ICANZ
THE RIGHT INSULATION MATTERS

The Energy Efficiency Project
Australian Building Codes Board
GPO Box 9839
CANBERRA ACT 2601

Attention: Mr John Kennedy

Dear John,

Re: RD 2004-01 – Energy Efficiency BCA Volume 1

The Insulation Council of Australia and New Zealand (ICANZ) was formed in July 2004 to replace the industry association, FARIMA. This body now includes New Zealand membership reflecting the trend towards common building standards, closer ties in research, testing and other trans-Tasman building initiatives.

Issues of energy supply, energy efficiency, climate change and sustainability are now high on the agendas of both government and industry. The insulation industry has an important role to play in addressing these issues.

ICANZ has undertaken a review of the above Regulation Document with emphasis on the requirements for insulation of building services and their relationship to existing Australian Standards in this field, as well as reviewing the overall building fabric proposals.

ICANZ strongly supports the proposals contained in the Regulation Document and believe they will contribute significantly to lifting minimum commercial building energy efficiency closer to European and USA standards for equivalent construction types and climatic conditions, and in the process assist in meeting Australian community expectations in relation to greenhouse gas emission reductions.

In addition we would highlight that most commercial buildings are leased and as such the benefit of the energy savings accruing from increased insulation standards is to the lessee and not the developer. A clear role for market intervention by government.

We include details of our review of the RD for further consideration.

ICANZ engaged EMET Consultants Pty Limited[1] to review the analyses conducted at the time of the development of AS4508 "*Thermal resistance of insulation for ductwork used in building air conditioning*" in line with the economic factors presented in the RD and additionally, with the methodology used in developing the RD requirements.

Some of the factors and methodologies used in the original models differ from those used in the BCA work. In many cases insufficient information has been provided in the RD's background notes to enable a direct comparison to be made with the AS4508 results, so in most cases a number of economic criteria were used to substantiate the findings.

Of particular note, the low energy rates used in the RD are not realistic from the consumer's point of view however this is offset to a degree by the generous 10 year payback used in the economic evaluations, yielding comparable results to those of the earlier standards.

[1] EMET were members of the Committee ME/77 which prepared AS4508

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In general the analysis supported the general approach and stringency levels adopted by the RD however a number of areas requiring revision or consideration were identified.

Following is a summary of the analysis results, comprising: a) Evaporative Cooler applications; b) Air Conditioning ductwork applications; and c) Building envelope thermal performance requirements.

a) Evaporative Cooling Ductwork Insulation

Under most circumstances, the optimum levels of insulation calculated by the AS4508 and BCA methodologies for evaporative cooler ductwork were found to be in agreement. However it is considered that there is justification for the use of climatic zone variations in the selection of evaporative cooler ductwork insulation levels (refer to example for the roofspace installation case – Figure 1).

The specification of different levels of insulation for semi-sheltered (insulated roof space) and exposed locations is justified. While the minimum insulation level of R0.6 for the semi-sheltered case is appropriate (followed by additional increases by climatic zone), there is a case to increase the minimum insulation level for the exposed case to R0.9, or more practically R1.0, also followed by additional increases by climatic zone.

For the cases evaluated, the optimum levels of insulation shown in Table 1 were established. A further variation for (or a bias towards) cities which have major evaporative cooler applications may be considered for some climatic zones (eg. Adelaide or Perth may be considered more appropriate for Zone 5 rather than Sydney)

Table 1 – Economic Analysis Solutions for Evaporative Cooling Ductwork

Climatic Zone	Sheltered Case	Exposed Case
Zone 3	R0.9	R1.5
Zone 5	R1.5	R1.5
Zone 7	R0.9	R0.6

* Note: optimum values are subject to selected economic criteria and modelling assumptions

Figure 1 shows a sample of the specific results achieved in the analysis of “Semi-Sheltered Evaporative Cooler” applications. The figure shows optimum levels for the following scenarios:

- The original level of insulation, as prescribed in AS4508;
- The original optimum level calculated in the AS4508 analysis for various cities;
- The new optimum level calculated using the original AS4508 methodology with updated economic factors;
- The optimum level identified by applying the BCA economic criteria to the original AS4508 models;
- The level of insulation prescribed in the RD

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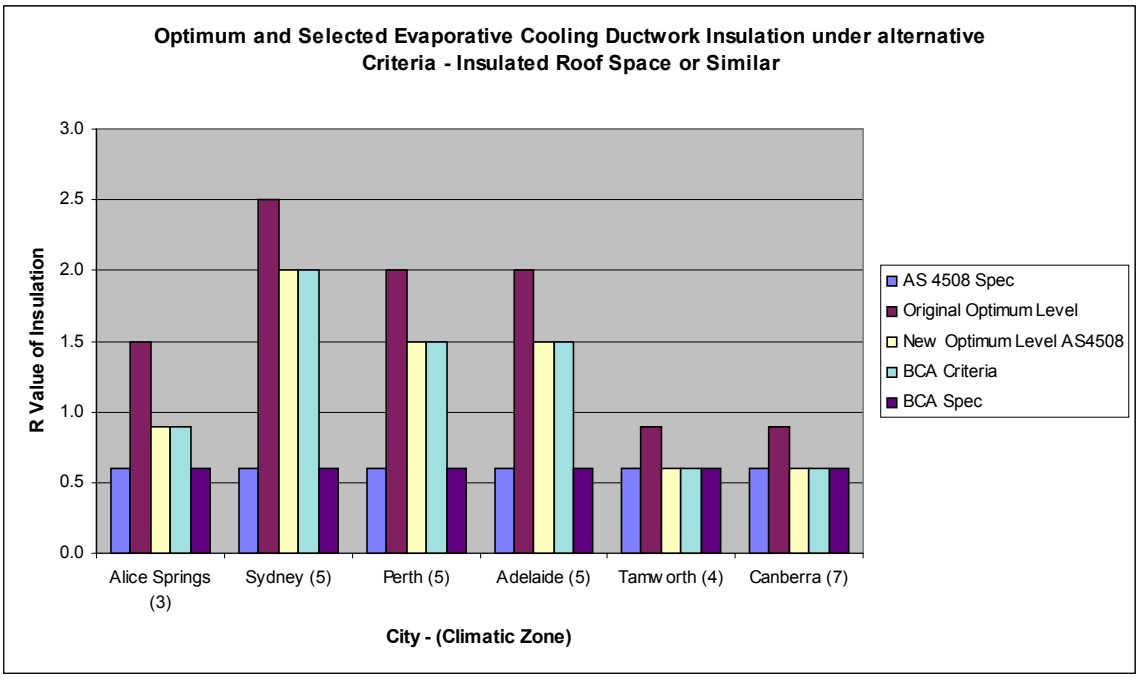

Figure 1 – Evaporative Cooling Ductwork Insulation – Comparison of Optimum Levels for the Semi-Sheltered Case

The results particularly show the climatic dependence of ductwork insulation, which is not currently reflected in the RD. The specified level of R0.6 is supported for climatic zones 4 and 7 however this level is considered inadequate for warmer and dryer areas, where evaporative cooling operates for more extended periods of time.

b) Air Conditioning Ductwork Insulation

In general, the levels of insulation for air conditioning ductwork prescribed within the RD fall short of the optimum levels calculated under the AS4508 methodology. In particular, the greatest discrepancies were found in all applications for climatic zones of 2 and 3 (it is assumed that this would also apply to zone 1 and to a lesser extent zone 4 although these two zones were not specifically evaluated in this component of the ICANZ analysis).

The levels of insulation of air conditioning ductwork in sheltered applications specified in the RD were also found to be generally less than optimum compared to the AS4508 results.

The applications with the closest agreement include Zone 5 (except for the sheltered case); and the semi-sheltered cases (excluding zones 2 and 3).

Table 2 shows the optimum levels of insulation levels calculated using the AS4508 criteria compared to the corresponding prescribed levels shown in the RD.

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Table 2 – Economic Analysis Solutions for Commercial Buildings Air Conditioning Ductwork (BCA specified level shown in parentheses)

Climatic Zone	Sheltered Case	Semi-Sheltered Case	Exposed Case
Zone 2	R1.5 (R0.75)	R1.6 (R1.0)	R1.7 (R1.0)
Zone 3	R1.8 (R0.75)	R2.0 (R1.0)	R2.0^{+} (R1.5)
Zone 5	R1.2 (R0.75)	R1.3 (R1.25)	R1.3 (R1.25)
Zone 6	R1.3 (R1.0)	R1.5 (R1.5)	R1.8 (R1.5)
Zone 7	R1.4 (R1.0)	R1.7 (R1.5)	R1.8 (R1.5)

* Note: optimum values are subject to selected economic criteria and modelling assumptions – (refer to the graphical representation of the Sheltered case in Figure 2)

Figure 2 shows the comparison of the specified and optimum levels of ductwork insulation for air conditioning systems in the Sheltered application for a number of locations. The following scenarios are represented:

i) The original level of insulation, as prescribed in AS4508;
ii) The original optimum level calculated in the AS4508 analysis for various cities;
iii) The new optimum level calculated using the original AS4508 methodology with updated economic factors;
iv) The optimum level identified by using the BCA energy costs and NPV criteria;
v) The optimum level identified by using the BCA energy costs and 10 year (or lowest available) payback criteria;
vi) The level of insulation prescribed in the RD

The level selected in Table 2 corresponds to the average of (ii) and (iii) above.

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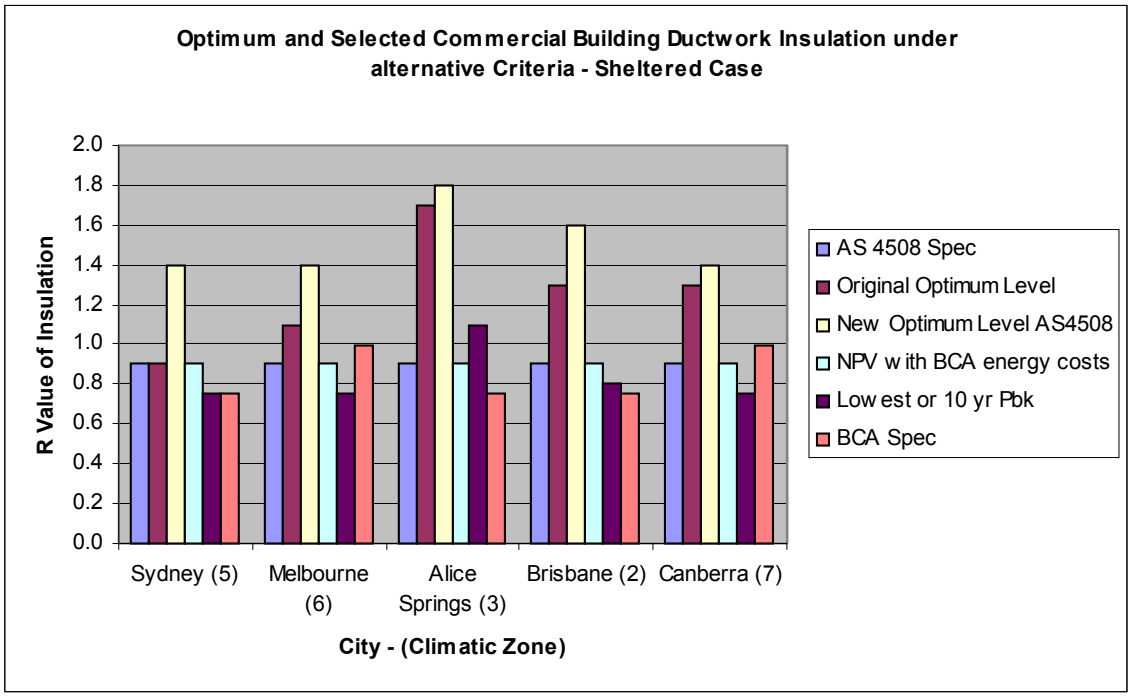

Figure 2 – Commercial Building Ductwork Insulation – Comparison of Optimum Levels - Sheltered Case

In general, it is considered that the levels of insulation for air conditioning ductwork prescribed in the RD are substantiated by previous works and should be strengthened in some cases; particularly for climatic zones 1 to 4 and for the sheltered applications generally.

In addition, ICANZ would submit that for both rigid metal ductwork and flexible ducting the added insulation R values should be simplified to R1.0 and R1.5 wherever possible to make for lower production and stocking costs for insulation and duct manufacturers.
This is most relevant in the case of Sydney which is split into two climate zones. Mechanical service contractors are concerned about specification and installation errors resulting from either R0.75 (current insulation level applied for condensation control on external lagging) or R1.0 being required, depending on suburb. ICANZ would propose that R0.75 requirements be simplified to R1.0. Similarly there is no current R1.25 product on the market and although this could easily be made available the volume is small and we would recommend R1.25 be increased to R1.5.

This involves very little increase in cost as insulation product represents only around 20% of the total installed duct costs, and in total, insulation represents only about 0.2% total construction costs in a typical high rise commercial building. In addition, for acoustic control it is common to use 50mm internal insulation lagging (R1.5) for the first 30% of rigid metal ductwork, so the incremental insulation involved in the other 70% of externally lagged ductwork is even less again.

Overall the ductwork provisions do not represent a significant departure from current installation practice and products are readily available to adjust to the increased energy efficiency standards with minimal cost impact, more than offset by the savings in energy costs as well as potential reductions in plant capital equipment costs.

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c) Pipe insulation

Like the duct insulation provisions, the move to R value ratings for insulation of hot and cold pipe work is long over due in Australia. Condensation control rather than energy efficiency has dominated specification of insulation in many cold water pipe applications until now.

ICANZ supports the pipe insulation proposals contained in the RD and advises that they can easily be met by standard products currently in the market with zero or minimal increased cost on current practice.

d) Commercial Buildings – Envelope Insulation Levels

ICANZ strongly supports the improvement in energy efficiency standards for commercial building fabric contained in the RD. In some cases these result in the insulation of areas not currently insulated and in others, increases on current practice.

These changes are long overdue in Australia and will not only result in lower energy usage and greenhouse gas reductions, but improved worker productivity, improved comfort, improved building fire safety and reduced noise levels in commercial buildings.

It is noted however that there are substantial issues with the establishment of representative costs for the installation of insulation in various envelope applications. Costs shown in the RD for the same application can vary by up to 250%. This has resulted in substantial discounting of the prescribed R-Value for envelope components.ICANZ feels that this issue requires resolution so that all of the prescribed levels may be re-evaluated.

These new minimum insulation levels will move Australia closer to European and USA building regulations. In these countries, insulation system designs are well established and incremental cost of installation is low. ICANZ believes the same scenario will evolve in Australia and indeed is already happening with many commercial builders developing low cost systems to meet the new standards.

Following are additional comments related to the evaluation of R-Values and insulation levels in relation to building envelope components.

The building modelling process methodology as related to the reference building method (refer to Section & Table JV3) omits to reinforce the R-Value requirements for the reference building model. Although there is a general reference earlier in the RD that the Reference building should contain the prescribed requirements generally, this requirement should be reinforced at this stage to ensure it is included. Omission of this factor would result in the reference building having a lower performance level compared to the other compliance methods.

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The requirements for shading of external walls in some climatic locations will be impractical, or very costly, for some buildings. An alternative with higher total R-Value or similar option should be considered and included in the provisions. This provision is also not carried across to the reference building modelling process leading to similar issues discussed in the first point above.

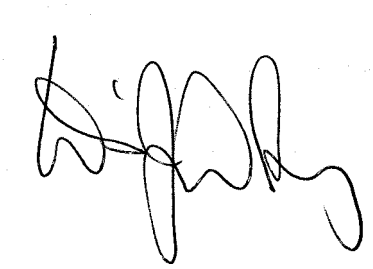
The variation (or lack thereof) of provisions for different climatic zones does not seem to correlate with results achieved for individual cities within those zones. Also, the grouping of major commercial centres in the same climatic zone does not always show the differentiation warranted by their specific climatic patterns. A review of these zones or variations for major centres may be worth considering as more fine-tuning occurs.

In general the envelope R-Values specified in the RD represent a significant step forward in achieving improved performance in this area, which has largely been ignored in commercial buildings to date. However more work should be done on evaluating the actual cost of insulation to allow these prescribed levels to be fine-tuned.

ICANZ welcomes the opportunity to provide this feedback on the proposed BCA changes and is willing to provide assistance in resolving some of the issues raised, particularly in calculating the actual cost of installed insulation in the various envelope applications, so that more robust recommendations can be made in this area.

In conclusion, we reiterate our strong support for the introduction of these energy efficiency measures for commercial buildings.

Yours Sincerely,



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