COM*check*-*Plus* User's Guide

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Contents

COMcheck-Plus

Software Overview

COM*check-Plus* is whole-building, performance-based software. This energy code compliance method requires minimum efficiency levels as opposed to prescribing particular features. Often less expensive materials and methods can be used to achieve the desired result. The program offers designers greater flexibility than other methods because compliance is based on the performance of the entire building design. For example, a designer can show compliance for a commercial building having greater window and skylight areas than would usually comply by specifying highly efficient HVAC and lighting systems to bring overall energy performance into compliance.

COM*check-Plus* is designed to simplify performance-based compliance and provides a wizard feature that greatly streamlines the process of entering design information. The program provides a "shell" that surrounds and manages interaction with the underlying building energy simulation tool, DOE-2.1E. A version of DOE-2 is installed on your computer when you install COM*check-Plus* and removed when you uninstall COM*check-Plus*. Users don't have to be experts in building simulation to use COM*check-Plus*. COM*check-Plus* automates and standardizes the compliance process, so users can get predictable and repeatable compliance results without needing to completely understand and interpret the compliance process. Users only need to describe the building design. The COM*check-Plus* program analyzes performance, generates a performance budget, and produces a compliance report suitable for submission with the building permit.

Traditionally, performance-based energy code compliance has been performed late in the design process due to its high cost and need for detailed design information. The ease with which COM*check-Plus* enables you to check compliance with limited information about the building, makes it feasible to move energy code checking earlier in the design process, when design changes are most easily accommodated.

COM*check-Plus* implements an Energy Cost Budget (ECB) approach. The ECB method provides criteria for the design of energy-efficient buildings that allow greater design flexibility than the other compliance paths of Standard 90.1-1989 while providing building energy-efficient levels consistent with the other paths. Since proposed designs may use varying amounts of different types of energy, energy cost is used as the common denominator. Using unit costs rather than units of energy or power such as Btu, kWh, or kW allows the energy use contribution of different fuel sources at different times to be added and compared. This path provides an opportunity for the building designer to evaluate and take credit for innovative energy conservation designs, materials, and equipment that cannot be accounted for in the other compliance paths.

The basis of the ECB method is an annual hourly energy simulation of both the proposed design and a code-compliant reference building. The problems with using the ECB method are two-fold: 1) you must be fluent in the use of an annual hourly energy simulation package (such as BLAST or DOE-2) and 2) you must be able to simulate the code-compliant reference building based on a complex series of rules that define the reference building and its relationship to the proposed design. COM*check-Plus* reduces these problems by providing a compliance shell wrapped around a DOE-2 simulation engine. The user does not have to know DOE-2

although it will help) and the user does not have to know the complex relationships between the proposed design and the reference building.

COM*check-Plus* Software Features

- Supports flexible performance-based compliance
- Includes a wizard to streamline data entry
- Incorporates a state-of-the-art energy simulation program
- Automates compliance analysis and compliance reporting.

COM*check-Plus* Limitations

COM*check-Plus* does have some limitations. These limitations are primarily the result of the need for a simple user interface for this program. Because the interface is simplified, the wizard does not allow you to enter more than one wall type or window type. You can, however, go into the building description created by the wizard and modify the individual wall and window types as necessary. Be aware of one thing as you modify walls and windows – the wizard creates DOE-2 descriptions of components and you therefore have to modify the descriptions using DOE-2 terminology. This can be somewhat confusing for the non-DOE-2 user, but resources are available to help you. Also be aware that COM*check-Plus* does not take advantage of the full complexity and power of DOE-2. COM*check-Plus* allows tradeoffs between walls, windows, roofs, skylights, slabs, equipment efficiency, lighting power densities, and economizers. COM*check-Plus* does not currently handle HVAC or lighting control strategies, any renewable energy sources, or any sort of thermal storage equipment.

When to Use COM*check-Plus*

Because COM*check-Plus* uses a whole building performance-based approach, it provides a high degree of design flexibility and trade-offs are permitted among major code sections. For example, if your building has a large amount of glazing, you might be able to trade off some of the glazing by installing more efficient HVAC equipment.

Some examples of situations illustrating when you might use COM*check-Plus* include:

- if you initially tried to show compliance using a prescriptive approach and your building didn't comply
- if you want to decrease the cost of the building but still have the building comply with the energy code
- if your building will be very energy efficient and you need a metric to describe how efficient it will be
- if you want to get "credit" for certain elements within your building (e.g., high efficiency equipment) that would not be included in another compliance approach
- if you qualify for an incentive program that requires that a performance-based approach be used
- if your building has a high glazing percentage and high internal gains
- if your building has unique characteristics (e.g., 24-hour operation).

Where can COM*check-Plus* be Used?

COM*check-Plus* is suitable for use in jurisdictions with energy codes based on ASHRAE/IES Standard 90.1-1989, such as the ASHRAE 90.1 Code, the 1998 and 2000 International Energy Conservation Codes (IECC), and many state-developed energy codes. Some provisions not found in the 90.1 Standard have been incorporated into COM*check-Plus* to improve ease of use and code enforcement, while ensuring that buildings

designed to comply with COM*check-Plus* can be "deemed to comply with" Standard 90.1. However, as with any code-related issue, the local jurisdiction has the final authority to determine whether COM*check-Plus* results will be accepted as adequate demonstration of compliance.

How Does COM*check-Plus* Differ from COM*check-EZ*?

Most codes based on Standard 90.1 offer three compliance options: 1) prescriptive, 2) system performance (in which trade-offs are permitted within major sections of the code – envelope, lighting, etc.), and 3) whole-building performance (in which trade-offs are also permitted *among* major sections of the code). COM*check-Plus* implements the whole-building performance option, which is known as the *Energy Cost Budget (ECB) Method* in Standard 90.1.

The COM*check-EZ* product is designed to make the first two compliance options as easy to use as possible. The printed COM*check-EZ* guides offer a simple prescriptive method, while the COM*check-EZ* software offers limited performance trade-offs within the envelope and lighting sections. In general, the different compliance options offer trade-offs between simple compliance and design flexibility. COM*check-Plus* is intended to complement rather than replace COM*check-EZ*.

Quick Start

This section describes the main items an advanced user should know before using COM*check-Plus*. If you're an experienced user of Windows programs, and you're familiar with building energy codes and compliance software, you may wish to simply review these few key points before getting started.

Select the Appropriate Code

The menu bar at the top of the screen contains a *Ruleset* option listing energy codes supported in this version of COM*check-Plus*. Before proceeding, select the appropriate code. Different codes require different user inputs, and the building description you enter using one code may not be usable when you switch to another.

Use the Wizard to Begin a Project

COM*check-Plus* includes a wizard feature that enables you to rapidly create a building description that is complete and error free. In most cases, the building description created by the wizard will require additional editing. However, starting with the wizard will save significant time over creating the building description manually.

Double-click on the prompt on the opening screen or click the *Building Wizard* button on the Toolbar to launch the wizard. You can click the *Finish* button at any time, and you can return to the wizard where you left off.

Check Compliance and Refine Using the Wizard

Like most wizards in today's software, the building creation wizard is intended to save you time at the beginning of the process. However, once you edit the description created by the wizard, you cannot relaunch the wizard without losing your edits. See *Wizard Caution*. Therefore, do as much evaluation of alternate ways to comply using the wizard as possible by selecting *Perform Analysis*, reviewing the compliance results, making edits in the wizard, selecting *Perform Analysis*, etc. Once you have finished this evaluation using the wizard, consult the *Post-Wizard Checklist* (under *Architecture Folder, Lighting Folder, and Mechanical Folder*) for items you may need to modify outside of the wizard.

Edit Using the Component Dialogs

After the wizard has created a generic building description, you can refine that description through a set of dialog boxes. To edit a component, select the component on the tree control at the left-hand side of the screen

and select ***E**dit* from the right mouse menu. Double-clicking on the tree has the same effect. (The tree control does not appear until you have created a project description using the wizard or loaded an existing project file [Ctrl+O]).

You can edit fields with white backgrounds. You cannot edit fields with gray backgrounds—those are included to provide information that is helpful in verifying other input or for information purposes only.

In keeping with good practice for use of any software, we recommend that you save your building description often and revise the file name once you have substantial effort invested in editing the description under the current file name.

Understand Parent/Child Relationships

In order to analyze a building's energy use, it is necessary to track relationships among building components. COM*check-Plus* displays these relationships using the familiar tree control, found in Windows Explorer and many other applications. For example, under the *Architecture* tab, exterior walls are shown as parents to windows (windows are connected to walls and appear underneath walls) and children to spaces.

Edit Generic Components

Some components are treated not as parents or children but as generically referenced objects, so that they can be defined once then applied in multiple places. Glass types, wall assemblies, materials, and schedules are examples of generically referenced objects. Much like word processor style sheets, these references can provide an efficient method for editing a building description. The wizard facilitates building-wide editing by applying generic references in the initial description.

To modify a wall construction throughout the building, edit the generically-referenced wall type. To modify a wall construction for a single instance, assign a different construction to the wall or create an entirely new construction.

Use the Tree Control for Rapid Editing

The tree control can be used to move and copy components or groups of components. To move a component, just drag and drop. To copy a component, select the component, copy, and paste. It is advisable to rename copied components to maintain readability. Whenever parents are moved, copied, or deleted, child components are included.

COM*check-Plus* includes optional floor and block components to the tree. These enable spaces to be organized and copied as a group. See the *Display Option* field on the *Project Data* dialog (*Project* tab).

Use the Right Mouse Button

The right mouse button provides convenient access to many useful features. Use it to create, rename, copy, paste, edit, and delete building components. It also provides access to context-sensitive Help, including an explanation of each user-input field.

Define New Components

To create new child components, click the parent component on the tree control to which the new component will be assigned. Then click the right mouse button and select ***C**reate* and the component you wish to define.

To create new referenced components, select *Create New...* from any drop-down menu that assigns referenced components, such as glass types, constructions, etc.

Also, any type of component can be created from the *C**r**eate Component* option under the ***E**dit* menu.

Understand Status Bar Messages

COM*check-Plus* includes a status bar at the bottom of the screen which contains information you may find helpful when developing a building description. The left-most pane of the status bar contains a brief explanation of the selected input (also displayed as a ToolTip).

The next field on the status bar indicates the source of the current information in the selected input field. For example, "*Rule Defined*" means the input has been set by the program's compliance rules. "*User Defined*" means the input has been set directly by the user or indirectly by the user through the wizard. For a more detailed explanation of this field, see *Status Bar*.

The right-most field on the status bar indicates whether you are required, or even permitted, to enter data in the selected field. For example, "*Compulsory*" indicates that you must enter an appropriate value before you can check compliance, while "*Optional*" means that you are free to leave the field blank. For a more detailed explanation of this field, see *Status Bar*.

Display Detailed Inputs

By default, COM*check-Plus* is set to hide many detailed inputs that most users don't need to deal with. If you need additional inputs to describe your building, select *Display Detailed Inputs* from the ***T**ools* menu.

The Help System

The User documentation for COM*check-Plus* is integrated directly into the program. In addition to standard Windows Help resources, (which include Contents, Index, and Search features), COM*check-Plus* includes three additional ways to get Help about user inputs.

- ToolTips – brief explanations of user input fields are displayed any time you hold the cursor over an input field.
- Status Bar – a brief explanation of the selected input field is displayed in the left-most pane of the status bar.
- **F1** or Right Mouse Menu – Item Help topics (i.e., *Help* on the selected input field) is accessible via the **F1** key or the *Item Help* topic on the right mouse menu.

For help with troubleshooting or user support on topics not covered here, send email to TechSupport@becp.pnl.gov.

Installation and Download

Configuration Requirements

This program was designed to run on a personal computer that meets or exceeds the following system requirements:

- **Hardware**: Intel Pentium or higher microprocessor
- **Memory**: 16 MB RAM and 20 MB of free hard disk space
- **Monitor**: Color VGA (800x600 minimum resolution)
- **Operating System**: Windows 95/98/NT/2000

Installing COM*check-Plus*

To install from the COM*check-Plus* installation CD:

- Click on *Start→Run*
- Type g:\setup.exe (where g: is the CD-ROM drive letter)
- Click on the *OK* button
- Follow the instructions in the COM*check-Plus* setup wizard.

Weather File Installation

A full set of weather data is available for COM*check-Plus* for locations in the United States and possessions. However, because the full data set is large (about 40 MB), only a sample of the weather data is loaded onto your hard disk at installation. Weather data for all other sites are copied to your hard disk when you run compliance analyses that require them.

The *Weather File Installation* dialog appears any time you attempt to run an analysis for a location whose weather data does not reside on your hard disk in the appropriate folder. The dialog offers two options:

1. Install From CD-ROM
2. Install Over Internet

To install from your CD-ROM drive, you need to have a COM*check-Plus* distribution CD in your CD-ROM drive and have the correct drive letter for your CD-ROM displayed in the CDROM Path field (e.g., d:\) of the *Weather File Installation* dialog.

To install over the Internet, you need to have Internet access available to your computer and either a live Internet port or system settings that will open an Internet port when needed. The weather files are maintained on a server at Pacific Northwest National Laboratory (PNNL) (COM*check-Plus* will find them automatically), and occasionally Internet traffic or server problems will prevent files from being downloaded successfully. If you encounter problems, try selecting Install Over Internet again, and if the problem persists, send an email to TechSupport@becp.pnl.gov.

If you would like to install all (or selected) weather files (to avoid being dependent on CD-ROM or Internet connection in the future), you can copy the weather files from the COM*check-Plus* CD-ROM to your hard disk using Windows Explorer or other software. First, identify the files you want to install, then follow these instructions:

Copy from: <drive>:\COMcheck-Plus\Doe2\Weather\Tmy2\weather file name.bin
where <drive> is the drive letter for your CD-ROM. (Some weather files will also be found in the Tmy\ folder.)

Copy to: <drive>:\folder>\COMcheck-Plus\Doe2\Weather\Tmy2\
where <drive:\folder> is the drive and folder on your hard disk where you installed the COM*check-Plus* program.

You cannot copy weather files directly from the PNNL Internet server. The server does not permit listing of directory contents because the weather data is licensed for use only with the COM*check-Plus* software. The COM*check-Plus* weather files are subject to the same license terms and conditions as other parts of the COM*check-Plus* software.

Removing COM*check-Plus*

To remove COM*check-Plus*:

- Click on *Start→Settings→Control Panel*
- Double-click on the *Add/Remove Programs* icon
- Select COM*check-Plus* from the program list
- Click the *Add/Remove* button or click on the *Uninstall* icon in the COM*check-Plus* program group.

Obtaining COM*check-Plus* Updates

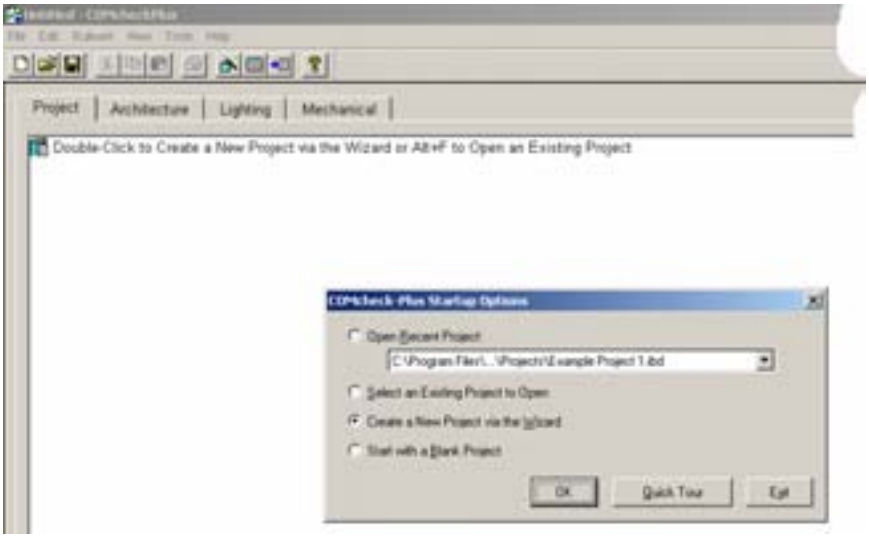
We expect to periodically update the COM*check-Plus* program. The quickest way to obtain an updated version of the program is to download it from the Building Energy Codes Program (BECP) web site at www.energycodes.gov.

Technical Support

Having problems? If you are having problems getting the software to run or have questions on how to use the software that are not addressed through the program's Help facilities, you can obtain technical support through DOE's BECP technical support at TechSupport@becp.pnl.gov.

Screen Layout

When you open the software, you will see the main screen which is used primarily for editing building descriptions.



Partial Main Screen

Title Bar

The title bar displays the name of the currently open project data file. If no file is open, the word *Untitled* is displayed.

Menu Bar

The menu bar is located directly under the title bar and displays the available menus, *File, Edit, Ruleset, View, Tools*, and *Help*.

Toolbar

The toolbar contains buttons with images representing some of the same options available in the menus.

New File

 This button closes the current file (if one is open) and opens a new file.

Open Existing File

 This button closes the current file (if one is open) and launches the *Open* dialog to enable you to select an existing file to open.

Save File

 This button saves the file under its current name or, if you have not named the file, launches the *Save As* dialog to enable you to provide a new file name.

Cut Selected Item

 This button is not currently enabled in COM*check-Plus*.

Copy Selected Item

 This button enables you to copy the selected item on the tree control (along with any child components) to the Windows clipboard. The *Copy* button is not available from within program dialogs, but you can use the keyboard equivalent, Ctrl+C, to copy selected text.

Paste Contents of Clipboard

 This button enables you to paste components copied from the tree control to the selected location in the tree control (provided that location is compatible with the stored component). The *Paste* button is not available from within program dialogs, but you can use the keyboard equivalent, Ctrl+V, to paste text from the Windows clipboard to the selected input field.

Print

 This button enables you to print compliance reports. The *Print* button is active in the COM*check-Plus Report Viewer* but is inactive in the main COM*check-Plus* application.

Building Wizard

 This button enables you to launch the *Building Creation Wizard*, a feature that enables you to readily create a description of your building that you can use in assessing energy code compliance.

Perform Analysis

 This button enables you to launch a compliance analysis using the currently loaded building description. You must save the current building description before performing the analysis.

Compliance Reports

 This icon launches the COM*check-Plus Report Viewer*. You cannot launch the report viewer unless there is a report available to view.

About COMcheck-Plus

 This button enables you to view program license and version information.

Print Preview

 This button enables you to view the compliance report as it will be printed. *Print Preview* is available only in the COM*check-Plus Report Viewer*.

Return to COMcheck-Plus

 This button returns you to the main COM*check-Plus* program from the report viewer and closes the report viewer. Alternatively, you can return to the main program using Alt+Tab, leaving the report viewer open and available for viewing.

Folder Tabs

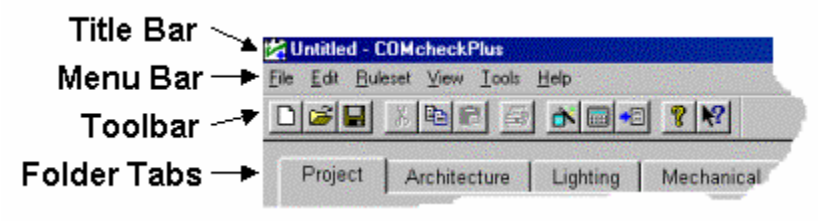
There are four folder tabs at the top of the main screen – *Project, Architecture, Lighting,* and *Mechanical*. These tabs provide four different views of the building description and provide access to four different subsets of the building description data.

Project – general information about the building project and its site

Architecture – information about the building envelope and internal building functions and processes

Lighting – information pertinent to interior lighting systems and the tasks and activities those systems are designed to support

Mechanical – heating, ventilating, air conditioning, and service hot water systems.



Colors Used in the Software

Black values have been defined by the user either directly through a user input or indirectly through wizard selections.

Blue values have been set by the program.

Red values are missing or out-of-range.

Input Fields:

Fields with a **white** background are available for user input.

Fields with a **gray** background are not user editable.

Note: If you feel you should be permitted to edit a field with a gray background, it is likely that you need to edit the child component instead. For example, the *Exterior Wall* dialog contains a gray *Total Window Area* field. You need to edit the windows belonging to the wall to affect the *Total Window Area* field which has been included on the *Wall* dialog to help you verify that you have entered the window information correctly.

Defaults

COM*check-Plus* provides default values for most user inputs. Blue values in the input fields indicate defaulted data. Below is an explanation of what these default values represent.

For inputs that do not relate directly to code requirements (e.g., wall height), defaults represent most likely or most typical values.

For inputs that do relate directly to code requirements, defaults represent values that generally lead to minimum compliance. However, due to the nature of many of the requirements, minimally compliant values are not always practical to compute.

Exceptions: For glass performance characteristics, two default options are available – "Code Criteria" and "Typical Values". The wizard uses Code Criteria.

The "Code Criteria" option sets the default performance characteristics of the glass to the criteria used in the budget building and the default glazing characteristics to generally compatible values.

The "Typical Values" option sets the default glazing characteristics to typical values for the selected climate and the default performance characteristics to reflect poor performance given the physical characteristics. This gives reasonable assurance that products with the given physical characteristics can easily be found that will perform as well as the performance default.

Restore Default – to return a modified value to the default value, right click and select ***R****estore Default*.

Status Bar

The status bar at the bottom of the screen provides useful information about each input field you select. There are three panes on the status bar that provide context-sensitive information. This same information is displayed in the ToolTips if you allow your mouse pointer to linger over an input field.

1. Input Description Pane – Concise descriptions of the selected input field are displayed at the far left of the status bar.
2. Input Classification Pane – The next pane to the right on the status bar displays a set of labels that indicates which inputs you are required to provide, which are optional, and which are unavailable for input. The input classification labels are explained in the table below.
3. Data Source Pane – The pane at the far right of the status bar displays a set of labels that identify the source of the information (if any) contained in the field. This can help you distinguish between information that is dictated by the compliance checking process and the information you have entered and for which you are responsible. The data source labels are explained below.

Input Classification Explanations

"No field selected"	No building data field is currently selected.
"Input is compulsory"	You are required to enter data in the selected field; the program cannot perform a compliance analysis unless you do.
"Input is required"	You are required to enter data in the selected field if the field is applicable to your project.
"Input is optional"	You may enter data in the selected field if the field is applicable to your project, but you are not required to do so. If the field contains a default value, you are permitted to simply use that value without considering its suitability for your project.
"Input is crit. default"	You may overwrite the data in the selected field with an entry more appropriate for your project than the default. However, if you do overwrite this "critical default" value, you must be prepared to provide documentation substantiating the value you have chosen.
"Field is not editable"	You cannot enter data in the selected field. The data in this field are defined by the compliance rule set or a supporting process. In some cases, the field may also be an

	intermediate calculated parameter or one that is not applicable to the currently selected compliance rule set.
"Navigation input"	The purpose of the selected field is to enable you to select components for editing.

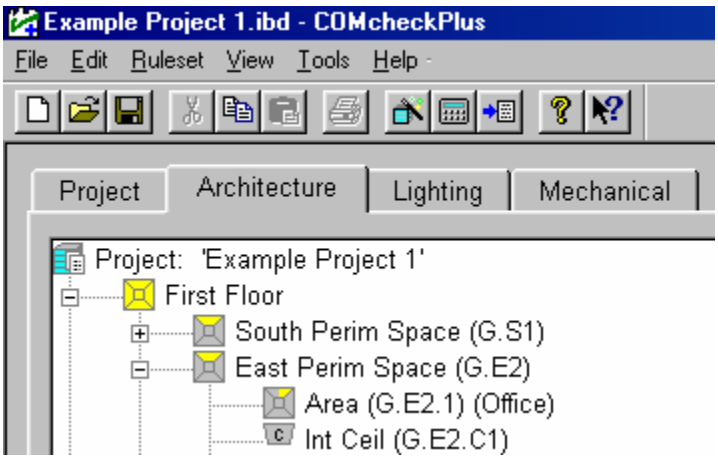
Data Source Explanations

(blank)	No building data field is currently selected.
"Value from user"	The data shown have been defined by the user either directly through a user input or indirectly through wizard selections.
"Value from simulation"	The data shown have been defined by an energy simulation.
"Value undefined"	No data have yet been defined for the field.
"Value from program"	The data in this field have been defined by the program either to implement requirements and procedures specified in the energy code or to conform with building energy modeling conventions.
"Value from user"	The data shown have been defined by the user either directly through a user input or indirectly through wizard selections.

Tree Control

A major feature of the main screen (outside of the wizard) is the "tree control". COM*check-Plus* uses this standard Windows graphical device to represent building components and their relationships. The tree control varies in the components that are displayed depending on which folder tab is currently selected.

Components that appear indented in the tree belong to the component above them. Click on the + or – sign to contract or expand the tree.



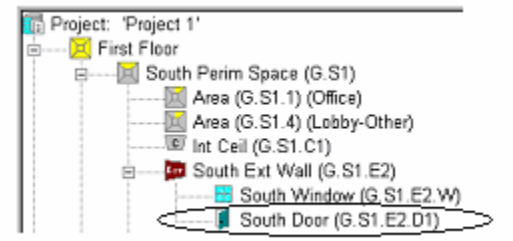
Partial Screen Illustrating Tree Structure

For information about individual components that appear in the tree, double-click on the component name or icon, single-click on any input field, then right click and select *Topic Help* from the menu.

COM*check-Plus* gives each building component a name designed to make the building description more understandable and to uniquely identify each component. You may, of course, rename any component by simply double-clicking on its icon on the tree control and editing the name field on the dialog.

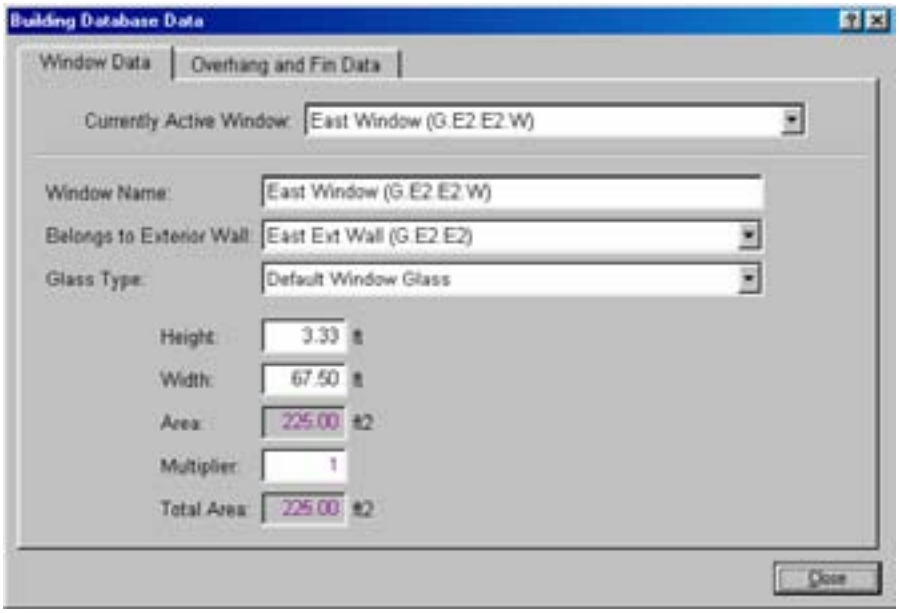
The part of each default component name within parentheses indicates where in the building that component occurs. Child components always inherit names from parent components, so for example, *South Exterior Wall (T.S1.E2)* inherits part of its name from its parent space *South Perimeter Space (T.S1)*.

Components are named using the convention: Floor.Space.Wall.Window or Door. Spaces and walls are numbered sequentially and also have an orientation designation. [For example, the item circled in the graphic below, South Door (G.S1.E2.D1), represents Ground Floor, South Space 1, East Wall 2, Door 1.]



Components shown on the tree can be moved to other components using a drag-and-drop technique, provided it results in a compatible parent-child relationship (see below). For example, you can drag a window onto a different wall, but not vice versa.

A set of right mouse menu edit commands can be used with the tree control. Double-clicking on any component on the tree opens its input dialog window. Below is an example of an input dialog window.

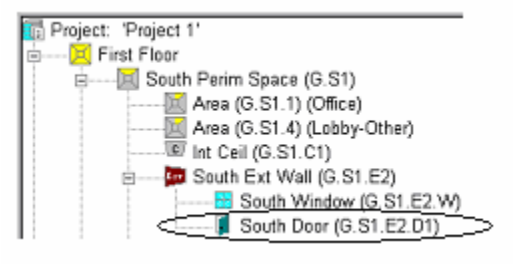


Example Dialog Window

Parent/Child Relationships

In order to analyze a building's energy use, it is necessary to track relationships among building components. COM*check-Plus* displays these relationships using the familiar tree control, found in Windows Explorer and

many other applications. For example, under the *Architecture* tab, exterior walls are shown as parents to windows (windows are connected to walls and appear underneath walls in the tree) and children to spaces.



Partial Screen Illustrating an Example of a Parent/Child Relationship

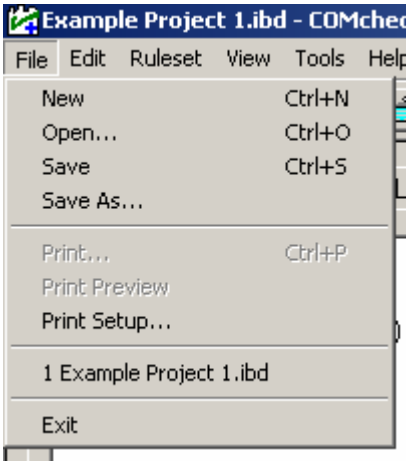
"Other" Components

Some components are treated not as parents or children but as generically referenced objects, so that they can be defined once then applied in multiple places. Glass types, wall assemblies, materials, and schedules are examples of generically referenced objects. Much like word processor style sheets, these references can provide an efficient method for editing a building description. The wizard facilitates building-wide editing by applying generic references in the initial description.

To modify a wall construction throughout the building, edit the generically-referenced wall type (see *Edit a Project*). To modify a wall construction for a single instance, assign a different construction to the wall or create an entirely new construction.

File Menu

The ***F**ile* menu contains the standard functions for file management, loading recently used files, and exiting the program.



File Menu

Edit Menu

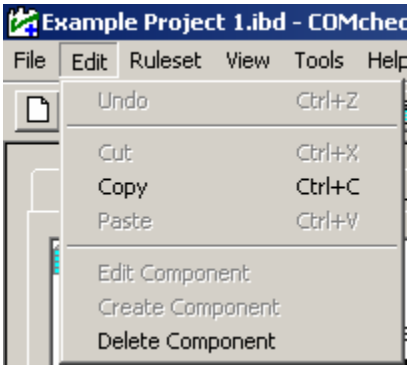
In addition to the standard Windows *Cut*, *Copy*, and *Paste* commands, the ***E**dit* menu contains several commands for editing building descriptions. They are:

***E**dit Component*

*C**r**eate Component*

***D**elete Component*

These menus allow you to edit all building components, including components that are not displayed on the tree control. Use this method to edit components like schedules and performance curves.



Edit Menu

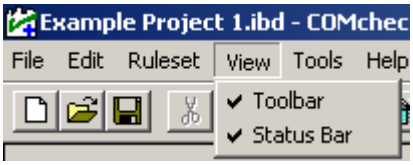
Ruleset Menu

Enables you to switch between different compliance rulesets. COM*check-Plus* is designed to support multiple rulesets that implement the requirements in different codes. However, note that different codes can require different information, therefore there is no guarantee that a building description developed under one code will execute without modification under another.

Ruleset Menu

View Menu

Enables you to toggle the display of the Toolbar and the Status Bar on and off.



View Menu

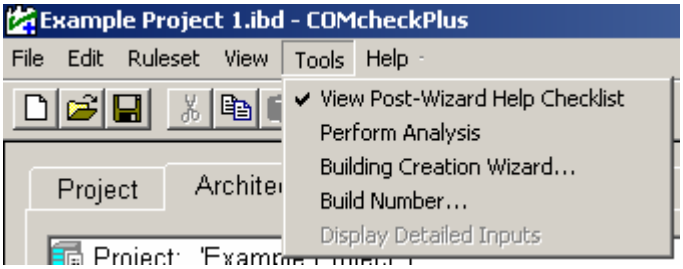
Tools Menu

The *Tools* menu contains three main options of interest to end-users.

Perform Analysis – Performs a complete compliance check based on the current building description.

Building Creation Wizard – Provides a quick and easy method for creating a complete building description.

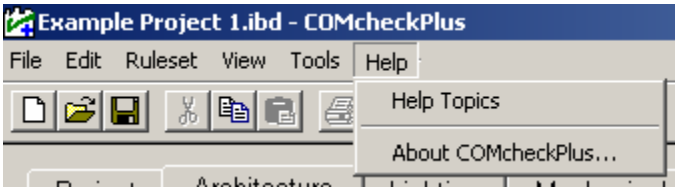
Display Detailed Inputs – By default, COM*check-Plus* is set to hide many detailed inputs that most users don't need to deal with. If you need additional inputs to describe your building, select *Display Detailed Inputs*.



Tools Menu

Help Menu

The *Help* menu provides general information on how to use COM*check-Plus*. The *Help Topics* option displays all of the Help topics within COM*check-Plus*. The *About COMcheckPlus* option displays the program's end-user license agreement, version number and release date.



Help Menu

The user documentation for COM*check-Plus* is integrated directly into the program. User help information can be accessed in a variety of different ways depending on where you are in the program.

ToolTips – Brief explanations of user input fields are displayed any time you hold the cursor over an input field.

Status bar – A brief explanation of the selected input fields is displayed in the left-most pane of the status bar.

Help from the menu bar – Click on ***H****elp* on the menu bar to access standard Windows *Help Contents* and *Index* features.

F1 key – The **F1** key can be used to access Help related to the currently-selected component or field from anywhere in the program.

Help button on wizard screen – When using the building creation wizard, click on the Help button at the bottom of each wizard screen. This option will provide Help information specific to the currently-selected input field. In COM*check-Plus* we call this Item Help.

Right mouse menu – Help is available from within any dialog via a right mouse button click. The right mouse menu provides access to two different kinds of context-sensitive Help – *Item Help* and *Topic Help*. *Item Help* provides an explanation of the specific field that is currently selected. *Topic Help* provides an explanation that relates to the currently-selected component and dialog.

Mandatory Requirements

Mandatory requirements are code requirements (or criteria) that must be met regardless of the compliance method you are using. These requirements are listed under the major code sections below and are included in abbreviated checklist form on the compliance reports designed for submission to the building department.

The checklist produced by COM*check-Plus* contains fewer requirements than are found in COM*check-EZ* or in the design by acceptable practice chapter of the International Energy Conservation Code (IECC). This is because COM*check-Plus* implements the more flexible whole-building compliance path, which allows all "prescriptive" requirements in the 90.1 Code (such as for economizers) to be traded off.

Envelope Requirements

Documenting Compliance

- Indicate component R-values and U-factors and the solar heat gain coefficients of windows and skylights on your project plans.
- Generate a complete set of compliance reports using the *Print* option under the *File* menu of the COM*check-Plus Report Viewer* and sign the *Summary Compliance Report* certifying the accuracy of the data you entered to describe the project. (Only one copy is needed for envelope, mechanical, and lighting compliance.)

Air Leakage

- All joints and penetrations in the building envelope that are potential sources of air leakage must be caulked, gasketed, weatherstripped, or otherwise sealed in an approved manner.
- Recessed lighting fixtures must be gasketed or insulation contact (IC) rated; i.e., rated for direct contact with insulation.
- The following areas must be sealed:
  - exterior joints around window and door frames
  - between wall sole plates, floors, and exterior-wall panels
  - openings for plumbing, electricity, and refrigerant and gas lines in exterior walls, floors, and roofs
  - service and access doors and hatches
  - all other similar openings in the building envelope.
- Maximum air leakage rates for manufactured windows and doors are specified in the table below. Windows and doors certified by an accredited laboratory (such as the Window and Door Manufacturers Association [WDMA] or the Architectural Aluminum Manufacturers Association [AAMA]) meet these requirements and are labeled. For noncertified windows and doors, check manufacturers' test reports to verify compliance with these air leakage requirements.

	Frame Type		
	Wood	**Aluminum**	**PVC**
Windows (cfm per ft of operable sash crack)	0.25	0.37	0.06
Sliding Doors (cfm per sq ft of door area)	N/A	0.37	0.37
Swinging Doors (cfm per sq ft of door area)	0.25	1.25	N/A

Maximum Allowed Air Leakage Rates

Building Component Certification

- Insulation R-values and glazing and door U-factors must be clearly marked on building plans and certifications.
- Certification of installed components is required and can be accomplished through any of the following methods:
  - product labels – for example, R-values of insulation printed directly on the insulation, striping codes, manufacturers' labels on windows

- contractor statements certifying the products they have installed
- check with your local building official for requirements on certifying building components in your jurisdiction.

Certifying Installed Insulation

- For blown or sprayed insulation, the initial installed thickness, settled thickness, coverage area, and number of bags used must be clearly posted at the job site.
- For components having a manufacturers' guaranteed R-value rating, thickness markers must be placed at least every 300 feet.
- For components without a manufacturers' guaranteed R-value rating, contact the Insulation Contractors Association of America for an approved way to ensure proper insulation levels are obtained.
- All insulation requirements assume the insulation is installed at its standard thickness. If insulation is compressed, the R-value is reduced and the building may not meet the requirements.

Fiberglass Batt Insulation R-Values and Standard Thicknesses

Insulation R-Value	Standard Thickness (in.)
R-11	3 ½
R-13	3 5/8
R-15	3 ½
R-19	6 ¼
R-21	5 ½
R-22	6 ¼
R-30	9 ½
R-38	12

Vapor Retarders

Except as noted below, vapor retarders must be installed in all nonvented framed areas in ceilings, walls, and floors. The vapor retarder must have a perm rating of 1.0 or less and must be installed on the warm-in-winter side of the insulation (between the insulation and conditioned space).

Exceptions:

- Vapor retarders are not required where moisture or its freezing will not damage materials.
- Vapor retarder requirements do not apply to buildings located in the following climate zones:

Texas	Zones 2-5
Alabama, Georgia, North Carolina, Oklahoma, South Carolina	Zones 4-6
Arkansas, Tennessee	Zones 6-7
Florida, Hawaii, Louisiana, Mississippi	All Zones

The climate zone for your location is shown on the *Site Data* dialog under the *Project* folder and on the *Summary Compliance* report.

Lighting Requirements

Documenting Compliance

- Indicate switching schemes, fixture types, and lamp/ballast types that comply on your project plans.
- Generate a complete set of compliance reports using the *Print* option under the ***F**ile* menu of the COM*check-Plus Report Viewer* and sign the *Summary Compliance Report* certifying the accuracy of the data you entered to describe the project. (Only one copy is needed for envelope, mechanical, and lighting compliance.)

Control, Switching, and Wiring Requirements

All lighting systems must have controls or switches that allow occupants to manually or automatically dim lights or turn them on and off.

Interior-Lighting Controls

Independent interior-lighting controls are required for each area enclosed by ceiling-height partitions. These controls can be any of the following:

- a switch located so the occupant can see the area controlled by the switch
- a switch that indicates whether the lights are on or off when it is impossible to see the controlled area from the switch location
- an occupant-sensing device.

Exceptions:

- areas that must be continuously illuminated for building security or emergency exits. These areas must be designated as security or emergency exit areas on the plans, and the lights must be controlled by switches accessible only to authorized personnel.
- public areas, such as building lobbies and retail stores. These lights can be controlled by a single switch for the entire area.

Master Switches in Hotel and Motel Guest Rooms

One or more master light switches are required at the entry door of hotel and motel guest rooms. Master switches operate all permanently wired luminaires and switched receptacles. These switches are usually three-way devices wired in combination with local controls. In multiple-room suites, a standard control device is required at the entrance to each separate room. Exception – bathroom lighting systems in hotel and motel guest rooms.

Bi-Level Switching

Lighting within a space must be switched so the occupant can reduce the connected lighting load by at least 50 percent in a reasonably uniform illumination pattern. Bi-level switching requirements may be met by:

- switching alternate luminaires in a row or alternate rows of luminaires
- separately switching half of the lamps in each luminaire or two lamps in three-lamp luminaires
- using dimming controls on all lamps or luminaires.

Exceptions – Bi-level switching is not required if:

- the area has only one luminaire
- an occupant-sensing device controls the area

- the area is a corridor, storage area, restroom, or main lobby.

Exterior-Lighting Controls

Automatic controls are required for all exterior lights. The control may be a directional photocell, an astronomical time switch, or a building automation system with astronomical time switch capabilities. The control must automatically turn off exterior lighting when daylight is available.

Exception:

Lights in parking garages, tunnels, and other large, covered areas that must be on during daylight hours are exempt from this requirement.

Tandem Wiring

The following types of one-lamp or three-lamp fluorescent fixtures must be tandem-wired:

- pendant- or surface-mounted luminaires in continuous rows
- recess-mounted luminaires located within 10 feet of each other and served by the same switch.

Exceptions:

- luminaires that use electronic high-frequency ballasts
- luminaires that are not on the same switch control or in the same area.

Interior Lighting Requirements

The connected load for interior lighting represented in the construction documents and installed in the building must not exceed those entered in this program and shown on the *Project Inspection Report*. Interior lighting includes all permanently installed general and task lighting shown on the plans. It does not include emergency lighting that is usually off, specialized lighting for medical or research purposes, lighting for museum or gallery displays, or lighting for plant growth.

Exterior Lighting Requirements

Exterior lighting must meet the following requirements when supplied through the building electrical service.

- Energy-efficient lighting must be used when illuminating paths, walkways, and parking areas. Qualifying types of energy-efficient lighting sources include fluorescent lamps and ballasts, compact fluorescents, metal halide lamps and ballasts, and high-pressure sodium lamps and ballasts. Any lighting source that has an efficacy of 45 lumens per watt or greater is allowed for exterior lighting.

Exceptions – these criteria do not apply to:

- specialized signal, directional, and marker lighting associated with air, rail, water, and road transportation
- lighting used to highlight features of registered historic landmarks structures or buildings
- lighting integral to advertising signage
- lighting used for safety or security specifically designed to meet health or life safety requirements
- low-voltage lighting used exclusively for landscaping.

Mechanical Requirements

Demonstrating Compliance

- Indicate equipment efficiencies, system controls, outdoor-air ventilation rates, duct insulation levels, duct sealing, and water-heating components that comply on your project plans.
- Generate a complete set of compliance reports using the *Print* option under the *File* menu of the COM*check-Plus Report Viewer* and sign the *Summary Compliance Report* certifying the accuracy of the data you entered to describe the project. (Only one copy is needed for envelope, mechanical, and lighting compliance.)

Equipment Efficiency

Most heating, cooling, and service water-heating equipment is covered by Federal standards for minimum energy efficiency. Therefore, available new equipment can be assumed to meet or exceed ASHRAE 90.1 ('89) Code requirements for equipment efficiency, unless the equipment falls into one of several categories not covered by Federal manufacturing standards.

If you are using equipment that falls into any of the following categories, check the appropriate equipment efficiency table to ensure it complies:

- condensing units
- ground- and groundwater-source heat pumps
- water chilling packages
- warm air duct furnaces and unit heaters
- equipment that is not newly manufactured.

All other equipment can be assumed to comply.

HVAC System Controls

- Each heating or cooling system serving a single zone must have its own temperature control device.
- Each humidification system must have its own humidity control device.
- Each zone of a multiple-zone system must have its own temperature control device.
  - *Exception*: Individual zone controls are not required if the specified system services a perimeter area and is designed to offset heating or cooling loads through the building envelope. To qualify for this exception, the area served by the system must have one temperature control device for each building exposure with exterior walls facing a single orientation for 50 contiguous feet or more, and each temperature control must be located within the spaces served by the system.
- Heat pumps having supplementary electric resistance heat shall have controls that, except during defrost, prevent supplementary heat operation when the heat pump can meet the heating load.
- Thermostats controlling both heating and cooling must be capable of maintaining a 5°F deadband (a range of temperature where no heating or cooling is provided).
  - *Exception:* Deadband capability is not required if the thermostat does not have automatic changeover capability between heating and cooling
- The system or zone control must be a programmable thermostat or other automatic control meeting the following criteria:

a) capable of setting back temperature to 55°F during heating and setting up to 85°F during cooling

b) capable of automatically setting back or shutting down systems during unoccupied hours using 7 different day schedules

c) have an accessible 2-hour occupant override

d) have a battery back-up capable of maintaining programmed settings for at least 10 hours without power

Exception: A setback or shutoff control is not required on thermostats that control systems serving areas that operate continuously.

Exception: A setback or shutoff control is not required on systems with total energy demand of 2 kW (6,826 Btu/h) or less.

Outdoor-Air Ventilation

- Outdoor-air supply systems with design airflow rates greater than 3,000 cfm of outdoor air and all exhaust systems must have dampers that are automatically closed while the equipment is not operating.
- The system must supply outside ventilation air as required by Chapter 4 of the International Mechanical Code. If the ventilation system is designed to supply outdoor-air quantities exceeding minimum required levels, the system must be capable of reducing outdoor-air flow to the minimum required levels.

Duct Insulation and Sealing

- Air ducts must be insulated to the following levels:

    a. Supply and return air ducts for conditioned air located in unconditioned spaces (spaces neither heated nor cooled) must be insulated with a minimum of R-5. Unconditioned spaces include attics, crawl spaces, unheated basements and unheated garages.

    b. Supply and return air ducts and plenums must be insulated to a minimum of R-8 when located outside the building.

    c. When ducts are located within exterior components (e.g., floors or roofs), minimum R-8 insulation is required only between the duct and the building exterior.

  Exception: Duct insulation is not required on ducts located within equipment.

  Exception: Duct insulation is not required when the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F.

- All joints, longitudinal and transverse seams, and connections in ductwork must be securely sealed using weldments; mechanical fasteners with seals, gaskets, or mastics; mesh and mastic sealing systems; or tapes. Tapes and mastics must be listed and labeled in accordance with UL 181A or UL 181B.
- Mechanical fasteners and seals, mastics, or gaskets must be used when connecting ducts to fans and other air distribution equipment including multiple-zone terminal units.
- If the distribution system is designed to operate at static pressure over 3 in. water column, the system must be leak tested in accordance with SMACNA standards. The contractor or engineer must submit a report to the enforcing jurisdiction documenting that a minimum of 25% of all duct surfaces have been tested and that tested ducts have a SMACNA rated air leakage class of less than 6.0.

Hydronic Systems Control

- Fan system terminal units must have separate hot and cold water supply and return piping.

Piping Insulation

All pipes serving space-conditioning systems must be insulated as follows:

Hot water piping for heating systems:

1 in. for pipes less than or equal to 1 ½-in. nominal diameter

2 in. for pipes greater than 1 ½-in. nominal diameter.

Chilled water, refrigerant, and brine piping systems:

1 in. insulation for pipes less than or equal to 1 ½-in. nominal diameter

1 ½ in. insulation for pipes greater than 1 ½-in. nominal diameter.

Steam piping:

1 ½ in. insulation for pipes less than or equal to 1 ½-in. nominal diameter

3 in. insulation for pipes greater than 1 ½-in. nominal diameter.

Exception: Pipe insulation is not required for factory-installed piping within HVAC equipment.

Exception: Pipe insulation is not required for piping that conveys fluids having a design operating temperature range between 55°F and 105°F.

Exception: Pipe insulation is not required for piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.

Exception: Pipe insulation is not required for runout piping not exceeding 4 ft. in length and 1 in. in diameter between the control valve and HVAC coil.

HVAC System Completion

- Each supply air outlet or diffuser and each zone terminal device (such as VAV or mixing box) must have its own balancing device. Acceptable balancing devices include adjustable dampers located within the ductwork, terminal devices, and supply air diffusers.
- Hydronic heating and cooling coils must be equipped with a way to pressure test connections and measure and balance water flow and pressure.
- Operation and maintenance documentation must be provided to the owner that includes at least the following information:
  - equipment capacity (input and output) and required maintenance actions
  - equipment operation and maintenance manuals
  - HVAC system control maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions; desired or field-determined set points must be permanently recorded on control drawings, at control devices, or, for digital control systems, in programming comments
  - complete narrative of how each system is intended to operate.

Service Water Heating

- Water-heating equipment must be provided with controls that allow the user to set the water temperature to 110°F for dwelling units and 90°F for other occupancies. Controls must limit output temperature of lavatories in public facility restrooms to 110°F.

- Heat traps are required on noncirculating water-heating systems on both inlet and outlet connections. Heat traps may be purchased or field-fabricated by creating a loop or inverted U-shape arrangement on the inlet and outlet pipes.
- Piping for circulating service hot water systems must be insulated with a minimum of 1-in. insulation having a conductivity no greater than 0.28 Btu in/(h ft2 ° F).
- For noncirculating service hot water systems, insulation is required for all piping in the following categories:
  - the first 8 ft. of outlet piping from any constant-temperature, noncirculating storage system
  - the inlet piping between the storage tank and a heat trap in a noncirculating storage system.

Pipe insulation must be at least ½ in. and have a conductivity no greater than 0.28 Btu in/(h ft2 ° F).

- Circulating service hot water systems must have a time switch control that can automatically turn off the system during unoccupied hours.
- Systems using heat trace tape must have a time switch control that can automatically turn off the system during unoccupied hours.

Enter a Project

Whole-building performance-based compliance (such as in COM*check-Plus*) requires you to describe your building design in sufficient detail for its performance to be simulated. There are two ways to create a building description in COM*check-Plus*: 1) launch the Building Creation Wizard, either by double-clicking on the prompt that appears on the screen when the program is first loaded or by clicking the Building Wizard icon on the toolbar (recommended approach) or 2) manually enter component by component using the main program interface. The Building Creation Wizard consists of up to 10 dialogs (or screens) that enable you to enter basic information about the building. The Building Creation Wizard enables you to describe even complex buildings very quickly. It also helps to minimize input errors, which can cause the analysis to fail or produce inaccurate results.

Things to Keep In Mind

- The compliance process does not require meticulous accuracy in the representation of building geometry, but a reasonably faithful description is expected. ASHRAE offers the following guidance on acceptable approximation when describing building geometry:
  - Exterior surfaces whose orientation and/or tilt differ by no more than 45 degrees may be combined into a single surface with components of the same construction.
  - Envelope assemblies that cover less than 5% of the total area of an assembly type (e.g., exterior walls) need not be separately described but may be added to the area of the adjacent assembly.
- If you copy a component created by the wizard (e.g., a space), associated components will also be created. But if you create a new space yourself, you will need to create the associated components, such as walls, roofs, and lighting and mechanical systems yourself. That is why copying existing components and editing them is **highly recommended** over creating new components manually.

Using the Wizard

COM*check-Plus* includes a wizard feature that enables you to rapidly create a building description that is complete and error free. In most cases, you will need to do some editing of the building description created by the wizard. These adjustments are made using the main interface dialogs, accessed by double-clicking on object names displayed in the tree. Starting with the wizard will save significant time over creating the building description manually.

Select *Create a New Project* via the wizard, double-click on the prompt on the opening screen or click the *Building Wizard* button on the toolbar to launch the wizard. The wizard consists of screens containing the minimum set of inputs needed to support an energy compliance analysis. The *Next* and *Previous* buttons take you forward and backward through the wizard. You can click the *Finish* button at any time, and the wizard will create a building description that can be analyzed, although unless you enter data on all of the screens, many of the default assumptions that are used will likely not be appropriate for use with your building.

Because the wizard is designed to help you quickly enter your building description, you only enter information for predominant component types. For example, your building may have four different exterior wall types, but you will enter only the predominant type in the wizard. The other walls will need to be edited outside of the wizard to reflect your building design.

You can relaunch the wizard later, and you will be returned to the screen where you left off. **However, it is important to understand that once you edit the building description (outside of the wizard), you cannot reuse the wizard without over-writing any detailed inputs you have entered.**

Using the Main Program Interface

Another way to enter your building in COM*check-Plus* is to select *Start With a Blank Project* from the first screen. The right mouse button is the key to entering a building in this way. Right click on the line *Double-Click to Create a New Project… and choose Create->Project.* This takes you through the Project dialogs (see *Appendix B* for more information on these dialogs).

Similarly, click on the *Architecture* tab and right click on *Project* to add your spaces and components. For example, you right click to add a space, then right click on the space to add a component, then right click on the component (e.g., wall) to add another element (e.g., window). Although it is possible to enter a building this way, it is not recommended as it can be very time consuming.

Edit a Project

There are two ways to edit a project in COM*check-Plus*:

- **Building Creation Wizard** – The wizard provides a quick way to create a project description but uses a limited set of inputs. You navigate through the wizard dialogs using the 'Next' and 'Previous' buttons. You can tell when you are using the Wizard by the wand icon at the left of the title bar of each wizard dialog.
- **Main Program Interface** – The main interface enables you to view and edit a project description in detail. You navigate by clicking on folder tabs and double-clicking on items in the tree control at the left of the screen to open that item's dialog.

Both methods enable you to edit the same building description, but the Wizard cannot keep track of changes you make using the main interface—its purpose is just to help you get started. You cannot go back to using the Wizard without losing the edits made during the main interface. Therefore, always do as much editing and "what-if" analysis as possible using the wizard before adding details using the main interface.

Using the Wizard

The wizard is by far the easiest way to refine the building description and show compliance. **Once you edit the building description outside of the wizard, you cannot resume use of the wizard without losing all of the edits you made.** Therefore, do as much evaluation of alternate ways to comply using the wizard as possible by selecting *Perform Analysis*, reviewing the compliance results, making edits in the wizard, selecting *Perform Analysis*, etc. Once you have finished this evaluation using the wizard, consult the *Post-Wizard Checklist* items that you may need to modify outside of the wizard. Also see *Using the Main Program Interface*.

Post-Wizard Compliance Checklist

The COM*check-Plus* building creation wizard provides a quick way to create a building description that is a rough approximation of your building design. However, until you have reviewed the building description (created with the wizard) and made the necessary adjustments, compliance results will not be valid and will not constitute an acceptable demonstration of energy code compliance. Checklist items have been organized into three categories – Architecture (see *Architecture Folder*), Mechanical (see *Mechanical Folder*), and Lighting (see *Lighting Folder*) in the order we recommend they be addressed.

After the Wizard

Once you have finished entering your building description in the wizard, you need to review the description and likely edit some elements in the three categories (as per the *Post-Wizard Compliance Checklist*).

Wizard Caution

YOU CAN ACCIDENTALLY OVERWRITE PART OF YOUR BUILDING DESCRIPTION if you don't understand how the two different features COM*check-Plus* provides for creating and editing building descriptions work.

Using the Main Program Interface

After you have created a generic building description, you can refine that description through a set of dialog boxes.

NOTE: COM*check-Plus* makes extensive use of the right mouse button. If you have trouble figuring out how to make a change, try a right mouse button click and the Help system.

The first decision to be made is whether the edit applies to all occurrences of a component type or only to a specific, individual component. Some items, such as glass types, wall assemblies, materials, and schedules are referenced components. This means the components are defined once but can be applied to multiple objects of a given type throughout the building.

How to Make a "Global" Edit (Edit a Referenced Component)

If you need to edit a referenced component, the easiest way is to re-enter the wizard. However, if you have already made some edits outside of the wizard, all of these changes will be lost if you relaunch the wizard. If this is the case, the change may be made by double-clicking on a component in the tree and selecting the specific detail to be changed and right clicking with the mouse until the appropriate dialog appears (the dialog containing the information that needs to be changed). The change is made using the *Edit* command from the right mouse menu. Once the change is made it has effectively been made for all components with that specific detail.

How to Edit a Single Component

If, on the other hand, you want to change only one specific individual component, you double-click on the component in the tree, right mouse click and select *Create New* from the right mouse menu and any changes made only apply to the single component you selected.

NOTE: You can edit fields with white backgrounds. You cannot edit fields with gray backgrounds – those are included to provide information that is helpful in verifying other input or for information purposes only.

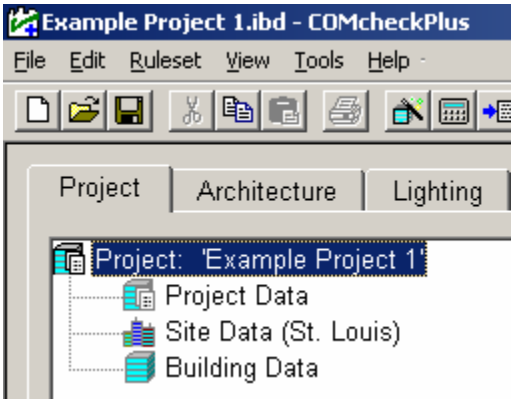
Utility Rates

COM*check-Plus* uses state-average data for utility rates as a default and these may be sufficient for your situation. However, if you have utility rates specific to your locale that you would like to use, double-click on *Project Data* (under the *Project* tab), select the *Summary Data* tab, click on the *Simulate with Utility Rate Files*

checkbox, and fill in the appropriate file name(s) under *Utility Rate Files*. The files must also be placed in the appropriate COM*check-Plus* directory. Please consult the Help message on this topic.

Project Folder

Includes basic information about the project. Additional details related to the project can be accessed by double-clicking on an item in the tree. See Appendix B for descriptions of the dialogs.



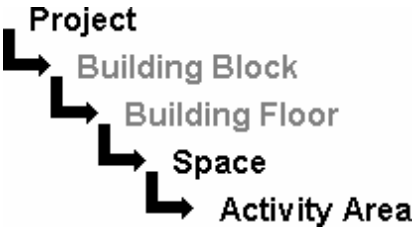
Project Data – General information about the project, such as name, location, and contacts

Site Data – Location and climate data for the building site

Building Data - Summary information about the building

Architecture Folder

Includes information about the building envelope and internal building functions and processes. COM*check-Plus* organizes building elements using this hierarchy:



Note: Display and use of *Building Block* and *Building Floor* are optional and are only applicable under the *Architecture* and *Lighting* folders.

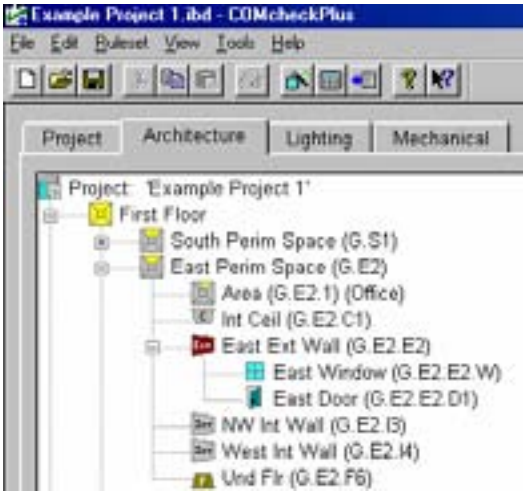
Additional details can be accessed by double-clicking on any of the items in the tree. See Appendix C for descriptions of the dialogs.

Building Block – Optional container object for organizing spaces that make up a building block; e.g., a wing or other major organizational feature of the building; used to organize the building description for buildings with major groupings of spaces (e.g., buildings with multiple wings). A project may contain one or more building blocks, and one or more building floors may be contained within a building block.

Building Floor – Optional container object for organizing spaces belonging to a building floor (or level); used as a container to organize the building description for buildings with multiple floors. A building block may contain one or more floors, and one or more spaces may be contained within a building floor.

Space – Major spatial subdivision of the building, which usually corresponds with thermal zones defined by heating, ventilation, and air-conditioning systems; used to describe areas of a building defined by thermal requirements. Spaces normally correspond with HVAC zones, although similar zones with the same orientation and HVAC equipment may be combined in a single space. A project may contain one or more spaces, and a space may contain up to four activity areas.

Activity Area – Subdivision of a building Space defined by function and lighting requirements; used to describe areas of the building defined by both location and function and their attendant requirements related to lighting, occupancy, ventilation, and equipment. Activity area designation generally corresponds with usage categories in the lighting section of the energy code. A space may contain up to four activity areas.



Exterior Wall

Window

Roof

Skylight

Floor - Including interior floors, floors exposed to crawl spaces or exterior conditions, and concrete slab-on-grade construction

Underground Wall

Interior Wall

Interior Ceiling

Default Component Names

Floors (Stories):

B = Below-grade

G = Ground

M = Middle

T = Top

Spaces:

N = North (the direction the space's exterior faces)

E = East

S = South

W = West

C = Core

To address situations in which more than one space faces a given orientation (such as where plenums are present), spaces are numbered counting counter-clockwise beginning with the south occupied space and ending with the core plenum space. For example, in a simple rectangular building with plenums, the wizard will assign to a south-facing perimeter space on the top floor the name *South Perimeter Space (T.S1)* and to a west-facing plenum space the name *West Perimeter Plenum (T.W9)*.

Envelope Components:

E = Exterior wall

R = Roof

F = Floor

U = Underground wall

I = Interior wall

C = Interior ceiling

Note that each of these components is also given a number (e.g., *T.S1.E2*) to ensure name uniqueness.

Envelope Child Components:

W = Window

D = Door

S = Skylight

Example: The component name *East Window (G.E2.E2.W)* indicates the window is in an east exterior wall identified as (*G.E2.E2*), which belongs to an east-facing perimeter space identified as (*G.E2*), which is located on the ground floor (*G*).

Activity Areas:

Activity areas are named after the space to which they belong plus a number (1 – 4) to ensure that names are unique; e.g., *Area (G.N3.1)* is the first activity area in *Space (G.N3)*.

Architecture Post-Wizard Checklist Items

Until you have reviewed the building description (created with the wizard) and made the necessary adjustments, compliance results will not be valid and will not constitute an acceptable demonstration of energy code compliance. Checklist items are listed in the recommended order they be addressed.

Building Is an Addition or an Alteration

If your project is an addition, an alteration, or involves future permitting of portions of the construction work, alternate strategies may be available for showing compliance. To learn what those options are and how they are supported in COM*check-Plus*, see *Using* COM*check-Plus for Additions and Alterations*.

Building Footprint Shape Not Available

The wizard provides a variety of building footprint shapes. There are two main options available to you when the options available in the wizard do not resemble the footprint of your building.

1. Add Copies of Existing Elements – You can create part of the building using the wizard and add copies of major elements, for example, to create a second building wing. Whenever a component is copied, child components are also copied, so a copied space will contain copies of walls and windows, lighting systems, and HVAC components (for single-zone systems).
2. Create New Spaces Component by Component – You can also create new spaces and other components manually using the *Create* option available on the right-mouse menu. However, we recommend that you copy wizard-created components and edit them rather than create entirely new components, as this approach is generally easier and more reliable.

Things to Keep In Mind

- The compliance process does not require meticulous accuracy in the representation of building geometry, but a reasonably faithful description is expected. ASHRAE offers the following guidance on acceptable approximation when describing building geometry:
  - Exterior surfaces whose orientation and/or tilt differ by no more than 45 degrees may be combined into a single surface with components of the same construction.
  - Envelope assemblies that cover less than 5% of the total area of an assembly type (e.g., exterior walls) need not be separately described but may be added to the area of the adjacent assembly.
- If you copy a component created by the wizard (e.g., a space), associated components will also be created. But if you create a new space yourself, you will need to create the associated components, such as walls, roofs, and lighting and mechanical systems yourself. That is why copying existing components and editing them is **highly recommended** over creating new components manually.

Non-Uniform Floor-to-Floor Dimensions

For simplicity, the wizard contains a single user input for floor-to-floor height, which is applied to all floors in the building. If your building has multiple stories with differing heights or the floor-to-floor height in some spaces vary from the rest, you may need to adjust the floor-to-floor height using the main interface.

To adjust the floor-to-floor height for part of the building follow these steps:

1. Adjust Ceiling Heights of Spaces

- Select the *Architecture* tab.

- Open the dialog for the first space [e.g., South Perimeter Space (G.S1)] to which the new floor-to-floor height applies by double-clicking on the space name.
- Enter the new value in the *Ceiling Height* field.
- Select the next space to which the new floor-to-floor height applies using the *Currently Active Space* drop-down list. Continue until all applicable spaces have been adjusted.

2. Adjust Ceiling Heights of Plenum Spaces

- For spaces with plenums, you may need to adjust plenum heights as well. To do this, select the plenum space [e.g., South Perimeter Plenum (G.S6)] from the *Currently Active Space* drop-down list and adjust the value in the *Ceiling Height* field. The building creation wizard adds plenum spaces anytime the *Floor-to-Floor Height* input in the wizard exceeds the *Floor-to-Ceiling Height* input by more than one foot.

3. Adjust Exterior Wall Heights

- Adjust exterior wall heights by opening the dialog for the first exterior wall [e.g., South Exterior Wall (G.S1.E2)] and entering the new value in the *Height* field. Using the *Currently Active Exterior Wall* drop-down list, continue until all applicable exterior walls have been adjusted.

4. Adjust Underground and Interior Wall Heights

- Finally, perform the same adjustment for underground walls and interior walls, if applicable. Adjusting interior walls (and modeling them at all) is optional, as their impact is generally minor.

Geometrically Complex Elements Present

It is not necessary to be precisely accurate when representing the dimensions or geometry of building elements for purposes of energy code compliance. Where building elements are geometrically complex or inherently difficult to describe as a series of rectangular surfaces, approximation of building geometry is encouraged. Simplifying assumptions generally take the form of combining the areas of geometrically complex elements with other similarly constructed elements, such as dormers whose wall and roof areas are combined with adjacent walls and roofs. Below are some guidelines for describing complex elements:

- Exterior surfaces whose orientation and/or tilt differ by no more than 45 degrees may be combined into a single surface with components of the same construction.
- Envelope assemblies that cover less than 5% of the total area of an assembly type (e.g., exterior walls) need not be separately described but may be added to the area of an adjacent assembly.
- The dimensions and orientation of architectural components (e.g., walls) are displayed in the COM*check-Plus* interface, but the relative positions of these elements generally are not. Realistic spatial geometry is not required for the program to execute correctly, and it is not necessary for exterior surfaces to meet at their edges and enclose space. Therefore, considerable flexibility can be exercised when approximating geometrically complex elements without adversely impacting the accuracy of compliance results.

Non-Uniform Window or Skylight Distribution

The building creation wizard applies windows and skylights uniformly to exterior walls and roofs based on wizard inputs for *Percent of Wall* and *Percent of Roof*, respectively. Windows are applied as a ribbon of glass across each exterior wall, and skylights are applied as one large horizontal skylight in each top-floor space.

Where windows are distributed uniformly across all orientations, where there are no fixed shading devices (i.e., overhangs or fins), and where you have entered the *Percent of Wall* input accurately, no editing of windows may be needed. In many cases though, window and skylight descriptions created by the wizard will need to be edited to accurately reflect your building design. Where good energy-efficient design practices have been employed, editing the wizard-created windows and skylights will improve compliance margins.

There are two different strategies that can be employed to edit windows and skylights.

1. Adjust the dimensions of the windows on each exterior wall

- Open the dialog for the first window [e.g., South Window (G.S1.E2.W)]. Enter revised *Height*, *Width*, and *Multiplier* for all identical windows in the exterior wall.
- If there are different sized windows for this exterior wall, select the *"-create new Window-"* option at the top of the drop-down list of the *Currently Active Window* field. This feature enables you to describe additional windows, which can be copied from existing windows and applied to any exterior wall you select.

2. Create a new window component, then copy the component to other exterior walls

- The second method for editing windows is to create a window with correct dimensions and *Glass Type* inputs, then copy the window to all locations where it is used. To create a window, right-mouse click on the parent exterior wall on the tree control and select *Create* | *Window.* After describing the window and pressing *OK*, right-click on the window and select *Copy*, right-mouse click on the Exterior Wall component were you want the window to be copied, and select *Paste*.

This may be the most effective strategy to use with buildings having some walls without any windows. In those cases, enter zero for *Percent of Wall* on the *Windows and Doors* screen in the wizard, and create the windows manually.

Skylights

Skylight editing works the same as for windows, although where plenums are present above spaces containing skylights, editing becomes more complicated. In COM*check-Plus*, skylight must be modeled as roof penetrations. Skylights impact occupied spaces not the plenums above them. The COM*check-Plus* wizard adds a roof component slightly larger than the skylight whenever a skylight is added to a space with a plenum. Because of this complication, when plenums are present we advise editing and copying skylights created by the wizard (following method 1 above) rather than by creating new skylights manually. To do this, copy the roof and skylight combination, not just the skylight. The area of the roof and skylight combination should then be removed from the roof area of the plenum above.

Skylights Not Horizontal

Tilt and orientation (azimuth direction) can significantly affect the performance of skylights. If any skylights in your design are oriented so as to diminish unfavorable solar gains during summer months or to provide beneficial solar gain in winter, it may be advantageous for building compliance for you to edit the *Tilt* and *Roof Faces* fields of roofs containing skylights. The building creation wizard sets all roofs in a flat (i.e., horizontal) position. It also defines all skylights as flat (i.e., not domed) and sets them parallel to the plane of the roof in which they are placed.

To edit skylight tilt and orientation, select the parent roof component and adjust the *Roof Slope* and *Roof Faces* fields. See Item Help (right-mouse click | *Item Help*) for explanations of these inputs.

Non-Uniform Window or Skylight Solar/Thermal Properties

The building creation wizard applies the physical and performance characteristics of the window and skylight glazing types that you specify to all windows and skylights in the project. If you have specified glazing materials with different solar or thermal properties for different locations and orientations in the building, those different products must be accurately described and applied. Failure to do so would negate the benefit toward compliance of good thermal design.

To create a new glazing-type description, double-click on the window to which the glazing characteristics will apply, select *"- create new Glass Type –"* from the *Window Data* | *Glass Type* field, and define new physical and performance characteristics for these windows. The new glass type will now appear in the *Glass Type* drop-down list and can be readily applied to the appropriate windows using the *Currently Active Window* field on the *Window Data* screen. Skylight and glazed door characteristics can be edited using the same method.

Fixed shading devices (i.e., overhangs and fins) are attributes of windows and not of glass types. See *Windows or Skylights are Shaded* for guidance on the related topic of fixed shading devices.

Windows or Skylights are Shaded

The building creation wizard does not address fixed shading devices (i.e., overhangs or fins) designed to control solar heat gain. If your design includes such devices and you wish to add them to the building description (to provide credit towards compliance), you must first ensure that the dimensions of the windows and skylights are correct. See the *Non-Uniform Window or Skylight Distribution* checklist Help topic before addressing fixed shading devices.

To add fixed shading devices to the building description, double-click on the affected window from the tree control and select the *Overhang and Fin Data* tab. Consult the Tooltips or Item Help (right-mouse | Item Help) for explanations of the various input fields. Keep in mind that the overhangs and fins are attributes of the window component and not of the glass type component. Therefore, if you wish to use the same window and fixed shading device combination in multiple locations, you can do so by describing the shading device and copying and pasting it wherever it applies.

Fixed shading devices are not normally used with skylights, hence this feature is not normally displayed in the user interface. See *Tools Menu*, *Display Detailed Inputs* Help topic if you want to enter fixed shading devices for skylights.

Unusual Opaque Assemblies Present

The building creation wizard enables you to select from among a small set of standard opaque assemblies for walls, roofs, and floors and to specify insulation R-values for those assemblies. If you are using an assembly type that does not match the available options or you want to model your actual assemblies with high accuracy, you can create new assembly descriptions.

To create new building assemblies, double-click on a component on the tree control to which you intend to apply the new assembly, for example, South Exterior Wall (G.S1.E2). Right-click on the *Wall Type* field and select *Create New Construction*. You are given the option to enter a name for the new construction and to select the name of an existing construction to copy from. Once the dialog is displayed, right-click on the *Layers* field and select *Create New layers*. You are again prompted to enter a name for the new layers component and to select the name of an existing layers component to copy from. On the *Assembly Layers* screen, you can select from among predefined materials or right-click on any of the material fields to create new material definitions.

Caution: Caution should be exercised in creating new underground wall and underground floor assembly descriptions. In order for assemblies in contact with the earth to be accurately simulated, the first two materials in these layers descriptions must contain certain materials. Creating new constructions that do not conform to these limitations will result in inaccurate results or simulation errors that prevent the compliance analyses from running.

Also, new material names cannot contain quotation marks ("), as quotation marks are used as delimiters. Use *in.* in place of *"*, as in *8 in. concrete wall* rather than *8" concrete wall*.

Interior Assemblies Not Accurately Described

The building creation wizard creates interior walls, ceilings, and floors between interior spaces (or thermal HVAC zones). Including these surfaces in the building description enables the modeling of heat conduction between spaces in the building and results in a more realistic model of overall building thermal performance.

However, **we do not recommend that you edit these components even if they are inaccurate except under specific circumstances.** The reason for this is that editing them can be quite time-consuming and their impact on overall building performance is normally quite minor.

However, it is necessary to edit interior assembly components in the following two situations:

1. **Spaces are Deleted or Added** – When you delete a space created by the wizard, you get a message warning you that the component you are deleting is referenced by other components in the model. Deleting some referenced components can cause the compliance analysis to fail. For example, if you delete a plenum in a multi-story building, the floor above will be left with an invalid reference to a nonexistent plenum on the underside of the floor. To correct the problem, you would need to edit the floor above to reference the occupied

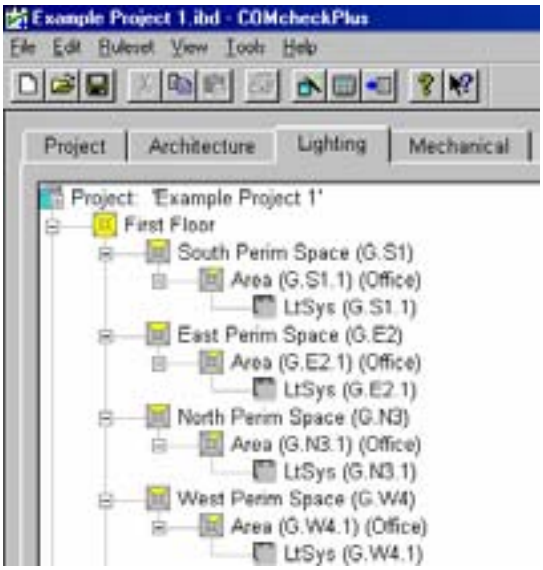
space below rather than the deleted plenum. When adding a space that is conditioned to the same temperature as adjacent spaces, it is beneficial but not necessary to create components representing intervening interior assemblies.

2. Demising Walls Separating Conditioned from Unconditioned Spaces – Where interior walls separate conditioned from unconditioned spaces, interior walls, floors, and ceilings should be described correctly in terms of the assemblies and their dimensions. In many cases, these assemblies are subject to insulation requirements under prescriptive compliance methods. Failure to include them in your building description will result in an incomplete demonstration of compliance.

Of course, you may edit interior surfaces to make them as accurate as you wish, and in some cases including these surfaces may make it easier to comply.

Lighting Folder

The *Lighting* folder includes information pertinent to interior lighting systems and the tasks and activities those systems are designed to support.



 Lighting System

COM*check-Plus* lets you describe actual lighting systems based on lamp and ballast descriptions and their corresponding input wattages. This approach eliminates the need for the user to perform external calculations while facilitating verification and enforcement by representing lighting systems in terms that can be directly observed.

COM*check-Plus* uses lighting-based activity area categories to determine lighting power budgets. Up to four different activity areas can be assigned to a single space (or thermal zone).

Additional details can be accessed by double-clicking on any of the items in the tree. See Appendix D for descriptions of the dialogs.

Lighting Post-Wizard Checklist Items

Until you have reviewed the building description (created with the wizard) and made the necessary adjustments, compliance results will not be valid and will not constitute an acceptable demonstration of energy code compliance. Checklist items are listed in the order we recommend they be addressed.

Lighting Under Separate Permit

COM*check-Plus* is currently not designed to facilitate its use in situations where a building permit is sought for only part of the construction work. Such situations arise frequently when the building shell and mechanical systems are permitted at initial construction, while lighting systems are deferred for installation by future tenants. See the *Future Permits* Help topic for guidance on use of COM*check-Plus* with a future permit for lighting.

Exempt Fixtures Present

Exempt lighting fixtures fall into two categories:

1. Fixtures that are exempt because they occur in space types that are not subject to power allowance limits.
2. Fixtures that by nature of the function they serve are exempt from inclusion in power allowance calculations.

Lighting in Exempt Space Types – Certain area types, such as *Hotel/Motel Guest Rooms* and *Multifamily Living Units* are exempt from power allowance limits, as most lighting in these occupancy types are not permanently installed and are not amenable to inspection prior to issuance of an occupancy permit. However, to improve the accuracy of the energy simulation, the wizard has been designed to include lighting systems with typical power densities in these spaces. However, regardless of what lighting system is assumed, the same system will be used in generating the energy cost budget as is used in analyzing the proposed design—in effect neutralizing the effect of the lighting system assumptions for these exempt spaces. Therefore, we recommend that you not change the wizard-defined lighting systems for these spaces.

Exempt Lighting Functions – Fixtures serving exempt functions **should not be entered** in COM*check-Plus*. The list of specific exemptions varies between codes. Normally, exempt fixtures are for special purposes, are not operated continuously, and are in addition to a separate general lighting system. Typically, exempt fixtures include emergency lighting that is usually off, specialized medical lighting, special display lighting, or lighting for plant growth.

For a detailed list of exempt lighting fixtures applicable to this code, see the *Mandatory Requirements* | *Lighting* | *Interior-Lighting Requirements* Help topic.

Exterior Lighting Present

Power for exterior lighting is not included in the energy cost budget, and there is no need to enter exterior lighting systems in the COM*check-Plus* program. However, exterior lighting is subject to certain light-source efficacy and lighting control requirements. These requirements are listed in the *Exterior-Lighting Requirements* Help topic (under *Mandatory Requirements* | *Lighting*).

Appropriate Type Not on Occupancy Type *List*

The *Occup. Type* drop-down list includes 25 or more different occupancy or area types. For definitions of these categories consult the *Activity Area Type* Help topic. If none matches exactly, select the most similar usage, with particular consideration to similarities in lighting needs. If in doubt, consult your local building official or use the *Other* category.

More Than Four Occupancy Types

The building creation wizard enables you to enter up to four area (or occupancy) types. COM*check-Plus* uses the area type information to determine lighting power densities, which affect the energy budget, and also to determine assumptions about how the building will be used and operated. Many commercial buildings will have uses that fall into more than the four area types provided for in the wizard.

If this is the case, make certain that the major area types (particularly those that occur widely throughout the building) are among the four you specify in the wizard. If possible, accurately enter the floor areas devoted to the top three area types, and combine all remaining area types under the fourth area type in the wizard.

Expanding the fourth activity area into the additional area types must be done by editing the building description using the main interface. To do so, right-click on the space on the tree control to which you intend to add an additional area type, and select *Create | Activity Area*. You will be prompted to select a name for the new activity area, the name of the space to which the activity area will belong, and the name of an existing activity area from which to copy data. Click *OK* and select the appropriate *Occupancy Type* from the drop-down list and enter the *Floor Area* devoted to this use. You then need to edit the *Floor Area* field of the activity area containing the combined area types to subtract out the area of this new activity area.

COM*check-Plus* permits each space (or thermal zone) to be assigned up to four different activity areas. In the unlikely event that more than four different area types occur within a single space, the only available option is to subdivide the space into two or more separate spaces, thereby allowing the specification of eight or more different area types.

Describe Actual Lighting Fixtures (Mandatory Item)

To show compliance, all nonexempt, interior lighting fixtures must be entered into the program. To enter lighting fixture information, select the *Lighting* tab on the main screen, double-click on the name of a lighting system, right-click on the first *Fixture* field, and select *Create New Lighting Fixture*... You are given options to provide a fixture name and to select an existing fixture from which to copy initial data before the *Lighting Fixture Data* dialog is displayed. Use this dialog to enter fixture descriptions, fixture IDs, and other data describing each type of fixture used in the project. This information should match information found on the lighting fixture schedule on the lighting plans for the building.

The program will provide total input wattage values for common lamp/ballast combinations. These values are provided for the convenience of the user in cases where actual lighting products have not yet been specified. These "typical" input wattages are designed to be somewhat conservative to ensure that fixtures that meet or exceed these efficiency values are readily available. **However, it remains the user's responsibility to ensure that the lighting equipment specified and installed in the building meets or exceeds the efficiencies displayed in the *Total Input Wattage* field and in the compliance report. We recommend that, if possible, actual specified products be entered on the lighting fixture dialog.**

The building creation wizard has been designed to create default lighting systems for each activity area, which can serve as templates for describing the actual lighting fixtures and quantities specified in the building. By default, the wizard creates the default lighting systems using popular fixture types, but you can describe the actual fixtures you intend to use within the wizard using the *Create New Lighting Fixture* feature (right-click on the *Lighting Fixture* field on the wizard *Activity Areas* screen. This approach is actually more efficient than editing the lighting system descriptions after the wizard has created them using default fixtures.

Enter Actual Lighting Fixture Counts (Mandatory Item)

To show compliance, you must enter all nonexempt, interior lighting fixtures and their quantities into the program. The building creation wizard creates default lighting systems that are designed to serve as templates for your use in describing actual lighting fixtures and quantities in the design. By default, the wizard creates these lighting systems using popular fixture types and applies them at fixture densities that approximate minimum compliance with the lighting power densities in the energy code. See *Describe Actual Lighting Fixtures* for guidance on entering fixture information.

After you have entered descriptions of the actual lighting fixtures, you must assign the fixtures and specify quantities for each activity area in each space. To do this, select the *Lighting* tab on the main screen, double-click on the name of a lighting system, select the appropriate fixture description from the drop-down list and enter the quantity in the *Number of Fixtures* field—thereby over-writing information from the default lighting system.

Each lighting system can include up to four different fixture types. Any group of lighting fixtures serving an activity area that share a common lighting control is considered a lighting system. In addition, up to four different lighting systems can be specified for each activity area. For example, a retail space might have separate lighting systems for general lighting and display lighting purposes. These should be entered as separate lighting systems with appropriate system names to clarify their function.

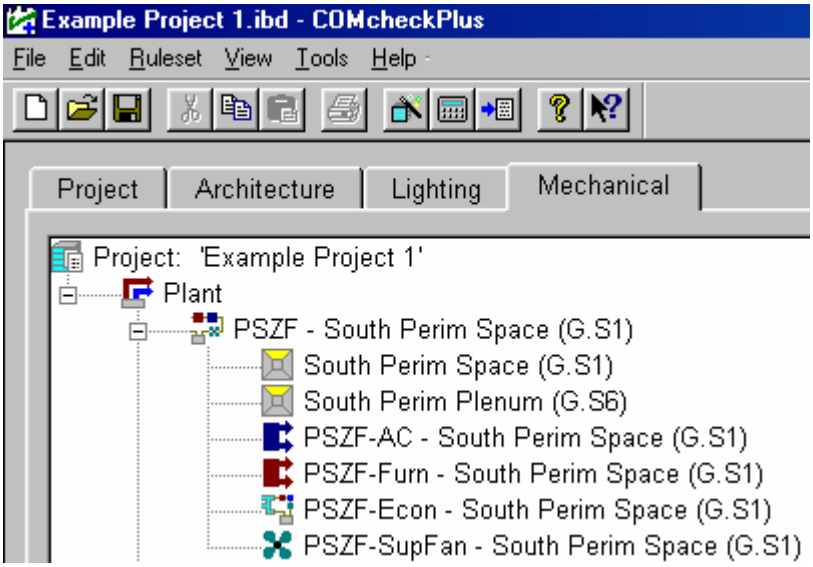
To add a new lighting system component, right-click on the activity area to be served by the system and select *Create* | *Lighting System*. You are given options to provide a lighting system name other than the default name, to select a different activity area for the system to serve, and to copy initial data from an existing lighting system before the *Lighting System Data* dialog is displayed. Select fixtures from the drop-down list and specify quantities, then select *OK*.

To complete the specification of lighting equipment, work through each area in the building specifying all nonexempt lighting fixtures and their corresponding fixture counts. This can be done efficiently using the *Currently Active Lighting System* field at top of the *Lighting System Data* dialog. This field contains a list of all lighting systems that have been defined for the project and enables you to step through them systematically and review and update the descriptions.

Mechanical Folder

The *Mechanical* folder includes information on heating, ventilating, air conditioning, and service hot water systems.

Additional details can be accessed by double-clicking on any of the items in the tree. See Appendix E for descriptions of the mechanical dialogs.



Plant - Includes service water-heating equipment

HVAC System

Air Conditioner

Furnace

Heat Pump

Economizer

 Supply or Return Fan

 Chiller

 Cooling Tower

 Boiler

 Pump

Default Component Names

Mechanical system components are named beginning with an abbreviation for the name of the system type to which the component is attached. The abbreviations below are used for package systems.

PSZ = Package single-zone

SSZ = Split-system single-zone

PT = Package terminal (air conditioner or heat pump)

PVAV = Package variable-air-volume

WS = Water source (or water loop) heat pump

The abbreviations below are used for package-system components.

AC = Air conditioner

F = Furnace

HP = Heat pump

EH = Electric heat

ER = Electric reheat

HWH = Hot water heat

HWR = Hot water reheat

Package system and component names include the spaces they serve followed by the system and equipment type abbreviations. For example, *PSZF-Air Conditioner – South Perimeter Space (B.S1)* identifies an air conditioner (AC) that is part of the package single-zone system with furnace (PSZF) serving the *South Perimeter Space (B.S1)*.

Most central-system mechanical components are given an abbreviated name followed by a number to ensure name uniqueness in cases where multiple components of the same type can be used. Abbreviations used with central systems and components are explained below.

SVAV = Standard variable-air-volume

PFVAV = Parallel fan-powered variable-air-volume

SFVAV = Series fan-powered variable-air-volume

SZAH = Single-zone air handler

2PFC = 2-pipe fan coils

4PFC = 4-pipe fan coils

The abbreviations below are used as additional central-system descriptors.

H = Heating only

C = Cooling only

EH = Electric heat

ER = Electric reheat

HWH = Hot water heat

HWR = Hot water reheat

The abbreviations below are used in central-system component names.

Elec = Electric

Recip = Reciprocating

Cent = Centrifugal

CHW = Chilled water

CW = Cooling water

HW = Hot water

Mechanical Post-Wizard Checklist Items

Until you have reviewed the building description (created with the wizard) and made the necessary adjustments, compliance results will not be valid and will not constitute an acceptable demonstration of energy code compliance. Checklist items are listed in the order we recommend they be addressed.

HVAC Zones Don't Match Uniform Perimeter Zone Depth

We recommend that in most cases you **do not** edit the spaces created by the wizard to make them match the HVAC zones used in the actual design. Editing the building description so that spaces match actual HVAC zones in the design will improve the accuracy of the analysis. However, doing so can be time consuming, and the default zoning provided by the wizard is generally adequate for code compliance purposes. Similar approximation methods are embedded in alternate compliance methods and were used in the analysis processes on which the code requirements in the code are based.

However, there are situations in which the improved accuracy from correcting HVAC zones will aid compliance. Those seeking accurate analyses of highly energy-efficient, above-code designs may want to edit the space descriptions to match HVAC zoning to improve the accuracy of the analysis. For example, correct zone descriptions may be necessary for accurate simulation of part-load HVAC system performance. The description of how the wizard defines spaces (which are used by the program as HVAC zones) and instructions on editing space descriptions to match actual HVAC system zones are provided for those wanting to go beyond what is necessary for demonstration of minimum code compliance.

How the Wizard Defines HVAC Zones – For rectangular building footprints and all but the smallest floor areas (e.g., under 4,000 ft^2/floor), five spaces (or HVAC zones) are created per floor. These spaces represent a core zone and four perimeter zones, one for each cardinal orientation with zone depths matching the *Perimeter Zone Depth* input field in the wizard. The single core zone per floor is rectangular in shapes and includes all floor area not assigned to the perimeter zones. Each perimeter zone is trapezoidal in shape, and includes a single exterior wall exposure (or underground wall, if below grade). As the area of the building footprint is reduced, the wizard eliminates the core zone, then reduces the number of perimeter zones, and finally describes the floor as a single zone. In multistory buildings, the wizard gives each floor the identical footprint and arrangement of spaces.

Steps for Editing HVAC Zones – These instructions provide general guidance on how to edit spaces (or HVAC zones) using the main COM*check-Plus* interface. Instructions are provided on the following topics:

- Creating a New HVAC Zone

- Deleting an Existing HVAC Zone
- Merging Two HVAC Zones
- Subdividing an HVAC Zone

The *Perimeter Zone Depth* field in the wizard should be used first to create the best possible match to actual building zoning before beginning editing using the main program interface. Also, because editing zone definitions can be complicated, it is **highly** recommended that you save files frequently and under a series of file names, so you will not lose significant work if you make a mistake.

Creating a New HVAC Zone

New HVAC zones are best created by copying an existing wizard-created HVAC space and editing it. To create a new space, follow these steps:

1. **Make a copy of an existing space** – Select an existing space that is as similar as possible to the new space you need. Select the *Architecture* folder, right-click on the space to be copied, and select *Copy*, then right-click again and select *Paste*. A copy of the space will appear at the bottom of the tree control. Rename the space to clarify its identity. If the space has a plenum, also make a copy of the plenum.
2. **Edit activity areas or add new ones** – Edit the *Occup. Type* and *Floor Area* fields of the activities area(s) listed under the space (double-click on the activity area names on the tree control) so they reflect the intended uses in the new space and their associated floor areas. If necessary, create new activity areas by right-clicking on the new space and selecting *Create | Activity Area* or delete activity areas by right-clicking on the activity area and selecting *Delete*.
3. **Edit walls, roofs, and floors or add new ones** – Edit walls, roofs, and floors of the new spaces or add or delete components using the same techniques as in step 2. If the space has a plenum, do the same for the plenum. You should also edit the *Next to* fields in existing interior walls, ceilings, and floors to reflect the new adjacencies. You may also create new interior walls, ceilings, and floors, but this is not required due to their relatively minor impact on analysis accuracy.
4. **Edit lighting systems** – Select the *Lighting* folder and double-click on each lighting system serving the new space to enable editing of fixture selections and fixture quantities. Add or delete lighting systems, if necessary.
5. **Edit space assignments to HVAC systems** – Select the *Mechanical* folder and, if single-zone systems are being used, ensure that one new HVAC System has been created, and that both the new space and its plenum have been assigned to the system. For multiple-zone systems, this review involves ensuring that the new space and plenum appear as children under the correct HVAC system.

Deleting an Existing HVAC Zone

If you want to delete a space completely, you also need to remove all references to the deleted space or the compliance analysis will fail. To delete a space, follow these steps:

- **Delete or edit adjacent interior surfaces** – Update the *Next to Space* references for interior wall and interior floor components that reference the space you intend to delete. Each space typically references one space next to it and one space above it unless a roof is above. If the deletion of the space will cause the interior surface to be adjacent to a different space, update the *Next to Space* field to reference that new space. If the deletion of the space will cause the interior surface to go away (such as the interior ceiling below a plenum that will also be deleted), simply delete the surface.
- **Delete or edit adjacent interior surfaces of plenum** – If the space has a plenum, also edit or delete interior surfaces that reference the plenum that will be deleted. For example, edit the *Next to Space* field of the interior wall of a plenum that will now be next to a different plenum, but delete any components that will be eliminated, such as the interior floor of a space over a plenum when the plenum and the space above will be deleted.

- **Delete lighting systems** – Select the *Lighting* tab and delete all lighting systems associated with the space you intend to delete.
- **Delete mechanical system or references** – Select the *Mechanical* tab and, if a single-zone system is used, delete the mechanical system associated with the space you intend to delete. You will be warned that the mechanical system is referenced by other component(s), which are the space and plenum that you will delete in the next step. If a multiple-zone system is used, simply delete the space and its plenum from the list of spaces that appear under the HVAC system on the tree control.
- **Delete space and plenum** – Finally, delete the space and associated plenum, if present. If you have successfully eliminated references to these spaces, you will be warned that all child components will also be deleted, but you will not be warned of any references to these spaces. If the warning message indicates that the space is still referenced by other components, select *No* and review the above steps for any you may have missed or performed incorrectly. Otherwise, the compliance analysis may fail when a nonexistent component is referenced.

Note: If a compliance analysis returns a *No Results* message, it is most likely because your building description still references a component that you deleted.

Merging Two HVAC Zones

To merge two existing HVAC zones into a single zone, follow these steps:

1. **Delete shared interior wall** - Select the *Architecture* folder, then delete any interior wall (Interior Wall) dividing the two spaces you are merging (right-click on the component on the tree and select *Delete*). The interior wall will be described as a component of one or the other of the spaces being merged. (Delete the interior wall that shows the other space being merged in the *Next to Space* field on the *Interior Wall Data* dialog.)
2. **Delete shared interior wall of plenum** – If the spaces have plenums, delete the interior wall separating the plenums.
3. **Change references for adjacent interior surfaces** – Update the *Next to Space* references for interior wall and interior floor components that reference the space or plenum you intend to eliminate. Each space or plenum typically references one space next to it and one space above it (unless a roof is above). For example, the floor above a plenum you are eliminating will need its *Next to Space* reference updated to list the merged plenum not the deleted plenum. Also, interior walls of spaces and plenums next to the deleted spaces and plenums will need their *Next to Space* references updated.
4. **Move space components** - Drag all exterior walls, roofs, underground walls, floors, remaining interior walls and ceilings, and activity areas from the space you intend to eliminate to the space with which it is being merged.
5. **Move plenum components -** If the spaces have plenums, drag all exterior walls, roofs, underground walls, and interior walls from the plenum you intend to eliminate to the plenum with which it is being merged.
6. **Delete HVAC system** - Select the *Mechanical* folder and delete the mechanical system serving the space you are eliminating.
7. **Delete space and plenum** - Select the *Architecture* folder and delete the space and plenum you intend to eliminate. If the warning message indicates that the space is still referenced by other components, select *No* and review the above steps for any you may have missed or performed incorrectly. Otherwise, the compliance analysis may fail when a nonexistent component is referenced.

Subdividing an HVAC Zone

To subdivide an existing HVAC zone into two, follow these steps:

1. **Make a copy of the space** – Select the *Architecture* folder, right-click on the space to be subdivided, and select *Copy*, then right-click again and select *Paste*. A copy of the space will appear at the bottom of the tree control. Rename both copies of the space to clarify their identities. If the space has a plenum, also make a copy of the plenum.
2. **Delete duplicate child components** – Delete any child components that now belong to either one or the other of the spaces but not to both. For example, delete interior walls that the spaces are no longer adjacent to and activity areas that are no longer part of the respective spaces. Deleting activity areas will also delete the associated lighting systems, which are child components of the activity areas, so ignore the warning when deleting these components.
3. **Edit components split between spaces** – Edit all components that now appear in both spaces to divide them appropriately between the spaces. These typically will include exterior and interior walls, ceilings, roofs, floors, activity areas, and lighting systems.
4. **Edit adjacent interior surfaces** – Edit interior walls, ceilings, and floors adjacent to the newly created space and plenum so that their *Next to* field references the newly created space and plenum rather than the old.
5. **Edit space assignments to HVAC systems** – Select the *Mechanical* folder, and with single-zone equipment ensure that one new HVAC System has been created and that both the new space and its plenum have been assigned to the system. For multiple-zone systems this review may simply involve ensuring that the new space and plenum appear as children under the correct HVAC system.

Natural Gas Is Not Available at the Building Site

First, read *Natural Gas Not Available* which contains an explanation and an important caveat related to use of this input. Then, if gas is not available at your building site, select the *Project* tab, double-click on *Project Data*, select the *Utility Rate Data* tab, and check the *Natural Gas is Not Available* checkbox.

More Than One Type of HVAC System Present

The building creation wizard allows you to specify only one type of system for the building. If a portion of the building is served by a different type of system than that entered in the wizard, it will be necessary to add the new system using the main program interface and to reassign spaces to the new systems. Because the steps necessary to accomplish this depend on the specific systems types to be added, only general guidelines can be provided here.

1. **Create a new HVAC system** – To create a new system, select the *Mechanical* folder, right-click on *Plant* on the tree control, and select *Create | HVAC System*. From within the *System Data* dialog that will be opened, make selections for *Heat Source*, *Cool Source*, and *Type* from the drop-down lists to define key characteristics of the new HVAC system.
2. **Create new equipment to serve the HVAC system** – From within the *System Data* dialog, create new equipment components by selecting the *Create New...* option for each new piece of equipment needed to serve the system; e.g., air conditioner, furnace, supply fan, and economizer.
3. **Review and edit the characteristics of each new piece of equipment** – The C*reate New...* and *Edit Selected...* options open the dialogs that enable equipment components to be edited. Enter the equipment characteristics beginning at the top and working from left to right; some of the fields are interdependent, and only relevant fields are displayed.
4. **Move spaces and plenums to the new HVAC system** – Once the equipment has been defined, close the dialogs and drag the spaces from the old HVAC system to the newly created HVAC system using the tree control.
5. **Delete unneeded components from the wizard-created HVAC system** – If any of the wizard-created components are now unused, delete them.

Specify Equipment Efficiencies (Mandatory Item)

The building creation wizard sets equipment efficiencies to match minimum code requirements, which in most cases match manufacturing standards, hence they represent the least efficient new equipment that can be purchased. For most equipment types, minimum efficiencies are capacity dependent, which is why equipment efficiency fields default to "- sim default – ", indicating that the default value is not set until the simulation has been run or capacities have been entered.

You should enter efficiencies based on the equipment that you are specifying and/or installing in the building. To do this, select the *Mechanical* folder and double-click on the name of a piece of equipment [e.g., PSZF-Air Conditioner - South Perimeter Space (G.S1)] on the tree control to open its dialog. First review and, if necessary, revise the equipment characteristics. Some equipment ratings and efficiency requirements depend on these characteristics, so you need to establish the characteristics before entering equipment efficiencies. If equipment capacities are known, enter them as well.

Finally, enter the rated efficiencies for your equipment. Equipment installed in the building must meet or exceed the efficiencies used in the analysis, even if you allow these inputs to default.

To expedite the process of entering equipment characteristics and efficiencies for multiple pieces of equipment, use the *Currently Active...* field at the top of each dialog. This feature enables you to step through the list of equipment of each type and systematically update the inputs for each unit. This process needs to be performed for each component type that appears in the tree control, for example, for air conditioners, furnaces, economizers, and fans.

IMPORTANT: If you allow equipment efficiencies to default, you will receive no credit towards compliance for any equipment that exceeds code minimum.

Specify HVAC System Equipment Capacities

If you know the capacities of the equipment that will be used, enter them in the capacity fields on the equipment dialogs. Capacity fields are available for air conditioners, furnaces, fans, and service water heaters. The capacities will be used in determining equipment efficiencies for the budget building that your design will be compared against and in setting the capacities used in the simulation of your design—provided the capacities are adequate to meet the simulated loads.

To enter equipment capacities, select the *Mechanical* folder and double-click on the name of a piece of equipment [e.g., PSZF-Air Conditioner - South Perimeter Space (G.S1)] on the tree control to open its dialog. Enter rated capacities at applicable rating conditions as listed in manufacturers' literature. To expedite the process of entering capacities for multiple pieces of equipment, use the *Currently Active...* field at the top of each dialog.

If Spaces Do Not Match Actual Zoning – We recommend that you use the default zoning implemented by the wizard, even when the resulting spaces do not match the HVAC zones in the building design. However, with unitary single-zone equipment, differences in zoning can create mismatches between loads and equipment capacities, leading to unmet loads or inaccurate performance of equipment because part-load ratios are incorrect.

To address this problem, we recommend that equipment capacities (if known) be entered accurately for the specified equipment and that the *Number of Units* field in the *HVAC System* dialog be used as a multiplier to scale capacities to adjust for zoning differences. The *Number of Units* field is intended primarily for use where multiple pieces of identical equipment are used to serve a single zone (or a series of essentially identical zones). However, this field accepts non-integer input values so that it can also be used to scale capacities as shown in the following example:

Example - A simple two-zone building is served by two 10-ton roof-top units, one serving a south zone and one serving a north zone. The building creation wizard sets up the building with four perimeter spaces. To account for the spaces in the building description being half the size (and having roughly have the load) of the actual zones, you enter the following values for each of the four air conditioners serving each of the four spaces:

Full Load Capacity: 120,000 Btu/h

Number of Units: 0.50

Use of the *Number of Units* field as a multiplier causes each air conditioner to be simulated with its capacity scaled proportionately to its load (four 5-ton units instead of two 10-ton units), while the actual capacity of equipment used in the building is accurately represented in this field in the compliance report. The energy cost budget will be generated using air conditioners matching the minimum efficiency for 10-ton units (Full-load EER = 8.7), rather than the minimum efficiency for 5-ton units (SEER = 9.7).

IMPORTANT: The *Number of Units* will only be visible for water heaters and for single-zone HVAC systems that include unitary heating or cooling equipment such as air conditioners, heat pumps or combustion furnaces.

Specify Central Plant Equipment Capacities

If you know the capacities of the equipment that will be used, enter them in the capacity fields on the equipment dialogs. The capacities will be used in determining equipment efficiencies for the budget building that your design will be compared against and in setting the capacities used in the simulation of your design—provided the capacities are adequate to meet the simulated loads.

To enter equipment capacities, select the *Mechanical* folder and double-click on the name of a piece of equipment [e.g., ElecCentOpen Chiller 1] on the tree control to open its dialog. Enter rated capacities at applicable rating conditions as listed in manufacturers' literature. To expedite the process of entering capacities for multiple pieces of equipment, use the *Currently Active...* field at the top of each dialog.

IMPORTANT: You must enter the capacities of chillers if you entered a value greater than 1 in the *Number of Chillers* field of the *Cooling Primary Equipment* dialog of the Wizard, and you must enter the capacities of boilers if you entered a value greater than 1 in the *Number of Boilers* field of the *Heating Primary Equipment* dialog of the Wizard. If either of these conditions is not met, the simulation will not be performed. An error message will appear.

Check Compliance

After all checklist items have been addressed, the edited building description is ready for use in demonstrating compliance. However, depending on your objectives, you may decide to use the building description in pursuing various objectives. These may include:

- showing minimum code compliance
- identifying less costly and/or more effective ways to comply
- exploring options for improved energy efficiency
- documenting expected energy savings and level of above-code energy-efficient performance.

Pursuing most of these options will involve making additional edits to describe design alternatives and running successive performance analyses. We recommend that you save each major alternative under a new file name. Compliance results can be captured and analyzed further by following these steps: 1) select (highlight) text in the compliance reports (the *Detailed Compliance Results* report will likely be most useful), 2) copy the data to the Windows clipboard, and 3) paste the data into a spreadsheet.

Before you are done, review *Mandatory Requirements* to ensure that your design complies with that set of energy code requirements, which applies to all commercial buildings.

To check compliance, save the building description to a file using the *Save* or *Save As* command from the *File* menu. Click on the *Perform Analysis* icon on the toolbar or select the *Perform Analysis* option from the *Tools* menu. (See *Compliance Analysis Process* below for an explanation of the multi-step compliance process used by COM*check-Plus*).

A small *Compliance Analysis Status* window is displayed to enable you to track progress of the analysis. A compliance analysis for a typical commercial building will take between one and five minutes to complete on a typical desktop computer. The compliance analysis can be run as a background task while you do other work.

If there are problems with your building description, such as missing data for inputs that are designated as Compulsory, a dialog box listing the errors will be displayed. Compulsory inputs are for data that are required because the program cannot generate meaningful results without it. At the completion of the analysis, a compliance/noncompliance message is displayed.

When the *Compliance Result* message is displayed at completion of the analysis, you have the option of returning to the main COM*check-Plus* program or opening the Report Viewer to examine the analysis results in greater detail. For information on using the viewer, see *Compliance Reports* below.

Compliance Analysis Process

COM*check-Plus* uses a multi-step compliance process:

1. A list of rules is applied to your proposed design to establish a standard set of conditions for analysis.
2. A simulation of your proposed design is performed to establish HVAC equipment capacities. This step ensures that space conditioning loads are met.
3. A final annual simulation is performed on your proposed design, and the results are used to calculate annual energy costs.
4. A list of rules is applied to convert your proposed design into a budget design, a version that minimally complies with prescriptive requirements of the energy code.
5. A simulation of the budget design is performed to establish HVAC equipment capacities. This step determines HVAC equipment capacities in the budget design.
6. A final annual simulation is performed on the budget design, and the results are used to calculate the energy cost budget.
7. Compliance is determined based on a comparison of annual energy costs for the proposed design with the energy cost budget.

At the completion of the analysis, a compliance/noncompliance message is displayed.

Compliance Reports

COM*check-Plus* provides a compliance report viewer application which is used for both viewing and printing program output. To access the viewer, click the *Compliance Reports* icon on the toolbar or select *View Compliance Reports* at the completion of a compliance analysis. Several different types of reports are available. To select a different report from the *Summary Compliance Report*, which is displayed initially, select the desired report from the tabs at the bottom of the screen.

To return to the main COM*check-Plus* program without closing the viewer, click the COM*check-Plus* icon on the toolbar or exit the Viewer as you would any other Windows application.

Note: The program only allows compliance reports to be redisplayed if they are current – once you alter the building description you must perform the analysis again before the compliance reporting features are available. This is intended to prevent the user from being misled by out-of-date results. However, if you wish, you may simply leave the Viewer open to preserve access to the previous compliance result. In addition, from within Windows Explorer, you can double-click on the previous compliance report found in the *Reports* folder (e.g., C:\Program Files\COMcheck-Plus\Reports) to view the most recently generated report.

Besides the *Summary Compliance Report*, a *Detailed Compliance Report*, *Mandatory Requirements Checklist*, and *Project Inspection Report* are also available. Most of the COM*check-Plus* output reports are designed for submission to the building department to support the building permitting process. The reports provide authentication of energy code compliance and checklists for use in plan review and site inspections.

Using COM*check-Plus* for Additions and Alterations

There are two options that are generally accepted for showing energy code compliance for additions and alterations. These options are:

1. **Analyze Addition as Standalone Building** – demonstrate that the new work conforms with the energy code on its own.
2. **Analyze Addition Plus Existing** – demonstrate that the new work plus any alterations to the existing building will produce annual energy costs no higher than the existing building with the addition built to code.

Analyze Addition as Standalone Building

Option 1 can be performed using various methods including COM*check-Plus*. Using COM*check-Plus*, simply model the new work as though independent of the existing building and show that the new work complies on its own. Where the addition connects with the existing building, intervening surfaces should simply be ignored provided the spaces are conditioned to the same temperatures on either side of the shared surface. If they are not, treat the shared assembly as though exposed to the exterior.

Analyze Addition Plus Existing

Option 2 requires somewhat more effort but may be necessary for additions that cannot reasonably be made to comply on their own. For example, this situation may arise when windows cover a large percentage of the exterior wall area of an addition. By analyzing the addition plus the existing building together, alterations to the existing building that improve efficiency can be used to offset noncompliant features of the addition. However, the procedure is designed so that any pre-existing under-compliance (or over-compliance) of the existing building will not affect the compliance assessment outcome for the new work.

Analysis Steps

To perform the analysis for Addition Plus Existing follow these steps:

1) Describe the building in its current condition using COM*check-Plus*. Use the words "Existing Building As Is" or similar in the *Project Name* field on the first building wizard screen, and save the building description.

Note: If the existing building will be changed to a new use following the alterations, enter the new uses in the COM*check-Plus* area type fields rather than the previous uses.

2) Perform a compliance analysis and record the total energy bill values for *Proposed and Budget* designs from the *Detailed Compliance Results* report. (This report is accessed from the Window menu on the *COMcheck-Plus Report Viewer*.)

3) Load the "Existing Building As Is" file into COM*check-Plus* and, using the File|Save As command, retitle the project by substituting "Proposed Addition Plus Existing" or similar in place of "Existing Building As Is." Add the addition to the description and modify the existing building description to reflect proposed alterations. Save the new description.

4) Perform a compliance analysis and record the new floor area and total energy bill values for *Proposed and Budget* designs from the *Detailed Compliance Results* report.

5) Calculate the adjusted budget energy bill for Addition Plus Existing using the following procedure:

$$Budget_{Adjusted} = Budget_{Combined} + (EnergyCosts_{Existing} - Budget_{Existing})$$

Where:

$Budget_{Adjusted}$ = the adjusted annual energy cost budget for the combined building (existing plus addition)

$Budget_{Combined}$ = the raw annual energy cost budget for the combined building

$EnergyCosts_{Existing}$ = the annual energy costs for the existing building prior to any alterations

$Budget_{Existing}$ = the annual energy costs budget for the existing building

6) Document the above calculation similar to how it is documented in the example below and submit it along with the compliance report.

Example: An older existing 45,000 ft^2 building is to receive a 15,000 ft^2 addition. The proposed addition will fill the central portion of a U-shaped courtyard, and the walls of the addition are mostly glass.

Annual Energy Costs for Existing Building As Is = $ 85,438
Budget for Existing Building As Is = $ 66,210
Adjustment for Existing building = + $ 19,228

Budget for Proposed Addition Plus Existing = $ 100,207
Adjusted Budget for Proposed Addition Plus Existing = $ 119,435

Energy Costs for Proposed Addition Plus Existing = $ 117,640
Project Complies
Project Compliance Margin = $ 1,795

Appendix A: Wizard Screen Descriptions

The following sections describe the screens within the wizard.

General Information

Enter general information about your project in the input fields provided.

Project Name

Enter the name or description that will be used to identify the project; by default this name is used as the project file name.

Building Type

Select a building type from the list. The building type is used in the initial assignment of space within the building to various occupancy and usage categories, called activity areas.

Assembly – A building or structure for the gathering together of persons, such as auditoriums, churches, dance halls, gymnasiums, theaters, museums, passenger depots, sports facilities, and public assembly halls.

Exercise Center – A building or structure used for recreational activities involving physical exertion designed to promote physical fitness and well-being.

Grocery Store – A building or structure that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.

Hotel/Motel – A building or structure for transient occupancy; e.g., resorts, hotels, motels, barracks, or dormitories.

Library – A building or structure in which literary and artistic materials, such as books, periodicals, and audiovisuals, are kept for reading, reference, and loan.

Medical and Clinical Care – A building or structure for the purpose of providing medical treatment, confinement or care, and sleeping facilities such as hospitals, sanitariums, clinics, orphanages, nursing homes, mental institutions, and reformatories.

Multifamily – A building or structure containing three or more dwelling units.

Museum – A building used for the display and preservation of objects of artistic, scientific, or cultural interest.

Office – A building or structure for office, professional, or service type transactions such as medical offices, banks, libraries, and government office buildings.

Religious Worship – A building for worship, religious services, and associated social and educational functions.

Restaurant – A building or structure for the preparation and consumption of food or drink, including coffee shops, cafeterias, bars, and fast food and leisure restaurants.

Retail Sales, Wholesale Showroom – A building or structure for the display and sale of merchandise such as shopping malls, food markets, auto dealerships, department stores, and specialty shops.

School – A building or structure for the purpose of instruction such as schools, colleges, universities, and academies.

Storage, Industrial and Commercial – A building or structure for storage, such as aircraft hangars, garages, warehouses, storage buildings, and freight depots.

Theater—Motion Picture – An assembly room, hall, or building with tiers of rising seats or steps for the showing of motion pictures.

Theater—Performance – An assembly room, hall, or building with tiers of rising seats or steps for the viewing of dramatic performances, lectures, musical events, and similar live performances.

Other – A building or structure whose intended use is currently not known or does not match any of the above categories.

State

Select the state in which the building will be located.

City

Select the city in which the building will be located.

Building Area

Enter the gross building floor area. Normally this area should include both conditioned and unconditioned spaces provided they are fully enclosed. For example, you should include an unconditioned storage space, but not a crawl space, an interstitial mechanical space, or a plenum space.

Floors Above Grade

Enter the number of floors (or stories) above grade. For floors partially above grade, enter them as above-grade floors if more than half of the associated wall area is above grade, otherwise enter them as below-grade walls.

Floors Below Grade

Enter the number of floors (or stories) below grade. For floors partially below grade, enter them as below-grade floors if 50% or more of the associated wall area is below grade, otherwise enter them as above-grade walls.

How is the Building Cooled?

Select the type of equipment used to cool the building. Additional cooling options are planned for future versions.

How is the Building Heated?

Select the type of equipment used to heat the building. Additional heating options are planned for future versions.

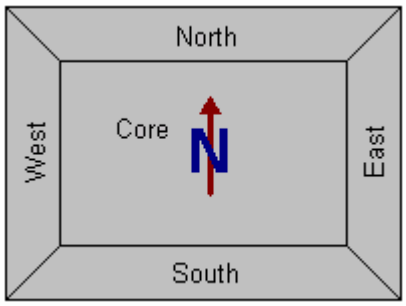
Building Footprint

Select the shape and orientation options that best match your building. Default dimensions are applied based on the shape you select and the gross building area entered on the previous screen. You should enter precise building dimensions if they are known. For complex building shapes that are not shown in the list, select the shape that with the fewest additions will match the actual shape.

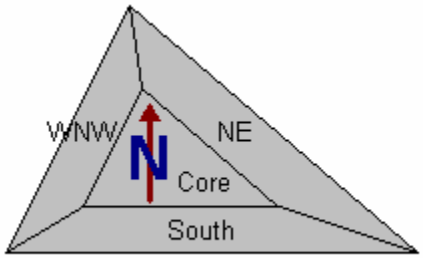
Footprint Shape

Select the footprint shape that best matches your building's overall shape and massing.

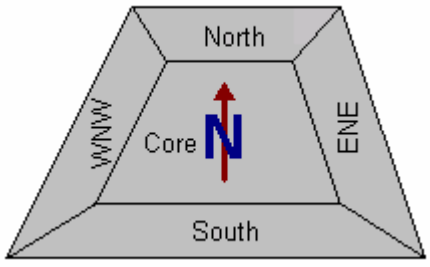
Rectangle



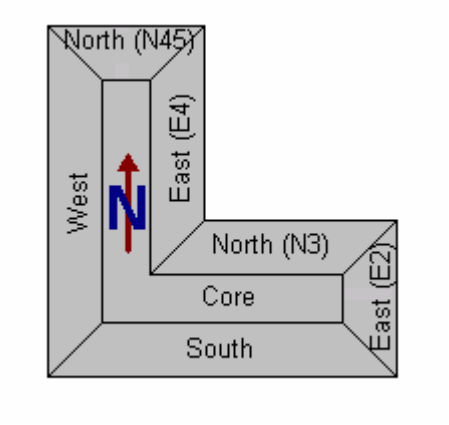
Triangle



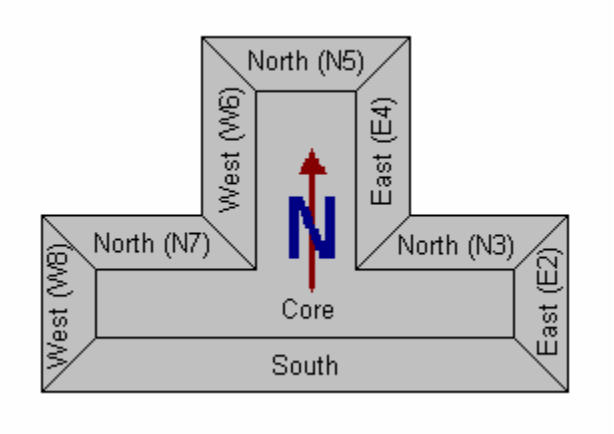
Trapezoid



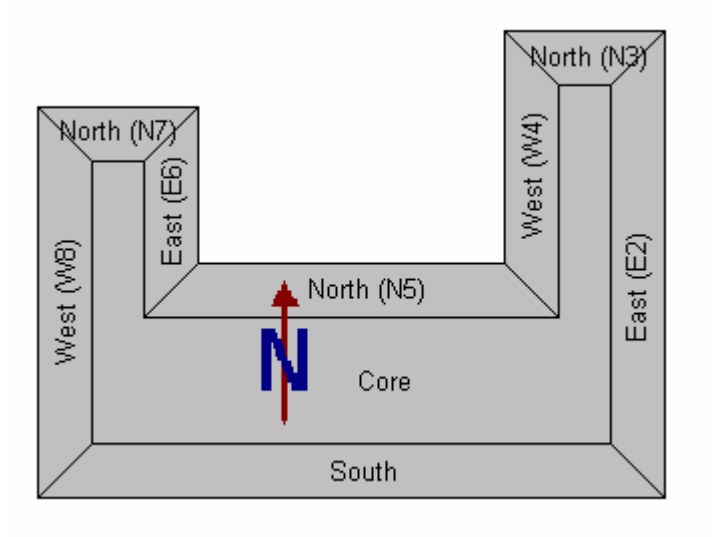
'L' Shape



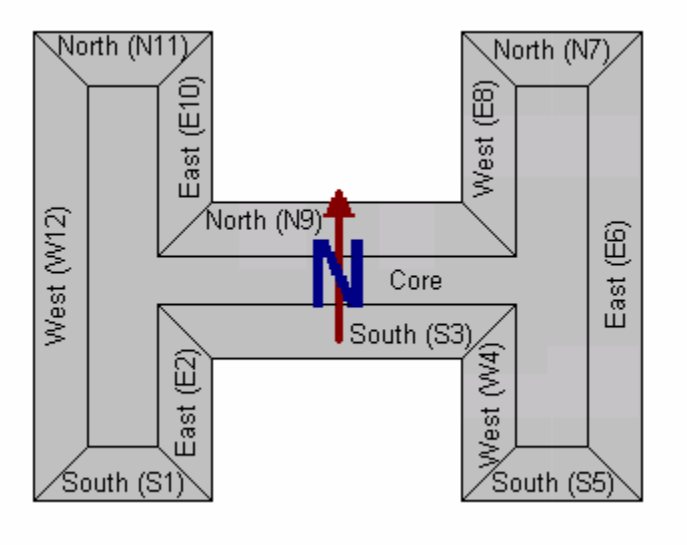
'T' Shape



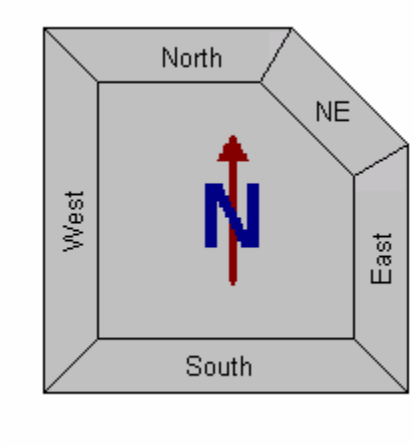
'U' Shape



'H' Shape



Rectangle Minus Corner



Building Orientation

Use the *Building Orientation* field to correctly orient the north arrow on the building footprint diagram you have selected.

X1

Enter the X1 dimension for your building as identified on the footprint diagram. Note that the initial default dimensions are set to match the gross building area and number of floors entered on the first screen.

Y1

Enter the Y1 dimension for your building as identified on the footprint diagram.

Perimeter Zone Depth

Enter the average depth of perimeter HVAC zones in the building, measured perpendicular to the exterior walls and inward towards the center of the building. Perimeter zones are HVAC zones (or spaces) adjacent to exterior walls. Typically a band of floor area next to (i.e., within 12 to 20 feet of) an exterior wall is served by a perimeter HVAC system designed to offset envelope heating and cooling loads. The COM*check-Plus* wizard

treats space within the Perimeter Zone Depth of an exterior wall as part of a perimeter zone even if the exterior wall has no doors or windows. The remainder of the space is assigned to a core zone. Core zones with thermal loads from the roofs or plenums are not considered perimeter zones.

Perimeter Zone

Perimeter zones are HVAC zones (or spaces) adjacent to exterior walls. Typically a band of floor area next to (i.e., within 12 to 20 feet of) an exterior wall is served by a perimeter HVAC system designed to offset envelope heating and cooling loads. The COM*check-Plus* wizard treats space within the *Perimeter Zone Depth* of an exterior wall as part of a perimeter zone even if the exterior wall has no doors or windows. The remainder of the space is assigned to a core zone. Core zones with thermal loads from the roofs or plenums are not considered perimeter zones.

Floor-to-Floor (or Floor-to-Roof) Height

Enter the average or most common floor-to-floor height in the building. For single-story buildings, enter the floor-to-roof height from the floor to the exterior side of the building thermal envelope.

Floor-to-Ceiling Height

Enter the average or most common floor-to-ceiling height in the building. Plenums are created for buildings in which the floor-to-floor height exceeds the floor-to-ceiling height by more than one foot.

Exterior Walls

Enter information about above-grade and below-grade (if applicable) exterior wall construction in the fields provided. Entries available change depending on selections made (e.g., *Furring* becomes available when *Structural Masonry* is chosen as the wall type).

Wall Type

Select the type of construction used for exterior above-grade walls. Where multiple wall types are used, select the most common. If a good match to the actual construction is not shown, make an arbitrary selection. COM*check-Plus* will enable you to easily replace the selection later with a construction you define.

Wall Sub-Type

Select the construction sub-type for exterior above-grade walls from the list.

Wall Furring Type

Select the type of furring or framing used (if any) with the exterior above-grade walls. If the wall construction varies, select the type that is most common.

Wall Cavity R-Value

Enter the R-value of any insulation material installed in the cavities between wall structural members. The entered value should represent a rated R-value for the insulation material, which is commonly printed on the material. Do not include the insulating value of other parts of the building assembly (e.g., gypsum board or air films).

Wall Continuous R-Value

Enter the R-value of any continuous insulation material in the wall assembly. Continuous insulation is insulation that is continuous over framing members or furring strips and is free of significant thermal bridging. The entered value should be a rated R-value for the insulation material, which is commonly printed on the material. Do not include the insulating value of other parts of the assembly, such as fiber board or gypsum wall sheathing or air films.

Exterior Below-Grade Wall Type

Select the type of construction used for exterior below-grade walls. Where multiple wall types are used, select the most common. If a good match to the actual construction is not shown, make an arbitrary selection. COM*check-Plus* will enable you to easily replace the selection later with a construction you define.

Below-Grade Wall Furring Type

Select the type of furring or framing used (if any) with the exterior below-grade walls. If the wall construction varies, select the type that is most common.

Below-Grade Wall Cavity R-Value

Enter the R-value of any insulation material installed in the cavities between wall structural members. The entered value should represent a rated R-value for the insulation material, which is commonly printed on the material. Do not include the insulating value of other parts of the building assembly (e.g., gypsum board or air films).

Below-Grade Wall Continuous R-Value

Enter the R-value of any continuous insulation material in the wall assembly. Continuous insulation is insulation that is continuous and free of significant thermal bridging. The entered value should be a rated R-value for the insulation material, which is commonly printed on the material. Do not include the insulating value of other parts of the assembly, such as gypsum wall board or air films.

Windows and Doors

Enter information about window and door characteristics in the fields provided.

Percent of Wall

Enter the building's total window area as a percentage of total exterior above-grade wall area (i.e., the total for walls, windows, and doors). Include window frames in your window area entries. You may figure window areas on the basis of rough-framed openings. However, rather than performing an extensive calculation outside of the program, we recommend you enter a quick estimate of the percentage here, and input the actual number of windows along with their heights and widths by editing the windows after finishing with the building creation wizard.

Window Glazing Layers

Select the number of glazing layers for the windows you intend to use from the listed options. Low-e coatings are included here because their effect is similar to that of additional glazing layers. The *Layers* input is used to provide default U-factors and solar heat gain coefficients and will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Window Glazing Type

Select the glazing type for the windows you intend to use from the available options. Use reflective if the glass has a reflective surface, even if the glass is also tinted. The *Glazing Type* input is used to provide default U-factors and solar heat gain coefficients and will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Window Frame Type

Select the frame type for the windows you intend to use from the available options. Frame type is useful in characterizing the thermal conductivity of the frame. For frame materials not listed, select the frame type that is thermally most similar; for example, for metal clad wood windows, you would select *Wood*. The *Frame Type* input is used to provide default U-factors and solar heat gain coefficients (it typically affects frame width) and

will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Window U-Factor

Enter the overall window U-factor, which includes the effects of window frames. Your entry should be consistent with manufacturer's literature and (preferably) represent a rated value developed in accordance with the National Fenestration Rating Council (NFRC) test procedures. Center-of-glass U-factors may not be used. The default value provided is based on the window characteristics--layers, glazing type, and frame type, and reflects typical to poor performance for the given characteristics. You may simply accept the default value, however, the final product you select must equal or exceed the efficiency used in your submission. (For U-factors, this means equal or lower.)

Window SHGC

Enter the glass solar heat gain coefficient (SHGC) for the windows, which should include the effect of the window frames. Your entry should be consistent with manufacturer's literature and (preferably) represent a rated value developed in accordance with the National Fenestration Rating Council (NFRC) test procedures. The default value provided is based on the window characteristics--layers, glazing type, and frame type, and represents a typical value for the given characteristics. You may simply accept the default value, however, the final product you select must equal or exceed the efficiency used in your submission. (For SHGC, this means equal or lower.)

SHGC is part of a system for rating glazing performance used by the National Fenestration Rating Council (NFRC), and SHGC has largely replaced 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.

Door Type

Select the door type from the list of generic door types that best matches doors in your project. Where multiple door types are used, select the most common. The generic door types are:

- **Sliding/Atrium Glass** – exterior doors that function principally as windows and are used occasionally for occupant circulation.
- **Glass** – exterior doors that are mostly glazed (i.e., glass covers more than half of the door's area) and are intended to accommodate occupant circulation.
- **Opaque** – exterior doors that are mostly opaque (i.e., glass covers less than half of the door's area) and are intended to accommodate occupant circulation.
- **Overhead** – any large exterior doors designed to accommodate large objects and/or vehicular circulation.
- **Air-lock Entry** – exterior doors arranged in pairs to limit infiltration associated with occupant circulation.
- **Revolving** – exterior doors such as those frequently used in hotels and retail establishments.

Door type is used in determining default U-factors and solar heat gain coefficient. Entries available change depending on selections made (e.g., *Glazing Layers*, *Glazing Type*, *Frame Type*, and *Glass SHGC* only appear if *Glass or Sliding/Atrium Glass* is selected as the door type).

Door Glazing Layers

Select the number of glazing layers for the glass door. See *Window Layers* for details on this input.

Door Glazing Type

Select the glazing type for the glass door. See *Window Glazing Type* for details on this input.

Glass Door Frame Type

Select the frame type for the glass door. See *Window Frame Type* for details on this input.

Number of Doors

Enter the number of doors in the building.

Average Door Size

Enter the average surface area for doors in the building. You may figure area based on rough framed opening dimensions.

Door U-Factor

Enter the overall U-factor for the door. Your entry should be consistent with manufacturer's literature, and for glass doors represent a rated value developed in accordance with the National Fenestration Rating Council (NFRC) test procedures. Center-of-glass U-factors may not be used. The default value provided is based on the door characteristics--layers, glazing type, and frame type, and reflects typical to poor performance for the given characteristics. You may simply accept the default value, but the final products you select must equal or exceed the efficiency used in your submission. (For U-factors, this means equal or lower.) For typical buildings with small door areas, it is safe to simply accept the defaults, as these values are conservative.

Glass Door SHGC

Enter the solar heat gain coefficient (SHGC) for the glass doors, which should include the effect of the window frame. Your entry should be consistent with manufacturer's literature and (preferably) represent a rated value developed in accordance with the National Fenestration Rating Council (NFRC) test procedures. The default value provided is based on the door characteristics--layers, glazing type, and frame type, and represents a typical value for the given characteristics. You may simply accept the default value, however, the final product you select must equal or exceed the efficiency used in your submission. (For SHGC, this means equal or lower.)

SHGC is part of a system for rating glazing performance used by the National Fenestration Rating Council (NFRC), and SHGC has largely replaced 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.

Roof and Skylights

Enter information about the roof construction and skylight characteristics (if applicable) in the fields provided.

Roof Type

Select the type of construction used for the roof. Where multiple roof types are used, select the most common. If a good match to the actual construction is not shown, make an arbitrary selection. COM*check-Plus* will enable you to replace the selection later with a construction you define.

Roof Cavity R-Value

Enter the R-value of any insulation material installed in the cavities between roof structural members. The entered value should represent a rated R-value for the insulation material, which is commonly printed on the material. Do not include the insulating value of other parts of the building assembly (e.g., gypsum board or air films).

Roof Continuous R-Value

Enter the R-value of any continuous insulation material in the roof assembly. Continuous insulation is insulation that is continuous over framing members and is free of significant thermal bridging. The entered value should be a rated R-value for the insulation material, which is commonly printed on the material. Do not include the insulating value of other parts of the assembly, such as gypsum board or air films.

Percentage of Roof

Enter the building's total skylight area as a percentage of total roof area (i.e., the total for roofs and skylights). Include skylight frames in your skylight area entries. You may figure skylight areas on the basis of rough-framed openings. However, rather than performing a careful calculation outside of the program, we recommend you enter a quick estimate of the percentage here, and input the actual number of skylights along with their dimensions by editing the skylights after finishing with the building creation wizard. If 0.0% is entered in this field, no other skylight entries are available.

Skylight Glazing Layers

Select the number of glazing layers for the skylights you intend to use from the listed options. Low-e coatings are included here because their effect is similar to that of additional glazing layers. The *Layers* input is used to provide default U-factors and solar heat gain coefficients and will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Skylight Glazing Type

Select the glazing type for the skylights you intend to use from the listed options. Use R*eflective* if the glass has a reflective surface, even if the glass is also tinted. The *Glazing Type* input is used to provide default U-factors and solar heat gain coefficients and will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Skylight Frame Type

Select the frame type for the skylights you intend to use from the available options. Frame type is useful in characterizing the thermal conductivity of the frame. For frame materials not listed, select the frame type that is thermally most similar; for example, for metal clad wood, you would select *Wood*. The *Frame Type* input is used to provide default U-factors and solar heat gain coefficients (it typically affects frame width) and will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Skylight U-Factor

Enter the overall skylight U-factor, which includes the effects of skylight frames. Your entry should be consistent with manufacturer's literature and (preferably) represent a rated value developed in accordance with the National Fenestration Rating Council (NFRC) test procedures. Center-of-glass U-factors may not be used. The default value provided is based on the skylight characteristics--layers, glazing type, and frame type, and reflects typical to poor performance for the given characteristics. You may simply accept the default value, however, the final product you select must equal or exceed the efficiency used in your submission. (For U-factors, this means equal or lower.)

Skylight SHGC

Enter the glass solar heat gain coefficient (SHGC) for the skylights, which should include the effect of the skylight frames. Your entry should be consistent with manufacturer's literature and (preferably) represent a rated value developed in accordance with the National Fenestration Rating Council (NFRC) test procedures. The default value provided is based on skylight characteristics--layers, glazing type, and frame type, and represents a typical value for the given characteristics. You may simply accept the default value, however, the final product you select must equal or exceed the efficiency used in your submission. (For SHGC, this means equal or lower.)

SHGC is part of a system for rating glazing performance used by the National Fenestration Rating Council (NFRC), and SHGC has largely replaced 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.

Floors

Enter information about the floor construction in the fields provided. Entries available change depending on selections made.

Floor Exposure

Select the exposure condition for the floor assembly. The floor exposure input in the building creation wizard affects only the bottom floor. Interior (or intermediate) floor assemblies in multi-story buildings are automatically created using a standard assembly.

Floor Type

Select the type of construction used for the floor. Where multiple floor types are used, select the most common. If a good match to the actual construction is not shown, make an arbitrary selection. COM*check-Plus* will enable you to replace the selection later with a construction you define.

Slab Insulation Position

Enter the position of the slab edge insulation, if used. Vertical insulation is placed either inside or outside the foundation wall and extends from the top of the slab vertically downward a specified distance. Insulation placed in the vertical position is thermally the most effective. Horizontal insulation can be placed either inside or outside of the foundation wall and extends from the top of the slab vertically downward to the bottom of the slab, then horizontally either under the slab (if placed inside the foundation wall) or away from the foundation (if placed outside the foundation wall). The combined vertical and horizontal distances represent the insulation depth.

Floor Cavity R-Value

Enter the R-value of any insulation material installed in the cavities between floor structural members. The entered value should represent a rated R-value for the insulation material, which is commonly printed on the material. Do not include the insulating value of other parts of the building assembly (e.g., flooring materials or air films).

Floor Continuous R-Value

Enter the R-value of any continuous insulation material in the floor assembly. Continuous insulation is insulation that is continuous over framing members and is free of significant thermal bridging. The entered value should be a rated R-value for the insulation material, which is commonly printed on the material. Do not include the insulating value of other parts of the assembly, flooring materials or air films.

Slab Insulation Depth

Enter the depth of slab edge insulation measured either vertically or horizontally, depending upon insulation position. The insulation is measured vertically from the top of the slab downward (if placed vertically) or (if placed horizontally) vertically from the top of the slab, then horizontally the width of the horizontally positioned insulation. The combined vertical and horizontal distances represent the insulation depth.

Perimeter Slab-Edge Insulation R-Value

Enter the R-value of perimeter slab-edge insulation. If the edge of the slab is uninsulated, enter 0.0.

Activity Areas

Enter information about major usage areas in the building and the lighting systems that serve those areas. If there are more than four different activity areas in your building, group some together. You can later edit the building description created by the wizard to match your actual design.

Activity Area Type

Select up to four activity area types from the listbox to be created by the wizard. Activity areas are usage categories that determine both lighting power budgets and various other occupancy-related assumptions. See *Activity Area Type* for definitions of these categories.

Activity Floor Area

Enter the total floor area assigned to each activity area type. By default, the program assigns a predefined percentage of the building's gross floor area to an appropriate activity area type based on the building type you selected in the first wizard screen.

Activity Area Occupant Density

Occupant density assumptions are based on activity area type. The occupant density is a peak (or design) value, which is modified on an hourly basis by an occupant schedule. This field is a calculated value and is not user editable.

Activity Area Plug Intensity

Plug (or receptacle) assumptions are based on activity area type. The Plug load is a peak (or design) value, which is modified on an hourly basis by a schedule. Plug loads represent the general service loads for the building. They include equipment loads normally served through electrical receptacles, such as office equipment and cooking appliances, but do not include either task lighting or equipment used for HVAC purposes. This field is a calculated value and is not user editable.

Activity Area Lighting Budget

The unit lighting power allowance for the activity area. This is the total connected load (i.e., input wattage) for lamps plus ballasts and is the lighting power value used in the budget building. This field is a calculated value and is not user editable.

Activity Area Core

If the *Core* checkbox is checked, the wizard will assign this activity area type entirely to the building core (interior zones) provided there is sufficient floor area there. If the Core checkbox is not checked, the wizard will assign this activity area type uniformly across interior and perimeter zones.

Activity Area Primary First Floor

If the *First Floor* checkbox is checked, the wizard will assign this activity area type entirely to the first above-grade floor of the building provided there is sufficient floor area there. If the *First Floor* checkbox is not checked, the wizard will assign this activity area type uniformly over all floors in the building.

Activity Area Lighting Fixture

Select the name/description of the fixture to be applied by the wizard in each Activity Area. If more than one fixture type will be used in areas of this type, select the predominant fixture type. You can add up to three additional fixture types for each area after finishing with the wizard. The fixture that is shown as the default is not necessarily recommended--it simply serves as an example. You can select a different fixture from the listbox, edit a fixture selected from the list (select a fixture, right mouse click on the fixture name, then select

Edit Selected Lighting Fixture, and make changes within the *Lighting Fixture Data* dialog), or create an entirely new fixture.

For Hotel/Motel guest rooms and Multifamily living units, you may (but are not required to) enter lighting fixtures. Lighting power for these activity areas is exempt, and proposed and budget lighting power are set to the same prescribed values. For this reason, lighting fixture inputs have no impact on compliance (although fixtures will appear in the compliance report). Lighting power has been exempted for these categories because most lighting in these spaces is connected through receptacles and installed after final building code inspection.

Activity Area Fixture Density

The *SqFt/Fixture* field provides a quick way to roughly assign the correct number of fixtures to each space in the building containing the selected area type. After finishing with the wizard, you can replace these estimates with actual fixture counts. By default, the program determines the lighting power density for the activity area type and, based on the input wattage of the selected fixture, sets the area per fixture. The result is a uniform and minimally compliant lighting configuration, which can serve as a template for describing your building's actual lighting systems and equipment.

HVAC Systems

Enter information about the HVAC system(s) serving the building using the fields provided. Entries available depend on selections made and heating and cooling methods selected on the *General Information* dialog.

HVAC System Type

Enter the HVAC system type from the listbox.

Furnace Fuel Type

Select the fuel type used to power the furnace from the listbox.

Fan Specification Method

Select the method you wish to use to specify the power requirements for HVAC system fans.

Fan Power

Enter the power requirements for the system fans in terms of inches of static pressure.

Fan Type in HVAC Wizard

Select the fan equipment type used to provide variable flow control for the system.

Reheat Source

Select the heat source used for reheat coils.

Economizer Type

Select the economizer control type. Selecting **None** will cause outside ventilation air to be fixed; i.e., to vary based on scheduled fan system operation only.

Selecting **Temperature** will cause a standard mixed-air controlled economizer to be used. The outside-air damper is returned to minimum whenever the outside drybulb temperature is higher than the economizer high-limit temperature, which is set (by default) based on climate.

Selecting **Enthalpy** will cause the outside-air damper to be set to minimum whenever the outside-air enthalpy is higher than the return-air enthalpy or the outside drybulb temperature is higher than the economizer high-limit temperature.

Cold Deck Reset

Select the cold deck reset control strategy. The three available options are *Constant*, *Outside Air Reset*, and *Warmest*.

- *Constant* - the cold deck temperature is set to a fixed temperature whenever the system is on.
- *Outside Air Reset* - the cold deck temperature is set based on an outside-air reset schedule, which is user editable.
- *Warmest* - the cold deck temperature is set to the highest temperature that will just meet the cooling requirements of the warmest zone.

Hot Deck Reset

Select the hot deck reset control strategy. The three available options are *Constant*, *Outside Air Reset*, and *Coldest*.

- *Constant* - the hot deck temperature is set to a fixed temperature whenever the system is on.
- *Outside Air Reset* - the hot deck temperature is set based on an outside-air reset schedule, which is user editable.
- *Coldest* - the hot deck temperature is set to the lowest temperature that will just meet the heating requirements of the coldest zone.

Project Information

Enter information about the project location and contact information for key participants. This information will be on the compliance reports generated by the software and are intended for submission to the building department.

Project Building Address

Enter the street address for the building.

Project City, State, Zip

Enter the city, state, and postal zip code for the building.

Owner Name

Enter the name of the building owner or owner's agent. The owner's agent may be the architect or engineer of record, the contractor, or other individual having primary responsibility for the project.

Owner Phone

Enter the telephone number of the person listed as owner/agent.

Owner Address

Enter the mailing address of the person listed as owner/agent.

Owner City, State, Zip

Enter the city, state, and postal zip code for the person listed as owner/agent.

Document Author Name

Enter the name of the person performing the compliance analysis or having primary oversight responsibility for the analysis. This is the person to whom any questions about the analysis should be addressed.

Document Author Phone

Enter the telephone number of the person listed as document author.

Appendix B: Project Folder Dialog Descriptions

The dialogs described in this section are accessed from the *Project* folder by double-clicking on the *Project Data*, *Site Data*, or *Building Data* items in the tree.

Project Data

Project Name

Enter the name or description that will be used to identify the project. By default this name is used as project file name.

Building Address

Enter the street address for the building.

Building City, State, Zip

Enter the city, state, and postal zip code for the building.

Display Option

Select the desired display option (i.e., displayed or hidden) for the block and floor groupings. The block and floor features provide a convenient way to organize the building description, however, block and floor have no impact on the way the building is simulated. *Block* is intended for use wherever a building has major groupings of spaces, for example, in a building with multiple wings or with blocks of floors in a high-rise building with services provided from special service floors. The *Floor* grouping is intended for use in buildings with multiple floors. Both types of groupings can be particularly useful where there are repetitive building elements. The first block or floor can be defined, then copied as a unit to represent the repetitive building elements.

Be aware that both space and floor multipliers are available within the space component. Those multipliers can only be used where spaces and floors can share identical descriptions, such as for intermediate floors in a high-rise office building. Use the space and floor multipliers wherever you can in preference to creating new floor descriptions. Additional floor descriptions will slow program execution.

Creation Date

This field displays the time and date when the project file was created under its current name. If you change the file name, the creation time and date will be updated.

Last Modified Date

This field displays the time and date when the project file was last saved.

Owner, Designer, Author Tab

Project Owner

Enter the name of the building owner or owner's agent. The owner's agent may be the architect or engineer of record, the contractor, or other individual having primary responsibility for the project.

Project Owner Phone

Enter the telephone number of the person listed as owner/agent.

Project Owner Address

Enter the mailing address of the person listed as owner/agent.

Project Owner City, State, Zip

Enter the city, state, and postal zip code for the person listed as owner/agent.

Building Designer

Enter the name of the architect or engineer of record or lead building designer.

Building Designer Phone

Enter the telephone number of the person listed as building designer.

Project Document Author

Enter the name of the person performing the compliance analysis or having primary oversight responsibility for the analysis. This is the person to whom any questions about the analysis should be addressed.

Project Document Author Phone

Enter the telephone number of the person listed as document author.

Summary Data Tab

Default Electric Rate

This field displays the state-average unit price for electricity used in commercial buildings, based on data published by the U.S. Department of Energy's Energy Information Administration. By default, COM*check-Plus* uses this state-average rate to convert estimated annual electricity consumption into estimated annual costs for electricity and the energy cost budget. Average unit prices are used only when no utility rate file has been specified. See *Simulate with Utility Rate File* for instructions on how to perform the analysis using the actual utility rates that will apply to the building.

Default Natural Gas Rate

The state-average unit price for natural gas (used when no utility rate file has been specified). This field displays the state-average unit price for natural gas used in commercial buildings, based on data published by the U.S. Department of Energy's Energy Information Administration. By default, COM*check-Plus* uses this state-average rate to convert estimated annual natural gas consumption into estimated annual costs for gas and the energy cost budget. Average unit prices are used only when no utility rate file has been specified. See *Simulate with Utility Rate File* for instructions on how to perform the analysis using the actual utility rates that will apply to the building.

Natural Gas Not Available

Check this checkbox if natural gas is not currently available at the building site and if it would be infeasible (i.e., prohibitively expensive) to bring natural-gas service to the building site. If a decision has been made not to use natural gas even though it is available at the site, do *NOT* check the checkbox.

ASHRAE/IES Standard 90.1-1989 Chapter 13, which is referenced by the 90.1 ('89) Code, requires that the energy cost budget be based on the least expensive fuel type for both space heating and service water heating.

In COM*check-Plus*, the intent of these requirements is accomplished by applying compliance rules that depend on whether natural gas is available at the building's location. In some cases, a higher budget will be calculated if natural gas is not available as an option for meeting these loads.

Simulate with Utility Rate Files

Select this option from the Project tab, Project Data dialog, Summary Data tab if you want energy costs to be calculated using actual utility rates that will apply to your building. This option requires that you prepare (or acquire) a rate file in BDL format (i.e., the language used by DOE-2) reflecting applicable rates for the project and reference the rate file in the *Utility Rate File* field. The rate files that come with the program and that are displayed in the *Utility Rate Files* fields serve as placeholders and are NOT suitable for use in an actual compliance analysis, as user-defined rates must be locally applicable. If you do not select this option, state-average unit prices are applied for electricity, natural gas, and fuel oil.

Use of utility rate files is advisable only when the building design includes features that are more effective in reducing energy costs under the actual utility rate than under a flat rate. It is also possible that a jurisdiction may require use of actual utility rates, although, only in unusual cases would the change to using actual rates result in a compliant building no longer complying.

Please Note

There is a limit of eight characters for utility rate file names. In addition, rate files must have an "inc" file extension (e.g., exmp_gas.inc), as they are treated as include files by the program.

The rate files do not include certain commands that would be used in a DOE-2 input file at the beginning and end of the file, such as "INPUT ECONOMICS .." and "STOP .." Use the input files in the program's Rates folder as examples of what is required. All DOE-2 keywords in the 2.1E version of DOE-2 are available in COM*check-Plus*.

Error Code

The *Error* field displays a code identifying the nature of errors that prevent successful compliance analysis execution.

Electric Rate File

Enter the name of a user-defined text file containing the rate schedule for electricity. The file must be in BDL format (i.e., the language used by DOE-2) and must reflect the rate that will apply to the building. The file name displayed by default in the *Utility Rate File* field is intended to serve only as a placeholder and is NOT suitable for use in an actual compliance analysis.

Natural Gas Rate File

Enter the name of a user-defined text file containing the rate schedule for natural gas. The file must be in BDL format (i.e., the language used by DOE-2) and must reflect the rate that will apply to the building. The file name displayed by default in the *Utility Rate File* field is intended to serve only as a placeholder and is NOT suitable for use in an actual compliance analysis.

Steam Rate File

Enter the name of a user-defined text file containing the rate schedule for steam. The file must be in BDL format (i.e., the language used by DOE-2) and must reflect the rate that will apply to the building.

Chilled Water Rate File

Enter the name of a user-defined text file containing the rate schedule for chilled water.

LPG Rate File

Enter the name of a user-defined text file containing the rate schedule for liquid petroleum gas.

Fuel Oil Rate File

Enter the name of a user-defined text file containing the rate schedule for fuel oil. The file must be in BDL format (i.e., the language used by DOE-2) and must reflect the rate that will apply to the building. The file name displayed by default in the *Utility Rate File* field is intended to serve only as a placeholder and is NOT suitable for use in an actual compliance analysis.

Diesel Rate File

Enter the name of a user-defined text file containing the rate schedule for diesel oil.

Coal Rate File

Enter the name of a user-defined text file containing the rate schedule for coal.

Site Data

Site Name

Enter a name for the building site.

Site State

Select the state in which the building will be located.

Site Location

Select the city or other jurisdiction in which the building will be located.

Weather File

The name of the weather file that will be used in the compliance analysis.

Weather File Number

The number of the weather file that will be used in the compliance analysis.

Latitude

The latitude for the building location.

Longitude

The longitude for the building location.

Elevation

The elevation for the building location.

Heating Days Base 65

The heating degree days base 65°F for the building location.

Heating Days Base 50

The heating degree days base 50°F for the building location.

Cooling Days Base 65

The cooling degree days base 65°F for the building location.

Cooling Days Base 50

The cooling degree days base 50°F for the building location.

Cooling Hours Base 80

The cooling degree hours base 80°F for the building location.

Incident Solar Tab

North Facing

Annual average daily incident solar radiation on north-facing surfaces.

East or West Facing

Annual average daily incident solar radiation on east- and west-facing surfaces.

South Facing

Annual average daily incident solar radiation on south-facing surfaces.

Building Data

Building Name

Enter a name for the building.

Cooling

The type of equipment/source used to cool the building.

Heating

The type of equipment/source used to heat the building.

Building Azimuth

Use the *Building Azimuth* field to precisely orient the principal façade of the building. *Principal façade* here means the one at the top of the wizard footprint diagram. The *Building Faces* field also enables you to reorient the building but it is limited to 22.5 degree increments.

Building Total Roof Area

The total roof area for the entire building including both roofs and skylights.

Building Total Skylight Area

The total skylight area for the entire building including skylight frames.

Building Total Wall Area

The total exterior above-grade wall area for the entire building including opaque walls, windows, and doors.

Building Total Window Area

The total window area for the entire building.

Appendix C: Architecture Folder Dialog Descriptions

The dialogs described in this section are accessed from the *Architecture* folder by double-clicking on the items in the tree.

Building Block Dialogs

Additional details related to the building block can be accessed by selecting the *Architecture* tab and double-clicking on any building block element in the tree.

The building block feature in COM*check-Plus* provides a convenient way to organize the building description. Building blocks are intended for use wherever a building has major groupings of spaces, for example, a building with multiple wings. Blocks can also be used to organize vertically, for example, with blocks of floors in a high-rise building with services provided from special service floors.

Block Height

The height of the building block.

Block X, Y, and Z

The building block X, Y, and Z coordinates enable the entire block of spaces to be repositioned relative to other blocks and spaces. However, unless objects have been defined that are capable of shading the building, changes to these coordinates will have no impact on the analysis.

Floor Dialogs

Additional details related to the building floor can be accessed by selecting the *Architecture* tab and double-clicking on any building floor element in the tree

Currently Active Floor

The building floor feature in COM*check-Plus* provides a convenient way to organize the building description. The building floor grouping is intended for use in buildings with multiple floors. However, be aware that both space and floor multipliers are available with the space component. Those multipliers can only be used where spaces and floors can share identical descriptions, such as for intermediate floors in a high-rise office building. Use the space and floor multipliers wherever you can in preference to creating new floor descriptions. Additional floor descriptions will slow program execution.

Floor Name

The building floor feature in COM*check-Plus* provides a convenient way to organize the building description. The building floor grouping is intended for use in buildings with multiple floors. However, be aware that both space and floor multipliers are available with the space component. Those multipliers can only be used where spaces and floors can share identical descriptions, such as for intermediate floors in a high-rise office building. Use the space and floor multipliers wherever you can in preference to creating new floor descriptions. Additional floor descriptions will slow program execution.

Floor Parent

The building block to which this floor belongs. In COM*check-Plus*, building floors can belong to building blocks, but not vice versa.

Floor Height

The height of the building block.

Floor X, Y, and Z

The building floor X, Y, and Z coordinates enable all spaces belonging to the floor to be repositioned relative to other parts of the building. However, unless objects have been defined that are capable of shading the building, changes to these coordinates will have no impact on the analysis.

Space Dialogs

Additional details related to the building spaces can be accessed by selecting the *Architecture* tab and double-clicking on any building space element in the tree.

Currently Active Space

The *Currently Active Space* feature enables you to quickly review and edit all existing space components in a single pass as well as to create new spaces.

Space Name

The building wizard gives each space a unique name designed to make the building description as easy to understand as possible. See *Default Component Names* for explanation. You may modify these default names to match designations on building plans and specifications

Space Parent

The building floor to which this space belongs.

Conditioning

Select from the listbox the type of conditioning provided to the space. Whether a space is considered conditioned or unconditioned can cause different requirements to apply to envelope components enclosing the space. If you designate a space as unconditioned, check the *Wall is Demising* checkbox on all interior walls that separate conditioned from unconditioned space. In most climates there are insulation requirements that apply to these components. A similar *Demising* checkbox is provided on the *Interior Ceilings Data* dialog, and the *Floor Data* dialog has an *Exposure* listbox for identifying floors that separate conditioned from unconditioned space.

Spaces designated as *Unconditioned* must still belong to an HVAC system in order to be modeled correctly. In addition, unconditioned spaces can only be assigned to an HVAC system that serves at least one conditioned space. To designate a space as unconditioned, first open the space dialog under the *Architecture* tab and select *Unconditioned* from the *Conditioning* listbox. Then close the dialog and select the *Mechanical* tab. Ensure that the space is listed as belonging to an HVAC system that serves at least one conditioned space. If it is not, you will need to move the space. Move it to an HVAC system that serves spaces having interior walls in common with the new unconditioned space. To do this, drag and drop the space's icon onto the target HVAC system. If this move leaves an HVAC system serving no conditioned zones, delete the system and all attached components.

Space Total Floor Area

The total gross floor area of a space is the sum of the floor areas of the activity areas belonging to the space.

Space Multiplier

A space multiplier multiplies simulation results for the space and is appropriate for duplicating and efficiently simulating situations in which it is appropriate to treat the multiple spaces as being identical. However, see *Floor Multiplier* if the identical spaces are stacked on multiple floors.

Space Floor Multiplier

A floor multiplier multiplies the simulation results for a space without causing the heat transfer through interior surfaces to be multiplied. *Floor Multiplier* is appropriate for use with multiple, essentially-identical spaces such as middle floors in multi-story buildings whose heat transfer to other spaces (ground and top floors) should NOT scale with the multiplier. Use *Space Multiplier* anywhere adjacencies SHOULD result in heat transfer through interior surfaces that scale with the multiplier.

Space Ceiling Height

Enter the floor-to-ceiling height for the space. If the ceiling height varies, use either the average or the predominant floor-to-ceiling height, but coordinate the height of any corresponding plenum such that total building wall area and building volume remain accurate.

Space Total Roof Area

The total roof area for the space including both roofs and skylights. Note that if an occupied space has a plenum, the roof above the space will belong to the plenum rather than to the occupied space and will not show up in this total. Also, when skylights are placed in roofs over plenums, a roof sufficient to hold the skylights is attached to the occupied space below. These components are created automatically by the building creation wizard, and the corresponding areas are reflected in these component totals at the space level.

Space Total Skylight Area

The total skylight area for the space including skylight frames.

Space Total Exterior Wall Area

The total above-grade exterior wall area for the space including opaque walls, windows, and doors.

Space Total Exterior Window Area

The total window area for the space.

Activity Area Dialogs

Additional details related to the building activity areas can be accessed by selecting the *Architecture* tab and double-clicking on any building area element in the tree.

Currently Active Area

The *Currently Active Activity Area* feature enables you to quickly review and edit all existing activity area components in a single pass as well as to create new activity areas.

Activity Area Name

The building wizard gives each activity area a unique name designed to make the building description as easy to understand as possible. You may modify these default names to match room names on building plans and specifications.

Activity areas are subdivisions of space defined on the basis of lighting requirements. Activity area designations are used to set both electric lighting power budgets and other occupancy-related assumptions, such

as schedule, ventilation rates, and receptacle loads. One or more activity areas may be included within each space or HVAC thermal zone.

Activity Area Type

Select the best match from the activity area types in the listbox. Activity area types are usage categories based on lighting requirements. Activity area type is used to set both electric lighting power budgets and other occupancy-related assumptions, such as schedule, ventilation rates, and receptacle loads.

Auditorium – An area with fixed seats used for public meetings or gatherings not specifically for the viewing of dramatic performances.

Bank/Financial Institution – An area for conducting financial transactions, including the custody, loan, exchange, or issue of money, for the extension of credit and for facilitating the transmission of funds.

Classroom/Lecture Hall – An area of a building where classes meet.

Convention, Conference or Meeting Center – An area used for meetings, conventions, and multiple purposes, including dramatic performances, that has neither fixed seating nor fixed staging.

Corridor, Restroom, Support Area – Corridor – an area used as a passageway to access compartments or rooms. Restroom: An area providing personal facilities such as toilets and washbasins. Support: An area used as a passageway, utility room, storage space, or other use associated with the building's primary function.

Dining – An area in a restaurant or hotel/motel (other than guest rooms) where meals served to the customers are consumed.

Exercise Center – An area of a building for recreational activities involving physical exertion designed to promote physical fitness and well-being.

Exhibition Hall – An area used for exhibition that has neither fixed seating nor fixed staging.

Grocery Store – An area of a building that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.

Gymnasium Playing Surface – An area of a building for organized athletic games such as basketball, volleyball, racquetball, and tennis.

Hotel Function – An area such as a hotel ballroom, meeting room, exhibit hall, or conference room, together with prefunction area and other spaces ancillary to its function.

Hotel/Motel Guest Room – A room or suite of rooms in a building for transient occupancy (such as a resort, hotel, motel, barracks, or dormitory), including living and sleeping areas, private bathrooms, and kitchenettes. (Note that hotel/motel guest rooms are exempt from lighting requirements but are included in the area category list for consistency and for use in determining internal loads for envelope compliance.)

Industrial Work, < 20 ft ceiling height – An area of a building in which a manufacturing operation, craft, or art is performed having a ceiling less than 20 ft above the floor.

Industrial Work, >= 20 ft ceiling height – An area of a building in which a manufacturing operation, craft, or art is performed having a ceiling 20 or more ft above the floor.

Kitchen – An area containing facilities for cooking and food preparation.

Library – An area of a building in which literary and artistic materials, such as books, periodicals, and audiovisuals, are kept for reading, reference, and loan.

Lobby—Hotel – An area in a hotel/motel between the main entrance and the front desk, including waiting and seating areas, and other spaces encompassing the activities normal to a hotel lobby function.

Lobby—Other – An area located directly inside the main entrance of a building and includes the reception area, sitting areas, and public areas.

Mall, Arcade, or Atrium – An area of a building used as a public passageway or concourse that provides access to rows of stores or shops.

Medical and Clinical Care – An area of a building where medical treatment is provided such as hospitals, sanitariums, clinics, orphanages, nursing homes, mental institutions, and reformatories.

Multifamily Living Unit – A private room or group of rooms for nontransient residential living that occur within a building or structure containing three or more dwelling units. (Note that multifamily living units are exempt from lighting requirements but are included in the area category list for consistency and for use in determining internal loads for envelope compliance.)

Museum – An area of a building used for the display or preservation of objects of artistic, scientific, or cultural interest.

Office – An area of a building for office, professional, or service-type transactions such as medical offices, banks, libraries, and government office buildings.

Religious Worship – An area of a building for worship or religious services.

Restaurant – An area of a building for the preparation and consumption of food or drink, including coffee shops, cafeterias, bars, and fast-food and leisure restaurants.

Retail Sales, Wholesale Showroom – An area of a building in which the primary activity is the sale of merchandise or the display of samples of merchandise.

Storage, Industrial and Commercial – An area of a building for storing items.

Theater—Motion Picture – An area of a building with tiers of rising seats or steps for the showing of motion pictures.

Theater—Performance – An area of a building with tiers of rising seats or steps for the viewing of dramatic performances, lectures, musical events, and similar live performances.

Other – An area of a building whose intended use is currently not known or does not match any of the above types.

Activity Area Multiplier

The *Activity Area Multiplier* creates multiple copies of the activity area and assigns them to the parent space. Multipliers can be useful where it is convenient to define a small unit of area (such as a room) that occurs multiple times. Activity areas (with multipliers) need to be coordinated with the space to which they belong.

Activity Floor Area

Enter the floor area (within the parent space) assigned to this activity area type.

Total Activity Floor Area

The total gross floor area of the activity area after the activity area multiplier has been applied.

Interior Wall Type

Select a wall type from the listbox containing the names of predefined wall construction types. You can also use the *Create New Construction* item at the top of the list to create and apply a new construction to this wall or right mouse click on the *Wall Construction Type* field to edit an existing construction type. Bear in mind that editing a construction type that has also been assigned to other walls will cause the wall construction to be changed for those other walls as well. Selecting a different construction from the listbox or creating a new construction for this wall changes this wall only.

Occupancy Density

Occupant density assumptions are based on activity area types you select for the building, either via the *Activity Areas* screen in the building creation wizard or via the *Activity Area Data* dialog in the main interface. At your option, you may over-ride the value for *Occupancy Density* provided by the program with a more accurate value for your project.

Occupant density is used to set the internal heat gains (both sensible and latent) from occupants and service water heating loads. Occupant density is NOT used to set ventilation rates, which are set based on activity area type (Occup. Type). Occupancy density values assumed by the program are derived mostly from ASHRAE Standard 90.1-1989 and other ASHRAE documents and may differ from occupancy density values assumed in other codes.

The *Occupant Density* input represents a peak (or design) value, which is modified on an hourly basis by an occupant schedule to obtain the values used in the hour-by-hour simulations.

Receptacle Load

Plug (or receptacle) assumptions are based on activity area type. The Plug Load is a peak (or design) value, which is modified on an hourly basis by a schedule. Plug loads represent the general service loads for the building. They include equipment loads normally served through electrical receptacles, such as office equipment and cooking appliances, but do not include either task lighting or equipment used for HVAC purposes.

Lighting Load

The *Lighting Load* field displays the cumulative lighting power density of all lighting systems serving the activity area. This value is based on rated input wattages of selected lamps and ballasts. This value is not editable, because it is based on the lighting systems belonging to the activity area, which are editable on the Lighting System Data dialog.

Minimum OSA Ventilation

Outside-air ventilation rate assumptions are based on activity area type. The outside-air ventilation rate is a peak (or design) value that applies during occupied periods.

Exterior Wall Dialogs

Additional details related to the building components can be accessed by selecting the *Architecture* tab and double-clicking on any building component in the tree.

Currently Active Exterior Wall

The *Currently Active Exterior Wall* feature enables you to quickly review and edit all exterior walls in the building in a single pass as well as to create new exterior walls.

Exterior Wall Name

The building creation wizard assigns a unique name to each exterior wall using a naming convention based on the space to which the wall is assigned, the orientation of the wall, etc. The program will also provide a default name for any new exterior wall you create. You may change the name of any component provided the resulting name is unique.

Exterior Wall Parent

Each exterior wall is assigned to a parent space. Selecting a different parent space from the *Belongs to Space:* listbox has the effect of moving the wall to the new parent space.

Exterior Wall Construction Type

Select a wall type from the listbox containing the names of predefined wall construction types. You can also use the *create new Construction* item at the top of the list to create a new construction or right mouse click on the *Wall Construction Type* field to edit an existing construction type.

Bear in mind that editing a construction type that has also been assigned to other exterior walls will cause the wall construction to be changed for those other walls as well. Selecting a different construction from the listbox or creating a new construction for this wall changes this wall only.

Wall Faces

Use the *Wall Faces* field to set the direction the wall faces. Normally the exterior of the wall will be set to face the compass direction shown. However, if the *Building Faces* field on the Project Tab | Building Data dialog has been adjusted for precise orientation of building north, the orientation of exterior building surfaces are adjusted appropriately, even though the *Wall Faces* field can display orientations only to the nearest 11-1/4 degrees.

Exterior Wall Height

Enter the height of the exterior wall. Bear in mind that if a plenum is present above the space, the exterior walls belonging to the occupied space will extend only to the ceiling. The plenum will have its own exterior walls and thereby account for the entire floor-to-floor height. If the wall height varies, use the average wall height.

Exterior Wall Width

Enter the width of the exterior wall. The dimensions of all exterior surfaces should be measured from the outside of exterior assemblies to the center line of interior assemblies.

Total Exterior Wall Area

The areas of exterior walls are measured at the exterior surface. User dimensional inputs all relate to gross areas, as the program automatically adjusts the areas it uses for window and door penetrations.

Total Exterior Wall Window Area

The total window area is the sum of all windows belonging to the exterior wall.

Opaque Area

The opaque surface area of the wall is the gross wall area less the total window area.

Exterior Wall X

The *Wall X* coordinate is the coordinate of the lower left-hand corner of the exterior wall (as viewed from outside) in the building coordinate system. The building coordinate system places the origin at the lower left-hand corner of the building footprint as viewed in the building footprint diagram in the building creation wizard. The coordinates are only useful when surfaces are defined that cause shading of the building or where daylight systems are being modeled. The building creation wizard populates the coordinate fields, providing a spatially complete building model, although the full value of this feature awaits future program enhancements.

Exterior Wall Y

The *Wall Y* coordinate is the coordinate of the lower left-hand corner of the exterior wall (as viewed from outside) in the building coordinate system. The building coordinate system places the origin at the lower left-hand corner of the building footprint as viewed in the building footprint diagram in the building creation wizard. The coordinates are only useful when surfaces are defined that cause shading of the building or where daylight systems are being modeled. The building creation wizard populates the coordinate fields, providing a spatially complete building model, although the full value of this feature awaits future program enhancements.

Exterior Wall Z

The *Wall Z* coordinate is the coordinate of the lower left-hand corner of the exterior wall (as viewed from outside) in the building coordinate system. The building coordinate system places the origin at the lower left-hand corner of the building footprint as viewed in the building footprint diagram in the building creation wizard.

The coordinates are only useful when surfaces are defined that cause shading of the building or where daylight systems are being modeled. The building creation wizard populates the coordinate fields, providing a spatially complete building model, although the full value of this feature awaits future program enhancements.

Roof Dialogs

Additional details related to roof components can be accessed by selecting the *Architecture* tab and double-clicking on any roof component in the tree.

Currently Active Roof

The *Currently Active Roof* feature enables you to quickly review and edit all roofs in the building in a single pass as well as to create new roofs.

Roof Name

The building creation wizard assigns a unique name to each roof using a naming convention based on the space to which the roof is assigned. The program will also provide a default name for any new roof you create. You may change the name of any component provided the resulting name is unique.

Roof Parent

Each roof is assigned to a parent space. Selecting a different parent space from the *Belongs to Space:* listbox has the effect of moving the roof to the new parent space.

Roof Construction Type

Select a roof type from the listbox containing the names of predefined roof construction types. You can also use the *create new Construction* item at the top of the list to create a new construction or right mouse click on the *Roof Construction Type* field to edit an existing construction type.

Bear in mind that editing a construction type that has also been assigned to other roofs will cause the roof construction to be changed for those other roofs as well. Selecting a different construction from the listbox or creating a new construction for this roof changes this roof only.

Roof Faces

Use the *Roof Faces* field to set the direction that the roof slopes. For flat roofs, the input has no real impact except that changing the *Roof Faces* input can affect which roof dimension is interpreted as depth and which as width.

Normally the roof will be set to face the compass direction shown. However, if the *Building Faces* field on the Project Tab | Building Data dialog has been adjusted for precise orientation of building north, the orientation of this and other exterior building surfaces are adjusted appropriately, even though the *Roof Faces* field displays orientations only to the nearest 11-1/4 degrees.

Roof Slope

Roof slope is the angle in degrees between the roof surface and horizontal. A flat roof, therefore, would have a slope of 0.0, while a 6 in 12 pitched roof would have a slope of 26.6.

Roof Depth

Roof depth is measured along the roof surface in the direction the roof faces (See *Roof Faces* field). By this we mean that the roof depth is measured along its sloped surface, rather than along its horizontal projection as you would for a site measurement. The roof depth of a north-facing (north-sloping) roof is to be measured in the north-south direction. Any overhangs should NOT be included in the roof dimensions; the relevant dimensions for all exterior assemblies are measured at the exterior side of the thermal envelope.

Roof Width

Roof width is measured along the roof surface perpendicular to the direction the roof faces (See *Roof Faces* field). For example, the roof width of a north-facing (north-sloping) roof is to be measured in the east-west direction. Any overhangs should NOT be included in the roof dimensions; the relevant dimensions for all exterior assemblies are measured at the exterior side of the thermal envelope.

Total Roof Area

Roof areas are measured at the exterior surface of the thermal envelope, hence an insulated ceiling below a pitched roof would be measured at the ceiling rather than at the roof. Total roof area includes both the area of roofs and the area of skylights.

Total Skylight Area

The total skylight area is the sum of all skylights belonging to the roof including skylight frames.

Opaque Roof Area

The opaque surface area of the roof is the gross roof area less the total skylight area, which includes skylight frames.

Interior Wall Dialogs

Additional details related to interior wall components can be accessed by selecting the *Architecture* tab and double-clicking on any interior wall component in the tree.

Currently Active Interior Wall

The *Currently Active Interior Wall* feature enables you to quickly review and edit all interior walls in the building in a single pass as well as to create new interior walls.

Interior Wall Name

The building creation wizard assigns a unique name to each interior wall using a naming convention based on the space to which the wall is assigned. The program will also provide a default name for any new interior wall you create. You may change the name of any component provided the resulting name is unique.

Interior Wall Parent

Each interior wall is assigned to a parent space. Selecting a different parent space from the *Belongs to Space:* listbox has the effect of moving the wall to the new parent space.

Interior Wall Next to Space

Each interior wall separates the space to which it belongs from the space it is next to. Each interior wall is described only once, and it does not matter which of the two adjacent spaces it belongs to and which it is next to.

Interior Wall is Demising

Use the checkbox to identify walls that separate conditioned from unconditioned space. Interior walls that do not separate conditioned from unconditioned space have no insulation requirements and are included in COM*check-Plus* only to model passive heat flows within the building. Demising walls--walls that separate spaces with different conditioning requirements--do have insulation requirements, and the requirements are applied to the budget building design and affect the energy cost budget.

Interior Wall Height

Enter the height of the interior wall.

Interior Wall Width

Enter the width of the interior wall.

Interior Ceiling Dialogs

Additional details related to interior ceiling components can be accessed by selecting the *Architecture* tab and double-clicking on any interior ceiling component in the tree.

Currently Active Interior Ceiling

The *Currently Active Interior Ceiling* feature enables you to quickly review and edit all interior ceilings in the building in a single pass as well as to create new interior ceilings.

Interior Ceiling Name

The building creation wizard assigns a unique name to each interior ceiling using a naming convention based on the space to which the ceiling is assigned. The program will also provide a default name for any new interior ceiling you create. You may change the name of any component provided the resulting name is unique.

Interior Ceiling Parent

Each interior ceiling is assigned to a parent space. Selecting a different parent space from the *Belongs to Space* listbox has the effect of moving the ceiling to the new parent space.

Interior Ceiling Next To

Each interior ceiling separates the space to which it belongs from the space it is next to. Each interior ceiling is described only once, and it does not matter which of the two adjacent spaces it belongs to and which it is next to.

Interior Ceiling Type

Select a ceiling type from the listbox containing the names of predefined ceiling construction types. You can also use the *Create New Construction* item at the top of the list to create a new construction or right mouse click on the *Ceiling Construction Type* field to edit an existing construction type.

Bear in mind that editing a construction type that has also been assigned to other ceilings will cause the ceiling construction to be changed for those other ceilings as well. Selecting a different construction from the listbox or creating a new construction for this ceiling changes this ceiling only.

Ceiling is Demising

Use the checkbox to identify ceilings that separate conditioned from unconditioned space. Interior ceilings that do not separate conditioned from unconditioned space are included in COM*check-Plus* only to model passive heat flows within the building.

Ceiling Depth

Enter the depth of the interior ceiling. Interior ceilings may be entered either using depth and width or using area. In general, it makes no difference which dimension of a rectangular ceiling is input as depth and which is input as width.

Ceiling Width

Enter the width of the interior ceiling. Interior ceilings may be entered either using depth and width or using area. In general, it makes no difference which dimension of a rectangular ceiling is input as depth and which is input as width.

Total Ceiling Area

Enter the area of the interior ceiling. Interior ceilings may be entered either using area or depth and width.

Below-Grade Wall Dialogs

Additional details related to below-grade wall components can be accessed by selecting the *Architecture* tab and double-clicking on any underground wall component in the tree.

Currently Active Below-Grade Wall

The *Currently Active Below-Grade Wall* feature enables you to quickly review and edit all below-grade walls in the building in a single pass as well as to create new below-grade walls.

Below-Grade Wall Name

The building creation wizard assigns a unique name to each below-grade wall using a naming convention based on the space to which the wall is assigned. The program will also provide a default name for any new below-grade wall you create. You may change the name of any component provided the resulting name is unique.

Below-Grade Wall Parent

Each below-grade wall is assigned to a parent space. Selecting a different parent space from the *Belongs to Space:* listbox has the effect of moving the below-grade wall to the new parent space.

Below-Grade Wall Type

Select a below-grade wall type from the listbox containing the names of predefined below-grade wall construction types. You can also use the *create new Construction* item at the top of the list to create a new construction or right mouse click on the *Below-Grade Wall Type* field to edit an existing construction type.

Bear in mind that editing a construction type that has also been assigned to other below-grade walls will cause the below-grade wall construction to be changed for those other below-grade walls as well. Selecting a different construction from the listbox or creating a new construction for this below-grade wall changes this below-grade wall only.

Exposed Perimeter

Enter the length of the below-grade wall exposed to exterior conditions. Normally this is the same as the length of the below-grade wall. Do not include below-grade walls that are greater than one story (10 ft. or more) below grade or portions of below-grade walls extending under conditioned space.

Below-Grade Wall Height

Enter the height of the below-grade wall measured from the top of the floor slab to grade. If this dimension varies, use an average value. The height input for below-grade walls may include up to 8” of wall that is actually above grade, however, if more than 8” of the below-grade wall assembly extends above grade, the wall must be entered as a separate above-grade wall component.

Below-Grade Wall Length

Enter the length of the below-grade wall. Normally this is the same as the length of exposed perimeter.

Below-Grade Surface Area

The surface area of the below-grade wall.

Below-Grade Insulation Depth

The depth of insulation measured from grade. By default, this dimension is set equal to the wall height--representing full-height insulation.

Below-Grade Error Code

To correctly model assemblies in contact with earth, the first two materials in the construction must be *Fictitious Earth Insulation* and *Soil (12in.)*. The ***Invalid 1st Layer-Press F1*** error message is displayed any time a construction is selected that does not contain these two materials in those positions. To eliminate the error, modify your construction to include these materials as the first and second layers or create your construction by modifying a pre-defined construction beginning with *BGW*; e.g., BGW - Solid Masonry 8 in., *No Furring Layers*.

Interior Floor Dialogs

Additional details related to interior floor components can be accessed by selecting the *Architecture* tab and double-clicking on any interior floor component in the tree.

Currently Active Floor Assembly

The *Currently Active Floor* feature enables you to quickly review and edit all floors in the building in a single pass as well as to create new floors. *Floor* here refers to a floor assembly rather than to a building floor, by which we mean the same thing as building story.

Floor Component Name

The building creation wizard assigns a unique name to each floor component using a naming convention based on the space to which the floor is assigned. The program will also provide a default name for any new floor you create. You may change the name of any component provided the resulting name is unique.

Floor Space Parent

Each floor is assigned to a parent space. Selecting a different parent space from the *Belongs to Space:* listbox has the effect of moving the floor to the new parent space.

Floor Type

Select a floor type from the listbox containing the names of predefined floor construction types. You can also use the *create new Construction* item at the top of the list to create a new construction or right mouse click on the *Floor Construction Type* field to edit an existing construction type.

Bear in mind that editing a construction type that has also been assigned to other floors will cause the floor construction to be changed for those other floors as well. Selecting a different construction from the listbox or creating a new construction for this floor changes this floor only.

Exposure

The *Floor* component is used to describe several different situations. These different situations may involve different insulation requirements under the code and may involve different modeling techniques in COM*check-Plus*. The *Exposure* field enables you to designate which type of floor you are describing. The options are:

- Slab on grade
- Exposed to Exterior Conditions

- Exposed to Unconditioned Space
- Exposed to Conditioned Space

Slab on grade – This selection is appropriate for all concrete slabs in contact with earth. In cold climates, prescriptive perimeter slab-edge insulation requirements apply to these floors, and those requirements are modeled for the budget building.

Exposed to Exterior Conditions – This selection is appropriate wherever a floor has conditioned space above and outside conditions below. Examples include floors over parking garages and cantilevered floor sections.

Exposed to Unconditioned Space – This selection is appropriate for interior floors that separate conditioned from unconditioned space. The insulation requirements that apply to these floors are the same as for floors exposed to exterior conditions, but the tempering effects of the unconditioned space are accounted for in the simulation. Examples include floors over crawl spaces and floors over unconditioned (but fully enclosed) basements.

Exposed to Conditioned Space – This selection is appropriate for interior floors, where there is conditioned space both above and below the floor. No insulation requirements apply in this situation, but the modest thermal impacts of subdividing the conditioned spaces is accounted for in the simulation.

Next to Space

Each interior floor separates the space to which it belongs from the space it is next to. Each interior floor is described only once, and it does not matter which of the two adjacent spaces it belongs to and which it is next to.

Exposed Perimeter (ft)

Enter the length of concrete slab edge exposed to exterior conditions. Consider slab edge that is less than the design frost depth in your area below grade to be exposed to exterior conditions. For concrete floor slabs that lie at greater than frost depth below grade, enter zero.

Slab Insulation Position

Enter the position of the slab edge insulation, if used. Vertical insulation is placed either inside or outside the foundation wall and extends from the top of the slab vertically downward a specified distance. Insulation placed in the vertical position is thermally the most effective. Horizontal insulation can be placed either inside or outside of the foundation wall and extends from the top of the slab vertically downward to the bottom of the slab, then horizontally either under the slab (if placed inside the foundation wall) or away from the foundation (if placed outside the foundation wall). The combined vertical and horizontal distances represent the insulation depth.

Perimeter Slab-Edge Insulation R-Value

The R-value of perimeter slab-edge insulation. If the edge of the slab is uninsulated, enter 0.0.

Slab Insulation Depth

Enter the depth of slab edge insulation measured either vertically or horizontally, depending upon insulation position. The insulation is measured vertically from the top of the slab downward (if placed vertically) or (if placed horizontally) vertically from the top of the slab, then horizontally the width of the horizontally positioned insulation. The combined vertical and horizontal distances represent the insulation depth.

Continuous at Edge

Check the *Continuous at Edge* checkbox if the slab edge insulation is continuous with no breaks from the top of slab to the depth indicated. A minimum of R-4 insulation must be maintained to qualify as continuous.

Length

Enter the length of this floor component. You may enter floor dimensions either as height and width or as area.

Width

Enter the width of this floor component. You may enter floor dimensions either as height and width or as area.

Floor Area

Enter the area of this floor component. You may enter floor dimensions either as area or height and width.

Material Construction Error Code

To correctly model assemblies in contact with earth, the first two materials in the construction must be *Fictitious Earth Insulation* and *Soil (12in.)*. The *Invalid 1st Layer-Press **F1*** error message is displayed any time a construction is selected that does not contain these two materials in those positions. To eliminate the error, modify your construction to include these materials as the first and second layers or create your construction by modifying a pre-defined slab on grade construction.

Floor is Demising

Use the checkbox to identify floors that separate conditioned from unconditioned space. Interior floors that do not separate conditioned from unconditioned space have no insulation requirements and are included in COM*check-Plus* only to model passive heat flows within the building. Demising floors--floors that separate conditioned from unconditioned space--do have insulation requirements, and those requirements are applied to the budget building design and do affect the energy cost budget.

Window Dialogs

Additional details related window components can be accessed by selecting the *Architecture* tab and double-clicking on any window component in the tree. Window dialogs have two tabs: *Window Data* and *Overhang and Fin Data*.

Currently Active Window

The *Currently Active Window* feature enables you to quickly review and edit all windows in the building in a single pass as well as to create new windows.

Window Name

The building creation wizard assigns a unique name to each window using a naming convention based on the space to which the parent wall is assigned. The program will also provide a default name for any new window you create. You may change the name of any component provided the resulting name is unique.

Window Parent

Each window is assigned to a parent wall. Selecting a different parent wall from the *Belongs to Exterior Wall:* listbox has the effect of moving the window to the new parent wall.

Glass Type

Select a glass type from the listbox containing the names of predefined glass types. You can also use the *create new Glass Type* item at the top of the list to create a new glass type or right mouse click on the *Glass Type* field to edit an existing glass type.

Bear in mind that editing a glass type that has also been assigned to other windows will cause the glass type to be changed for those other windows as well. Selecting a different glass type from the listbox or creating a new glass type for this window changes this window only.

Window Height

Enter the height of the window including window frame. You may use the dimensions of the rough window opening.

The building creation wizard creates all windows as ribbons of glass that extend across the width of the wall. Areas are set to match the percent of wall entered on the *Windows and Doors* screen in the wizard.

Entering actual window dimensions is required only if you intend to describe overhangs or fins. Usually it is **easiest** to replace the windows created by the wizard with actual window dimensions and a multiplier (number of window units) using the *Window Data* dialog in the main interface. That way you do not need to accurately calculate the percentage of wall covered by the windows for entry in the wizard.

Window Width

Enter the width of the window including window frame. You may use the dimensions of the rough window opening.

The building creation wizard creates all windows as ribbons of glass that extend across the width of the wall. Areas are set to match the percent of wall entered on the *Windows and Doors* screen in the wizard.

Entering actual window dimensions is required only if you intend to describe overhangs or fins. Usually it is **easiest** to replace the windows created by the wizard with actual window dimensions and a multiplier (number of window units) using the *Window Data* dialog in the main interface. That way you do not need to accurately calculate the percentage of wall covered by the windows for entry in the wizard.

Window Area

The gross area of the window including window frame.

Window Multiplier

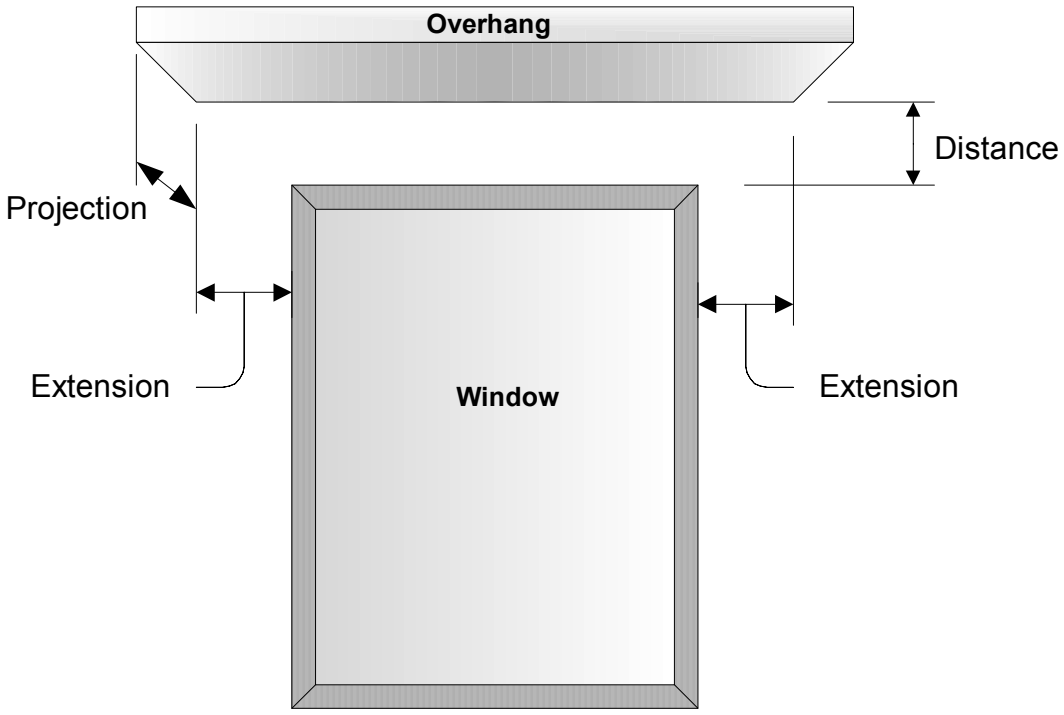
If multiple identical windows are used, enter the height and width of a single window along with a window multiplier.

Window Total Area

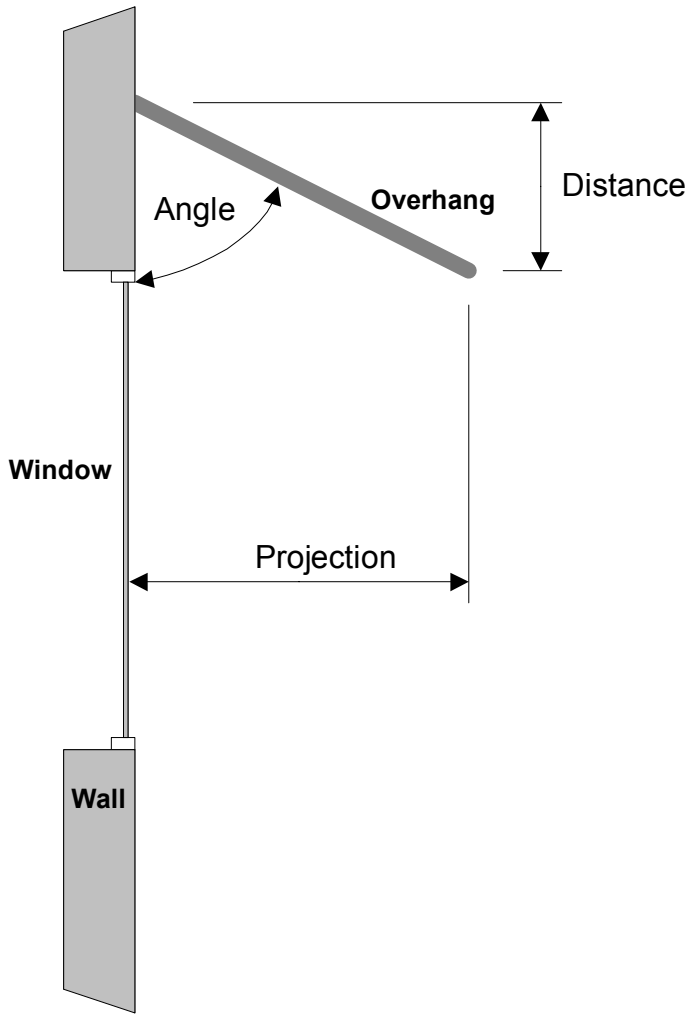
The total window area after adjustment by the window multiplier.

Overhangs and Fins

Window overhangs and fins are entered on the *Overhang and Fin Data* tab of the *Windows* dialog. The figures below show the inputs available in COM*check-Plus* for describing overhangs and fins. Overhangs are assumed to be positioned symmetrically over the windows.

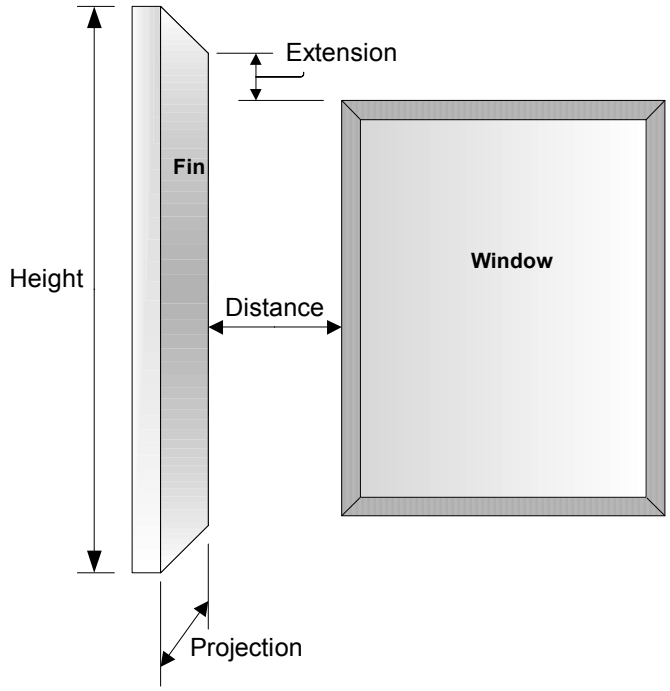


Horizontal Window Overhang Viewed in Elevation from Exterior of Building.



Sloped Window Overhang Viewed in Section

Fins on the left and right sides of windows are entered separately. Left and right fins are defined based on their position as viewed from the building exterior.



Left Fin Viewed in Elevation from the Exterior of the Building. Note that the *Extension* input as shown (i.e., where the top of the fin extends above the window head) would be entered as a negative extension distance.

Overhang Projection

Enter the distance the overhang projects horizontally from the plane of the window. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Overhang Distance

Enter the distance from the top of the window to the underside of the overhang. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Overhang Extension

Enter the distance the overhang extends horizontally in the plane of the window past the edge of the window jambs. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Overhang Angle

Enter the angle between the plane of the window and the overhang. For example, the overhang angle of a horizontal projection over a vertical window would be 90. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Left Fin Projection

Enter the distance the left fin (as viewed from outside) projects horizontally from the plane of the window. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Left Fin Distance

Enter the distance from the left edge of the window to the inside of the left fin. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Left Fin Height

Enter the height of the left fin. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Left Fin Extension

Enter the distance the left fin projects vertically from the top of the window. A +1 ft. distance would locate the top of the fin 1 ft. below the head of the window, while a value of -1 ft. would locate the top of the fin 1 ft. above the head of the window. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Right Fin Projection

Enter the distance the right fin (as viewed from outside) projects horizontally from the plane of the window. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Right Fin Distance

Enter the distance from the right edge of the window to the inside of the right fin. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Right Fin Height

Enter the height of the right fin. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Right Fin Extension

Enter the distance the right fin projects vertically from the top of the window. A +1 ft. distance would locate the top of the fin 1 ft. below the head of the window, while a value of -1 ft. would locate the top of the fin 1 ft. above the head of the window. For a graphic explanation of this input see the *Overhangs and Fins* Help topic.

Skylight Dialogs

Additional details related skylight components can be accessed by selecting the *Architecture* tab and double-clicking on any skylight component in the tree.

Currently Active Skylight

The *Currently Active Skylight* feature enables you to quickly review and edit all skylights in the building in a single pass as well as to create new skylights.

Skylight Name

The building creation wizard assigns a unique name to each skylight using a naming convention based on the space to which the parent roof is assigned. The program will also provide a default name for any new skylight you create. You may change the name of any component provided the resulting name is unique.

Parent Roof

Each skylight is assigned to a parent roof. Selecting a different parent roof from the *Belongs to Exterior Roof:* listbox has the effect of moving the skylight to the new parent roof.

Skylight Glass Type

Select a glass type from the listbox containing the names of predefined glass types. You can also use the *create new Glass Type* item at the top of the list to create a new glass type or right mouse click on the *Glass Type* field to edit an existing glass type.

Bear in mind that editing a glass type that has also been assigned to other skylights will cause the glass type to be changed for those other skylights as well. Selecting a different glass type from the listbox or creating a new glass type for this skylight changes this skylight only.

Skylight Height

Enter the height of the skylight including skylight frame. You may use the dimensions of the rough skylight opening.

The building creation wizard creates skylights as a single square skylight for each occupied space on the building's top floor. Areas are set to match the percent of roof entered on the *Roof and Skylights* screen in the wizard.

It is usually easiest to replace the skylights created by the wizard with actual skylight dimensions and a multiplier (number of skylight units) using the *Skylight Data* dialog in the main interface. That way you do not need to accurately calculate the percentage of roof covered by the skylights for entry in the wizard.

Skylight Width

Enter the width of the skylight including skylight frame. You may use the dimensions of the rough skylight opening.

The building creation wizard creates skylights as a single square skylight for each occupied space on the building's top floor. Areas are set to match the percent of roof entered on the *Roof and Skylights* screen in the wizard.

It is usually easiest to replace the skylights created by the wizard with actual skylight dimensions and a multiplier (number of skylight units) using the *Skylight Data* dialog in the main interface. That way you do not need to accurately calculate the percentage of roof covered by the skylights for entry in the wizard.

Skylight Area

The gross area of the skylight including skylight frame.

Skylight Multiplier

If multiple identical skylights are used, enter the height and width of a single skylight along with a skylight multiplier.

Skylight Total Area

The total skylight area after adjustment by the skylight multiplier.

Door Dialogs

Additional details related door components can be accessed by selecting the *Architecture* tab and double-clicking on any door component in the tree.

Currently Active Door

The *Currently Active Door* feature enables you to quickly review and edit all doors in the building in a single pass as well as to create new doors.

Door Name

The building creation wizard assigns a unique name to each door using a naming convention based on the space to which the parent wall is assigned. The program will also provide a default name for any new door you create. You may change the name of any component provided the resulting name is unique.

Door Parent

Each door is assigned to a parent wall. Selecting a different parent wall from the *Belongs to Exterior Wall:* listbox has the effect of moving the door to the new parent wall.

Door Category

The category of door.

Door Type

Select a door type from the listbox containing the names of predefined door types. You can also use the *create new Construction* item at the top of the list to create a new door type or right mouse click on the *Door Type* field to edit an existing door type.

Bear in mind that editing a door type that has also been assigned to other doors will cause the door type to be changed for those other doors as well. Selecting a different door type from the listbox or creating a new door type for this door changes this door only.

Door Height

Enter the height of the door including door frame. You may use the dimensions of the rough door opening.

Door Width

Enter the width of the door including door frame. You may use the dimensions of the rough door opening.

Door Area

The gross area of the door including door frame.

Door Multiplier

If multiple identical doors are used, enter the height and width of a single door along with a door multiplier.

Door Total Area

The total door area after adjustment by the door multiplier.

Glass Types

Additional details related to glass types can be accessed by selecting the *Architecture* tab and double-clicking on any window, door, or skylight component in the tree. **To access the glass type dialogs, right-click on the *Glass Type* field in the window, door, or skylight dialog and select one of the options (create new, default, minimally compliant or Wizard default).**

Glass Active Glass Type

The *Currently Active Glass Type* feature enables you to quickly review and edit all glass types referenced in the building in a single pass as well as to create new glass types.

Glass Type Name

Each glass type must have a unique name. If you attempt to edit a predefined glass type that is part of the program library, a copy of the glass type will be created, which you can rename provided the resulting name is unique.

Glass Describes Listbox

The *Glass Type Data* dialog is shared by three component types--windows, skylights, and doors--each of which can have assigned glass types. The *Describes* field indicates the component type to which this glass type is assigned.

Default Option

For glass performance characteristics, two default modes are available—*Code Criteria* and *Typical Values*. The Building Creation Wizard uses Code Criteria.

The *Code Criteria* option sets the default performance characteristics of the glass to the criteria used in the budget building and the default glazing characteristics to generally compatible values.

The *Typical Values* options sets the default glazing characteristics to typical values for the selected climate and the default performance characteristics to reflect poor performance given the physical characteristics. If you use this mode and set the characteristics to those you expect to use, you can be confident that you can easily find products with the given physical characteristics that will perform as well as the performance defaults; i.e., *Overall U-factor* and *Solar Heat Gain Coefficient*.

Glazing Layers

Select the number of glazing layers from the listbox. Low-e coatings are included here because their effect is similar to that of additional glazing layers. The *Layers* input is used to provide default U-factors and solar heat gain coefficients and will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Glazing Type

Select the glazing type from the listbox. Use *reflective* if the glass has a reflective surface, even if the glass is also tinted. The *Glazing Type* input is used to provide default U-factors and solar heat gain coefficients and will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Frame Type

Select the frame type from the listbox. Frame type is useful in characterizing the thermal conductivity of the frame. For frame materials not listed, select the frame type that is thermally most similar; for example, for metal clad wood windows, you would select *Wood*. The *Frame Type* input is used to provide default U-factors and solar heat gain coefficients (it typically affects frame width) and will be reported on compliance reports to facilitate code enforcement. However, the input is not used directly in calculations used to determine compliance.

Overall Window U-Factor

Enter the overall window U-factor, which includes the effects of window frames. Your entry should be consistent with manufacturer's literature and (preferably) represent a rated value developed in accordance with National Fenestration Rating Council (NFRC) test procedures. Center-of-glass U-factors may not be used. The default value provided is based on the window characteristics--layers, glazing type, and frame type. You may simply accept the default value, however, the final product you select must equal or exceed the efficiency used in your submission. (For U-factors, this means equal or lower.)

Glass SHGC

Enter the glass solar heat gain coefficient (SHGC) for the windows, which should include the effect of the window frames. Your entry should be consistent with manufacturer's literature and (preferably) represent a rated value developed in accordance with National Fenestration Rating Council (NFRC) test procedures. The default value provided is based on the window characteristics--layers, glazing type, and frame type. You may

simply accept the default value, however, the final product you select must equal or exceed the efficiency used in your submission. (For SHGC, this means equal or lower.)

SHGC is part of a system for rating glazing performance used by the National Fenestration Rating Council (NFRC), and SHGC has largely replaced 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.

Construction Types

Additional details related to construction types (for walls, roofs, and floors) can be accessed by selecting the *Architecture* tab and double-clicking on any wall, roof, or floor component in the tree. **To access the construction type dialogs, right-click on the *Wall, Roof, or Floor Type* field in the wall, roof, or floor dialog and select one of the options (create new, edit, or delete).**

Currently Active Construction

The *Currently Active Construction* feature enables you to quickly review and edit all constructions referenced in the building in a single pass as well as to create new constructions. In COM*check-Plus*, a construction is an assembly of material layers that can be applied as a generic assembly type to one or more walls, roofs, floors or doors in the building. The *Construction* object differs from the *Assembly Layers* object primarily in that constructions include exterior surface properties, such as absorptance.

Construction Name

Each construction must have a unique name. If you attempt to edit a predefined construction that is part of the program library, a copy of the construction will be created, which you can rename provided the resulting name is unique.

Construction Describes Listbox

The Construction Data dialog is shared for various types of components--walls, roofs, floors, etc. The *Describes* field indicates the component type to which this construction is assigned.

Construction Layers

The selected layers component, which defines each material layer and corresponding thickness in the construction.

Absorptance

Enter the solar radiation absorptance of the exterior surface expressed as a decimal fraction. If you enter a surface absorptance lower than the default, you should be prepared to document the basis for the lower value for the building department.

Construction U-Factor

The overall U-factor for the construction including interior and exterior air films. This value is calculated based on the referenced assembly layers.

Assembly Layer Dialogs

Additional details related to assembly layers (for walls, roofs, and floors) can be accessed by selecting the *Architecture* tab and double-clicking on any wall, roof, or floor component in the tree. **To access the assembly layer dialogs, right-click on the *Wall, Roof, or Floor Type* field in the wall, roof, or floor dialog and select one of the options (create new, edit, or delete) and then right click in the *Layers* field.**

Currently Active Assembly Layers

The *Currently Active Layers* feature enables you to quickly review and edit all layers referenced in the building in a single pass as well as to create new layers components. In COM*check-Plus*, an assembly layers component is a set of material layers that can be applied as a generic set to one or more construction components. The *Assembly Layers* object differs from the *Construction* object primarily in that constructions include exterior surface properties, such as absorptance.

Assembly Layer Name

Each assembly layer component must have a unique name. If you attempt to edit a predefined assembly layer component that is part of the program library, a copy of the component will be created, which you can rename provided the resulting name is unique.

Inside Air Film Resistance

COM*check-Plus* sets the assumed thermal resistance of the inside air film to a standard value based on the position of the surface and, in some cases, assumed direction of heat flow.

Overall Assembly Layer R-Value

The overall R-value of this assembly layer component including both interior and exterior air films. An R-value of 0.17 (corresponding with a 15-MPH wind) is assumed for exterior air films for this calculation. The actual simulation calculates this value hourly based on wind speed.

Assembly Paths

COM*check-Plus* supports two different methods for modeling building assemblies: *Single Path* and *Parallel Paths*. Single path simply models the assembly as a series of homogeneous layers. The parallel paths method models the assembly as two separate constructions subject to parallel heat flows. The parallel path method is intended for use with assemblies in which there is significant thermal bridging, such as with stud walls.

Percent Primary Path

% Primary Path is used when there are two parallel conduction paths through the assembly—usually insulation and structure. *Percent Primary Path* is the percentage of the sectional area of the assembly (cut normal to the direction of heat flow) providing the primary conduction path; the remaining percent is automatically assigned to the secondary conduction path. For example, an insulated floor consisting of insulation between 2x10 wood floor joists @ 16” o.c. would normally use a 90% value for Primary Path [(16” - 1.5”) / 16” = 90.625%].

For metal studs, use the width of the stud flange in determining the percent primary path. For example, a wall consisting of metal studs @24” o.c. with a 1-1/4” wide flange would have 6.25% (1.5 / 24 = 0.0625) assigned to the secondary path in addition to top and bottom plates, framing for window and door opening, headers. Use the same percent primary values as used with predefined assemblies in the program library unless you are prepared to document the basis for different assumptions. Note that in the case of metal studs and other metal structural materials, the material properties in the program library have been adjusted to account for the fact that they are not solid homogeneous materials. [See the *Materials* Help messages (R-Value and Density) for detailed information on the modeling methods and assumptions when creating new materials and assembly descriptions.]

Assembly Material

Select the material assigned to the assembly layer (beginning at building exterior) but excluding the exterior air film.

Assembly Material Path

The *Path(s)* fields enable you to assign each material to the primary path, the secondary path, or to both paths. The primary path is assumed to include heat flow through insulation in the cavities between structural elements.

The secondary path is assumed to include heat flows through structural elements that bridge (or short-circuit) the cavity insulation.

Assembly Material Thickness

Enter the effective thickness of the material. In most cases, this is simply the thickness of the material. However, in some cases, the full thickness of the material may be irrelevant because only a portion of the material thickness is part of the thermal assembly; for example, where ceiling joists are deeper than the insulation used between them.

Primary Path R-Value

The overall R-value of the primary thermal path including both interior and exterior air films. An R-value of 0.17 (corresponding with a 15-MPH wind) is assumed for exterior air films for this calculation. The actual simulation calculates this value hourly based on wind speed.

Secondary Path R-Value

The overall R-value of the secondary thermal path including both interior and exterior air films. An R-value of 0.17 (corresponding with a 15-MPH wind) is assumed for exterior air films for this calculation. The actual simulation calculates this value hourly based on wind speed.

Material Dialogs

Additional details related to materials in assembly layers (for walls, roofs, and floors) can be accessed by selecting the *Architecture* tab and double-clicking on any wall, roof, or floor component in the tree. **To access the material dialogs, right-click on the *Wall, Roof, or Floor Type* field in the wall, roof, or floor dialog and select one of the options (create new, edit, or delete), right click in the *Layers* field and select one of the options (create new, edit, or delete) and right click in the *Materials* field and select one of the options (create new, edit, or delete).**

Currently Active Material

The *Currently Active Material* feature enables you to quickly review and edit all materials referenced in the building in a single pass as well as to create new material components.

Material Name

Each material must have a unique name. If you attempt to edit a predefined material that is part of the program library, a copy of the component will be created, which you can rename provided the resulting name is unique.

Material Thickness

Enter the thickness of the material in inches. The *Thickness* field has been restricted to values that are no thinner than 0.0012 inches and thicker than 12 inches. The reason for these limits is that the DOE-2 program can produce errors that are fatal to the simulation if material layers are either too thin or too thick. For materials with a thickness outside of these limits, we recommend that you set the thickness equal to the limit. This is likely to yield a very good approximation of simulation results that would have been generated had the actual material thickness been successfully modeled.

Material Density

The density of the material. For materials such as metal studs that do not form a homogeneous volume, the material's density requires adjustment. Instead of the density of the material, use the weight of the stud divided by the solid volume that it occupies. For example a 0.02 in thick 3-1/2” deep stud with 1- 1/4” flanges would have a density value of 13.4 lb/ft3 rather than 489 lb/ft3 for steel. The effective density was calculated as follows:

Density stud(eff) = Density steel × Volume stud material / Volume stud shape

= [489 lb/ft3] × [0.02” ×1.25”+3.5”+1.25”) × 12”] / [3.5” × 1.25” × 12”] = 3.4 lb/ft^3

Specific Heat

Specific heat is the ratio of the amount of heat it takes to raise a unit of mass of the material one degree relative to the amount of heat it takes to raise a unit of mass of water one degree. Most building materials have specific heats in the range of 0.2 to 0.4.

R-Value Per Inch

The R-value per inch of thickness of the material. For metal building materials that do not form a homogeneous volume, such as metal studs, the *R-Value / Inch* input requires adjustment. Instead of basing the RVal/Inch on the extremely high thermal conductivity of steel (which would be appropriate with a solid steel volume), multiply one over the conductivity of the steel by the ratio of the width of the stud flange to the thickness of the stud material. For a 0.02” thick steel stud with 1.25” flanges, the RVal/Inch would be 0.20 rather than the 0.0032 for solid steel. The effective R-value per inch for the stud was calculated as follows:

RVal/Inchstud(eff) = Widthflange / Thicknessstudweb × (1 / Thermal Conductivitysteel)

= 1.25” / 0.02” × 1 / [314 Btu·in/(h·ft2·ºF)] = 0.20 ºF·ft2 h/(Btu in)

Note that the percent primary value for assembly layers using nonhomogeneous metal building materials (or any other material requiring the above type of adjustment) must be coordinated.

Resistance

The overall R-value of the material for the thickness shown. See *R-Value Per Inch* for a description of adjustments necessary for some metallic building materials.

Thermal Conductance

The thermal conductance of the material for the thickness shown. Thermal conductance is the reciprocal of thermal resistance.

Appendix D: Lighting Folder Dialog Descriptions

The dialogs described in this section are accessed from the *Lighting* folder by double-clicking on the items in the tree.

Lighting System Dialogs

Additional details related to lighting can be accessed by selecting the *Lighting* tab and double-clicking on any lighting system in the tree.

Currently Active Lighting System

The *Currently Active Lighting System* feature enables you to quickly review and edit all existing lighting systems in a single pass as well as to create new lighting systems.

Lighting System Name

Enter a unique name or description for this lighting system or leave the default name generated by the building creation wizard.

Serves Activity Area

Each lighting system has a unique name and is assigned to a "parent" activity area that it serves.

Total System Watts

The total input wattage for this lighting system obtained by multiplying fixture quantity by fixture input wattage and summing over each of the fixture types that make up the lighting system.

Lighting Fixture

Select the name/description of the fixture type to be used in this lighting system. Up to four different fixture types can be used in each lighting system. You can select a different fixture from the listbox, edit a fixture selected from the list (select a fixture, right mouse click on the fixture name, then select *Edit Selected Lighting Fixture*, and make changes within the *Lighting Fixture Data* dialog), or create an entirely new fixture.

Quantity of Lighting Fixtures

Enter the quantity of fixtures of the given type for this lighting system. The building creation wizard sets this quantity to create a minimally code compliant configuration; i.e., based on the lighting power allowance for the activity area served by the system and the input wattage of the selected fixture type. The wizard entries are only intended to provide you a convenient starting place for demonstrating compliance for your building. **You MUST REPLACE the values provided by the wizard with the actual quantities specified in the actual design.**

Square Foot Per Fixture

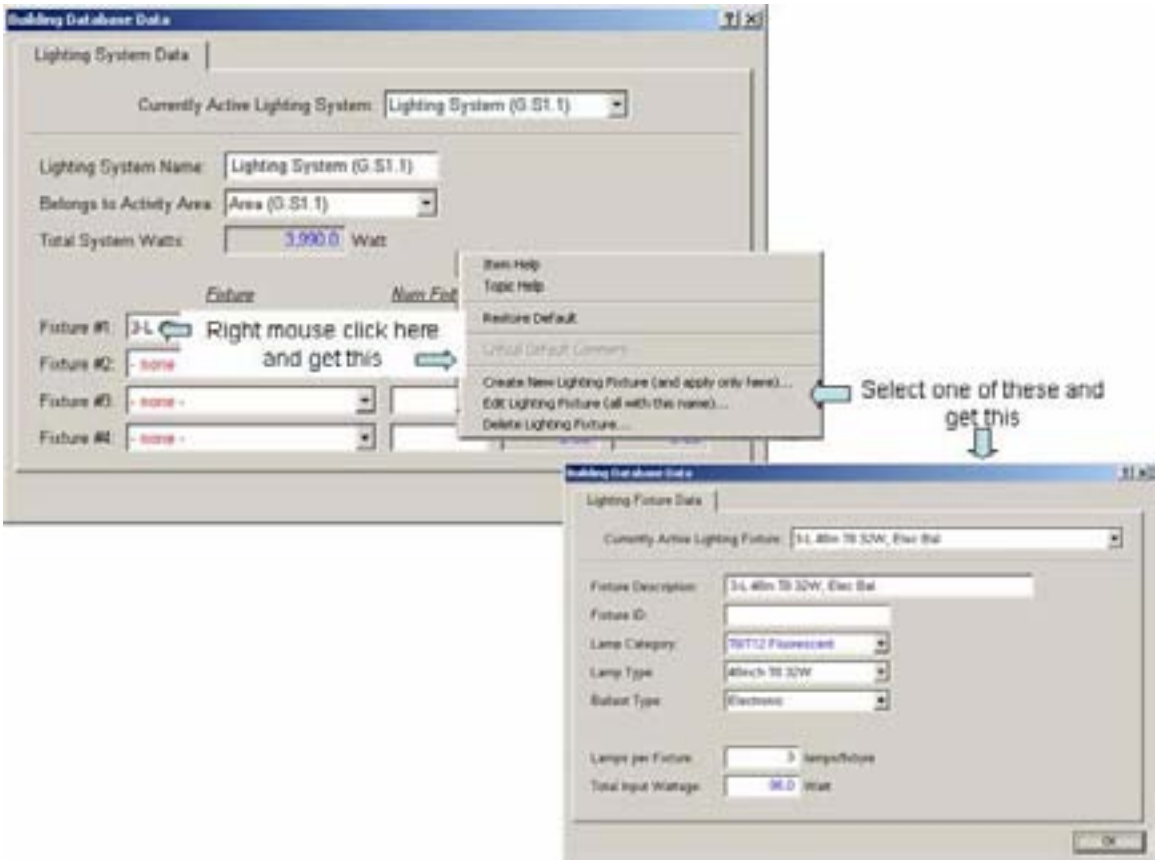
A square ft. per fixture value is used by the building creation wizard in the initial allocation of fixtures to the lighting system. Outside of the wizard, the *Square Ft. Per Fixture* field is merely informative, and the *Number of Fixtures* field becomes the basis for lighting system specification.

Watts Per Square Foot

The lighting power densities of the types of fixtures for this lighting system. This is the fixture quantity times the fixture input wattage divided by the floor area of the activity area served.

Lighting Fixture Dialogs

Additional details related to lighting can be accessed by selecting the *Lighting* tab and double-clicking on any lighting system in the tree. **To access the lighting fixture dialogs, right-click on the *Fixture* field in the L*ighting System* dialog and select one of the options (create a new fixture, edit a fixture, or delete a fixture).**



Currently Active Lighting Fixture

The *Currently Active Lighting Fixture* feature enables you to quickly review and edit currently assigned lighting fixtures as well as to create new lighting fixtures.

Fixture Description

Enter a name or description of the lighting fixture. Ideally this description will match descriptions found in construction plans and specifications. The default descriptions used by the wizard identify only lamps and ballasts. Actual fixture descriptions that describe physical characteristics (e.g., suspended, louvered, etc.) are preferred, as they better facilitate review and inspection.

Fixture ID

Enter the fixture ID used on lighting fixture schedules on plans and specifications, if applicable.

Lamp Category

Select the general lamp category from the listbox.

Lamp Type

Select the lamp type designation from the listbox. If the lamp you intend to use does not appear on the list, select *Other*. *Lamp Type* is used to provide default input wattages for lamp/ballast combinations and to facilitate review and inspection.

Ballast Type

Select from the list of available ballast types. Available ballast types are magnetic, electronic, and hybrid. Default input wattages are provided for commonly-used lamp/ballast combinations. The following definitions have been used in determining default input wattages.

- **Magnetic ballast** - contains conventional capacitor, rectifier, and/or transformer components (core and coil) and operates at a 60 Hz frequency.
- **Electronic ballast** - contains advanced electronic components and no (or very small) core and coil transformers and operates at high frequency--typically 20,000 Hz or above.
- **Hybrid ballast** - contains both efficient conventional components and electronic circuitry and operates at 60Hz frequency.

Lamps per Fixture

Select the number of lamps per fixture.

Total Input Wattage

Enter the rated input wattage for the lamp/ballast combination. COM*check-Plus* provides default input wattages for common lamp/ballast combinations. If you have not yet selected specific fixtures or do not have input wattage information from manufacturer's literature, you may use the default input wattages. The defaults have been defined conservatively so that most equipment will perform at least as efficiently. **However, the actual equipment that goes into the building must meet or exceed the efficiencies you used in the compliance analysis.**

Wattage per Lamp

Enter the nominal wattage of the lamp; i.e., not including the wattage of the ballast.

Appendix E: Mechanical Folder Dialog Descriptions

Additional details related to mechanical can be accessed by selecting the *Mechanical* tab and double-clicking on any mechanical system in the tree.

Cooling Primary Equipment

Enter information about the primary HVAC cooling equipment (i.e., chillers and associated pumps) serving the building using the fields provided. This dialog appears only if applicable entries were made in earlier dialogs.

Chiller Type

Select the type of chiller(s) from the listbox. If you are using more than one type of chiller, select the most common type for this wizard input. You can later edit the chiller type for individual chillers using the main program interface. Up to four different chiller types can be selected for a single building.

Number of Chillers

Enter the number of chillers for the entire building.

Condenser Type

Select from the available condenser types in the listbox.

Chilled-Water Loop Configuration

Select the appropriate configuration of the chilled-water loop pump(s) and piping from the listbox.

Pump Control for Main CHW Loop

Select the flow-control capability of the pump(s) serving the main chilled water loop.

Number of Main System CHW Loop Pumps

Enter the number of pumps serving the main chilled water loop.

Motor Efficiency for Main System CHW Loop Pumps

Select the motor type (i.e., efficiency rating) of the pump(s) serving the main chilled water loop. For an explanation of the efficiency ratings, see *Pump Motor Efficiency*.

Pump Control for Individual Chiller CHW Loop Pumps

Select the flow-control capability of the pump(s) serving chilled water loops for individual chillers.

Motor Efficiency for Individual Chiller CHW Loop Pumps

Select the motor type (i.e., efficiency rating) of the pump(s) serving chilled water loops for individual chillers. For an explanation of the efficiency ratings, see *Pump Motor Efficiency*.

Primary Equipment Heat Rejection

Enter information about the primary heat rejection equipment (i.e., cooling towers, water-cooled condensers, and associated pumps) serving the building using the fields provided.

Water-Cooled Condenser Configuration

Select the water-cooled condenser/cooling tower configuration from the listbox.

Water-Cooled Condenser Capacity Control

Select the capacity control method for the cooling tower from the listbox.

Water-Cooled Condenser Pumping System Configuration

Select the appropriate pump/piping configuration for the water-cooled condenser/cooling tower from the listbox.

System Pump Control

Select the appropriate flow-control capability for the main cooling water loop pump(s) from the listbox.

System Pump Motor Efficiency

Select the motor type (i.e., efficiency rating) of the chiller condenser water pump(s). For an explanation of the efficiency ratings, see *Pump Motor Efficiency*.

Chiller Condenser Pump Control

Select the appropriate flow-control capability for the chiller condenser water pump(s) from the listbox.

Chiller Condenser Pump Motor Efficiency

Select the motor type (i.e., efficiency rating) of the chiller condenser water pump(s).

Tower Pump Control

Select the appropriate flow-control capability for the cooling tower pump(s) from the listbox.

Tower Pump Motor Efficiency

Select the motor type (i.e., efficiency rating) of the cooling tower pump(s). For an explanation of the efficiency ratings, see *Pump Motor Efficiency*.

Heating Primary Equipment

Enter information about the primary HVAC heating equipment (i.e., boilers and associated pumps) serving the building using the fields provided.

Boiler Type

Select the boiler/draft type for the boiler(s) from the listbox.

Number of Boilers

Enter the number of boilers used for space heating purposes.

Boiler Energy Source

Select the fuel type used to power the boiler(s) from the listbox.

Boiler Pump Configuration

Select the pump/piping configuration for the hot loop.

Number of Main System HW Loop Pumps

Enter the number of pumps serving the main hot water loop.

Pump Control for Main System HW Loop

Select the flow-control capability of the pump(s) serving the main hot water loop.

Motor Efficiency for Main System HW Loop Pumps

Select the motor type (i.e., efficiency rating) of the pump(s) serving the main hot water loop. For an explanation of the efficiency ratings, see *Pump Motor Efficiency*.

Pump Control for Individual Boiler HW Loop Pumps

Select the flow-control capability of the pump(s) serving individual boiler hot water loops.

Pump Type

The *Pump Type* field serves as a label indicating the use or function served by the pump. Pump type is defined when the pump is created, either by the Building Creation Wizard or the user. *Pump Type* is not editable from within the *Pump* dialog. For example, you cannot change a chilled water pump into a boiler pump.

To create a new pump component outside of the wizard, first open the dialog of the piece of equipment served by the pump, select *Create new pump* from the *Pump* field, which will create a new pump object and open its dialog for editing.

Motor Efficiency for Individual Boiler HW Loop Pumps

Select the motor type (i.e., efficiency rating) of the pumps serving individual boiler hot water loops. For an explanation of the efficiency ratings, see *Pump Motor Efficiency*.

Water-Source HP Equipment

Enter information about the equipment serving the water loop heat pump system including boilers, cooling towers, and pumps using the fields provided.

WLHP Pump Configuration

Select the pump/piping configuration of the water loop heat pump system.

WLHP System Number of Pumps

Enter the number of water loop heat pump system pumps.

WLHP System Loop Flow Characteristic

Enter the flow-control strategy for the main water loop heat pump system loop pump(s).

WLHP System Pump Motor Efficiency

Select the motor type (i.e., efficiency rating) of the main water loop heat pump system loop pump(s). For an explanation of the efficiency ratings, see *Pump Motor Efficiency*.

WLHP System Pump Control

Select the appropriate flow-control capability for the main water loop heat pump system condenser pump(s) from the listbox.

WLHP Condenser Pump Motor Efficiency

Select the motor type (i.e., efficiency rating) of the water loop heat pump system condenser pump(s). For an explanation of the efficiency ratings, see *Pump Motor Efficiency*.

WLHP Condenser Pump Control

Select the appropriate flow-control capability for the water loop heat pump system condenser pump from the listbox.

Service Water Heating Equipment

Enter information about the service water heating equipment in the building using the fields provided.

SWH Fuel Type

Select the type of fuel used for service water heating.

SWH Storage Capacity

Enter the storage capacity of the service water heating equipment. If there is more than one service water heater in the building, enter the predominant capacity.

SWH Input Rating

Enter the rated input capacity of the service water heating equipment. If there is more than one service water heater in the building, enter the predominant input capacity.

Number of Water Heaters

Enter the number of service (or domestic) water heaters to be installed. Efficiency requirements are in some cases dependent on the storage capacity and input rating of the water heating equipment. Therefore, always enter correct values for storage capacity, input rating, and number of units rather than the cumulative capacity of multiple units.

Where different sizes and capacities are used, enter average values for those inputs. You can enter only one fuel type. If different types of water heaters will be used, enter the most common type. The result of failing to enter service water heating equipment is that you will have no opportunity to receive credit for service water heating equipment that exceeds the requirements of the code.

Do not include water heaters serving process loads here. See the *Plant and Service Water Heating* topic for further information on entering process loads.

Optional Inputs

Baseboard Heating Source

Select the heating source for the zone baseboard heaters.

Chilled Water Circulation Pump Quantity

This field represents the number of pumps that serve the chilled water circulation loop.

Chilled Water Pump

Select the name of the chilled water pump(s) or use the *create new*... option to create a new chilled water pump description. Select -*none*-, if no chilled water pumps are present.

Chilled Water Pump Sizing Method

The method used to size the chilled water pumps.

Chilled Water Supply Temperature

This field represents the temperature at which chilled water is delivered to space cooling coils.

Chilled Water System Pipe Loss

This field represents the piping loss fraction for the chilled water circulation system; i.e., the thermal losses from the chilled water circulation system piping expressed as a decimal fraction of the total thermal energy entering the circulation system.

Chilled Water System Temperature Drop

This field represents the total temperature rise through the chilled water circulation system; i.e., the difference in temperature between water leaving the chiller and water entering the chiller.

Condenser Water Circulation Pump Quantity

This field represents the number of pumps that serve the condenser water circulation loop.

Condenser Water Pump

Select the name of the condenser water pump(s) or use the *create new…* option to create a new condenser water pump description. Select -*none*-, if no condenser water pumps are present.

Condenser Water System Pipe Loss

Enter the piping loss fraction for the condenser water circulation system; i.e., the thermal losses from the condenser water circulation system piping expressed as a decimal fraction of the total thermal energy entering the circulation system.

Heat Pump

Select the name of the heat pump associated with this system, use the *create new…* option to create a new heat pump description for the system, or select -*none*-, if no heat pump is present.

Heat Pump Boiler

Select the name of the boiler serving the water loop heat pump system or use the *create new…* option to create a new boiler description. Select -*none*-, if no boiler is present.

Heat Pump Circulation Loop Cooling Tower

Select the name of the cooling tower serving the water loop heat pump system or use the *create new…* option to create a new cooling tower description. Select -*none*-, if no cooling tower is present.

Heat Pump Circulation Loop Pump Quantity

This field represents the number of pumps that serve the hydronic heat pump circulation loop.

Hot Water Circulation Pump Quantity

This field represents the number of pumps that serve the hot water circulation loop.

Hot Water Pump Sizing Method

The method used to size the hot water pumps.

Hot Water Supply Temperature

This field represents the temperature at which hot water is delivered to space heating coils.

Hot Water System Pipe Loss

This field represents the piping loss fraction for the hot water circulation system; i.e., the thermal losses from the hot water circulation system piping expressed as a decimal fraction of the total thermal energy entering the circulation system.

Hot Water System Temperature Drop

This field represents the total temperature drop through the hot water circulation system; i.e., the difference in temperature between water leaving the boiler and water entering the boiler, expressed as a positive number.

Main Heat Pump Circulation Loop Pump

Select the name of the main heat pump circulation loop pump(s) or use the *create new…* option to create a pump description. Select -*none*-, if no heat pump circulation loop pumps are present.

Pump Motor Brake Horsepower

Pump Motor Brake Horsepower is the calculated power needed to drive the pump in the particular application. This value is usually less than the nominal (or motor nameplate) horsepower, but may be larger in some cases, particularly for submersible pumps.

Pump Motor Nominal Horsepower

Pump Motor Nominal Horsepower is the rated power of the motor as it appears on the motor nameplate. This value is usually greater than the brake horsepower, which is the calculated power needed to drive the pump in the particular application, but may be smaller in some cases, particularly for submersible pumps.

Zone Terminal Unit Heat Source

Select the heating source for the heating section of the zone terminal units.