

Development of AccuRate Xpress – Stage 1

Dong Chen and Wan Yee Chan CAF R-00555-49-018 June 2010

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Contents

| EXEC | CUTIV | E SUMMARY | 3 |
|------|-------|--|-----|
| 1. | BAC | KGROUND | 4 |
| 2. | ACCI | JRATE XPRESS IMPLEMENTATION | 6 |
| | 2.1 | Client and Assessor Detail Save and Load | . 6 |
| | 2.2 | Site Detail Save and Load | . 7 |
| | 2.3 | Automatic Creation of Bedroom Zones | . 7 |
| | 2.4 | Explicit Creation of Roof Space and Subfloor Zones | . 9 |
| | 2.5 | Automatic Creation of New Zones Using Predefined Types | 12 |
| | 2.6 | Demonstration of External Wall Construction with Accompanying Images | 13 |
| | 2.7 | Window Schedule Construction with Interactive Pane Images | 14 |
| 3. | CON | CLUSIONS | 16 |
| ACKI | NOWL | EDGEMENT | 16 |
| REFE | | CES | 16 |

List of Figures

| Figure 1 | AccuRate Xpress loads client details | 6 |
|-----------|---|------|
| Figure 2 | AccuRate Xpress loads assessor details | 6 |
| Figure 3 | AccuRate Xpress loads project site details | 7 |
| Figure 4 | AccuRate Xpress automatic creation of bedrooms | 8 |
| Figure 5 | AccuRate Xpress bedroom detail input | 8 |
| Figure 6 | AccuRate Xpress roof space detail input | 9 |
| Figure 7 | Assigning zones below roof space | . 10 |
| Figure 8 | AccuRate Xpress subfloor detail input | . 10 |
| Figure 9 | Assigning zones above subfloor | . 11 |
| Figure 10 | AccuRate Xpress garage detail input | . 11 |
| Figure 11 | Assign and modify predefined zone details | . 12 |
| Figure 12 | Create external wall constructions in AccuRate Xpress | . 13 |
| Figure 13 | Create a window schedule in AccuRate Xpress | . 14 |
| Figure 14 | Create window element in the Element Page using a window schedule | . 15 |
| Figure 15 | Window schedule image in the window element. | . 15 |

List of Tables

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EXECUTIVE SUMMARY

Regulatory building thermal performance assessment tool requires the balances between fast parameter input for high productivity and comprehensiveness of the input information for accurate building representation; between flexibility parameter input for coping complex or innovative building designs and the rigorousness and unambiguousness of the input information for reducing input errors. Existing AccuRate provides almost unlimited construction design capacity. This powerful design facility is enjoyed by experienced assessors and designers. However, it requires more user inputs and potentially is prone to input errors for inexperienced users.

Discussions between then DEWHA (the Department and Environment, Water Heritage and the Arts), ABSA and CSIRO suggested that an Xpress mode of AccuRate should be developed. AccuRate Xpress should provide a more user friendly with reduced input (with lock-down fields) version of the AccuRate tool based on wide provisions of 'generic' construction systems. By providing commonly used constructions and lockdown fields, AccuRate Xpress will be faster to use and will be less likely to result in input ambiguity and user errors.

CSIRO was commissioned by then DEWHA (now in the Department of Climate Change and Energy Efficiency (DCCEE)) for Stage 1 AccuRate Xpress development in March 2010. Stage 1 of the AccuRate Xpress development accomplished the following deliverables:

- a. On the project page, the client details, assessor details and the site location details can be saved to file for future use;
- b. Graphical selection of house surrounding terrain;
- c. Automatic creation of bedroom zones based on number of bedrooms specified;
- d. Explicit creation of roof space & subfloor zone;
- e. Automatic creation of other new zone & zone attributes using predefined zone types;
- f. Automatic assignment of the floor and zone height using the story floor and story height;
- g. A fixed shading scheme used for an external wall element cannot be used by the windows in this wall and vice versa.
- h. An external wall library with interactive insulation insertion, reflective foil selection and accompanying images should be implemented and should demonstrate its use;
- i. Window schedule construction with interactive pane images and opening types should be implemented and demonstrate its use.

This report details Stage 1 AccuRate Xpress development.

1. BACKGROUND

Thermal performance simulation programs such as AccuRate offer a powerful tool for assessing building energy efficiency, optimising energy efficient house designs, encouraging innovations and assisting building regulators and governments in formulating standards and policies. In order to provide the flexibility to ensure that experienced assessors and designers can assess a house with innovative or complex constructions, existing AccuRate (including the latest AccuRate Version 1.1.4.1) provides almost unlimited construction design capacity. This powerful design facility is, on one hand, enjoyed by experienced assessors and designers. On the other hand, it requires more user inputs and potentially is prone to user input errors.

Discussions between then DEWHA, ABSA and CSIRO suggested that a 'regulatory mode' of AccuRate (later renamed as AccuRate Xpress) should be developed. AccuRate Xpress should be built on some of the work previously undertaken with the fast input mechanism (Khoo *et al*, 2009) to provide a more user friendly with reduced input (with lock-down fields) version of the AccuRate tool based on wide provisions of 'generic' construction systems. By providing commonly used constructions and lock-down fields, AccuRate Xpress will be faster to use and will be less likely to result in input ambiguity and user errors.

CSIRO was commissioned by then DEWHA (now in DCCEE) to develop AccuRate Xpress in early March 2010 with the following deliverables:

- 1) Identify "Fast Input" items and aspects to minimise potential user errors and to facilitate faster user input;
- 2) Construct generic libraries with information provided by the Residential Building Group in the then DEWHA (now in DCCEE);
- 3) Design user interface for AccuRate Xpress;
- 4) Implement online help for AccuRate Xpress;
- 5) Test AccuRate Xpress by experienced assessors;
- 6) Finalize AccuRate Xpress and release.

In the development of AccuRate Xpress, fast input concepts similar to those in the previous fast input mechanism project have been indentified which include:

- a. On the project page, the client details, assessor details and the site location details can be saved to file for future use;
- b. Graphical selection of house surrounding terrain;
- c. Automatic creation of bedroom zones based on number of bedrooms specified;
- d. Explicit creation of roof space & subfloor zone;
- e. Automatic creation of other new zone & zone attributes using predefined zone types;
- f. Automatic assignment of the floor and zone height using the story floor and story height;
- g. Properly check the validity of the input data in all the above items.

During the process of defining the lock-down libraries, a number of areas were identified which can be improved through further modifications of the element input page by using window schedules, shading and screen schemes, graphical visualization of windows and shadings, automatic calculation of translucent verandas solar transmissions, simplified internal wall opening inputs. It was also suggested that a number of the items in the ABSA streamline report should be considered for implementation.

Both DCCEE and CSIRO recognize that these identified areas are extremely valuable in reducing the ambiguity for user input and in speeding up the input at the same time. However, the implementation of these improvements will require a second stage of the AccuRate Xpress project.

It is suggested that the current stage (Stage 1) of the AccuRate Xpress project should completed with the implementation of the following aspects in addition to the identified aspects a) to g):

- h. A fixed shading scheme used for an external wall element cannot be used by the windows in this wall and vice versa.
- i. Implement relevant online help for aspects a) to g)
- An external wall library with interactive insulation insertion, reflective foil selection and accompanying images should be implemented and should demonstrate its use;
- k. Window schedule construction with interactive pane images and opening types should be implemented and demonstrate its use.

Stage 2 of the AccuRate Xpress project will include the following tasks:

- 1. Implement internal wall, floor/ceiling libraries with interactive insulation insertion, reflective foil selection and accompanying images and their related element input;
- 2. Implement shading, external screen schemes and wing wall with graphical guidance and their related element input;
- 3. Automatically calculate translucent verandas solar transmissions;
- 4. Implement subfloor ceiling to multiple zones above;
- 5. Implement roof space floor to multiple zones under;
- 6. Simplify internal wall opening inputs using single or double door sizes;
- 7. Implement online help for AccuRate Xpress;
- Deliver a trial AccuRate Xpress version and tested by experienced assessors (to be commissioned by DCCEE);
- 9. Finalize AccuRate Xpress and release a beta version in accordance with AccuRate release.

This report details the development and implementation of Stage 1 of the AccuRate Xpress project. Since AccuRate Xpress is special version of AccuRate and is built on the existing AccuRate software, it is assumed that the reader of this document has preliminary knowledge of the AccuRate software.

2. ACCURATE XPRESS IMPLEMENTATION

2.1 Client and Assessor Detail Save and Load

When the client and/or assessor information are repeated, retrieving previous stored information can speed up the project input. As shown in Figure 1 and Figure 2, AccuRate Xpress can clear, load and save the client and assessor details in its Project, Client & Assessor page.

| S Ac | ccuRate V2.1.3.1 Xpress *** BETA VERS | N *** : New Project - FAccuRate Express Version1 | X |
|-------------|---|--|-------------|
| 👂 Fi | le Actions Configure Window Help Tools | pen file: | ? 🔀 💷 💷 🕹 |
| | Project, Client & Assesor Site & Building Zones | Look in: 🔁 projects 💽 🗲 🖻 📑 | + |
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| B | Project name: New Project | Assessor Details | |
| 圓 | Project code: | Documents ScheduledConstructions | |
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| (D) | Client details | Desktop | |
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| | State. | | |
| | | | sus 1 |
| | | | <u>2ave</u> |
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| V. | Assessor details | | |
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| | Dissue | Exer | <u> </u> |
| Ð | Senerate project Check data | <u>ep</u> | |
| | | | Rating |

Figure 1

AccuRate Xpress loads client details

| AccuRate V2.1.3.1 Xpress **** BETA VERS | ON *** : New Project - FAccuRate Express Version1 | |
|--|--|------------|
| Difference Configure Window Help Tools | Open file: | _ 8 × |
| Project, Client & Assesor Site & Building Zones | Look in: 🔁 projects 💽 🔶 🖆 📰 - | |
| Client details Name Phone: Email Phone: Phon | Wy Recent Documents Sted Jector Structures Desktop Sted Jector Structures Desktop Sted Jector Structures Wy Documents Sted Jector Structures My Network Places File name: File of type: You Desktop File of type: Assessor details ["init) Open Cancel | |
| Assessor details | | |
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| Name: | | |
| Phone: | Fax | |
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| 0 | | × |
| Generate project Check data | Help | D = 51 = 2 |

Figure 2 AccuRate Xpress loads assessor details

2.2 Site Detail Save and Load

In the Site & Building page of AccuRate Xpress, the building site information such as building address, climate zone number, postcode, council name and site terrain type can be created, saved and loaded as shown in Figure 3. Similar to AccuRateNZ, AccuRate Xpress adopts a graphical selection for the house surrounding terrain type which can reduce the ambiguity of terrain type selection.

| 🔗 Ac | cuRate V2.1.3.1 Xpress *** BETA VERS | N *** : New Project - FAccuRate Express Version] | 🔳 🗖 🔜 |
|------|---|--|----------|
| 🔑 Fi | le Actions Configure Window Help Tools | Open file: | _ = × |
| | Project, Client & Assesor Site & Building Zones | Look in: 🗀 projects 💽 🔶 🖶 📸 🎫 | _ |
| | Site details | Svn | <u></u> |
| Ø | Address | AssessorDetails | |
| | Please tick if Site Address is the same. | Documents ScheduledConstructions | |
| | P.O. Box | Comparis SiteDetails | |
| U) | | Desktop | |
| 6 | Suburb: Highett | | |
| • | State: | | |
| | | My Documents | |
| | Council submitted to (if known by assessor) | | |
| | | My Computer | |
| | Climate Zone: | | |
| | Ground Reflectance: Others | | _ |
| | Exposure/Terrain: Suburban - Low-rise | My Network File name: Open | |
| | | Files of type: Site details (*.ini) Cancel | |
| | | | |
| | | | |
| | | | |
| | | 🧷 Clear 🛛 🔂 Load 🔒 Save | |
| V, | | | |
| | Building details | | |
| | Floor Level | | |
| Υ. | Number of Level: | Elonr Level: Ground Elon: Ceilinn Heinht 2400 mm | <u>▼</u> |
| Ð | Generate project Check data | elp Help | |
| | | | Rating |

Figure 3 AccuRate Xpress loads project site details

2.3 Automatic Creation of Bedroom Zones

As shown in Figure 4, the number of floor levels, the floor and ceiling height for each level can be globally specified in the Site & Building page. These information will be automatically transferred to all the zones created in the corresponding levels. It should be noted that the current AccuRate Xpress implementation cannot handle zones which occupies multiple levels.

By entering the number of bedrooms, bedrooms will be automatically generated and assigned to the top level of the house (as default) and the zone floor and ceiling height will be set automatically in the Zone page (see Figure 5). The floor level of the bedrooms can be adjusted in the Zone page by clicking the Data Entry button

Bedroom: Data Entry... which opens a Bedroom Data Entry sub-page (see Figure 5). After assigning a new floor level for a bedroom, its floor and ceiling height will update automatically. Alternatively, the user may want to specify the bedroom floor and ceiling height manually. In the Bedroom Data Entry sub-page, other detailed information such as infiltration related parameters can be specified similar to the existing AccuRate user input in the Zone page.

| 👂 Accul | Rate V2.1.3.1 Xpress *** BETA VERSION *** : New Project - [AccuRate Express Version] | |
|----------|--|--------|
| Se File | Actions Configure Window Help Tools Version | - 8 × |
| | Building details | ~ |
| 2 | Floor Level | |
| | Number of Levet 1 🗧 Floor Levet: Ground Floor 💌 Ceiling Height: 2400 🔿 mm | |
| | Floor Height 600 🚖 mm | |
| | Bedrooms | |
| | Number of bedroom(s): Floor Lever: Ground Floor | |
| 9 | Roof Tuner C Strillion G Profession 1 | |
| | | |
| | Floor Type: C Slab on grade C Suspended floor Floor Height 600 🛊 mm | |
| | Azimuth of highlighted facade: 0 🚭 degrees | |
| | Foolpint of Building | н |
| | | |
| | 45UU 💭 mm | |
| | | ~ |
| O | 🗞 Generate project. 🛛 🔽 Check data 🖉 🕖 <u>H</u> elp | |
| | | Rating |

Figure 4 AccuRate Xpress automatic creation of bedrooms

| <u>ک</u> ۸ | ccuRate V2.1.3.1 Xpress *** BETA VI | RSION *** : New Project - [AccuRate Express Version] | |
|------------|---|---|---------------|
| ~ | Project. Client & Assesor Site & Building Zo | ines | |
| | Roofspace Subfloor Garage Conditione | d Zones | |
| | | 🔑 frmXpressZonesConditionedDataEntryMain | |
| | Bedroom: 🚵 Data Entry | Bedroom: Bedroom 1 | |
| D | Name | Zone Type: Bedroom Floor Levet: Ground Floor V | Chimneys Unse |
| DI. | Bedroom 1 | 2400 | 0 |
| | Bedroom 2 | Floor Area 2400 | 0 |
| 9 | Bedroom 3 | Length: 8000 \$ mm Volume: 32.40 \$ m ³ 2400 | 0 |
| | | Width: 4500 🖨 mm Floor Height: 600 🖨 mm | |
| | < | Area: 13.50 🛊 m² 【 Height Above 2400 🖨 mm | > |
| | Others conditoned zone | nuo. | ^ |
| | | Heated: 🔽 Cooled: 🔽 | |
| | Floor Level: Ground Floor | C Infiltration Ceiling Fans | |
| | | No. Unsealed No. Sealed | |
| | Available Zones Bathroom (with patural ventilation) | Chimneys: 0 🛫 0 🚖 | |
| | Bathroom (without natural ventilation) | Wal/Ceiling Vents: 0 💭 | |
| | Family Room / TV Room Hallway (majority of openings to bedroom s | Exhaust Fans: 0 🗢 0 🗢 | |
| | Hallway (majority of openings to living space Laundry (with natural ventilition) | Vented Downlights: 0 | |
| | Laundry (without natural ventiltion) | Unflued Gas Heaters: 0 🗘 | |
| V. | Open Plan Living Kitchen | | |
| | Name | ✓ <u>0</u> k X <u>C</u> ancel) Ceiling Height (mm) | Chimneys U |
| 0 | < | | ~ |
| | | | |
| Ð | Check d | ata 😢 Help | |
| | | | Rating |

Figure 5

AccuRate Xpress bedroom detail input

2.4 Explicit Creation of Roof Space and Subfloor Zones

AccuRate Xpress allows users to explicitly create single or multiple roof space(s), subfloor zone and garage zone (see Figure 4). AccuRate Xpress assumes that the house has either a single slab on ground foundation or has a single subfloor zone.

Detailed attributes and parameters of the roof space(s) can be edited in the Roof

To speed up user input, zones under the roof space can be assigned as shown in Figure 7 with an adjustable percentage of roof space covered ceiling area for each zone respectively. A ceiling element for each zone is automatically created which links the zone and the roof space. Similarly, details of the subfloor zones, zones above the subfloor and the percentage of floor area above the subfloor for each zone can be assigned as shown in Figure 8 and Figure 9. A floor element for each zone is automatically created which links the zone and the subfloor.

For garage zone(s), detailed parameters can be assigned via the garage Data Entry sub-page (See Figure 10).

| Roof Length (mm) Roof Width (mm) I |
|------------------------------------|
| |
| |
| |
| Ground Floor |
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| \wedge |
| |
| I Brown (|
| v Percent (. |
| Hipped roof |
| |
| |
| VUK Kuncel Pating |
| |

Figure 6 AccuRate Xpi

AccuRate Xpress roof space detail input



Figure 7 Assigning zones below roof space

| 🟓 Fi | ile Actions Configure | e Window Help Tools Version | n | | | | | _ 8 × |
|------------|--|--|------------------------------------|--------------------------------------|------------------|----------------|-------------|----------|
| | Project, Client & Asses | or Site & Building Zones | | | | | | |
| | Roofspace Subfloor | Garage Conditioned Zones | | | | | | |
| ø | Subfloor: 🔂 D | ata Entry | | | | | | |
| | Name | | Туре | Length (mm) | Width (mm) | Area (m²) | /olume (m³) | Floor He |
| U) | Sub-floor | | Sub-floor | 3000 | 4500 | 13.50 | 3.10 | 0 |
| a | < | | | | | | | |
| 9 | < | 🔗 fræ Varona 7a par Subflag | • DataEnteulóain | | | | | > |
| | | | nDatachtrymain | | | | | ^ |
| | Zones above Su | Subfloor Sub-floor | | | | | | |
| | Avaliable Zones Bedroom 1 Bedroom 2 Bedroom 3 | Floor Area Length: 3000 € Width: 4500 € Area: 13.50 € | mm Volur mm Floor m² 🚺 Heigh | ne: Height: Ceiling t Above | 8.10 0 600 | m³ mm mm | | |
| | Zone | Openness: Enclosed | _ | | | | Above Pe | ercent (|
| | | Is there a wall cavity allowing | g unobstructed air flow betwee | n | | | | |
| | | the subfloor and roofspace o ር ነ | r outdoors? ′es ເ⊛ No | | | | | |
| \bigcirc | | Area of subfloor ventilation o | penings 6000 💌 mr | r∕m | | | | |
| 0 | C Generate proi | | | _~ | <u>0</u> k | X Cancel | | > |
| | | | | | | | R | ating // |

Figure 8

AccuRate Xpress subfloor detail input

| Ac | cuRate V2.1.3.1 Xpress *** BETA VERSION * | ** : New Project - [Acc | uRate Express | Version] | | | | | | |
|-------|--|-------------------------|-----------------------------------|--------------------------------------|-------------------|---------------|-------------------|--------------------|------------|----------|
| Se Hi | e Actions Configure Window Help Tools Versio | | | | | | | | | × |
| | Project, Llient & Assesor Site & Building 20ries | | | | | | | | | |
| ~ | Roorspace Subilion Garage Conditioned Zones | | | | | | | | | 1 |
| | Subfloor: 👌 Data Entry | | | | | | | | | |
| | Name | Туре | Length (mm) | √idth (mm) | Area (m²) | Volume (m²) F | loor Height (mm) | Ceiling Height (mm |) Openness | Wall C |
| C) | Sub-floor | Sub-floor | 3000 4 | 500 | 13.50 | 8.10 0 | | 600 | Enclosed | × |
| | | | · · · · | | | · · · · | | · | | |
| Θ | < | | | | | | | | | > |
| m | | | | | | | | | | - |
| | Zones shove Sub-floor | - | | | | | | | | |
| | | | | | | | | | | |
| | Avaliable Zones | | Selecte | ed Zones: | | | | / | vea below | |
| | Bedoom 1 Bedoom 2 Bedoom 3 Bethroom (with natural ventilation) LO | | Bedro Bedro Bedro Bathro | om 1 om 2 om 3 oom (with na | tural ventilation | n) LO | | | 100 🔶 🗶 | 1111 |
| | | | | | | | | | | |
| | Zone | F | Floor Area (m²) | Subfloor | | Above Perce | nt (%) Above Area | a (m²) | | |
| A A | Bedroom 1 | | 13.50 | Sub-floor | | 100 | 13.50 | | | |
| | Bedroom 2 | | 13.50 | Sub-floor | | 100 | 13.50 | | | |
| | Bedroom 3 | - | 13.50 | Sub-floor | | 100 | 13.50 | | | |
| 0 | Bathroom (with patural ventilation) L0 | ŀ | 13.50 | Sub-floor | | 100 | 1350 | | | <u> </u> |
| 0 | Generate project Check data | 🥑 Help | | | | | | | | |
| | | | | | | | | | Ra | iting 🥢 |

Figure 9 Assigning zones above subfloor

| Rootspace Sublior Garage Conditioned Zones Image: Image Conditioned Zones Image: Image Conditioned Zones Image: Image Conditioned Zones Image: Image: Image Conditioned DataEntryMain Image: Image: Image: Image Image: Image: Image: Image: Image: Image Image: | File Actions Configure With Project, Client & Assesor Single | ndow Help Tools Vers ite & Building Zones | ion | | | | | | . a x |
|---|---|--|---------------------|-------------------|--------------|---------------------|---------------|-------------|-------|
| Garage: Data Entry Image: Zone Type: Level Length (mm) Vidth (mm) Area (m²) Volume: 3000 Garage: Garage Image: Garage Image: Garage Image: Garage: Image: Floor Levet: Image: Image: Image: Image: Image: Image: Image: Image: Image: | Roofspace Subfloor Ga | rage Conditioned Zones | | | | | | | |
| Name Zore Type Level Lergth (mm) Width (mm) Area (m²) Volume (m²) F Garage 1 Garage 0 3000 4500 13.50 32.40 0 Image 1 Garage 0 3000 4500 13.50 32.40 0 Image 1 Garage 1 Cone Type: Garage 1 Cone Type: Garage 1 Image 2 Cone Type: Garage 1 Cone Type: Garage 1 Image 2 Cone Type: Garage 1 Cone Type: Garage 1 Image 2 Cone Type: Garage 1 Cone Type: Image 1 Image 2 Cone Type: Garage 1 Cone Type: Image 1 Image 2 Cone Type: Garage 1 Cone Type: Image 1 Image 2 Cone Type: Image 1 Cone Type: Image 1 Image 2 Cone Type: Image 1 Image 1 Image 1 Image 2 Image 1 Cone Type: Image 1 Image 1 Image 2 Image 1 Image 1 Image 1 Image 1 Image 2 Image 2 Image 1 Image 1 Image 1 Image 2 Image 2 Image 1 Image 1 Image 1 Image 2 Image 1 Image 1 Image 1 Image 1 Image 2 Image 1 Image 1 Image 1 Image 1 Image 2 Image 1 Image 1 Image 1 Image 1 Image 2 Image 1 Image 1 Image 1 Image 1 Image 2 Image 1 | Garage: 🔂 Data Er | ntry | | | | | | | |
| Garage 1 Garage 0 3000 4500 13.50 32.40 0 Image: frmX pressZonesConditionedDataEntryMain Image: | Name | | Zone Type | Level | Length (mm) | Width (mm) | Area (m²) | Volume (m²) |) Fic |
| Image: | Garage 1 | | Garage | 0 | 3000 | 4500 | 13.50 | 32.40 | 0 |
| Garage: Garage1 Zone Type: Garage Floor Area Length: Width: 4500 \$mm Area: 1350 \$m^2 \$No Heated: Cooled: Infiltration No. Sealed Chimneys: 0 \$No Vall/Ceiling Vents: 0 \$No Vented Downights: 0 \$No Vented Downights: 0 \$No Unflued Gas Heater: 0 \$No Vented Downights: 0 \$No | S 8m | 1XpressZonesConditio | onedDataEntryMain | | | | | | |
| Zone Type: Garage Floor Area Length: Width: 4500 \$\colored: No. Unsealed No. Sealed Chimneys: 0 \$\colored: Number: 0 \$\colored: Vall/Ceiling Vents: 0 \$\colored: Vall/Ceiling Vents: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: 0 \$\colored: Vented Downlights: | Garag | e: Garage 1 | | | | | | | |
| Floor Area Length: Width: 4500 € mm Area: 1350 € m² Area: 1350 € m² Max Ceiling Heated: Cooled: Infiltration No. Unsealed No. Sealed Chimneys: 0 € Wall/Ceiling Vents: 0 € Vented Downlights: 0 € Unflued Gas Heaters: 0 € X Encel | Zone | Type: Garage | 1 | loor Lev | el: Ground P | loor | Ŧ | | |
| Image: Senerate p Foor Area Image: Senerate p Foor Height: Senerate p Image: Senerate p Foor Area Image: Senerate p Foor Area <t< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<> | | | | | | | | | |
| Image: Sease in mining in the sease in the s | Floo | atha | [| | | 32.40 🛋 🔐 | , | | |
| Width: 4300 \$\cong mm Area: 1350 \$\cong m^2 Heated: Cooled: Inilitation Ceiing Fans No. Unsealed No. Sealed Chimneys: 0 \$\cong 4 Wall/Ceiing Vents: 0 \$\cong 4 Eshaust Fans: 0 \$\cong 4 Vented Downlights: 0 \$\cong 4 Unflued Gas Heaters: 0 \$\cong 4 | Len | gur. 🖸 🗠 🗸 | 1 5 | vor Heigh | at | | ~ | | |
| Area: 1350 • m² Height Above 2400 • mm Floor: Floor: Hested: Collegt Infiltration No. Unsealed No. Sealed Chimneys: 0 • 0 • Wall/Ceiling Vents: 0 • Vented Downlights: 0 • Unflued Gas Heaters: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: 0 • Vented Downlights: <td< th=""><th>Wid</th><th>ith: 4500 🛫</th><th>mm M</th><th>ax. Ceiling</th><th>g</th><th>· •</th><th></th><th></th><th></th></td<> | Wid | ith: 4500 🛫 | mm M | ax. Ceiling | g | · • | | | |
| Heated: Cooled: Infiltration No. Unsealed Chimneys: 0 ÷ Wall/Ceiling Vents: 0 ÷ Unflued Gas Heaters: 0 ÷ | Are | a: 13.50 🌩 | m² 🚺 He | eight Abo oor: | ove | 2400 🖵 m | n | | |
| Heated: Cooled: Imiliation No. Unsealed Chimneys: 0 ÷ Wall/Ceiling Vents: 0 ÷ Wall/Ceiling Vents: 0 ÷ Vented Downlights: 0 ÷ Unflued Gas Heaters: 0 ÷ Munders: 0 ÷ Mail / Ceiling Vents: 0 ÷ Vented Downlights: 0 ÷ Vented Downlights | | | _ | | | | | | |
| Infiltration No. Unsealed No. Sealed Chimneys: 0 \$ 0 \$ Wall/Ceiling Vents: 0 \$ 0 \$ Exhaust Fans: 0 \$ 0 \$ Vented Downlights: 0 \$ 0 \$ Unflued Gas Heaters: 0 \$ 0 \$ | Heate | ed: 🔽 Cooled: | | | | | | | |
| No. Unsealed No. Sealed Chimneys: 0 ÷ Wall/Ceiling Vents: 0 ÷ Exhaust Fans: 0 ÷ Vented Downlights: 0 ÷ Unflued Gas Heaters: 0 ÷ | Infi | tration | University No. Cont | 1 | Ceiling | Fans | | | |
| Wall/Ceiling Vents: 0 \$ Wall/Ceiling Vents: 0 \$ Exhaust Fans: 0 \$ Vented Downlights: 0 \$ Unflued Gas Heaters: 0 \$ | | Chimneys: | 0 | ea 1 | Number | : 0 🛊 | | | |
| Exhaust Fans: 0 (1) Vented Downlights: 0 (1) Unifued Gas Heaters: 0 (1) Generate p 0 (1) | | Wall/Ceiling Vents: | 0 | - | Type: | | - | | |
| Vented Downlights: 0 € Unflued Gas Heaters: 0 € © Generate p ✓ 0k | <u> </u> | Exhaust Eans: | 0 0 | • | | | | | |
| O Unifued Gas Heaters: 0 € O Cenerate p | a . | Vented Downlights: | 0 📤 | •1 | | | | | |
| Concerte p | Ur | nflued Gas Heaters: | 0 🔷 | | | | | | |
| Generate p ✓ <u>0</u> k ★ <u>Cancel</u> | | , | | | | | | | > |
| | 🌎 Generate p | | | | | √ <u>0</u> k | 🗙 <u>C</u> an | | |

Figure 10 AccuRate Xpress garage detail input

2.5 Automatic Creation of New Zones Using Predefined Types

In AccuRate Xpress, zones other than bedrooms, roof space(s), subfloor and garage can be assigned via the predefined Available Zones box in the Zone page as shown in Figure 11. Table 1 lists the predefined zone types and their corresponding space heating and cooling status (for completeness, garage, bedroom, subfloor and roof space zones are also included at the end of Table 1).

Based on the floor level of these zones assigned to, their corresponding floor and ceiling heights will be set automatically. Again, the details of the selected zones can be edited via the Data Entry sub-page. The APPLYALL equivalents to select all the 'Selected Zones' and change their details in one go.

| Name | Zone Type | Cooling & Heating |
|---|--------------------------|----------------------|
| Living | Living | Y |
| Kitchen | Kitchen | Y |
| Dining | Living | Y |
| Open Plan Living/Kitchen | Living/Kitchen | Y |
| Study | Bedroom | Y |
| Hallway (majority of openings to living spaces, with natural ventilation) | Other (daytime usage) | N |
| Hallway (majority of openings to bedroom spaces, without natural | | |
| ventilation) | Other (night-time usage) | Y |
| Bathroom (with natural ventilation) | Other (daytime usage) | Ν |
| Bathroom (without natural ventilation) | Other (daytime usage) | Y |
| Toilet (with natural ventilation) | Other (daytime usage) | N |
| Toilet (without natural ventilation) | Other (daytime usage) | Y |
| Walk in Wardrobe (greater than 6m ² , with natural ventilation) | Other (night-time usage) | N |
| Walk in Wardrobe (greater than 6m ² , without natural ventilation) | Other (night-time usage) | Y |
| Laundry (with natural ventiltion) | Other (daytime usage) | N |
| Laundry (without natural ventiltion) | Other (daytime usage) | Y |
| Family Room / TV Room | Living | Y |
| Garage | Garage | N |
| Bedroom | Bedrom | Y |
| Roof Space | Roof Space | N |
| Subfloor | Subfloor | N |

| Table | 1 | Predefined | zone t | vnes | and | their | space | heating | and | cooling | status |
|-------|---|--------------|---------|------|-----|-------|-------|---------|-----|---------|--------|
| rabic | | i icuciliicu | 20110 1 | ypcs | anu | uicii | Space | nearing | anu | cooming | Sidius |



Figure 11 Assign and modify predefined zone details

2.6 Demonstration of External Wall Construction with Accompanying Images

AccuRate Xpress provides a new external wall library with interactive insulation insertion, reflective foil selection and accompanying images. By selecting an external wall type, the insulation level and whether reflective or non-reflective, the external wall construction can be automatically created as shown in Figure 12. The accompanying image assists user visualising the external wall constructions.

| 🔑 Ac | cuRate V2.1.3.1 | Xpress *** BETA VERSION *** C:\AccuRateXpress\Nathers4\projects\AccuRateXpressSample 03.PRX | |
|---------|-------------------------|---|---------------|
| File / | Actions Configure | Window Help Tools Version | |
| | 🏓 Databook 🌔 | 😕 Library Manager | |
| | Project Construc | | |
| | External | Select Library Type: External Wall | xternal Wall |
| | LAterna | Library Data (1 items) | |
| -1 | Number [| ARL 100 + birck inner AS Demed | Area in use [|
| | | AAC 200 mm Glass fibre batt: R1.5 | |
| ୍ୱ | | Brick outer + AAC 100 - Glass fibre batt: R2.5 | |
| m | | Brick Veneer (single-sided anti-gate relective foil on outside of frame) Brick Veneer (single-sided reflective foil on outside of frame) Glass fibre batt: R3.5 | <u>00</u> m² |
| | 🤨 Library | Bruck Veneer (uninsulated) Glass fibre batt: R4.0 | |
| | Description: | Aerated autoclaved concrete block | |
| | External Laver | Air gap vertical 31-65 mm (40 nominal) unventilated non-reflective (U.S/U.9; E = 0.82) Glass fibre batt: R3.0 | |
| | | | |
| | | | |
| | Internal | C Reflective Non Reflective | - Delete |
| | < 1 | Lood @ | |
| | Total R (heat flow | | _ |
| | External Surfac | AAC veneer 100+100 mm | |
| | Colour: | | |
| | Solar Absorptance: | | |
| | | | |
| 0 | | V Dk 🕜 Help | |
| Ð | ✓ Apply ¶ | N Paucei A Tah | |
| Load se | elected Library items i | nto Project | Rating |

Figure 12 Create external wall constructions in AccuRate Xpress

2.7 Window Schedule Construction with Interactive Pane Images

In AccuRate Xpress, a window schedule page has been implemented. After creating window constructions in the Construction page, window schedule can be created. As shown in Figure 13, a window schedule is constructed with horizontal and vertical pane numbers, an overall window height and width, the opening for each pane and other related information. The percentage opening for the whole window schedule is calculated automatically based on the window types and individual pane opening types. Window schedules can be created, saved and loaded for future use.

After creating (or loading) the window schedules in the current AccuRate project, each window in the Element|External wall page can be assigned with window schedule as shown in Figure 14. With the window schedule facility, the user can specify a window element with only four inputs (i.e., schedule name, window name, fixed shading and the horizontal offset) which could speed up window element creation. A window schedule image can be called up by click the Details button as shown in Figure 15.

In AccuRate, a fixed shading scheme for an external wall is also automatically shading the windows in this external wall. However, the existing AccuRate implementation allows the user to select this fixed shading scheme (already applied to the external wall) for the window element. The consequence is that the window element will be shaded twice by the specific shading device which is not correct. In AccuRate Xpress, a fixed shading scheme used for an external wall element cannot be used by the windows in this wall and vice versa and thus eliminates the potential user input error.

| S Ac | cuRate V2.1.3.1 Xpress *** BETA VERSION *** : C | : C:\AccuRateXpress\Nathers4\projects\AccuRateXpressSample 02.PRX - [D 🔳 🗖 | X | | | | | | | | | |
|-------------|---|--|-----|--|--|--|--|--|--|--|--|--|
| 🔑 Fi | e Actions Configure Window Help Tools Version | | 3 × | | | | | | | | | |
| | Project Constructions Zones Shading Schedule Constructions Elements Ventilation | | | | | | | | | | | |
| | New 2015] | | | | | | | | | | | |
| 6 | | | | | | | | | | | | |
| ٨ | Construction Generic 02: Aluminium improved single-gla | glazed: clear glass: U = 6.35: SHGC = 0.77 ▼ | ^ | | | | | | | | | |
| 1 | Window Type Awning 💌 | Horizontal Panes 2 🖨 | | | | | | | | | | |
| | Label [New 2615] | Vertical Panes 📃 2 🖨 | | | | | | | | | | |
| 9 | Frame None 🔻 | | | | | | | | | | | |
| | Glazing None 💌 | 1 2 | | | | | | | | | | |
| | Indoor Covering None 💌 | | | | | | | | | | | |
| | Outdoor Covering None | | | | | | | | | | | |
| | Insect Screens | | | | | | | | | | | |
| | Weather Stripped | 3 4 | | | | | | | | | | |
| | Height 1500 🌩 mm | | | | | | | | | | | |
| | Width 1500 🌩 mm | | | | | | | | | | | |
| | Head Height 2000 🖨 mm | | | | | | | | | | | |
| | Gap Size | Pane 1 Width 750 🜩 mm Height 750 🜩 mm Opening None 💌 | | | | | | | | | | |
| | Small C Medium C Large | Pane 2 Width 750 🛊 mm Height 750 🛊 mm Opening Left 💌 | | | | | | | | | | |
| Ø | Openable Percent 20 | Pane 3 Width 750 🌩 mm Height 750 🌩 mm Opening None 💌 | | | | | | | | | | |
| | | Pane 4 Width 750 🛊 mm Height 750 🖨 mm Opening Left 💌 | | | | | | | | | | |
| | | | ~ | | | | | | | | | |
| | 🖨 New 🖉 😽 Áppin 🖉 🗖 Debra | | | | | | | | | | | |
| Ð | | | | | | | | | | | | |
| | | Rating | | | | | | | | | | |

Figure 13 Create a window schedule in AccuRate Xpress

| derna | al Wall | | | ž | Zones: Bedroom 1 | | - | Element Type: | External W |
|-----------|--------------------|-----------------------|-------------------------|----------------------------|-------------------|----------------|----------------------------|----------------|-------------|
| , 5 | New Window | / | | | | | l Shade | Opening | Wing Wall |
| oom 1 | Properties | - | | | 1 | | 5 | 0.00 | |
| oom 1 | Schedule: | [New 2615] | | - | <u>U</u> etails | | | 0.00 | |
| | Name: | 1 | | Fixed Shade: | None | - | | | |
| | Type: | Awning | v | Wall Shaded By: | | | | | |
| | | Generic 02: Aluminium | improved single-glazed: | clear glass: U = 6.35; SH) | GC = 0.77 | ~ | | | |
| Neur | | 1500 🍨 mm | Width: 1500 🌩 n | m Indoor Covering | p. None | v | | | |
| New | HeadHeight: | 2000 🚔 mm | | | p: None | ~ | | | |
| mon F | Horizontal Offset: | 0 🌩 mm | | Gap Size | | | /s | | |
| struct | | 20 🔹 % | | © Small (| C Medium C L | arge | nstruction meric 02: Al | uminium improv | ed sinale-c |
| Len | | | antherChinesed | | | | | | |
| Azimi | | 1 | controloupped. | | | | | | |
| d Sha | | | | ✓ <u>□</u> k | 🗙 <u>C</u> ancel | 🕑 <u>H</u> elp | | | |
| upen L | , | | | | | | | | |
| /ing Wall | sens: V | C Edit. | | | | | | | |
| - | | 22 5-0 | | | | | | | |

Figure 14 Create window element in the Element Page using a window schedule.

| Acc | uRate V2.1 | 1.3.1 Xpress ** | BETA VERSION | I*** : C:\AccuRate | Xpress\Nathers4 | projects\AccuRateXpres | sSample 02.PRX | · [Databook (Base D 🔳 🗖 🗙 |
|---------|--------------------------|-------------------------|-------------------|-----------------------|------------------|------------------------|----------------|---|
| | Project Cons | structions Zones | Shading Schedul | e Constructions Eleme | nts Ventilation | | | |
| | Extern | al Wall | | | | Zones: Bedroom 1 | • | Element Type: External Wall 💽 |
| | Zone | 🔗 New Window | v | | | | J Shade | Opening Wing Wall Ext. Screens |
| | Bedroom 1 Bedroom 1 | Properties Schedule: | [New 2615] | | | ✓ Details | | 0.00 |
| \odot | | Name: | | | Fixed Sł | nade: None | • | |
| | | Type: | Awning | 🔗 Scheduled Con | struction Window | | | |
| | | | Generic 02: Alumi | 1 | 2 | | | |
| | ∯ <u>N</u> ew | | 1500 🍨 mm | | $ $ | | | |
| Ī | Common P | HeadHeight: | | | | | | |
| | Construct | Openable: | 20 🔮 % | 3 | 4 | | | Height (mm) uminium improved single-gla 1500 |
| | Azim | Insect Screens: | | | | | | |
| | Fixed Sha | | | | | | | |
| | Open | | | | | | | |
| | Wing Wa | ills: | 🖉 Edit | | | | | |
| | External Sc | creens: | 🖉 Edit | | | | | > |
| 6 | ✓ As | pply Sance | el 🥑 Help | | | (| Canad | Select All |
| | | | | | | | | Rating |

Figure 15 Window schedule image in the window element.

3. CONCLUSIONS

In order to speed up AccuRate user input and minimise input ambiguity and user errors, an Xpress mode of AccuRate is in developing with the support from then DEWHA (now in DCCEE). Stage 1 of the AccuRate Xpress development has accomplished the following deliverables:

- a. On the project page, the client details, assessor details and the site location details can be saved to file for future use;
- b. Graphical selection of house surrounding terrain;
- c. Automatic creation of bedroom zones based on number of bedrooms specified;
- d. Explicit creation of roof space & subfloor zone;
- e. Automatic creation of other new zone & zone attributes using predefined zone types;
- f. Automatic assignment of the floor and zone height using the story floor and story height;
- g. A fixed shading scheme used for an external wall element cannot be used by the windows in this wall and vice versa.
- h. An external wall library with interactive insulation insertion, reflective foil selection and accompanying images should be implemented and should demonstrate its use;
- i. Window schedule construction with interactive pane images and opening types should be implemented and demonstrate its use.

Considering that the current implementation is still subject to changes, online help was not implemented at this stage and will be implemented in Stage 2 of AccuRate Xpress development.

It is believed that these development will minimize the user input efforts and reduce the ambiguity of user input.

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