NCC Public Comment Draft
Response Sheet

This response sheet is to be used for submitting responses to the National Construction Code (NCC) 2022 Public Comment Draft.

How to use this response sheet

1. Provide your details including name, organisation and contact details.
2. Provide your response(s) to the Public Comment Draft. For each response you should include—
   - the relevant NCC volume(s) that your response relates to by clicking in the appropriate box(es);
   - the "**Clause/Figure/Table**" that you are responding to, e.g. J6D3(1)(a), Housing Provision Figure 7.2.3 or Table C2D2;
   - your "**recommended change to draft**", e.g. it is recommended that the proposed drafting to J6D3(1)(a) be amended as follows…(*see example*);

     If you are not recommending a change, insert "N/A" in this field;
   - your "**comments/reasons for change**". This should include justification to support your recommended change, e.g. heaters that emit light do not need to be excluded because these heaters have already been exempted by J6D3(3)(d) (*see example*).

     If you are including multiple "**comments/reasons**", use dot points or a numbered list.
3. Submit your response using the online response form on the ABCB website.

Notes:

Completing all relevant fields will help to describe what change in the Public Comment Draft you are commenting on, what your alternative change is and why it should be made.

This response form is to only be used for submitting responses to proposed NCC amendments contained within the NCC 2022 Public Comment Draft. If you wish to make comments or a submission on documents that have been released with the Public Comment Draft, please follow the instructions accompanying that document.

ABCB

Response Sheet

Your details

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Response(s)

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Condensation Provisions

Recommended change to draft:

General comment

Comment/reason for change:

Condensation challenges

The Housing Industry Asociation (HIA) recognises the importance of measures to address condensation risks in buildings. HIA is also concerned to ensure that other proposed NCC reforms do not result in detrimental impacts to the building and increase condensation risks and/or fire or safety risks.

The NCC 2019 condensation measures were introduced that lacked clarity and conflicted with existing parts of the NCC dealing with ventilation, exhausts, wall wrap/sarking, etc.

More importantly the provisions lacked a clear purpose in what they were seeking to address and failed to fully articulate the problem.

For NCC 2022 there remains concern that the project work has continued to progress with measures for the NCC without clearly defining the scope, purpose and problem seeking to be addressed.

The process also continues to look at the provisions in isolation of existing parts of the NCC, namely structural, weatherproofing, fire, thermal bridging and acoustics. It is noted that the condensation and energy efficiency provisions have sought to resolve some of these inconsistencies however, there remain issues such as the thermal bridging measures, roof space ventilation, etc that appear to be overlooked.

The provisions are becoming more complex in the way they are being drafted and it appears limited regard has been given to their practical application by builders, designers and approval authorities in their day to day application.

One only has to look at how the NCC across the code deals with sarking/wall wrap provisions and uses no less than 6 different terms and is asking this simple product to meet multiple outcomes - fire, weatherproofing, condensation and energy efficiency provisions - yet each part of the NCC is drafted differently with different criteria for this product.

What hope does a builder or tradie have when they are turning up at a hardware supplier trying to pick the right wall wrap product and its compliant installation when there is so much competing aspects of the NCC?

Whether there are even products available to meet the different parts of the NCC in one product is questionable.

A better rationalisation is needed to take the draft provisions and provide practical and clearly understandable provisions including figures and installation diagrams along with simpler calculations and solutions that can be easily applied on site.

Lack of true consideration of impacts

The proposed NCC 2022 condensation changes have been progressed without any cost impact assessment being undertaken despite the significant impacts the changes will have on certain products and construction practices such as mandatory ducting of exhausts for all homes.

For example mandatory ducting, while encouraged and promoted, is not practically achievable under all circumstances i.e. laundry cupboards, centrally located toilets, kitchens, bathrooms that are built on ground floors of row houses or zero lot line houses.

To achieve compliance this proposal has impacts on a range of building features including what type of floor joists/trusses can be used and on fire rating of grills into fire rated wall systems or vents or extensive ducting and consideration of location of any steel beams.

In the ventilation and exhausting provisions, the provisions are aiming to remove damp air from buildings by ducting, make up air, and fan/exhaust performance. However, there has been little to no regard of what impact this will have for products already in the market and what transition will be applied for selling off these products.

The majority of traditional ceiling mounted exhaust fans currently sold on a daily basis across Australia will unlikely meet the new flow rates and similarly for recirculating range hoods meaning the provisions are essentially banning recirculating range hoods.

These two product categories are very large sellers in the market and a 1 year transition to move the market completely away from these products would be inadequate and significant.

The effected manufacturers and suppliers of these products should be directly consulted prior to a move to essentially ban them from use in new buildings and major renovations/extensions.

Prior to progressing and finalising NCC 2022 condensation provisions at a minimum a Preliminary Impact Assessment should be undertaken to assess true and real impacts.

Increased energy efficiency standards impacts on condensation

Concern continues to be had about the impact of increased energy efficiency standards and greater sealing up of buildings and the related impact this will have on condensation and moisture build up in residential buildings.

With the proposed stringency increases in energy efficiency standards, the insulation upgrades required to meet the NCC will see wall cavities between studs in most climate zones, and in particular the colder and moderate climates, having insulation in excess of thehighest R-Value permissible placed in between and depending on framing type may need additional wall wrap or rigid board insulation to achieve compliance.

For roof spaces in most situations will be R4.0 or even up to R6.0-&7.0 to achieve compliance as well as under roof insulation. This will add additional weight to plasterboard and ceiling battens as well at perimeter of building will see insulation abutting roofing or require some sort of baffles or perimeter batts – increasing complexity and materials and installation practices.

For floor and sub floor wall insulation, the energy efficiency provisions are increasing the required sub floor insulation requirements between the sub floor members and depending on climate zones introducing new requirements for sub floor wall insulation.

There is a real risk that this will actually increase condensation risk in sub floors and have detrimental impact on sub floor members and reducing circulation of air and ability for building elements to breathe.

Maintaining ventilation of sub floors spaces is an important component of the NCC framing provisions (Part 3.4) as are maintaining breeze paths in sub floor spaces. It is also important for visual inspection perspective to ensure no termite activity.

Hot and humid climates

The issue of condensation in buildings emerged in the cold climates of Australia, however, concerns with condensation risk and condensation build up in buildings is now being raised in all areas of Australia.

The majority of the reforms for NCC 2022 will only apply to buildings Climate Zone 4 to 8 which leaves the top half of Australia not covered by the provisions.

The analysis and work has not focussed on these regions such as south, north and central Queensland, Northern Territory and Western Australia.

Whether the same reforms are needed for these regions and what the more humid situations and condensation risk presented, needs to be considered but certainly these areas of Australia should be considered going forward.

Apartments vs houses

The condensation work has essentially focussed on houses and essentially replicated the provisions for Volume Two in Volume One to apply to apartment buildings.This is not appropriate.

The construction practices differ greatly between houses and apartments and it could be argued that the condensation and mould build up is greater problem in apartments than it is for houses that have more natural breeze paths and ventilation to an apartment building particularly a high rise apartment in central city locations that may have limited to no openable windows and centrally located bathrooms and laundries.

The provisions and associated impact assessments should be looking at apartments and houses separately as reforms for one do not necessarily work for the other and vice versa.

Further work

With these considerations in mind, there would be merit in holding over both the energy efficiency and condensation changes and undertaking a more thorough and holistic analysis, supported by a dedicated condensation RIS, for NCC 2025.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Energy Efficiency Provisions

Recommended change to draft:

1. Maintain the current the building fabric star rating as per NCC 2019
2. In place of increasing the building fabric star rating, the following enhancements to NCC 2022 energy efficiency provisions be made:
    1. Introduce the new whole of home/energy usage provisions (with the building fabric set at 6 stars)
    2. Introduce the thermal bridging mitigation measures for both steel and timber framing to provide a true 6 star performance
    3. Combie the NatHERS house rating tools and whole of house assessment tools incorporating energy usage/building services provisions, building fabric assessment, heating and cooling loads, thermal bridging and building sealing

4. Incorporate the new NatHERS climate files into the energy rating tools
5. Complete the re-write of the DTS elemental provisions, having these set at 6 star taking account of new knowledge on the current DTS design level
6. Introduce new enhanced detailed installation of insulation provisions as per later comments in this submission
7. Introduce the new condensation provisions and air spaces and building wall wrap permeability requirements and undertake a broader analysis of condensation risks of higher energy efficiency standards and a full cost benefit assessment of all future changes
8. Introduce the new Universal Certificate template and associated checklists
9. Introduce the new energy assessor whole of home Cert IV training units and undertake a national training program for assessors on the new NCC energy efficiency provisions
10. Commence a review of the solar panel installation and battery storage Australian Standards and commence the development of associated NCC Deemed to Satisfy Provisions, where PVs and battery storage systems are installed in houses for future incorporation in the NCC to provide single source of truth and location for onsite installation provisions.

Comment/reason for change:
The residential building industry acknowledges the need to build environmentally responsible housing to the extent that it does not negatively impact on housing affordability and supply.

The Housing Industry Association (HIA) does not however, support the proposed NCC 2022 building fabric stringency increases and imposing additional costs and design and construction implications that would accompany the introduction of the proposed changes for all new houses and apartments and home renovations.

The Consultation RIS (CRIS) that was released alongside the NCC draft provisions concludes that the anticipated costs associated with the changes – which would effectively require new homes and apartments to meet a 7-Star NatHERS rating and meet higher standards for the energy efficiency of fixed appliances – would exceed benefits by a factor of three to one and four to one, respectively.

Overall, the CRIS confirms that this would result in a net social and economic loss to households and society of $2.366 billion under one scenario or $1.795 billion under the second scenario.

The RIS clearly demonstrated that both of regulatory options considered would result in a significant net cost to the community in the billions of dollars, and as a direct consequence increase housing costs for home buyers and renters and reduce housing affordability.

The additional home building cost, home loan costs and resulting additional stamp duty on the dwelling will affect every homeowner going forward, whether they see this set of requirements as their preferred approach to achieving reduced energy and emissions impacts as opposed to other more holistic approaches.

HIA holds the view that the RIS significantly undervalues the true cost of implementing minimum requirements for higher energy efficient design.

Costs relating to house redesign, internal layout changes and compromising internal room configurations, structural building changes and the specification of current industry standard building materials and products, are underestimated.

The draft NCC technical provisions contain numerous issues that must be addressed if changes are to proceed in this form.

The resolution of these issues will have significant influence over final house designs and the products and materials that will need to be specified in the future.

Adapting allotment sizes, site conditions, designs, specifications and costings to meet the changes requires a significantly longer lead-in time. Client engagement, awareness and marketing time lines add to the challenges.

HIA recently completed a national seminar series on the public comment draft with over 1,000 attendees. HIA has also been directly engaging with a range of building product manufacturers and suppliers that will be significantly affected by these changes.

Subsequent feedback from designers, builders and manufacturers reinforces the above and highlights the substantial impact these changes will have on their businesses' .

Summary of impacts of the changes

As noted HIA is not supportive of increasing the building fabric stringency to 7 stars and further detail on these issues are outlined in the specific comments on the draft changes which highlight the following technical and practical implications:

- Technical difficulties associated with proposed provisions
- Significant cost implications for the changes for homeowners
- Implications of the changes and corresponding thermal bridging changes
- Impact on standing building materials and construction practices
- Design implications of the changes
- Impacts on extensions and alterations
- The proposed increases exceeding the building fabric proposals in the Trajectory for low energy homes
- Construction, product and design transitional implications
- Added building envelope complexity
- A number of the provisions being incompatible creates contradictions with other parts of the NCC
- Increased condensation risk with the provisions with higher efficiency standards and increased wall, floor and ceiling/roof insulation provisions that will limit the ability for building to breathe, and cavities being packed with insulation and at capacity of space allowable
- Increased fire risk with the higher efficiency standards and increased wall, floor and ceiling/roof insulation provisions
- Availability of products to meet the new requirements
- Additional weight on ceilings and ceiling battens in achieving increases ceiling insulation
- Added complexity for design, assessment, approval and application of the NCC provisions and ultimately compliance challenges due to the added complexity.

Further details on these issues are set out below.

Further stringency on the building fabric and Star Rating Increase

NCC 2022 proposed changes provided a real opportunity to progress a new and more truly holistic approach to residential energy efficiency standards as supported by the Trajectory for Low Energy Homes of net zero 'ready' homes and move away from energy efficiency standards being set based on the poorly defined and understood energy efficiency 'star rating' that only address one element of both energy efficiency and emissions reduction.

It is disappointing that after all of the consultation and background work on the Trajectory for low energy homes and the ABCB Scoping Study, that instead of proceeding with a true whole of home approach to energy efficiency standards for residential buildings the proposed changes have reverted to just increasing building fabric star ratings and requiring

higher performing building services/fixed appliances with energy offsets only a potential inclusion.

The building fabric is already meeting 6 stars and generally requires the highest insulation levels standard wall, roof/ceiling cavities could readily and economically take based on the common construction methods in Australia.

Most houses in moderate and colder climate zones will also require some form of double glazing. To move to 7 stars there is not much more that can be done to the building fabric through ‘simple’ additions – it will require a range of changes to design and significant construction changes to be achieved across all house design in each region.

A far better approach is to move away from focusing solely on the building envelop to deliver an energy and emissions reduction outcomes and to move towards a more “whole of house” approach similar to BASIX in NSW.

While it is acknowledged that the new ‘whole of home’ assessment is an attempt to make this change, it fails on two accounts.

Firstly the proposed whole of home approach in the NCC 2022 proposals is not significantly different from the NCC 2019 provisions apart from applying a higher stringency for both the fabric and appliances and only available offset is for installation of solar panels for the regulated building services.

Secondly, the assessment metrics remain solely focused on energy usage as a proxy for emissions reduction, with no direct reference to emissions in the calculation methods.

Noting that the CRIS demonstrates that the costs of the proposed changes outweigh the benefits it is hoped that the ABCB will now take the opportunity to revisit the approach proposed and look at a broader range of options for the manner in which the code moves to achieve zero energy (and carbon) ready buildings.

Design Impacts Changes for 7 Star Homes and Apartments

Moving to 7 stars will be a serious issue and the documentation on the NCC changes, case studies and the CRIS all under estimates how hard that is actually going to be for the industry if all houses and apartments in all climate zones of Australia are going to be required to meet 7 star standard.

Achieving 5 stars was generally achieved with insulation upgrades for most houses which is an affordable and practical upgrade for the standard home design and construction methods used Australia at that time.

Moving to 6 stars required the highest insulation levels to be used in the standard wall, roof/ceiling cavities but was achievable with most houses in moderate and colder climate zones also required to use some form of higher performing window glazing.

What is never discussed is that with the dozen or so software updates over the last 10 years and other changes in the NatHERS protocols a home that was 6.0 stars in 2011 certainly is not 6.0 stars in 2021, it is more likely to be 5.5 stars.

There have been multiple unregulated software updates throughout that 10 year period where every single rating reduced by 0.1 stars. Now to achieve 6 stars a high majority of houses require double glazing apart from the smallest single storey designs.

Achieving 7 star building fabric will be all about design as when you have upgraded all insulation to maximums and double glazed all windows and glazed doors, your only option is to change window specification (size) and change the house design. The availability of products to achieve the 7 stars without significant design change will be extremely challenging.

Member experiences on projects where they have designed 7 star homes using the current NatHERS tools, including volume builders, shows they reach the same conclusion - that the

increase in price due to design changes and upgraded construction is too expensive for the customer to remain interested enough in this improved outcome to pay for the additional costs.

Complex designs - Designs that are having trouble with 6 Stars

There are many standard houses designs that all already struggling to achieve 6 star design and if 7 stars is introduced those house designs would need to be scrapped or may be limited to construction on certain orientations only.

This issue is not limited to volume or project homes and has a large, if not larger impact on custom built homes.

This was further demonstrated by a recent ABCB commissioned study into difficult blocks that presently struggle to meet 6 star standards and subsequently how they would meet 7 stars if changes were to proceed.

Some of the observations from the report were:

- that the Typical Houses in colder climates required significant upgrades under each difficult block scenario (with high performance double, thermally broken, argon filled, high solar gain, low e glazing required).
- specifications and upgrades required for sub optimal house designs result in an increase in cost can be observed ranging from 5 to 25%

These challenges are not limited to project homes and equally affect custom designed houses which home owners have a specific house design in mind and willing to pay for this outcome often struggle with 6 stars. Most of these designs would never achieve 7 stars no matter what insulation and glazing specification was thrown at them.

The only solution in these scenarios is for the architects to engage the energy rater immediately at concept stage and change the way they design. All houses will start looking the same, squares or rectangles with no courtyards or return walls to limit exposed walls to atmosphere.

The days of large expanses of windows will be completely gone as the window to floor area ratio will need to come back to around 22% as we simply don't have window specification in the country that will allow for large windows in a custom design and still achieve 7 stars.

Further to this the sample houses they have used for the cost benefit analysis of 7 stars case studies used for the CRIS are not representative examples of homes and apartments built, or are choosing optimal orientations and situations on these case studies, as opposed to the real world challenges faced on house sites and design issues.

For apartments, the issues are equally challenging to achieve a 7 star average across the apartment building. The window to floor area ratio and therefore window/glass performance levels would add excessive costs and design challenges.

Changing over to larger sections of cladding in lieu of window/glazed facades is not likely to be a desirable outcome for apartment owners due to consumer preferences for natural ight, views and overall amenity and livability.

The CRIS case studies for apartments also need a much broader representation of case studies and examples to ascertain the real world challenges and costs.

Ability to adequately review and comment on the NCC 2022 changes

The ability of industry to provide a comprehensive analysis of the NCC 2022 proposed changes to the 7 star standard proposals has not been possible due to the need for accessing the future NatHERS tools and only one of these (the least commonly used tool) being available during public comment that incorporated the updated climate files and other features required to test compliance with the proposed NCC 2022 proposals.

It is noted that there has been demonstrations and case studies available, however, for industry to be able to truly assess the real world implications of the proposals, they should be able to access to the 4 accredited NatHERS tools in some way, and that each of these have all the necessary features and functions and correct climate file settings and whole of home features.

Further to this, there should be the ability to have much longer consultation period so they are able to assess a range of building designs and projects with the fully functioning ratings tools and be able to get a broad understanding of the impacts of 6 vs 7 star homes, and the energy usage provisions.

Reviewing and commentating on the changes to the star ratings, has historically been extremely challenging to do and to gauge the true impacts of changes.

This is like no other part to the NCC where changes are proposed as there are not clearly prescribed changes given the high use of simulation assessments and the truly known impacts are only realised when the final accredited assessment tools and trained energy assessors are able to undertake proper assessments against real world house projects.

This aspect of the system remain a significant flaw and once again is placing industry and governments in an inappropriate and invidious position that the true and transparent outcomes of these changes are in fact unclear.

Reliance is placed on a small number of consultants to assure all parties that the outcomes will be what is predicted – genuine testing and comparison is essentially impossible.

Differences in approach from the Trajectory

It is important to note that the Trajectory for Low energy buildings, which industry was broadly supportive of the principles, did not recommend a 7 star stringency increase across all jurisdictions/climate zones. Rather it proposed between 6.5 and 7 in the colder climate zones 6, 7 and 8.

For the other climate zones it recommended 6.5 in climate zones 1 and 5, and 6 stars in climate zones 2, 3 and 4.

The Trajectory recommendations for Class 1 buildings were:

Findings from the various options modelled indicate for new Class 1 dwellings to be built to at least:

- *Between 6.5 and 7.0 NatHERS stars equivalent in NCC climates 6, 7 and 8;*
- *6.5 stars equivalent in NCC climates 1 and 5;*
- *Up to 6 stars equivalent in NCC Climates 2, 3 and 4*

(noting many homes in these climates currently have credits available to build below 6 stars); and

- *Total combined energy usage budget for the building and services of 115MJ/m2 equivalent.*

The Trajectory recommendations for Class 2 and Class 4 buildings were:

- *7 star average and 5.5 star minimum in NCC climates 7 and 8;*
- *6.5 star average and 5.5 star minimum in NCC climates 1, 4, 5 and 6;*
- *6 star average and 5 star minimum in NCC climates 2 and 3.*

Unfortunately the Consultation RIS and the draft NCC provisions has not assessed these recommendations and the NCC provisions have proposed an alternative approach using 7 star average across all climate zones.

Much of the concerns and issues raised above would still exist with the trajectory settings, however, if Governments proceed with NCC changes a more pragmatic approach would be to align the NCC provisions with the agreed recommendations for the thermal fabric settings being tailored for each climate zone as set out and agreed to in the Trajectory.

Broader implications for Class 1 buildings

NCC 2022 is likely to be the largest single amendment to the NCC and there are a range significant amendments beyond energy efficiency that will be introduced.

These include:

- Mandatory accessible housing provisions for all new and extensions for Class 1 buildings
- More stringent condensation management provisions
- Waterproofing provisions
- Fixing and flashing requirements
- Broad range of Australian Standards changes
- NCC restructuring changes; and
- Performance Solutions changes.

All of these provisions add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 1 projects.

These changes need to better rationalized and not looked at in silos as individual reforms. They must be considered as the cumulative package of changes and an assessment of their overall impact be made for all housing forms.

Broader implications for Class 2 buildings

Most new Class 2 buildings are constructed as mixed use buildings and the building and manufacturing sector are still adapting to the substantive changes made under NCC 2019 Section J. Many of the changes are only coming online to projects now and their substantive impacts on design and material selection are yet to be well understood.

As such prior to progressing further energy efficiency changes to both the individual apartments building fabric and higher building services (energy usage) provisions, for Class 2 buildings, the NCC 2019 Section J changes should be given further time to be embedded into construction and materials and designs.

Furthermore, there are other significant changes being proposed for Class 2 buildings under NCC 2022 which follow significant fire safety and other changes made for Class 2 buildings in NCC 2019 (including mandatory sprinkler provisions and aforementioned Section J changes in NCC 2019 for Class 2 buildings).

These include:

- Mandatory accessible housing provisions for all Class 2 buildings
- Significant more stringent waterproofing and weatherproofing provisions
- Further fire safety provisions changes and restrictions
- More stringent condensation changes
- EV charging future proofing and solar ready zones

All of these provisions add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 2 apartment projects.

These changes need to better rationalized and not be looked at in silos or individual reforms but look at the cumulative impacts of these changes. If they are proceed they should be staged for introduction and preferable not commence until 2025.

Low cost package of reforms that could achieve same benefit without the significant disruption and costs

HIA has identified a range of reforms that could be progressed that would result in much lower cost impacts and build upon our current well performing energy efficiency standards.

Most of these reforms utilisise much of the work both the ABCB and NatHERS Administrator have been progressing for NCC 2022 though adjusted to be aligned to current building fabric stringency for NCC 2019.

The reforms would be delivered as a package of reforms for NCC 2022 or alongside NCC 2022 and include:

1. Introduce the new whole of home/energy usage provisions (with the building fabric set at 6 stars)
2. Introduce the thermal bridging mitigation measures for both steel and timber framing to provide a true 6 star performance
3. Combie the NatHERS house rating tools and whole of house assessment tools incorporating energy usage/building services provisions, building fabric assessment, heating and cooling loads, thermal bridging and building sealing
4. Incorporate the new NatHERS climate files into the energy rating tools
5. Complete the re-write of the DTS elemental provisions, having these set at 6 star taking account of new knowledge on the current DTS design level
6. Introduce new enhanced detailed installation of insulation provisions as per later comments in this submission
7. Introduce the new condensation provisions and air spaces and building wall wrap permeability requirements and undertake a broader analysis of condensation risks of higher energy efficiency standards and a full cost benefit assessment of all future changes
8. Introduce the new Universal Certificate template and associated checklists
9. Introduce the new energy assessor whole of home Cert IV training units and undertake a national training program for assessors on the new NCC energy efficiency provisions
10. Commence a review of the solar panel installation and battery storage Australian Standards and commence the development of associated NCC Deemed to Satisfy Provisions, where PVs and battery storage systems are installed in houses for future incorporation in the NCC to provide single source of truth and location for onsite installation provisions.

Greater advantage in emissions reduction for improving performance of existing homes

HIA supports greater efforts being invested in improving the energy efficiency of existing housing stock as opposed to regulations continually targeting only new buildings. This approach would deliver a marked improvement in emissions reductions nationally as opposed to making incremental and more expensive changes to standards that already do the required heavy lifting.

The Trajectory for Low Energy Homes Report noted the following in respect to existing buildings:

- *'Existing homes represent the largest potential for energy savings in the residential building sector.'*
- *'The vast majority of Australia's housing was built before the introduction of minimum energy efficiency regulations (estimated at 8-10 million homes) for residential buildings in 2005. This means existing (pre-2005) housing will continue to pose large energy costs, health and emission issues for households, regardless of standard increases in the NCC.'*

- *Based on initial modelling…. By improving the performance of existing buildings by a relatively small amount, the energy savings and benefits roughly double.*
  For example, by improving existing housing stock by just 1 per cent could deliver an additional $1.5 billion in net present value.'

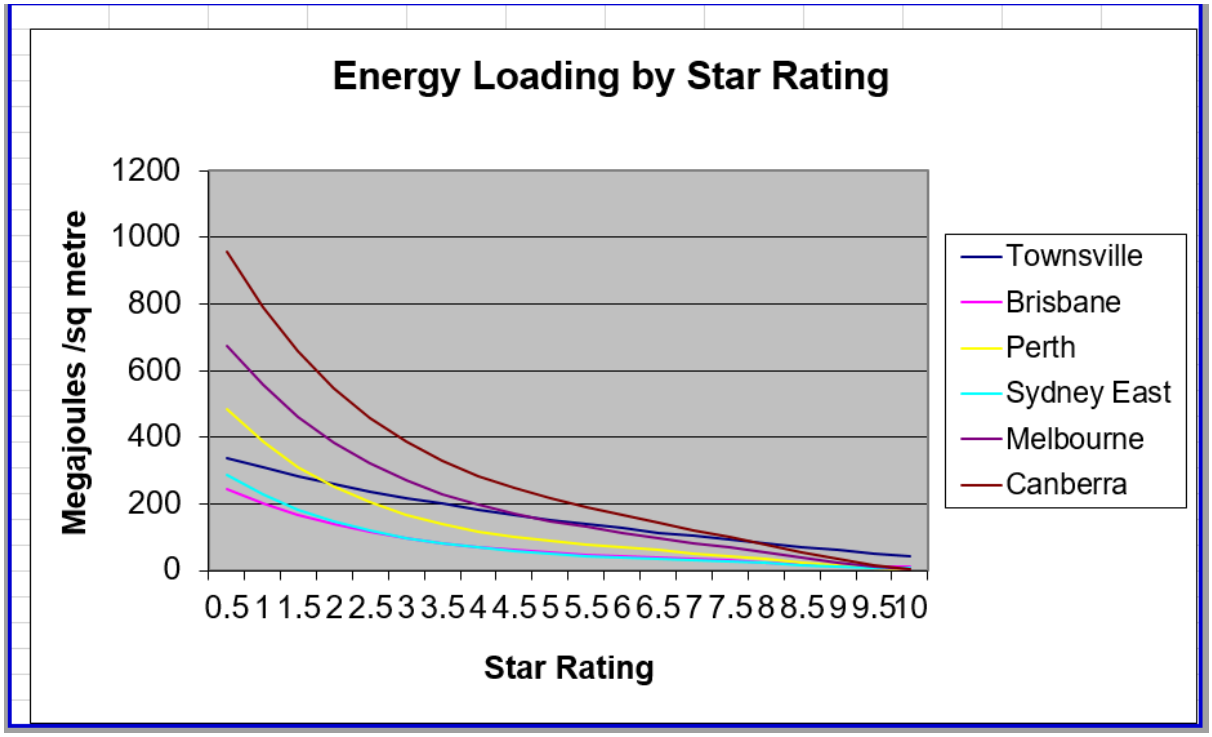
These findings are compelling and supports that there would be far greater gains to be had by tackling energy efficiency upgrades for existing housing stock rather than seeking to further increase standards for our already highly efficient new houses and apartments.

Understanding true meaning of NatHERS 'star' rating

The pursuit of further discrete changes in the building fabric performance solely on the basis that the rating scheme in place has higher standards (10 stars) completely fails to align with the actual overall public policy outcome sought from the Trajectory.

In this regard it is important to understanding the NatHERS ratings, shows that the changes proposed will offer only a marginal decrease in energy consumption as opposed to improvement that was delivered by the first three benchmarks for building fabric (4, to 5, to 6 stars).

This is depicted in the following chart and associated graph (based on climate zone and region) which shows the dimishing return on energy savings as the star ratings increase beyond the initial 4 and 5 star benchmarks introduced:



Region	Climate region Location	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Region 1
1	Darwin	853	773	706	648	598	555	516	480	446	413	381	349	317	285	253	222	192	164	140	119	2
2	Port Hedland	643	569	507	455	411	373	340	310	284	260	237	215	194	172	151	131	111	93	76	62	3
3	Longreach	654	550	465	396	340	294	257	226	200	178	159	141	124	107	90	74	58	43	29	18	4
4	Carnarvon	209	181	157	137	120	105	93	82	73	66	59	53	47	41	36	31	27	22	18	14	5
5	Townsville	337	309	283	259	238	218	200	183	168	153	140	127	114	103	92	81	71	61	52	44	6
6	Alice Springs	681	562	464	385	321	269	228	196	170	148	130	113	99	84	70	56	43	29	17	7	7
7	Rockhampton	344	295	255	222	194	171	152	136	122	110	99	90	80	71	63	54	46	38	31	24	8
8	Moree	597	481	388	315	258	214	180	155	135	119	106	94	83	71	60	47	35	24	14	7	9
9	Amberley	407	334	275	226	187	157	132	113	97	85	75	67	59	52	45	38	31	24	18	12	10
10	Brisbane	245	203	167	139	116	97	83	71	62	55	48	43	38	34	30	25	21	17	13	10	11
11	Coffs Harbour	286	232	188	153	125	103	86	73	63	55	49	44	39	34	29	24	19	15	11	7	12
12	Geraldton	349	285	233	191	158	132	112	96	83	73	64	57	50	43	36	29	22	16	10	5	13
13	Perth	483	387	311	251	204	167	139	118	102	89	79	70	61	52	44	34	25	17	9	4	14
14	Armidale	801	661	545	451	375	314	266	227	195	169	147	128	110	93	76	60	43	27	13	1	15
15	Williamtown	429	349	284	232	191	159	133	114	98	86	76	67	58	50	42	34	26	19	12	6	16
16	Adelaide	584	480	394	325	270	227	192	165	143	125	109	96	83	70	58	46	33	22	11	3	17
17	Sydney East	286	230	184	148	120	98	81	68	58	50	44	39	35	30	26	22	17	13	9	6	18
18	Nowra	517	423	346	284	235	195	164	140	121	105	92	81	70	60	50	40	30	20	12	5	19
19	Charleville	525	434	359	298	249	209	177	151	131	114	100	87	76	66	56	45	35	26	17	9	20
20	Wagga	804	663	548	455	380	321	273	235	204	178	156	137	118	100	82	64	47	30	15	3	21
21	Melbourne	676	559	462	384	321	271	230	198	171	149	131	114	98	83	68	54	39	25	13	2	22
22	East Sale	791	653	541	449	376	317	269	231	201	175	153	133	115	98	80	63	46	30	15	2	23
23	Launceston	895	740	615	513	431	366	314	272	237	208	183	160	138	117	95	74	53	33	15	1	24
24	Canberra	957	792	657	547	458	387	330	284	247	216	189	165	142	120	99	77	56	35	17	2	25
25	Cabramurra	1666	1404	1188	1012	870	753	658	580	513	454	401	352	303	255	208	160	114	71	33	1	26
26	Hobart	876	723	598	498	417	354	303	262	229	202	177	155	134	113	92	71	51	31	14	0	27
27	Mildura	660	541	444	367	305	256	218	187	163	143	126	110	96	81	67	53	38	25	13	3	28
28	Richmond	555	450	365	298	245	203	171	146	127	112	99	87	77	66	55	44	34	23	14	7	29
29	Weipa	830	743	671	611	560	517	479	445	414	384	355	326	296	266	237	207	179	153	130	111	30
30	Wyndham	1229	1071	943	839	754	685	626	576	530	488	447	406	364	321	278	234	192	154	121	95	

Further its also important to note that:

- A 10 star house is not a net zero energy house.
- A 10 star house is not a net zero (and carbon ready) house.
- A 10 star house is only a home which requires no mechanical heating and cooling.

There is no basis or rationale in the NatHERS assessment that achieves a net zero outcome.

Such an outcome can only every be delivered through a complete reform of what we are measuring and the way we are combining the potential tools that can deliver this outcome.

The expected out can be achieved with:

- a good performing building fabric (to reduce heating and cooling);
- high performing fixed appliances primarily managed by market measures such as MEPS and GEMS but with minimum installation benchmarks for new buildings as per the NCC today;
- a comprehensive assessment of the buildings energy consumption from fix and unfixed appliances (fridges, TVs, etc) to formulate a ‘whole of house’ energy assessment and
- appropriate renewable energy methods to offset the total energy use – whether in individual homes or via community based offsets.

To achieve this outcome, the approach to energy efficiency in the NCC needed to fundamentally change. Simply moving the dial up one star is not the right soluition.

The proposed 2022 package of reforms has the scope to begin this change, but for a range of reasons it will not deliver the change needed or expected. This reality is evidenced by the CRIS which confirms that simply shifting benchmarks on what we already have does not achieve the benefits expected, but does come with more costs.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Energy Usage Provisions

Recommended change to draft:

General comments

Comment/reason for change:

- The tables included in the Whole-of-home Efficiency Factors document do not differentiate between the same water heater technologies with significantly different performance characteristics
- It is disappointing that storage gas water heaters have not been represented fairly in both the Efficiency Factors document and the ABCB Whole of Home calculator.
- 5 star gas storage water heaters have the same energy consumption profile as 5 star gas instantaneous gas water heaters, yet the Whole of Home calculator indicates that storage water heaters underperform their instantaneous equivalents.
- It is considered that the whole of home calculation is likely to see an increase in demand for heat pump water heaters (HPWH), however existing regulations surrounding heat pump performance (the Clean Energy Regulator's TRNSYS modelling) are not watertight. For example, a heat pump product can be designed to theoretically meet the TRNSYS model's heating loads in cold weather, however anecdotal feedback from the field is that some HPWHs do not provide the same outcome in real life, often at the expense of consumer amenity
- Whilst supportive of the whole of home approach, HIA questions whether the "societal cost of energy" (SCoE) metric that is used to drive the energy calculation is appropriate. It is understood that an assumed carbon price of $12 per tonne has been used, however unaware that that the Australian Government had agreed a price for carbon, nor is it clear as with regards to the weighting that this component has in calculating the overall SCoE.
- HIA is concerned that the proposed update frequency for the energy factors used in Volume Two is insufficient given that some will be 3 years out of date by their time of publication.
- There is concern on the added complexity to this change and how the regulated services will be interpreted and applied in practice with energy assessors making the choices as part of their assessment and default selections made.
- Many of the decisions on hot water and heating appliances in made interactively throughout a project with home owners and factor into construction costs and evolve as project progresses. This will no longer be able to occur and will require far greater upfront design and selections.
- There is concern of introducing the provision of installation of PV panels on roofs without appropriate design and installation standards and available orientation, roof space/roof design, weatherproofing, structural loading and maintenance and fire safety provisions.
- It is also unclear how the energy usage provisions would apply to renovation and extension projects when it is making assessment against the whole building and that the building fabric is set at 7 stars.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Energy Usage Provisions

Recommended change to draft:

General Comment

Comment/reason for change:

HIA has had a number of conversations with representatives from the gas industry, and they have expressed their significant concerns over the impacts the proposed changes will have on the viability of the gas sector going forward..

HIA supports the concerns of the gas industry and believe that any future NCC changes should not seek to provide an advantage to one technology/energy source over another.

Homeowners would also be effected by any such changes where they may seek to use gas instantaneous hot water, gas for their air-conditioning units and gas cooktops.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Thermal Bridging

Recommended change to draft:

General comment

Comment/reason for change:

HIA has a range of concerns with the proposed introduction of thermal bridging requirements.

This includes –

1. The variability of research on this matter
2. Suitability of solutions being put forward
3. Cost impacts of the changes on steel framing and lightweight cladding
4. Practical and buildability issues on the thermal bridging options
5. The need for thermal bridge at ceiling levels for steel framed roofs
6. Conflicting provisions with other NCC parts
7. Safety issues with the floor and roof proposed thermal bridging mitigation measures for example the options of strips over ceiling joists/framing or continuous layer of insulation are not practical or build able solutions and create safety risks by people working in roof spaces and structural supports that they are relying on.
8. That the provisions will make the use of standard 90 mm framing extremely difficult to achieve compliance with going forward in moderate and cold climate zones and in particular Climate Zone 6
9. Applying the measures to one form of construction and material type and the impacts this will have on selection and choice of framing solution given it penalises one form of construction over others.

There has been much discussion on the effect of thermal bridging on the thermal resistance of framed building elements. As is widely known and acknowledged, thermal bridging depends on many factors and all efforts to identify, quantify and mitigate its effects have practical limitations.

HIA agrees in principle with the concept of equivalent performance, subject to recognition that:

- all methods of quantifying thermal bridging effects is imprecise;
- simplified calculation methods have limitations
- heat gains and losses in buildings depend on other factors such as convective bridging, and
- over- and under-performance of individual building elements and dwellings is inevitable, regardless of the materials and configurations used.

Placing precise bounds on “R-Value equivalence” without recognising these factors is unlikely to deliver better energy efficiency outcomes but may have the effect of reducing the structural choices available to designers and builders.

Further detailed comments on the technical matters outlined above are included in this submission against the relevant clauses and further comments on the broader impact the changes will have will be provided in response to the CRIS.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: EV Charging Future Proofing and Solar Ready Zones

Recommended change to draft:

1. Hold over changes and give further consideration for NCC 2025
2. Produce an ABCB Handbook that provides information and design option for future proofing Class 2-9 buildings with EV charging infrastructure, battery storage systems and solar ready zones to encourage further voluntary uptake and promote further market demand for these inclusions prior to progressing with regulation.

Comment/reason for change:

Electric vehicles (EVs) presently account for a small fraction of Australia’s passenger vehicle fleet.

While it is acknowledged through a range of policy and other mechanisms that there is likely to be a greater uptake in electric vehicles over the next decade, however, it is considered that it is premature to require all Class 2 buildings to require the future proofing measures at this time based on a range of assumptions.

A core part of the NCC provisions is about minimum necessary regulation and to address a demonstrated need and that there are no other non-regulatory solutions available and therefore regulatory intervention being a last resort.

While it is acknowledged these provisions are about ‘future proofing’ for the potential for this infrastructure to be fitted in future, and to avoid potentially costs retrofitting where it is required for the building post the completion and years down the track if and when there is significantly greater uptake of electrical vehicles.

However, the current proposals are making a number of assumptions on demand and jumping straight to a regulatory solution without progressing this firstly through non-regulatory means and incentivising and increasing market demand and improved knowledge for choice.

The apartment market is very much a demand driven market, and if apartment owners are seeking specific inclusions when they are looking at purchasing new apartments they will make choices based on their specific needs. If this becomes a high demand item, the developers and builders of apartments will respond with providing the inclusions that they seek.

The additional costs for the EV charging future proofing as stated in the PIA is an average of approx. $400 per car parking space and if that is factored across the entire apartment building that is a significant additional expensive on all apartment owners regardless of whether they will ever want or use the EV charging infrastructure.

There are other significant changes being proposed for Class 2 buildings for NCC 2022 and follows significant fire safety and other changes for Class 2 buildings in NCC 2019 (including mandatory sprinkler provisions and aforementioned Section J changes in NCC 2019 for Class 2 buildings).

These include:

- Mandatory accessible housing provisions for all Class 2 buildings
- Significant more stringent waterproofing and weatherproofing provisions
- Further fire safety provisions changes and restrictions
- More stringent condensation changes
- Significant energy efficiency stringency increases and energy usage provisions.

All of these provisions add more complexity, stringency increases and ultimately have significant impact on affordability and viability of Class 2 apartment projects.

These changes need to better rationalized and not be looked at in silos or individual reforms but considered in light of the cumulative impacts of these changes.

As such it is recommended that the EV charging infrastructure proposals and solar ready zones, be held over for further consideration for NCC 2025 alongside the next proposed changes for commercial buildings arising from the Trajectory proposals.

Over the interim period the ABCB could produce an ABCB Handbook that provides information including design options, structural loading and fire safety considerations for future proofing Class 2-9 buildings with EV charging infrastructure, battery storage systems and solar ready zones to encourage further voluntary uptake and promote further market demand for these inclusions prior to progressing with regulation.

This would also provide further time to look at the fire safety risks and additional structural loading and design implications that have been raised and concerns on the different challenges these would present.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H4P7 & F8P1

Recommended change to draft:

Revise the Performance Requirement to—

(a) be less qualitative and provide more quantified values
(b) subject to (a) the Performance Requirement should be broken down to provide better linkages to the relevant aspects of the condensation DTS Provisions namely:
    (i) wall sarking permeance
    (ii) roof space air spaces and ventilation
    (iii) ventilation and ducting
    (iv) exhaust/fans performance

Comment/reason for change:

Whilst it is acknowledged that, H4P7 (F8P1 Volume One) the relevant condensation management Performance Requirement is not proposed to be changed for NCC 2022, it is considered that the current Performance Requirement is highly qualitative and lacks appropriate detail.

By having such a qualitative Performance Requirement and also given that it provides little to no linkages to the corresponding DTS Provisions, it makes undertaking Performance Solutions relating to the condensation provisions very difficult for practitioners and approval authorities to consider, formulate and accept solutions.

It also increases the risk of inconsistent and variable solutions as there is not established benchmarks or metrics to develop the solution against as to what an acceptance criteria would be and would be up to the individuals own opinions.

In reality the relevant Performance Solutions related to condensation will be minor DTS variations but how that would relate to the Performance Requirement as drafted is unclear.

Yes this could be done through guidance or case studies, but given all the efforts the ABCB is going to quantify the NCC Performance Requirements that newly introduces Performance Requirements should be incorporated that are quantified as far as practical.

These comments were also provided to the NCC 2019 drafting of this Performance Requirement, and it was hoped through the Stage 2 work that this would've been addressed and goes to the heart of what the NCC is seeking to address related to condensation in buildings but is yet to be clearly defined.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H4V5 & F8V1

Recommended change to draft:

1. Confirm that the AIRAH DA07 document complies with ABCB Protocol for referenced documents OR include the relevant sections called up in the in H4V5 within NCC itself as opposed to included further referenced documents when only specific clauses or sections are being referenced
2. Confirm/provide information on how it can be verified in practice on the criteria of 'from the 5th year after construction onwards'

Comment/reason for change:

Refer to comment on recommended change to draft.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6O1, H6F1, J1O1, J1F1

Recommended change to draft:

Do not include H6O1(d) and J6O1(d), H6F1(d) and J1F1(d) and await the further ABCB work on building resilience project

Comment/reason for change:

Don't believe it is appropriate at this time to include information in a subtle sub-clause to an Objective on building resilience and should await broader discussions on this topic.

If the NCC was to go there, why is this Objective not in the structural section for resisting cyclones and high wind events, bushfire section for bushfire resistance, water ingress resistance section, etc.

Does it not also open the door to criticism of whether NCC can actually deliver on these matters such as black outs which is far beyond control of NCC and individual building.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6P1

Recommended change to draft:

Do not include the new Performance Requirement H6P1 and maintain the drafting of the building fabric Performance Requirement P2.6.1 from NCC 2019

Comment/reason for change:
HIA continues to hold reservations on the complexity and suitability of the new proposed building fabric Performance Requirement as it relates to Class 1 buildings.

Most Performance Solutions for Class 1 buildings would only relate to small DTS variations for example going forward using the ISO thermal bridging standard as opposed to the NZS standard.

How this new Performance Requirement would apply to those types of Performance Solutions and be able to verify, formulated, criteria, etc. it is not clear.

Whilst the current the drafting of the building fabric Performance Requirement P2.6.1 from NCC 2019, is somewhat qualitative in nature, it is considered to have a more direct relationship/linkages to the corresponding DTS Provisions and simpler and clearer for the potential development of Performance Solutions for Class 1 buildings to the various aspects of the DTS Provisions as opposed to a first principle holistic Performance Solution which would be extremely rare for houses.

If the PR proceeds as drafted case studies on developing and documenting those types of Performance Solutions is needed.

If the PR does proceed an application box should be included to note that assessment of both heating and cooling loads is not required in all climate zones.

Noting that the Performance Requirement only applies to the loads of habitable rooms only it should be made clearer as most assessments have generally been based on the floor area of the building as opposed to only the habitable rooms.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6V2

Recommended change to draft:

1. Provide further information and report on the proposed changes to H6V2 to aid consideration particularly given there was a raft of changes in NCC 2019 on this Verification Method and it is now proposed a range of new elements to the method
2. If changes proceed, the NCC should provide worked examples/case studies of applying the revised verification using reference building method and new inputs and modelling requirements

Comment/reason for change:

1. It is important to note that BCC nor the residential working group were provided with the draft changes for H6V2 prior to inclusion in the public comment draft or the report to accompany the changes. Prior to discussing suitability of proposed changes BCC and the residential working group should be given the opportunity to review and comment on the report.
2. Notwithstanding comment 1, if changes proceed for H6V2, the NCC should provide worked examples/case studies of applying the revised verification using reference building method and new inputs and modelling requirements

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NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6V2(2)(v)(iii), (v)(iv)

Recommended change to draft:

Clarify why cooking equipment and appliances are being regulated in the Verification Method, when the NCC doesn't regulate these matters.

If they are intended for specific purpose under the Verification Method – provide explanatory information as to purpose/extent of their application for this Verification Method and how it can be verified as appliances and cooking equipment are not part of building approval requirements.

Comment/reason for change:

Refer to comment on recommended change to draft.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6V2(2)(w)(ii)

Recommended change to draft:

Rationalise application of H6V2(2)(w)(ii)(B)&(C) as the clause as drafted is essentially regulating compliance with both the building sealing DTS Provisions and the Verification of Building sealing (blower door) Verification Method whereas they are alternate compliance paths.

Comment/reason for change:

Refer to comment on recommended change to draft.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6V3(c)

Recommended change to draft:

Write out the ventilation provisions of clause 6.4 of AS/NZS 5601.1 into the NCC as opposed to adopting the gas standard into the NCC and Volume Two.

Comment/reason for change:

H6V3(c) is specifying the ventilation provisions of clause 6.4 of AS/NZS 5601.1 where a gas fuelled combustion appliance is installed, it would be a more complete solution for the NCC to include the requirements within NCC itself as opposed to referencing compliance with specific clauses of AS/NZS 5601.1.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1P2

Recommended change to draft:

Provide clarity on application of J1P2 where the building is a mixed use building and documenting compliance

Comment/reason for change:

Whilst a specific Performance Requirement for Class 2 SOUs is supported as opposed to a single Section J Performance Requirement for all buildings, it remains unclear how it applies to a mixed use building or a building containing a mix of both Class 2 and Class 3 buildings.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1P3

Recommended change to draft:

1. Provide clarity on application of J1P3 where the building uses combined services across the building and/or as a mixed use building and how this is determined.
2. Explain the application of J1P3 to a renovation to a Class 2 building that triggers NCC compliance.

Comment/reason for change:

Whilst a specific Performance Requirement for Class 2 SOUs building services is supported.

However, it remains unclear how this Performance Requirement and associated DTS Provisions applies with broader JP1/Section J commercial provisions as it applies to where:

- the Class 2 building is provided with combined services across the apartment complex, or
-
- Where the building contains a combination of shared services and individual services a building; or
- mixed use building or a building containing a mix of both Class 2 and Class 3 buildings; or
- to a renovation to a Class 2 building that triggers NCC compliance.

These situations are very common and standalone Class 2 buildings are less common and most have some form of mixed use component, there are also a range of apartments built with a combination of self-contained apartments (Class 2) and serviced apartments (Class 3) and practitioners and approval bodies would benefit from clarity on these matters if the new provisions are introduced.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1P4

Recommended change to draft:

Include application box on what building classes this Performance Requirement applies to and the extent to which it applies

Comment/reason for change:

The Performance Requirement is written that it would apply to all Class 2-9 buildings and all carparks for a building whereas the corresponding DTS provisions contain limitations on what class of buildings to which the provisions pertain to and also contains a number of exemptions from compliance for the solar ready zones.

An application and limitation clause should be included with the Performance Requirement to align application with the corresponding DTS Provisions of J9 if the provisions proceed for NCC 2022.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1V5

Recommended change to draft:

1. Provide case studies and worked examples of applying the new Verification Method J1V5

Comment/reason for change:

This new Verification Method is very complex and would benefit from case studies/guidance.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1V5(1)(a)(ii) & (b)(ii)

Recommended change to draft:

Explain logic and clarify why a building needs to meet a heating and cooling equal to 120% of the heating/cooling loads from the building fabric Performance Requirement.

Comment/reason for change:

This seems excessive and essentially appears to requiring application of this method to achieve a higher building fabric performance to the mandatory Performance Requirement.

If this is the case it is therefore questionable to suitability of its inclusion or benefit to its inclusion.

Better clarity and explanation of the VM is needed.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J2D2(2)(b)

Recommended change to draft:

Consider suitability of the use of term in this clause

'improving the thermal performance of the building fabric'

as it doesn't seem to fit in a DTS Provision and would appear more consistent to be saying

'by complying with-'

and then directing users to the relevant DTS provisions you need to meet.

Comment/reason for change:

Refer to comment on recommended change to draft.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J3D3

Recommended change to draft:

Include the provisions of J3D3 for reducing heating and cooling loads of SOUs of Class 2 or Class 4 Part using house energy rating software (star rating) in its own Section J Part.

Comment/reason for change:

Part J3 is titled 'elemental provisions for a Class 2 building and Class 4 part' however, the provision of J3D3 for reducing heating and cooling loads of SOUs of Class 2 or Class 4 Part using house energy rating software (star rating) and what energy rating must be achieved is contained with Part J3 under the part titled elemental provisions.

Whilst Part J2 provides a flag/application clause that directs the reader to J3D3 where they using house energy rating software (star rating) to demonstrate compliance, however, this creates unnecessary confusion and it is considered a better approach to include under its own Part in Section J or under the new proposed Part J2.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J1P4 Renewable energy and electric vehicle charging

Recommended change to draft:

A building must have features that facilitate incorporation of renewable energy *infrastructure, including* electric vehicle charging equipment.

Comment/reason for change:

Sentence reads as needing '*renewable energy charging equipment'*, in the absence of "electric vehicle". Commas are needed to clarify the differences, or specify that electric vehicle charging equipment is an additional requirement.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: F8D3(2), 10.8.1(2)

Recommended change to draft:

Provide greater clarity on application of this clause to brick veneer and cavity construction

Comment/reason for change:

There remains significant confusion on application of this clause and whether it applies to a sarking installed where a cavity is in place i.e. for a battened out cavity construction system or brick veneer.

I.e. sarking isn't required to be installed in this situation but if it is installed in CZ 4-8 is it then required to be vapour permeable even though a cavity is installed between cladding and sarking.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2(a) and (b)

Recommended change to draft:

Clarify application/interpretation of 'operated on demand' and 'operated continuously'

Comment/reason for change:

Feedback on this clause is that it would benefit from definition or explanatory information on what/how 'operated on demand' and 'operated continuously' applies/should be interpreted i.e. for a toilet exhaust fan or a 3 in 1 bathroom light, exhaust, heater.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2(a) and (b)

Recommended change to draft:

Provide information on verifying flow rates of exhausts and different flow rates for current products on market

Comment/reason for change:

Feedback on this clause is that it would benefit from information on verifying flow rates of exhausts and different flow rates for current products on market and that occasionally these products are not installed until after building has been signed off given they have not historically been a regulated building element.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Condensation Provisions 10.8.1 (3) (Housing provisions) & F8D3 (3)

Recommended change to draft:

Except for single skin masonry, or single skin concrete, structural insulated panels (SIP's), Insulated Sandwhich Panels or single skin solid timber/cross laminated timber (CLT) walls, where a pliable building membrane is not installed in an external wall, the primary water control layer must be separated from water sensitive materials by a drained cavity.

Comment/reason for change:

Allowances are already made for single skin masonry and single skin concrete. Considering the insulation values are higher within structural insulated panels and cross laminated timber, it makes sense to include them within the Deemed-to-Satisfy provisions.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.1 (2) (Housing Provisions) & F8D3 (2).

Recommended change to draft:

Where pliable building membranes, sarking-type materials or insulation layers are installed on the exterior side of the primary insulation layer of an external wall they must have a vapour permeance of no less than-

(a) in climate zones 4 and 5, 0.143 ug/N.s (Class 3 in accordance with AS 4200.1): and
(b) in climate zones 6, 7 and 8, 1.14ug/N.s (Class 4 in accordance with AS 4200.1)

Comment/reason for change:

It would be more practical if the requirements are express in 'class' as this is easily identifiable with the manufacturers specifications.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.1 (2) (Housing Provisions) & F8D3 (2).

Recommended change to draft:

Where pliable building membranes, sarking-type materials or insulation layers are installed on the exterior side of the primary insulation layer of an external wall they must have a vapour permeance of no less than-

(a) in climate zones 4, 5, 6 and 7, 0.143 ug/N.s (Class 3 in accordance with AS 4200.1): and
(b) in climate zones 6, 7 and 8, 1.14ug/N.s (Class 4 in accordance with AS 4200.1)

Comment/reason for change:
The Sustainable Building Research Centre (SBRC) at the University of Wollongong has been conducting hydrothermal research related to walls with vapour-permeable membranes in cooler climates.

This work has undertaken a range of modelling on the NCC 2022 condensation proposals and the primary findings of the SBRC report was that Class 3 vapour-permeable wall configurations perform as well as Class 4 wall configurations in cool climates.

The simulations presented demonstrate that walls with Class 3 membranes can pass the AIRAH DA07 mould index test when simulated in NCC Climate Zones 6 and 7.

HIA supports the findings of this work, which also enables a broader range of building wall wraps primarily Class 3 membranes to be used to meet both the condensation and energy efficiency provisions.

This particularly important for Climate Zone 6 and the use of reflective membranes (which meet a Class 3 type membrane in accordance with AS 4200.1) to assist in achieving total wall R-values under the elemental DTS external wall provisions for CZ6 which is extremely limiting without this inclusion and was including in earlier drafts from TIC.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2 (1)(b)(ii) (Housing Provisions) & F8D4 (1)(b)

Recommended change to draft:

Separation of continuously vented kitchen areas into two L/S (air flow rate) values, one for zoned kitchens and another for open planned living

Comment/reason for change:

Continuous ventilation is typically applied to buildings that have a high performing passive designs.

Knowing air flow rates can be determined in such cases using verification methods J1V4 or H6V3 which require area size as an input data, the DtS proposal appears to neglect kitchens layouts. Some house designs have kitchens within open plan living areas, others may be located in their own separate zone.

This will have an impact on the required air flow dispersal, it is suggested the ABCB provide separate values for both *zoned kitchens*; it is also suggested definitions are provided for each situation.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.3 (1) (Housing provisions) & F8D4 (Volume 1)

Recommended change to draft:

Excluding single skin masonry, single skin concrete, structural insulated panels (SIP's), Structuraly Insulated Panels, or single skin or solid timber/ cross laminated timber (CLT) roofs/ceilings, in climate zones 6, 7 and 8, a roof must have a roof space that

(a) is located immediately above the primary insulation layer; and
(b) has a height of not less than 20mm; and
(c) is either-
    (i) ventilated to outdoor air through evenly distributed openings in accordance with Table 10.8.3; or
    (ii) located immediately underneath the sarking of a tiled roof where the sarking has a vapour permeance of not less than 1.14 ug/N.s or Class 3 in accordance with AS 4200.1

Comment/reason for change:

While it is accepted within NCC 2019 certain types of single leaf wall constructions are exempt from condensation provisions, the same philosophy has not been applied to roof construction. It is therefore flawed not to provide such options to the end user as part of Deemed-to-Satisfy provisions.

Further to this, it becomes particularly problematic for precast concrete floors/roofs to be providing an air gap where there is not a subsequent ceiling in place.

As for reasons expressed earlier, it is also advisable to state the class of membrane required.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 10.8.2 (Housing Provisions) & Table F8D4 (Volume 1)

Recommended change to draft:

Add following notes to Table

NOTE:

1. The distance from the bottom of the door to the floor coverings is acceptable at 15mm in circumstances where privacy is compromised.
2. These provisions do not apply to a European or laundry cupboard
3. The door undercut would only apply provided it wouldn't compromise the structural integrity of the door
4. If a door is an inwards opening door into a sanitary compartment and has lift off hinges, the door gap provided for the door would satisfy the provisions of this table

Comment/reason for change:

1. The undercuts in the table are excessive and for most bathrooms and toilets the floor areas will be between 3m2 -10m2 in and the flow rates of the exhaust would not need to be in excess of the minimum stated.

   The undercut should be similar to the requirements in AS 2688 Clause 4.1.2 which states that clearances at the bottom of doors should not exceed 15 mm this is an appropriate dimension that can act as an exemption within DtS provision for figures nominated in the table.

   Issues including air quality and sound dispersal may have a detrimental effect on an occupants wellbeing should they feel their privacy is compromised.
2. In apartments and small lot houses/secondary dwellings – European or laundry cupboards are common and driers in these rooms usually have bi-fold, sliding or concertina doors or other type of cabinetry doors that run on a top and bottom track. If these doors were required to be cut down the structural integrity and functionality would be significantly compromised or require a completely different system.

   Further to this when in operation of a drier in most instances the Euro laundry/laundry cupboard doors are left open.

   As such it is recommended that European laundries be exempt from the door undercut provisions.
3. Most internal doors in houses and apartments are hollow core doors with only a top and bottom rail in the door for structural integrity and these rails are generally 25-30 mm any cuts larger than 15mm – ideally 10 mm max significantly compromise the structural integrity of the door.
4. Under the construction of sanitary compartments provisions of 3.8.3.3 it has provisions requiring if a door opens inwards into a sanitary compartment and there isn't a clear 1.2 m space that it be readily removed from outside the compartment. In practice this involves cutting the top of door down approx. 15mm and using lift off hinges as such if that door gap is already provided it should suffice in lieu of a door undercut.

Alternative options are also desirable, wall and door ventilation grills. Could be defined in terms of total clear area (similar to subfloor ventilation).

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2(4) F8D4(4)

Recommended change to draft:

1. Clarify how it will be known what type of clothes dryer is being installed?
2. Provide exemption and clarification that the door undercut provisions do not apply to an external door

Comment/reason for change:

1. The provisions get triggered where the room has a venting clothes dryer but the selection and installation of a clothes dryer is not known at time of installation and appliances such as dryers can change over time and should clarify how this would be verified.
2. The door undercut provisions should not be applied to external doors as they are openable and therefore able to provide natural ventilation to the room and further to this cutting them down would compromise the building sealing and weatherproofing. Providing a simple clarification on application will help to avoid any potential misunderstandings or arguments on site between parties on this matter.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2(2)

Recommended change to draft:

1. Retain current option for roof space ventilation provisions in lieu of ducting/exhausting provision from NCC 2019 or include a Verification Method on roof space ventilation as per the provisions for NCC 2019.
2. Consider introducing a 2-3 year transition period for the kitchen ducting/exhausting provisions to enable a sell down of existing recirculating range hoods.

Comment/reason for change:

Mandatory ducting/exhausting to outside while encouraged and promoted is not practically achievable under all circumstances i.e. laundry cupboards, centrally located toilets, kitchens, bathrooms that are built on ground floors of row houses or zero lot line houses is very difficult to achieve compliance.

To achieve compliance it has impacts on a range of building features including what type of floor joists/trusses can be used and on fire rating of grills or vents or extensive ducting and consideration of location of any steel beams.

It can also mean that fire rated walls are needed to have penetrations and vents to achieve compliance.

Whilst the intent of the changes in seeking to remove damp area from buildings by ducting, make up air, fan/exhaust performance. However, in practice it can be very challenging to di this under all circumstances.

Further to this, there has been little to no regard for what impact this will have for products already in the market and what will the transition be in selling off these products.

The bulk majority of traditional ceiling mounted exhaust fans currently sold daily in the market will unlikely meet the new flow rates and the ability to duct to outside.

The provisions are also essentially banning use of recirculating (pull out) range hoods.

These two product categories are very large sellers in the market and a 1 year transition to move the market completely away from these products is significant and shouldn’t be under estimated.

The effected manufacturers and suppliers of these products should be directly consulted prior to a move to essentially ban them from use in new buildings and major renovations/extensions.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

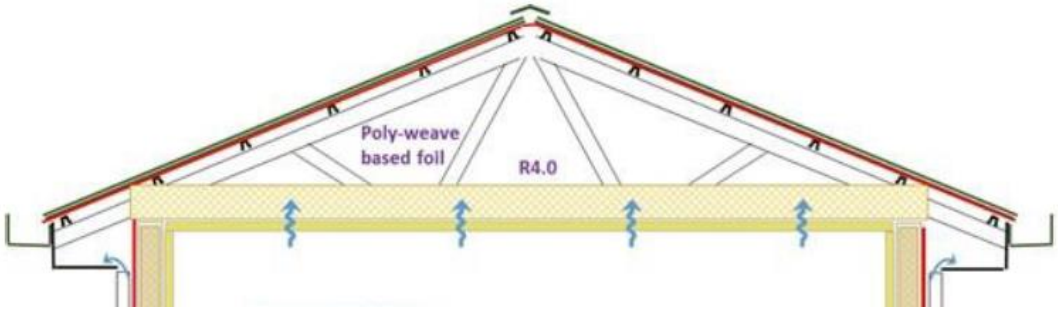
Clause/Figure/Table: 10.8.3 and Table 10.8.3, F8D5 and Table F8D5

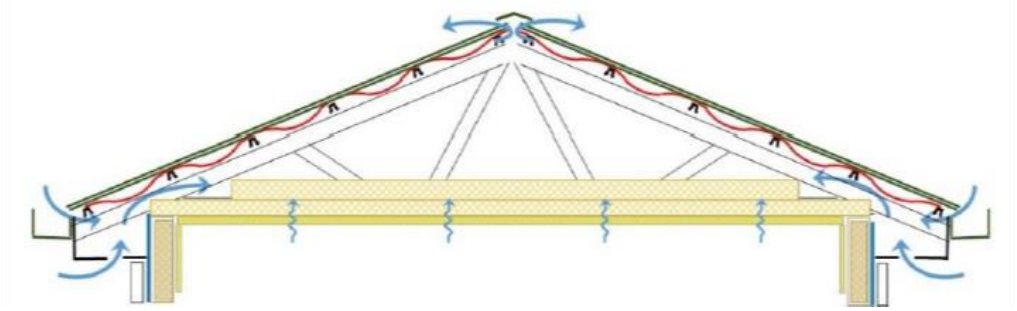
Recommended change to draft:

1. Provide clarity on where the 20 mm air space applies to in the roof and relationship to battens, sarking and ceiling space
2. Provide solutions/options for the perimeter of the building at roof/wall where the insulation would be abutting up to the roofing

Comment/reason for change:

1. There has been confusion from various parties on the application of the 20 mm air space in the roof and where this applies and how this relates to roof battens installation. Some explanatory information and figures would assist with interpretation
2. At the perimeter of the outside of walls and with the increased insulation required to get to 7 stars will see the need to use R4.0 and up to R6.0-R7.0 and will mean that the insulation batts will interact with roof at external walls as depicted below. The NCC needs to look at providing options to overcome this such as by permitting use of perimeter batts that may be able to be at lower R value to ensure air gaps still maintained.





NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.3 and Table 10.8.3, F8D5 and Table F8D5

Recommended change to draft:

Provide figures/depictive construction details in the NCC (not a handbook) for the roof space ventilation requirements related to application of Table 10.8.3

Comment/reason for change:

The NCC should include construction detail figures of what and how the roof be constructed as per the prescribed ventilation openings in Table 10.8.3 i.e. The installation of sarking at eaves and ridge, ridge capping and what additional ventilation is required.

Worked examples would also be useful rather than just relying on interpretation of the relevant ventilation openings table

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NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2 (1) (a)(ii) and F8D4(a)(i)(ii)

Recommended change to draft:

Provide an explanatory note to clarify whether operated continuously means the installation of a mechanical ventilation system and that the exhaust system will need to operate 24hrs a day where the room is in use of not

Comment/reason for change:

Clarification will assist with interpretation and application of clause

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NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 10.8.2 (3) & (4) & F8D4(4)

Recommended change to draft:

Change the term naturally ventilated to not ventilated in accordance with Clause 10.6.2 (broader ventilation DTS Provisions).

An exhaust system serving a bathroom or sanitary compartment that is not ventilated in accordance with clause 10.6.2 must -

Comment/reason for change:

The term naturally ventilated is not defined nor is there an explanation of how this is achieved. If the purpose is just to indicate that it must have a window that can be openable then a cross reference to the clause is a better option.

However, this does not indicate that the window must be opened while the exhaust system is running. Therefore benefits of the clause will not be achieved if people don't open the window. Condensation will continue to be a problem.

If naturally ventilated has additional meanings i.e. the ventilation must be a fixed ventilation opening then this should be included in an explanatory note. Something along the lines of (i.e. fixed window pane with permanent fixed vent with an area equal to 5% of the floor area of the room).

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: F8D5 of Volume One & Part 10.8.3

Recommended change to draft:

<u>Part 10.8.3 of Housing Provisions:</u>

(1) In climate zones 6, 7 and 8, a roof must have a roof space that—

(a) is located immediately above the primary insulation layer; and

(b) has a height of not less than 20mm; and

(c) is either—

(i) ventilated to outdoor air through evenly distributed openings in accordance with Table 10.8.3; or

(ii) located immediately underneath the sarking of a tiled roof where the sarking has a vapour permeance of not less than 1.4 µg/N.s; or

(iii) tiled roof without sarking type material at roof level.

F8D5 of Volume One:

(1) In climate zones 6, 7 and 8, a roof must have a roof space that—

(a) is located immediately above the primary insulation layer; and

(b) has a height of not less than 20mm; and

(c) is either—

(i) ventilated to outdoor air through evenly distributed openings in accordance with Table F8D5; or

(ii) located immediately underneath the sarking of a tiled roof where the sarking has a vapour permeance of not less than 1.4 µg/N.s; or

(iii) tiled roof without sarking type material at roof level.

(2) The requirement of (1) do not apply to a roof that is subject to Bushfire Attack Level FZ requirement.

Comment/reason for change:

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table notes (2) for Tables 13.2.3 under Housing Prov. & - Tables J3D7 under NCC Volume One.

Recommended change to draft:

Add (iv) to Table Notes (2) under Tables 13.2.3a - Tables 13.2.3r of ABCB Housing Provisions:

(2) A roof is considered 'Vented' if it –

(i) has one wind-driven roof ventilator per 50 m^2 of respective ceiling area, in addition to roof vents; or

(ii) has one powered roof ventilator per 200m^2 of respective ceiling area, in addition to roof vents~~.~~; or

(iii) complies with Part 10.6; or

(iv) a tiled roof without sarking type material at roof level.

Add (iv) to Table Notes (2) under Table J3D7a - Table J3D7e NCC Volume One:

(2) A roof is considered 'Vented' if it –

(i) has one wind-driven roof ventilator per 50 m^2 of respective ceiling area, in addition to roof vents; or

(ii) has one powered roof ventilator per 200m^2 of respective ceiling area, in addition to roof vents~~.~~; or

(iii) complies with Part 10.6 of F8D5; or

(iv) a tiled roof without sarking type material at roof level.

Comment/reason for change:

Previously under NCC 2019, unsarked tiled roofs are deemed ventilated. This definition is recommended to be maintained as tiled roofing without sarking are known to provide a ventilated roof space.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: F8D5(1)(a) 10.8.3(1)(a)

Recommended change to draft:

Provide explanatory information on what constitutes the 'primary insulation layer'.

Comment/reason for change:

It is common in metal roof construction for roof insulation to be located both at ceiling level and at roof level. This has advantages where the level of insulation required for a roof may be that it is more practical to provide at both ceiling and roof levels. It is also a common condensation management technique to place an insulation blanket directly below metal roofing.

It needs to be clarified if the primary insulation layer relates to R-Value, the primary insulation layer being the higher R-Value. This is important where an insulation blanket is used for both the overall required R-Value and condensation management as stated.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.5k and various other external wall tables

Recommended change to draft:

Re-craft the Table to allow a broader range of options while maintaining a standard 90 mm wall for two storey and lightweight cladding solutions.

Comment/reason for change:

As a starting point for most of the available solutions for Table 13.2.5k for example it results in R2.7 wall insulation being required which is the largest permissible for a 90 mm wall.

However, this is only for a single storey wall brick veneer wall at 2.4m or 2.7m.

If the wall is a 2 storey wall you need to add for both upper and lower storey another R0.5.

That would equate to that wall now being R3.2.

If you use a lightweight cladding it then requires you add another R0.3.

That would equate to that wall now being R3.5.

If that wall had metal/steel wall framing you would also need to apply the thermal bridging mitigation measure.

This table therefore is not workable and needs to be re-developed to provide more readily attainable solutions.

Many of the other elemental tables for the various climate zones for external walls in applying similar common situations significantly disadvantage 2 storey and lightweight cladding designs and further compounded with the thermal bridging mitigation measures.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: F8D3(2), 10.8.1(2), Table 13.2.5u and Table 13.2.5v, C1.9

Recommended change to draft:

Review the thermal bridging mitigation options for steel wall frames i.e. option of lining outer surface with insulation R-Value of at least R0.6 or additional insulation strips, to ensure it doesn't contradict or compromise the condensation provisions and fire safety/non-combustibility provisions.

Ensure there are available products in the market to satisfy the proposed measures.

May need to consider an exemption for NCC 2022 where it also needs to meet thermal bridging mitigation measure from the vapour permeability criteria, and let market catch up and innovate for introduction in NCC 2025.

Comment/reason for change:

Most if not all products on-market that would achieve required R-value and incompressible criteria (to ensure they don't reduce installation issues and retain thermal performance) are impermeable, having a continuous layer of impermeable insulation would conflict with condensation management.

Furthermore, complying strip of correct R-Value thermal break is not readily available in Australia. R0.6 thermal breaks limited commercial product available in Australia or NZ.

Given required thickness it would likely mean that the sarking would need to be a rigid board insulation and be thicker than the permissible exemption in C1.9 for sarking type materials from non-combustibility requirements and need to be non-combustible however the condensation provisions would require it to be vapour permeable. It's unlikely a product will be able to meet both non-combustible and vapour permeability requirements.

Further consideration is needed on the relationship between the various provisions for wall wraps.

This would also need to be considered from weatherproofing perspective for wall cladding also.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.2(2)

Recommended change to draft:

Clarify application of this clause as it relates to the pliable building installation standard AS 4200.1

Comment/reason for change:

This clause, though not proposing to change, contains installation requirements for reflective insulation whereas AS 4200.1 is referenced in other parts of NCC including condensation provisions which creates uncertainty on what must be followed for installation of reflective insulation.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.2

Recommended change to draft:

13.2.2 should be re-written to be provide more detailed installation of insulation requirements.

Comment/reason for change:

13.2.2 and formerly 3.12.1.1 are written in very qualitative language and provides no real details of correct insulation installation. There has been a range of work done both for AS 3999 and on insulation road map and compliance reports that show that there would benefit in the NCC providing more detailed installation of insulation requirements to assist with compliance.

With the ramping up of insulation required in roofs, ceilings, walls, and sub floors having correct installation details becomes increasing important and even more so with the proposed thermal bridging provisions to ensure safe and compliant installations.

Further detailed provisions and installation figures should be included for:

Floor insulation and installation requirements including-

- slab edge insulation
- under slab insulation
- sub floor insulation installation
- sub floor wall installation

Wall insulation and installation requirements for-

- building wall wrap
- bulk insulation
- insulating double brick walls
- panel and single skin construction

Roof/ceiling insulation and installation requirements for:

- roof blanket
- sarking
- ceiling insulation
- thermal bridging measures
- cathedral roofs
- single skin roofing panels.

This is important as these provisions apply to all of the NCC compliance paths i.e. reference method, elemental and star rating.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Part 13.2

Recommended change to draft:

Separate Part 13.2 so that roofs, walls and floors all have their own dedicated Parts or Specifications for each.

Comment/reason for change:

It is recommended that Part 13.2 be separated so that each of roofs, walls and floors all have their own dedicated Parts or Specifications.

This could be:

- Part 13.2.1 - **Roofs** with the corresponding tables and roof lights provisions
- Part 3.12.3 – **External Walls** with the corresponding tables
- Part 3.12.4 – **Floors and slabs** with the corresponding tables

This will help with interpretation and application and not have tables spreading over pages and pages.

This change would complement the suggested changes to 13.2.2 in making the provisions simpler to understand and more logical layout.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.3(2)

Recommended change to draft:

Remove provision restricting roof and wall colours in climate zone 1-5

Comment/reason for change:
Thermal modelling was done on a home across 8 climate zones: Sydney, Brisbane, Darwin, Hobart, Perth, Adelaide, Canberra, and Melbourne.

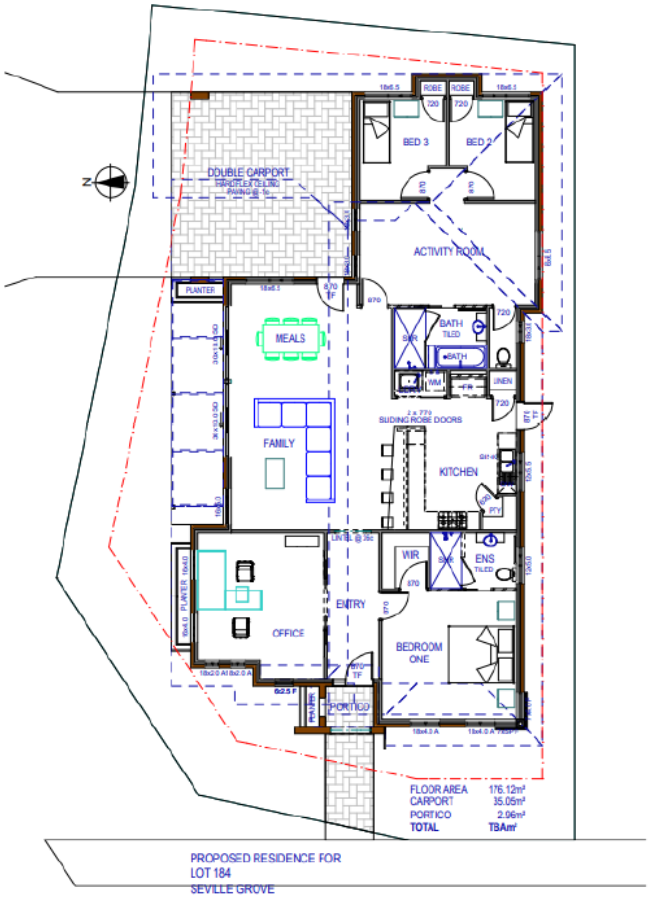
In this modelling the effect of different wall construction types (cavity brick, brick veneer, and lightweight), wall colour (light, medium, and dark), wall insulation (R1, R1.5, R2, R2.5, and R3) and roof and wall colour (light, medium, dark) on the star rating and total energy usage was investigated.

The findings of the modelling showed that there was minimal benefits from an overall total energy usage from limiting the roof and wall colours as proposed in the NCC draft provisions in respect to the total of the cooling and heating energy loads required to keep the home at a comfortable climate.

Modelling

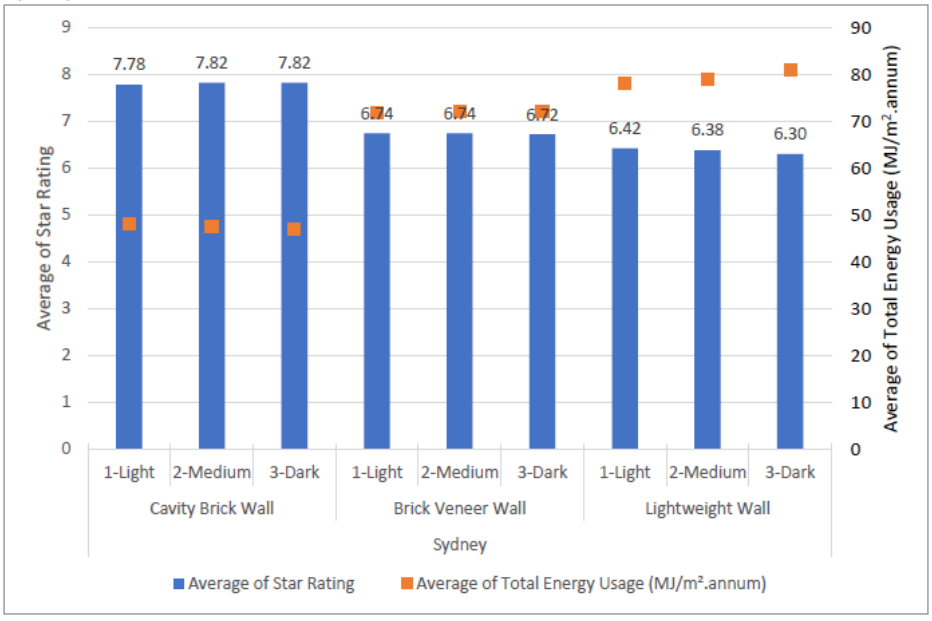
This modelling contains the below graphs which compare the effect of wall construction type and wall colour across the 8 climate zones listed above. Roof colour was kept constant at medium and the insulation was averaged across all levels. The floor plan of the building that was modelled is below.

The modelling provided herein primarily relates to the roof colours but similar modelling was done for the walls which resulted in similar findings and can be provided to ABCB if required.

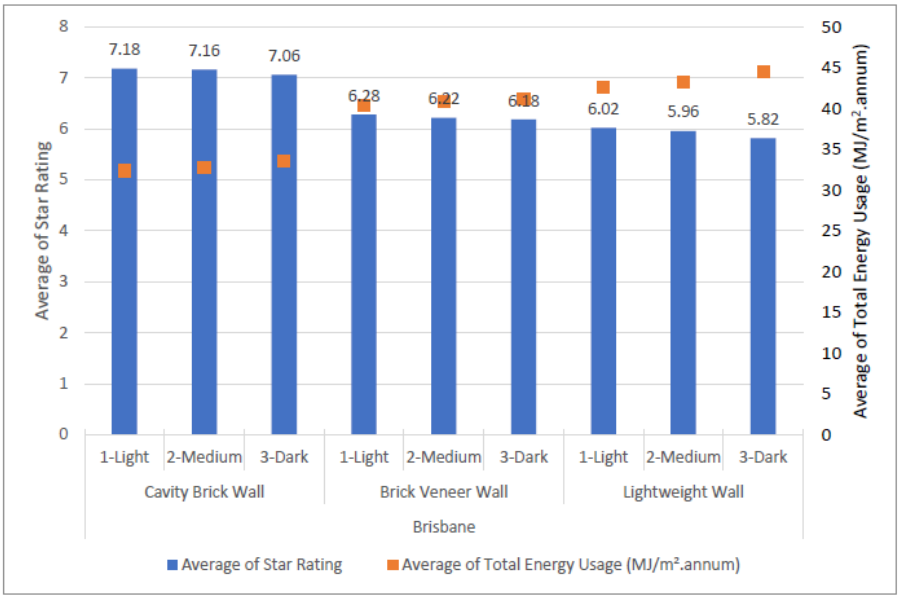


Wall Type vs. Wall Colour by Climate Zone

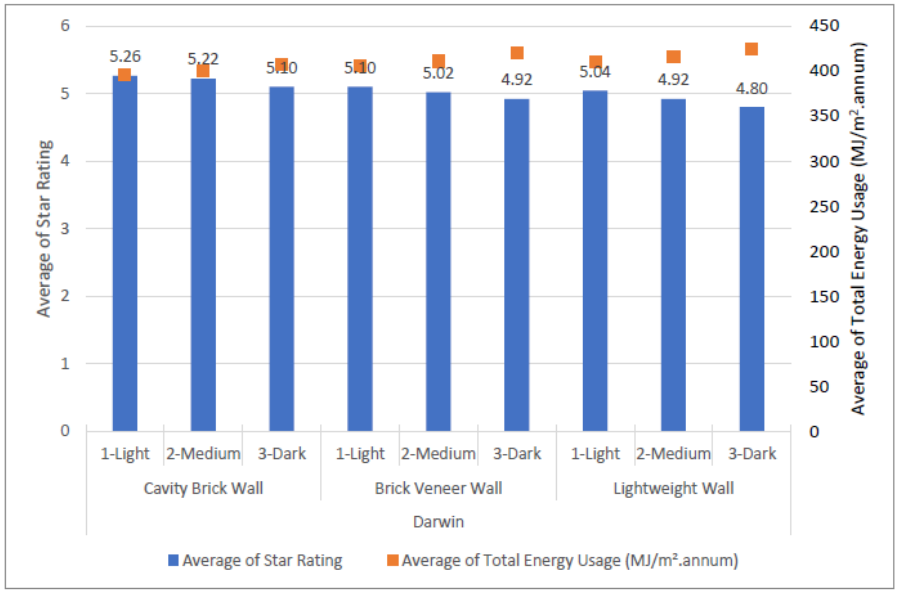
Sydney:



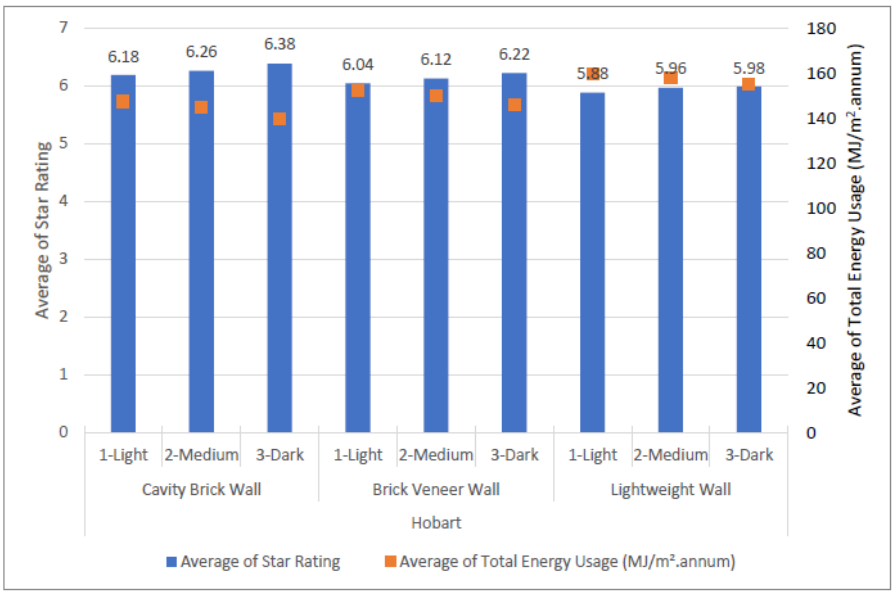
Brisbane:



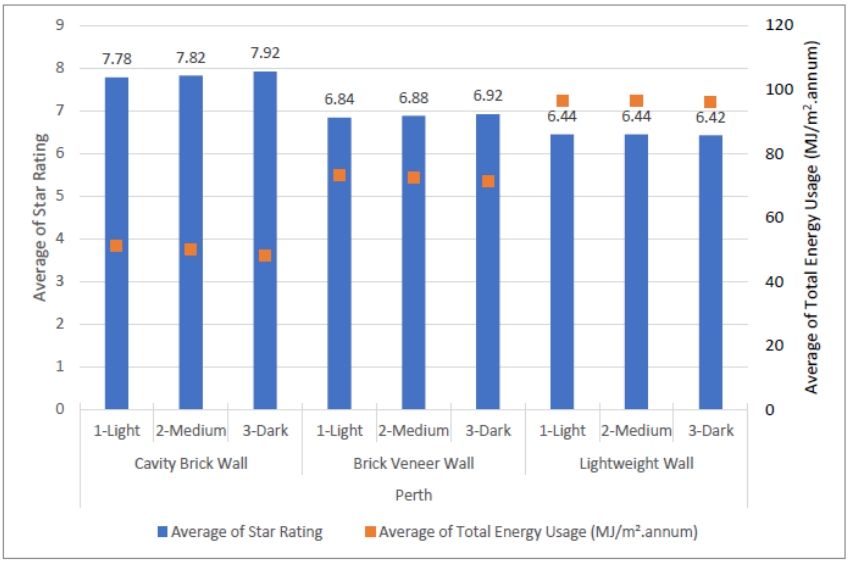
Darwin:



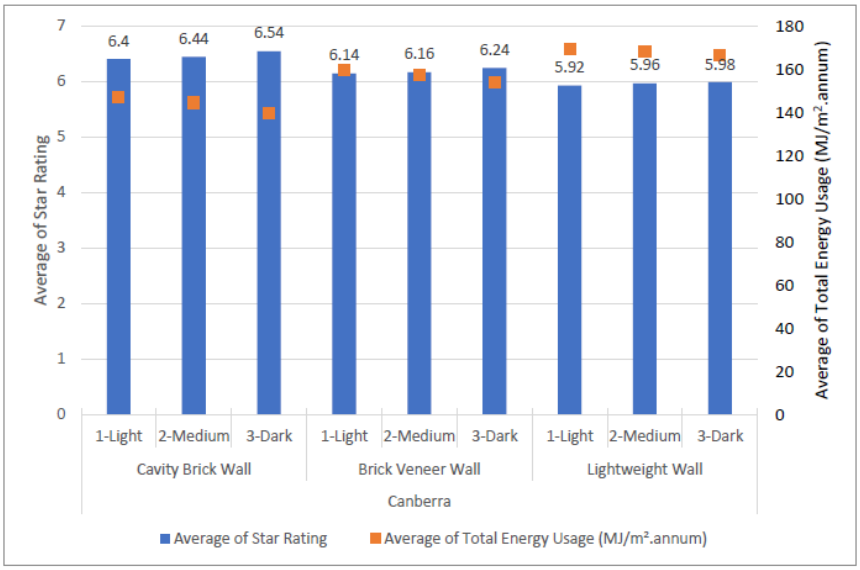
Hobart:



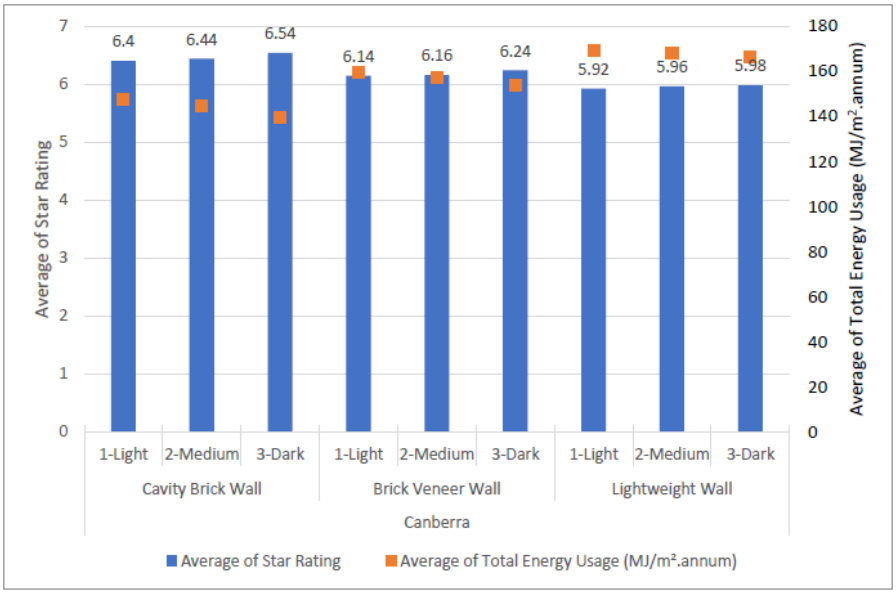
Perth:



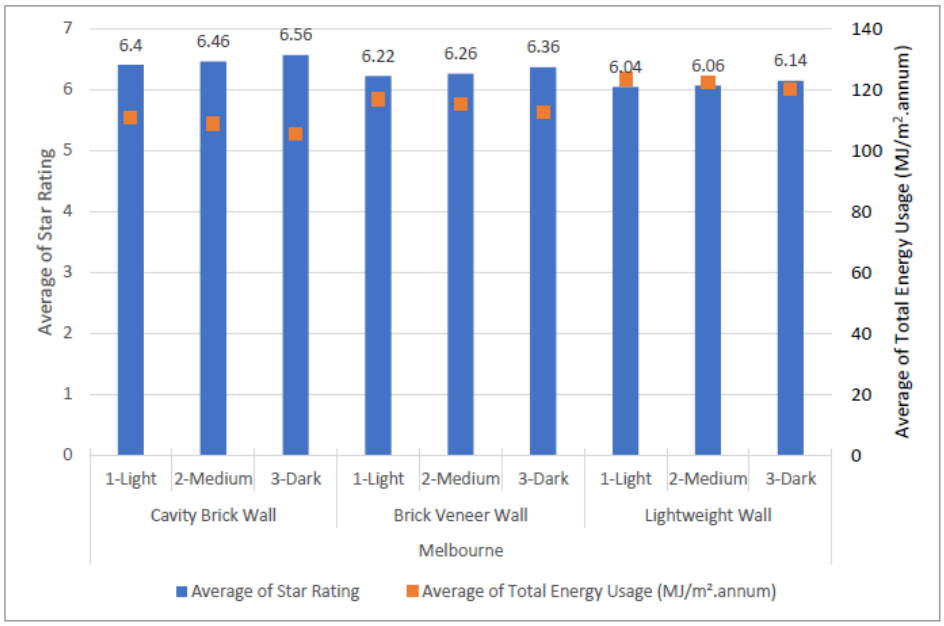
Adelaide:



Canberra:



Melbourne:



NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.3 a-r

Recommended change to draft:

1. Notes to the table. Note (4) needs to be completed. . roof ventilation must comply with ????
2. Notes to the table. Note (2)(c) needs to be completed. Complies with ????

Comment/reason for change:

Note hasn't been completed

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.3 a-r

Recommended change to draft:

Amend Notes (2)(a) & (b) to the table. By changing the words “in addition to roof vents” to -

In addition to ventilation required by Clause 10.8.2.

Comment/reason for change:

There are no additional vents required in the roof space with the exception of required in Climate Zones 6, 7 and 8 so why reference additional vents.

Just specify the wind driven or powered roof ventilator.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6D2(2)

Recommended change to draft:

Re draft H6D2(2) to address that a number of the provisions of Part 13.7 of the Housing Provisions applies to installation of building services regardless of which compliance path is used to determine the regulated building services energy usage for the building.

Comment/reason for change:

As currently drafted H6D2(2) states that Performance Requirement H6P2 for the net equivalent energy usage of the building is satisfied by – complying with either:

(a) S42C3 (house energy rating assessment path) OR
(b) With Part 13.6 and 13.7 of the ABCB Housing Provisions; OR
(c) For a heated water supply system, with Part B2 of The PCA

However, there are provisions of Part 13.7 that would apply regardless of which path is used to determine the regulated appliances energy performance for the building. This would include:

- Insulation of the services (13.7.2)
- Central heating water piping (13.7.3)
- Heating and cooling ductwork (13.7.4)
- Where an electric resistance space heating is installed (control and isolating switches 13.7.5 (a) and (b))
- Switching and installation provisions for artificial lighting (13.7.6)
- Cover and time switch requirements for swimming and spa pool plant (13.7.8 & 13.7.9)

Essentially this is a similar issue to the building fabric requirements whereby regardless of which path is used to determine the building fabric provisions i.e. VURB, star rating, etc. that there are components of the elemental DTS Provisions that need to be meet in addition to the rating/modelling.

Another approach could be to better rationalise Part 13.6 and 13.7 and separate the components related to energy usage and installation requirements.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6D2(2)(c)

Recommended change to draft:

Re draft H6D2(2) to address how the clause applies to the other regulated building services where the heated water supply system complies with H6D2(2)(c) i.e. complies with Part B2 of the Plumbing Code of Australia (PCA).

Comment/reason for change:

The provisions of H6D2(2) is not clear how the whole of home/energy usage provisions apply to the other regulated services where the heated water system is done in accordance with B2 of the PCA.

For example if the heated water system is determined in accordance with the PCA as per H6D2(2) what does the heating/air-conditioning, lighting and where relevant swimming pool and spa plant need to meet?

It is assumed that those other regulated services would need to then meet either a house rating assessment or complying with the relevant Parts of 13.6/13.7 of Housing Provisions but that is not clear by current drafting.

Furthermore, it is not clear how the whole of home provisions would apply and the whole of home calculator and potential offsetting through installation of on-site solar panels.

Additional aspect includes whether it is the building certifier/surveyor who determines compliance of the heated water system or plumbing regulator dependant on whether solutions using the BCA or follows the PCA.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6D2(2)

Recommended change to draft:

Clarify how the whole of house energy usage provisions/whole of home provisions will apply to an extension or alteration or addition to home that triggers NCC compliance.

Comment/reason for change:

The new whole of home provisions are written essentially assuming the building is a new building but under many circumstances the provisions of the NCC will apply to an extension or alteration or addition to home.

How will the new whole of home provisions apply to these situations? The new whole of home provisions are not practical or feasible for extension or alteration or addition to home

The NCC should provide clarity on this matter and potentially exemptions and not just dismiss this comment as the application of the NCC to existing buildings and to renovations and additions is to the determination of each state and territory Government.

These new provisions will require guidance and clarity to practitioners and home owners on application to this type of projects.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: H6D2(1)(a) and Specification 42

Recommended change to draft:

Amend H6D2(1)(a) and Specification 42 as follows:

H6D2(1)(a):

Performance Requirement H6P1 for the thermal Performance of the building is satisfied by—

(a)Complying with—

(i) Specification 42, for using house energy rating software ~~reducing the heating or cooling loads; and~~

~~(ii) Section 13 of the ABCB Housing Provisions clauses—~~

~~(A) 13.2.2 for building fabric thermal insulation~~
~~(B) 13.2.3(6) and 13.2.5(5) for thermal breaks; and~~
~~(C) 13.2.3(4) for compensating for loss of ceiling insulation, other than where the house rating tool used can automatically compensate for loss of ceiling insulation; and~~
~~(D) 13.2.6(3) and 13.2.6(4) for floor edge insulation; and~~
(E) ~~Part 13.4 for building sealing.~~

Specification 42 Using house energy rating software:

S42C3 Additional Deemed-to-Satisfy Provisions

In addition to complying with the house energy rating a building must comply with Section 13 of ABCB Housing Provisions clauses—

(A) 13.2.2 for building fabric thermal insulation
(B) 13.2.3(6) and 13.2.5(5) for thermal breaks; and
(C) 13.2.3(4) for compensating for loss of ceiling insulation, other than where the house rating tool used can automatically compensate for loss of ceiling insulation; and
(D) 13.2.6(3) and 13.2.6(4) for floor edge insulation; and
(E) Part 13.4 for building sealing

Comment/reason for change:

1. In relation to change to H6D2(1)(a) it would align the terminology and title to Specification 42
2. It is also suggested to include the 'hang over or extra' DTS elemental provisions that need to be complied with in addition to having a star rating assessment listed within Specification 42 for completeness and will also enable clearer wording on NatHERS certificates in that they will be able to refer back to Specification 42 of NCC as to what the assessment relates to and other provisions that need to be meet.
   This has been a poorly understood component of the star rating pathway that these other provisions also apply.
   The drafting proposed similar approach used in Volume One for JV1, JV2 and JV3

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: S42C3

Recommended change to draft:

Re-draft clause to include the whole of home rating requirement within clause itself as opposed to referencing the benchmark specified in H6P2

Comment/reason for change:

The drafting of this clause could be inferred that the whole of home rating needs to be a Performance Solution given that it is referring the DTS back to the Performance Requirement.

I can't think of another DTS clause in the NCC that requires referring back to the Performance Requirement for determining compliance for a DTS solution.

How this would be documented in the Universal Certificate (UC) and verified is also problematic and will continue the disconnect that exists between the energy rating and the NCC itself and documenting compliance.

It would clearer and more complete solution to reference the specific acceptance criteria for regulated appliances under a house rating in S42C3 itself which would form the basis of the settings on this matter in the rating tools and also documented on the UC.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Definition for energy value

Recommended change to draft:

Remove notion of cost to society from a technical based NCC definition

Comment/reason for change:

The focus of the definition should be based on a more practical approach and standard NCC convention of focus on technical focus related to the building itself.

Suggest it would be better to maintain the focus on the buildings regulated services having features that facilitate the efficient use of energy aligned with the approach in NCC 2019 as opposed to incorporating the notion of net cost to society that moves the NCC away from a technical basis.

The definition of energy value reads more like what an NCC Objective of Functional Statement would constitute as it's talking to intent of the policy/technical provisions.

The notion of net cost to society also further complicates an already highly complex part of the NCC and the Performance Requirement.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.6 (4)(b) Floors and subfloor walls

Recommended change to draft:

Provide alternate to waffle pod option for traditional raft slab with appropriate underfloor insulation in climate zones 6, 7 and 8

Comment/reason for change:

Waffle pod slabs have limitations on the effectiveness in all site classifications and many practitioners have a preference for using traditional raft slabs. As an alternate to waffle pod slabs a solution should be provided for raft slab with required under slab or slab edge insulation.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.6 (4)(b) Floors and subfloor walls

Recommended change to draft:

(4) (b) when in climate zones 6, 7 or 8, must be a waffle pod slab *(excluding Class A and Class S sites);* and

Comment/reason for change:

1. Sandy soils do not wick heat to the same extent as clay soils, even when fully saturated.
2. Please find attached the following papers that confirm the finding at (1) –

Thermal Properties of Soils as affected by Density of Water Content

Soil Thermal Conductivity – Effects of Saturation and Dry Density

Thermal Properties of Soils – United States Army Corps of Engineers

3. The Summary of changes against 13.2.6 (p14) notes that;
   "…*The most commonly used floor construction in Australia, as shown in CSIRO data, is waffle pod slab floors. It is the dominant floor construction in the cooler climates of Victoria*

and the ACT. In cooler climates, the use of a waffle pod slab instead of a concrete slab-on-ground will improve the NatHERS rating by around 0.4 stars. Hence, it is proposed to acknowledge the benefits of waffle pod slabs by requiring waffle pods in climate zone 6 to 8 under the DTS elemental provisions…"

This data has been drawn from the CSIRO NatHERS data portal, however, the portal has a limited sample size to draw from for Queensland and WA and WA in particular. WA uses very limited portion of waffle pod slabs due to relatively sandy soils and different construction methodologies used. As such it doesn't present a representative sample for that region.

4. Waffle pods may be isolative on Class M and H sites, but achieve very little benefit on Class A and S sites, and very disproportionate in both cost and benefit when considered against the additional 20m³ (twenty cubic metres) of concrete required to construct over a typical CSOG.

Based on the finding of the attached papers, and the additional energy generated by the additional concrete requirements for a waffle pod slab, their limited use and benefits for this type of slab type in Class A and S sites, these site classifications should be exempt in the affected climate zones.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.3h and other roofing tables

Recommended change to draft:

Clarify impact on associated structural members, fixings, battens and plasterboard due to the additional weight of the ceiling insulation increases for 7 star

Comment/reason for change:

Table 13.2.3h for example generally requires R4.5 insulation at ceiling level, but this doesn't account for loss of ceiling insulation calculations that would apply in addition to this also meaning even higher than R4.5 insulation would be required.

If the frame is steel/metal frame it would also require the thermal bridging mitigation measure meaning more weight in the ceiling frame and plaster board ceiling.

Under other scenarios R3.0 insulation in ceiling if metal frame would require the thermal bridging mitigation measure to increase ceiling insulation to R6.0.

These additional weights will impact associated structural members, fixings, battens and plasterboard due to the additional weight of the ceiling insulation increases

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NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.3v

Recommended change to draft:

Include other thermal bridging solutions that are more practically achievable

Comment/reason for change:

The options available for thermal bridging mitigation are very limiting for 7 stars where insulation at ceiling level is reqired to be R4.0 or greater.

The most practical option of increased insulation between framing members is not an option, and option of insulation strip above the ceiling framing is impractical and creates safety issues for subsequent trades who need to move around in the ceiling space and need to support themselves on the structural members.

The continuous layer is also not practical or buildable.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.6

Recommended change to draft:

Provide guidance on how to measure the sub-floor wall height. For example, by referring to the subfloor ventilation floor height measurement.

Also provide guidance on how to determine sub-floor wall height for sloping sites – is it the minimum, the maximum, or applying the average height along a given length of the wall?

Comment/reason for change:

Provision is unclear on how the sub-floor height is measured and could lead to inconsistency in application. Some may measure to the underside of the lowest horizontal member of the subfloor space, some may measure the underside of the floor, and others may measure to the underside of the sub-floor insulation.

Clarity would be beneficial and the tables differ based on height.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.6b

Recommended change to draft:

1. Provide information on performance of insulation products in close proximity to the ground
2. Provide information on bushfire performance requirements for insulation products in close proximity to the ground

Comment/reason for change:

Subfloor wall insulation is not a common inclusion in houses and the proposed changes will now require sub-floor insulation for a number of climate zones and depending on sub-floor wall height.

As noted this is not currently done, and the sub-floor walls are not like an external walls and if the sub-floor has shielding to make it enclosed it will only be enclosed on the outside face be open frame on inside face or a block or brickwork wall. The NCC hasn't provide the solutions for how to construct the insulated sub-floor wall or what products to be used particularly if they are left exposed on internal face.

Further, if the building is in a bushfire prone area there are requirements for sub-floor spaces and members within certain distances from the ground to say be non-combustible. As such the energy efficiency provisions should clarify or include a note of what is required for the insulation if the building is in a bushfire prone area.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.3v and Table 13.2.3w, and 13.2.5s through 13.2.5w

Recommended change to draft:

1. Remove option for continuous layers of insulation.
2. Consider alternative locations for the additional insulation layers

Comment/reason for change:

Concerns are raised with how the provisions would work from an installation perspective. Especially where material is placed within framing connections not allowed under the framing and other construction standards (e.g. AS 2699 has not considered impact of thermal breaks on load/deflection of masonry ties, AS 3999 does not allow installation of material between structural members). This is true for both the continuous layers and the strips.

Also, most if not all products on-market that would achieve required R-value and incompressible (to reduce installation issues and retain thermal performance) are impermeable, having a continuous layer of impermeable insulation would conflict with condensation management.

- Required bulk insulations assumed in tables are too thick to work with standard framing sizes, for both timber and steel
- Complex thermal break options, need to be standardised and simplified
- application of board or strip across Climate Zones & building type is inconsistent
- Complying strip of correct R-Value thermal break is not readily available in Australia, max thickness likely ~30mm. R0.6 thermal breaks limited commercial product available in Australia or NZ
- Timber batten 35mm ~R0.25 for light weight cladding is a common practice, but not included here

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NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.3(3)

Recommended change to draft:

Include a diagram of the intended arrangement for insulation, reflective insulation, and 20mm air gap for pitched roofs

Include an explanation of where the 20mm air-gap should be in relation to vapour permeable roof sarking (e.g. for low-pitched metal roofs)

Comment/reason for change:

This is causing some confusion regarding relationship between air-gap in roof, and space between roof and ceiling.

Questioned as to if it will clash with 13.2.2(3): The 20mm ventilation required under condensation will affect the thickness of the insulation asked for in 13.2.2 (3).

A pitched roof naturally gets closer to the ceiling height at the external wall. The thickness of the insulation will be minimized to allow 20mm ventilation gap which affects following the provision of 13.2.2 (3) (a) (insulation installed so it maintains its position and thickness.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table Table 13.2.5v

Recommended change to draft:

Either add:

a *sarking-type material* on the external side of the frame with an outward facing emissivity of no more than 0.1, or

a continuous insulation product with an R-value of at least R0.38, or add R0.6 to the frame only.

Comment/reason for change:

The use of the term "**reflective pliable moisture permeable membrane**" is neither defined within the NCC, referenced standards or used within industry; and if adopted it would further add to the growing list of terms used to describe flexible building membranes. This approach references existing, defined terms and provides clear guidance on the material performance requirements.

The specification already nominates the emissivity performance characteristics of the material and could also nominate the permeability if required.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.5a to 13.2.5o

Recommended change to draft:

Add reflective foil (with suitable permeability limits) provisions for timber framed brick veneer construction to allow more achievable solutions for higher wall heights and 2 storey applications. E.g R3.0 in these tables becomes R2.5 + reflective.

Comment/reason for change:

This option is currently *unavailable* in the (baseline) timber brick veneer tables where foil would be equally effective in providing a cost effective added R-value adjacent to the air-gap created by the drainage cavity.

This solution is both cost effective and frequently used in the market so requires no re-training to implement. It is recommended that reflective foil options be added to the brick veneer tables to provide an easily installed option to increase the R-value of the overall wall system.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.5a to 13.2.5o

Recommended change to draft:

Add continuous insulation (with suitable permeability limits) provisions for timber framed brick veneer construction to allow more achievable solutions for higher wall heights and 2 storey applications.

Comment/reason for change:

This option is currently unavailable in the (baseline) timber brick veneer tables where it could be an option in providing an added R-value. It is recommended that a continuous insulation option be added to the timber tables.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.3, J3D7 (3)

Recommended change to draft:

Clause 13.2.3 (3) (c) (ii) below is a general roofing clause and is currently applicable to all climate zones. Propose that this clause is limited to CZ 6, 7, 8 to align with the corresponding condensation provisions in 10.8.3.

Recommended change: 13.2.3 (3) (c) (ii) in accordance with 10.8.3 for climate zones 6, 7 and 8

(3) *Reflective insulation* installed to comply with (1) must—

(a) be downward facing; and

(b) have an emissivity of not more than 0.05; and

(c) be adjacent to a roof space—

(i) of not less than 20 mm; and

(ii) in accordance with 10.8.3.

The same should apply to J3D7(3) where F8D5 is referenced.

Comment/reason for change:

As drafted clause 13.2.3(3)(c)(ii) is a general roofing clause applicable across all climate zones, but this clause makes specific reference to Clause 10.8.3 which is only applicable to climate zones 6, 7 and 8.

Additionally, by making reference to 10.8.3, this clause is in conflict with the "Vented/Standard" options presented in each of the climate zone Tables 13.2.3a to 13.2.3r as these options appear for all climate zones, including 6/7/8.

These need to be better rationalised and clear on scope of application between the varying NCC Parts.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.3 (5) (a), J3D7(5)(a)

Recommended change to draft:

Delete clause 13.2.3 (5) (a), 13.2.5(4)(a), J3D7(5)(a)

(5) The thermal bridging in a steel-framed roof must be addressed by—

(a) achieving the *Total R-Value* in Tables 13.2.3t and 13.2.3u, calculated in accordance with AS/NZS 4859.2; or

(b) complying with one of the options in Tables 13.2.3v or 13.2.3w.

Comment/reason for change:

Total R-value is a calculation designed to show the performance of a material assembly – by definition from the notes below the table shown below, it is inclusive of the frame, insulation and lining – as it compares the entire assembly the target Total R-values for timber and steel frame should be the same if the overall assembly is going to provide the same performance – only the insulation material (bag) R-value will vary to offset thermal bridging.

This difference is clear in the DTS elemental solution tables but very unclear and potentially misleading in the Total R-value tables as the values require reverse analysis to generate a useable Material R-value – in Table 13.2.3t below, there is a very real risk that practitioners either do not notice the shift from Material to Total R-value or do not have the skill or list of assembly variables to make the reverse calculation. Given there are already Material R-value solutions provided within the NCC it is recommended that these Total R-value tables be deleted.

Table 13.2.3t: Pitched steel-framed roof with flat ceiling – Minimum Total R-Value to account for thermal bridging

Minimum *R-Value* from Tables 13.2.3a to 13.2.3i, and Table 13.2.3s if applicable	Minimum ceiling *Total R-Value*
1.0	1.05
1.5	1.49
2.0	1.87
2.5	2.25
3.0	2.59
3.5	2.90
4.0	3.19
4.5	3.46
5.0	3.72
5.5	3.95
6.0	4.17

Table Notes

The *Total R-Value* calculation must only include the ceiling frame, insulation and lining. It is not to include the internal air film, roof space or roof lining.

Total R-value calculation is to be done in accordance with AS/NZS 4859.2, which references NZS 4214 for thermal bridging. This standard however is low on details for calculation of thermal bridging in roofs.

In walls the framing and insulation are sandwiched between cladding layers, and the only air layers are inside and outside the wall.

In a ceiling there are likely to be differences in the height of the frame and the insulation beside it, yet the notes to the tables don't allow for air films or the roof space to be included in the calculation.

So the path to calculating a Total R-value for the system is not clear, and will be subject to variance in how it is conducted in industry.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Thermal bridging mitigation Tables J3D7v,w, Tables 13.2.3v,w, Tables 13.2.5t,u,v,w and Table 13.2.6j,

Recommended change to draft:

Add additional detail and installation guidance to ensure consistent application of the thermal bridging mitigation requirements.

Comment/reason for change:

The buildability of thermal break strips and continuous insulation is currently heavily dependent upon installation techniques and may result in a wide range of performance outcomes.

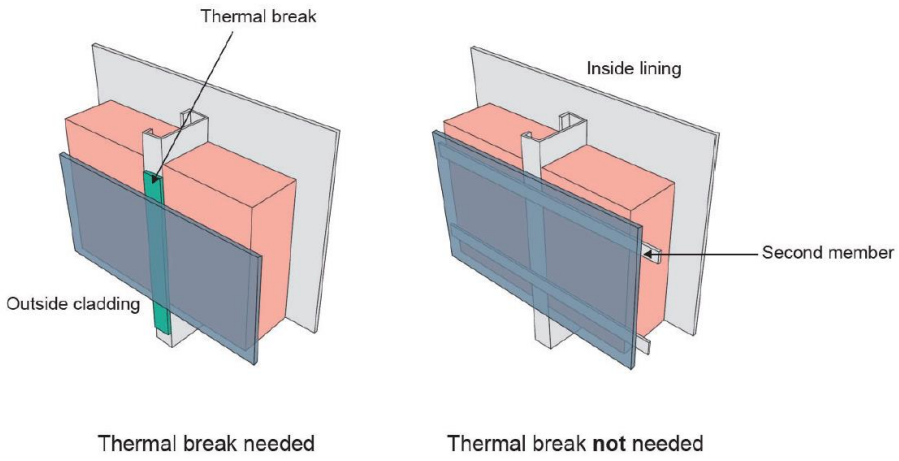
To ensure a consistent market outcome, the use of thermal break strips and continuous insulation needs to be defined to cover the following variables:

1. Compression – is the R-value stated in the Tables compressed in-situ or the uncompressed R-value – without definition there is a risk that materials will not offer the correct resistance to thermal bridging or construction will not provide sufficient space for the insulation.
2. Installation guidance – given the presence of structural members, services, downlights, flues, HVAC units and other obstacles within the roof space there needs to be further guidance on how to adequately install a 'continuous layer' of insulation whilst avoiding these elements…but still being 'continuous'.
3. Safety – in ceilings, the use of continuous insulation will conceal the position of the joists meaning that future access to the roof space will be dangerous - homeowners

and trades alike will need to undertake a survey of the roof space to establish the position of a safe walkway for services.

4. Batten construction – if a counter batten is used in a lightweight wall to create a space for insulation, will the batten require a thermal break and if so what value (if any) does this thermal break need to be?
   Refer **Handbook: Energy Efficiency NCC Volume One Figure 10.4 Wall thermal break construction** – can this detail be included as a note or mandatory guidance within the Housing Provisions?

Figure 10.4 Wall thermal break construction



NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.6j

Recommended change to draft:

Specify in Table 13.2.6j how to mitigate thermal bridging where floor insulation from Tables 13.2.6a and 13.2.6d to 13.2.6h as applicable is equal to R0.5.

Comment/reason for change:

Table 13.2.6d contains floor insulation R-values of 0.5. Table 13.2.6i specifies how to mitigate thermal bridging for floors requiring R0.5, but the alternate mitigation Table 13.2.6j does not have a solution for this situation. As it is specified in Table 13.2.6i, it seems that the omission in Table 13.2.6j is an oversight.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.6a – 13.2.6j

Recommended change to draft:

Remove reflective insulation option due to safety concerns

Comment/reason for change:

Use of foil under floors has been banned in New Zealand since 2016 due to the risk of electrocution after underfloor installations were linked to installer deaths.

The primary reasoning is concern relating to the attachment of the foil to the building (typically with electrically conductive fasteners) and proximity to electrical wiring which it typically run along or below sub-floor joists/bearers.

Furthermore, having reflective insulation installed above the joists would create a significant safety issue in laying the subsequent floor and need for trades to be walking on the joists as part of installation.

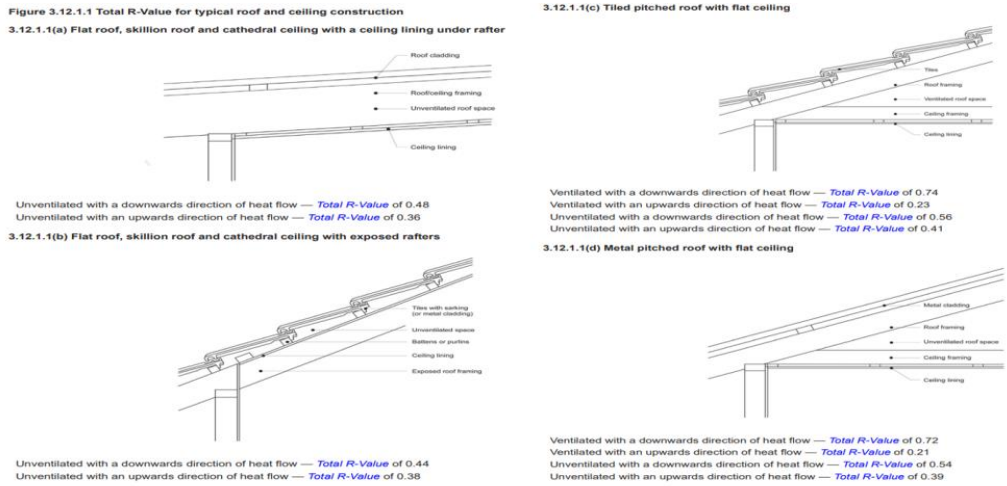
The only real viable option for sub floor insulation is installing insulation between the joists.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Figure 3.12.1.1 (a)(b)(c)(d)

Recommended change to draft:

Recommend to retain the Figures 3.12.1.1 in the Housing Provisions:



Comment/reason for change:

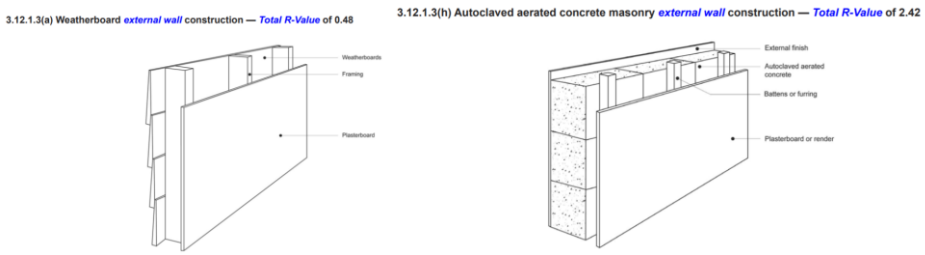
These images provide good guidance and show the typical roofing construction for residential buildings. It is recommended to retain these images to support practitioners in identifying differences between typical roofing systems.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

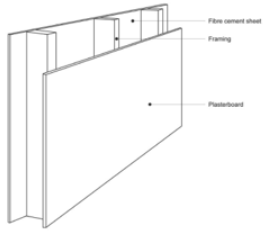
Clause/Figure/Table: Figure 3.12.1.3 (a) - Figure 3.12.1.3 (h)

Recommended change to draft:

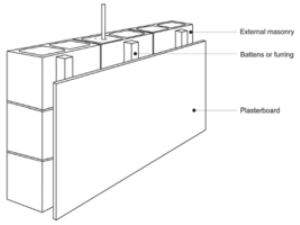
Recommend to retain the Figures 3.12.1.1 from Volume 2 or move them to Housing Provisions:



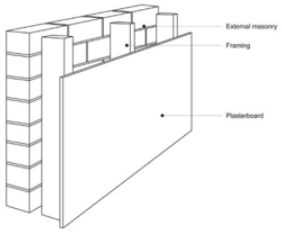
3.12.1.3(b) Fibre-cement sheet *external wall* construction — *Total R-Value* of 0.42



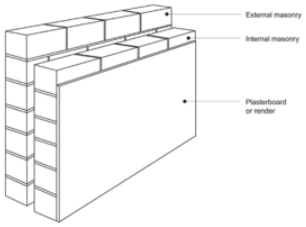
3.12.1.3(d) — Concrete blockwork masonry *external wall* construction — *Total R-Value* of 0.54



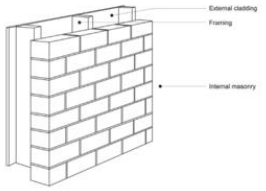
3.12.1.3(c) Clay masonry veneer *external wall* construction — *Total R-Value* of 0.56



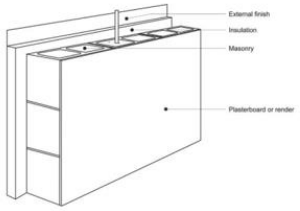
3.12.1.3(e) Cavity clay masonry *external wall* construction — *Total R-Value* of 0.69



3.12.1.3(f) Externally insulated clay masonry (reverse clay masonry veneer) *external wall* construction *R-Value* of 0.53



3.12.1.3(g) Externally insulated concrete masonry *external wall* construction — *Total R-Value* of 0.46



Comment/reason for change:

These images provide good guidance and show the typical walling construction for residential buildings. It is recommended to retain these images to support practitioners in identifying differences between typical roofing systems and the respective thermal performance.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: J3D6

Recommended change to draft:
Change clause as highlighted below**.**

J3D6 Wall thermal breaks of a sole-occupancy unit of a Class 2 building and a Class 4 part

A wall must have a thermal break, consisting of a material with an *R-Value* of not less than R0.2, installed at all points of contact between the external cladding and the metal frame if the wall—
(a) does not have a wall lining or has a wall lining that is fixed directly to the same metal frame; and
(b) has lightweight external cladding with low thermal mass such as weatherboards, fibre-cement or metal sheeting fixed to a metal frame.

Comment/reason for change:

To better clarify the thermal characteristics of what lightweight cladding is beyond just the examples listed (as the examples may not cover all products). This would be in line with the Explanatory note in 13.2.5. (3) of the Housing Provisions.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table J3D7p

Recommended change to draft:

Renumber tables from Table J3D7p onwards.

Provide for additional Tables between existing J3D7o and J3D7p to accommodate;

A table for ***Timber-frame flat, skillion or cathedral roof – minimum R Value for ceiling insulation: climate zone 6,*** and

A table for ***Flat concrete roof – minimum R Value for ceiling insulation: climate zone 6.***

Comment/reason for change:

Elemental provisions missing for Climate Zone 6.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table J3D14b

Recommended change to draft:

Climate Zone 5 - WA - *2.56*

Comment/reason for change:

Extent of WA Climate Zone 5 resembles the extent and conditions of SA, so the Energy Factors (E_F) should match.

NCC Volume(s): ☒ One ☐ Two ☐ Three ☐ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table J3D14b

Recommended change to draft:

Climate Zone 6 - WA - *3.58*

Comment/reason for change:

Extent of WA Climate Zone 6 resembles the extent and conditions of SA, so the Energy Factors (E_F) should match.

Clause/Figure/Table: Table 13.2.3v

Recommended change to draft:

- Delete table and replace with:
- “No thermal bridging mitigation measures required for steel framing”.

Comment/reason for change:

Analysis undertaken by NASH and others has shown that no mitigation measures are required due to different frame ratios for steel and timber, encapsulation of the bottom chord of the truss by insulation, timber conductivity and the use of ceiling battens.

Clause/Figure/Table: Table 13.2.5c, Table 13.2.5v, Table 13.2.5k

Recommended change to draft:

- Simplify table.
- Develop solutions for 90 mm studs.

Comment/reason for change:

The maximum insulation batt for a 90 mm stud is R2.7. The R-values in the table after stud height and double storey are taken into account, the R-values required rise to R3.5. This is further exacerbated with light weight wall construction where an additional R0.3 is required. This requirement will reduce competition within the house building industry and lead to subsequent cost increases.

Clause/Figure/Table: *Table 13.2.5u*

Recommended change to draft:

- Add new option:

Vapour permeable (Class 3) reflective membrane with minimum 20 mm air space.

- Change “line the outer surface of the frame with additional insulation with an R-value of at least R0.26” to “provide a thermal break to the studs with an R-value of at least R0.25”.
- Change “line the outer surface of the frame with additional insulation with an R-value of at least R0.45” to “provide a thermal break to the studs with an R-value of at least R0.25”.
- Change “add an additional continuous insulation product with an R-value of at least R0.3” to “provide a thermal break to the studs with an R-value of at least R0.25”.

Comment/reason for change:

Reflective membrane with an air space will provide a satisfactory solution in most cases.

The wording for thermal breaks and continuous insulation layers is currently confusing and the products specified are not commercially available.

The continuous insulation sheath will not meet the vapour permeability requirements set out in the condensation provisions.

The thickness of the thermal breaks or insulation layer will increase the wall thickness and therefore reduce liveable area in the house.

Clause/Figure/Table: Table 13.2.5w

Recommended change to draft:

- Add new option:

Vapour permeable (Class 3) reflective membrane with minimum 20 mm air space.

- Clarify and rationalise what is meant by the current descriptions of continuous insulation product and add R0.6 to frame only.

Comment/reason for change:

Reflective membrane with an air space will provide a satisfactory solution.

The wording for thermal breaks and continuous insulation layers is currently confusing and the products specified are not commercially available.

The continuous insulation sheath will not meet the vapour permeability requirements set out in the condensation provisions.

The thickness of the thermal breaks or insulation layer will increase the cavity depth and hence the total wall thickness and therefore reduce liveable area in the house. The increased cavity depth may require more expensive brick ties to adequately support the brick work.

NCC Volume(s): ☐ One ☐ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Tables 13.2.3 a to r Table Note 2(c)

Recommended change to draft:

(2) A roof is considered 'Vented' if it—

(a) has one wind-driven roof ventilator per 50 m^2 of respective ceiling area, in addition to roof vents; or

(b) has one powered roof ventilator per 200 m^2 of respective ceiling area, in addition to roof vents; or

(c) complies with .

Complete note (c).

Comment/reason for change:

(c) notes 'complies with' but does not advise what is needs to comply with.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: 13.2.7(c)

Recommended change to draft:

Do not remove the option for climate zone 5.

Comment/reason for change:

Do not support the removal of 13.2.7(c) as it provides a suitable option for masonry separating construction and high thermal mass solution for climate zone 5 for the construction of the wall separating the house and the attached Class 10a building.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Table 13.2.5c

Recommended change to draft:

Resolve the anomaly in the table for eaves between 450 and 600 mm and wall height between 2.4 and 2.7.

Comment/reason for change:

It is considered that this is an ammonal in the Table in requiring R2.5 for eaves between 450 and 600 mm and wall height between 2.4 and 2.7. Looking at the table it looks like it would make more sense for requiring R2.0. based on the corresponding requirement for lightweight and darker wall colours.

NCC Volume(s): ☐ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Explanatory note in 13.2.5. (3) of the Housing Provisions

Recommended change to draft:

Include definition of what is considered lightweight cladding to exclude higher thermal mass claddings that may otherwise be considered lightweight such as AAC cladding.

Comment/reason for change:

Presently the various external wall tables require higher insulation R values for lightweight claddings but doesn't define what constitutes a lightweight cladding beyond some examples in explanatory information. These leaves the matter for interpretation and that is not an ideal outcome.

Inclusion of a definition or further expansion of the explanatory information that excludes higher thermal mass cladding such as AAC cladding would better clarify the thermal characteristics of what lightweight cladding is beyond just the examples listed.

NCC Volume(s): ☒ One ☒ Two ☐ Three ☒ Housing Prov. ☐ Livable Housing

Clause/Figure/Table: Solar absorptance values

Recommended change to draft:

Include a table of expanded explanatory information on the various solar absorptance tables to assist with application of the wall and roof elemental tables.

Comment/reason for change:

The various external wall and roof elemental tables contain different values for insulation required for the wall and roof/ceiling based on solar absorptance colours/values.

However, there is no clause or table to define the various solar absortance values or does it cover the likes of raw timber cladding for example.

Given the application of these tables is dependent on the solar absorptance values it is considered that additional detail is needed for the NCC to assist with application.

This may be through explanatory information and examples solar absorptance values and referring to manufactures product technical statements or similar.