Beware of non-compliant external wall cladding systems

In residential buildings in Victoria the use of external wall cladding systems such as those incorporating polystyrene have dramatically increased in recent years.

These systems are not referenced as a Deemed-to-Satisfy (DtS) solution in the ***Building Code of Australia*** (BCA***).*** The cladding systems must therefore be presented as an Alternative Solution in a form that a building surveyor can assess and be satisfied that the material, form of construction or design meets the Performance Requirements of the BCA.

The Building Regulations Advisory Committee has considered this matter and has noted that any Alternative Solution must demonstrate compliance with the Performance Requirements of the BCA, or the solution must be at least equivalent to the DtS provisions. A combination of both methods may also be used.

The relevant building surveyor (RBS) is required to ensure that the process outlined in 1.0.8, 1.0.9 and 1.0.10 of BCA Volume Two is followed when considering an application for a building permit.

As part of 1.0.9 the RBS may seek evidence to support that the use of the material, form of construction or design meets a Performance Requirement or a DtS as described in 1.2.2 of BCA Volume Two.

1.2.2 lists amongst other things, a report from a Registered Testing Authority (eg CSIRO) and a Victorian or National (CodeMark) certificate of accreditation as evidence of suitability. Currently there are no certificates of accreditation for polystyrene cladding systems.

However, a number of systems have been assessed and reported on by CSIRO through their Building Products and Systems Appraisal Scheme. The validity of the Technical Assessments can be checked on the CSIRO Appraisals website (http://www.cmmt.csiro.au/services/appraisals/) or by contacting CSIRO Enquiries. CSIRO is discontinuing the CSIRO Appraisal Scheme and all Technical Assessments will no longer be valid after 31 December 2009. Some current Technical Assessments may expire prior to this.

It is important to check that appraisals and technical reports cover all relevant BCA Performance Requirements of the cladding system proposed to be used and that the

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appraisal is current where it is being utilised to assist with the preparation of the Alternative Solution.

Architects and Registered Building Practitioners, especially building designers should take care in selecting and specifying polystyrene or other external wall cladding systems that have at least been assessed by an appraisal body in order to assist the RBS in determining whether this form of construction is an acceptable Alternative Solution.

RBS's, when assessing an application for a building permit, must be satisfied that the applicant has provided appropriate evidence that all relevant Performance Requirements will be met. The RBS must also give due consideration to the conditions or limitation of any material or system provided to them by the applicant. Expansion and construction joint provisions may need to be determined by engineering principles. Some products may only address bending, shear or fastening testing. These tests alone do not represent a complete appraisal or compliance with P2.1 of BCA Volume Two.

It is important that RBS's act properly in accordance with Victorian building controls by ensuring that the Alternative Solution meets the relevant BCA Performance Requirements to avoid potential problems associated with the installation of an external building fabric which does not comply with the BCA.

If involved with the use of a non-compliant external wall cladding system, the RBS or other Registered Building Practitioner associated with such a project could be the subject of an investigation and resultant sanctions of the Building Practitioners Board.

For further details regarding this matter refer to the following information:

The use of non-compliant external wall cladding systems in residential buildings in Victoria

Introduction

In residential buildings in Victoria the use of external wall cladding systems such as those incorporating polystyrene have dramatically increased in recent years.

These systems are not referenced as a Deemed to Satisfy (DtS) solution in the ***Building Code of Australia*** (BCA). The cladding systems must therefore be presented as an Alternative Solution in a form that a building surveyor can assess and satisfy him/herself that the material, form of construction or design meets the Performance Requirements of the BCA.

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Background

The ***Building Act 1993*** *section 24* requires that the relevant building surveyor must not issue a building permit unless he is satisfied that the building work and the building permit will comply with ***the Act*** and the ***Building Regulations 2006*** (and therefore the BCA).

Part 3.5.3 Wall Cladding of the BCA Volume Two describes the type, use and fixing of weatherboard cladding, fibre cement sheet and plywood sheet cladding systems. There may be inherent problems with the application of some of these systems (some common with polystyrene systems) but prescriptive application in the form described in the BCA will allow the building surveyor confidence of legislative compliance when approving documents and at signing off at completion of building work.

Monolithic polystyrene claddings systems are not a DtS system and therefore the RBS is obliged to follow the Alternative Solution assessment process outlined in the BCA.

The Alternative Solution must demonstrate the solution complies with the Performance Requirements of the BCA, or the solution is at least equivalent to the DtS provisions. A combination of both methods may also be used.

The RBS is required to ensure that the process outlined in 1.0.8, 1.0.9 and 1.0.10 of BCA Volume Two is followed – copies attached. As one of the Assessment Methods in 1.0.9 is Expert Judgement.

Some manufacturers of polystyrene and other external wall cladding systems have opted to have their products assessed and reported on by the CSIRO. These reports can be found at http://www.cmmt.csiro.au/services/appraisals/..

These reports can be used as evidence to support that the use of a material, form of construction or design meets a Performance Requirement as identified in 1.2.2(a)(i) of BCA Volume Two .

The CodeMark product certification scheme also gives building surveyors and building practitioners confidence of legislative compliance. Certification bodies are accredited through the Joint Accreditation System of Australia and New Zealand (JAS-ANZ) who in turn evaluate and certify building products. Building certifiers are obliged to accept CodeMark certified products. (ABCB; 2005).

The RBS must be aware of the conditions or limitation of any report. Expansion and construction joints may need to be determined by engineering principles. Some products may only address bending, shear or fastening testing. These tests alone do not represent a complete appraisal for compliance with P2.1 of BCA Volume Two.

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Duties of applicants/designers

Regulation 301 of the ***Building Regulations 2006*** requires applicants for building permits to ensure an application contains sufficient information to show that the building work will comply with ***the Act*** and ***the Regulations*** and the relevant provisions of Part 3 of ***the Regulations.***
The RBS should only accept documentation that is sufficient to enable proper assessment for compliance with the BCA. As far as practicable relevant certificates, reports and forms should be submitted at design stage including all details of Alternative Solutions.

The RBS ought to be aware of the proportional liability provisions of the ***Building Act 1993***. An RBS who accepts less than adequate documentation and simple referencing (particularly in regard to Alternative Solutions) may find him/herself open to a broader litigation claim than may otherwise be the case.

Potential consequences of failure of the polystyrene or other cladding systems

The cladding system must resist any actions it may be reasonably subject to (Performance Requirement P2.1 of BCA Volume Two). It must also resist the penetration of water that may cause unhealthy or dangerous conditions, loss of amenity for occupants and undue dampness or deterioration of building elements (Performance Requirement P2.2.2 of BCA Volume Two). Other Performance Requirements may be relevant.

Polystyrene and other cladding systems are often constructed in manner where there are little or no margins for error. Moisture that has penetrated or collected on the inside face of the external cladding cannot escape the building fabric either by natural drainage or by ventilation of a cavity.

Water may accumulate around horizontal members (bottom plate, heads, sills, deck joists, nogging, and parapets) with potential to cause deterioration of the building elements.

Decks are of particular concern. Undetected decay of cantilevered and simply supported floors and polystyrene-clad timber framed balustrades have obvious and significant life safety concerns.

Hidden fungal growth may seriously affect the health of occupants causing respiratory and skin problems. The young and old are most a risk and those with weakened immune systems. Damp also encourages dust mites. (Consumerbuild[2], 2007).

Damp thermal insulation will reduce in effectiveness and in turn will make it harder to heat rooms.

Sources of water contamination

Water may penetrate from outside the building. Wind forces even at low pressures can be higher than those inside the building assisting water to enter through penetrations, gaps and joins. Localised pressure at corners and exposed edges are of particular concern.

Condensation is likely to occur in the external wall frame as the temperature gradient drop across the width of the wall. Warm moist air from inside the building will condense as it cools forming moisture droplets in the insulation, framework surface, internal face of the cladding and elsewhere.

Condensation in Victoria and Tasmania is possibly more problematic than in other States and Territories. To suggest polystyrene cladding systems should be accepted on the grounds of their extended use in other parts of Australia is fraught with danger.

Buildings in Victoria tend to be closed and sealed over the winter period allowing for higher levels of air-borne moisture in the building. In warmer climes, buildings will tend to be aired more often and temperature differentials from inside to outside the building will not be as severe.

Further, the New Zealand experience with cladding systems (leaky building syndrome) suggests climates like Victoria, Tasmania and New Zealand with similar precipitation, humidity and wind loading pose problems not evident in other States and Territories.

The Canadian inquiry into exterior insulation and finishes systems in 1996 noted water exposure in coastal climate buildings is high while drying potential is low (Hunn: 2002: 10). In Vancouver a moratorium on exterior insulation and finish systems was called in 1996 after the city had tried unsuccessfully for three years to abate the problem of watertightness. (Hunn; 2002;10)

It is estimated the cost to repair leaky buildings in New Zealand is in excess of $NZ1.9 billion (Syft, 2007). Repair costs to some houses have been in the order of $NZ300,000 (Consumerbuild[3], 2004).

Since 1997 the North Carolina Building Code Council (Hunn; 2002;11) has adopted guidelines that require foam bases exterior insulation and finishes systems to provide a 20 year guarantee, and require all systems to provide an internal drainage system.

It is worth noting the BCA performance requirements do not specifically identify the need for removal of general household air-borne moisture from within the building (though air quality is mentioned in P2.4.5 of BCA Volume Two).

It is suggested that the introduction of the energy efficiency provisions of the BCA in regard to building sealing requirements may see condensation becoming more problematic in Victoria.

Technical issues

The following are some questions all building practitioners should consider when making decisions in the use of polystyrene or other cladding systems.

Fixing of Panelling

- What is the environment in which the system is being used? – are the fixings suitable to resist the corrosive affect of a seaside or polluted environment?
- What is the local wind loading or other racking forces? What twisting or movement of the building can be expected?
- Are the fixings suitable for use in hardwood, green timber, softwood or steel framing? What length of fixings is required and what is the adequate penetration into the fixing element?
- What number of fixings per panel is required to resist wind loading (especially due to negative pressures)? Should additional fastenings be provided on corners?
- Is the washer system rigid, flexible or robust enough to prevent localised stress cracking? (Washers must be flexible but strong enough not to crack – too flexible will allow foam to cladding to pull).
- Should a batten system be used to provide physical separation and movement between the cladding and structural wall frame?
- Battens may allow moisture to escape and cavity to ventilate but what flashing and weephole details are required at the base of walls?
- Should the back of the panel be ribbed so that moisture may escape from behind cladding/frame/batten interface?
- If a batten system is used how should it be lapped, and what type of batten is most suitable (timber, steel)?
- What spacing is necessary? What relationship is there between batten spacings and thickness of cladding?
- How panels should be joined? Over studs, with blocking?
- Should mesh systems be used – what is the mesh size and openness of weave, is it compatible with other materials (alkaline resistant), will the grid system allow render to get through and fully bind with strands?
- What is the optimum placement of the mesh in the render – near the surface or against the cladding?

Control joints

- How often and where should control joints be placed? What is the method of fixing and what type of backing material/system should be used? Should bond breaking tape be used?
- What precautions need to be made where panels are fixed across wall frames and onto other framing systems such as a trussed gable roof?

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- What precautions are taken in regard to shrinkage of frame particularly over a two or more storey building?
- What precautions need to be taken at base and frame interphase for horizontal control joints?
- What effect has the site (soil classification) on number and location of control joint? What are the effects of heave and distortion from ground movement?
- What effect do different bases have – masonry, mega anchors, concrete slab, pole, structural steel?
- All houses deflect –how will the cladding system accommodate deflection?
- What is the coefficient of expansion of the materials used? Steel frame buildings will expand and contract more than a timber frame building. Should more control joints be used?

Waterproofing

- What system of sealing is used around windows and doors, other claddings, balconies, plumbing and electrical penetrations?
- What is the compatibility and flexibility of sealants -are the material suitable for use with aluminium or timber framework, the cladding and the textured finish?
- Is there eaves and what eave widths should be used?
- What is the wind speed? – is the building envelope able resist high wind driving rain? (air flowing gaps, impact of rain splashes and bounces behind laps and over flashings).
- How effective are corner mouldings? Are they UV resistant, how they are keyed into rendering?
- Does the cladding system “breath”?
- Are “drips” provided on sills?
- What is the long term effect of sliding doors, air conditioning units and other vibrations on seals – what system of isolation is used?

Ground Contact

- Can the system be in contact with the ground, paving, etc? Will the cladding deteriorate, will moisture be drawn up the wall by capillary action, what sort of flashing system should be used?
- What is the effect of splash back at ground level?

Workmanship

- What is the level of skill of the applicator?
- Is the tradesman aware of the technical specifications and their scope and limitations? What is their technical knowledge?
- How long has the cladding been left prior to rendering? How much water entrapment has occurred, has the surface oxidised or reacted with the environment prior to application of the render? Has the cladding started to

breakdown under UV exposure (will depend on time of year as to the amount of UV.)?
- What is the compatibility of render to cladding?
- Are there residual chemicals that need to be removed? (Cladding & beading may have residual films from the manufacturing process).
- Are sprayed on applications more effective?
- Renders will always shrink – how does the applicator deal with this?
- Alignment of sheets will affect the thickness of render – how careful is the fixer?
- Is the render mixed on site or premixed (quality control)?
- Will over screwing of washers results in increase thickness of render and therefore uneven stresses?
- Will over-screwing of washers on thin sheets reduce the strength and performance of sheet?
- What is the best number of coats? One thick coat is more prone to cracking – two of more coats may result in delamination.
- Are corners of openings provided with adequate stress reinforcement?
- What effect has temperature on the material being applied?
- What effect has the formation of dew, rain or frost on the cladding when render is being applied?
- Is detailing around parapets, box gutters, windows etc adequate? How skilled is the roof plumber in fitting effective flashing systems – is the roof plumber aware of compatibility of sealant systems?

Sources of moisture

- What is the effect of condensation and how will it escape the building?
- What is the residual moisture in the cladding material?
- Will there be a breakdown at control joints, penetrations, flashings?
- Is the cladding system suitable for exposed parapets?

Polystyrene panels

- What is the grade of polystyrene being used, the chemical compounds used and the entrapment of air and oxygen? What quality controls are in place during the manufacturing process- are the materials made overseas?
- Are the adhesives compatible?
- What ability has the material to resist insect, vermin and mould attack?
- What are the fire properties?

Paint system

- Is the paint system flexible enough?
- Does the paint system need to “breath”?
- What is the texture of the finished product? Course textures will pick up contaminants in the air –pores will be filled and may result in a build up of acid particles.

- Is the paint system robust enough to prevent UV breakdown of the cladding system?

Conclusion

International experience over a number of years indicates special care and consideration is necessary in the use of polystyrene or any other untested cladding system. The questions above highlight the complexity and uncertainty inherent when using untested and poorly detailed systems.

It is incumbent on the RBS that he/she be reasonably satisfied that the material, form of construction or a design meets the Performance Requirements of the BCA.

The failure of a building system may require the RBS to justify how a decision was made that an Alternative Solution has met the Performance Requirements of the BCA.

Acceptance of properly presented documentation for tested systems from an acceptable third party authority will give the RBS a degree of confidence that his/her obligations have been met. Care must be taken that all issues have been addressed. Often reports will rely on further assessment by qualified experts.

Any system used must be applied in accordance with the tested system. Mixing and matching of systems may void reliance on the test results and reports.

Documentation provided at completion of the project should include certification of the installation in accordance with specifications from a competent person.

Peter Nassau
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Based on a paper by: Mick Galloway, *GRIFFITHS AND GALLOWAY BUILDING SURVEYORS*, *TASMANIA* 01 June 2007

Bibliography

Australian Building Codes Board (ABCB); June 2005; "*CodeMark –The New Product Certification Scheme*"; Canberra. www.abcb.gov.au/

Building Standards and Regulation, (BSR); January 2007; "*Good Documents = Good Job*", Tas. www.wst.tas.gov.au/building/publications.

Consumerbuild[1], Department of Building and Housing (NZ); 2004; "*Why homes leak: Background to the problem*", www.consumerbuild.org.nz/publish/leaky/leaky-background.php

Consumerbuild[2], Department of Building and Housing (NZ), 2004; "*Health risks*", www.consumerbuild.org.nz/publish/leaky/leaky-health-risks.php

Consumerbuild[3], Department of Building and Housing (NZ), 2004; "Case study 2"; www.consumerbuild.org.nz/publish/leaky/leaky-casestudy-2.php

CSIRO; October 2003; "Technical Assessment 310, Unitex Thermal Wall Systems (Uni-TWS)'; Highett, Vic. www.cmit.csiro.au/services/appraisals/test.cfm?id=310

Hunn, 2002; "*Report of the Overview Group on the Weathertightness of Buildings to the Building Industry Authority*"; Building Industry Authority (NZ), Wellington. http://www.dbh.govt.nz/UserFiles/File/Weathertightness/Reports/pdf/bia-report-17-9-02.pdf

Syft Technologies Ltd; 2007; "*An Overview of Leaky Building Syndrome*"; NZ, www.syft.com/?id=64.

