| Case | Model ID | Description | Wall Build-up[1,3] | | Interior Conditions[1] | Exterior Conditions[1] | Notes[1] |
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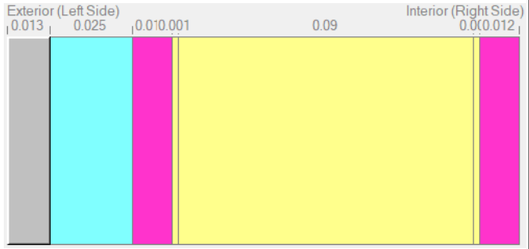
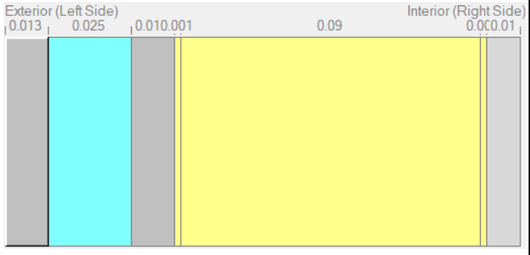
| *Analysis Task 1 – Baseline vs. saveBOARD* | | | | | | | |
| 1a | KEL-SB-001 | saveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | BRANZ Study:<br>16.4°C ± 4°C<br>64% RH ± 10% RH | Auckland NIWA Weather file | • The RH between the exterior saveBOARD and batt insulation is max 83% RH; The RH between the interior saveBOARD and batt insulation is max 85% RH[4].<br>• The saveboard acts as a vapour barrier on both sides of the timber framing, both limiting the vapour drive through the assembly and the ability for trapped moisture within the insulation cavity to dry out of the assembly.<br>• The Mould Index[5] is 0.091 at the worst-case location and therefore presents a low risk of mould growth within the assembly under these conditions. |
| 1b | KEL-SB-002 | Baseline Build-up (Fibre cement rainscreen) | Plasterboard interior lining – 10mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Gib Weatherline sheathing – 13mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | BRANZ Study:<br>16.4°C ± 4°C<br>64% RH ± 10% RH | Auckland NIWA Weather file | • The RH between the interior plasterboard and batt insulation is maximum 90% RH.[4]<br>• The plasterboard and Gib Weatherline have a higher permeability and allow the interior humidity to transfer through the assembly.<br>• The Mould Index[5] is 0.105 at the worst-case location; this presents a low risk of mould growth within the assembly. |

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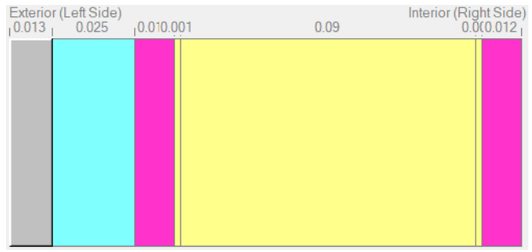
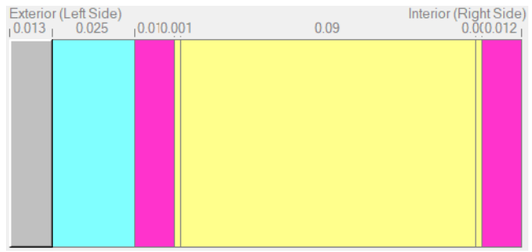
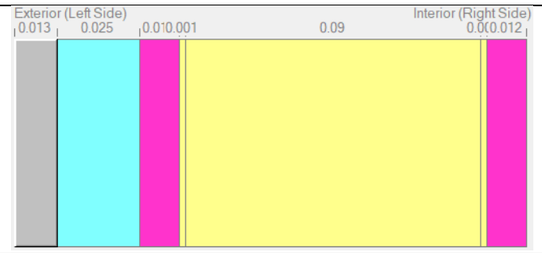
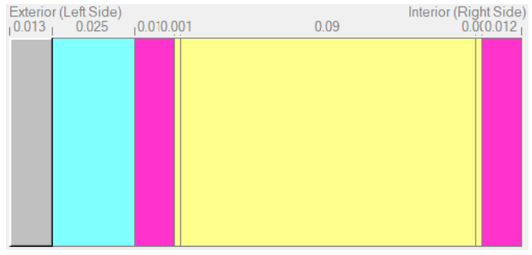
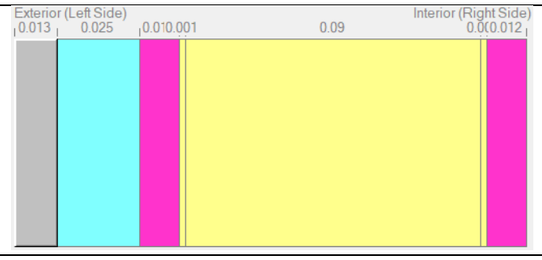
| *Analysis Task 2 – No Interior Climate Controls (Varied Exterior Climate Location)* | | | | | | | |
| 2a | KEL-SB-001 | saveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | BRANZ Study:<br>16.4°C ± 4°C<br>64% RH ± 10% RH | Auckland<br>NIWA<br>Weather file | • The RH between the exterior saveBOARD and batt insulation is max 83% RH; The RH between the interior saveBOARD and batt insulation is max 85% RH[4].<br>• The Mould Index[5] is 0.091 at the worst-case location and therefore presents a low risk of mould growth within the assembly under these conditions. |
| 2b | KEL-SB-003 | saveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | BRANZ Study:<br>16.4°C ± 4°C<br>64% RH ± 10% RH | Hamilton<br>NIWA<br>Weather file | • The RH between the exterior saveBOARD and batt insulation is max 89%; The RH between the interior saveBOARD and batt insulation is max 83% RH[4].<br>• The Mould Index[5] is 0.096 at the worst-case location and therefore presents a low risk of mould growth within the assembly under these conditions. |
| 2c | KEL-SB-004 | saveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | BRANZ Study:<br>16.4°C ± 4°C<br>64% RH ± 10% RH | Tauranga<br>NIWA<br>Weather file | • The RH between the exterior saveBOARD and batt insulation is max 87%; The RH between the interior saveBOARD and batt insulation is max 84% RH[4].<br>• The Mould Index[5] is 0.07 at the worst-case location and therefore presents a low risk of mould growth within the assembly under these conditions. |
| *Analysis Task 3 – Targeted Interior Climate Controls (Varied Exterior Climate Location)* | | | | | | | |
| 3a | KEL-SB-005 | SaveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | <u>Set Points</u><br>Heating: 20°C<br>Cooling: 24°C<br><br><u>RH Control</u><br>Max. 60% RH | Auckland<br>NIWA<br>Weather file | • The RH between the exterior saveBOARD and batt insulation is max 85%; The RH between the interior saveBOARD and batt insulation is max 73% RH[4].<br>• The Mould Index[5] is 0.049 at the worst-case location and therefore presents a low risk of mould growth within the assembly under these conditions. |
| 3b | KEL-SB-006 | saveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | <u>Set Points</u><br>Heating: 20°C<br>Cooling: 24°C<br><br><u>RH Control</u><br>Max. 60% RH | Hamilton<br>NIWA<br>Weather file | • The RH between the exterior saveBOARD and batt insulation is max 88%; the RH between the interior saveBOARD and batt insulation is max 74% RH[4].<br>• The Mould Index[5] is 0.135 at the worst-case location and therefore presents a low risk of mould growth within the assembly under these conditions. |

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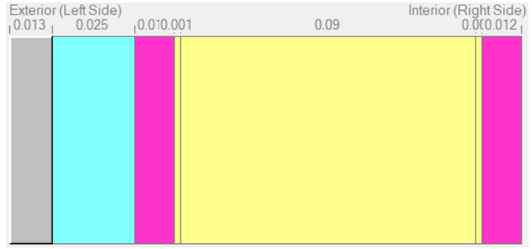
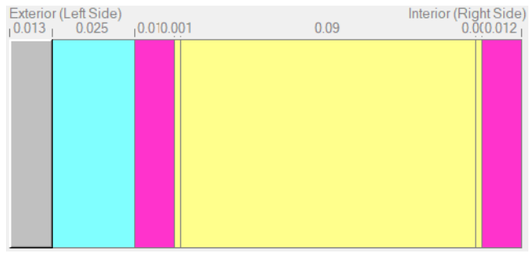
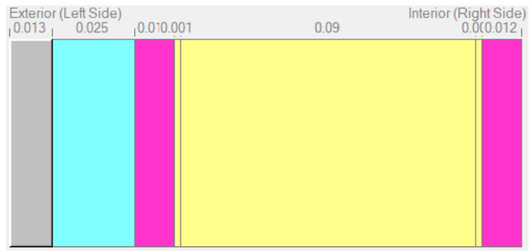
| 3c | KEL-SB-007 | SaveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | <u>Set Points</u><br>Heating: 20°C<br>Cooling: 24°C<br><br><u>RH Control</u><br>Max. 60% RH | Tauranga<br>NIWA<br>Weather file | • The RH between the exterior saveBOARD and batt insulation is max 93%; the RH between the interior saveBOARD and batt insulation is max 76% RH[4].<br>• The Mould Index[5] is 0.129 at the worst-case location and therefore presents a low risk of mould growth within the assembly under these conditions. |
| *Analysis Task 4 – Worst Case Orientation (South Facing)* | | | | | | | |
| 4a | KEL-SB-008 | SaveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | BRANZ Study:<br>16.4°C ± 4°C<br>64% RH ± 10% RH | Auckland<br>NIWA<br>Weather file | • The RH between the exterior saveBOARD and batt insulation is max 93%; the RH between the interior saveBOARD and batt insulation is max 88% RH[4].<br>• The Mould Index[5] is 3.52 at the worst-case location, interior of the exterior saveBOARD, and therefore **presents a high risk of mould growth** under these conditions.<br>• When re-evaluated with a 'sensitive' sensitivity class, the MI is 0.58 and presents a low risk of mould growth.[6] |
| 4b | KEL-SB-009 | SaveBOARD Standard Build-up (Fibre cement rainscreen) | Saveboard interior lining – 12mm<br>Timber stud / R2.4 batt insulation – 90mm<br>Saveboard exterior sheathing – 10mm<br>Rainscreen cavity – 25mm<br>Fibre cement cladding – 13mm |  | <u>Set Points</u><br>Heating: 20°C<br>Cooling: 24°C<br><br><u>RH Control</u><br>Max. 60% RH | Auckland<br>NIWA<br>Weather file | • The RH between the exterior saveBOARD and batt insulation is max 95%; the RH between the interior saveBOARD and batt insulation is max 74% RH[4].<br>• The Mould Index[5] is 3.4 at the worst-case location and therefore presents **a high risk of mould growth** within the assembly.<br>• When re-evaluated with a 'sensitive' sensitivity class, the MI is 0.573 and presents a low risk of mould growth.[6] |

<u>Summary</u>

1. The WUFI wall models have the following assumptions:
    - For Analysis Tasks 1-3, the building is oriented towards the north; this is not considered the worst-case orientation (i.e. South), which is considered in Analysis Task 4.
    - The interior surface is painted with a Latex Paint (sd Value of 0.2m).
    - All materials within the WUFI assembly start with an initial built-in moisture content corresponding to a relative humidity of 80% RH and temperature of 20°C. This allows drying trends within all components to be analysed.
    - The rainscreen cavity is ventilated at a rate of 50 air changes per hour with exterior air (NIWA weather file) per guidance from WUFI.
    - The calculation period for all models is 5 years to analyse trends within the materials.

- The uncontrolled interior climate is modelled using a sine wave, with maximum relative humidity in July, and maximum temperature in January. The interior climate is based on a 2016 BRANZ Study 'Indoor Climate in New Zealand Homes', that found an average indoor temperature of 16.4°C and a median RH of 64% in New Zealand bedrooms over a year. This forms a minimum baseline for average homes across New Zealand.
- The controlled interior climate is modelled using the ASHRAE Standard function as AC with Dehumidification. The RH control set point is 60% RH and the temperature is controlled between 20°C and 24°C. The building volume is assumed to be 200m$^3$ with 3 bedrooms.

2. The WUFI models have the following limitations:
   - One dimensional WUFI modelling does not account for the effects of uncontrolled air or water leakage, or the effects of thermal bridging that may occur through structural components (e.g. timber battens) within the wall assembly.
   - The WUFI models consist of a cross section through the insulation and air layers and not through the timber framing and cavity battens.
3. All build-ups modelled are based on discussions with saveBOARD and do not necessarily represent a worst-case or project specific condition. The models and their materials have the following assumptions and/or properties:
   - Interior insulation is a batt insulation of R2.4 as outlined by saveBOARD.
   - All models incorporate a fibre cement rainscreen cladding. The fibre cement is a 13mm board taken from the WUFI database.
   - The saveBOARD materials properties are taken from the information supplied by saveBOARD. Where this information is not available, we adopt and apply/modify WUFI's built-in product databases with a comparable material. The saveBOARD material is modelled with the following material properties:
     - Density: 750kg/m$^3$
     - Specific Heat Capacity: Enthalpy of 13 MJ/kg at 20°C input as hygrothermal function within WUFI material data
     - Thermal Conductivity: 0.08 W/mK
     - Water Vapour Diffusion Resistance Factor: 208 (measured as 12.5 MN.s/g and 1.4 Perms in ASTM E96 test; converted using the WUFI conversion spreadsheet)
     - Porosity: Assumed 50% based on similar materials in the WUFI database.
4. We evaluated both the interior side of the sheathing and exterior side of the interior lining for worst case relative humidity. We note the highest relative humidity values.
5. The Mould Index is determined using WUFI's post-processing tool, WUFI VTT, and is based on the ASHRAE Standard 160. ASHRAE 160 defines criteria for determining the level of biological growth on material surfaces with a Mould Index (MI) number on a scale from zero (no mould growth), to six (heavy and tight mould growth around 100% surface coverage). The MI is calculated from the simulation results at any material surface using time, surface temperature, surface relative humidity (RH), and material sensitivity. ASHRAE states that the MI should not exceed 3.0, the threshold for visible biological growth. The MI for the saveBOARD models is conservatively determined assuming the saveBOARD is a "worst-case" building material[7]. We assessed the worst-case locations for mould, i.e. where humidity exceeded 80% RH; when the Mould Index is less than 1 this presents a low risk for mould growth; when the Mould Index is above 1 but below 3, this presents an elevated risk however, is still considered acceptable.
6. The 'worst-case building material' input in the WUFI VTT tool assumes a material with a 'very sensitive' sensitivity class, 'relatively low decline' material class, and a 'soiled' surface. In the instances where the MI exceeded 3 under these conditions, the MI was re-evaluated with a less conservative assumption based on the guidance in the WUFI VTT information and Mould Resistance Testing of the saveBOARD prepared by Intertek in 2013.
7. Timber limitations imposed by saveBOARD have not been included within a WUFI model.
8. Our assessment is based on the information presented by saveBOARD and available testing documentation at the time of this analysis. This assessment should not be taken as review of the product's suitability on a specific project. For project specific applications, we recommend that a facade engineer, or other designated member of the design team, evaluate the ability of these products to meet the project-specific performance requirements and compliance with the NZBC.