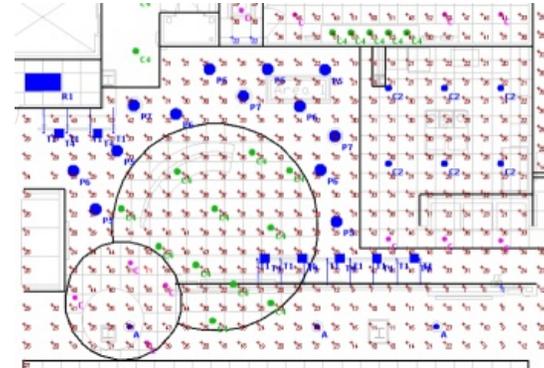


Chapter 5 - Model Construction

Flexibility is one of Visual's most powerful attributes. Achieving maximal benefit of flexibility without over-complicating the data entry process can be quite challenging however.

A method was sought to provide a simple means of constructing lighting *models* to any level of complexity without compromising the speed with which more common or basic configurations can be entered.

The solution lies in a flexible, graphic-based system similar in function to *CAD* programs. The following chapter introduces the basic components of a Visual lighting *model* and describes the process by which they are created and located within the *model* space.



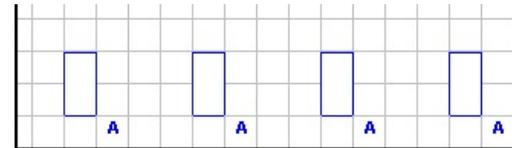
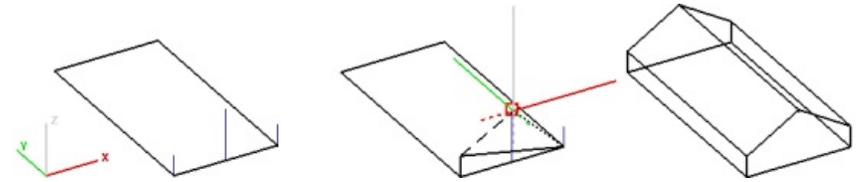
5.1 Constructing Background Objects

Background Objects are very useful for communicating visual information independent of the lighting analysis.

Background Objects can be invaluable as an aid in the construction of complex *models*. **Lines** may be initially placed so that their endpoints terminate at key locations in the *model* space. **Solid Objects** can then be added using the **Endpoint Object Snap** method so that the **Lines** essentially act as a skeletal map for construction.

Since **Lines** may be extended and trimmed (see [Modify](#)), this is often the easiest way to enter complex geometry such as multiple sloped *planes*. **Lines** used as a construction aid are easily erased or made invisible once the *model* has been completed.

A common use for **Background Lines** is to represent ceiling grid. The **Lines** can be made **Inactive** (but still **Visible**) to disallow selection of them while moving **Luminaires** but **Luminaires** may be placed with the **Intersection Object Snap** and moved into the center of a "tile". See [Placing and Orienting Luminaires](#).



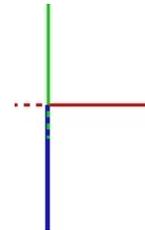
5.1.1 Arcs

Arcs are **Circle** segments constructed in Visual by selecting start and end *coordinates*, and a "bulge" *vector*.

To construct an **Arc**, select the command from the **Reference panel** of the **Construct tab** in the **Ribbonbar**.



Select the **Arc** start and end *coordinates* by either navigating the mouse *crosshairs* to the appropriate *coordinate* location, entering the *coordinates* numerically at the **Command Line**, or by selecting an object using one of the **Object Snap** methods.

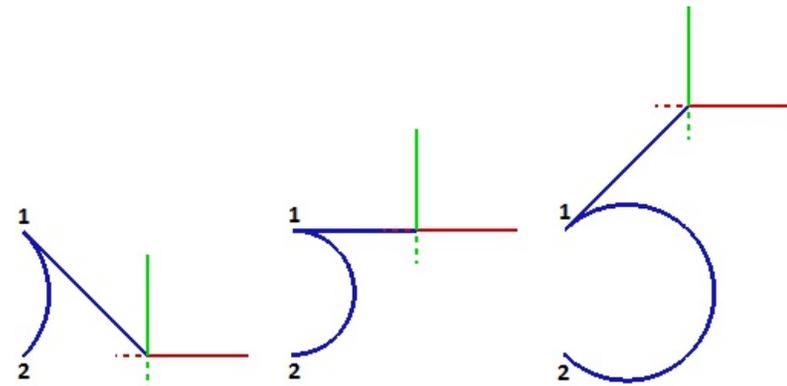


After both start and end points are specified, Visual displays the "bulge" *vector* that is *tangent* to the **Arc** at the endpoint.

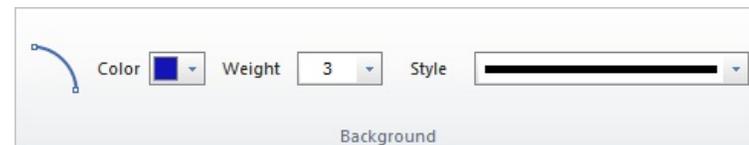
Visual also draws the implied **Arc** to show the result prior to final *coordinate* selection.

Moving the mouse to the opposite side of the line connecting the start and end points will cause the mirror-image **Arc** to be drawn.

Left-click to select the *coordinate* location that results in the desired **Arc** and end the command.



While executing the command, **Color**, **Weight**, and **Style** can be selected from the **Properties tab** in the **Ribbonbar** that will automatically be shown. See [Using the Color Dialog](#) for information on selecting **Color**.

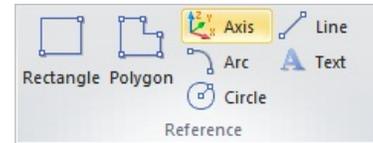


Remember that construction of any object can occur in different *planes* by pressing the *Tab* key.

5.1.2 Axis

Visual can draw numbered axes to allow for *coordinate* identification in the **Design Environment** and when making a printed **Page** in **Print Editor**.

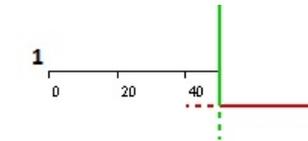
The **Axis** button can be found on the **Construct tab** of the **Ribbonbar**.



To create an **Axis**, select the **Base Point** with the mouse, keyboard, or **Object Snap**.

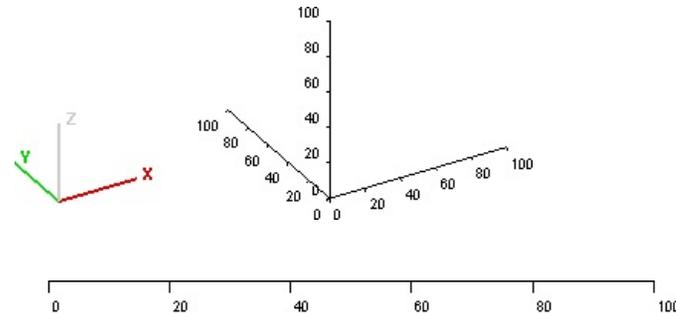


Movement of the mouse in the command shows the implied **Axis** that will be drawn in the **Active Plane**.



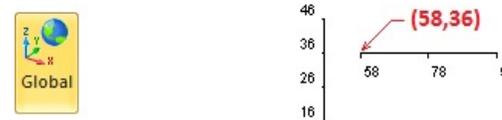
Axis Increment indicates how far apart **Axis** tick marks and labels are created.

At right, the **Axis** command has been used to draw an **Axis** from the (0,0,0) origin in each of the x, y, and z *cardinal* directions.

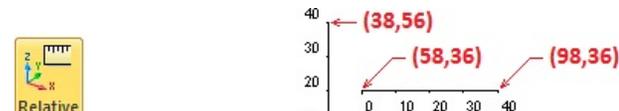


Select the endpoint of the **Axis** line with the mouse, keyboard, or **Object Snap**. Visual automatically ends the command and draws the **Axis**.

The **Global Axis** option restricts the Visual **Axis** to being parallel with one of the *Cartesian* axes. **Axis** labels are coincident with the X, Y, or Z-dimension related to that spot on the **Axis**.



The **Relative Axis** option allows for an **Axis** to be placed such that labels are based on zero being the **Base Point** of the **Axis** as specified and labelling is independent of global (X.Y.Z) *coordinates*. The **Axis** can be applied at any angle in the **Active Plane**.

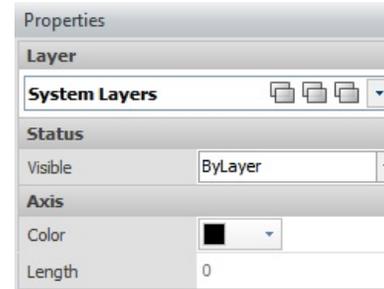


At right, the global *coordinates* are indicated for each Relative **Axis**, which then aligns with the **Global Axis** example above.



After creation, **Layer**, **Color**, and visibility [Properties](#) can be modified.

Label, line, and tick mark use the same **Color** for each **Axis**.

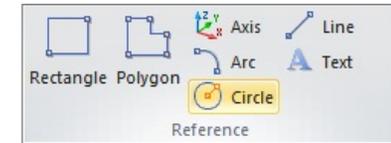
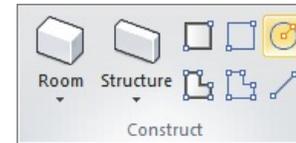


The most common use for an **Axis** would be in conjunction with the insertion of a [Luminaire Locations](#) table on a printed *page* to allow for the end-user to discern (x,y) *coordinates* of *pole* locations related to site lighting projects.

5.1.3 Circles

Background Circles can be drawn in Visual.

The buttons for **Background Circles** can be found in the **Construct panel** on the **Home tab** of the **Ribbonbar** or in the **Reference panel** on the **Construct tab**.



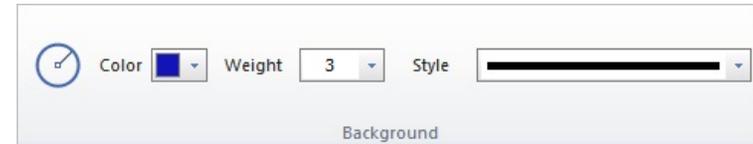
Color, Weight, and Style can be selected from the **Properties tab** in the **Ribbonbar** that will automatically be shown. See [Using the Color Dialog](#) for information on selecting **Color**. See [Lines and Polylines](#) for information on **Weight** and **Style**.

Examples shown here are drawn with a **Weight** of "3".

To construct a **Circle**, specify the *coordinates* of the first *vertex* (the center of the circle) using the mouse, keyboard, or **Object Snap**. In the command, moving the mouse causes Visual to draw the implied *radius vector* and the implied **Circle** showing what will be created when the command is completed. Specify the *radius*. To end the command, right-click the mouse or press *Enter*.

During any command, **Undo** will remove the last specified *coordinate* (*vertex*).

Background Circles can be converted to **Solids** if necessary. See [Converting Object Types](#). (Note that in the example at right, the **Background** object has a **Line Width** of 3.)



Remember that construction of any object can occur in different *planes* by pressing the **Tab** key.

5.1.4 Lines and Polylines

Lines and **Polylines** are constructed in an identical fashion and the separation of the two in Visual is purely semantics.

Polylines are a connected series of **Line** segments. A *vertex* is the connection of two segments.

Lines are single segments with a start and an end point.

To construct a **Line** or **Polyline**, click the **Line** button in the **Construct panel** of the **Home tab** or in the **Reference panel** of the **Construct tab** in the **Ribbonbar**.

Specify the *coordinates* of the first *vertex* using the mouse, keyboard, or **Object Snap**.

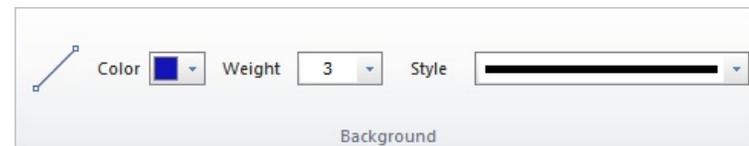
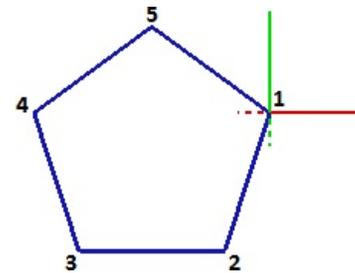
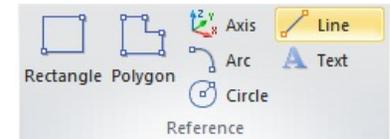
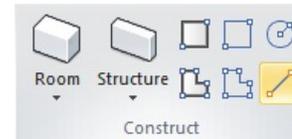
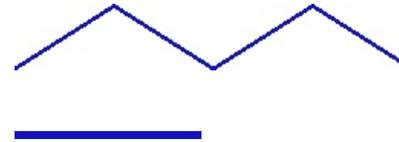
Specify additional *coordinates* as necessary.

Right-click the mouse or press *Enter* to end the command.

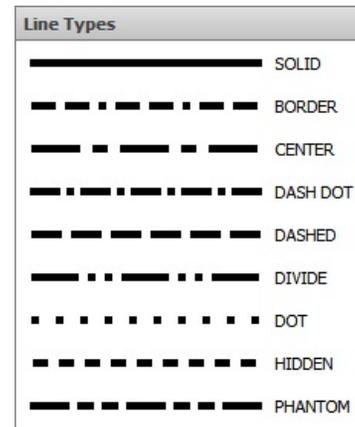
Even when **Polylines** appear to be closed (as at right), Visual does not consider them to be closed and therefore **Polygons**. The **Polygon** command must be used to make **Polygons**.

While executing the command, **Color**, **Weight**, and **Style** can be selected from the **Properties tab** in the **Ribbonbar** that will automatically be shown. See [Using the Color Dialog](#) for information on selecting **Color**.

Line Weight can be changed by selecting from one of the five values in the drop-down list. Values are the width in pixels the line will be drawn regardless of **Zoom** value.



The available **Styles** for **Lines** and **Polylines** are shown at right.

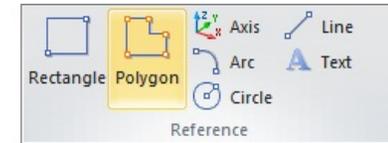
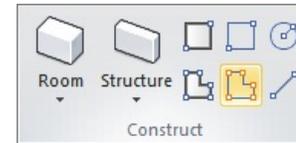


Remember that construction of any object can occur in different *planes* by pressing the *Tab* key.

5.1.5 Polygons

Background Polygons can be created in Visual.

The buttons for **Background Polygons** can be found in the **Construct panel** on the **Home tab** of the **Ribbonbar** or in the **Reference panel** on the **Construct tab**.



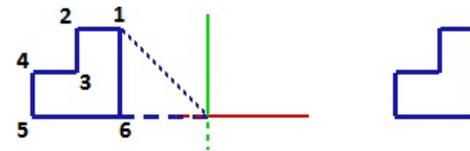
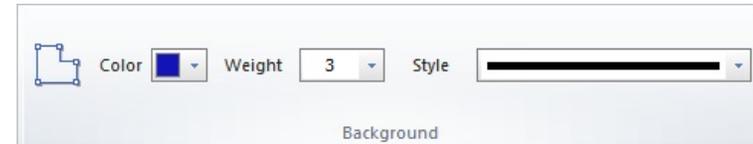
Color, **Weight**, and **Style** can be selected from the **Properties tab** in the **Ribbonbar** that will automatically be shown. See [Using the Color Dialog](#) for information on selecting **Color**. See [Lines and Polylines](#) for information on **Weight** and **Style**.

Examples shown here are drawn with a **Weight** of "3".

To construct a **Polygon**, specify the **coordinates** of the **vertices** using the mouse, keyboard, or **Object Snap**. In the command, moving the mouse causes Visual to draw two types of implied lines: the small-dash line connects the cursor to the first **vertex** and the large-dash line connects the cursor to the last **vertex** specified. Visual also shows the implied connection between the first and last **vertices** to illustrate the result if the command is ended. To end the command, right-click the mouse or press **Enter**.

During any command, **Undo** will remove the last specified **coordinate (vertex)**.

Background Polygons can be converted to **Solids** if necessary. See [Converting Object Types](#). (Note that in the example at right, the **Background** object has a **Line Width** of 3.)

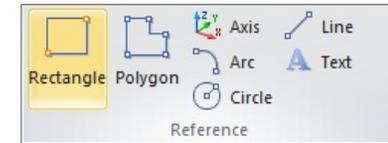
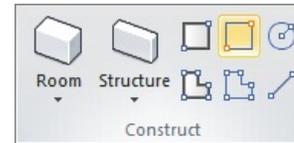


Remember that construction of any object can occur in different **planes** by pressing the **Tab** key.

5.1.6 Rectangles

Background Rectangles can be drawn in Visual.

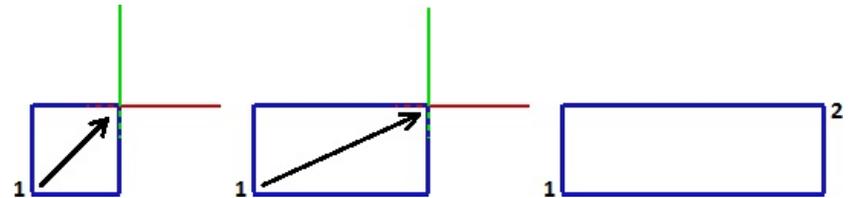
The buttons for **Background Rectangles** can be found in the **Construct panel** on the **Home tab** of the **Ribbonbar** or in the **Reference panel** on the **Construct tab**.



Color, **Weight**, and **Style** can be selected from the **Properties tab** in the **Ribbonbar** that will automatically be shown. See [Using the Color Dialog](#) for information on selecting **Color**. See [Lines and Polylines](#) for information on **Weight** and **Style**.

Examples shown here are drawn with a **Weight** of "3".

To construct a **Rectangle**, specify the *coordinates* of the first *vertex* using the mouse, keyboard, or **Object Snap**. In the command, moving the mouse causes Visual to draw the implied **Rectangle** showing what will be created when the command is completed. To end the command, right-click the mouse or press *Enter*.



During any command, **Undo** will remove the last specified *coordinate (vertex)*.

Background Rectangles can be converted to **Solids** if necessary. See [Converting Object Types](#). (Note that in the example at right, the **Background** object has a **Line Width** of 3.)



5.1.7 Text

Background Text is useful for annotating features of a lighting *model* or describing particular aspects of a lighting design.

To add **Background Text** to a design, select the **Text** command from the **Construct** menu.

The **Text Editor**, will appear.

Type the desired text into the editing area of the **Text Editor**.

Height can be specified in the same units as used in the **Design Environment** for other elements; feet or meters. To select the **Height**, choose one of the options from the *drop-down menu* or enter a value (integer or decimal) with the keyboard. The **Height** of the "tall" letters will be drawn to that size; for example "l", "t", or "d".

Left, Center, or Right Alignment can be chosen. Examples of the output are shown below.

The **Wordwrap** button will cause **Text** to be placed on multiple lines. Without this button active (gold), Visual will place all **Text** on one line.

Pressing the *Enter* key inserts a carriage return, and unlike most other commands, does not end the command, for obvious reasons.

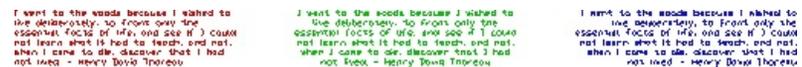
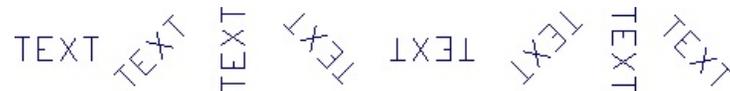
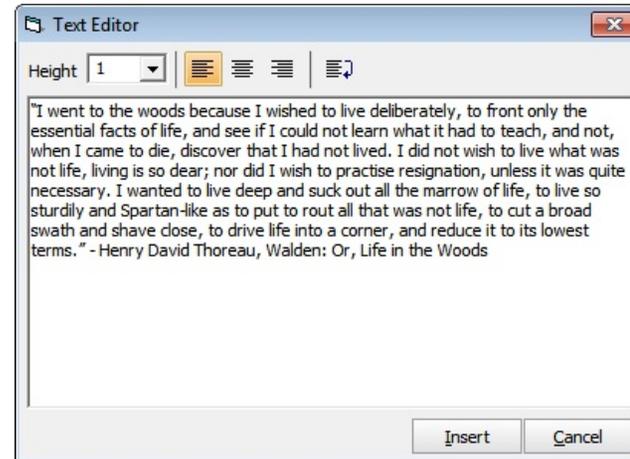
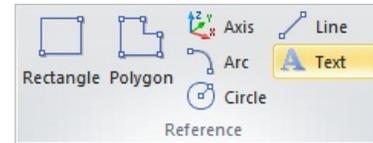
Click the **Insert** button to continue.

Visual requires the specification of a line to know where to place the **Text**. Specify the first and second points with the mouse, the keyboard, or with **Object Snap**. Visual places the **Text** along that line. The specification of the second point ends the command automatically and places the text. (Visual does not draw the line once the text is placed.) Alternately, right-clicking the mouse ends the command and uses the default (0 degrees) orientation.

Visual will place **Text** at any angle specified by the implied line between the two points. For example, specifying the second point to the left of the first draws the **Text** inverted.

As mentioned above, **Wordwrap** can be set to **Left** (default), **Center**, or **Right Alignment** with respect to the two input points.

Text Color is set by the **Layer** on which it resides. Unlike other **Background** objects, **Text** does not have **Color** unto itself.



It is possible that characters entered into the **Text Editor** cannot be displayed by Visual. In that case, a substitute *symbol* is inserted instead. This is rare.



The "Visual font" is shown at right for reference.

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

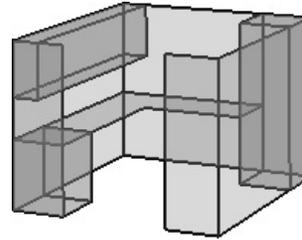
Note that when importing *CAD* information in *DWG* or *DXF* format, any **Text** in the file is converted to the Visual font.

To place formatted text using typical fonts, colors, and other augmentation, see [Text](#) for information on placing text in the **Print Editor**.

5.2 Constructing Solid Objects

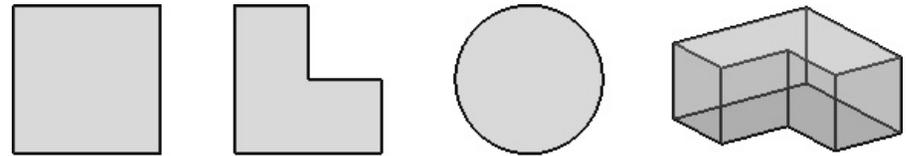
Solid Objects (Solids) are an important component of lighting system analysis.

Rooms, Structures, and Walls (or other more complex obstructions like modular furniture shown at right) can all have a dramatic impact on lighting system performance and it is frequently important to *model* these features to then take them into account in the calculation.



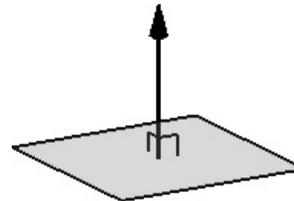
In Visual, such items are comprised of one or more **Solid Objects** in the form of **Rectangles, Polygons, or Circles**.

Solids can be constructed in a pre-grouped fashion as Rooms and Structures.



Visual creates **Solid Objects** with a coplanar front and back having the same properties. There is no need to create extra surfaces to have a correct *model*, as is the case in some other lighting software. A common wall can be created between two rooms without impacting the average noticeably in most cases if it is convenient. For example, a 60x40 room versus a 61x41 room will have 1% difference in average *illuminance* with the same lighting system, which is inside the 2% standard *photometric* test error. Imported *CAD* files almost always contain both sides of a given wall, and when an enclosed **Room** is created, Visual's algorithms calculate succinctly so the seeming duplication is not a detriment. See [Rooms and Structures](#) for more information.

Solids are created with a **Surface Normal** to discern the front face from the back face. This is stored in the object **Properties** and accessed with the **Properties** command. The **Surface Normal** is a unit *vector* indicating direction. (0,0,1) indicates the positive-Z direction. (0,1,0) indicates the positive-Y direction. (1,0,0) indicates the positive-X direction.



The **Surface Normal** is important in that Visual uses that information (which side is the front side) when for example a **Calculation Zone** is placed on a **Solid**. See [Placing Calculation Zones on Existing Solid Objects](#)

The **Surface Normal** can be "Flipped" by modifying object **Properties**. See [Solid Properties](#).

Solid Circles, Rectangles, and Polygons can be converted to **Background** objects if necessary. See [Convert to Background](#). (Note that the resulting **Background** objects will have a **Line Width** of 1.)



It is important to select **Color** and **Reflectance** to align with the properties of the materials in the actual project. For example, 80% **Reflectance** is valid for a ceiling composed of higher end acoustic tile, but is certainly not appropriate for raw materials used in most "open to deck" scenarios or sprayed-on insulation, especially when an indirect *luminaire* is used. The default is 50% **Reflectance** for all **Solids**.

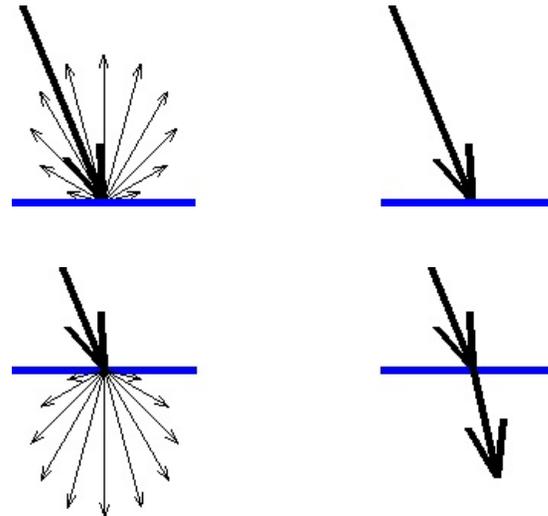
The choice of a **Color** is only necessary if **Color Rendering** is a desired output from Visual. Grayscale choices yield the same numeric results as "colored" choices, assuming the **Reflectance** value is the same.

The **Color** and **Reflectance** chosen for **Solids** is independent of the **Layer Color**. The **Layer Color** is used to provide user feedback in the **Design Environment** and the **Color** and **Reflectance** is used for calculation.

On the right, the objects with a black border have different **Color** (and therefore **Reflectance**) on the **Solids System Layer** (**Color** is **ByLayer**) and those with a green border are on a separate **Layer**, also with different **Color** (and **Reflectance**). In **Shaded Display Mode** shown at the bottom, borders (drawn in the **Layer Color**) are not shown. The gray, red, and blue all yield the same calculational result because they are all 50% **Reflectance**.



Solid Objects can be modeled to simply block the direct travel of light or reflect light diffusely. See [Solid Object Properties](#) for more information.



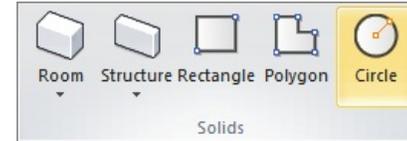
Solids can be modified to transmit light diffusely or transparently. See [Solid Object Properties](#) for more information.

The following section will detail the various methods used to construct and assign properties to **Solid Objects** along with some useful techniques for rapidly developing both common and complex architectural geometry.

5.2.1 Circles

The most basic means of entering **Solid Objects (Solids and/or Surfaces)** is by *coordinate* selection, building one surface at a time. *Coordinates* are identified, either graphically or by text *coordinate* entry at the **Command Line**, to define the location and orientation of each **Solid Objects**.

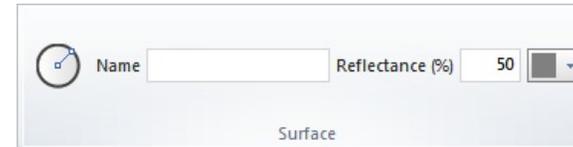
The button for **Solid Circles** can be found in the **Solids panel** on the **Construct tab** of the **Ribbonbar**.



Solid Circles share a similar interface in the **Properties tab** of the **Ribbonbar** that is shown upon command execution.

Solids can be named for later reference. If no name is user-defined, Visual will call all **Solid Objects** "Solid". Naming objects can be useful, but it is not required.

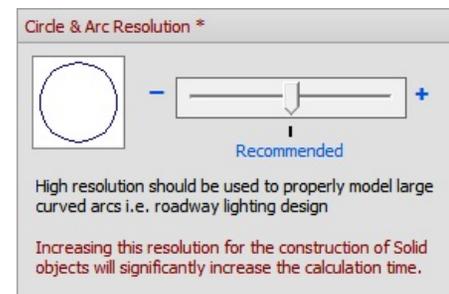
The **Color** and **Reflectance** of **Solids** are tied together in Visual. Specifying a numeric **Reflectance** will cause Visual to choose the analogous gray shade to match. Clicking the **Color** button will launch the [Color Dialog](#) to allow for more detailed **Color** selection.



To construct a **Solid Circle**, specify the *coordinates* of the first *vertex* (the center of the circle) using the mouse, keyboard, or **Object Snap**. In the command, moving the mouse causes Visual to draw the implied *radius vector* and the implied **Circle** showing what will be created when the command is completed. Specify the *radius*. To end the command, right-click the mouse or press *Enter*.



Note that Visual creates faceted **Circles** based on system parameters. If large **Circles** are being created, it may be necessary to modify the parameter to yield a smooth **Circle**. See [Drawing Aids Settings](#) for more information.

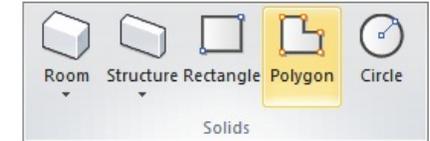
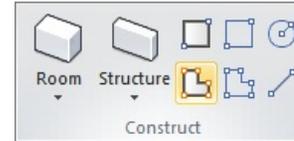


See [Constructing Solid Objects](#) for important information about various parameters and behavior of **Solid Objects**.

5.2.2 Polygons

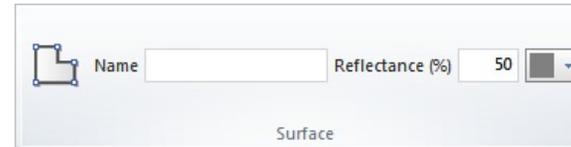
The most basic means of entering **Solid Objects (Solids and/or Surfaces)** is by *coordinate* selection, building one surface at a time. *Coordinates* are identified, either graphically or by text *coordinate* entry at the **Command Line**, to define the location and orientation of each **Solid Objects**.

The buttons for **Solid Polygons** can be found in the **Construct panel** on the **Home tab** of the **Ribbonbar** and in the **Solids panel** on the **Construct tab**.



Solids can be named for later reference. If no name is user-defined, Visual will call all **Solid Objects** "Solid". Naming objects can be useful, but it is not required.

The **Color** and **Reflectance** of **Solids** are tied together in Visual. Specifying a numeric **Reflectance** will cause Visual to choose the analogous gray shade to match. Clicking the **Color** button will launch the **Color Dialog** to allow for more detailed **Color** selection.

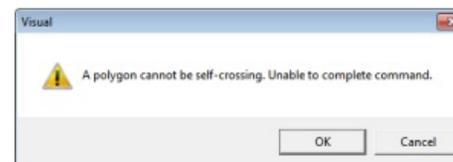
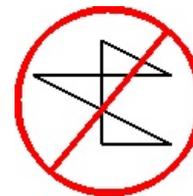


To construct a **Polygon**, specify the *coordinates* of the *vertices* using the mouse, keyboard, or **Object Snap**. In the command, moving the mouse causes Visual to draw two types of implied lines: the small-dash line connects the cursor to the first *vertex* and the large-dash line connects the cursor to the last *vertex* specified. Visual also shows the implied connection between the first and last *vertices* to illustrate the result if the command is ended. To end the command, right-click the mouse or press *Enter*.



Solid Polygons cannot be self-crossing. Visual makes the determination at the completion of the command and provides a message box. All *coordinate* input during the command is lost; therefore careful selection of points should be made.

For example, the perimeter of a complex large parking lot is being traced with an **Imported CAD** file as reference. There can easily be an improper selection when **Object Snap** is used and the **Polygon** can be crossing without it being apparent.

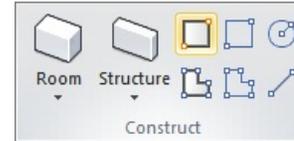


See [Constructing Solid Objects](#) for important information about various parameters and behavior of **Solid Objects**.

5.2.3 Rectangles

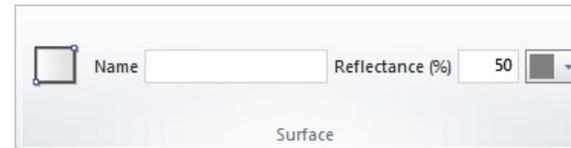
The most basic means of entering **Solid Objects (Solids and/or Surfaces)** is by *coordinate* selection, building one surface at a time. *Coordinates* are identified, either graphically or by text *coordinate* entry at the **Command Line**, to define the location and orientation of each **Solid Objects**.

The buttons for **Solid Rectangles** can be found in the **Construct panel** on the **Home tab** of the **Ribbonbar** and in the **Solids panel** on the **Construct tab**. The **Solid Circles** button is only on the **Construct tab**.

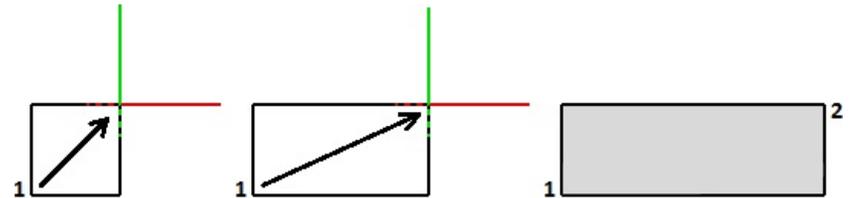


Solids can be named for later reference. If no name is user-defined, Visual will call all **Solid Objects** "Solid". Naming objects can be useful, but it is not required.

The **Color** and **Reflectance** of **Solids** are tied together in Visual. Specifying a numeric **Reflectance** will cause Visual to choose the analogous gray shade to match. Clicking the **Color** button will launch the **Color Dialog** to allow for more detailed **Color** selection.



To construct a **Rectangle**, specify the *coordinates* of the first *vertex* using the mouse, keyboard, or **Object Snap**. In the command, moving the mouse causes Visual to draw the implied **Rectangle** showing what will be created when the command is completed. To end the command, right-click the mouse or press *Enter*.



See [Constructing Solid Objects](#) for important information about various parameters and behavior of **Solid Objects**.

5.2.4 Rooms and Structures

A large majority of projects will include **Rooms** and **Structures** that are **Polygonal** or **Rectangular** in plan view and will have flat ceilings and roofs. Visual includes the ability to quickly construct these **Rooms** and **Structures** that are a pre-Grouped collection of **Solid Objects** (**Solids** and/or **Surfaces**).

Rooms and **Structures** can be created in **Polygonal** or **Rectangular** form. The semantics of **Surface Normals** is the only difference: **Rooms** will have all normals pointed inward. **Structures** will have all normals pointed outward; this aids surface-based commands such as placing [Calculation Zones](#).

Because of the orientation of normals, **Rooms** are normally used for Interior calculations and **Structures** used in **Exterior** calculations. **Structures** could be used to model details of an **Interior** project such as bookcases and desks.

The **Room** and **Structure** buttons can be found in the **Construct panel** of the **Home tab** and the **Solids panel** of the **Construct tab** in the **Ribbonbar**.

The **Room** button is dual function; the upper portion executes the command, the lower portion initiates a **drop-down menu**.

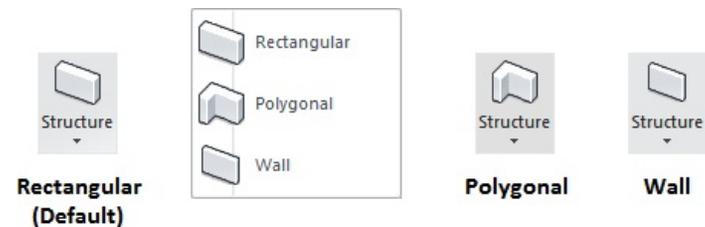
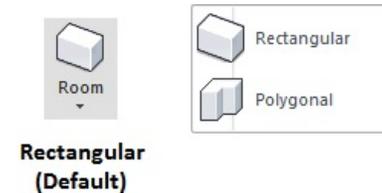
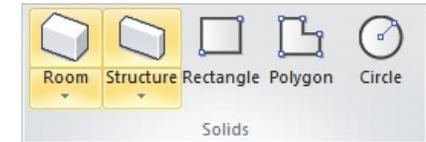
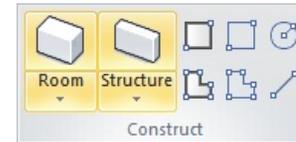
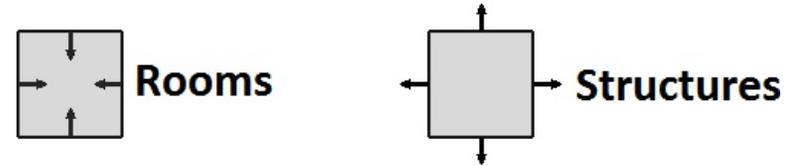
Once **Polygonal** has been chosen, the upper button portion will change to execute that command with the next press and the graphic is changed accordingly. Selecting **Rectangular** from the drop-down menu will revert the button to that mode.

The **Structure** button is dual function; the upper portion executes the command, the lower portion initiates a **drop-down menu**.

Once **Polygonal** or **Wall** has been chosen, the upper button portion will change to execute that command with the next press and the graphic is changed accordingly. Selecting one of the other commands from the **drop-down menu** will revert the button to that mode.

Rooms or **Structures** share a similar interface in the **Properties tab** of the **Ribbonbar** that is shown upon command execution. Note the similarities to single **Solid** construction.

Rooms and **Structures** can be named for later reference. If no name is user-defined, Visual will call the **Grouped Solid Objects** "Solid". Individual **Surfaces** are named "Floor", "Ceiling", and Wall x" accordingly. Naming objects can be useful, but it is not required.



The **Height** of the **Room** or **Structure** must be specified. Note that the **Height** last specified as input for the command will be used as the default (which can of course be changed) upon the next execution of the command; the idea being that heights of **Rooms** and **Structures** will be the same in most cases for a given project.

Parameters specified for one type of **Room** or **Structure** do not carry over to other types.

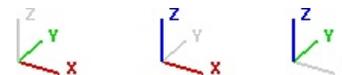
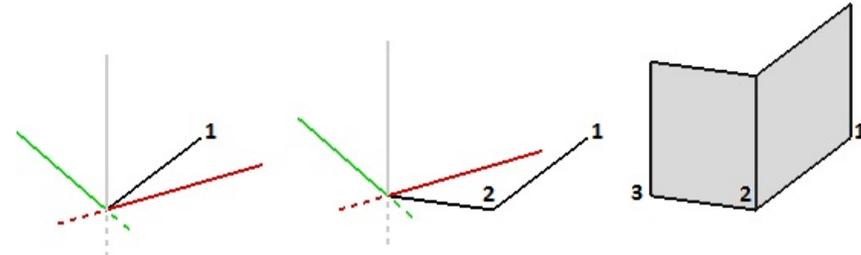
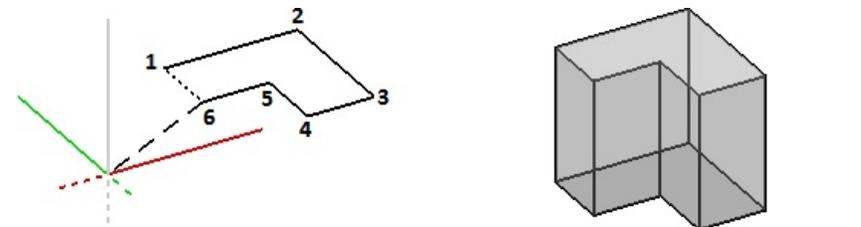
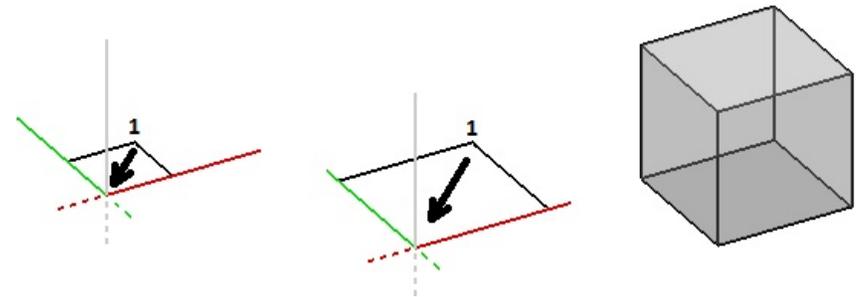
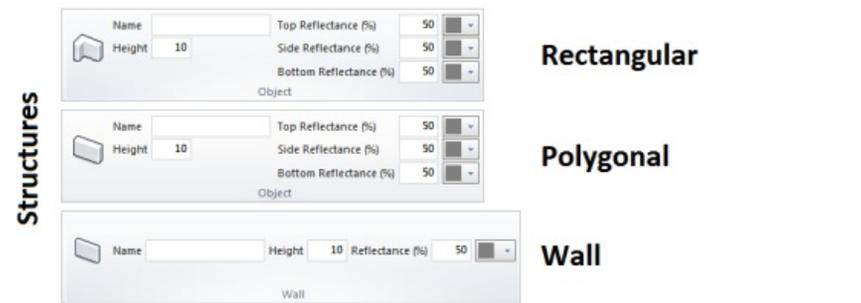
The **Color** and **Reflectance** of **Ceiling**, **Walls**, and **Floor** are chosen individually. Recall that **Color** and **Reflectance** are tied together in Visual. Specifying a numeric **Reflectance** will cause Visual to choose the analogous gray shade to match. Clicking the **Color** button will launch the **Color Dialog** to allow for more detailed **Color** selection.

To construct a **Rectangular Room** or **Structure**, specify the coordinates of the first **vertex** using the mouse, keyboard, or **Object Snap**. In the command, moving the mouse causes Visual to draw the implied **Rectangle** showing what will be created when the command is completed. To end the command, right-click the mouse or press *Enter*.

To construct a **Polygonal Room** or **Structure**, specify the coordinates of the **vertices** using the mouse, keyboard, or **Object Snap**. In the command, moving the mouse causes Visual to draw two types of implied lines: the small-dash line connects the first point to the last specified point to illustrate the result if the command is ended and the large-dash line connects the cursor to the last **vertex** specified. To end the command, right-click the mouse or press *Enter*.

To construct a **Wall**, specify the coordinates of the **vertices** using the mouse, keyboard, or **Object Snap**. Visual will extrude the specified **polyline** to the **Height** chosen in the **Properties tab**. In the command, Visual will connect the mouse cursor to the last point specified with a solid line. Right-click the mouse or press *Enter* to end the command.

Note that these commands can be used when the **Active Plane** is set to Y-Z or X-Z. Extrusion (the effective operation that gives **Rooms** and **Structures** their **Height**) occurs in the positive direction perpendicular to the **Active Plane**.



It is important to select **Color** and **Reflectance** to align with the properties of the materials in the actual project. For example, 80% **Reflectance** is valid for a ceiling composed of higher end acoustic tile, but is certainly not appropriate for raw materials used in most "open to deck" scenarios or sprayed-on insulation, especially when an indirect **luminaire** is used. The default values for **Rooms** are 80% ceiling, 50% wall, and 20% floor **Reflectance** (often referred to as "80/50/20"). **Structures** and **Walls** have 50% **Reflectance** for all **Solids**.

The choice of a **Color** is only necessary if **Color Rendering** is a desired output from Visual. Grayscale choices yield the same numeric results as "colored" choices, assuming the **Reflectance** value is the same.

The **Color** and **Reflectance** chosen for **Solids** is independent of the **Layer Color**. The **Layer Color** is used to provide user feedback in the **Design Environment** and the **Color** and **Reflectance** is used for calculation.

On the right, the objects with a black border have different **Color** (and therefore **Reflectance**) on the **Solids System Layer** (**Color** is **ByLayer**) and those with a green border are on a separate **Layer**, also with different **Color** (and **Reflectance**). In **Shaded Display Mode** shown at the bottom, borders (drawn in the **Layer Color**) are not shown. The gray, red, and blue all yield the same calculational result because they are all 50% **Reflectance**.

The **Solids** created by these commands are **Grouped**. See [Group](#) for more information. Note that **Solid Objects** are named "Floor", "Ceiling", and "Wall x" accordingly.

Rooms and **Structures** can be modified with the **Properties** command just like single objects. When a **Room** or **Structure** is selected, Visual displays the associated **Solids** in the **Surfaces** section of the **Sidebar** (as shown at right). See [Ribbonbar Properties Tab](#) for information on object modification and how **Single Selection** and **Multiple Selection** impact selection of **Grouped** objects when editing **Properties**.



Note that **Rooms** and **Structures** can be created, **Exploded**, and modified as part of the process of **drawing** more complex models. For example, a **Structure** could be created mimicking a column then **Exploded**, the top and bottom (ceiling and floor) **Eras**ed, and then the objects re-**Grouped** for later ease of use. See [Modify](#).