB

OSB can be cut by a hand or power saw and machined (routed, spindled, planed and bored) with normal woodworking machinery. Tungsten carbide cutting edges are recommended for use with powered tools.

a) Mechanical joints and fixings

Wherever possible, fittings that depend upon face fixing should be selected; fittings that depend upon the expansion of a component inserted into the board edge should be avoided.

Conventional woodworking fixings and techniques can be applied to OSB which provides good holding power for screw fixings into the board faces; generally, edge fixing is not recommended. Parallel core screws should be used because they have greater holding power than conventional wood screws. A high ratio of overall diameter to core diameter is desirable.

Drill pilot holes for all screw fixings. Typically, the holes should be 85 to 90% of the screw core diameter. Fixings into the board face should not be within 8mm of edges and 25mm of the corners.

Nails and staples can be used for lightly loaded fixings or to hold glued joints while the adhesive sets.

Further information on working with OSB is included in Section 4.4 of PanelGuide.

b) Adhesive-bonded joints

A wide variety of jointing methods can be used, provided the following simple guidelines are observed:

- The joint parts should be accurately machined.
- Use sharp cutters to avoid tearing or burnishing the surfaces to be bonded.
- Use a high solids content adhesive with low flowing properties such as polyvinyl acetate or urea formaldehyde.
- Locate mating pieces accurately and hold them under pressure while the adhesive sets.
- The width of grooves machined in OSB should be limited to about one-third of the thickness of the board. The depth of groove is typically about one-half of the board thickness.
- Allow adhesive-bonded joints to condition for several days before sanding and finishing; this avoids the appearance of sunken joints and is essential with high-gloss finishes.
- A tongue and groove joint is very efficient, provided the fit of the joints is not too tight to cause a split along the edge.
- When attaching lippings, the tongue should be machined on the solid wood piece.

c) Finishing

Where smooth surfaces are required pre-sanded panels should be specified.

Additional information on finishing OSB is provided in Section 4.7 of PanelGuide.

Health and Safety

a) Dust

OSB will generate dust when it is machined and, like any other wood dust, is a potentially hazardous substance and must be controlled. There is no evidence that exposure produces health effects that are different in nature to those associated with exposure to similar levels of dust from other wood sources.

Dust from cutting operations can be controlled adequately by complying with the Control of Substances Hazardous to Health (COSHH) Regulations 2002. Under these regulations OSB dust has a Maximum Exposure Limit (MEL) of $5mg/m^2$ expressed as an 8-hour time-weighted average. Exposure must be reduced as far as possible below this limit, usually with properly designed and maintained dust extraction equipment fitted to woodworking machines.

Extraction equipment is often not practicable or even available when using portable or hand-held tools, so a suitable dust mask (for example, Type FFP2 to BS EN 149) should be worn. If possible, work in a well-ventilated place.

Further information on dust is given in Section 6.3 of PanelGuide.

b) Formaldehyde

Free formaldehyde in the workplace atmosphere has an MEL of 2 parts per million (ppm). However, studies indicate that anyone machining OSB in mechanically ventilated situations is exposed to levels of free formaldehyde significantly below this.

Two classes of formaldehyde potential (determined in accordance with BS EN 120, BS EN 717-1 and BS EN 717-2) are specified in the Harmonised standard (BS EN 13986) for OSB.

Class E1 ≤ 8mg/100g
Class E2 > 8 to ≤ 30mg/100g

Uncoated OSB manufactured using phenol formaldehyde or isocyanate resins does not require to be tested for formaldehyde and is automatically rated as E1. Uncoated panels produced in the UK and Ireland, therefore, have an E1 rating. Further information on formaldehyde is given in Section 6.4 of PanelGuide.

c) Hazards and control

In sheet or processed form, OSB is non-classifiable under the COSHH regulations. However, there may be handling hazards.

COSHH Regulation 6 requires an assessment to be made (and normally recorded) of health risks associated with wood dust or formaldehyde together with any action needed to prevent or control those hazards.

The table below gives the most common hazards and identifies control methods to minimise the risk of harm actually occurring.

Common hazards and methods of control

Activity	Hazard	Control
Manual handling (in full sheet form	Large sheet sizes present a risk of strain or crush injuries if not handled correctly.	Store carefully in uniform stacks on a flat level base. Use mechanical handling equipment Adopt correct manual handling procedures.
Carpentry work Activities likely to produce high dust levels include: • Sanding by machine and hand • Sawing, routing and turning • Hand assembling machined or sanded components	Wood dust in general (including dust from OSB) may cause dermatitis and allergic respiratory effects. Wood dust is flammable.	Off site: preparation under exhaust ventilated plant. On site: enclosure and exhaust ventilation. Dust extraction on portable tools. Good ventilation. Respiratory protection equipment. *Note*: Any health hazards arising from the use of OSB at work can and should be controlled by compliance with the requirements of the Control of Substances Hazardous to Health (COSHH) Regulations 2002.