# Swish Building Products

## The Sustainability Credentials of Cellular PVC Building Products

This CPD presentation has been approved by RIBA.

May 2010

## Commentary

As you scroll through the pages of this presentation a commentary on the page content will appear in this section.

# PVC

## What is PVC?

- Polyvinyl Chloride
- Chlorine from common salt
- Ethylene from oil

## Commentary

PVC is an excellent material for the construction industry because of its lightness, strength, formability and long life span.

It is efficiently formed into a large number of shapes but unlike other materials it will not rot, flake, warp or peel and so has a long working life.

PVC as you probably know stands for Poly Vinyl Chloride.

PVC is derived from Chlorine and Ethylene which in turn are derived from Salt and Oil.

# PVC

## What is PVC?

Polyvinyl Chloride

Chlorine from common salt

Ethylene from oil

## PVCu

Poly Vinyl Chloride
Unplasticised

## Commentary

There are many forms of PVC, but the two commonly used in the roofline industry are:

**1. PVCu**, where the ‘u’ stands for unplasticised – in other words it forms a rigid profile –

# PVC

## What is PVC?

Polyvinyl Chloride

Chlorine from common salt

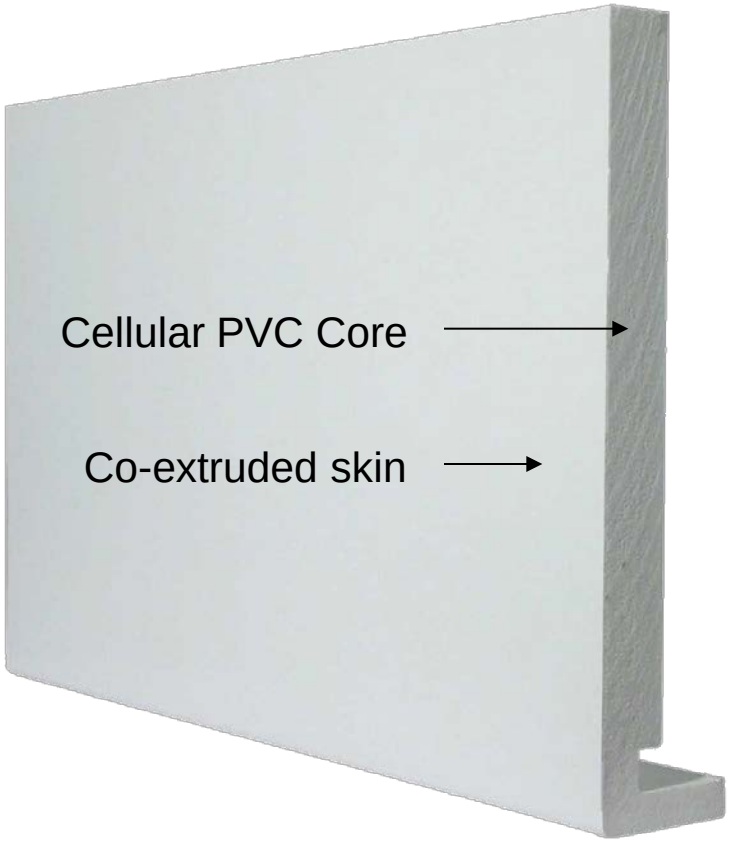
Ethylene from oil

## PVCu

Poly Vinyl Chloride
Unplasticised

## PVCue

Poly Vinyl Chloride
Unplasticised
Expanded




## Commentary

**2.** And **PVCue** where the ‘e’ stands for expanded.

Swish manufactures expanded or cellular PVC profiles for use in roofline and cladding systems.

The foaming process, which employs bi carbonate of soda – like a cake, produces a strong, lightweight board that is many times thicker than could be made in solid PVC.

During the process a smooth skin is co-extruded onto one side of the board to form the exposed face. This enhances the appearance of the board and allows colour variations to be created.

Cellular PVC can be cut, drilled, nailed and routed, using conventional carpentry tools. It is also light and easy to handle and fix.

# Product & System Attributes

## Complete System

- Roofline & Cladding
- Many sizes
- Corners/joints/trims
- Vent system
- Pre-finished

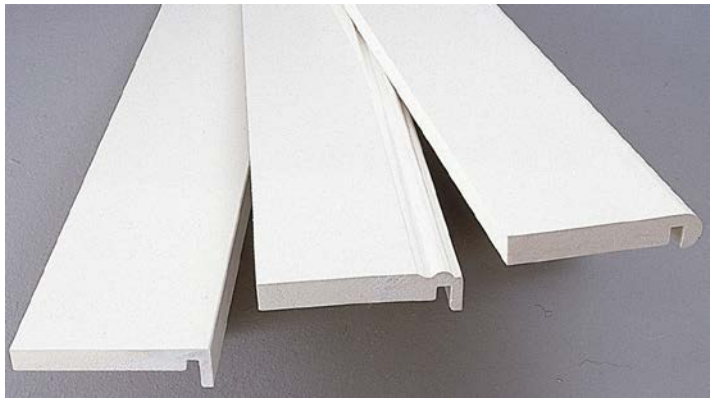
## Commentary

In general terms the moulded nature of roofline and cladding profiles means that a variety of shapes and sizes can be produced together with corners and joints that ease the installation process.

Importantly the surface is prefinished which reduces the time spent onsite.

# Product & System Attributes

- Complete System
  - Roofline & Cladding
  - Many sizes
  - Corners/joints/trims
  - Vent system
  - Pre-finished
- Aesthetics
  - Shapes
  - Colours



## Commentary

In addition to a number of fascia and cladding board shapes, a variety of finished colours can be produced either as a foil applied to the surface of the finished board or as a self coloured skin.
Swish produces a number of foiled finishes to match popular window and door systems.

# Product & System Attributes

- Complete System
  - Roofline & Cladding
  - Many sizes
  - Corners/joints/trims
  - Vent system
  - Pre-finished
- Aesthetics
  - Shapes
  - Colours
- Workability
  - Standard tools

## Commentary

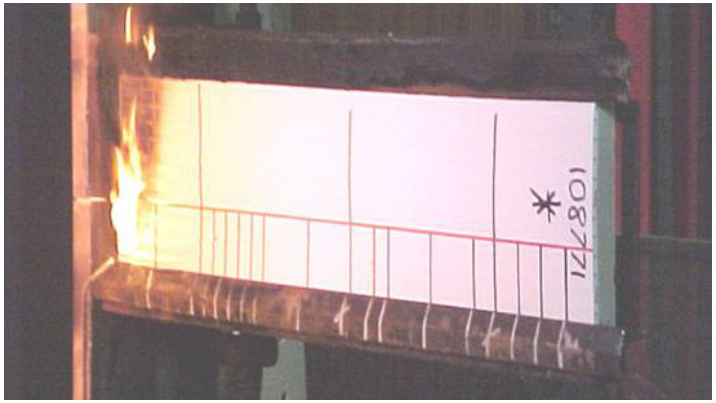
One of the remarkable aspects of cellular PVC is the ease with which it can be worked with conventional carpentry tools.

It can be sawn, cut, drilled and routed in the same way as timber and fixed with screws and nails in the same way.

Industry good practice is to use A4 marine grade fixings to prolong the life of the installation

# Product & System Attributes

- Complete System
  - Roofline & Cladding
  - Many sizes
  - Corners/joints/trims
  - Vent system
  - Pre-finished
- Aesthetics
  - Shapes
  - Colours
- Workability
  - Standard tools
- Safety
  - Does not contribute to fire
    - Class 1Y Self extinguishing
    - Low spread of flame
  - Inert material




BS476 surface spread of flame test.

## Commentary

Cellular PVCu has limited combustibility with slow surface spread of flame which reduces the risk of fire jumping from building to building.

The old British Standard (BS) product test shown here, and the new European Single Burning Item (SBI) test, clearly show that Cellular PVC will stop burning when the direct source of flame is removed and does not produce “flaming droplets”.

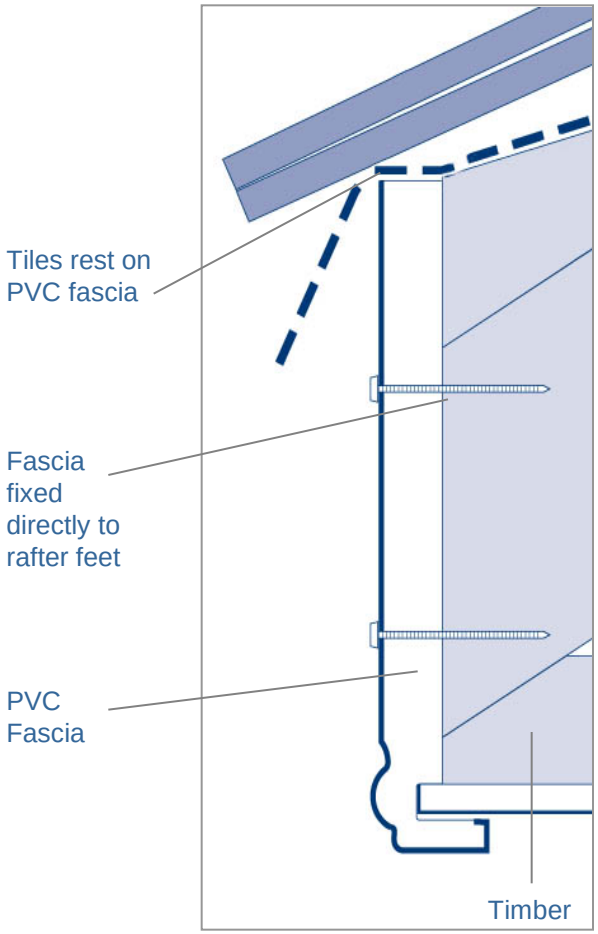
.

Cellular PVC is also inert in that it will not “leach” into rainwater or landfill should it end up there.

# Product & System Attributes

## Replacement and New build

- 16mm to 25mm thick
- Timber backing board not required
- Guttering fixed directly to fascia
- Tiles rest on upper edge of fascia
- Full replacement of fascia is industry BEST PRACTICE




## Commentary

Cellular PVC is a tough material that performs as well as timber.
PVC fascias for replacement or newbuild vary in thickness from 16mm to 25mm. They can be fixed directly to the rafter feet and do not require a backing board.

The gutter system may be screwed to the fascia and it will also bear the weight of the eaves row of tiles without the assistance of a kick fillet.

It is best practice within the industry to fully replace old timber fascia in order to eliminate the possibility of timbers rotting behind the PVC fascia.

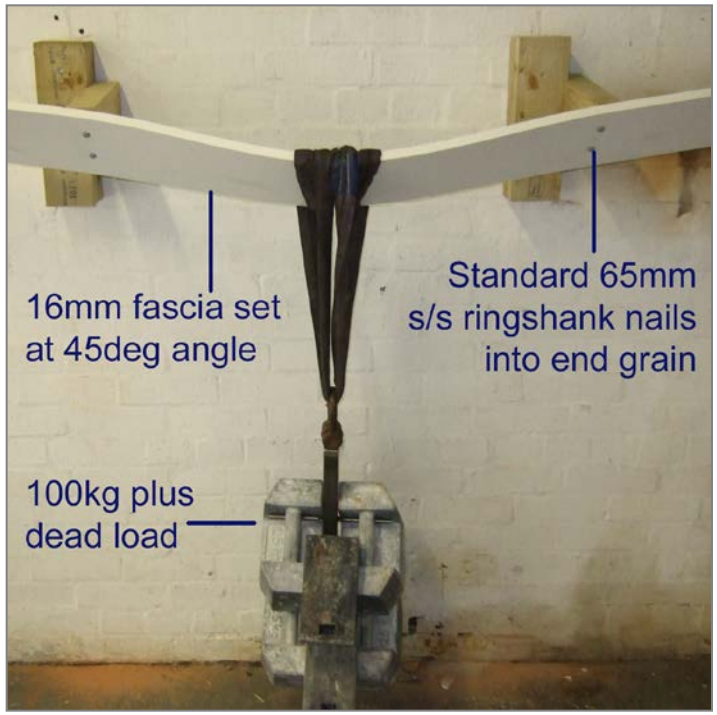
# Product & System Attributes

## Replacement and New build

- 16mm to 25mm thick
- Timber backing board not required
- Guttering fixed directly to fascia
- Tiles rest on upper edge of fascia
- Full replacement of fascia is industry BEST PRACTICE

## Fascia load test

- 100kg plus
- Fascia at 45deg




## Commentary

The strength of these boards is best demonstrated by the fascia load test carried out as part of the BBA Certification.

100kg is hung from a board which is set at 45degrees and secured by 4 65mm ringshank nails.

# Product & System Attributes

## Replacement and New build

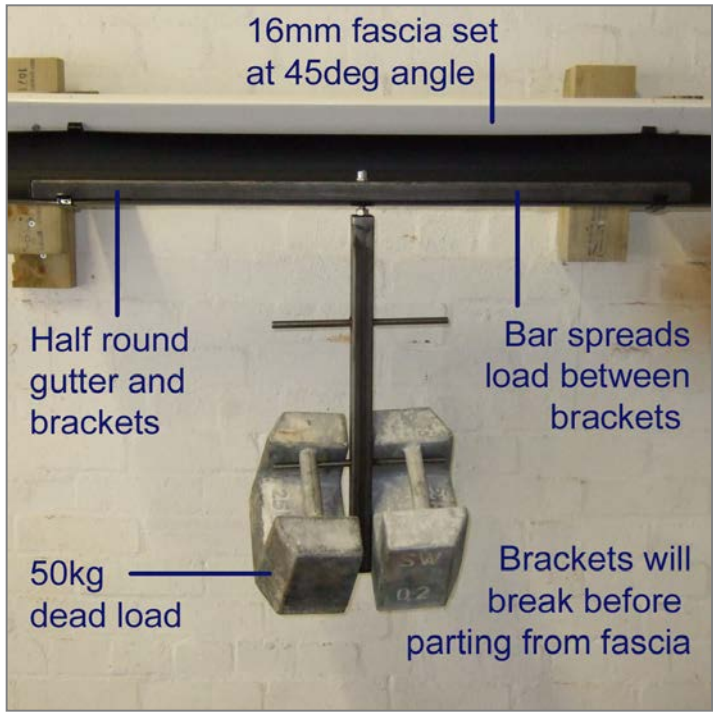
- 16mm to 25mm thick
- Timber backing board not required
- Guttering fixed directly to fascia
- Tiles rest on upper edge of fascia
- Full replacement of fascia is industry BEST PRACTICE

## Fascia load test

- 100kg plus
- Fascia at 45deg

## Gutter load test

- Gutter brackets will destruct first




## Commentary

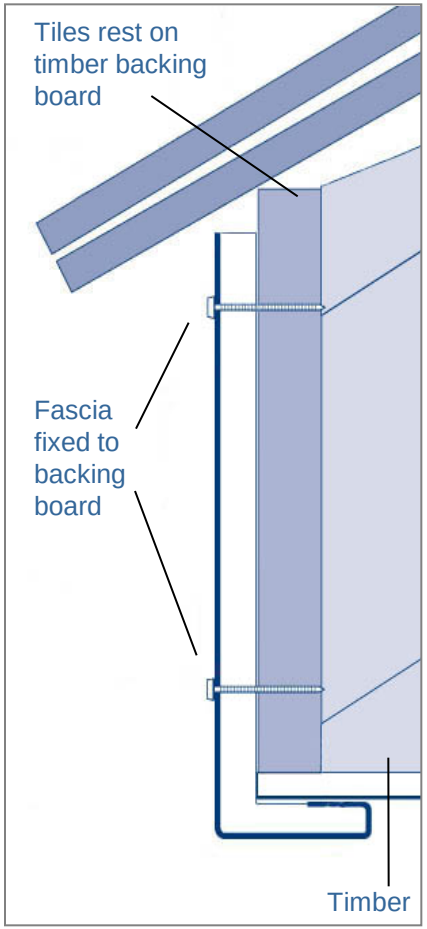
The gutter load test also demonstrates how secure a gutter system is when fixed to a PVC fascia.

The usual outcome of a destruction test is that the gutter brackets fail with no sign of the bracket parting from the fascia.

# Roofline - capping

## Capping fascia

- Approximately 9mm thick
- Tiles rest on top of backing board
- Guttering fixed through into timber
- Fascia and gutter loading depend on timber
- Backing board must be sound




## Commentary

Capping boards are an alternative to replacement fascias but should only be used where there is a timber backing board that is well seasoned and in sound condition.

Capping boards are sometimes used in bargeboard applications to cover the gable ladder. Here the location is often more sheltered from moisture and there is no load bearing requirement.

These 9mm boards are therefore purely cosmetic, they cannot bear the weight of eaves tiles, and the gutter system must be fixed through to the timber backing board.

# Roofline - ventilation requirements

## Inadequate ventilation promotes rot

- Building Regulations require adequate ventilation at the eaves
- Equivalent to continuous air gap of 10mm or 25mm

## Commentary

In a typical cold roof situation it is essential to establish a free flow of air into and through the roof void. This is essential to avoid rot occurring in structural timbers.

The building regulations recognise this and require the equivalent of a continuous 10mm or 25mm air gap ath the eaves, dependent upon the roof pitch and layout.

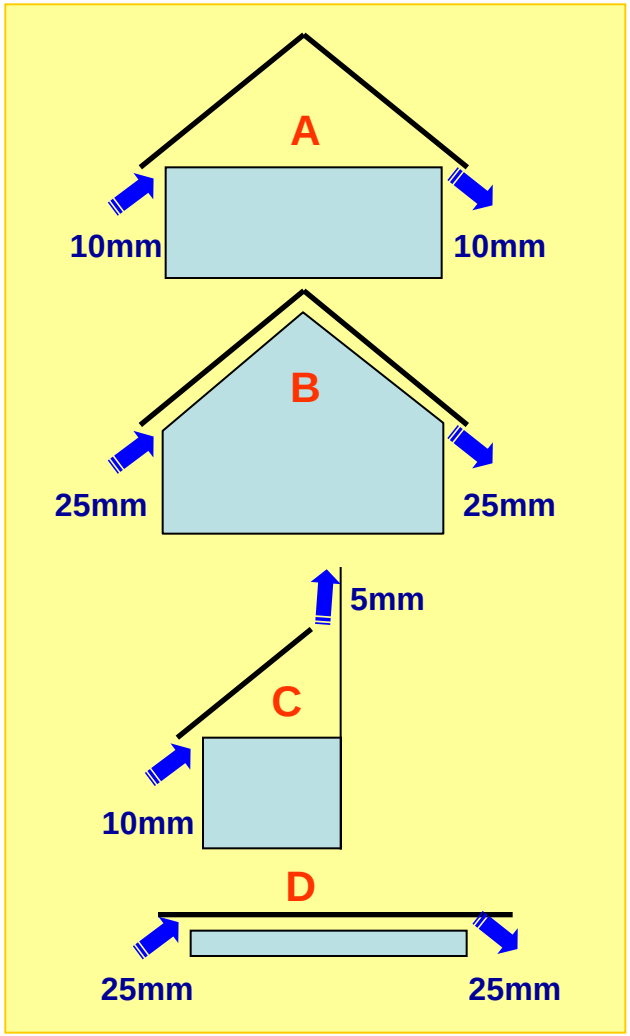
# Roofline - ventilation requirements

## Inadequate ventilation promotes rot

- Building Regulations require adequate ventilation at the eaves
- Equivalent to continuous air gap of 10mm or 25mm

## 4 common designs.

- A - Pitched between $15^0$ and $70^0$.
- B - Like A but ceiling follows line of roof (eg. in a loft conversion)
- C - As in A but a mono pitched roof.
- D - Typical flat roof




## Commentary

There are four common cold roof designs identified in the regulations.

The standard design, A that most people recognise, with a pitched roof between 15 and 70 degrees requires a 10mm air path.

Where the loft has been converted to accommodation, as in B, this is increased to 25mm.

With a mono pitched roof the eaves ventilation remains at 10mm but provision must be made for a 5mm vent at the wall.

All flat roofs must have a 25mm equivalent air gap at the eaves.

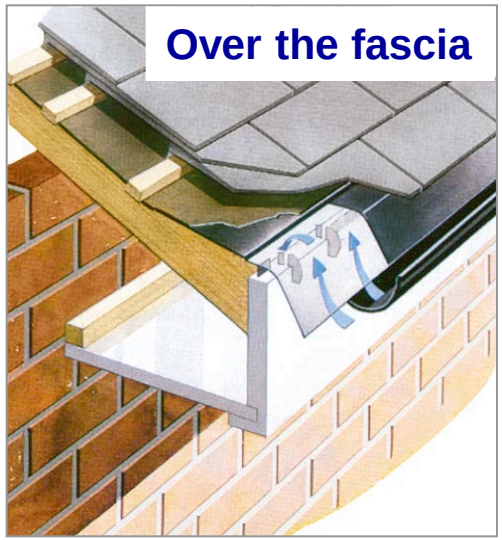
# Roofline - providing ventilation

## Over fascia

- Ventilator unit nailed to top of fascia.
- Roofing felt rests on top.
- Reduce height of fascia to accommodate ventilator unit.
- Produces ‘clean’ soffit look

## Through the soffit

- Ready slotted boards - 10mm or 25mm air gap.
- Slotted cladding profiles available as soffits.





## Commentary

There are two recognised methods of providing ventilation at the eaves.

A ventilator may be fixed to the top of the fascia board to provide over fascia ventilation. This ventilator may also be combined with over fascia protection and has the advantage of producing a clean look at the soffit.

An alternative and widely used method is to provide ventilation through pre-formed slots in the soffit board. This has a slight cost advantage but not appear as neat as over fascia ventilation.

# Roofline - the ponding process

Roofing felt protects the roof void.

Felt behind the fascia board can sag and accumulate water.

Roof tiles may eventually sever the felt over the top of the fascia board allowing it to drop back.

Water encourages mould growth and rot in the rafters.

Felt must be cut back and dpc material inserted underneath OR rigid PVC profile nailed to top of the fascia board to support edge of felt.

## Commentary

The other condition that can lead to timber rot is known as ponding.

This occurs where the roofing felt behind the fascia sags and allows water to accumulate in the resultant hollow.

Sagging may occur where the felt has severed at the top of the fascia as the eaves course of tiles press down on it.

The remedy is to replace the felt entirely or to cut back the broken or rotted felt to a sound edge and to feed dpc material or an over fascia protection profile underneath the lead edge of the felt.

Ultimately the lead edge of the felt should dress down into the gutter

# Fixings & fixing centres

Maximum fixing centres are:

- 600mm for white boards
- 400mm for coloured and foiled

Maximum fixing centres and quantity of fixings required for the prevailing conditions must be observed.

All nails and screws must be of A4 marine grade stainless steel.


| | | | | |
|---|---|---|---|---|
| 16mm+ Replacement Fascia Board | Nail | 65mm | 2 | White 600mm<br>Foiled 400mm<br>(and colours) |
| | Screw | 50mm | 2 | |
| 9mm Capping Fascia Board | Nail | 50mm | 2 | |
| | Screw | 40mm | 2 | |
| 9mm flat boards (eg soffits) | Nail | 40mm | 2 | |
| | Screw | 40mm | 2 | |

## Commentary

Not observing the recommended maximum fixing centres and the number of fixings required, can lead to the deterioration of the installation.

In addition the fixings must be A4 marine grade stainless steel.

Silicone or a general purpose adhesive can be used to affix some corners and joints.

# The Right Kit

Stable access essential. Senior managers obliged to ensure safety and security of employees working at height.

A stable cutting platform is important

Carpentry tools are adequate for working with cellular PVC

## Commentary

The process of fitting roofline components is fairly straight forward.

As with any installation of this kind close attention must be paid to the safety of the installation team.

Working at height regulations require that senior managers should be responsible for providing a safe working environment.

At the very least installers should work from a stable, cantilevered deck system. Preferably they should be accessing the roof from a full scaffold system erected by a reputable firm.

Standard carpentry tools, manual and powered are more than adequate but power saws should only be used at ground level on a stable working surface.

# Stripping Out

## New build

- Installed before tiles
- Allows maximum access
- Roof covering one operation

## Refurbishment

- Remedial work
- Common ventilation requirements
- Common build requirements



## Commentary

In a new build situation the roofline will usually be fitted after the rafter components have been installed and before the roofing felt and tiles.

This allows maximum access to the roofline area and means that the installation of the entire roof covering including the setting of the gable tiles can be undertaken in one operation.

In a refurbishment situation there is the usual stripping down and remedial work to be carried out on the substrate but thereafter the ventilation decisions and the roofline build up are the same as in newbuild.

The following description of the installation process therefore starts at the point where refurbishment begins.

# Stripping Out

Check for asbestos components (usually the soffit). Consult the local authority about removal.

Remove gutter system

Push back the second row of tiles and lift and stack the second row.

## Commentary

The property should be inspected for asbestos materials which are sometimes found in the soffit board. The local authority should be consulted about removal

The gutter system should be removed and the first two rows of tiles pushed back or lifted and stacked securely.

In most cases this will reveal that the sarking felt has severed along the top of the fascia and occasionally will have dropped back.

# Stripping Out

Cut back rotted roofing felt to a clean edge

Remove fascia and soffit.

## Commentary

The damaged roofing felt should be cut back to a sound edge. Eventually a section of dpc material or rigid PVC will have to be fitted under the cut edge to ensure any moisture runs over the fascia into the gutter.

The fascia and soffit are now removed and the rafter feet inspected for damage or rot.

# Well Hung

Swish BUILDING PRODUCTS

Fit timber or PVC hangers to rafter feet

- in line & level
- well secured
- wide enough to accept a fixing
- Treated or seasoned timber

## Commentary

In newbuild the alignment of the rafter feet is generally good but care should still be taken to check this and to make adjustments with packing pieces as necessary.

In refurbishment a number of alignment techniques are practiced. They are all reliant on fitting a string line to verify final alignment.

Here it can be seen that sections of thick cellular PVC board have been fixed to the rafter feet at either end of the run to act as hangers. These pick up the correct size and position of the chosen fascia and soffit boards.

Thereafter each rafter foot has had a similar hanger attached. Many installers also use seasoned timber as hangers.

# Well Hung

- Fit treated timber hangers to rafter feet
  - in line & level
  - well secured
  - wide enough to accept a fixing
- Soffit may
  - Abut to wall - use battens or support trims
  - Rest on wall - allow for reveal depth over window heads
- Timber frame
  - Experience has shown that timber frames compress
  - Allow for compression when fixing soffit



## Commentary

The height of the fascia and the depth of the soffit tend to be dictated by the angle of the roof and the amount of overhang at the eaves.

In addition the choice of ventilation system may vary the height of the fascia. The size of the over fascia vent unit must be allowed for, as shown in the first image.

If the soffit is to abut to the wall it will be shorter than one that sits on top of the outer course of bricks, as shown in the second image.

Specifiers and installers should be aware that timber frames tend to settle and soffits mounted on top of the wall may dislodge or fracture with this movement.

# Fixing Soffits

Fix soffit at each rafter foot or hanger

Fix deep soffits every 200mm

Soffit protrudes past the rafter foot and at gable ends.

Make soffit joints between rafters – allow 8mm expansion gap at end of each board.

## Commentary

The soffit should be screwed or nailed up at each rafter foot and an extra fixing applied if the soffit depth is greater than 200mm.

If the fascia is to form part of the soffit support then the soffit must protrude up to 10mm past the end of the rafter foot to ensure it engages properly in the back of the fascia board.

Joints should be made between rafters and an expansion gap of 8mm allowed for. This gap is especially important in foiled or colour installations.

# Fixing Fascias

Swish BUILDING PRODUCTS

Offer up the fascia and engage the soffit

Mark position of fascia fixings to ensure correct alignment

Partially secure fascia to each rafter foot with x2 65mm plastic headed, s/steel, nails or screws

Remove protective film and fully insert fixings.

## Commentary

If the fascia is to form part of the soffit support, then the soffit must protrude up to 10mm past the end of the rafter foot to ensure it engages properly in the back of the fascia board.

With the protective film still in place, the fascia board is marked with two parallel lines that show where the two 65mm plastic headed nails or screws will go at each rafter foot. This means that when the fascia is fitted to the rafter feet the run of nail or screw heads will present in a neat line.

The nails are only partially inserted in order to allow the film to be removed.

Afterwards they are driven fully home.

# Fixing Fascias

Join two lengths of fascia

Measure and cut a joint to size.

Fix joint to one board end

Leave 8mm expansion gap.

## Commentary

To join two lengths of fascia measure and cut a section of joint.

Fix the joint to the end of one board using screws or nails. Be sure to leave an 8mm expansion gap behind the joint when you place the board ends together

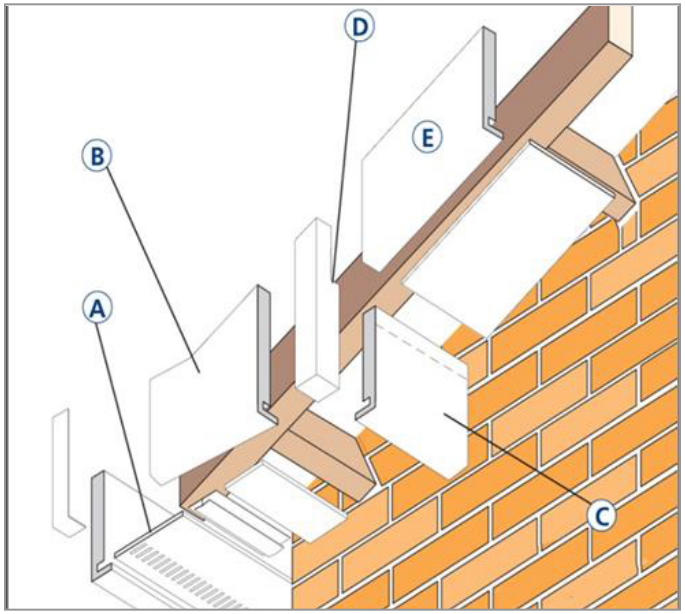
# Constructing the Box End

**A** - Finish fascia level with face of gable rafter. Soffit may be cut square or mitred.

**B** - Measure and cut the box end from a deep board.

**C** – Create a piece of fascia to form the return to the gable wall.

**D** - Remove a section from the corner joint
to fit around rafter




## Commentary

The box end basically consists of four units; the front and rear corner pieces, a piece of deep fascia board to cover the end of the soffit and a section of fascia to return to the gable wall.

The elements should be measured using a spirit level for accuracy

For the sake of aesthetics the box end should be secured with as few visible fixings as possible.

These are the main technical aspects to roofline installation. What follows is the sustainability case for cellular PVC as an excellent alternative to timber.

# The Challenge at the Roofline

## Challenging conditions

- Elevation and exposure
- Proximity of water (guttering)
- Wind blown moisture
- Degraded roofing felt

## Maintenance Requirement

- Every 5 years (BRE)
- Inaccessibility for maintenance
- High cost of safe maintenance (scaffold etc)
- Inadequate maintenance reduces life of installation

## Commentary

In many applications timber is an excellent material that gives us elegant, functional and long lasting products that enhance our living environment.

However it is wrong to assume that timber is a sustainable material for all applications to which it is put, just because it is ‘natural’ and ‘renewable’.

The roofline of any house is vulnerable to the elements because of the exposed and inaccessible position that the system occupies.

Therefore a material like timber that requires regular maintenance is not appropriate in such a location.

Building elements that start life in excellent condition should not look poor and dilapidated less than 40 years later, when the life expectancy of the building itself is at least 60 years.

# Code for Sustainable Homes

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## Materials Section

## Key Building Element

PVC Cladding A+ product = 3 points

## Responsible Sourcing

PVC Cladding

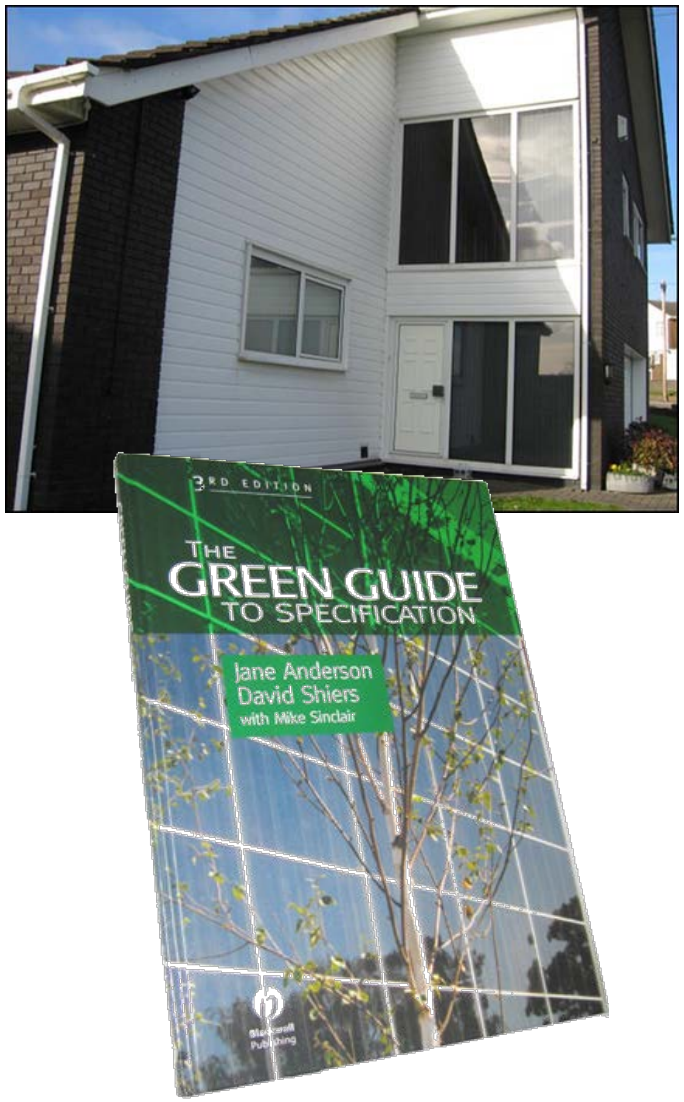
**Building Elements**– Tier 3 product and gains 1.5 points

PVC Roofline

**Finishing Elements** – Tier 3 product and gains 1.5 points

## Tier 3 products – Where both the manufacturerand main material supplier hold ISO14001

## Reference Service life of 35 Years




## Commentary

The BRE recognises the sustainability of PVC in the materials section of the Code for Sustainable Homes.

In the BRE's Green Guide PVC Cladding has an A+ rating as part of an insulated wall system.

Code for Sustainable Homes points can also be gained for both PVC roofline and Cladding because they qualify as responsibly sourced, Tier3 materials when purchased from a manufacturer that holds ISO14001.

Green Guide gives PVC construction products a reference service life of 35 years. This is because the market is only that old and a Reference Service Life is based on real time data.

# Longevity of PVC

Swish audit 2006

- No loss of protective functionality
- All remained completely impervious to water
- Last another 30+ years

Swish cellular profiles likely to exceed BRE's 60 year service life for buildings.

60+ Year Service Life

## Commentary

In the spring of 2006, as part of the BRE investigations into product lifeycles, Swish Building Products undertook an audit of some of its cellular PVC products that were installed over thirty years ago.

None of the profiles surveyed had lost their protective functionality and all remained completely impervious to water.

Swish believes that the condition of these products, which are made of PVC alone, means that they could be expected to last many more decades before replacement becomes an issue.

In particular it is likely that cellular PVC rooflines will last longer than the 60 year service life of a building against which all products are assessed in the Green Guide.

# Maintenance of timber

Timber has 35 year reference life

Issues with timber:

Affordable timber generally has high water content

Requires regular maintenance

Sometimes questionable sources

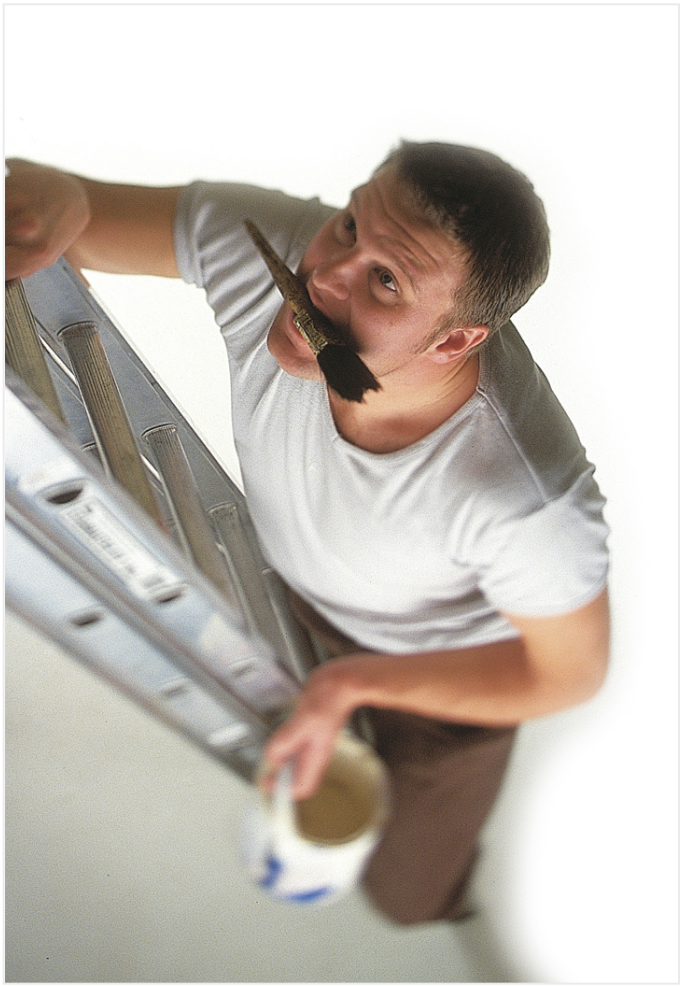
Issues with paint:

Paint life 5 years or less

Reverse of boards not painted

Vulnerable fascia top not painted

Maintenance costs money



## Commentary

Timber also has a 35 year reference service life, but bearing in mind that this is measured in real time, this says little for the durability of timber.

Maintenance is the key. Even when painting is carried out regularly, timber that started life with a high water content is likely to shrink and crack the paint while exposing the unprotected interior of the joint.

In addition it is not always possible to ascertain the real origin of some timber.

Paint also presents problems. No contract gloss will last more than 5 years and even when recoated the vulnerable areas of a roofline, around the gutter brackets and along the top and back of the board, will not get touched. In addition VOC's are released during the painting process and treated timber cannot easily be recycled.

Importantly maintenance also costs money.

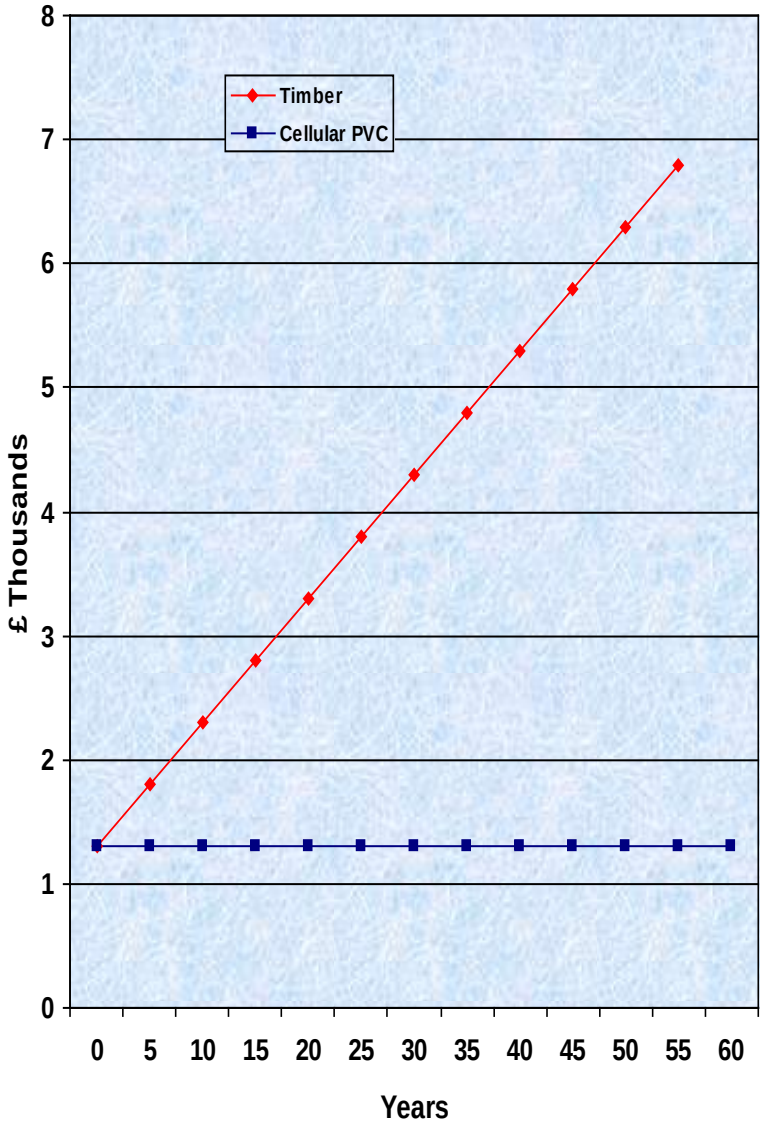
# Lifetime Costs

Comparable installed costs

Timber life time maintenance £6000 to £7000 per property

Unwelcome charges

Extended maintenance cycles encourage timber degradation




## Commentary

PVC and Timber cost roughly the same to install, but within the 60 year service life of the building it will have had 11 re-coats (based on a 5 year cycle) and will have cost a total of between £6000 and £7000, assuming that each repaint costs about £400. Multiplied by the number of houses operated by many social housing providers this represents a significant lifetime cost.

In social housing and private rented accommodation the landlord will want to minimise maintenance costs which are always unwelcome.

In reality it is rare that a landlord or private house holder will keep up a strict maintenance regime. Even with a 10-year refurbishment cycle the lifetime cost for timber is high and extended maintenance cycles encourage timber degradation.

# Myths about PVC Roofline

Thermal movement
Static loading
Colour fastness
Workability

## Commentary

Despite the many advantages that cellular PVC offers there are a number of myths that persist about it.

There is no thermal movement disadvantage for PVC provided installers observe the recommended maximum fixing centres; 600mm for white profiles and 400mm for colours and foiled profiles.

PVC fascia boards of 16mm and above do not require a timber backing and BBA testing shows that these fascias are more than capable of supporting a loaded gutter system and the weight of the eaves tiles.

PVC formulations based on non lead stabilisers like Swish are essentially colour stable as assessed under BS 1006.

Cellular PVC can be worked using conventional carpentry tools for cutting, drilling and shaping. Nails, screws and specified adhesives are used for fixing.

# PVC Recycling

Swish BUILDING PRODUCTS

Vinyl 2010 voluntary agreement

Recovinyl scheme

AJI Europe study

- <10% manufacturing waste
- 96% recycled


Aji-Europe

## Commentary

PVC is 100% recyclable

Under its voluntary Vinyl 2010 agreement the European PVC industry funds several approaches to developing the infrastructure for post consumer recycling covering all types of PVC.

Relevant to the construction industry is the Recovinyl scheme bringing together recyclers with demolition and construction companies. The scheme aims to recycle 200,000 tonnes of post-consumer PVC waste per year in Europe by the end of 2010, Within the PVC construction products sector generally, recycling rates for production waste are high. A study conducted by AJI Europe in 2005 found that within the EU15, production waste from window and door manufacturers, represented less than 10% of their total output and 96% of that waste was recycled onsite.

# PVC Recycling

## Swish has large recycling programme

All waste streams identified and segregated



## Commentary

On average Swish cellular PVC products contain 9% recycled material but Swish has already produced some profiles with a recycled content in excess of 90%.

All production waste including start-up waste is identify and recycled, even saw dust from inline saws.

All waste streams are identified and segregated Everything that can be recycled is recycled, and only under unusual circumstances is material sent to land fill.

# Specifying Roofline

Swish BUILDING PRODUCTS

- Lasts the life time of the building
- Requires no maintenance
- Has a low lifetime cost
- Can be recycled

## Commentary

In conclusion, Cellular PVC roofline is a sustainable building material because it is capable of lasting the lifetime of the building, during which time it requires no maintenance.

The lifetime costs that this produces are low and there is no further environmental impact associated with its service life.

At the end of its life it can be removed and easily recycled.