

# **REScheck Software User's Guide**

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**Building Energy Codes Program**





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# Software User's Guide

This section describes how to use the REScheck™ Software. REScheck is designed to demonstrate compliance with the requirements of the Council of American Building Officials (CABO) Model Energy Code (MEC) and the International Code Council (ICC) International Energy Conservation Code (IECC). It is the most flexible approach for meeting the MEC insulation and window requirements (refer to the *Basic Requirements Guide* in the *REScheck Workbook* for additional requirements that must also be satisfied). The REScheck software runs on the Microsoft Windows operating system.

The REScheck software demonstrates compliance with the 1992, 1993, and 1995 editions of the MEC, the 1998 and 2000 editions of the IECC, and the following state and county residential codes: Arkansas, Georgia, Massachusetts, Minnesota, New Hampshire, New York, Vermont, Wisconsin, and Pima County, Arizona. The software enables you to quickly compare different insulation levels in different parts of your building to arrive at a package that works best for you. A report that can be submitted with your building plans for plan review is automatically generated.

REScheck performs a simple **U-factor** x Area (**UA**) calculation for each building assembly to determine the overall UA of your building. The UA that would result from a building conforming to the code requirements is compared against the UA for your building. If the total heat loss (represented as a UA) through the envelope of your building does not exceed the total heat loss from the same building conforming to the code, then the software declares that you pass. A high-efficiency equipment trade-off can also be performed.

REScheck is appropriate for insulation and window trade-off calculations in residential detached one- and two-family buildings (referred to as single-family buildings) and **multifamily** buildings (such as apartments, condominiums, townhouses, and rowhouses). Multifamily buildings include **residential buildings** three stories or less in height with three or more attached dwelling units.

**New Hampshire:** The New Hampshire Code applies to residential structures under four stories in height and commercial structures under 4,000 square feet (ft<sup>2</sup>).

**Wisconsin:** The Wisconsin Residential Code does not include multifamily buildings.

The REScheck software generates a report that lists the insulation and window levels of your proposed building, as well as the additional basic requirements found in the code.

# Table Columns and Rows

The *Envelope* and *Mechanical* screens have grid-like tables used to enter and store data. The rows and columns in the tables can be deleted, moved, collapsed and expanded.

## Rows

### Selecting Rows

To select a row, click on the tree label corresponding to that row or click on the leftmost column of that row (the column containing row numbers). The row will be reversed (black background) when correctly selected. You can also select multiple rows by holding down the left mouse button on the left-hand column and dragging it over the desired rows.

### Moving Rows

Rows can be moved by:

1. selecting the row(s) to be moved (as described above),
2. releasing the mouse button,
3. clicking and holding down the mouse button on the leftmost column of any of the selected rows (a small box will appear at the tail end of the arrow cursor),
4. dragging the mouse to the new location – a thin red line will appear indicating where the row(s) should be placed,
5. releasing the mouse button when the red line has been placed in the desired location.



Arrow cursor when dragging rows or columns.

A single table row can also be moved by dragging the corresponding row label in the tree located to the left of the table. Click the mouse on the desired label and drag it to another label on the tree. After releasing the mouse, the dragged label (and row) will be positioned directly under the label on which it was dropped.

Some restrictions apply to the placement of rows. In the *Envelope* screen, for example, window and **door** rows can only be placed under above-grade wall or basement wall rows. **Skylight** rows can only be placed under **ceiling** rows.

## Collapsing and Expanding Rows

On the *Envelope* screen, rows can also be collapsed and expanded by using the tree located to the left of the table. Rows that fall below a "parent" row on the tree can be collapsed so they are not displayed. For example, an exterior wall row with several windows and doors under it can be collapsed to hide the windows and doors. A tree label with a minus sign to the left of the label is already expanded. It can be collapsed by clicking on the box containing the minus sign. Tree labels that are already collapsed have a plus sign to the left of the label. They can be expanded by clicking the box containing the plus sign. Clicking the plus or minus sign to the left of the *Building* label will expand or collapse all rows in the table.

## Deleting Rows

Rows can be deleted by selecting the row or rows to be deleted and selecting *Delete Row(s)* from the *Edit* menu or selecting the delete rows icon from the toolbar.



Multiple consecutive rows can be selected by holding down the left mouse button on the left-hand column and dragging it over the desired rows. Non-consecutive rows can be selected by holding down the **Ctrl** key while clicking on the leftmost column of each row to be selected.

In the *Envelope* screen, if you delete a wall or basement row with windows or doors linked to it, the windows and doors will also be deleted. Likewise, deleting a ceiling row with a skylight linked to it will cause the skylight to be deleted as well.

## Duplicating Rows

Rows can be duplicated by selecting the row or rows to be duplicated and selecting *Duplicate Row(s)* from the *Edit* menu or selecting the duplicate rows icon from the toolbar.



Multiple rows can be duplicated, but they must be consecutive.

# Columns

## Selecting Columns


Select a single column by clicking the left mouse button on the column heading. Select multiple columns by clicking and holding down the left mouse button and dragging it over the desired column headings. Selected columns will be reversed (black background).

## Moving Columns

Columns can be moved by:

1. selecting the column(s) to be moved (as described above),
2. releasing the mouse button,
3. clicking and holding down the mouse button on the column heading of any of the selected columns (a small box will appear at the tail end of the arrow cursor),
4. dragging the mouse to the new location-a thin red line will appear indicating where the column(s) should be placed,
5. releasing the mouse button when the red line has been placed in the desired location.

## Changing Column Widths

Table column widths can also be modified. To change the width of a column, move the mouse over the right edge of the corresponding column header until the mouse pointer changes to a double-sided arrow. 

When the mouse pointer changes, drag the column to the desired width. Columns that have been totally collapsed can be restored by double-clicking the mouse on the column header separation (the vertical line in the top row representing the hidden column).

# Project Folder

Your building's location and construction type (**single family** or **multifamily**) are entered in the *Project* screen. REScheck lists the cities or counties for each state. The location and construction type of your building are necessary for REScheck to determine compliance. If this information is not accurate, the results will not be valid.

**New Hampshire:** The New Hampshire Code applies to residential structures under four stories in height and commercial structures under 4,000 square feet (ft<sup>2</sup>). Since the code is the same for all locations within the state, there are no entries for location or construction type.

**Wisconsin:** The Wisconsin code does not include multifamily buildings.

The *Project* screen also has input fields entitled *Date of Plans*, *Title*, *Project*, *Company*, and *Notes*. All of the information entered in these fields is included in your project report. None of this information is required by the software to determine compliance with the code. This information may be useful, however, to the building department or as a way to track and label your reports.

Whenever you exit REScheck, the currently selected building location and construction type are saved. When re-entering the software, the location and construction type fields are automatically updated to reflect your last entries.

## Project Folder Required Inputs

### State

To choose a new state, select the arrow button to the right of the field. A list appears containing state names. If a state code is selected from the *Code* menu, the state corresponding to the new code will be the only one listed.

### City or County

Each time you enter a new state, the list of cities or counties changes – reflecting only the cities or counties located in the new state. To choose a new location, select the arrow button to the right of the field. A list appears containing the names of cities or counties located in the selected state. If you cannot find the city in which your building will be located, choose a city that is close to your building site and has similar weather conditions.

**New Hampshire:** The New Hampshire state code is the same for the entire state. If you select *New Hampshire* from the *Code* menu, the *City/County* field will disappear.

## Construction Type

The code specifies different requirements for 1- and 2-family detached (single family) buildings and multifamily buildings, so REScheck must know which of these construction types you are going to build. You must select either the *1- and 2-Family, Detached* or the *Multifamily* button.

**1- and 2-Family Detached** - To choose single-family construction (defined as all detached one- and two-family dwellings), click on the *1- and 2-Family, Detached* radio button.

**Multifamily** - To choose multifamily construction, click on the *Multifamily* radio button. Multifamily buildings are three stories or less in height and contain three or more attached dwelling units. Apartments, condominiums, townhouses, dormitories, and rowhouses are included in this category. Multifamily buildings can be considered as a whole or separate reports can be generated for each **dwelling unit**. Where individual units are identical, one report may be submitted as representative of the others. Contact the authority having jurisdiction to determine which approach to take.

**New Hampshire:** The New Hampshire residential code applies to all residential structures under four (4) stories in height and commercial structures under 4,000 square feet (ft<sup>2</sup>). It does not distinguish between single family and multifamily buildings. If you select *New Hampshire* from the *Code* menu, the *Construction Type* options will disappear.

## Heating System Type

*Heating System Type* applies when *Massachusetts*, *New York*, or *Wisconsin* is selected from the *Code* menu.

**Massachusetts:** If the dwelling is primarily **heated** with electric resistance heating, select the *Electric Resistance* button. If the dwelling is primarily heated with any other heating system, select the *Other* button. An electric heat pump is not electric resistance heating. The code has more stringent envelope requirements for single-family dwellings with electric resistance heating.

**New York:** The code has more stringent envelope requirements for buildings with electric resistance heating. If electric resistance heating is used, select the *Electric* button. This option should be selected for dwellings heated with baseboards, electric furnaces, and air-source heat pumps containing an electric resistance coil in the air handler section. If the dwelling is heated with non-electric fossil fuel or ground source heat pumps, select the *Non-Electric* button. For example, select *Non-Electric* for air-to-air heat pumps installed with gas backup that DO NOT use an electric coil backup.

**Wisconsin:** The code has more stringent requirements for electrically heated homes. If the dwelling is primarily heated with electric heat (including electric heat pumps), select the *Electric* button. If the dwelling is primarily heated with any other non-electric heating system, select the *Non-Electric* button.

## Conditioned Floor Area

*Conditioned Floor Area* applies when *Sustainable Energy Standard* is selected from the *Code* menu.

**Sustainable Energy Standard:** If you are determining compliance to the Sustainable Energy Standard, you must enter the conditioned floor area. If this information is not accurate, the results will not be valid. The conditioned floor area includes the gross area of all heated and/or **cooled** rooms, including the floor area of heated or cooled basements.

## Project Folder Optional Inputs

### Date of Plans

The *Date of Plans* field is used to record the date stamped on the building plans. This date can be used to track the plans on which the REScheck documentation is based, in the event that the plans are later modified.

### Title

The *Title* field is a single-line text field used to enter a project title. You can use the title to identify specific projects. This title is displayed at the top of your report.

### Project

Enter a description of your project in the *Project* field (such as the project name and address).

### Company

Enter a description of your company in the *Company* field (such as the name and address).

### Notes

Enter any additional information in the *Notes* field.

# Envelope Folder

The blue-on-white black-on-grey buttons at the top of the *Envelope* screen are used for choosing the building components in your proposed design. You can select from buttons representing general building components – ceilings, skylights, walls, windows, doors, basement walls, floors, and **crawl space** walls. When you select any of these buttons the component is added to the table on the *Envelope* screen. The table continues to grow as you add new components. You may add as many components as you need to describe your building, including multiple components of the same type. The status bar message at the bottom of the screen explains what type of information goes into the currently selected field. To edit the component name, double-click in the appropriate cell in the *Component* column.

After you have filled in the information about each component, the program computes the **UA** of your proposed building and the UA of the code building. The code building has the same dimensions as your building but conforms to the code requirements. If the total UA of your building is less than or equal to the total UA of the code building, your building complies with the code and the *Compliance* field displays the message "Passes."

## Ceilings

Ceilings include opaque portions of the **building envelope** that are above conditioned space and are horizontal or tilted at less than 60 degrees from horizontal.

Select the **Ceiling** button to add a ceiling component to the description of your design on the *Envelope* screen. Each unique ceiling assembly should be entered as a separate component, but multiple ceiling elements sharing the same construction may be entered as one component with appropriate total area.

## Ceiling Types

After selecting the *Ceiling* button, a new ceiling assembly is added to the table and a popup menu is displayed in the *Assembly* field. Choose from the following ceiling types:

- Flat Ceiling or Scissor Truss - Wood-frame ceiling structures with attics in which batt or loose-fill insulation is placed between and on top of structural ceiling members.

- Cathedral Ceiling (no attic) - Sloped, wood-frame ceiling structures without attic spaces.
- Raised or Energy Truss - Wood-frame ceiling structures with raised or oversized truss construction allowing the insulation to achieve its full thickness over the plate lines of exterior walls.
- Structural Insulated Panels (SIPs) - Typically 4" to 6" stressed-skin panels with foam insulation sandwiched between oriented strand-board (OSB). For SIPs assemblies, you must provide the manufacturer-reported **R-value** in the **Continuous Insulation R-Value** field.
- Other - Ceiling assemblies that do not fit into any of the other ceiling types, including steel-framed roofs. If you use the *Other* ceiling type, you must enter an overall **U-factor** for the entire ceiling assembly (including air films). Be prepared to provide the building department with manufacturers' literature or documentation of U-factor calculations.

## Ceiling Software Inputs

- Gross Area - Enter the gross area of the ceiling component in the *Gross Area* field. The gross ceiling area includes the area of all skylights within the ceiling. You must link the ceiling to the skylights within that ceiling by using the tree on the left side of the *Envelope* screen. To link a **skylight** to a ceiling assembly, drag the skylight label on the tree to the ceiling label and release the mouse. The ceiling area should be measured on the slope of the finished interior surface.
- **Cavity Insulation R-Value** - Enter the R-value of any insulation to be installed in the cavities between ceiling structural members, including all blown insulation. The insulating values of other parts of the building assemblies (e.g., gypsum board and air films) are accounted for by the program and should not be included.
- Continuous Insulation R-Value - Enter the R-value of any continuous ceiling insulation. Continuous insulation is insulation that runs continuously over structural members and is free of significant thermal bridging; such as rigid foam insulation above the ceiling deck. For ventilated ceilings, insulating sheathing must be placed between the conditioned space and the ventilated portion of the ceiling (typically applied to the trusses or rafters immediately behind the drywall or other ceiling finish material). For structural insulated panels, enter the manufacturer-reported R-value for the entire assembly.
- Assembly U-Factor - If you have selected the *Other* ceiling type option, enter the overall U-factor of the ceiling assembly including exterior and

interior air films. Do not include the finished ceiling in the U-factor calculation if the space between ceiling and ceiling structure is used as an HVAC plenum. Building departments may require supporting documentation for assemblies entered using the *Other* ceiling type and *U-Factor* field.

## Skylights

Skylights are defined as any transparent or translucent section in a building **ceiling**. **Glazing** having a slope less than 60 degrees from horizontal is considered a **skylight**, while glazing having a slope greater than 60 degrees from horizontal is considered a window.

Click the *Skylight* button to add a skylight component to the description of your design on the *Envelope* screen. Each unique skylight assembly should be entered as a separate component, but multiple skylight elements having the same characteristics may be entered as one component with the appropriate total area.

Skylights must be linked to their corresponding ceiling component. Link a skylight to a ceiling by using the tree on the left side of the *Envelope* screen. Drag the skylight label on the tree to the ceiling label and release the mouse.

## Skylight Types

- **Frame Type** - The frame type enables you to identify the skylight frame material. Use *Other* for frame types that do not fit into any of the other frame types.
- **Glazing Layers** - The glazing layers enables you to identify the number of glazing layers in the skylights (i.e., single, double, or triple). *Double Pane with Low-E* is included because the performance impact of low-emissivity films is similar to that of additional glass layers.

## Skylight Software Inputs

- **Gross Area** - Enter the area of the entire skylight component in square feet (ft<sup>2</sup>) in the *Gross Area* field. Skylight area is the interior surface area of the entire assembly, including glazing and framing elements. The nominal area or rough opening is also acceptable.
- **U-Factor** - Enter the U-factor for each component in its corresponding *U-Factor* field. U-factors for glazing must be tested and documented by the manufacturer in accordance with the NFRC test procedure or taken from

the default glazing U-factors table in default tables. Center-of-glass U-factors cannot be used.

- **Locations <3500 HDD when 1998 IECC or 2000 IECC is selected, or when Pima County 2000 IECC < 4000 ft or Georgia Calendar year 2004 and beyond is selected:** The Solar Heat Gain Coefficient enables you to specify the glazing's effectiveness in rejecting solar heat gain. **SHGC** is part of a system for rating glazing performance used by the National Fenestration Rating Council (NFRC). If you are using glass whose performance is listed in terms of shading coefficient (SC), you may convert to SHGC by multiplying the SC value by 0.87.

## Walls

Select the *Wall* button to add an above-grade wall component to the description of your design on the *Envelope* screen. Each unique above-grade wall assembly should be entered as a separate component, but multiple wall elements sharing the same construction may be entered as one component with appropriate total area.

### Wall Types

- Wood Frame, 16" o.c. - Wood frame walls with 16" on-center stud spacing. The category is intended primarily for lightweight walls but may also be used for walls with masonry veneers.
- Wood Frame, 24" o.c. - Wood frame walls with 24" on-center stud spacing. The category is intended primarily for lightweight walls but may also be used for walls with masonry veneers.
- Steel Frame, 16" o.c. - Steel frame (stud) walls of any gauge or depth, with 16" on-center stud spacing. The category is intended primarily for lightweight walls but may also be used for walls with masonry veneers.
- Steel Frame, 24" o.c. - Steel frame (stud) walls of any gauge or depth, with 24" on-center stud spacing. The category is intended primarily for lightweight walls but may also be used for walls with masonry veneers.
- Solid Concrete or Masonry - Solid precast or poured-in-place concrete as well as concrete masonry units with grouted cells. In making this selection, you must also indicate whether the insulation will be located on the interior or exterior of the wall. If insulation will be placed on both the interior and exterior of the wall, select the option corresponding to the larger insulative **R-value**. For example, if R-5 exterior sheathing will be used with R-13 interior cavity insulation on a furred concrete wall, select

the *Interior Insulation* option. To receive full credit for light-weight (insulated) concrete walls, use the *Other* wall type.

- **Masonry Block with Empty Cells** - Concrete masonry block units with at least 50% of the cells free of grout. In making this selection, you must also indicate whether the insulation will be located on the interior or exterior of the wall. If insulation will be placed on both the interior and exterior of the wall, select the option corresponding to the larger insulative R-value. To receive full credit for light-weight (insulated) concrete walls, use the *Other* wall type.
- **Masonry Block with Integral Insulation** - Concrete masonry block units with integral insulation, such as perlite or rigid foam inserts. Integral insulation means insulation placed within the cells. Selecting this wall type gives you credit for integral insulation. DO NOT enter values for cavity R-value and continuous R-value unless additional insulation will be installed. In making this selection, you must also indicate whether the additional insulation will be located on the interior or exterior of the wall. If additional insulation will be placed on both the interior and exterior of the wall, select the option corresponding to the larger insulative R-value. To receive full credit for light-weight (insulated) concrete walls, use the *Other* wall type.
- **Log** - Walls constructed from 5" or larger nominal width logs.

NOTE: Concrete, masonry, and log walls with 7" or larger nominal width logs receive a mass wall credit in some locations. In order to qualify for this credit, the heat capacity of the exterior wall must be greater than or equal to 6 Btu/ft<sup>2</sup> °F [123 kJ/m<sup>2</sup> °K] of exterior wall area. Masonry and concrete walls having a mass greater than or equal to 30 lb/ft<sup>2</sup> of exterior wall area (146 kg/m<sup>2</sup>) will meet this requirement. Masonry and concrete walls with lesser mass should be entered as wood-framed walls. Log walls with 5" and 6" nominal width logs may be entered as log walls, but will not receive the mass wall credit. The insulating value of the logs themselves is accounted for in the software. You should only enter a cavity R-value if there is additional insulation being used.

**Vermont:** The Vermont residential code has lesser overall thermal envelope requirements but greater heating system efficiency requirements for log wall homes. Contact the Department of Public Service to find out more about log homes and their requirements.

- **Structural Insulated Panels** - Typically 4" to 6" stressed-skin panels with foam insulation sandwiched between oriented strand-board (OSB). For SIPs assemblies, you must provide the manufacturer-reported R-value in the **Continuous Insulation R-Value** field.
- **Insulated Concrete Forms** - ICFs are insulating, stay-in-place forms for poured concrete walls. The forms, which remain a permanent part of the

wall assembly, are either pre-formed interlocking blocks or separate panels connected with plastic ties. For ICF systems, you must provide the manufacturer-reported R-value in the Continuous Insulation R-Value field. This R-value should include air films and all materials used in the assembly, including insulation but excluding soil effects. The effects of mortar joints and steel framing reinforcement that penetrates insulation must be included. The R-value of the insulation only may not be used. To determine the total assembly R-value, manufacturers may use the Series-Parallel method described in the ASHRAE Fundamentals Handbook, or may provide third-party independent test results from a physical testing laboratory. Acceptable physical testing procedures include ASTM C177, ASTM C518, ASTM C236 or ASTM C976. Tested R-value results should be included with permit submittals.

- Other - Wall assemblies that do not fit into any of the other above-grade wall types. Also use the *Other* wall type to receive full credit for the extra insulative value of light-weight (insulated) concrete walls. You must enter an overall **U-factor** for the entire wall assembly (including air films). Be prepared to provide the building department with manufacturers' literature or documentation of U-factor calculations.

**Wisconsin:** Assembly U-factors entered under the *Other* wall type must be approved through the Department of Commerce.

## Wall Software Inputs

- Gross Area - Enter the gross area of the wall component in the *Gross Area* field. The **gross wall area** includes the area of all windows and doors within the wall. You must link the wall to the windows and doors within that wall by using the tree on the left side of the *Envelope* screen. To link a window or **door** to a wall, drag the window or door label on the tree to the wall label and release the mouse. The gross wall area also includes the peripheral edges of floors (the area of the band joist and subfloor between floors).

The gross area of any individual wall of a conditioned basement with an average depth less than 50% below grade should be entered as a wall (not as a basement). In this case, the gross wall area includes the below-grade portion of the wall and the areas of doors and windows within those walls.

- **Cavity Insulation** R-Value - Enter the R-value of any insulation to be installed in the cavities between above-grade wall structural members. The insulating values of other parts of the building assembly (e.g., gypsum board and air films) are accounted for by the program and should not be included.

- Continuous Insulation R-Value - Enter the R-value of any continuous insulation in the above-grade wall. Continuous insulation is continuous over framing members or furring strips and is free of significant thermal bridging. The R-values of other parts of the building assembly (e.g., gypsum board and air films) are accounted for by the program and should not be entered. Insulating sheathing installed on the exterior of above-grade walls is an example of continuous insulation. For structural insulated panels and insulated concrete forms, enter the manufacturer-reported R-value for the entire assembly.
- Assembly U-Factor - If you have selected the *Other* wall type, enter the overall U-factor of the above-grade wall assembly including exterior and interior air films. Building departments may require supporting documentation for assemblies entered using the *Other* wall type and *U-Factor* field.

## Windows

Windows are defined as any transparent or translucent section in an exterior building wall including glass block but excluding glass doors (which are entered using the **Door** button). **Glazing** having a slope greater than 60 degrees from horizontal is considered a window while glazing having a slope less than 60 degrees from horizontal is considered a **skylight**.

Click the *Window* button to add a window component to the description of your design on the *Envelope* screen. Each unique window assembly should be entered as a separate component, but multiple window elements having the same characteristics may be entered as one component with an appropriate total area.

Windows must be linked to their corresponding wall component. Link a window to a wall by using the tree label on the left side of the *Envelope* screen. Drag the window or door label on the tree to the wall label and release the mouse. Windows in the exterior walls of conditioned basements should be included in the table and should be linked to their corresponding **basement wall** assembly. Windows in **unconditioned** basements are NOT included.

## Window Types

- Frame Type - The frame type enables you to identify the window frame material. Use *Other* for frame types that do not fit into any of the other frame types.
- Glazing Layers - The glazing layers enables you to identify the number of glazing layers in the windows (i.e., single, double, or triple). Double Pane

with Low-E is included because the performance impact of low-emissivity films is similar to that of additional glass layers.

## Window Software Inputs

- Gross Area – Enter the area of the entire window component in square feet (ft<sup>2</sup>) in the *Gross Area* field. Window area is the interior surface area of the entire assembly, including glazing, sash, curbing, and other framing elements. The nominal area or rough opening is also acceptable for flat windows.
- **U-Factor** – Enter the U-factor for each component in its corresponding *U-Factor* field. U-factors for glazing must be tested and documented by the manufacturer in accordance with the NFRC test procedure or taken from the default glazing U-factors table in the default tables. Center-of-glass U-factors cannot be used.

**Minnesota:** The Minnesota residential code further requires that the area-weighted average U-factor of all foundation windows 5.6 ft<sup>2</sup> and less not exceed 0.51. The area-weighted average U-factor of all skylights may not exceed 0.55. The area-weighted average U-factor for all other windows and sliding glass doors may not exceed 0.37.

- **Locations <3500 HDD when 1998 IECC or 2000 IECC is selected, or when Pima County 2000 IECC < 4000 ft or Georgia Calendar year 2004 and beyond is selected:** The Solar Heat Gain Coefficient enables you to specify the glazing's effectiveness in rejecting solar heat gain. **SHGC** is part of a system for rating glazing performance used by the National Fenestration Rating Council (NFRC). If you are using glass whose performance is listed in terms of shading coefficient (SC), you may convert to SHGC by multiplying the SC value by 0.87.

## Doors

Click the **Door** button to add a door component to the description of your design on the *Envelope* screen. Each unique door assembly should be entered as a separate component, but multiple door elements sharing the same construction may be entered as one component with the appropriate total area.

### Door Types

- Solid (under 50% **glazing**) - Exterior doors that are mostly opaque (i.e., glass covers 50% or less of the door's area).

- Glass (over 50% glazing) - Exterior doors that are mostly glazed (i.e., glass covers more than 50% of the door's area).
- Sidelites: Decorative door sidelites can be included with the door area and **U-factor** if an aggregate U-factor is known for the entire assembly (the door plus all sidelites). If the U-factor rating does not include the sidelites, enter the sidelites separately as windows and use a default glazing U-factor from the default tables.

## Door Software Inputs

- Gross Area – Enter the total area of the door in square feet (ft<sup>2</sup>) including any glazed portions in the *Gross Area* field. The nominal area or rough opening is also acceptable.
- U-Factor – Door U-factors must be tested and documented by the manufacturer in accordance with the NFRC test procedure or taken from the default door U-factors table.
- **Locations <3500 HDD when 1998 IECC or 2000 IECC is selected, or when Pima County 2000 IECC < 4000 ft or Georgia Calendar year 2004 and beyond is selected:** SHGC – For glass doors, the Solar Heat Gain Coefficient enables you to specify the glazing's effectiveness in rejecting solar heat gain. SHGC is part of a system for rating glazing performance used by the National Fenestration Rating Council (NFRC). If you are using glass whose performance is listed in terms of shading coefficient (SC), you may convert to SHGC by multiplying the SC value by 0.87.

If the door is rated with an aggregate **R-value** (an R-value that includes both the glass and opaque area), the following equation applies:

$$U - \text{Factor} = \frac{1}{R - \text{Value}}$$

If an opaque door contains glass and an aggregate R-value or U-factor rating for that door is not available, enter the door's glass area as a separate glazing component, enter the opaque area as an opaque door component, and enter an opaque door U-factor taken from the default tables. The U-factors listed in the default tables are only for doors without glass.

## Basements

Any individual wall of a conditioned basement with an average depth 50% or more below grade should be entered using the *Basement* button. Walls of

conditioned basements with an average depth LESS than 50% below grade should be entered as an above-grade wall using the *Wall* button.

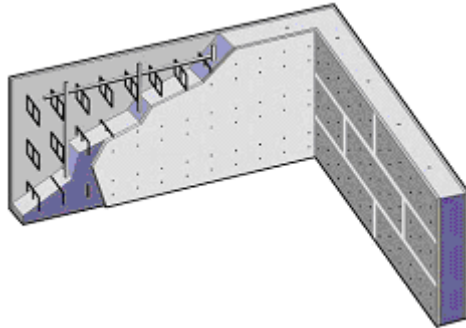
Click the *Basement* button to add a **basement wall** component to the description of your design on the *Envelope* screen. Each unique basement wall assembly should be entered as a separate component, but multiple basement wall elements sharing the same construction may be entered as one component with the appropriate total area.

**2000 IECC** requires exterior foundation wall insulation to have a rigid, opaque, and weather-resistant covering that prevents the degradation of the insulation's performance. The protective covering must cover the exposed (above-grade) area of the insulation and extend to a minimum of 6 in. (153 mm) below grade.

## Basement Wall Types

- Solid Concrete or Masonry - Solid precast or poured-in-place concrete as well as concrete masonry units with grouted cells. To receive full credit for light-weight (insulated) concrete walls, use the *Other* basement wall type.
- Masonry Block with Empty Cells – Concrete masonry block units with at least 50% of the cells free of grout. To receive full credit for light-weight (insulated) concrete walls, use the *Other* basement wall type.
- Masonry Block with Integral Insulation - Concrete masonry block units with integral insulation, such as perlite or rigid foam inserts. Integral insulation means insulation placed within the cells. Selecting this wall type gives you credit for integral insulation. DO NOT enter values for cavity **R-value** and continuous R-value unless additional insulation will be installed. To receive full credit for light-weight (insulated) concrete walls, use the *Other* basement wall type.
- Wood Frame - Wood-frame walls with any stud spacing.
- Insulated Concrete Forms - ICFs are insulating, stay-in-place forms for poured concrete walls. The forms, which remain a permanent part of the wall assembly, are either pre-formed interlocking blocks or separate panels connected with plastic ties. For ICF systems, you must provide the manufacturer-reported R-value in the **Continuous Insulation R-Value** field. The assembly R-value should include air films and all materials used in the assembly, including insulation but excluding soil effects. The effects of mortar joints and steel framing reinforcement that penetrates insulation must be included. The R-value of the insulation only may not be used. To determine the total assembly R-value, manufacturers may use the Series-Parallel method described in the ASHRAE Fundamentals Handbook, or may provide third-party independent test results from a

physical testing laboratory. Acceptable physical testing procedures include ASTM C177, ASTM C518, ASTM C236 or ASTM C976. Tested R-value results should be included with permit submittals.



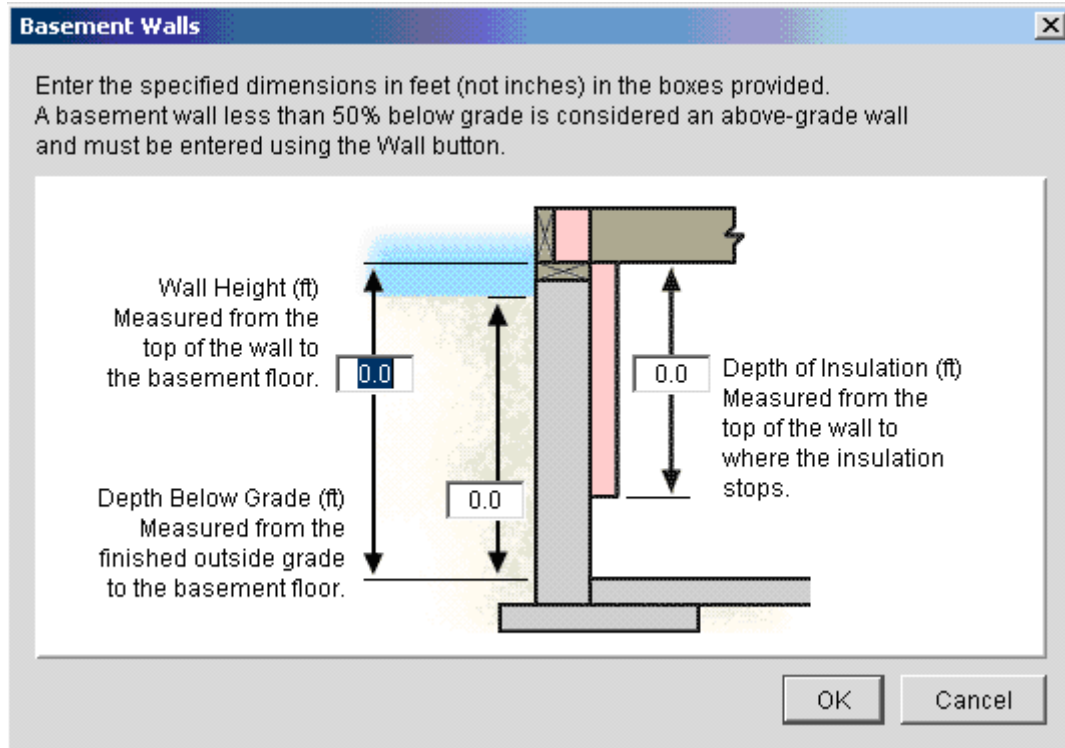
*Cutaway of Insulated Concrete Form (ICF) - Courtesy of Portland Cement Association*

- Other - Basement wall assemblies that do not fit into any of the other basement wall types. Also use the *Other* basement wall type to receive full credit for the extra insulative value of light-weight (insulated) concrete walls. If you use the *Other* basement wall type, you must enter an overall **U-factor** for the entire wall assembly (including interior air film but excluding earth). Be prepared to provide U-factor calculations or documentation from manufacturer's literature to the building department.

**Wisconsin:** Assembly U-factors entered under the *Other* wall type must be approved through the Department of Commerce.

## Basement Software Inputs

After selecting a basement wall type, a basement wall illustration will appear with input boxes for the basement wall height, depth below grade, and depth of insulation. The illustration helps identify the dimensions being requested. You may enter basement wall dimensions directly into this illustration and select the *OK* button to have them transferred to the corresponding row in the table on the *Envelope* screen. If you prefer to enter the dimensions directly into the table on the *Envelope* screen, you can select *Cancel* to remove the illustration without entering dimensions. To view the basement wall illustration and inputs at a later time, click the right-mouse button anywhere on the basement row and select *Edit Basement Inputs* from the popup menu.



- Wall Height - Provide the height of the wall (ft) as measured from the top of the wall to basement floor. If the height is not uniform, provide an average height. If you are entering a partial basement wall component (such as wood kneewalls), enter the height of the wall section instead of the height of the entire wall.
- Depth Below Grade - Provide the depth (ft) that the wall extends from the finished outside grade surface to the basement floor. If the grade is sloped or uneven, provide an average depth below grade. If you are entering a partial basement wall component (such as wood kneewalls), enter the depth below grade of the wall section instead of the depth below grade of the entire wall. For wood kneewalls, the wall section may be entirely above grade, in which case you would enter 0.
- Depth of Insulation - Basement insulation requirements are for the full depth of the basement wall (up to 10 ft). REScheck, however, allows the depth of the basement wall insulation to be traded against other envelope components. Therefore, you must indicate the depth (ft) of the insulation you intend to install on your basement wall as measured from the top of the wall to where the insulation stops. The insulation must extend from the top of the basement wall downward to a depth equal to the value entered in this field. Note that for a fully insulated wall the depth of insulation should be equal to the height of the wall. For basement walls with non-uniform insulation depths, enter an average. REScheck accepts basement insulation depths from 0 to 12 ft. If you enter an insulation

depth of 0, the program assumes no insulation is installed regardless of the values in the *Cavity Insulation R-Value* and *Continuous Insulation R-Value* fields.

- Gross Area - Enter the gross area of the basement wall component in the *Gross Area* field. The gross basement wall area includes the area of all windows and doors within the wall. You must link the wall to the windows and doors within that wall by using the tree on the left side of the *Envelope* screen. To link a window or **door** to a wall, drag the window or door label on the tree to the wall label and release the mouse.

The gross area of any individual wall of a conditioned basement with an average depth less than 50% below grade should be entered as a wall (not as a basement).

- **Cavity Insulation** R-Value - If the basement will be furred, provide the R-value of the insulation to be installed between furring in the *Cavity Insulation R-Value* field. Do not include the R-value of other materials (such as interior drywall).
- Continuous Insulation R-Value - Enter continuous insulation in the *Continuous Insulation R-Value* field. Continuous insulation includes exterior rigid foam products and any continuous insulation installed on the exterior or interior of an unfurred basement wall. For ICFs, enter the manufacturer-reported R-value for the entire assembly in the *Continuous Insulation R-Value* field.

**Georgia:** The Georgia Residential Code does not allow below-grade exterior foam plastic insulation.

**Minnesota:** R-5 is the minimum basement wall insulation R-value allowed by the Minnesota residential code.

### **Example 1: Wood Kneewalls**

Assume a basement is to be constructed with 3-ft-high wood kneewalls built on a 5-ft-high concrete foundation. R-13 insulation will be installed in the wood kneewall cavities and R-5 rigid insulation will be installed on the concrete foundation walls.

The wood kneewalls are completely above grade and fully insulated. The concrete foundation walls are 4 ft below grade and fully insulated.

Create one basement wall component for the wood kneewalls and enter the following information:

- Wall Height 3 ft.

- Depth Below Grade 0 ft.
- Depth of Insulation 3 ft.

Create a second basement wall component for the concrete foundation and enter the following information:

- Wall Height 5 ft.
- Depth Below Grade 4 ft.
- Depth of Insulation 5 ft.

Two basement wall components will be added to your list of building components. Provide the **gross wall area** of the wood kneewalls and enter the insulation R-value as R-13 in the *Cavity Insulation R-Value* field. Provide the gross wall area of the concrete foundation walls and enter the cavity R-value as R-5 in the *Continuous Insulation R-Value* field.

## Example 2: Walk-Out Basement

Assume an 8-ft. basement is to be built on a slope so that the front wall is 7 ft. below grade and the rear wall is totally above grade. The ground level along both side walls is sloped so that approximately 50% of each wall is below grade. The rear basement wall will be wood-frame construction with R-19 cavity insulation. The other three walls will be concrete walls with R-10 rigid insulation. All four walls will be fully insulated.

Create one basement component for the front wall and enter the following information:

- Wall Height 8 ft.
- Depth Below Grade 7 ft.
- Depth of Insulation 8 ft.

The two side walls are at least 50% below grade, so they are entered as a basement wall component. If they were less than 50% below grade, they would be entered as an above-grade wall component. Therefore, create a second basement wall component for the two side walls and enter the following information:

- Wall Height 8 ft.
- Depth Below Grade 4 ft.
- Depth of Insulation 8 ft.

The rear wall is fully above grade and should be entered as an above-grade wall using the *Wall* button. Note that the basement floor along this wall should be considered a slab-on-grade component. Create a slab component using the *Floor* button and enter the length of the basement floor along this wall in the *Gross Area or Slab Perimeter* field.

### **Example 3: Below-Grade Exterior Insulation**

An 8-ft. high by 21-ft. wide foundation wall is 7 ft. below grade and is to be insulated using R-5 exterior rigid foam. The insulation will start at grade level and run down to the bottom of the foundation wall. There is 1 foot of uninsulated exposed above-grade wall. The wall has no openings.

This wall is entered in REScheck by creating two basement wall components. The first component will be used for entering the uninsulated above-grade portion of the wall.

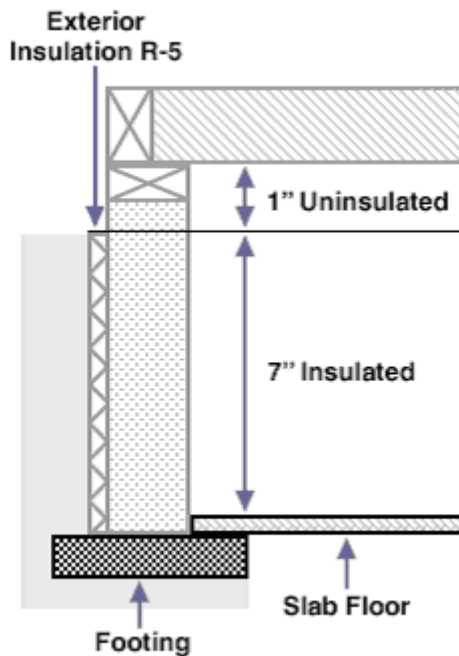
Click the *Basement* button and enter the following information:

- Wall Height 1 ft.
- Depth Below Grade 0 ft.
- Depth of Insulation 0 ft.

The second component will be used for entering the insulated below-grade portion of the wall. Click the *Basement* button again and enter the following information:

- Wall Height 7 ft.
- Depth Below Grade 7 ft.
- Depth of Insulation 7 ft.

After these components have been created, enter the gross area of each component and the R-value of the insulation used on the below-grade component.



#### Example 4: Draped Interior Insulation

Some builders choose to insulate the interior of basement walls with faced insulation batts. Some products have reinforced stapling tabs at the top and bottom of the batts for installation on furring strips using a hammer-stapler. They might also be power-nailed directly to a solid concrete or block wall or installed on pins glued directly to the foundation wall. The batts typically come in 4-ft. wide rolls, and are sometimes installed on only the top four ft. of the wall.

A solid concrete basement has 10-ft. high walls and is buried 9 ft. below grade. Foil faced, R-11 basement batt insulation is to be installed on the first four ft. of the interior of the basement walls. Click the *Basement* button, select the *Solid Concrete or Masonry* option, and enter the following information:

- Wall Height 10 ft.
- Depth Below Grade 9 ft.
- Depth of Insulation 4 ft.

With these inputs, the software will assume the lower 6 ft. of the wall is uninsulated. The R-value of the uninsulated concrete wall is provided by the software and should not be entered by the user. After the basement component has been created, enter the sum of the gross area of all exterior basement walls in the *Gross Area* field and enter the assembly R-value (R-11) in the *Continuous*

*Insulation R-Value* field. Note that the gross area equals the sum of the insulated and uninsulated areas.

## Floors

Click the *Floor* button to add a floor component to the description of your design on the *Envelope* screen. Each unique exposed floor assembly should be entered as a separate component, but multiple floor elements sharing the same construction may be entered as one component with the appropriate total area. Slab-on-grade components include all slab edges that are part of the **building envelope** and are less than 12" below grade (i.e., all edges separating conditioned from **unconditioned** space). Edges of slab floors over 12" below grade (such as basement floors) are not subject to code requirements and do not need to be entered in the software. Each unique concrete slab/insulation combination (i.e., insulation **R-value** and depth) should be entered separately, but all slabs sharing insulation methods may be entered as a single component with the appropriate total perimeter length.

**2000 IECC** requires slab perimeter insulation to have a rigid, opaque, and weather-resistant covering that prevents the degradation of the insulation's performance. The protective covering must cover the exposed (above-grade) area of the insulation and extend to a minimum of 6 feet (153 mm) below grade.

## Floor Types

- All-Wood Joist/ Truss - Any structural wood floor in which insulation is placed between the structural members; e.g., batt insulation between wood floor joists.
- Structural Insulated Panels - Typically 4" to 6" stressed-skin panels with foam insulation sandwiched between oriented strand-board (OSB). For SIPs assemblies, you must provide the manufacturer-reported R-value in the **Continuous Insulation R-value** field.
- Slab-On-Grade Unheated - A slab that is not **heated**.
- Slab-On-Grade Heated - A heated slab is one in which the heating elements or hot air distribution system is in contact with or placed within the slab or subgrade. Heated slabs have higher insulation requirements than unheated slabs under the code.

**Georgia:** The Georgia Residential Code does not allow below-grade exterior foam plastic insulation, but does give some credit for carpet or hardwood on plywood applied to slab floors. If the code is set to

*Georgia*, you will also be asked to indicate whether the slab is covered with either of these treatments.

**Minnesota:** R-5 is the minimum slab perimeter insulation R-value allowed by the Minnesota residential code.

- Other - Floor assemblies that do not fit into any of the other floor types. You must enter an overall **U-factor** for the entire floor assembly (including air films). Be prepared to provide the building department with manufacturers' literature or documentation of U-factor calculations.
- Floor Location - For some floor types you must also indicate whether the floor is located over an unconditioned space or over outside air. Floors over unconditioned space include all floors over unconditioned (neither heated nor **cooled**) basements, crawl spaces, and garages. Floors over outside air include floor cantilevers, floors of an elevated home, and floors over overhangs (such as the floor directly above a recessed entryway or open carport). Floors over heated spaces are not part of the building envelope and should not be included.

## Floor Software Inputs

- Gross Area or Slab Perimeter - Enter the gross area of the floor (in square feet) along the boundary where it separates conditioned from unconditioned space. For slabs-on-grade, enter the perimeter (in linear feet) which should include the length of all edges of a slab foundation that are part of the building envelope and are less than 12" below grade.
- **Cavity Insulation** R-Value - Enter the R-value of any insulation to be installed in the cavities between floor structural members. The insulating values of other parts of the building assembly (e.g., subfloor and air films) are accounted for by the program.
- Continuous Insulation R-Value - Enter the R-value of any continuous floor insulation. Continuous insulation is insulation that runs continuously over structural members and is free of significant thermal bridging. The insulating values of other parts of the building assembly (e.g., subfloor and air films) are accounted for by the program. For slabs, enter the R-value of the slab perimeter insulation.

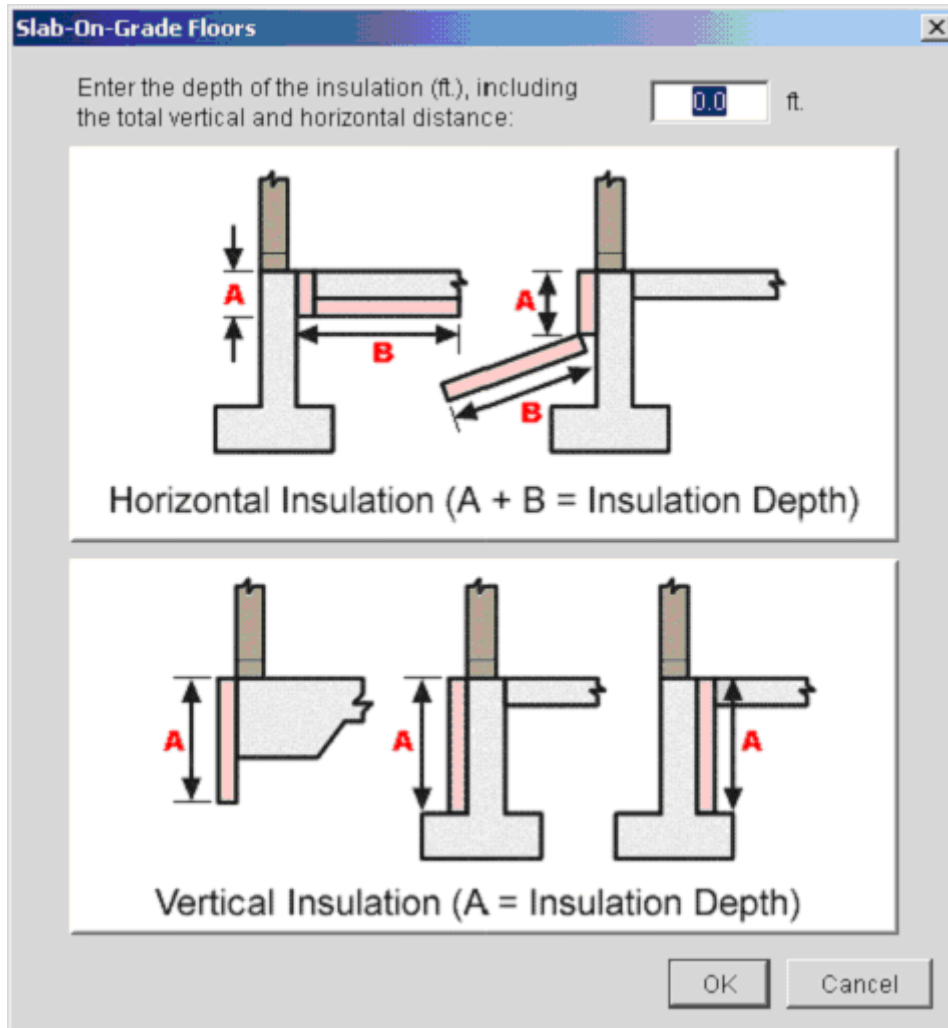
**Georgia:** The Georgia Residential Code does not allow below-grade exterior foam plastic insulation. The *Continuous Insulation R-Value* field is disabled when the code is set to *Georgia*.

- Assembly U-Factor - If you have selected the *Other* floor type option, you must enter the overall U-factor of the floor assembly including exterior and interior air films. Building departments may require supporting

documentation for assemblies entered using the *Other* floor type and *U-Factor* field.

- Depth of Insulation - Enter the depth (ft) of the insulation you intend to install as measured from the top of the slab to where the insulation stops. This distance should include the total vertical plus horizontal distance. Refer to the illustration below of acceptable configurations. If you enter a depth of 0, the program assumes no insulation is to be installed.

After selecting a slab type, an illustration of various slab configurations will appear with an input box for the depth of insulation. The illustration helps identify the dimension being requested for various insulation configurations. You may enter the depth of insulation directly into this illustration and select the *OK* button to have it transferred to the corresponding row in the table on the *Envelope* screen. If you prefer to enter the insulation depth directly into the table on the *Envelope* screen, you can select *Cancel* to remove the illustration without entering a value. To view the slab illustration at a later time, click the right-mouse button anywhere on the slab row and select *Edit Slab Input* from the popup menu.



## Crawl Space Walls

The **crawl space** wall option is for walls of unventilated crawl spaces (i.e. not directly vented to the outside). If you are insulating the floor above the crawl space, do not use the crawl space walls option.

Click the *Crawl Wall* button to add a crawl space wall component to the description of your design on the *Envelope* screen. Each unique crawl space wall assembly should be entered as a separate component, but multiple crawl space wall elements sharing the same construction may be entered as one component with the appropriate total area.

## Crawl Space Wall Types

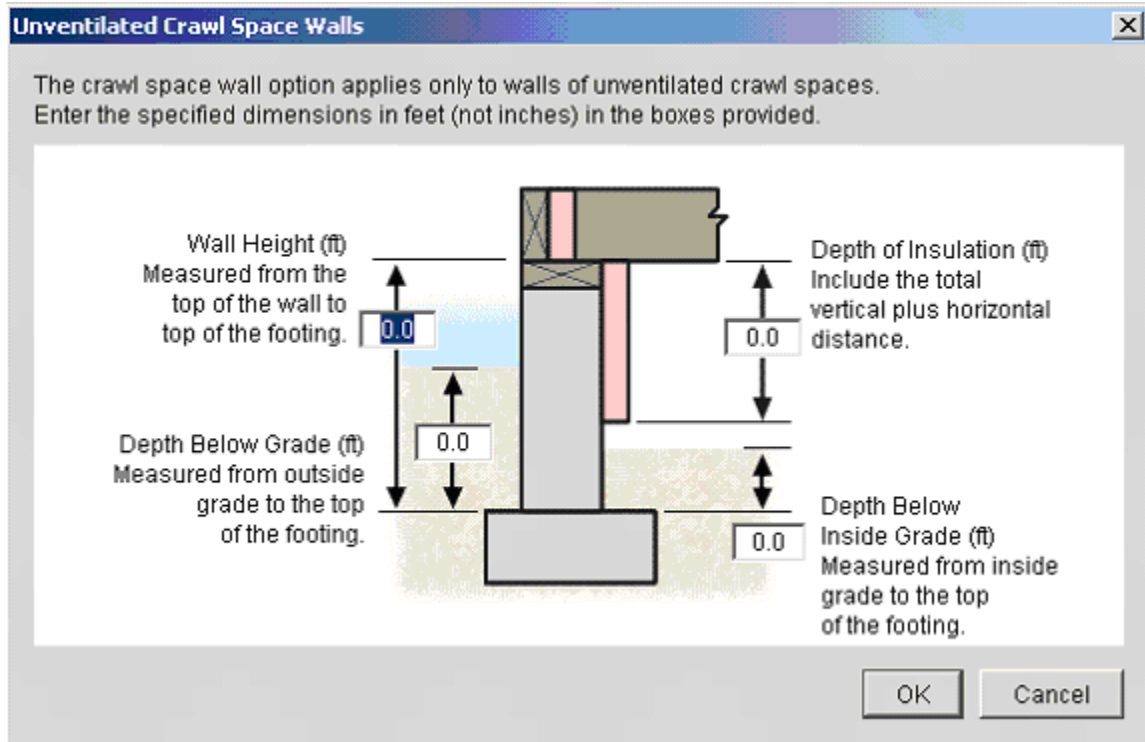
- Solid Concrete or Masonry - Solid precast or poured-in-place concrete as well as concrete masonry units with grouted cells. To receive full credit for

light-weight (insulated) concrete walls, use the *Other* crawl space wall type.

- **Masonry Block with Empty Cells** - Concrete masonry block units with at least 50% of the cells free of grout. To receive full credit for light-weight (insulated) concrete walls, use the *Other* crawl space wall type.
- **Masonry Block with Integral Insulation** - Concrete masonry block units with integral insulation, such as perlite or rigid foam inserts. Integral insulation means insulation placed within the cells. Selecting this wall type gives you credit for integral insulation. DO NOT enter values for cavity **R-value** and continuous R-value unless additional insulation will be installed. To receive full credit for light-weight (insulated) concrete walls, use the *Other* crawl space wall type.
- **Wood Frame** - Wood-frame walls with any stud spacing.
- **Insulated Concrete Forms** - ICFs are insulating, stay-in-place forms for poured concrete walls. The forms, which remain a permanent part of the wall assembly, are either pre-formed interlocking blocks or separate panels connected with plastic ties. For ICF systems, you must provide the manufacturer-reported R-value in the *Continuous R-Value* field.
- **Other** - Crawl space wall assemblies that do not fit into any of the other crawl space wall types. Also use the *Other* crawl space wall type to receive full credit for the extra insulative value of light-weight (insulated) concrete walls. If you use the *Other* crawl space wall type, you must enter an overall **U-factor** for the entire wall assembly (including interior air film but excluding earth). Be prepared to provide U-factor calculations or documentation from manufacturer's literature to the building department.

## Crawl Space Wall Software Inputs

After selecting a crawl space wall type, a crawl space wall illustration will appear with input boxes for the crawl space wall height, depth below grade, depth of insulation, and depth below inside grade. The illustration helps identify the dimensions being requested. You may enter crawl space wall dimensions directly into this illustration and select the *OK* button to have them transferred to the corresponding row in the table on the *Envelope* screen. If you prefer to enter the dimensions directly into the table on the *Envelope* screen, you can select *Cancel* to remove the illustration without entering dimensions. To view the crawl space wall illustration and inputs at a later time, click the right-mouse button anywhere on the crawl space row and select *Edit Crawl Inputs* from the popup menu.



- Wall Height (ft) - Provide the height of the wall (ft) as measured from the sill to the top of the footing.
- Depth Below Grade (ft) - Provide the depth (ft) that the wall extends from the outside finished grade surface to the top of the footing.
- Depth of Insulation (ft) - Provide the depth (ft) of the insulation you intend to install as measured from the top of the wall to where the insulation stops. This distance should include the total vertical plus horizontal distance. Because the horizontal distance is included, the depth of insulation may be greater than the height of the wall. If you enter a depth of 0, the program assumes no insulation is to be installed.
- Inside Depth Below Grade (ft) - Provide the depth (ft) as measured from the inside grade to the top of the footing.
- Gross Area - Enter the gross area of the crawl space wall component in the *Gross Area* field. The area should include the area of the entire wall as measured from the sill to the top of the footing, even if only a portion of the wall is insulated.
- **Cavity Insulation** R-Value - Provide the R-value of any insulation to be installed between structural members in the *Cavity Insulation R-Value* field. Do not include the R-value of other materials.

- **Continuous Insulation R-Value** - Continuous insulation includes exterior rigid foam products and any continuous insulation installed on the exterior or interior of the wall. For ICFs, enter the manufacturer-reported R-value for the entire assembly in the *Continuous Insulation R-Value* field.

**Georgia:** The Georgia Residential Code does not allow below-grade exterior foam plastic insulation.

**Massachusetts:** The Massachusetts Code does not allow crawl space wall insulation and therefore the *Crawl Wall* button does not appear on the *Envelope* screen when the code is set to *Massachusetts*. The floor above the crawl space must be insulated.

**Minnesota:** R-5 is the minimum crawl space wall insulation R-value allowed by the Minnesota residential code.

# Mechanical Folder

Use the blue-on-white buttons at the top of the *Mechanical* folder to enter the HVAC equipment in your proposed design. Completion of this section of the software is entirely optional. However, using high-efficiency HVAC equipment may improve the percentage by which your building compares with the code building. The message at the bottom of the screen explains what type of information goes into the currently selected field.

## Mechanical Equipment

### What to do if your mechanical equipment is not an option in the software

REScheck does not allow tradeoffs for ground source heat pumps, forced hot water, and some other systems in the *Mechanical* folder. The software does allow tradeoffs with air source heat pumps, fossil fuel furnaces, boilers, and air conditioners.

Note, however, that you do NOT have to enter mechanical equipment information at all unless you are using such equipment in a tradeoff. Simply do not fill out the *Mechanical* folder at all - the software will judge compliance based only on your envelope inputs.

Although mechanical information is not required in REScheck, building codes do have requirements for mechanical equipment, which may include sizing, thermostats, piping insulation, and others.

If you are installing a system that is not handled in REScheck, you should do three things to help your code official.

1. Make a note in the *Project* folder that gives your mechanical system specifics.
2. Attach documents to your REScheck compliance report that provide information about equipment type, efficiency, installation, and sizing.
3. Meet the appropriate requirements for the mechanical code in your area.

### Why some mechanical equipment is not available in the REScheck software

REScheck makes only the most common equipment types available for tradeoff (those types which are covered by Federal appliance standards and are rated with an AFUE, SEER, or HSPF). Other systems such as radiant floors, geothermal heat pumps, evaporative coolers, and others require complex

calculations not available in REScheck. These systems can receive tradeoff credit only through a whole-house performance (i.e., Chapter 4) analysis.

You may consider using another software tool to do full performance analyses. If you use an energy simulation approach with a high-efficiency equipment type, be aware that you are reducing your building envelope energy efficiency while increasing equipment efficiency. It may be better to increase both the equipment efficiency and the building envelope energy efficiency.

## HVAC Efficiency

Trade-offs are allowed for efficient gas and oil furnaces, boilers, and electric heat pumps and air conditioners. No credit is given for electric resistance heating.

Minimum-required heating and cooling equipment efficiencies are displayed in the *Minimum Efficiency* column. If the efficiency of the equipment you plan to install exceeds these minimums, you qualify for the high-efficiency equipment credit. Enter the annual fuel utilization efficiency (**AFUE**), heating seasonal performance factor (**HSPF**), or seasonal energy efficiency ratio (**SEER**) in the appropriate column.

You can receive credit for only one piece of heating equipment and one piece of cooling equipment (or a single heat pump). When multiple heating equipment or multiple cooling equipment is entered, the least efficient equipment will be used to determine compliance. However, if two furnaces having different efficiencies will be installed, you may create a single furnace entry and enter the average efficiency of both units in the *Heating Efficiency* field. In this case, modify the output report to indicate that the reported efficiency is an average. Enter the make and model number of BOTH pieces of equipment on the line provided in the *Inspection Checklist* portion of the output report.

The high-efficiency equipment credit is applied as a percent increase in the code house **UA**. To see how much credit you are getting, observe the UA value displayed in the *Max. UA* field. The UA will probably be smaller before taking the credit than after. Some locations along the California coast do not qualify for the cooling equipment credit.

**New York:** The New York residential code does not give additional credit for heat pumps.

**Wisconsin:** The Wisconsin residential code requires furnaces (non-electric) to have an efficiency rating of 90% or better to receive credit. Buildings **heated** with heat pumps are treated like homes with electric resistance heating. However, credit is given for heat pumps with HSPF ratings of 7.8 or better. Boiler systems receive credit for any value above 80%.

# Wisconsin Heating Loads

The Wisconsin residential code requires a load calculation for sizing the heating equipment of the building. In the *Loads* folder, enter values for the floor area, **ceiling** height, infiltration rate, and oversizing factor. Once these values are entered into the software, the *Total Building Heating Load* is calculated and can be used for selecting properly sized heating equipment. The total building heating load is the sum of the loads from the assemblies entered in the *Envelope* folder (*Conductive Losses*), the infiltration loads (*Infiltration Losses*), and the loads resulting from the oversizing factor (*Oversizing Factor Losses*).

- **Conditioned Floor Area** - The conditioned floor area includes the gross floor area of all **heated** rooms, including heated basement floor area.
- **Average Ceiling Height** - The average ceiling height is the area-weighted average height of the ceiling as measured from the finished floor to the underside of the ceiling.
- **Infiltration Rate** - The infiltration rate is the normalized air changes per hour that is anticipated for your building. The software will not accept values above 0.5 ACH or below 0.20 ACH.
- **Equipment Oversizing Factor** - The equipment oversizing factor is a percentage indicating the amount of oversizing you desire in selecting your heating equipment. The software will not accept values over 15%.

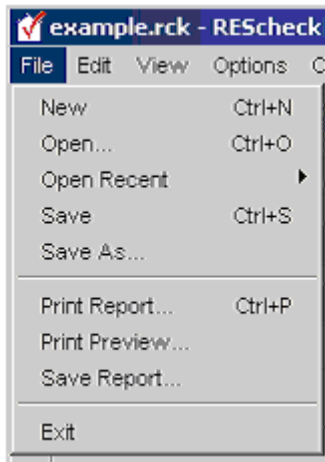
# Menus

The menu bar located at the top of the *Envelope* screen is used to select the *File*, *Edit*, *View*, *Options*, *Code*, *Tools*, and *Help* menus.


## File Menu

The data you enter into REScheck can be stored on your hard drive in a project data file. Separate data files can be created for different building projects or for alternate designs of the same project. Data files allow you to retrieve and alter designs at any time. Report files allow you to print the information you have entered and to document the compliance results determined by REScheck. The *File* menu contains options allowing you to create (*New*), retrieve (*Open*), and save project data files and to print project reports.

Data files created by REScheck must have the extension .CCK or .RCK, and report files must have the extension .RPT. If you prefer, when you are asked to provide a filename, you may leave the extensions off and let REScheck enter them for you.



### File Menu

 **New** - The *New* option allows you to erase the current data and begin a new project data file. When you select *New* and unsaved data exists, REScheck asks if you wish to save the current data. Select *Yes* to save the current data or *No* if you do not want to save the current data. If you select *Yes* and a file is already open, the open file is updated to contain the current data. If no file is open, the *Files* screen appears and you are asked for a filename to which the data will be saved. You can also open a new file by selecting the corresponding icon from the toolbar.



**Open** - When you want to revise or examine an existing file, you must retrieve a copy of the file by bringing it to the screen. This is referred to as opening the file. The *Open* option allows you to open an existing project data file. When you select *Open*, the *Files* screen appears and you are asked for the filename of the project data file to retrieve. If unsaved data exists, you are asked if you wish to save the current data before opening the new file. If an unsaved file is already open, you are asked if you wish to save the currently open file before opening the new file. You can also open an existing file by selecting the corresponding icon from the toolbar.

**Open Recent** - The *Open Recent* option allows you to quickly access the most recently opened files.



**Save** - The *Save* option allows you to save your current data to the filename shown on the title bar. If no file is open, the *Files* screen appears and you are asked for a filename. You can also save data by selecting the corresponding icon from the toolbar.

**Save As** - The *Save As* option allows you to save your current project data file to a new name. This option is useful when an existing file is opened then modified. If you want to save copies of both the original and the modified file, use *Save As* to rename the modified file.



**Print Report** - This option allows you to print a report listing project data and compliance results. A popup window is displayed from which you can elect to print a Compliance Report, an Inspection Checklist, or both. After choosing the report types to print, the *Print* dialog box will appear allowing you to select the number of copies and the printer. You can also print reports by selecting the corresponding icon from the toolbar. The print icon can be used for direct printing, in which case the printer setup dialog is not displayed and the report is sent to the default printer.

**Print Preview** - Select this option to view the Compliance Report and/or Inspection Checklist before printing.

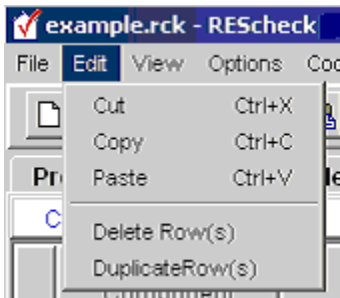
**Save Report** - This option allows you to save a report to a file. A popup window is displayed from which you can elect to generate a Compliance Report, an Inspection Checklist, or both. After choosing the report types, the *Save Report* dialog box will appear allowing you to provide a name for the file. The report will be saved in Rich Text Format (RTF), which can be loaded into most text processing software.

**Exit** - The *Exit* option allows you to exit REScheck.

# Edit Menu

Use the *Edit* menu to cut, copy, and paste data in editable fields, and to delete and duplicate entire rows. Editable fields include:

- The *Date of Plans*, *Title*, *Project*, *Company*, and *Notes* fields on the *Project* screen
- All black-on-white (or red-on-white) fields in the tables on the *Envelope* and *Mechanical* screens
- The tree component labels corresponding to these tables when in edit mode (tree labels are put into edit mode by double-clicking on them).



## Edit Menu



**Cut** - The *Cut* option will delete highlighted text in an editable field and copy it to the clipboard. The deleted text can be pasted into another editable field. You can also cut text by selecting the corresponding icon from the toolbar.



**Copy** - The *Copy* option will copy highlighted text in an editable field to the clipboard. The copied text can be pasted into another editable field. You can also copy text by selecting the corresponding icon from the toolbar.



**Paste** - The *Paste* option will paste the last copied text into the selected field at the current cursor location. You can also paste text by selecting the corresponding icon from the toolbar.



**Delete Row(s)** - The *Delete Row(s)* option will delete all selected rows. To select a row, click on the tree label corresponding to that row or click on the leftmost column of that row (the column containing row numbers). Multiple consecutive rows can be selected by holding down the left mouse button on the left-hand column and dragging it over the desired rows. Non-consecutive rows can be selected by holding down the **Ctrl** key while clicking on the leftmost

column of each row to be selected. You can also delete rows by selecting the corresponding icon from the toolbar.



**Duplicate Row(s)** - The *Duplicate Row(s)* option will duplicate one or more consecutive selected rows. If non-consecutive rows are selected, this option will be disabled. To select a row, click on the tree label corresponding to that row or click on the leftmost column of that row (the column containing row numbers). Multiple consecutive rows can be selected by holding down the left mouse button on the left-hand column and dragging it over the desired rows. You can also duplicate rows by selecting the corresponding icon from the toolbar.

## View Menu



### *View Menu*

**Toolbar** - Toggle the *Toolbar* option to display and hide the toolbar at the top of the screen.

**Status Bar** - Toggle the *Status Bar* option to display and hide the status bar at the bottom of the screen.

**Georgia Calendar year 2003: R-Value** Requirements – The *R-Value Requirements* screen shows the minimum R-values allowed by the Georgia residential code.

**Georgia Calendar year 2004 and beyond: R-Value/U-Factor** Requirements – The *R-Value/U-Factor Requirements* screen shows the minimum R-values and maximum U-factors allowed by the Georgia residential code.

**Minnesota: Proposed and Maximum U-Values** - The *Proposed and Maximum U-Values* screen shows the maximum U-value requirements allowed by the Minnesota residential code. The screen displays the maximum U-values for **glazing** and floors and compares these to the area-weighted average U-values for your proposed components. If the area-weighted average U-values of your glazing or floor components exceeds any of the maximums on this screen, your building will not comply. If the glazing U-value maximum is exceeded, the *Compliance* field will display the message *Glazing Exceeds Maximum* in red letters. If the floor U-value maximum is exceeded, the *Compliance* field will display the message *Floor Uo Exceeds Maximum* in red letters.

# Options Menu



## Options Menu

**Locations < 3500 HDD when 1998 IECC or 2000 IECC is selected, or when Pima County < 4000 ft or Georgia Calendar year 2004 and beyond is selected:**

- Orientation (Envelope) – Select this to enable the *Front Faces* drop list for the building and create the *Orientation* column for walls, windows, doors, and basement walls. For walls, use the *Orientation* column to select the wall's orientation relative to the front of the building. Any windows or doors entered belonging to a wall with a set orientation will have the same orientation as the parent wall.
- Front Faces represents the angle of the front face of the building relative to North. If the building front faces North, the building orientation will be 0 degrees; if the building front faces East, this will be 90 degrees and so on. Select one of the eight cardinal points in the drop list or choose *Custom*. *Custom* allows the user to specify an angle (in degrees) by rotating the building using a diagram.
- Overhang Projection Factor (Envelope) – If an overhang exists, select this to create the *Overhang Projection Factor* column. Enter the overhang's projection factor (ratio of the overhang width to the overhang height above the window sill).

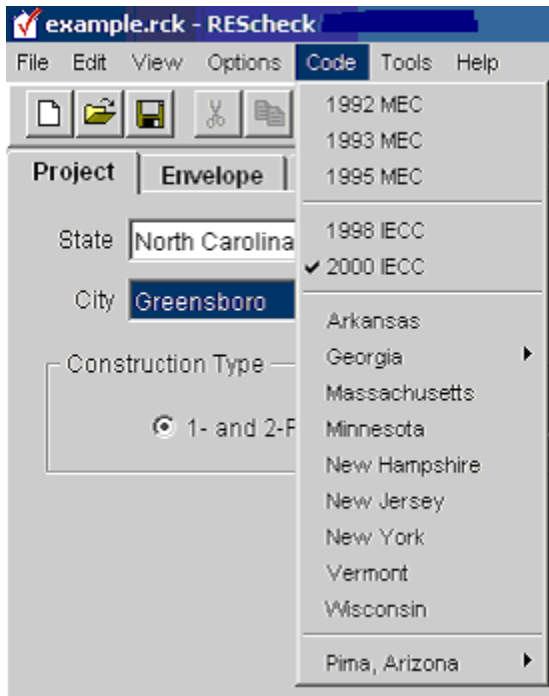
**Georgia Calendar year 2004 and beyond:**

- Solar Shade Screens – If a permanent solar shade screen is present on a window, select this to create the *Solar Shade Screens* column. Select *Half Screen*, *Full Screen* or *None* from the drop list.

Comments/Description (Envelope) - Select this option to create a *Comments/Description* column on the *Envelope* screen. Use the *Comments/Description* column to type additional information about a building assembly that you wish to be included in the Inspection Checklist, such as its location. The blank *Comment* lines provided in the Inspection Checklist are replaced with any text entered in this column.

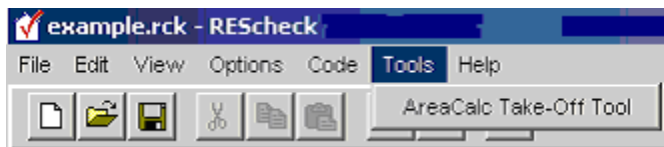
# Code Menu

The *Code* menu is used to select the code edition applicable to your jurisdiction.



*Code Menu*

# Tools Menu

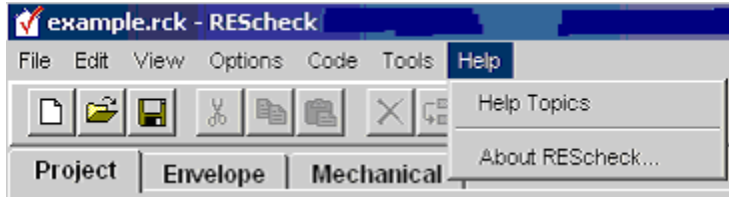


*Tools Menu*

AreaCalc Take-Off Tool - This option launches the AreaCalc software tool that can be used to do building take-offs. The areas computed in AreaCalc can be transferred directly to REScheck.

# Help Menu

The *Help* menu provides general information on how to use REScheck.



### Help Menu

Help Topics - The *Help Topics* option displays the help topics available for REScheck.

About REScheck - The *About REScheck* option displays the program's version number and release date.

## Context Menu

Clicking the right mouse button on a tree component label or table displays a pop-up list, referred to as a context menu. The context menu options are applied to a single field in a table or to an entire row in a table, depending on where the mouse is clicked. If the mouse is clicked on a tree component label, the menu options are applied to the row corresponding to that label. If the mouse is clicked on the left field of a row in a table, the row is selected and the options are applied to the entire row. Some options are applicable to individual fields of a table, and the mouse must be clicked on the given field to activate the option.

Cut, Copy, Paste - The *Cut*, *Copy*, and *Paste* options are available from the *Edit* menu in the menu bar, from toolbar buttons, and from the context menu. See the *Edit Menu* section for a description of these options. The *Cut*, *Copy*, and *Paste* options are applied to individual fields in a table.

Duplicate Row(s), Delete Row(s) - The *Duplicate Row(s)* and *Delete Row(s)* options are available from the *Edit* menu, the toolbar, and the context menu. See the *Edit Menu* section for a description of these options. The *Duplicate Row(s)* and *Delete Row(s)* options apply to selected rows.

Select Default - The *Select Default* option enables you to enter a default **U-factor** for windows, skylights, and doors that do not have an NFRC rating. The *Select Default* option can be selected by clicking the right mouse button in the *U-Factor* column of any window, **skylight**, or **door** assembly. A table of default U-factors based on characteristics of the given assembly will be displayed. Choose the U-factor corresponding to the characteristics of your assembly, then select the *OK* button to transfer this default to the table on the *Envelope* screen.

Edit Inputs - **Basement wall**, **crawl space** wall, and slab-on-grade assemblies display screens which illustrate dimensions being requested of the user. You may enter these dimensions directly into the illustration, then select the *OK*

button to transfer them to the table on the *Envelope* screen. You may change any previously entered dimensions directly on the table, or you may use the *Edit Inputs* option to redisplay the illustration with the previously entered values. The *Edit Inputs* option can be selected by clicking the right mouse button on the tree label or table row of any basement wall, crawl space wall, or slab assembly. The option name in the context menu changes to *Edit Basement Inputs*, *Edit Crawl Inputs*, or *Edit Slab Input*, depending on the row being selected.

**Locations < 3500 when 1998 IECC or 2000 IECC is selected, or when Pima County < 4000 ft or Georgia Calendar year 2004 and beyond is selected:**

Edit Overhang Ratio - An *Overhang Projection Factor* illustration displays the entries needed to calculate the overhang ratio. You may enter this information directly into the illustration, then select the *OK* button to transfer the calculated ratio to the *Envelope* screen. You may change the previously entered ratio directly on the table, or you may use the *Edit Overhang Ratio* to redisplay the illustration with the previously entered values.

## Changing Location Files

The following text provides instructions for changing from the city version of the REScheck software to the county version.

The REScheck software contains two location files:

1. CITIES.dat contains a list of cities for each state.
2. COUNTIES.dat contains a list of counties for each state.

The useCounties variable contained in the CHECK.PRP file determines which of these location files is used by the software. To modify this variable, open the CHECK.PRP file in a text processor (preferably NOTEPAD) and set useCounties to true or false. By default, the software uses cities:

```
useCounties=false
```

You **MUST** save this file in an ASCII text format. The best text processor to accomplish this is NOTEPAD.

Noteworthy:

If you have saved a data file for a building, the location for that building is also saved. If you subsequently change the location file as described above and try to load that data file back into the REScheck software, REScheck will not find the specified building location and will set the location to a default. Therefore, after

loading the file into the program, you must go back to the *Project* screen and reselect your location.

# Glossary

## A

**addition:** An extension or increase in the height, conditioned floor area, or conditioned volume of a building. The code applies to additions of existing buildings.

**AFUE:** Annual fuel utilization efficiency; combustion heating equipment efficiency is expressed in terms of AFUE. New equipment typically ranges from about 78- to 96-percent AFUE. Higher AFUE ratings indicate more efficient equipment.

**alteration:** Any construction renovation, or change in a mechanical system that involves an extension, addition, or change to the arrangement, type, or purpose of the original installation.

## B

**basement wall:** Basement walls that enclose conditioned spaces are part of the building envelope. Basement wall refers to the opaque portion of the wall (excluding windows and doors). To be considered a basement wall, at least 50% of the wall's total wall area (including openings) must be below grade. Treat walls on each side of the basement individually when determining if they are above grade or basement walls. For any individual wall less than 50% below grade, include the entire opaque wall area of that individual wall as part of the above-grade walls.

**building envelope:** All components of a building that enclose conditioned space. Building envelope components separate conditioned spaces from unconditioned spaces or from outside air (see conditioned space). For example, walls and doors between an unheated garage and a living area are part of the building envelope; walls separating an unheated garage from the outside are not. Although floors of conditioned basements and conditioned crawl spaces are technically part of the building envelope, the code does not specify insulation requirements for these components and they can be ignored.

## C

**cavity insulation:** Insulation installed between structural members.

**ceiling:** The ceiling requirements apply to portions of the roof and/or ceiling through which heat flows. Ceiling components include the interior surface of flat ceilings below attics, the interior surface of cathedral or vaulted ceilings, skylights, or vaulted ceilings, skylights and sloped building assemblies less than 60 from horizontal, but excluding skylight shafts.

Refer to Building Envelope Components in Appendix C for a comprehensive list of ceiling components.

**conditioned space:** A space is conditioned if heating and/or cooling is deliberately supplied to it or is indirectly supplied through uninsulated surfaces of water or heating equipment; uninsulated ducts; or uninsulated floors, ceilings, or walls between it and another conditioned space. For example, a basement is conditioned if: 1) it has registers or heating devices designed to supply heat, or 2) the basement ceiling is not insulated and the space above it is conditioned, or 3) the space contains uninsulated ducts or uninsulated surfaces of water heaters or space heating equipment.

**continuous insulation:** Insulation that runs continuously over structural members and is free of significant thermal bridging; such as rigid foam insulation above the ceiling deck.

**cooled:** A space within a building which is provided with a positive cooling supply.

**crawl space:** The REScheck crawl space wall insulation requirements are for the exterior walls of unventilated crawl spaces (i.e. not directly vented to the outside) below uninsulated floors. A crawl space wall component includes the opaque portion of a wall that encloses a crawl space and is partially or totally below grade, as measured from the sill to the top of the footing.

**crawl space wall:** The opaque portion of a wall which encloses a crawl space and is partially or totally below grade.

## D

**door:** Doors include all openable opaque assemblies located in exterior walls of the building envelope. Doors with glass can be treated as a single door assembly, in which case an aggregate U-factor (a U-factor that includes both the glass and the opaque area) must be used; OR the glass area of the door can be included with the other glazing and an opaque door U-factor can be used to determine compliance of the door.

**dwelling unit:** A single housekeeping unit of one or more rooms providing complete, independent living facilities, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

## E

**equipment efficiency:** The measure of equipment efficiency varies with equipment type. Combustion heating equipment efficiency is expressed in terms of annual fuel utilization efficiency (AFUE). New equipment typically ranges from about 78- to 96-percent AFUE. Cooling efficiency for electric air conditioners and heat pumps is expressed in terms of seasonal energy efficiency ratio (SEER). New equipment ranges from 10 to about 16

SEER. Heat pump heating is expressed in terms of heating seasonal performance factor (HSPF). New equipment ranges from about 6.8 to 10.0 HSPF. Higher AFUE, SEER, and HSPF ratings indicate more efficient equipment.

## G

**glazing:** Any translucent or transparent material in exterior openings of buildings, including windows, skylights, sliding doors, the glass area of opaque doors, and glass block.

**glazing area:** The area of a glazing assembly is the interior surface area of the entire assembly, including glazing, sash, curbing, and other framing elements. The nominal area or rough opening is also acceptable for flat windows and doors.

**gross wall area:** The gross wall area includes the opaque area of above-grade walls, the opaque area of any individual wall of a conditioned basement less than 50% below grade (including the below-grade portions), all windows and doors (including windows and doors of conditioned basements), and the peripheral edges of floors.

## H

**heated:** A space within a building which is provided with a positive heat supply.

**heating degree days:** A unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65F (18C), there exists as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65F (18C).

**HSPF:** Heating seasonal performance factor; heat pump heating is expressed in terms of HSPF. New equipment ranges from about 6.8 to 10.0 HSPF. Higher HSPF ratings indicate more efficient equipment.

## I

**IECC:** International Energy Conservation Code

## M

**MEC:** Model Energy Code

**multifamily:** A multifamily building is a residential building three stories or less in height that contains three or more attached dwelling units. Multifamily buildings include apartments, condominiums, townhouses, and

rowhouses. Hotels and motels are considered commercial rather than residential buildings.

## N

**NAECA:** The National Appliance Energy Conservation Act of 1987, 42 USC 6291 et seq., as amended, Public Law 100-12.

**net wall area:** The net wall area includes the opaque wall area of all above-grade walls enclosing conditioned spaces, the opaque area of conditioned basement walls less than 50% below grade (including the below-grade portions), and peripheral edges of floors. The net wall area does not include windows, doors, or other such openings, as they are treated separately.

## O

**opaque areas:** Opaque areas referenced in this guide include all areas of the building envelope except openings for windows, skylights, doors, and building service systems. For example, although solid wood and metal doors are opaque, they should not be included as part of the opaque wall area (also referred to as the net wall area).

## R

**R-value:** A measure (h ft<sup>2</sup> F/Btu) of thermal resistance, or how well a material or series of materials resists the flow of heat. R-value is the reciprocal of U-factor.

**raised truss:** Raised truss refers to any roof/ceiling construction that allows the insulation to achieve its full thickness over the plate line of exterior walls. Several constructions allow for this, including elevating the heel (sometimes referred to as an energy truss, raised-heel truss, or Arkansas truss), use of cantilevered or oversized trusses, lowering the ceiling joists, or framing with a raised rafter plate.

**RECD:** The Rural Economic and Community Development, formerly the Farmer's Home Administration.

**repair:** A repair includes the reconstruction or renewal of any part of an existing building for maintenance purposes.

**residential buildings:** For the purposes of the code, Group R residential buildings include: Type A-1 – Detached one- and two-family dwellings; and Type A-2 – All other residential buildings, three stories or less in height

## S

- SEER:** Seasonal energy efficiency ratio; cooling efficiency for electric air conditioners and heat pumps is expressed in terms of SEER. New equipment ranges from about 10 to 16 SEER. Higher SEER ratings indicate more efficient equipment.
- SHGC:** Solar heat gain coefficient; SHGC is the glazing's effectiveness in rejecting solar heat gain. SHGC is part of a system for rating window performance used by the National Fenestration Rating Council (NFRC). SHGC is gradually replacing the older index, shading coefficient (SC), in product literature and design standards. If you are using glass whose performance is listed in terms of SC, you may convert to SHGC by multiplying the SC value by 0.87.
- single family:** A detached one- and two-family residential building, irrespective of height.
- skylight:** Glazing that is horizontal or sloped at an angle less than 60 (1.1 rad) from horizontal.
- slab-on-grade floor:** A floor that is poured in direct contact with the earth.
- slab edge:** Slab edge refers to the perimeter of a slab-on-grade floor, where the top edge of the slab floor is above the finished grade or 12 in. or less below the finished grade. The slab perimeter should include the length of all edges of a slab foundation that are part of the building envelope and are less than 12 in. below grade (i.e. all edges separating conditioned space from unconditioned space). The insulation can be installed using any of the following configurations, but in all cases it must start at the top of the slab: The slab insulation extends from the top of the slab downward to the required depth. The slab insulation extends from the top of the slab downward to the bottom of the slab and then horizontally underneath the slab for a minimum total linear distance equal to or greater than the required length. The slab insulation extends from the top of the slab downward to the bottom of the slab and then horizontally away from the slab for a minimum total linear distance equal to or greater than the required depth. The horizontal insulation must be covered by pavement or at least 10 in. of soil. The top edge of insulation installed between the exterior wall and the interior slab can be cut at a 45 angle away from the exterior wall.

## U

- U-factor:** A measure (Btu/h ft<sup>2</sup> F) of how well a material or series of materials conducts heat. U-factors for window and door assemblies are the reciprocal of the assembly R-value.
- UA:** U-factor X Area; REScheck performs a simple UA calculation for each building assembly to determine the overall UA of your building. The UA that would result from a building conforming to the code requirements is compared against the UA for your building. If the total heat loss

(represented as a UA) through the envelope of your building does not exceed the total heat loss from the same building conforming to the code, then the software declares that you pass. A high-efficiency equipment trade-off can also be performed.

**unconditioned:** An enclosed space within a building that is not a conditioned space.

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