

## 2.9 Application of panels in the production of formwork

### 2.9.1 Selection of panels for formwork

The selection of wood-based panels for formwork depends on a number of factors of which the most important are

- very high levels of stiffness and strength in bending
- durability
- smoothness of surface.



**Figure 2.21** Illustrating the use of wood-based panels in formwork.

Wood-based panel products are used in all types of formwork from in-situ concrete construction to modular system formwork for hire or sale and in precast manufacturing units. An indication of the type of boards used in various formwork applications is given in Table 2.12.

The choice of lining material is based on a balance between the performance required and cost. The main technical factors affecting choice are considered below.

## **Structural performance**

The formwork lining is normally required to take the direct load of the concrete during placing and setting and to make a contribution to the structural strength of the form during handling, erection, striking and storage. These loads give rise to both dynamic and static forces, but they are not normally of long term duration in the accepted structural sense. Moisture contents in excess of 20% can be expected and design procedures must take account of load and moisture content considerations. Wood-based panels are usually required to distribute the superimposed concrete loads to secondary timber or steel framing members at centres characteristically in the range 300-600mm. The formwork may on occasions be designed as a stressed-skin panel where the lining also makes a structural contribution to the "long-span" strength. Deflection at the form face is likely to be the determining criterion in design.

## **Environmental factors**

Normal weathering and proximity to wet concrete gives rise to timber moisture contents normally greater than 20% and up to or above fibre saturation point.

Green, or wet stresses should be used in design calculations. BS 5268-2 or EN 1995-1-1 (Eurocode 5) gives modification factors for plywood so that wet stresses can be derived.

Surface or edge sealing of panels will reduce the rate of moisture build up (and probably render this pick-up more uniform throughout the board – thus reducing distortion) but will not normally prevent a panel reaching fibre saturation during its life as a formwork lining. The onus is therefore on the designer to establish that this will not be the case if he wishes to use design values appropriate to a drier condition.

## **Surface appearance of the concrete**

The achievement of a good appearance to concrete in terms of smoothness of surface and uniformity of colour is influenced by the choice of lining material, release agents and by other factors.

## **Re-use potential**

Placing and compaction of concrete causes abrasion and possible physical damage to formwork linings. The number of re-uses attained with a particular lining material will be dependent on its resistance to such wear. The majority of in-situ applications require only a limited number of re-uses (usually less than 15) and there are some applications, for example, below ground work, where deterioration of appearance with successive pours would be acceptable. Contract hire modular system formwork, while not often selected where surface finish is the most important criterion, requires a high re-use potential with its functional efficiency unimpaired.

Precast work often requires a consistent high degree of finish over prolonged re-use which justifies the use of higher quality lining materials.

## **2.9.2 Sitework**

The application of a specified quantity of release agent to the surface of all types of formwork between uses (and after cleaning) facilitates stripping of the form and reduces damage to the concrete surface. Many traditional release agents are oil-based, either in neat form or emulsified with water. These generally contain additives to improve ease of striking and to improve the cast finish. Chemical release agents have also been found to be successful and a wide range of proprietary brands is available. The manufacturer's recommendations should be followed.

### **2.9.2.1 Assembly of formwork**

All wood-based panels accept a wide range of fixings to timber and other sub frames. The most popular are screws, nails or staples – hand or power driven. When fixing through the face of panels it is good practice to make good the surface over the fixing with a water-resistant filler. Alternatively, back fixing of panels is recommended, particularly where expensive, overlaid panels are concerned and where high quality, multiple re-uses are required. If panels are to be stripped for re-use, fixing with lost-head nails or panel pins facilitates removal with a minimum of panel damage.

### **2.9.2.2 Edge treatment**

All panel edges should be sealed to inhibit moisture uptake and many overlaid panels are supplied with edges ready sealed. This treatment will not normally prevent ultimate uptake of moisture to fibre saturation, but will delay considerably the rate at which it occurs, thus keeping distortion of the form to a minimum. For the same reason, it is wise to cut panels with sharp tools and to seal any subsequently cut edges, drilled holes etc. There is a variety of effective edge sealers appropriate to site application, eg aluminium primer, neoprene, polyurethane and epoxy paints and cold-set phenol resin. Additional edge protection to panels should be provided if handling problems are likely to occur or where particularly long formwork life is sought.

### **2.9.2.3 Repair**

Edge damage to panels is difficult to repair, so adequate provision should be made at the design stage to minimise it. Particleboard is generally more prone to edge damage than plywood.

Repair of face damage is time-consuming, and although not technically difficult, is often a problem on site. Local areas of damage can be made good, after cleaning and drying the area, by the use of inert fillers such as polyester putty, proprietary wood plugs or metal discs.

Although perfectly practical to make extensive repairs, it is only in the case of more expensive and elaborate forms that such repairs are usually carried out. The repaired area will sometimes give rise to concrete of a different colour, particularly if it has a different degree of moisture absorption from the main panel.

### **2.9.3.4 Storage and handling**

Before use, panels should be stored flat and level and under shelter. Between uses, weather protection may be less practical, but after cleaning, the forms should again be stored flat and level and not be subjected to distorting forces. Direct exposure of the casting face of the lining to sunlight should be avoided. Proper mechanical equipment should be used in all handling operations and suitable pick-up attachments should be provided on the forms as part of the standard design procedure.

**TABLE 2.12 PANEL GRADES\* FOR FORMWORK**

Selection	<b>Formwork</b>	<b>PLYWOOD EN 636</b>	<b>PARTICLEBOARD EN 312</b>	<b>OSB EN 300</b>	<b>MDF EN 622-5</b>	<b>FIBREBOARD EN 622-2</b>	<b>CBPB EN 634</b>
	Low re-use; appearance not important	636-3	P5 +/- coating	OSB/3	-	HB.E	-
	Good surface; Up to 15 re-uses	636-3	P5 coated	-	-	-	-
	Good surface; Over 15 re-uses	636-3 coated	-	-	-	-	-
	Hire formwork	626-3 +/- coating	-	-	-	-	-
	Precast formwork	636-3 coated	-	-	-	-	-

\* Broad guide only; each of the above panel types may be used in specialist, purpose-designed formwork.

The table provides the minimum grade of panel that satisfies the particular set of requirements: panels of higher quality may be substituted, and their selection may result in a reduction in required thickness.

Although all the panels meeting the grade specifications will satisfy a particular set of requirements, the level of performance of different brands of these panels may vary considerably, some may even be endowed with high levels of properties not directly covered by the table.