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STAND SURE

ENERGY EFFICIENCY NEWSLETTER

May 2002

BCA UPDATE

An Energy Efficiency Measure has been proposed for The Building Code of Australia Volume 2 (Housing Provisions). Implementation is scheduled from **1 January 2003**. This newsletter is a summary. Full details are available from the following Internet Site: **www.abcb.gov.au/content/energy**.

Public comment on the Proposal closes on **28 June 2002**.

WHAT DOES THE PROPOSAL MEAN FOR **BRISBANE** HOUSING (Class 1 buildings)?

According to the Climate Zones in the BCA Proposal, Brisbane falls in **Climate Zone 2**, which extends east of the Great Dividing Range from Port Macquarie to Bundaberg. Different requirements apply to different Climate Zones.

There are several elements of the BCA Proposal

1. The building *fabric* must achieve a set level of thermal performance.
2. Solar radiation must be controlled.
3. The building's *envelope* must be sealed against air leakage.
4. Appropriate air movement must be provided.
5. A building's services must facilitate energy efficiency.

1. BUILDING *FABRIC*

For the required level of thermal performance, Acceptable Construction (Deemed-to-Satisfy) includes:

1) Application requirements for *RFL* (Reflective Foil Laminate) and bulk insulation are provided.
2) Roof
   a) **Roof or ceiling** must achieve a total insulation *R-Value* of R2.2
   (eg. with 12mm plasterboard ceiling:
   For Tiles add R1.5,
   For Metal add R1.7)
   - With a minimum of 25mm air space, *RFL* can achieve part of the required roof insulation.
     RFL + 25mm with Tiles *R-Value* = R1.05
     RFL + 25mm with Metal *R-Value* = R1.23

   b) **OR Roof** must be **light** colour (eg. off white, light cream. Zinc aluminium is too dark), and
   - *RFL* must be installed below the roof, and
   - Roof must have cross-flow **ventilation** not less than 5% of the ceiling area. (not suitable for flat, skillion or cathedral ceilings)

3) *Roof Lights* (**skylights**) have various requirements, depending on the length of the light shaft and size relative to floor area.
4) External Walls [excluding solid doors]
   a) **Unshaded External Walls** must achieve a total insulation *R-Value* of R1.4
   (eg. with 12mm plasterboard internal walls:
   For Weatherboard add R0.93,
   For FC Sheeting add R1.0,
   For Brick Veneer add R0.89,
   For Concrete Block add R0.99,
   For Cavity Brick add R0.76)
   - *RFL* in walls can achieve part of this requirement (eg. masonry and/or frame cavity):
     RFL + 50mm space *R-Value* = 0.41
     RFL + 90mm space *R-Value* = 0.45
     RFL + both spaces *R-Value* = 1.02

   b) **Shaded External Walls** do not require added insulation. Adequate shading is defined as the building projection (eg. eaves) being more than ⅓ of the height from internal floor to underside of the projection. [eg. for 2400mm "height" the building projection must be more than 800mm]
5) Glazing (see Solar Radiation below)
6) Floors – no requirements for Climate Zone 2
7) Attached Class 10 buildings (eg. garage) must either:
   achieve the thermal performance required for the Class 1 building;
   or the separation elements to the Class 1 building must meet the external requirements. (eg. internal wall to garage to meet external wall requirements).

2. SOLAR RADIATION

External *glazing* and associated shading have complicated requirements. For simplicity, only 3mm single, clear glass in aluminium frames will be discussed. Generally, toned [tinted] glass, low-e [reflective] glass, double glazing, thermally improved Al frames or timber/uPVC frames allow more glazing area. Refer to the Proposal for more information on other glazing types.

Firstly, there is a definition of Orientation Sectors:

- North Sector = NNW to NNE
- East Sector = NNE to SE
- South Sector = SE to SW
- West Sector = SW to NNW

[Some houses may not have a North Sector as it covers only 45°. These houses may have two sides in either East Sector or West Sector.]

For Climate Zone 2, a Table is provided for allowable **Shading Projection (P)** (mm measured horizontally) versus **Glazing %** (to floor area of room). This Table is based on 1200mm height from underside of the Shading Projection to the bottom edge of the *glazing*. To calculate the allowable Shading Projection for a different **height H**, use the formula:

$$P_1 = \frac{H * P}{1200}$$

P	Sector		
Glazing %	NORTH	EAST&WEST	SOUTH
50%	Shade	Shade	OK
45%	Shade	Shade	OK
40%	Shade	Shade	OK
35%	1200	Shade	OK
30%	800	Shade	OK
25%	600	1200	OK
20%	400	800	OK
15%	OK	600	OK
10%	OK	OK	OK

Notes:

Shade = Adjustable Shading Device required or shade projection must be greater than *glazing* height

Number = Adjustable Shading Device required or shade projection not less than width shown

OK = no shading requirement

[For example, for an actual window height of 2100mm in a room with Glazing of 15% of room floor area in the East Sector, the adjusted Shading Projection is therefore:

$$P_1 = 2100 * 600 / 1200 = 1050mm]$$

For rooms with *glazing* in more than one Orientation Sector, use the following steps:

1) Add all external *glazing* areas to arrive at a total *glazing* area.
2) Divide total *glazing* area by room area and multiply by 100% to achieve the percentage of *glazing.*
3) This percentage of *glazing* is used for each applicable Orientation Sector.

[For example, consider a 20m^2 floor area room having *glazing* of 3m^2 in the North Sector and 1m^2 in the West Sector. The total *glazing* area is 4m^2 and the percentage of *glazing* is 4 / 20 * 100% = 20% for both North and West Sectors.]

Adjustable Shading Devices may be used to satisfy the Solar Radiation control requirement:

- Must be constructed of weather resistant materials
- Must be permanently fixed to the exterior of the building
- Must fully cover the *glazing* when in place
- Must be readily operated by the occupants
- Can be a blind with direct solar transmittance not more than 10% in fully closed or lowered position.
- Can be made of fixed blades, battens or slats etc. arranged to restrict sun penetration
- Can be external shutters with blades or leaves.

Building projections can be used to satisfy the shading projection requirement. These include permanently fixed features such as: eaves, eaves and gutters, pergola [adjusted for percentage of transmittance?], carport, verandah, fixed canopy, shading hood, and balcony.

Building projections used for shading of *glazing* must extend past each side of the *glazing* not less than the required shading projection.

3. BUILDING SEALING

This *Performance Requirement* is satisfied if the sealing of the windows complies with AS2047 [Windows in Buildings – Selection and Installation].

Particular consideration is given to rooms that are artificially heated or cooled (*conditioned space*).

- Chimneys and Flues must be provided with a damper or flap that can be closed
- Roof Lights must be sealed by an imperforate [no holes] ceiling diffuser
- External doors and openable windows must be fitted with a compressible seal. Louvre doors or windows are exempt if they are not more than 10% of room floor area. For louvres more than 10% of room floor area, maximum air infiltration is specified in the Proposal.
- Exhaust fans must be fitted with self closing dampers or a high density filter (eg. common in kitchen range hoods)
- Roofs, walls and floors must be enclosed by internal lining systems that are sealed or close fitting at ceiling, wall and floor junctions.
- Any gaps around a window, door or other opening must be sealed with caulking or enclosed by architraves etc. to minimise air leakage.

4. AIR MOVEMENT

Ventilation openings must be provided to all *habitable* rooms. The purpose is to allow the interior of the building to take full advantage of any breeze. Consideration should be given to avoid "dead air pockets", by design attention to the type and location of openings.

In Climate Zone 2 *ventilation openings* must have a total opening area of at least 15% of room floor area and can be located on:

- 2 or more external walls, with not less than 25% of total opening area on one wall.
- 1 external wall and one internal opening (more than 1.5m^2) accessing a **breeze path** (distance between ventilation openings less than 20m). In connecting the breeze path to the *required ventilation openings,* no more than one opening in an internal wall is permitted.
- 1 external wall, 2 openings each providing opening area not less than 10% of room floor area. If the distance between openings is less than 2m, an **external divider** the full height of the openings and more than 400mm wide (from the external wall face) must be fitted.
- External doors forming *ventilation openings* or internal doors forming part of a breeze path must be fitted with a device to hold the door **fully open**.

Ceiling fans must be provided to all habitable rooms in buildings with electricity supply if the floor area is more than 15 m^2. The ceiling fan:

- Must be permanently fixed to the ceiling
- Must have a controller for ready use of the occupants
- Must have blades no less than 2300mm above the floor [floor to ceiling height minimum 2600mm]
- Must have blade rotation diameter no less than 1200mm
- Is to be installed to ensure no hazard to the building occupants.
- Will generally serve a floor area of 20m^2 for each 1200mm fan

5. SERVICES

A hot water supply system should be designed and installed in accordance with AS/NZS 3500.4.2 [National Plumbing and Drainage Code – Hot water supply systems – Acceptable solutions].

For the energy efficiency of a central hot water system, the piping must be thermally insulated with minimum total *R-Value* of R0.3 on:

- All hot water piping encased within a concrete slab (except as part of a slab heating system).
- All flow and return piping not within a habitable space that is artificially heated or cooled. [including inside walls?]

Piping passing through a timber member, such as a wall stud, is considered to have sufficient insulation.

Solar hot water supply system piping is not *required* to comply with the above insulation [though would also improve energy efficiency].

Heating and refrigerated cooling system ductwork under floor or ceiling must be thermally insulated to achieve minimum total *R-Value* of R1.0, and R1.5 for ductwork external to the building.

Evaporative cooling ductwork must be insulated to achieve minimum total *R-Value* of R0.6.

Heated metal fittings must be thermally insulated to a minimum total *R-Value* of R0.1.

Refrigerated cooling fittings should be insulated to prevent damage due to condensation.

The Proposal provides example insulation properties considered appropriate.

6. COMMENTS

In the above discussion words in the [square] brackets are additional comments.

There will be additional costs associated with these BCA Proposals. For Climate Zone 2, estimates start at $2300 for a typical small single storey house, to $6600 (ref: Regulatory Impact Statement).

All houses in Climate Zone 2 can benefit from ceiling insulation as opposed to roof insulation, particularly in winter.

Roof Ventilation without dampers is detrimental in winter as it increases the heat loss through the ceiling.

The formula to calculate the required shading projection for rooms having glazing in two Orientation Sectors, disadvantages the practice of locating small windows on West or East walls. It may also not provide adequate shading for sliding doors. It may be simpler to set the relationship for shading projection by glazing height rather than glazing area.

The increased window sizes to satisfy ventilation will increase heat transfer through the glass and reduce the thermal mass of external walls. Large rooms may have mostly glass on one external wall. This will therefore increase the shading requirement. To achieve the same opening area, sliding and double hung windows will need to be double the size of awning, casement or louvre windows. There is no consideration of prevailing cooling Summer breezes, apart from mention of window location.

Requiring ceiling fans for all habitable spaces will increase the minimum allowable ceiling height. This was not costed in the Impact Statement. The Proposal does not consider alternative means of mechanical air circulation, which would be equivalent

to ceiling fans.

The Proposal states the objective is Energy Efficiency and not comfort, by achieving conditions that "are sufficiently tolerable for occupants to minimise their use of artificial heating or cooling." (Regulatory Proposal P17).

However, the measurement method used to achieve the Deemed-to-Satisfy Provisions was NatHERS (Nationwide House Energy Rating Scheme) which uses the same thermal simulation engine as BERS. These computer-based thermal simulations use actual hourly climate data to achieve an energy consumption estimate for each month. They assume the habitable areas (Living and Sleeping Zones) are artificially heated or cooled to thermostat settings (with windows and curtains opened and closed as appropriate).

There is no Verification Method proposed to allow Alternative Solutions. This is a serious oversight and needs immediate attention if implementation is to start in January 2003. There are a large number of certified Energy Efficiency Assessors using either BERS or NatHERS in NSW, ACT, and SE Queensland (Victoria uses FirstRate, a point-score system also based on NatHERS). This skill resource could be used for Verification. Since NatHERS thermal simulations were used to derive the BCA requirements, this seems a reasonable approach.

A solution may include using the BCA minimum requirements as a benchmark for comparison with proposed design variations on a case-by-case basis. The achievement of the same level of energy efficiency (possibly "Free Running Mode", ie. without thermostats) can then be deemed to comply with the BCA requirements for Energy Efficiency. Only the "Conditioned" simulation mode would be required where the proposed dwelling has refrigerated cooling in Climate Zone 2.

Thermal mass of concrete floor and slab-on-ground allows the internal temperature to be regulated, improving the performance in summer. This is especially true of floor without carpet and with little direct sunlight penetration in Summer. The BCA Energy Efficiency Proposal doesn't consider the benefits of floor thermal mass.

Wall shading is proposed to be an alternative to wall insulation. Wall colours have not been considered. Increased wall shading for East and West and no wall shading for South will be beneficial in Climate Zone 2, especially for light-weight construction. Most houses will benefit from RFL in the external walls, regardless of wall shading. Slab-on-ground, brick veneer houses perform reasonably well without adding RFL to external walls, depending on orientation of glazing.

Curtains also reduce the heat transfer through glazing by adding an extra layer of insulating air. Pelmets that seal curtains at the top as well as the sides enhance this air pocket. Heavy drapes also reduce direct sunlight penetration by reduced transmission and partial reflection. None of these energy efficiency benefits are included in the Code Proposal, probably because they can be occupier-dependent.

A series of Client Information Sheets are being developed by Clyde Anderson Pty Ltd:

CIS0103	Who is Dr Clyde Anderson?
CIS0203	What is an Energy Rating?
CIS0303	What Information is Needed for an Energy Rating?
CIS0404	Hints for Low Cost House Design Energy Efficiency
CIS0503	Window Design for House Energy Efficiency
CIS0603	Window Shading for House Energy Efficiency
Brochure	Assessing Energy Efficient House Designs (and extensions >50m^2 floor area)

Clyde Anderson Pty Ltd is a certified and licensed operator of BERS Version 3.2 to deliver Council-required Energy Efficiency Assessments for Residential Developments, having performed hundreds of Energy Efficiency Ratings for clients in the Building Industry, including owners, designers, builders, developers and certifiers.

As a Registered Professional Engineer, Queensland (No. 2185) and a Certified Professional Engineer (CPEng), clients can be assured of high standards of accuracy and professionalism.

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