The Wood Component Company

TIMBER CLADDING & DETAIL DESIGN

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Cladding & Choice of Species

Softwoods

The most common choice for cladding is softwood and there are a number of alternative species suitable. The most commonly used include European Redwood, European Whitewood, Douglas Fir and Western Red Cedar. However, it is the Western Red Cedar that has the advantage over these softwoods as it is very durable, very stable regardless of constant wetting and drying and it is available in some good sizes and lengths. It does not require any treatment unlike some of the other mentioned softwoods.

Other softwoods are coming onto the market, eg, Western Hemlock, Southern Yellow Pine, Sequoia, that have suitable properties for cladding but are as yet rarely used in the Ireland and the UK. The majority however are “non-durable” and will therefore require treatment with preservative.

Tropical hardwoods

There has always been a wide range of tropical hardwoods used for timber cladding, even if less frequently used than softwood and generally limited to use on more prestigious buildings. These woods include Teak, Opepe, Balau, African Mahogany, Sapele and more recently, Australian woods such as Jarrah. Currently the most commonly used Tropical Hardwood is Iroko. This is due, at least in part to the fact that it has many of the traditional properties of Teak. As it is not possible to include a full range of tropical hardwoods that are suitable for cladding, it is necessary to generalise on the typical features relevant to their use.

Generally Tropical Hardwoods are stronger, more robust and more durable than Softwoods and may be a preferable choice if there is a high risk of mechanical damage, frequent wetting etc. Because of their density they are less absorbent and will react more slowly to any variations in moisture but it is still preferable to use a species referred to as a small or medium movement wood. Tropical woods are often supplied kiln dried rather than “green”, and if imported in log form the wood will need to be dried after cutting into boards. While many Tropical Timbers are rated as durable or very durable, this only applies to the heartwood and all sapwood should be excluded. Most tropical hardwoods are highly resistant to any treatment with preservative. Care should be taken to ensure that the timber species selected either possesses sufficient natural durability or can be treated effectively with a wood preservative.

All the tropical hardwoods commonly used for cladding and listed above, can be left unfinished and in this form they will all eventually weather to grey, whatever the original colour. While tropical hardwoods can be satisfactorily finished with coatings, care must be taken with the oilier woods, such as iroko and teak. It is likely that coatings may require more frequent maintenance than when used on softwoods.
If the bleached colour is acceptable, they are therefore better left unfinished and should not then require any maintenance for the lifetime of the building.

Exposure to ultra-violet light will not damage these hardwoods other than bleaching out the natural colour, but the increased uptake or loss of moisture can lead to some surface checking.
Because these woods are denser and stronger than softwoods, thinner sections can be used and tongued or rebated profiles are less likely to be damaged during construction or in use.

Temperate hardwoods

As an alternative to using tropical hardwoods for cladding, there is increasing use of durable temperate hardwoods such as European Oak or Sweet Chestnut. European oak is readily available either home-grown or imported from other parts of Europe, particularly France. Home-grown Oak may not be generally available in the lengths of the imported wood, and this should be considered when designing the cladding layout. It is rated as a “durable” timber and can be used untreated for cladding providing sapwood is excluded. As a medium movement wood it will, if left unfinished, tend to develop small surface checks due to variation in moisture content but this will not affect the durability of the wood.

Although American White Oak is technically suitable for use as external cladding, most of the supplies available in the UK and Ireland are dried to levels suitable only for internal environments. If this timber is selected, care should be taken to ensure that it can be sourced at an appropriate moisture content. It may not be sufficient to recondition timber previously dried to low moisture content levels.

While kiln dried temperate hardwoods can be used in the same way as tropical hardwoods, there is a considerable economy if the wood is used ‘green’ as this saves the cost of kiln drying. Because boards used for cladding are relatively thin they will air dry quite rapidly after installation but in the process the boards will shrink and tend to distort if not firmly restrained. It is important to make sufficient allowance for this shrinkage by using narrow boards and keeping fixings relatively close together. The fixings must also be designed to absorb this shrinkage without the boards developing stresses that can lead to splitting. Because the boards will tend to distort as well as shrink, fixings should be close enough along the length of the board to restrain these natural tendencies.

The other characteristic of using European oak or sweet chestnut green is that both woods contain a great deal of tannin which will exude from the wood as it dries. This will appear as a black deposit on the face of the boards and will be gradually washed down by rainfall. This tannin can cause corrosion in steel and stain porous surfaces below the cladding such as brick walls or paving. Tannin may continue to be exuded for many months, and it is therefore sensible to use corrosion resistant fixings and to protect any surfaces below during this period. This is because, whilst it is possible to remove the staining from masonry or concrete, this can be a laborious and time-consuming process.

Detail design - Timber Cladding

Basic principles

In principle, any Timber Cladding should be designed as a rainscreen. Assuming that the Cladding will always be subject to some penetration of moisture, a separate protective membrane will be necessary behind the Cladding largely protected from wind, rain and daylight by the Cladding itself. If there is a masonry wall behind the Cladding, a separate membrane is not usually necessary. The amount of moisture that penetrates will depend on the design of the cladding, an open-jointed system obviously allowing more moisture penetration than, for instance, a tongued and grooved design. Whatever system is used, a cavity should always be provided behind the Cladding to allow for the drainage of any moisture that penetrates the Cladding and to provide sufficient ventilation to dissipate any internally generated vapour. Ventilating the cavity will also mean that both external and internal faces of the cladding are exposed to the same ambient humidity and consequently will have a similar moisture content. This will reduce any natural tendency of the wood to distort due to any variation of the moisture content on opposite faces.

Cladding support

The cavity behind the cladding should not be less than 19mm wide but the width is usually determined by the size of battens necessary to fix the boards. For standard nails the battens should be at least 2.5 times the thickness of the boards to be fixed, but with improved nails (eg annular ring shank) or screws, a batten twice the thickness as the board is adequate.
Horizontal boards only require to be fixed to vertical battens and these will not restrict either drainage or the vertical circulation of air in the cavity, see Figure 1.

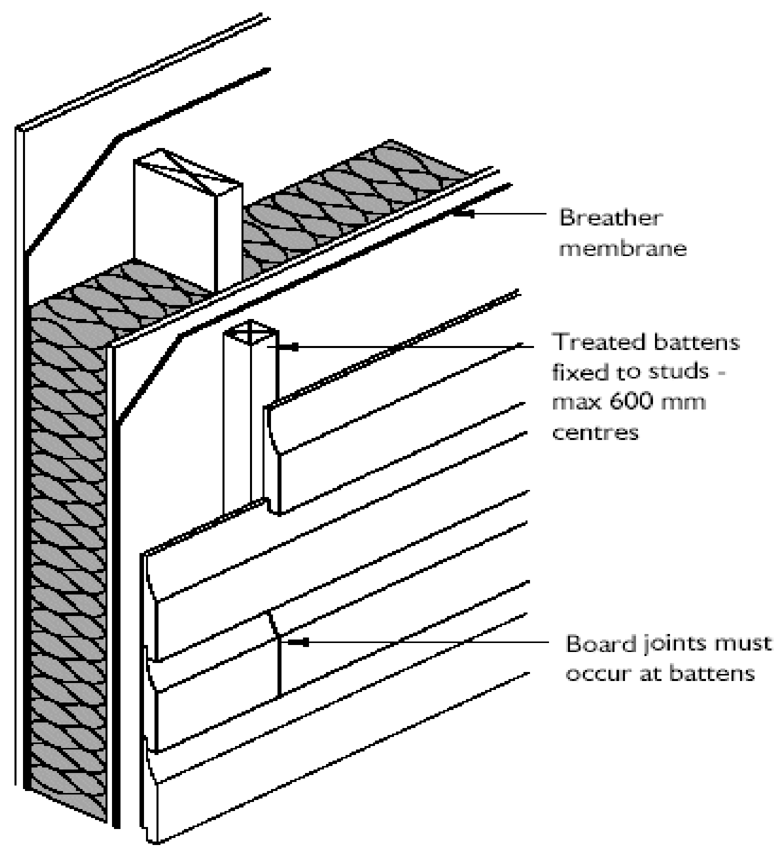
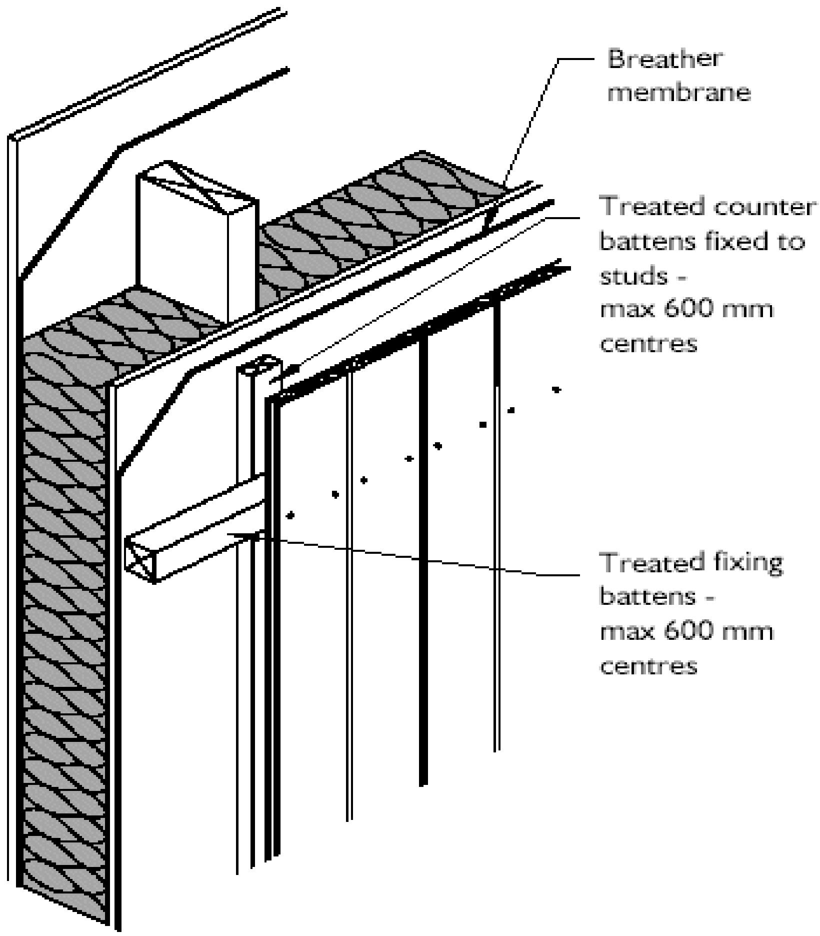


Figure 1 Typical construction: horizontal weatherboarding on vertical timber battens. Note: The drawings show cladding details on conventional timber frame construction. For other forms of construction, the details from the breather membrane out are the same.



Vertical boards will be fixed to horizontal battens and if the boards are tight-jointed it will be necessary to introduce vertical counter battens behind these horizontal battens which would otherwise prevent drainage and vertical circulation of air, see Figure 2. Although a 12mm minimum gap would theoretically be adequate between the horizontal battens and the inner wall, counter battens of solid wood should be increased in thickness to reduce the risk of the wood splitting when the battens are nailed through to studwork or masonry behind. If the horizontal battens are only to be fixed to the counter battens, these must be of sufficient thickness to take the fixing nails. If the horizontal battens are unsupported other than at studs or counter battens they should also be stiff enough not to flex unduly when the boards are nailed to them.

Figure 2 Typical construction: vertical tongued and grooved boarding on horizontal battens and counterbattens.

If a board-on-board or an open-jointed type of vertical cladding is used it is not necessary to provide counter-battens as there will be sufficient ventilation and drainage behind the outer boards, through the open joints, see Figure 3. In this case it is preferable if the horizontal battens are on the top edge to shed any water outwards. When counter battens are used, the horizontal battens should be chamfered to slope inwards and drain any water into the cavity behind the horizontal battens.
Support battens should not exceed 600mm spacing, whether vertical or horizontal, in order to limit the span of the cladding board and therefore its thickness. For diagonal boards it is preferable if the batten centres do not exceed 400mm, unless these are also fixed diagonally. Another reason for limiting the spacing of the support battens is that the relatively close spacing of fixings will tend to restrain any natural tendency for the boards to twist, bow or cup.

To avoid infestation by insects any openings at the top or bottom of close jointed boards should be protected by an insect mesh. If insect protection is considered necessary with open-jointed or board-on-board types of cladding an insect mesh layer should be stapled to the battens across the whole wall surface before the boards are fixed.

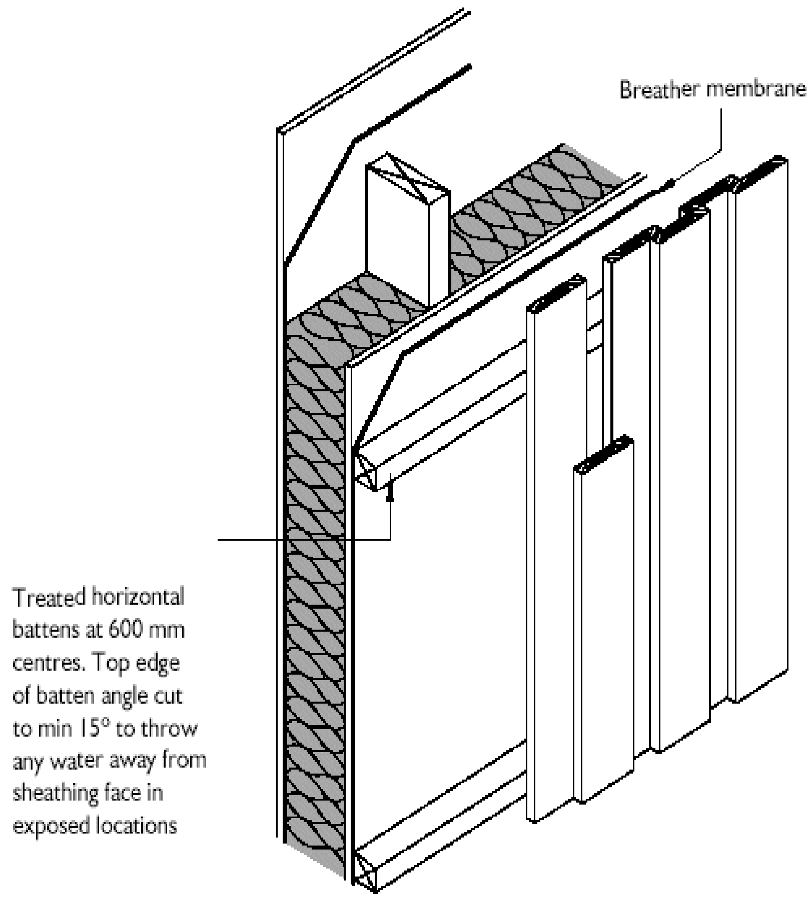


Figure 3 Typical construction: board-on-board cladding on horizontal timber battens. Note: The drawing shows cladding details on conventional timber frame construction. For other forms of construction, the details from the breather membrane out are the same.

Board profiles

Recommendations have already been made as to the suitability of particular profile for various cladding layouts and in particular the need to ensure that there is sufficient overlap or engagement of tongues to minimise any water penetration. Open-jointed systems will always be subject to some water penetration. Although the strength of the species chosen has some bearing on the thickness of board, this thickness is more likely to be determined by the profile chosen. While square cut boards might be reduced to 16mm thickness, rebated boards should never be less than 17mm thick and tongued and grooved boards also not less than 17mm thick when used externally. The thin edge of feather-edged boards should never be less than 7 mm.

Horizontal Boards

Horizontal boards should preferably not exceed 150mm width and for this width the vertical overlaps on square or feather-edge boards should be a minimum of 15mm.

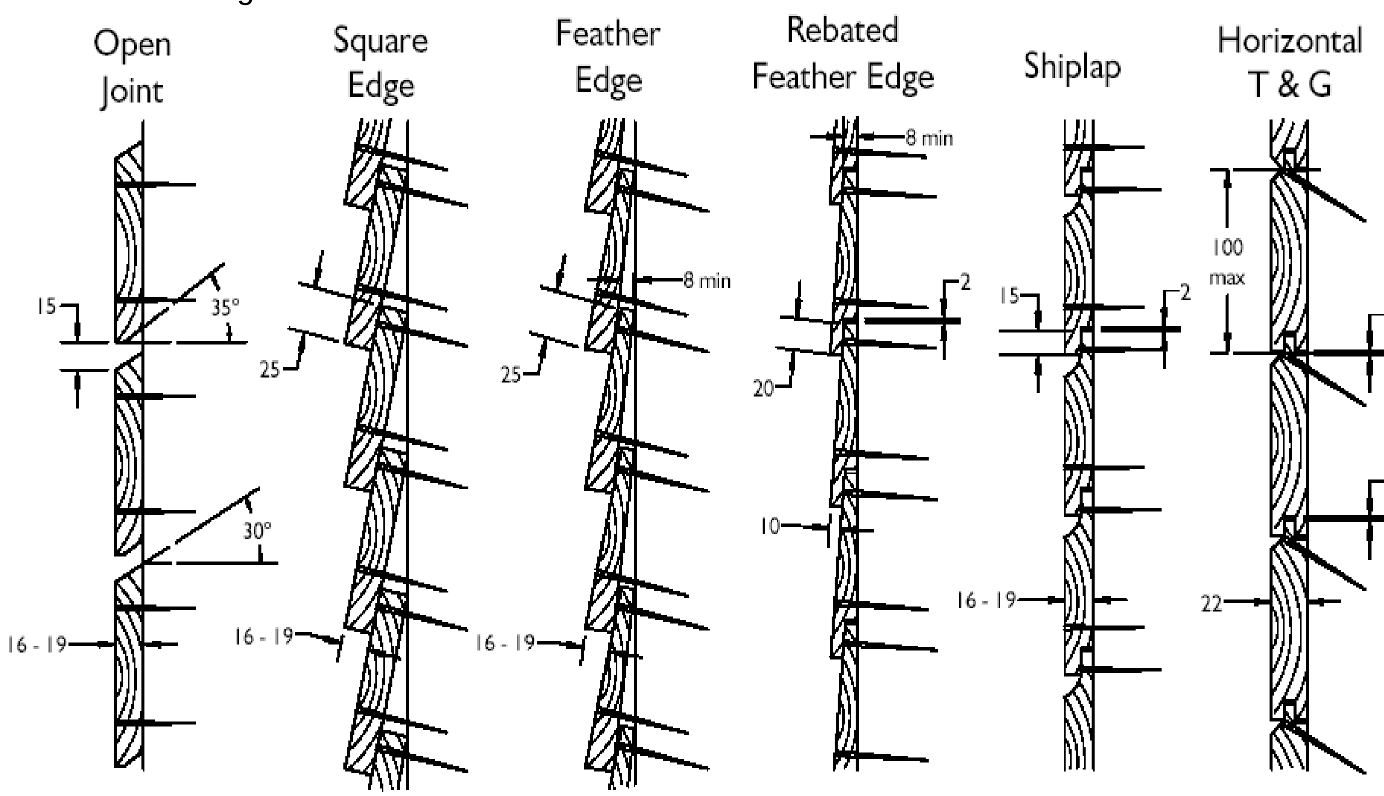


Figure 4 Horizontal boarding profiles.

For shiplap or rebated feather edge boards the overlap can be reduced to a minimum 9mm but a 2mm gap should be provided between upstand or rebate to allow for possible expansion of the boards. The curved or chamfered shoulder to shiplap boards drains water away effectively and produces a strong shadowline.

Horizontal tongued and grooved boards should be limited to 144mm face width, with a minimum 9mm deep groove, and 2mm clearance above the tongue when installed to allow for possible expansion. Horizontal tongued and grooved boards should always be installed tongue uppermost with the shoulder of the board at the base of the tongue chamfered to shed water away from the tongue. The underside of the board should be square cut or slightly chamfered away from the tongue.

Horizontal open-jointed boards should have a 9 - 12mm gap at the outer face. If the top and bottom edges of the board are chamfered at different angles, the increasing gap towards the inner face will tend to reduce pressure and consequently the amount of water driven into the cavity. Chamfered edges also allow the boards to be slightly overlapped, reducing any view into the cavity and ensuring that any breather membrane behind is not exposed to direct sunlight.

A shiplap profile is most appropriate for this application as the curved shoulder will effectively channel water away from the upstand, providing it is sufficiently large. Simple overlapping boards are not suitable as they will let water through by capillary action or wind pressure. Tongued and grooved boards should be installed tongue up, but even so, water will tend to be drawn up the face of the tongues by capillary action which can result in sustained wetting of the joint.

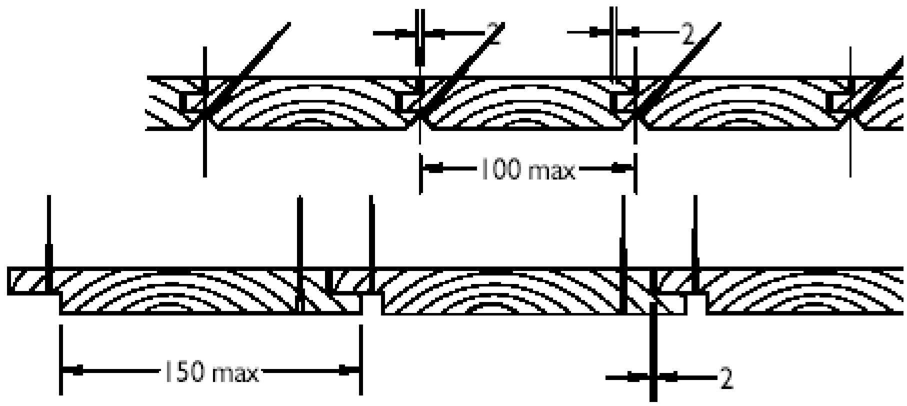


Figure 5 Profiles suitable for diagonal and vertical boarding.

Vertical Boards

Although tongued and grooved boards work effectively vertically they should not exceed 144mm face width. The tongues should be of the same size as those recommended for tongued and grooved boards used horizontally but the traditional v-joint can be used in this case. A rebated board similar to the horizontal shiplap board is frequently used for vertical boards in North Europe but rarely in the Ireland and the UK. Providing that there is a minimum 9mm overlap this profile works well vertically, and gives a strong shadow line.
The simplest and most versatile arrangement for vertical cladding is board-on-board. Simple square-cut boards can be used but the width of top or bottom boards can be varied to give different visual effects. The outer board can also be shaped in different ways to add more modelling of the surface. The preferred overlap between outer and inner board should be approximately 25mm. An additional refinement is to run drainage grooves near the edges of both the inner and outer boards. When installed these grooves oppose each other and provide an effective pressure relief and drainage channel. With this additional grooving the board-on-board arrangement can even work effectively as a roof finish.

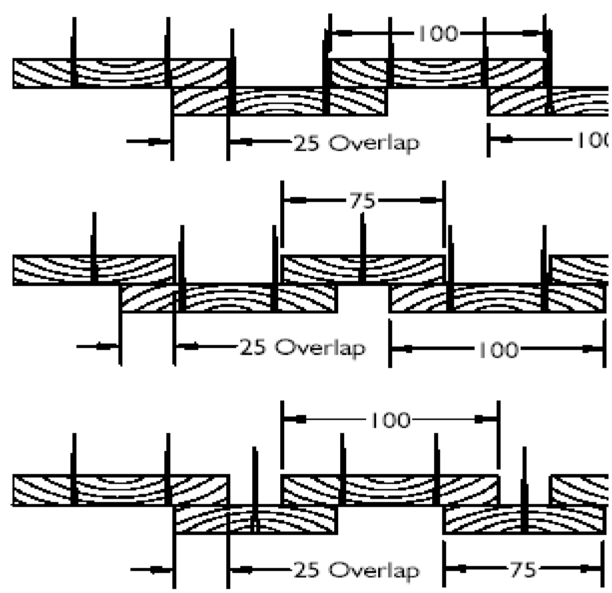


Figure 6 Profiles suitable for vertical boarding.

Fixings

Softwood

Softwood boards are normally nailed in position. Standard wire nails can be used but annular ring-shank nails are preferred for their improved holding power. Lost-head, small head, or siding nails are suitable for most softwoods, but round-head nails are recommended for Western red cedar because small heads can tend to pull through this soft wood. Stainless Steel or Galvanised nails should also be used for Cedar due to its highly corrosive properties. Nail penetration into the batten should normally be 2.5 times the thickness of the board being fixed (2 times when annular ring shank nails are used). Nails should be driven marginally below the surface to compensate for possible shrinkage of the wood which may otherwise cause the nail heads to stand proud of the surface.

Overlapping boards 100mm wide or above should be double nailed. Nails should preferably be located at quarter points in the board width, but it is important that where boards are overlapped, or in a board-on-board pattern, that the nails fixing the outer boards do not penetrate the inner boards, as this can lead to splitting of these boards.

Where boards are butt-jointed the junction should always occur over battens and nail fixings should be at least 20mm from the end of the boards and this may require wider or additional fixing battens behind.

For all boards to be left without a surface coating austenitic stainless steel nails should be used in order to avoid long term rust stains on the wood. This is especially important on woods with a high tannin content, where the reaction between the tannin and any ferrous metal will produce purple-black staining which cannot be removed.

Stainless steel will weather to a matt grey colour similar to that of bleached wood, reducing the visibility of nails. Even if the cladding is to have a surface coating, stainless steel nails are preferred, rather than plated steel, because galvanising or other plating can be damaged when the nails are driven home, leading to corrosion. The typical low-build stain coatings applied to cladding will not provide long term protection to exposed mild steel.

Hardwood

Hardwood boards are normally fixed by screwing to treated softwood fixing battens. Even for boards erected close to their in-use moisture content it is advisable to overdrill the holes in the boards to provide a clearance around the shank of the screw to allow for seasonal variations in moisture content. The head of a countersunk screw will normally provide sufficient retention but using larger diameter screws with bigger heads is preferred for this reason. Restricting the board width to a maximum 150mm, and locating the screws on the quarter points of the board width, will limit the width of wood that will swell or shrink between the screws. A 2mm clearance between the shank of the screw and the hole in the board should be adequate for woods rated as small or medium movement if the boards are installed at about 16% moisture content.

However if green wood is to be used considerable shrinkage of the wood will take place between the fixings. It is advisable in this case to predrill the boards to provide a 4-6mm clearance between the shank of the screw and the hole. As the head of the screw will not then be large enough to hold the board it will be necessary to fit washers under the screw heads in order to provide sufficient cover. The washers can be slotted to allow them to move with the wood, although care must be taken in aligning the slots and ensuring that the screws are in the outer ends of the slots initially. Alternatively drilled washers can be set into recessed holes in the wood which are sufficiently oversized to allow movement between the washers and the wood. Roundhead or panhead screws are normally used with washers, but there are also various sheeting screws available with built in washers and these have been successfully used for fixing green wood. They have the additional advantage of including a compressible rubber seal under the metal washer which will keep pressure on the boards even if they shrink in thickness. The use of large screws particularly in conjunction with metal washers, will have a strong impact on the appearance of the cladding. While this might often be desirable, sometimes concealing the fixings is preferred. One way of achieving this is to assemble the boards into panels by screwing through the battens into the back of the boards. It is possible to get sufficient screw retention in the thickness of a hardwood board but this is not feasible with a softwood board. In this case adequate clearance holes must be provided in the battens rather than the boards. The panels can then be fitted as a whole to the face of the building, either by screwing back the battens through open joints between the boards or screwing right through both the boards and battens and pelleting these holes after the panels are in place.

Figure 7 Use of oversized washers to allow timber movement.

An alternative method of secret fixing horizontal boards is to hold each board on metal clips fixed to the vertical battens, which engage in a slot in the underside of the board. The top of the board is then held by screwing through the rebated upstand. This is a similar principle to tongued and grooved boarding, but the upstand of the clip can be long enough to allow for considerable shrinkage in the board width and is both easier to engage and less liable to damage than an extended tongue. An additional advantage is that the bottom edge of abutting boards fixed to the vertical batten can be held and aligned with a single wide clip. This system is best suited to an open-joint type of boarding. The clip system however requires careful design for each specific use taking into account the likely shrinkage, species, thickness of board and other characteristics.

Screw fixings should be at least 40mm away from the ends of hardwood boards to avoid splits developing. At butt joints it is usually necessary to have separate fixing battens for the ends of each board. This is best accommodated by panelising the board layout so that the ends of boards always occur in line. All unfinished hardwood boards should be fixed with austenitic stainless steel screws and any washers or clips should be of the same material. Even if the boards are to be stained or painted, stainless steel screws are preferable as any damage to a plated screw during fixing can result in corrosion and staining. However, if the boards are to be directly fixed to mild steel or galvanised members, electrolytic action may occur between the metals if stainless steel fixings are used. For this reason it is always preferable to introduce wood battens between the boards and any metal framing. The boards can then still be fixed to the battens with stainless steel screws but plated screws or bolts can be used to fix the battens to the steelwork.

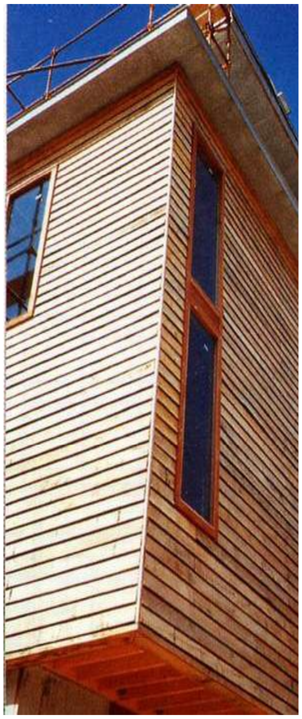


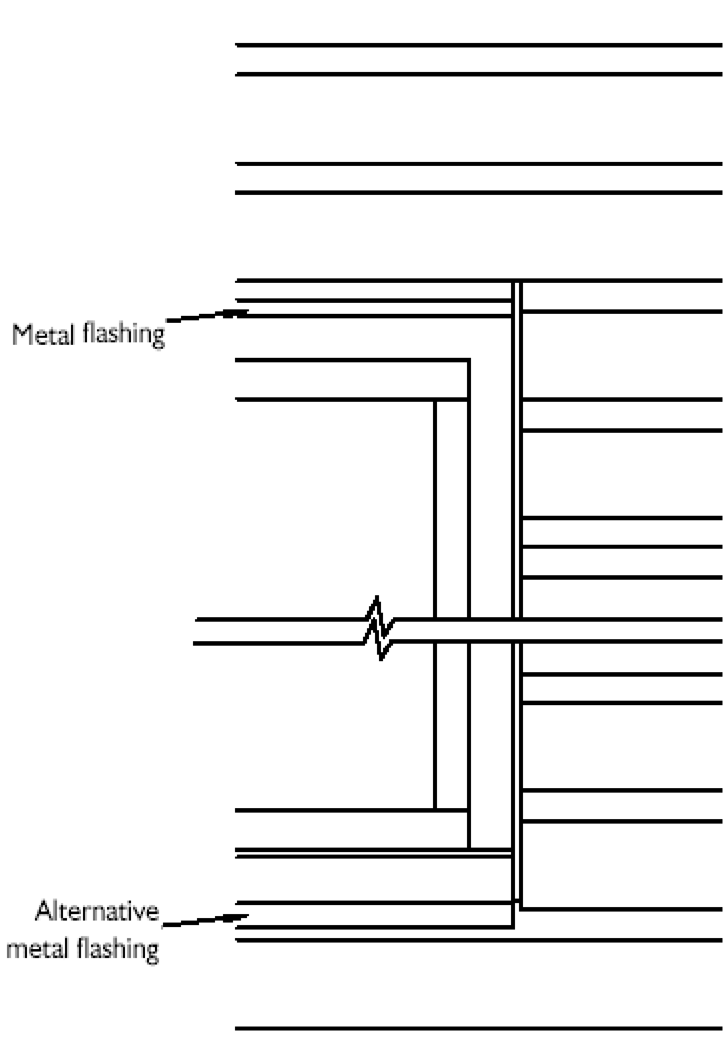
Figure 8 'Secret fixing.

Relating timber cladding to building configuration

The overall visual quality of timber cladding will be very dependent on the details relating it to building configuration such as corners, changes of level, parapets, openings, junctions with other materials etc. These conditions need careful consideration, particularly in relating the natural dimensions of the cladding system to other elements of the building.

Openings

Most areas of timber cladding will either contain openings for windows or doors, or be contained within a dimensional framework determined by areas of glazing or a regular pattern of windows. Ideally any openings should be in multiples of the chosen board width to avoid the need to notch or split boards. Even diagonal boards have dimensional implications if the end of boards are not to require notching. Having to notch or split boards around openings is difficult practically and can lead to poor appearance. A dimensional relationship is particularly important between openings and board widths for board-on-board cladding otherwise the pattern of boarding may end up being different on either side of an opening. If the sizes and locations of openings are already determined, it may be necessary to choose a size of board, or vary the amount of overlap, specifically to relate to the predetermined dimensions of the openings. It is also important to consider the three dimensional relationship of flashings, sills and dpcs around any openings formed in the timber cladding to ensure that any water is drained away to the outside of the wall.



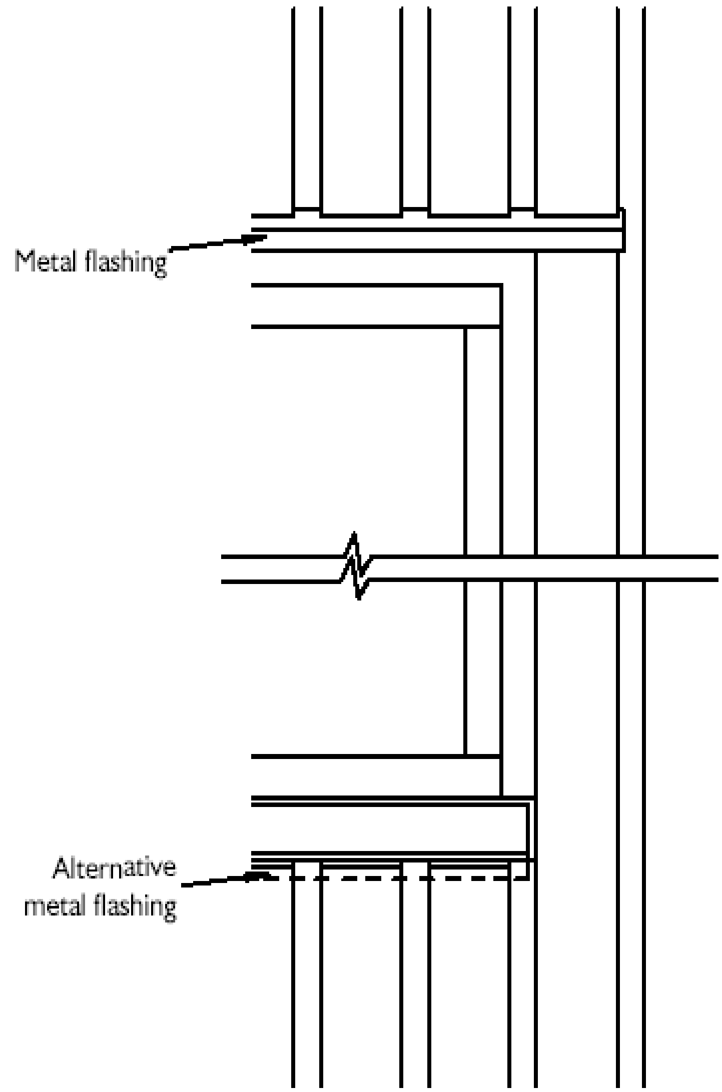
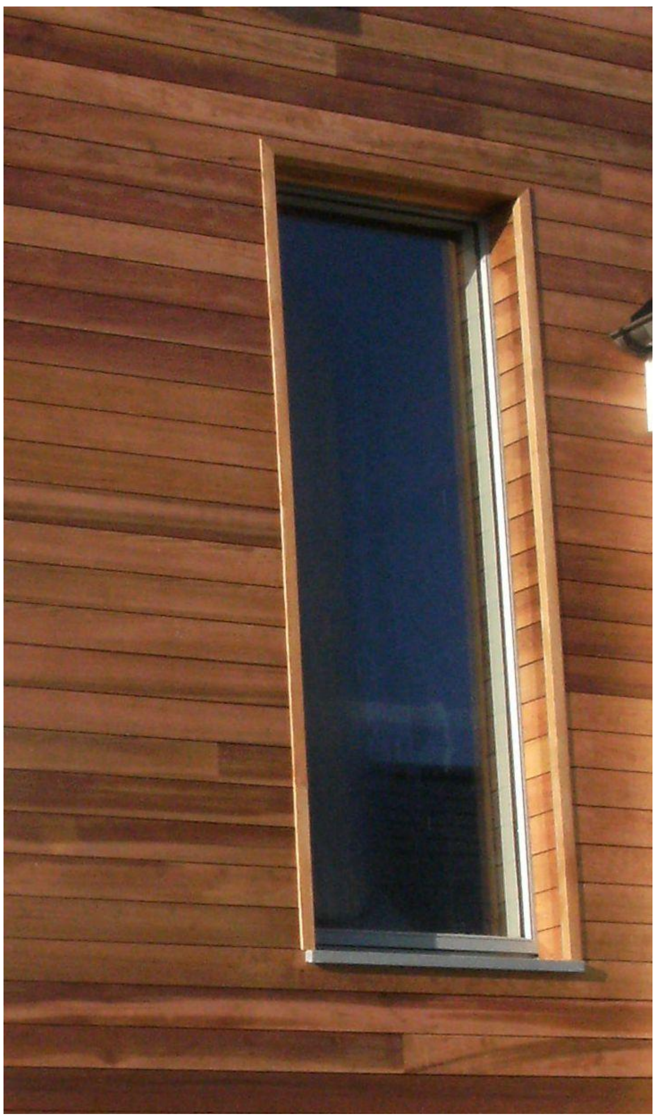


Figure 9 Typical elevation detail of window in horizontal boarding.

Figure 10 Typical elevation detail of window in vertical board-on-board cladding.

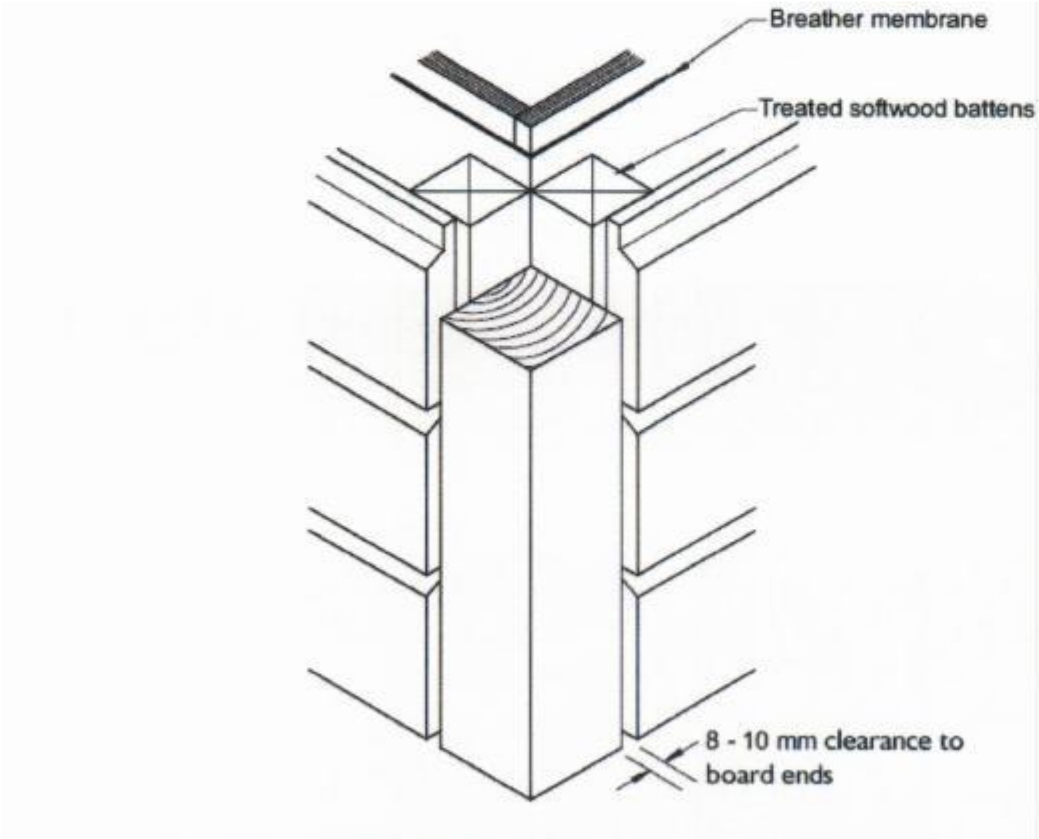
Pictures of some Timber Window Reveals



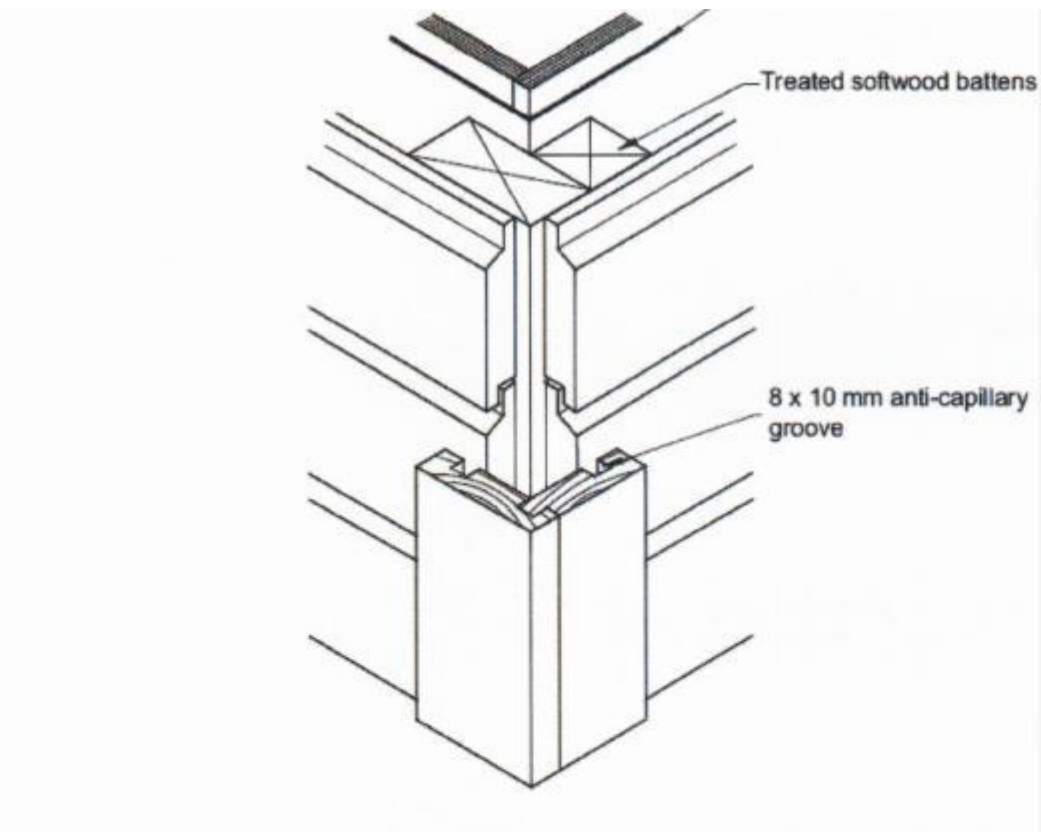
Board layout
It has already been noted that there are limits on the length of board likely to be available in any species. In softwood a reasonable maximum length would probably be about 4.8m, although longer lengths might be available to special order. For tropical hardwoods, depending on the species, maximum lengths between 4.0 and 5.0m might be the limits. For temperate hardwoods such as European oak while 3.6m may be the maximum length available, lengths of 2.4m would be more easily obtainable, particularly in home-grown wood. The reason for considering these dimensions is that they can have a significant impact on how the pattern of cladding will relate to the overall dimensions of the building elevations either vertically or horizontally. Another consideration should be the structural module of the building, particularly if the cladding is to be directly fixed to a timber or steel framed structure.
Non-orthogonal shapes ie curved surfaces in plan, section or elevation, or angled facades need careful choice of cladding. These may determine whether vertical, horizontal or even diagonal board layouts are the most practical. For instance a shallow angle pitched façade can be more easily accommodated by cutting the ends of vertical boards, than tapering horizontal boards, but for steeper angles either method is suitable. Using diagonal boards can sometimes simplify the junction with sloping planes.

Junctions with other materials
Where timber cladding with a cavity behind abuts walls of other material, either at re-entrants or in line, it is not usually necessary to introduce an additional dpc if there is already a breather membrane which can be extended around to the edge of the wall and held tight against it by a vertical batten. This applies if the connection is to the outer leaf of a cavity wall, but if the cavity is in line, or behind a vertical dpc between the leaves, this dpc should be extended to cover the joint between any framing or sheathing and the wall. Compressed bitumen, wax or neoprene loaded foam sealing tapes may be preferred to dpc's or mastic in these locations, because they maintain good contact over uneven surfaces and will continue to expand to fill any gaps even if there is shrinkage or movement at the interface between the wall and any timber component. Whatever junction is made between battens and the abutting wall it is important that there is at least an 8 - 10 mm gap between the wood and any other wall material.

Corners
The detailing of both external and internal corners in timber cladding will have a strong visual impact, and should be related to such features as the detailing of the cladding around window openings. In horizontal cladding, whether overlapped or flush, window openings were traditionally surrounded with an architrave section which covered the cut ends of the boards and the edge of the window frame. Corners were therefore treated in a similar way, with cover boards over the ends of the boards. It is now more common to stop the boards short of a fully expressed window frame, creating a shadow gap all round. This requires a high standard of workmanship in cutting the boards, particularly if they are overlapped. The window frames are then usually carried forward flush with the ends of the boards. Transferring this principle to the corner, means that a solid corner piece is required flush with the outer face of the boards in the same relationship as the window framing. This can be achieved either with a solid square section, or by forming an L-shaped corner. An L-shape is sometimes reversed to emphasise and create a re-entrant corner.

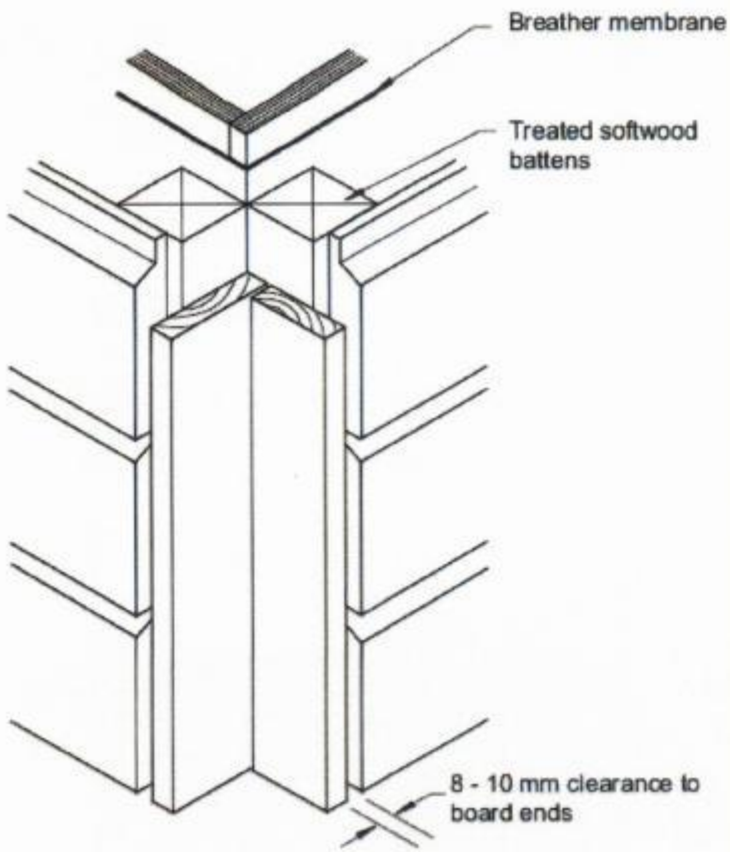


Solid timber corner detail in horizontal boarding

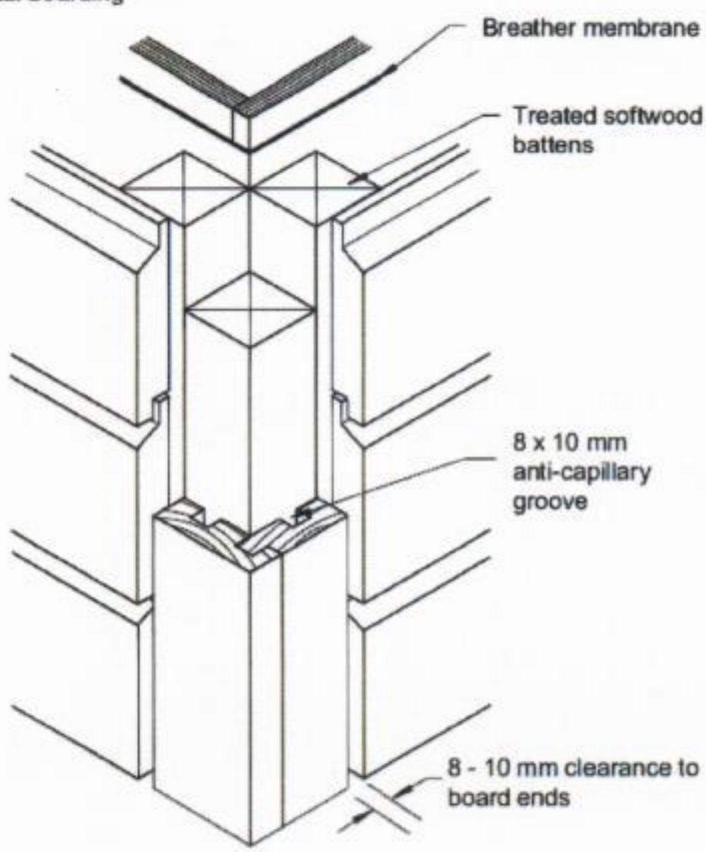


Covered corner detail in horizontal boarding

Can be produced in a solid L shape section

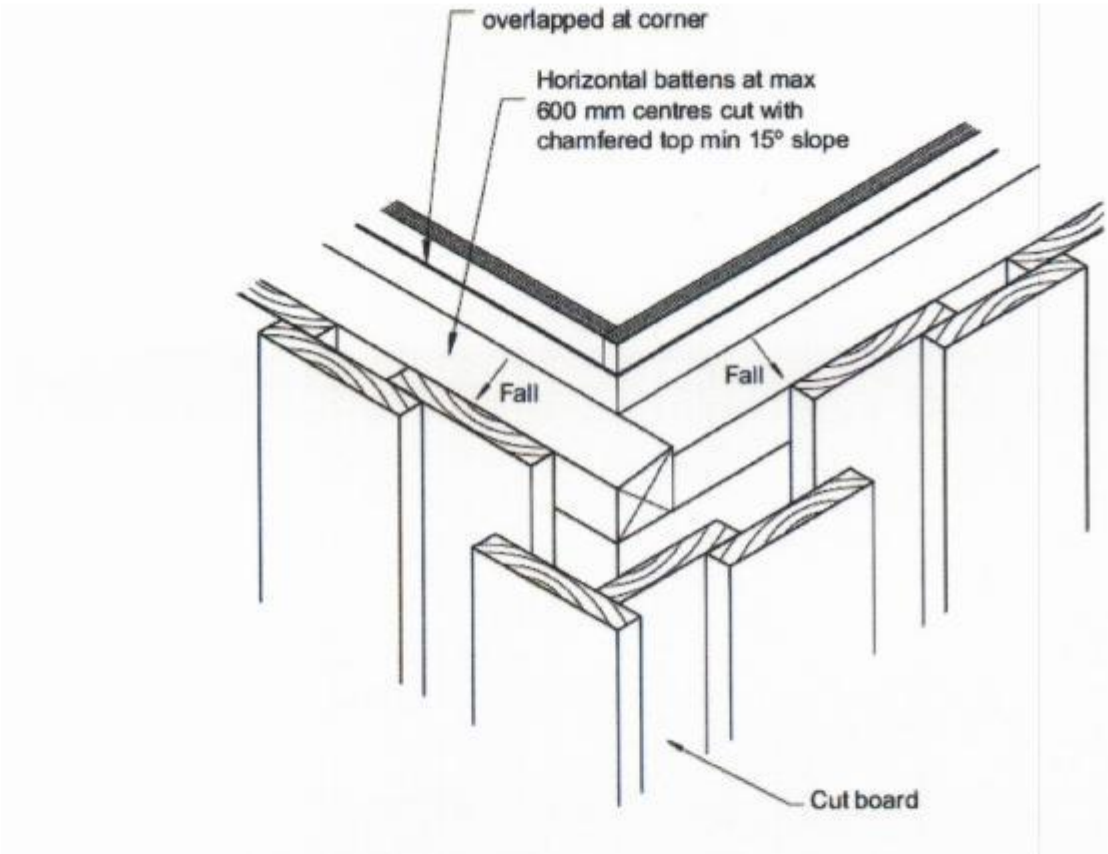


Re-entrant corner in horizontal boarding



Solid corner detail in horizontal boarding with preformed capping pieces

Can be produced in a solid L shape section



Typical corner detail in vertical board-on-board cladding

Shadow Gap Mitred Corner details

Cladding Species

Western Red Cedar
This timber is imported from British Colombia, Canada. The heartwood has a wide range of colours, from salmon pink to chocolate brown, which weather over a period of time to a silver grey colour if left unsealed. Cedar heartwood is resistant to decay and is highly durable, giving it an anticipated lifespan of 40 to 60 years without any need for preservative treatment. It is a dimensionally stable timber with very low movement in service owing to its light weight and low density (390kg per m^3 when dry).

Iroko
This hardwood is imported from Africa. It is a durable hardwood which can be used as external cladding. It is a clear grade hardwood with no knots and, due to its density, it can be suitable for use in areas where high impact or abrasion may occur. The timber itself can vary from a light tan to dark brown in colour and will weather to a silver or grey colour if left unsealed.
Density is approx 660kg per m^3.

Douglas Fir
Yet another timber from the British Colombia region of Canada, this timber is a popular choice amongst architects and designers for use as a timber cladding. This timber is not to be mistaken for Native Douglas Fir as it is a much clearer grade of timber, it can be supplied almost knot free and has a very nice grain pattern. It is required as moderately durable and can be supplied both treated and untreated. It is stable in use and can be supplied in long lengths.
Density is approx 530kg per m^3.

European Oak
Not to be mistaken for its American counterpart American White Oak, European Oak is a beautiful timber which has been used for centuries as cladding and joinery material. It can be used 'green' but careful allowance must be made for shrinkage and movement of the boards. It is mainly supplied as well seasoned Air Dried or Kiln Dried in both clear and knotty/character grades. The boards tend to be much shorter in length compared to other cladding species, averaging 2.4m in length. This timber can be left natural to weather to a silver grey colour, and stainless steel fixings should be used to help prevent staining.
Density is approx 730kg per m^3.

European Larch
This timber is one of the harder conifers available on the market (density 510kg per m^3). It is classed as moderately durable timber. It is a small movement wood and, if the sapwood is excluded, can be used untreated. It is light yellow in colour and has good resistance to impact and wear due to its density. It contains knots which are live, tight and sound.

Treated Softwoods
Treated softwoods can be supplied using Red or White Deal which has been treated using a Tanalith treatment or a Vacum pressure treatment with chemicals to produce a durable softwood (Hazard Class III). The treatment can be clear, green or bright yellow in colour. Both Red and White Deal are knotty softwoods from Finland and Sweden. They are not naturally durable, but with the new treatments on the market today, they can be a less expensive alternative to other cladding species.

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