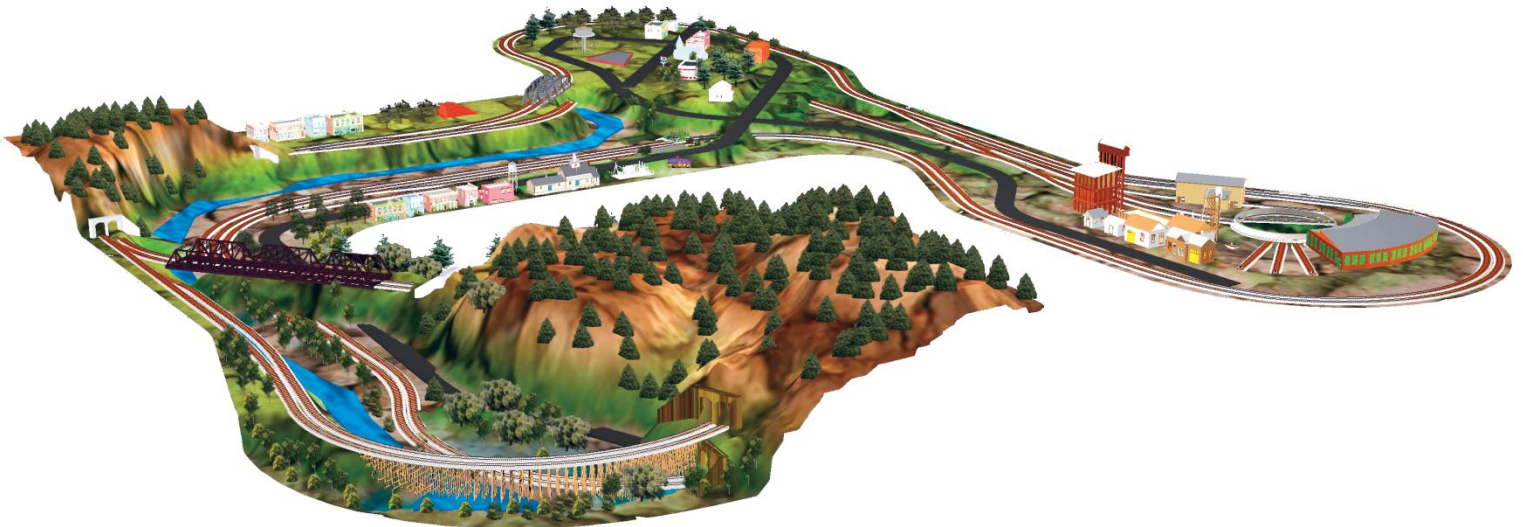


3rd Planttm

Model Railroad CAD



El Dorado Software

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3rd PlanIt User's Manual

Software Version 12

*Sincere thanks to everyone for your contributions to 3rd PlanIt
With special recognition to the dedicated users who test this product*

El Dorado Software
<http://www.TrackPlanning.com>

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1. Introduction

Thank you for purchasing *3rd PlanIt!* We have created this program to bring more enjoyment to your model railroading, and more pleasure and success in your track planning. Please take a few minutes to read this manual, as a little knowledge can increase your ability greatly.

3rd PlanIt is a powerful CAD program designed specifically for the needs of model railroading. The program draws strongly from the Windows user interface methods, such as right-clicking the mouse, and using the Control, Shift and Alt keys during editing. You can choose between the “Press-Move-Release” drawing style or the “Click-Move-Click” style to suit your preference, and numerous automated features make creating complex designs easier than ever before.

First, this manual presents tutorial examples to introduce you to 3rd PlanIt’s track and terrain editing techniques with simple track plans. Then, later chapters describe 3rd PlanIt’s features in detail. A tutorial is provided in Chapter 28 to demonstrate using 3rd PlanIt for both sectional and flex track.

Enjoy using 3rd PlanIt, and enjoy your model railroad!

1.1 System Requirements

3rd PlanIt requires an PC-compatible computer with a Pentium processor (or newer). It operates under Windows XP, Vista, Windows 7, Windows 8, and Windows 10. It needs a minimum 100 MB of disk and 512 MB of RAM beyond your other programs. Since 3rd PlanIt is a true CAD program, it performs better with faster processors, more memory, and accelerated video graphics cards such as the NVIDIA GTX series.

1.2 Right Mouse Button and Mac use

Some systems have software that allows the function of the right mouse button to be modified. Disable this feature when running the program. Also, some systems do not transmit the “Right mouse button down” message when the left mouse button is already down. If you are having a problem right-clicking when the left button is pressed, the space bar can be used in the same manner as the right mouse button.

Mac users can also use 3rd PlanIt, using the space key as described above. Best performance is usually found under BootCamp and Crossover; VMWare and Parallels have shown good results as well. For fastest 3D rendering, look for a version that supports hardware acceleration of OpenGL, the 3D graphics rendering system used by 3rd PlanIt. BootCamp operates under Windows, and always has hardware acceleration available.

For convenient access to hotkeys that don’t exist on a Mac, you can purchase a USB numeric keypad or the PC-compatible Apple Keyboard upgrade. Alternatively, you can use **Tools / Shortcuts** to assign commands to keys you prefer.

(Windows XP, Vista, Windows 7, Windows 8 and Windows 10 are trademarks of Microsoft Corporation)

1.3 Installation

To install 3rd PlanIt on your machine, place the CD-ROM in an available drive. If you have Auto-Run enabled, the 3rd PlanIt Installation Wizard will appear. If not, run the program **3pi_full_11_xx_yyy.exe** on the CD to install 3rd PlanIt.

1.3.1 Adobe Acrobat

The Tutorial and the User's Manual are distributed in PDF format, and can be read using the free Acrobat Reader available at <http://www.adobe.com>. If you don't have Acrobat Reader installed on your system, you will not be able to view the Tutorial or User's Manual on your computer.

1.3.2 Customer Site

You can also visit the El Dorado Software Customer Site using your Web Browser. This site contains the most recent updates of software, as well as advice on model railroad design and construction:

<http://www.TrackPlanning.com/release.htm>

An online forum is available for interaction with other 3rd PlanIt users:

<http://groups.yahoo.com/group/3rdPlanIt>

Online support forum for technical issues:

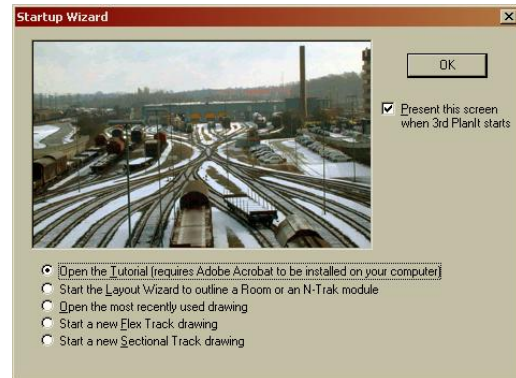
<http://forum.3rdPlanIt.com/>

2. Getting Started

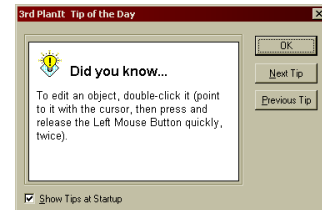
2.1 Starting 3rd PlanIt

Once you have installed 3rd PlanIt on your computer, you can begin using it by pressing the Start button on the Windows task bar, then selecting 3rd PlanIt. You may also start 3rd PlanIt by opening a file with the extension “.3pi”, once you have created and saved a track plan.

When you start 3rd PlanIt you will be shown the Startup Wizard. Here you are given a choice of viewing this Tutorial, starting the Layout Wizard (a tool to help you design a room or an N-Trak module), or starting a new Sectional or Flex-Track drawing. To begin a new drawing, select a category, and press **OK**.



You'll also see a Tip-of-the-Day dialog. This contains hints on using 3rd PlanIt that change each time you start the program. You can also move through them one at a time. You can disable the feature using the checkbox at the bottom.

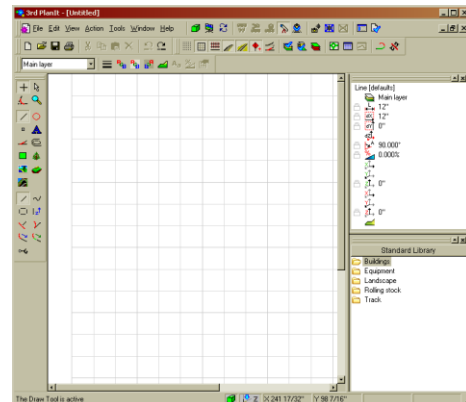


2.2 Lower-Resolution Displays

If you are using a lower-resolution display, such as 800x600, you may see a display similar to the example at the right.

You can customize the appearance of 3rd PlanIt in many ways to provide the best working area for your particular needs. First, you'll want to resize the docked toolbars on the right side of the screen. Point to the border between the toolbars and the drawing grid until you see a double-ended arrow appear. Press and hold the left mouse button, then move the border until the toolbars have a pleasing size.

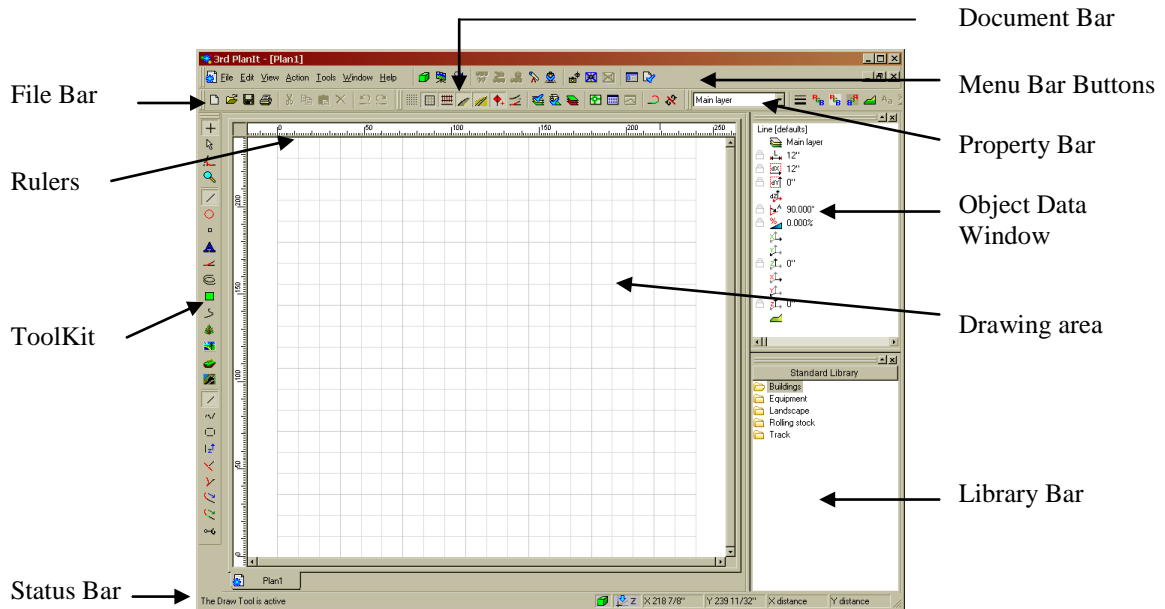
You may also turn the various toolbars at the top on and off as you wish, or move them so they are floating. To turn toolbars on and off, use the **View / Toolbars...** menu selection. To “float” a toolbar, point to the pair of lines on its top or left side, press and hold the left mouse button, and drag the toolbar elsewhere. You can prevent it from re-docking by holding the Ctrl key down while you drag it. After you change toolbars, you can once again fill the drawing area with the Grid by selecting **View / Zoom / Full Grid** or by pressing **Shift+F3**.



At the bottom of the drawing window, you can see a tab marked “Untitled”. This “Workbook view” allows you to select from several open documents quite easily. You can reclaim this space by disabling the **Window / Workbook Style** menu selection.

2.3 The User Interface and Controls

When you start 3rd PlanIt the first time, a number of standard conditions are set up for your convenience. The first time you start 3rd PlanIt, it will look very much like this:



In this chapter, we will introduce the controls you use to create and modify your drawing. There are eight primary controls or informational areas within 3rd PlanIt. They are:

- ToolKit Control
- Property Bar
- Document Bar
- Object Data Window
- Library Bar
- File Bar
- Status Bar
- Menu Bar Buttons

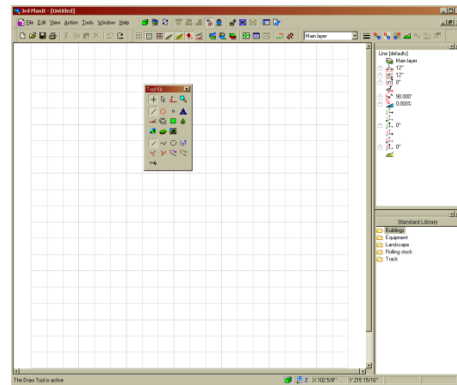
3. Controls

3.1 ToolKit Control

Perhaps the most important control is the ToolKit control, along the left side of the view. This control lists all the editing tools available for you to use. As is the case with all 3rd PlanIt toolbars, the ToolKit is a floating, dockable toolbar. This means you can move it to another area of the view if you wish, or place it anywhere on your Windows desktop for your use.

3.1.1 Floating ToolKit

3rd PlanIt offers a unique feature to save space on your display, and provide you with convenient access to the ToolKit wherever your cursor may be pointed. To try this feature out, point to the two lines at the top of the ToolKit, press the left mouse button and drag the ToolKit onto the drawing area, resulting in a display such as the example. The ToolKit assumes a compact rectangular shape when it is floating. As you can see, this gives you a lot more room for the design area itself. You can press **Shift+F3** to make the grid fill the available space once again. The grid is a 20x20 foot area in which you will draw your track plan, seen at low magnification. The size of the grid can be changed in the **File / Settings / Units / Drawing dimensions**.



What's more, when you select a tool, it disappears! You can bring it back any time simply by clicking the right mouse button when you are not pointing at an object. It will repeatedly appear and disappear as you successively click the right mouse button, always positioned near your cursor for easy access. If you double-click the right mouse button, the Context Menu choices will be presented instead of the ToolKit.

This way, the ToolKit is always where you need it!

3.1.2 ToolKit

When you drag the ToolKit from its docked position, it will appear as shown at the right. As you change tools or tools modes, the box will resize to concisely display the available commands.

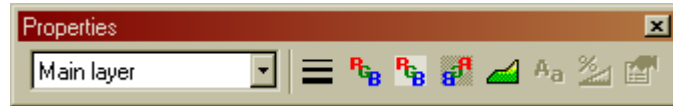
Looking below the Draw Tool, you can see the various objects that can be drawn: Lines, Circles, Points, Text, Turnouts, Helix objects, Polygons, Images and Meshes. The **Draw Line** button is pressed in the example. There are nine line-draw options in the next group of buttons: freehand lines (selected), multi-line, rectangle, vertical lines, line perpendicular to another object, line tangent to another object, and lines to be treated as couplers. (You can choose to start with the Select Tool active in **Tools / Options / Startup**).

These tools may be used to design track, terrain, buildings, equipment and anything else you want for your model railroad. You will be introduced to each of these tools and their use in the next chapter.



3.2 Property Bar

This control allows you to change the properties of one or more objects, or to set the default properties assigned to new objects. From the left to the right, the controls in the property bar operate as follows:



Layer Select When no object is selected, shows the layer in which all new objects will be created. When an object is selected, shows the layer that holds the object. You may change either the default layer for new objects or the layer holding a selected object using the pull-down menu.

Line Style Shows the line style of the currently selected object, or the line style of newly created objects of the current type. You may select a default style for Lines, Circles and Points independently.



When you press the **Line Style** button, you are presented with a choice menu that shows the ten high-speed line styles, and a button to set the Native Line Width of solid lines. There is also an assortment of wood and wall elements that you can select (see the chapter “Wood and Walls”). The currently selected choice is highlighted. High-speed lines are fixed width and always available, so they draw very quickly. Native line widths are used in trees, buildings and other objects that a user may wish to enhance in certain views, such as 3D rendering.

Note: An object’s native line width is set to the same width as the high-speed line width the first time the line style is set to any style other than hairline. From that time on, the native line width is independent of the high-speed line width.

Set Line Color (RGB) Set the line color of the currently selected object or objects; if no object is selected, set the default color for newly created objects of the current type. You may select a default line color for Lines, Circles and Points independently. This color is the object’s “Native color”. If you have set up your display for **Color By Layer (Alt+B)** you won’t see this color. To see objects in their native colors, press **Alt+N** or **File / Settings / Display / Native Object Colors**.

After pressing the **Set Color** button, you are presented with a standard Color Selection dialog box. In addition to the array of default colors, you may create virtually any color you desire, and add your color to a palette of 16 possible custom colors that is saved with the document.

Set Fill Color Set the fill color of the currently selected polygon or polygons; if no object is selected set the default color for newly created polygons. As with the **Set Line Color** command, the standard Windows Color Selection dialog box is presented.

Set Back Color Set the fill color of the backside of the currently selected polygon or polygons; if no object is selected, set the default backside color for newly created polygons.

Set Cut and Fill Set the Cut and Fill profile for the currently selected object, or the default for new objects of the current type. See the chapter on “Terrain” for more details.

Set Font (Aa) Set the font of the currently selected text object or objects. If no text object is selected, set the default font for newly created text objects. For more information, see the Object Properties chapter.

Set Elevation and Grade Sets the Elevation and grade of the currently selected object or path. For more information, see the chapter on Object Properties.

Properties Brings up the Object Properties dialog for the selected object(s).

3.3 Document Bar

The Document Bar controls settings that are carried with the document from session to session, or enable alternate views of your current document. From left to right, the Document Bar controls operation as follows:



Snap on/off Turn the snap feature on or off. If snap is on, the cursor position “snaps” to an imaginary grid while drawing, moving and many other similar operations. The snap grid settings are different than the display grid (described below) and are generally much finer – on the order of an inch, a centimeter or similar distance.

Grid on/off Turns the grid on or off. You may control the grid spacing and colors in the **File / Settings** menu choice.

Track on/off You can enable and disable automatic display of rails and ties with this button. When active, rails and ties appear as you increase viewing magnification.

Show Ballast Turns on and off the automatic display of Auto-Ballast in 2D and 3D views.

Show Roadbed Turns on and off the automatic display of Auto-Roadbed in 2D and 3D views.

Show switchstands Turns on and off the automatic display of switchstands in 2D and 3D views.

Show spline ends Show and hide the flex tips on spline segments.

Show turnout routing Toggle routing mode to control the routing of turnouts in the 2D plan view. Click a turnout to change its routing when this mode is selected.

Modify layers Brings up the **Enable Layers** dialog (**Ctrl+D**). With this control, you prioritize the layers for display, create new layers or modify the existing layers. By double-clicking on a layer or pressing the modify button in the dialog box, you can enable or disable a layer from view, freeze the layer from further changes, define whether it creates track, determine whether it will show in the document map or set the layer colors. See the Layers chapter for more information.

Modify Active Layer Brings up the **Modify Layer** dialog (**Ctrl+Shift+D**). You can enable or disable a layer from view, freeze the layer from further changes, define whether it creates track, determine whether it will show in the document map or set the layer colors. See the Layers chapter for more information.

Edit only Active Layer Locks the objects in all layers except the Active Layer. This helps prevent accidentally moving or modifying the wrong object.

Document Map on/off Turns on or off the display of the full plan in a smaller window. This display provides a view of the entire plan and allows you to navigate around the layout while you are zoomed into the main window.

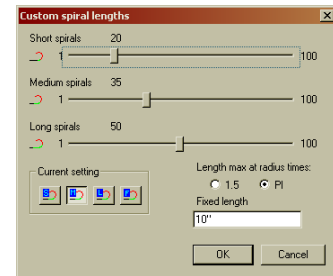
Display Object List Brings up the interactive Object List; you may also press **F8**. The Object List is useful for editing or locating objects within a drawing. See the Object List chapter for more information.

Display Profile View Show a profile view of the track selected in a Path.

Set Spiral Length Controls the length of Spiral Easements when they are created, relative to the radius of the Circle to which they are connected.



After clicking the **Set Spiral Length** button, you are given the Spiral Length choice menu. The current selection is highlighted. 3rd PlanIt automatically creates easements between circles and tangents for you. This menu allows you to choose short, medium, long or fixed-length spirals. Longer Spiral Easements require more room, both from the center of the circle and along the tangent, but look more pleasing.



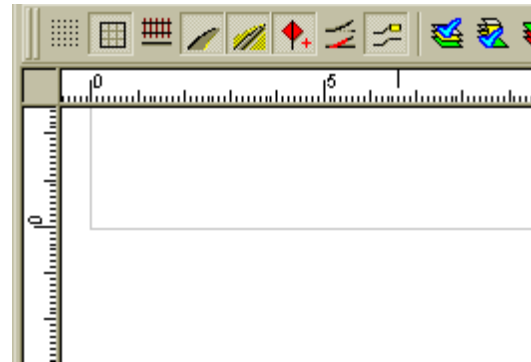
By pressing the check-marked button, you may adjust the length of short, medium long and fixed-length spirals. Use the slider to set spiral length from 1 to 100, as a percent of the maximum spiral length possible when you are making a connection. The field **Fixed length** determines the size of all new fixed-length spirals. **Using shorter easements for broader curves** makes spirals shorter as the radius of a curve increases. Many users prefer this setting as it saves space in the layout yet is quite appropriate for smooth operations.

Uncouple Uncouple the select rolling stock and/or locomotives from their neighbors.

3.4 Rulers

Two rulers are provided to help navigate around your drawing. The rulers' zero is originally set to the origin of the drawing, location (0.0, 0.0, 0.0). The rulers extend in both the positive and negative direction, with rules appropriate to the **Units** setting of the drawing.

At the point where the two rulers intersect at the upper left, there is a small square. This square allows you to reset the drawing's ruler origin, which defaults to the lower left of the grid (0, 0, 0). To move the origin, point the cursor to the square at the ruler's intersection. Press and hold the left mouse button, then drag the origin to where you want it in the drawing.



If you hold the Alt key down while moving the origin, you can snap the origin to an object's nearest end. This lets you draw "zero-based" locations from, for example, the lower-left corner of your room or a piece of rolling stock. To reset the origin to (0, 0, 0), double-click the box at the rulers' intersection.

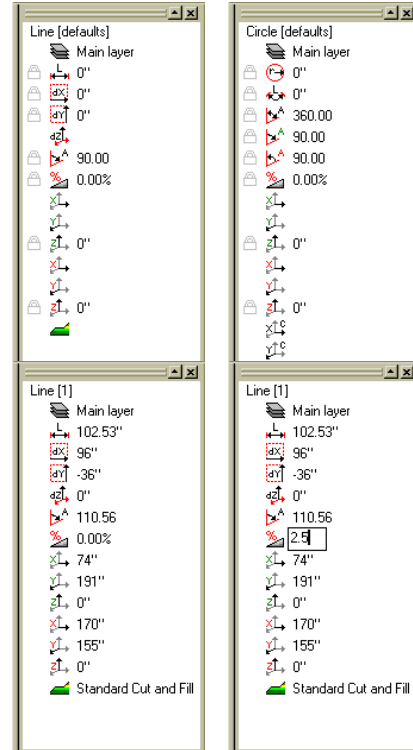
3.5 The Object Data Window

The Object Data Window provides a complete display of the details of objects, as well as the ability to “Lock” certain dimensions while you are drawing. You can also change the layer of an object (or a selection of several objects) by clicking on the Layer field in the first data line.

When you start 3rd PlanIt, you will see the display shown at the immediate right. The fields for a Line are, from top to bottom, Length, Delta X, Y and Z, Azimuth, Grade, and the starting and ending X, Y and Z coordinates. See Appendix C for more information. The last entry shows the Cut-and-Fill for the object; see the Terrain chapter.

If you select the Draw Circle tool, you will see the display at the far right. Most of the fields are the same, but the circle includes total angle, and start and end azimuths. In this example, the Radius of new circles has been locked at 30”. Each object type has fields appropriate for that type of object.

When you draw an object, the Object Data Window is updated while you are drawing so you can monitor the progress of the object. An existing object can be selected, and its dimensions will similarly be shown. Please note the example at the far right. You may double-click any field for an existing object and edit its value to change the dimension. If you are changing the grade, the start or end height will be changed to achieve the desired grade (you can right-click the Object Data Window to select which end is “fixed”).



To lock a dimension, make sure no objects are selected. You will see “[defaults]” in the display as shown at the upper right. Double click any displayed field to enter a “fixed” value. When you press Enter to complete entry of the number, the Lock will automatically be highlighted. You can Lock and Unlock fields by clicking the Lock icon to the left of the field. More than one dimension can be locked at a time. When you draw new objects, their locked dimensions will be fixed to the values shown in the window, while others remain free.

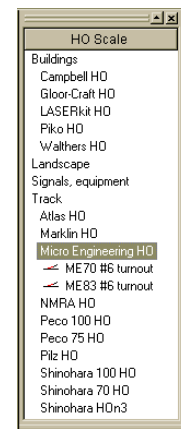
3.6 Non-Proportional Resizing

By default, if you resize an object using the Object Data Window, the object resizes in all dimensions proportionally. For example, if you change the dX of a Polygon, its dY will change by the same ratio. You can change the resizing to Non-Proportional by right-clicking in the Object Data Window and selecting **Non-Proportional Resizing**.

3.7 Library Bar

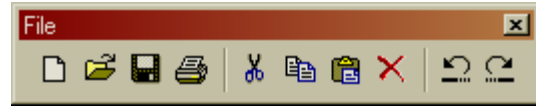
Using the Library Bar, you can insert objects into your drawing or add custom objects to the library. The Library Bar has many capabilities, so it’s been given a chapter of its own.

Note: you may also choose to have the Library and Data Bars appear as two overlapping tabs in one window. Select **Tools / Options / Controls / Tabbed Data/Library bar**.



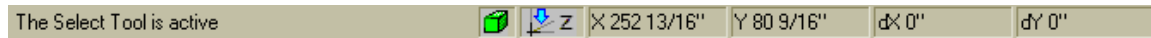
3.8 File Bar

This standard toolbar allows you to create new 3rd PlanIt files, open a file, save the current file or print the current file. The common edit functions Cut, Copy and Paste are also available. The two buttons at the right are Undo and Redo, and are only highlighted when it's valid to use them.



3.9 Status Bar

The Status Bar at the bottom of the 3rd PlanIt program window displays helpful hints as you use the program. The green cube allows you to swap into 3D and back to 2D. To its right is an indication of the current 2D view – in this case, looking down along the Z axis.



Next come two pairs of status fields. The two left fields displays the current cursor location, and the two right fields display the amount the cursor has moved during the current operation. You can expand or reduce the size of these fields using **View / Toolbars / Increase/decrease position width** or the hot keys **Ctrl+Alt+PgUp** and **Ctrl+Alt+PgDn**.

There are many output styles available for position information. The Fractional Inches option is shown in this example, but you can also select decimal and/or metric representations. See **File / Settings** for the complete list of output styles for position measurements.

3.10 Menu Bar Buttons

3rd PlanIt allows you to have toolbar buttons embedded in the menu bar. As this space is typically unused, this allows you to have more buttons available while keeping the drawing area as large as possible. You may customize the buttons in the Menu Bar, as well as in all toolbars, from **Tools / Customize**.

You can enable and disable this option from **Tools / Options / Controls / Menu Bar Buttons**.

3.11 Snapshot Bar

You can save the positions of the 3D Camera and Origin in **Snapshots**. The 3D Camera and Origin control what you see in 3D. Taking a snapshot allows you to return to the same position and view at a later time, to see the layout with design changes in place. Display of this bar is controlled using the menu choice **View / Toolbars / Snapshot Bar**. Each time you take a snapshot, the location of both Camera and Origin is saved. Clicking the name of a snapshot moves Camera and Origin to their positions when the snapshot was taken.

3.12 Animation Bar

Some sample files have animations in them. You can control display of this bar using the menu choice **View / Toolbars / Animation Bar**. Clicking on a checkbox in the Animation Bar starts or stops the chosen animation. At this time, animations are not supported for general use.

4. The ToolKit

The ToolKit is the most frequently used control in 3rd PlanIt, and the most powerful. As a result, it takes the most time to learn. A lot of information will be presented in this section, so don't be concerned if you don't recall it all as you read.

Also remember that you learn best by using – not by reading. A quick read of this section will familiarize you with the ToolKit. After that, you will find that the icons and ToolTips help you understand the tools' functions, and this section will serve as a good reference. (ToolTips are the small text boxes that are displayed when you point at a button or other similar control.)

4.1 The Draw Tool

4.1.1 Line drawing

The ToolKit display shown at the right contains buttons for drawing lines in six different styles. Each style shown in the bottom rows of the ToolKit changes as you select a different type of object to draw. If the snap grid is enabled, the start and end points of any line will be aligned to a grid intersection.

**Freehand line**

Draw a line from any point to any other point. Move the mouse to the starting point, press the left mouse button and drag the mouse to the end point. When you release the mouse button, the new line is added to the document.

Multi-segment line

Draws several lines, one after another. When all segments have been drawn, double-click the Left Mouse Button to end the multi-segment draw, or press the Esc key to abort it.

Rectangle

Draw a rectangle of four connected lines. You may use the Undo command (Ctrl+Z) to remove all four lines with a single keystroke.

Vertical line

Draw a vertical line at the position the left mouse button is next clicked. After clicking the mouse, you will be presented a dialog box to enter the starting and ending elevations of the line.

Perpendicular line

Draw a line perpendicular to an object. You may draw a line perpendicular to any object other than a point.

Tangent line

Draw a line tangent to an object. You may draw a line tangent to any object other than a point, including another line. If you draw a line tangent to another line, it effectively "projects" the existing line to the new line.

Projecting line

Draw a line projecting from the end of an existing object.

Draw curve and line

Draw a transition curve and a line projecting from the end of an existing circle.

Coupler

Draw a coupler for use in Rolling Stock groups (see the Rolling Stock chapter).

4.1.2 Circle drawing

A circle can be complete, or can be partial (a curve). The example at the right shows the ToolKit when you wish to draw a circle.

Draw from center

In this mode, you start the circle draw by pressing the left mouse button at the location which will be the center of the circle. As you hold the button and draw the cursor away from the center, the circle enlarges. Release the mouse button to complete the circle.

Draw from tangent

Another way of drawing a circle is to start the circle on its tangent, pulling the center of the circle away from the tangent point. The circle “rotates” around the point.

Draw tangent to object

This is similar to Draw From Tangent. In this mode, you must click an existing object (line, circle or spiral) to begin your draw. The circle is then drawn tangent to the selected object and you cannot rotate the circle out of alignment. Hold the Alt key while clicking the first object to select the exact endpoint of the object as the tangent point.

Draw Projecting Curve

Draw a partial circle (a curve) projecting from an existing object, tangent to an endpoint. Hold down the **Shift** key to change the radius of the curve. If you click the Right Mouse Button while drawing, the direction of the curve will swap. If an S-curve is formed, a short segment of straight track will be inserted.

Draw Transition Curve

Draw an easement (a transition curve) and a curve projecting from an existing object, tangent to an endpoint. Hold down the **Shift** key to change the radius of the curve. If you click the Right Mouse Button while drawing, the direction of the curve will swap. If an S-curve is formed, two easements will join the curves.

When you are drawing a circle, its color may be red or black. If the circle’s radius is smaller than the Minimum Radius for the layer, it will be red. When the radius is equal to or larger than the minimum, it will be black. Once you are done drawing the circle it assumes its normal color based on your settings.



4.1.3 Point drawing

Several kinds of point-like objects can be drawn with this tool. A simple point is usually drawn for reference when creating the drawing. Four drawing modes are available for points:

Draw freehand

Draws the point at the cursor location.

Draw at center of circle

To draw a point at the exact center of the circle, click the left mouse button while pointing at an existing circle.

Draw Reference Point

A Reference Point provides aid in constructing the layout. Refer to the chapter “Designing and Building your Layout” for instructions on the use of reference points. The Reference Point is drawn at the cursor location.

Draw Light

Draws a Light at the cursor location. Lights are used in 3D rendering of buildings and terrain to provide realistic views of the design.

Draw Viewpoint

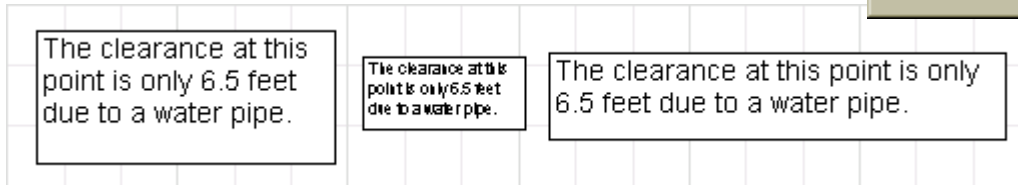
Places a Viewpoint at the cursor location. A viewpoint is like a “Tripod” on which the 3D Camera can sit while following a locomotive or other train object (see the chapter “Train Running and Operations”).



4.1.4 Text drawing

All text in 3rd PlanIt is drawn within a rectangle. To enter text into a drawing, select the Draw Text Tool and rubber-band a rectangle in which the text will be enclosed.

When you release the mouse button, you will be presented with a dialog box that accepts your text. You may enter any length text you wish; however, if it does not fit within your box you may only see a portion of it – or none at all! (Remember that a large font may actually make each character or word larger than the box you have provided for the text.) The text will be created using the font characteristics last set using the button in the Property Bar.



The text lies within a frame the same size as the outline you made when you entered the text. You may change the size of the text box at any time; the words you have typed will “word wrap” inside the box as long as they fit. Note that when a text object is selected, it is surrounded by eight handles rather than by four handles typical of other objects. The four handles at the corners of the text will resize the box and the text within it proportionally. The four handles on the sides, top and bottom change the size of the text box without affecting the size of the text itself. Both examples are shown above. The optional border has been turned on to illustrate the changes.

As you zoom in and zoom out, the text changes size to reflect its true appearance at the selected magnification. Here we see the result of “zooming into” the upper left corner of the center text box in the prior example. We can see it’s only hard to read in the above example because of the low magnification.

4.1.4.1 Elevation Markers

Another form of the text drawing tool is the Elevation Marker™. This automatically displays the elevation of any object at a point. A dotted line is drawn between the elevation and the point. If the elevation of the point changes for any reason, the elevation shown in the Elevation Marker is updated to the new value.

To place a marker, select the Elevation Marker tool as shown at the right. Point to any object whose elevation you’d like to display and press the left mouse button near the desired endpoint. You can move the marker into position; then, release the left mouse button to complete the marker.

In the Property Sheet **File / Settings / Layout**, you can set a value that is added to all Elevation Markers. By setting the actual height above the floor of the “zero elevation” point in your drawing properly, all Elevation Markers will show the height above the floor, rather than the plan height.

4.1.4.2 Coordinate Markers

Similar to Elevation Markers, Coordinate Markers display the X, Y and Z values for a given point on any object. Select the Coordinate Marker tool, point to the desired object and press the left mouse button. Drag the text field to the desired location.

4.1.4.3 Radius Markers

Radius Markers display the radius of a selected circle/curve. Choose the Radius Marker tool, point to the desired curve and press the left mouse button. Drag the text field to the desired location.

4.1.4.4 Grade Markers

Grade Markers display the grade of a selected track object. Select the Grade Marker tool, point to the track object of your choice, and press the left mouse button. Drag the text field to the desired location.

4.1.5 Drawing a Smart Turnout

3rd PlanIt includes mathematically based Smart Turnouts™ to simplify many aspects of track planning. Although it is possible to use Groups of objects to define a turnout, the program does not understand any specifics about a Group or its use. 3rd PlanIt “understands” the role of a Smart Turnout, and can therefore perform many functions automatically.

You may draw a Smart Turnout anywhere on your drawing, or you may draw a Smart Turnout directly onto an existing tangent line. Only standard straight turnouts can be inserted into tangent tracks.

To draw a turnout, select the Draw Tool, Turnout Object and then the type of turnout you would like to draw. The default dimensions and style of each type turnout may be changed using the Library Bar. After selecting the tool, you will be provided a cursor with a turnout symbol near it. To place a turnout anywhere on the drawing, simply point to the location and click the left mouse button.



To draw a turnout directly on an existing tangent track, point to the desired track and the tangent track will highlight (turn green) when you are pointed at the track centerline. Press and hold the left mouse button. The turnout will be drawn on the tangent track centered on your pointer. You may then move the turnout along the tangent track while holding the mouse button down. You can flip the entry and exit of the turnout by clicking the right mouse button (while still holding the left mouse button down). You may also flip the turnout right or left by moving your pointer on either side of the tangent track. Release the mouse button and the turnout is inserted in the track where it is located. The track is cut and trimmed at the same time.

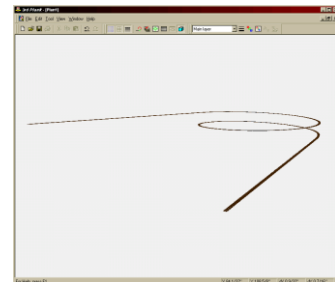
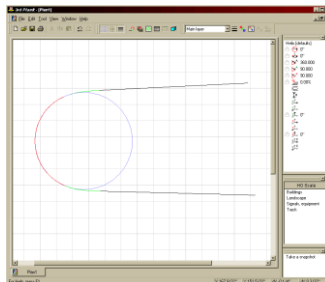
You may move the turnout along the tangent line. As long as you move the turnout to somewhere else on the same tangent track, the track is “repaired” at the old location and the turnout is gracefully inserted at the new location.

If a turnout already is present in the drawing, you can move it to a tangent track and it will auto-insert in the track. As you move it to the tangent track, the track highlights and the turnout aligns to the track. When you release the mouse button, the turnout is inserted in its current location.

4.1.6 Drawing Helix Objects

The Helix is supported as a unique drawing object in 3rd PlanIt. It is derived from a Circle object, and behaves in most ways as a circle does.

In the example at the right, a helix was drawn first. To create the entry and exit tracks, the Connect With Easements tool was used. The helix was clicked first, and then the control key was held while clicking the second time, terminating the connection at the tangent. The same procedure was used on the other side of the helix.

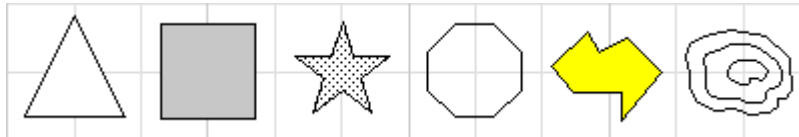


To set the elevations and grade through the helix, use the Path Tool to select a path through the helix. In this example, if we assume the entry to the lower part of the helix is the top track, you would click the top tangent track near the helix end. Clicking the lower tangent track completes the Path.

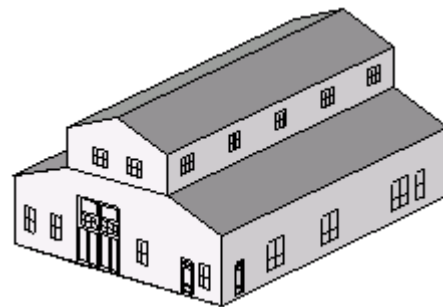
Setting the elevation through a helix is no different than any other grade. Simply define the starting and ending points (or grade and one end point) and press OK. Viewing the helix in 3D confirms the grade is set through the helix, the easements, and tangent tracks. If you select the helix in 2D, the Object Data Window will show the number of turns and clearance.

4.1.7 Polygons

Polygons are objects with one or more vertex connected by lines. Closed polygons of three or more vertices may be filled with a solid color, a hatch pattern, or a bitmap pattern. Here are a few closed Polygons with different numbers of vertices and different fill patterns:



You can use Polygons in a wide variety of roles in your drawings: individually, to color or highlight areas of interest, together in 3 dimensional solids as simple as cubes or as complex as locomotives, or in sheets to represent terrain in the layout. Polygons may be grouped together, tilted up, and otherwise manipulated to make possible a wide variety of objects to populate your "virtual railroad".



This rendering of LASERKit™ #704 shows the results of combining several polygons and a few groups of windows and doors. Windows and doors are themselves groups of lines created separately from the building and usable in other buildings... just like leftover parts being saved for kit bashing. When viewed in 3D, the controllable Light Source highlights wall and roof segments properly, and the building takes on a very realistic appearance.

4.1.7.1 Drawing Polygons

You can draw two basic kinds of Polygons: defined shapes such as triangles and stars, and freehand shapes you enter on your own. If you are entering a freehand Polygon, you can choose to make it a typical closed Polygon, or you can draw a Contour Line. A Contour Line is a Polygon that is not filled and need not be closed.

In the example at the right, the Contour Line ToolKit button is depressed. The Freehand Polygon button is at its left; it has an oddly shaped icon to represent its freehand nature.

To draw any regular Polygon, select the shape you desire from the ToolKit. Point to the upper left corner of the location for the new object and press the left mouse button. Drag the mouse to the lower right and release it when the object is the size and shape you're looking for. If you hold the Shift key down while drawing the Polygon, 3rd PlanIt will "square off" the object so the X and Y dimensions are equal.

Freehand Polygons and Contour Lines are drawn differently, since you want to choose the exact location of each vertex. After selecting the Freehand Polygon or Contour Line tool, point to the location of the first vertex and click the left mouse button. Point to the location of the next vertex and click the left mouse button again.

Continue entering each vertex like this until you are ready to position the final vertex. Double-click the left mouse button to place the final vertex. If you are drawing a freehand polygon, 3rd PlanIt will make the connection between the final point and the starting point automatically. If you are drawing a contour line,



you may leave it “open”, or you can “close” it by placing the final vertex directly over the first vertex (use the Alt key to ensure exact alignment).

You may use the **Alt** key to snap a freehand vertex to an existing object. Point at an existing object near one of its endpoints, then hold down the Alt key while clicking the left mouse button. The new vertex will appear at the nearest endpoint of the target object.

4.1.7.2 Editing Polygons

After you've drawn a Polygon, you can change the location of each vertex individually. The object may be a regular Polygon or one drawn freehand; once the object is created it is simply a collection of vertices.

To edit a Polygon, point to it with the Select Tool, double click the left mouse button and you will be presented with a number of handles to manipulate the object, one at each vertex. If the Polygon was filled in any way, the effect will be turned off while you are editing it.

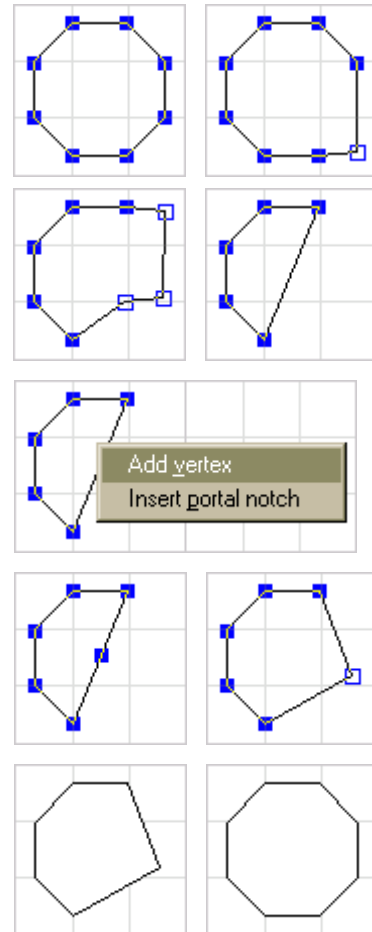
To move any vertex, point to its handle and press the left mouse button. Drag the vertex to its new location and release the mouse button.

You can also move more than one vertex at a time. Use the Select Tool to rubber-band the vertices you'd like to move. Point to any of the selected handles, then press and hold the left mouse button. As you drag the mouse, all of the selected vertices move at the same time. Release the mouse button when you are happy with their location.

You can delete the currently selected vertex or vertices by pressing the **Delete** key. You can also add a vertex at a particular point on the polygon. Point the cursor to a polygon line at the location you want the new vertex, click the right mouse button, and select **Add Vertex**.

To finish editing the Polygon, point to any free area in the drawing and double-click the left mouse button. The handles will disappear and the fill pattern will again be displayed. The entire operation can be reversed using the **Undo** command.

Polygons embedded within groups may be edited in place. Double-click the group to begin in-place editing and then double-click the chosen Polygon. This can be useful in Contour Sheets for making minor esthetic adjustments.



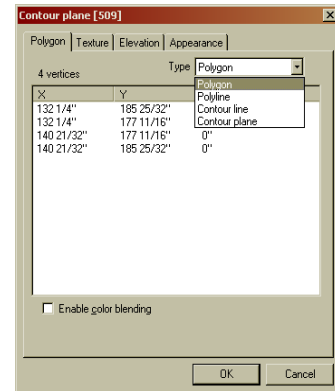
4.1.7.3 Front and Back Surfaces

When viewed in 3D, polygons have front and back surfaces, determined by the order the vertices are added to the polygon. You may select an option in **Tools / Options / 3D Settings** to color both sides of polygons. However, it's best NOT to color both sides, so you can ensure that all the polygons in a 3D object have their front faces on the outside of the object. Refer to “3D Object Design” for an example of this.

4.1.7.4 Other Polygon Operations

There are several forms of Polygons as shown at the right. A Polyline is an unfilled Polygon whose start and end points need not necessarily be the same (it may be “open” as well as “closed”). A Contour Line is a Polyline that is used to make Terrain Connections, and is usually drawn only in 2D, not 3D. A Contour Plane is a regular Polygon, except that the lines surrounding it can be selectively turned on and off in 2D and 3D views. You’ll find there are times you want to see the edges of Contour Planes, and other times you’d rather have just the colors of the areas without the clutter of the polygon mesh lines.

Polygons can be rotated, resized, grouped, tilted, and otherwise treated like any other 3rd PlanIt drawing object. Since polygons are composed of line segments, they can be tilted into the Z-axis as group members along any other line segments. Color blending lets the colors of each vertex determine the face coloring.

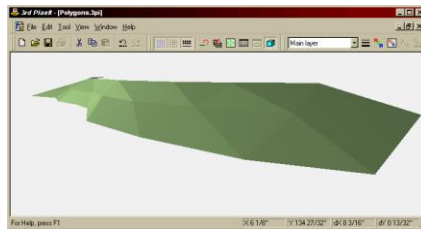


4.1.7.5 Contour Lines

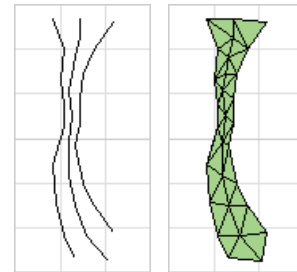


Contour Lines are your way of describing to 3rd PlanIt the elevation of the terrain on your layout. They are used in the same manner as contour lines on a map – the object at the left is a hill with a small creek running towards the lower right.

A contour line “closed”. The made of three lines around the right, three sharper slope. and 4”. They tool, resulting



can be “open” or above hill is closed contour each other. On open contour lines are shown; these define a The contour lines were set to elevations 0”, 2” were then connected with the **Connect Terrain** in the terrain shown in 3D at the left.



4.1.8 Bitmap Plants

3rd PlanIt offers a realistic way to represent landscape elements such as trees and bushes, known as Bitmap Plants. The plants are drawn from a bitmap image, such as a JPG, BMP or TGA file.

Bitmap Plants are drawn using the Draw Tool as shown at the right. There are 13 kinds of plants available to be drawn directly from the ToolKit. Their types display as you point your cursor at each plant type button (e.g., Oak, Cherry, etc.)

Bitmap Plants may be drawn with their base at the same elevation as an existing object. Simply hold the Alt key down when drawing the plant and point the cursor to an object already in the drawing. Click the Left Mouse Button to place the plant.

You can change the look of the plant by selecting it, switching to 3D mode, and pressing the Backslash key (\). If you hold the Shift key while pressing Backslash, the plant will retain the same shape but grow larger. Similarly, the Ctrl key causes the plant to grow smaller.

To set the Properties of a Bitmap Plant, double click it, or select it and choose Edit / Properties. You can change the texture used for the plant to one of your own choosing.



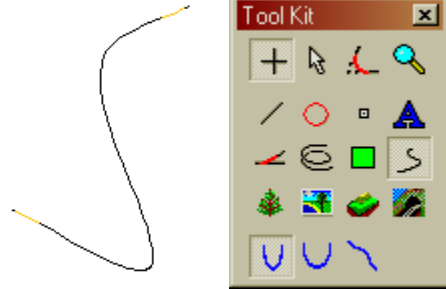
4.2 Splines

There are three kinds of splines available in 3rd PlanIt: Cubic, Rounded and MA (Minimum Acceleration). The first two splines use geometry defined entirely within the spline, and thus cannot have their entry or exit aligned to existing objects. MA splines are specifically designed for track planning, allowing the direction of endpoints to be aligned to other objects. All of the splines assume the curvature at each end is zero, so you can reasonably align tangent (straight) track or lines to splines.

4.2.1 Cubic Splines

The cubic spline is what you may have come across in other drawing programs, a smooth curve that connects three or more points. Although a cubic spline may have two points, it ends up as a straight line.

To draw a cubic spline, or any other spline, first select the kind of spline you prefer from the ToolKit. Point to the location for the spline to begin, then click the left mouse button. As you move the mouse, a line will be drawn from the first point to your cursor's location.

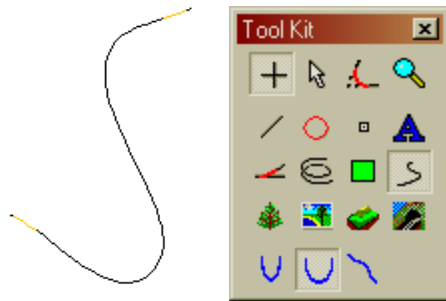


At the location you want the second point, click the left mouse button again. Now, as you drag the mouse, the spline curve will begin to show. You may point to a third location and click the left mouse button again. Continue this procedure until you get to the last point of the curve, and then double-click the left mouse button.

4.2.2 Rounded Splines

These splines are, as the name implies, more rounded than the cubic spline. They are more suited for track planning, as the sharp bends present in cubic spirals are rounded.

The example at the right was not drawn; it was made from the example above. Using the object's Properties dialog, the spline was changed from cubic to rounded. You can see the difference between the two examples. If you wish, you can align objects to the spline's endpoints. These should generally be straight lines, as splines end with zero curvature.



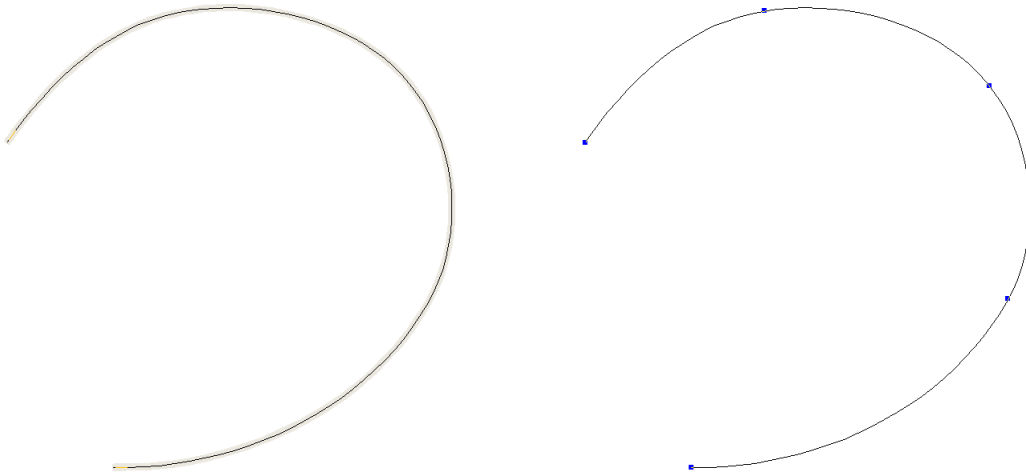
It's worth noting that the ends of cubic and rounded splines have a bit a "reverse curvature". This is the nature of these curves, which are not particularly suited for trackwork.

4.2.3 Minimum Acceleration Splines

Minimum Acceleration splines – MA splines – have been specifically designed for track planning. Their endpoints can be aligned to existing objects. In addition, their curvature is designed to provide the least horizontal acceleration through the curve given the start and end directions. Finally, MA splines can be straightened, letting you design complex track with multiple curves in one spline.

In the example below, we see a reversing loop that might appear on a peninsula in our layout. The curve has been defined by five points, as can be seen more clearly on the right.

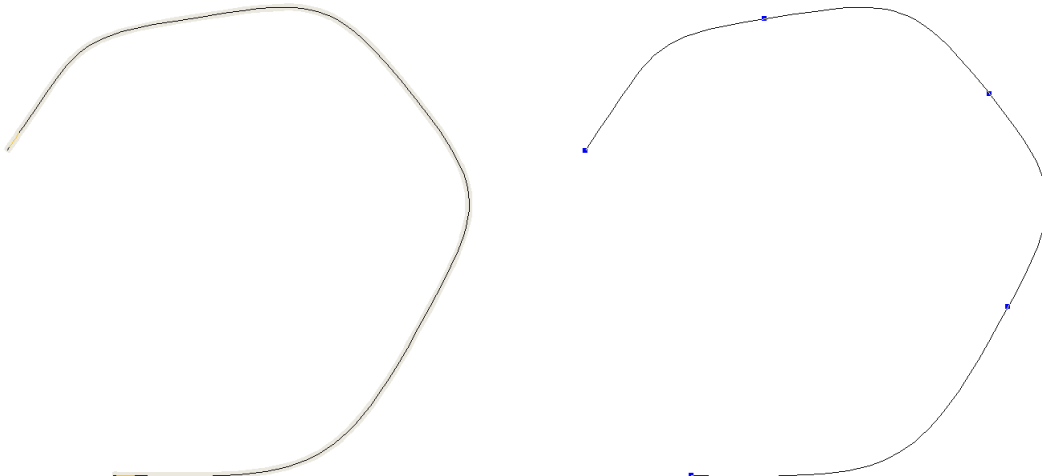




MA splines minimize horizontal acceleration, as measured over the whole curve. Because of this, moving one vertex will result in changes throughout the curve, especially between the vertex being moved and its neighbors.

4.2.4 Straightened MA Splines

With MA splines, you can design track with several curves, controlling the position and radius of curves by the location of the spline vertices, along with the straightening percentage. To serve as an example, the same MA spline used in the previous section was used here.

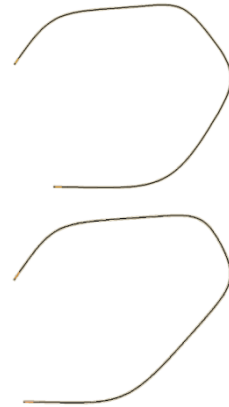


You can turn on straightening either from the spline's property page, or by clicking on **Straighten** in the Object Data Window. In either case, you can also set the straightening percentage. In this example, a 80% straightening was chosen.

4.2.4.1 Editing Blocks of Track

One of the great benefits of MA splines is the ability to edit areas of track as a whole. You can make such changes while editing the spline. To enter object editing mode, double-click on the spline. Each vertex will have a blue handle that you can move independently – or as part of a group. To move one vertex, point at its handle, press and hold the left mouse button, then move it around. Release the mouse button when you're done.

To move a group of vertices, double-click the spline using the Select Tool to edit its vertices. Then “rubber-band” a number of vertex handles. When you move any one of them, all of them will move together. The example on the right was made by moving the three vertices in the upper-right of the spline to the right. The result is still an orderly, useful track segment that is a bit wider than before.

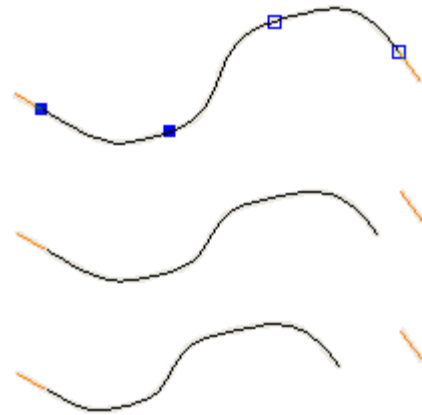


In the next step of this example, the lower two vertices were moved to the left. The minimum radius is about 27” again, with two broad curves and two more narrow curves.

This large change in track geometry was accomplished in just a few simple operations. All the curves are smoothed by cubic easements and flow into each other as part of a balanced whole. It’s easy to try a wide range of layout options in a short time using MA splines, with elegant results.

4.2.4.2 S-Curves with MA Splines

This example shows an S-Curve embedded within an MA spline, as well as editing blocks of track. To help visualize the changes between the drawings, an orange line was added to each end of the spline. Both lines stay in their original positions as changes are made.



The first edit moved the upper-right two vertices a bit lower and to the left. Compare the end of the spline to the end of the line to which it was adjacent. After that, three of the four vertices were moved to the left as a block, shortening the lower-left track.

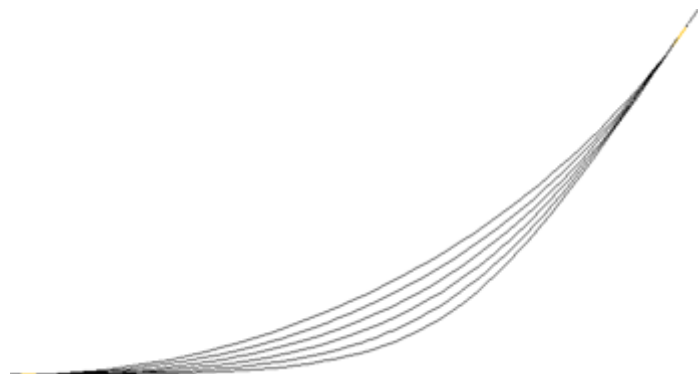
While you are editing an MA spline, if the radius becomes too small at some point, the spline will become first orange, then red where the radius is under the minimum. You can also see the changing radius in the Object Data Window as you edit.

4.2.4.3 Transitions between Straight Lines

You can use MA splines as transition track between two straight lines (tangent track). If you want to transition between one or more curved segments, you are better off using Quintic Easements, as shown in the SoftTrak chapter.

In the image on the right, you can see the range of straightening available to MA splines, ranging from 0% to 100%, every 20%. The radii of the curves vary from just over 12” to about 33”.

By adjusting the straightening value, you can achieve the working radius you want. Adding a point mid-spline will generally not achieve the same results, unless you turn straightening off.



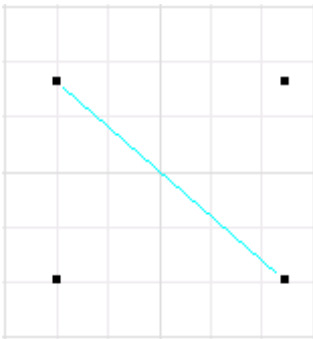
4.3 The Select Tool

4.3.1 Selecting, Moving and Resizing Objects

Once you have created an object, you will manipulate it primarily with the Select Tool and its variants, the Copy Tool, Parallel Tool and Align Tool. To use the Select Tool to select an object, point at the object and click the left mouse button. You may select more than one object by holding the shift key while clicking an object. If the object is not selected, it is added to the selection. If it is already selected, it is removed from the selection.



The Copy Tool is used so frequently that it is available in another way – the traditional Windows copy technique, holding the Control (Ctrl) key while dragging a selection with the Select Tool.



When you choose the select tool you are provided the standard arrow cursor to select and manipulate objects. If you draw a line, double-clicks to get the Select Tool, and select the line, the line appears as shown. You may drag the line around the screen by pointing to the line, pressing the left mouse button and moving the mouse. Release the button to drop the line in a new place.

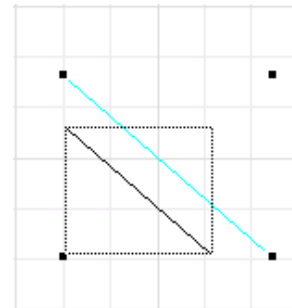
IMPORTANT NOTE: Polygons must be “grabbed” by an edge, not an internal region. This allows you to easily select an object that has terrain underneath it.

You can also move an object, or several objects, with the arrow keys. The arrow keys move all selected objects one screen pixel at the current magnification. Therefore, the more you are zoomed-in, the smaller each arrow movement will be in actual distance.

The four black squares surrounding the line are called Handles. You can “grab” a handle with the mouse to proportionally resize an object such as this line. In this example, the upper right handle was dragged to the lower left to shrink the line.

When you resize an object, its elevation is adjusted proportionally, as well. This line retained the same grade after adjusting its size, indicating the Z values had been scaled similarly to the X and Y values.

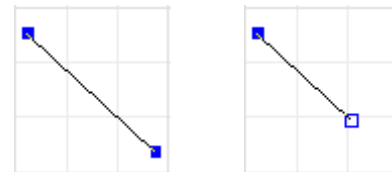
You may also resize an object by a precise factor, which can be useful when converting from feet to inches, American to metric, or for changing scales of existing objects. For example, if you are an N-Scaler and would like to use an HO Scale building object in your drawing, you could resize the building by a factor of 0.544375 (87.1 / 160). The **Resize By Factor** command is available under the Edit menu, and from the context menu after right-clicking an object.



4.3.2 Editing objects

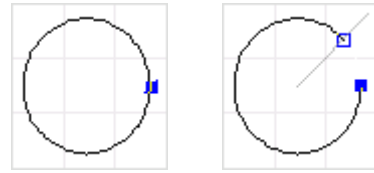
The Select Tool allows you to edit objects in powerful ways. Start editing an object by double-clicking it. When a single object (not a group) is being edited, the black resizing handles are replaced by blue editing handles, as shown.

To change the object, move the Select Tool over one of the handles (in this case, the lower right). Press the left mouse button, and move the mouse to change the length of the line.



The line is constrained to the angle at which it was originally drawn when you move the mouse. If you would like to freely move the endpoint to any location on the screen, hold the Shift key down while moving the object. The endpoint you are moving stays directly under the cursor, while the far end remains fixed.

A circle may be similarly edited; you may adjust the start and end points anywhere along the circle defined by its radius. When a circle is first drawn, both the start and end points are set to an Azimuth of 90. As you move an endpoint, the circle is redrawn and a gray guideline is drawn to your cursor. You may extend the guideline anywhere on the screen; it will be removed when the mouse button is released. If you hold the Shift key down while moving a handle, the circle's radius changes and the other vertex does not move.



Spirals may not be edited; they are precisely fitted between circles and lines. Spirals should be recreated if the adjoining circle or line is modified significantly.

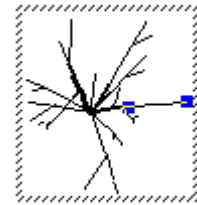
4.3.3 Editing groups

In 3rd PlanIt, groups are made of one or more objects bound together in a single object. You may name a group, and assign other characteristics to it such as cost. You can also edit a group by double-clicking it.

The examples show the editing process using a tree from the Object Library. When pasted into a drawing, the tree group may be moved around as a single object. If you want to edit a single object in the group (in this case a branch of the tree), you may double click the group and it will appear as shown, with a special hatched rectangle.

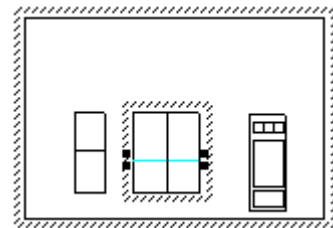


When you are editing a group, all actions you take become relative to the group. If you draw a new line or paste an object, it becomes part of the group. You may delete objects from the group, and you may resize and edit objects within the group. The hatched border will change to reflect the new size of the overall group after you change its objects.



Should one group contain another group, you may double click *that* group and similarly edit it. When you are done editing a group, double-click the background to remove the hatched rectangle and return to normal operation. The example at the right shows a group designed to be the wall of a building. The wall group contains the outer rectangle, two windows and a door.

To demonstrate the “drill-down” group editing capability, the wall group was double-clicked first. This surrounded the whole group with the hatched rectangle. Then the window group was double clicked, resulting in a second hatched rectangle around it. A line in the window is selected in this example.



The line can then be repositioned in-place. What's more, most any other edit operation can be performed while you are editing in-place. You could add a second mullion to the window using the Draw Tool. You could then double-click the left mouse button to end the window edit; the second mullion will be part of the window group from that point on.

Similarly, you could delete the window on the left at this point and perhaps add a different one. When you again double-click the left mouse button, you will end the editing of the overall wall. All your changes would be incorporated into the remaining group. A **Ctrl-Z** or **File / Undo** removes all the changes in a single command.

4.3.4 Selecting When Objects Are Stacked Above Each Other

If two or more objects are stacked above each other, you can select a specific object from among them as follows. Point the Select Tool at the objects, then Press and Hold the Left Mouse Button. If the proper object is not selected, **CLICK** (press and release) the Right Mouse Button while still holding the Left Mouse Button down. One by one, each stacked object will be selected with each click of the Right Mouse Button.

4.4 The Copy Tool

The Copy Tool works much like the Select Tool, except that every time you move an object, it is copied rather than moved.

4.5 The Parallel Tool

You may easily create parallel objects with this tool. And, if a number of objects were connected with the Connect Tool, they may all be paralleled in one action. See the Tutorial (Chapter 2) for an example of using the parallel tool.

When you have chosen the Parallel Tool, if you hold the Control key while you select an object, the selection is extended to all connected objects on both sides of the original object. This is shown in the Tutorial.

When a document is created the default parallel distance setting is 2 inches. If you wish to change the default value, use the **Tools / Options / Tools** menu selection. You may also set the parallel distance on the fly by right-clicking the mouse while dragging a selection with the parallel tool.

4.6 The Align Tool

It is often desirable to precisely align one object with another. In the tutorial, you found that you can use the Alt key to select an object at an end and hold the Alt key while dragging to snap the object to other objects' ends. This is a nice technique if you have an occasional object to align. If you want to align quite a few objects, you may select the Align Tool from the ToolKit.

The Align Tool works much like on-the-fly alignment, except you don't need to hold down the Alt key. Simply press the left mouse button over the first object, near the end you will want to align. Drag the object to any other object; when it snaps to the end you desire, release the mouse and the first object will align itself to the second with their endpoints exactly coincident.

4.6.1 Auto-Alignment

3rd PlanIt offers an Auto-Alignment feature for track objects. When you first start 3rd PlanIt, this feature is turned on. When you are using Auto-Alignment, whenever you move an object marked as a Track Object, it automatically snaps to the end of target objects and aligns the object when you release the mouse button.

This feature causes Track Objects to appear to "jump around the screen" while you are moving them. This happens when they snap to the end of a target object, confirming their final location when you release the mouse button. If you do not want Auto-Alignment on, you can use **Tools / Options / Tools** to turn off the Auto-Alignment feature.

4.7 Eyedropper and Paintbucket

This set of tools allows you to transfer a color from one object to another. To start the process, select the Eyedropper as seen on the right. You will then be presented with the Eyedropper cursor.



Carefully point to the color you want to sample. If you look at your screen carefully, you'll note that it's made of an array of many tiny dots, or pixels. The Eyedropper samples one of those pixels and saves it to be applied to other objects. The RGB color of the pixel is shown in the Status Bar. To sample the color of a pixel, click the Left Mouse Button.

You can then select one of three Paintbuckets. The first applies the stored color to objects' lines. The second, to the front face, and the third applies color to the back face. Point the bottom tip of paint in the cursor to the object that is to receive the saved color.



4.8 The Connect Tool

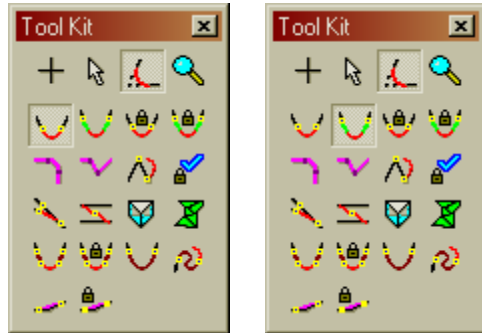
The Connect Tool greatly speeds layout of connections in your design, while providing high precision that assures you of a reliable and well-functioning model railroad. Powerful transition curves let you change curvature and grade smoothly, following traditional or high-speed rail standards.

4.8.1 Connect Direct and Connect With Easement

The Tutorial showed the Connect Tool in use in two capacities: to connect two lines with a circle and two spiral easements, and to connect two circles with a line and two spiral easements.

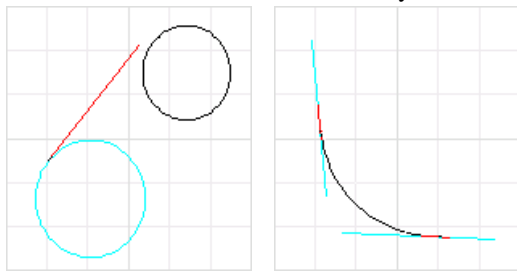
There are several different Connect Tool variants available to simply create trackwork, 3D objects, terrain, and vertical easements.

The two tools shown selected at the right can both connect in the same ways; the left tool connects without easements, and the tool to its right connects with easements.



4.8.2 The Two Step Connect Process

The Connect Tool works differently from other 3rd PlanIt tools. While all other tools are “Press and Move”, the Connect Tool is designed to work with *two* objects.



To work with two objects, the Connect Tool has a two step process: “Click the first object, then Press and Move”. After you click the first object to be connected, the mouse draws a guide line while you point to the second object. If you’ve selected a circle as the first object, the guide line follows about the circle as a tangent line. This helps you envision the final connection that will be made by 3rd PlanIt.

Place your pointer over the second object – near the point it would reasonably connect to the first object as shown by the guide line. Then press and hold the left mouse button; if you like the connection you may release the mouse button; If you don’t like it, you can hit the Esc key, or adjust its position if you are connecting two lines.

If your connection is between two circles as in the first example, or between a circle and a line, you may not adjust the connection with the mouse. The spiral length settings determine the placement of the connection. If you are connecting two lines as shown in the second example, when you move the mouse the position of the circle and the spiral easements move freely along the length of the lines.

4.8.3 Connecting with Quintic Easements

The Connect Tool has six modes that create Quintic Easements™, located at the bottom of the ToolKit. These CAD-based transition curves operate in three dimensions, allowing vertical as well as horizontal easements.

Please refer to the SoftTrak chapter for a complete overview of the various uses for these powerful objects.



4.8.4 A Special Case – Connecting a Circle to a Random Point

This useful feature is very helpful in real-world track planning. Let's say you're working on a design and have placed some basic minimum-radius circles.

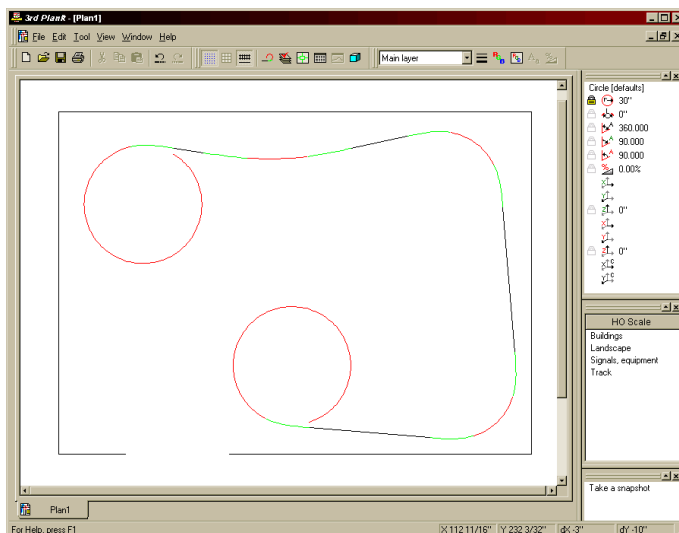
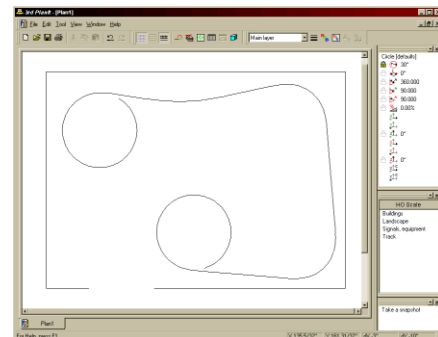
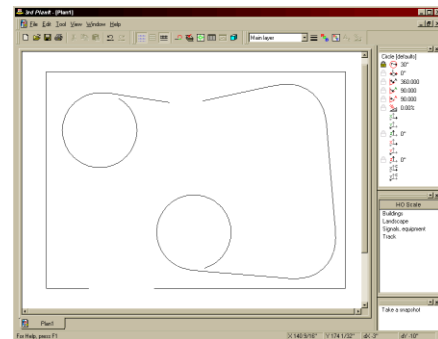
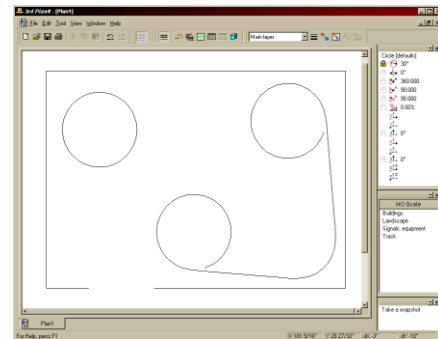
As you think about connecting the two circles near the back wall, you decide you don't want a simple line with easements connecting them. You'd like a broad, sweeping turn that is more photogenic to take some pictures of your models.

To accomplish this, click the first object with the Connect Tool in the usual manner. Then press the Control key, and move your cursor anywhere on the plan. The Control key "frees" the Connect Tool to place a new line (and optional easement) from the circle to the selected point. Click the left mouse button to complete the connection. Do this with both circles, as shown in the middle example on the right.

Next, using the same connect tool, connect the two new lines. In this example, easements have been selected for all connections, and they will be placed in this new segment as well.

The resulting smooth curve shown in the bottom example consists of one circle, two lines and four spiral easements joining the left and right circles.

You will also be able to keep your track plan current more easily. Frequently, as we move from "drafting board" to construction, we would like to make a few changes. 3rd PlanIt's rapid editing allows you to keep your drawing in step with your work in just a few minutes.

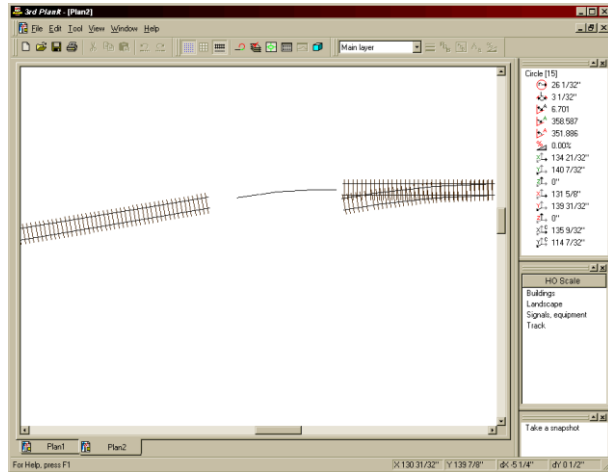


4.8.5 The Key to Success in Connecting

This whole process has looked quite simple. How, one might ask, can there be a problem when connecting objects like this?

The one real source of problems comes when connecting between two lines, or a line and a turnout. If the connection overlaps the far end of a line or penetrates a turnout, the connection will not be made. You would be warned about the overlap and offered suggestions on different approaches.

It's really best to try this to see what happens. Make a quick drawing like this example, and try the connection. Intentionally try moving it "too far" beyond the lines and releasing it. You'll receive a warning message and the track will remain unchanged.



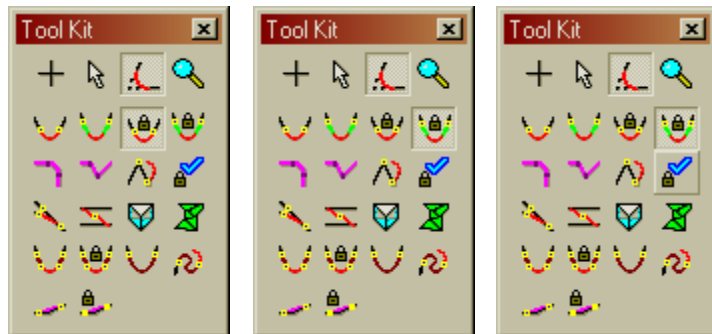
But there's no need for this to be a problem. Simply position the connection so that there is a gap between the new connecting object and the turnout.

When connecting between a group and another object, or between two groups, this is especially important. Groups in 3rd PlanIt are units; much as in the real world, you can't just "extend" the end of a turnout for convenience. 3rd PlanIt automates this by inserting an extra line between the turnout/group and the connection. Therefore, always make sure you always leave room between the connection and the grouped objects or turnouts.

4.8.6 Fixed Radius Connections

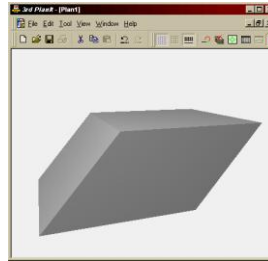
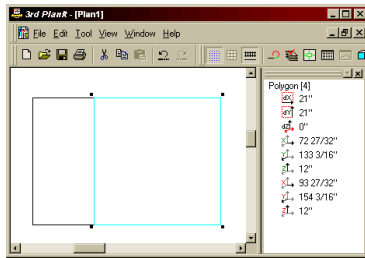
You may set a specific radius to be used when connecting between two lines using a circle and optional easements.

The examples at the right show the Connect Direct and Connect With Easements modes, as well as the button used to set the fixed radius value.



4.8.7 Polygon Connections

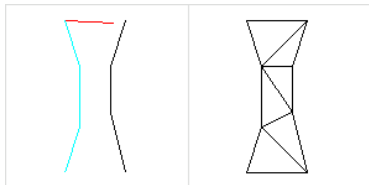
Polygon connections are used to make 3D solid objects. In the example below, a square polygon was drawn. A copy was made and placed to the right of the first polygon. The height of the second polygon was set to 12", then the two were connected using the **Connect Polygons** tool. The resulting 3D solid is shown below.



4.8.8 Terrain Connections

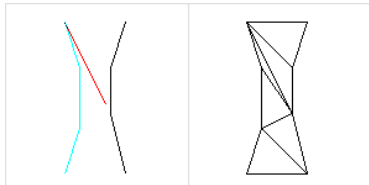
The **Connect Terrain** tool is the primary tool for creating terrain on your virtual model railroad. It is used to join two Contour Lines with a "Terrain Sheet", a mesh of triangles that can be set to chosen colors.

The Contour Lines you draw determine the nature of the Terrain Sheet that's created. Each triangle in the mesh has 3 vertices, and each of the triangle's vertices will be at the same location of a vertex in the contour line. Let's start with a simple example that highlights the nature of the triangle mesh.



At the left you can see two simple contour lines that were made for this example. Each contour line has four vertices – the two ends and two vertices in the middle.

the top of the left contour line, then



Terrain connections are made using the same two-step technique used for other connections. To recreate the top example, point the cursor to the top of the left contour line, then click the left mouse button. In the top left frame, you can see the red reminder line being drawn as the cursor is dragged toward the second contour line. To complete the connection, point to the top of the right contour line and click the left mouse button. The terrain that's created is shown in the example.

In the second example you can see how the **Connect Terrain** tool uses your input to fashion the Terrain Sheet. The connection was started at the top of the left contour line as in the first example, but as you can see, the cursor was pointed at the third vertex from the top to complete the connection. The terrain sheet's triangles clearly show the connection starting from the two selected points and proceeding from there.

IMPORTANT HINT: if you are creating a ridge top or a creek, you can use this feature of the **Connect Terrain** tool to your advantage. Create your contour lines, then make all the connections between the high or low points of the topographical feature. This ensures the ridge or creek takes the course you desire.

There are many important and useful features in terrain connection. See the chapter on Terrain Contouring for details on more advanced aspects of terrain building.

4.8.9 Polygon Connections

See Section 19.6.1 for a description of **Connect / Add Polygons** and **Connect / Subtract Polygons**.

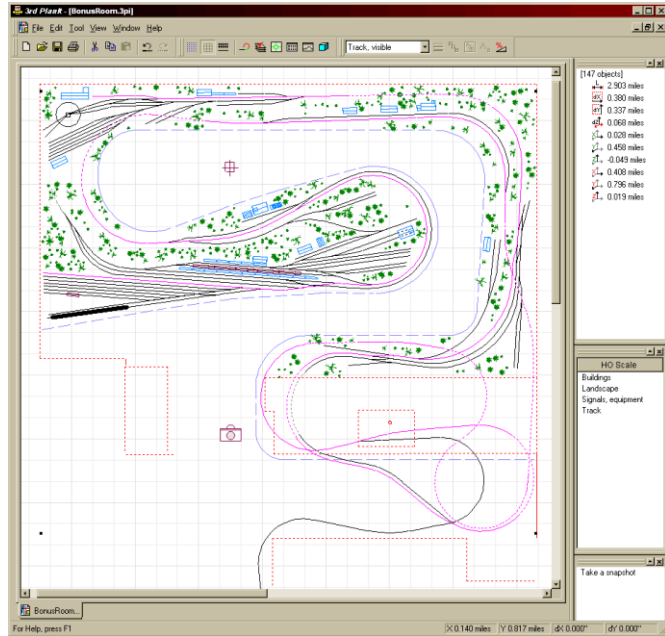


4.9 The Path Tool

The Path Tool, a variant of the Connect Tool is used to find a path between any two objects. Even in the most complex drawing, if a valid path exists between two objects, 3rd PlanIt will find it and highlight it for you. Here is an example using the BonusRoom.3pi drawing included in your release kit.

Note that BonusRoom is a very large file. 3rd PlanIt will handle the largest drawing and run the fastest when your computer has enough memory to hold the entire plan at one time.

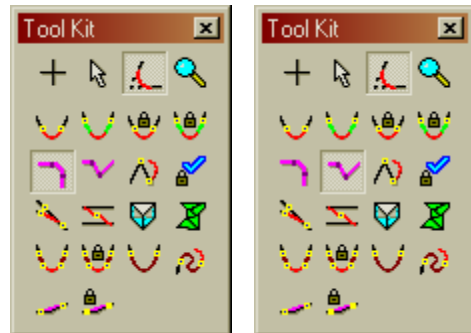
The Path Tool has highlighted a track segment running from one end of the layout to the other. 3rd PlanIt has been set to Use Model Scale, and we can immediately see the length of this path to be 2.9 miles in HO Scale. This worked out to about 175 actual feet (**View / Use Model Scale**).



4.9.1 Using the Path Tool

The Path Tool and the Crooked Path Tool both are used in the same way, and each is similar to other Connect Tool variants in that you click on two objects to create a path.

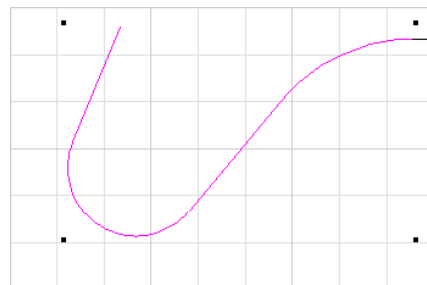
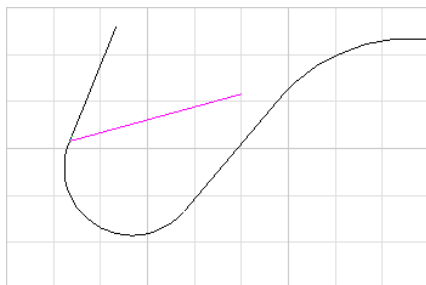
A path is not a group; it is temporary and exists for setting elevation, viewing in profile, and determining path length. If the path does not go through any groups, you may group the path members for later use. (It's not possible to group members of another group... they do not exist independently, they are part of a group and objects may only be members of one group).



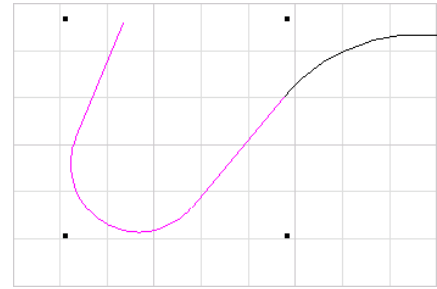
In the lower left view, a pair of lines has been connected with a circle. The path is started from the left line, which is clicked near the departure end of the line. You can see the guide line emerging from the departure end, and the Message Window directing the user to click the second object.

In the right view, the second circle down the track has been clicked, and the path highlighted in magenta. A short segment of tangent track is visible in black at the upper right; it is not part of the path.

The length of this path is now shown in the Object Data Window. You may now set its elevation from the Property Bar, or from Edit / Elevation. If the objects were not connected smoothly as these are, the Crooked Path Tool would be used to traverse them.

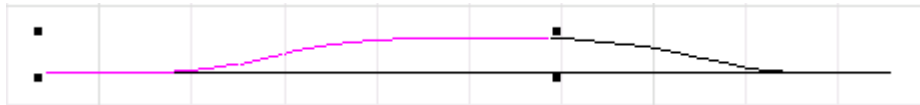


You may press the shift key when clicking an object to extend or shorten an existing path. In this final view, the second circle has been removed from the path. The line segment before the circle was clicked to remove the circle. Always click the last object you want in a path.

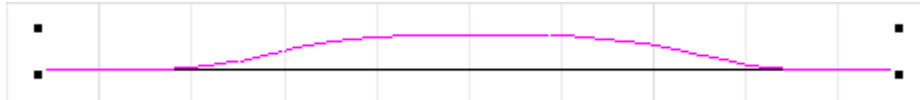


4.9.2 Choosing the Path You Want

When you choose the two endpoints of a path, the Path Tool finds a plausible path between them. However, the tool may choose the main line when you had wanted to include a siding track, or other particular situations.

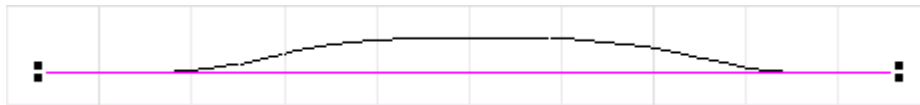


To choose a specific path when alternate paths exist, use the Shift key to create the path in several steps. Start by choosing a path through the junction, then Shift-Click the track where you'd like the path to go next. You can repeat this process indefinitely, negotiating a path through several junctions.

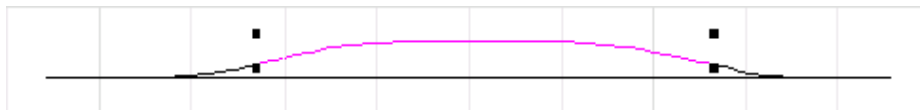


4.9.3 Setting Elevations Through Turnouts

When trackwork like that above is on a grade, it can be tricky to set the elevation of the siding. It's easy to set the main line... select a path through the turnouts, set the elevation, and you're done. To make it easy to set the elevation of the siding, 3rd PlanIt does something when setting elevations along paths.



Whenever a path goes through a turnout and elevations are being set, every point in the turnout is set to the proper grade. The endpoints of objects coincident to the turnout are set to the turnout elevation as well. Setting elevation on the second leg of a siding is then simple, as the endpoints are already set to the proper elevation. Simply bring up the elevation dialog box and click OK, and the elevation of all the intermediate objects will be set properly.



4.10 Connecting End Points

You may easily connect two endpoints without regard to alignment using this Connect Tool mode. When Connecting End Points, you do not need to hold the Alt key to select an object's endpoint; the tool selects endpoints by default.

By clicking two objects, you draw a straight line between their nearest endpoints, and set the connecting object pointer in each of the objects. If you were to draw a line using the Draw Tool and holding the Alt key, the result would look the same, but 3rd PlanIt would not know that you had intended to treat them as connected. Connected objects may be multiply selected by selecting just one of the objects in the connected chain as described in the Tutorial.



4.11 Connections with Turnouts

Since 3rd PlanIt understands a turnout's geometry and purpose, it can automate the tedious process of crossover layout and yard design.

4.11.1 The Connect Turnout Tool



This is a very flexible tool that can be used in many layout situations. The first task we will address is layout of switching yards. Our design goal is an HO scale yard with the first track separated from the main line by 2 3/4" and the remainder separated by 2 1/4". The turnout from the main line will be a #5, the turnout to the first lead will be a #6, and the remaining turnouts will be #5. This makes for a compact yard design, but minimizes the problems associated with the inherent S-curve leading into the first yard track.

In the first example to the right, the #5 turnout has been placed in the main line, and the yard tracks have been positioned to their desired spacing. Using the Library Bar, set the default turnout to a number six for the next connection. Point your cursor to the routing track of the number five turnout and click the left mouse button. Point to the first yard track and click the left mouse button again. The turnout is positioned and connected properly as in the second example.

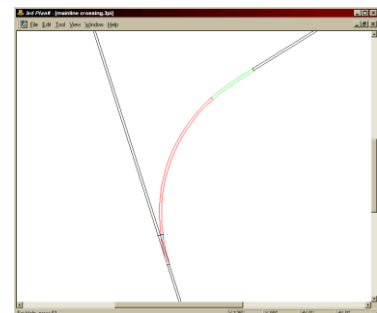
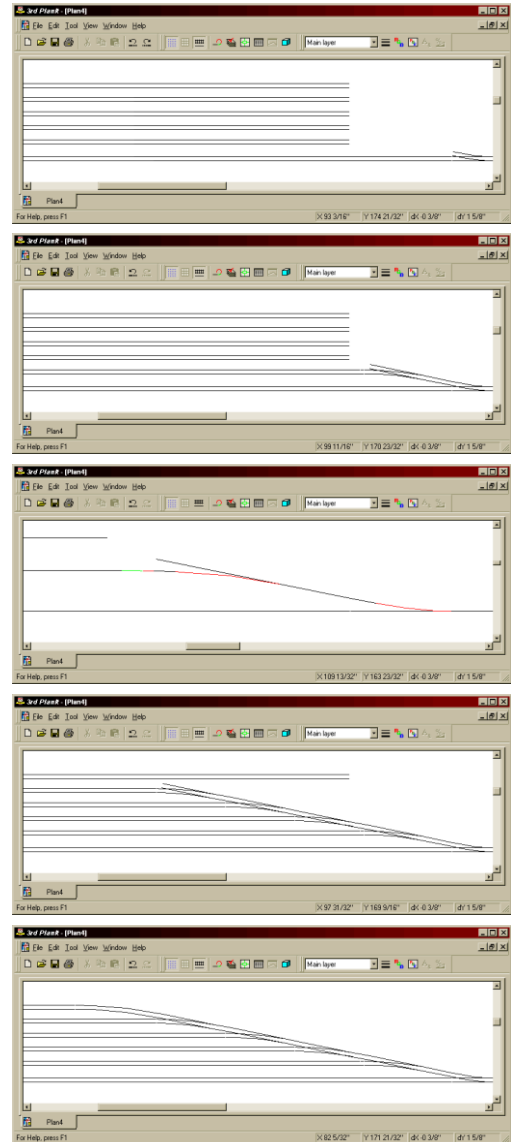
Zooming in closely as in the third illustration, we can see that a short segment of curve and a segment of spiral easement have been added in addition to the turnout. This is because the #6 turnout has a smaller frog angle than the #5 turnout which establishes the switch lead. 3rd PlanIt calculates the proper connecting curve and offsets the turnout the right distance so everything aligns precisely.

Finishing the yard is easy as shown in the fourth drawing. From **File / Settings / Turnouts**, select the #5 turnout once again. Click the final turnout at its normal exit, then click the next yard track. Each time you do this, the connecting tangent track is added and the yard track is trimmed to the proper length. The final connection is made using the standard Connect Tool or Connect With Easements.

The Connect Turnout Tool is also useful for making junctions other than in the yard. For example, here the Connect Turnout Tool was used to form the junction between a main line and a branch line.

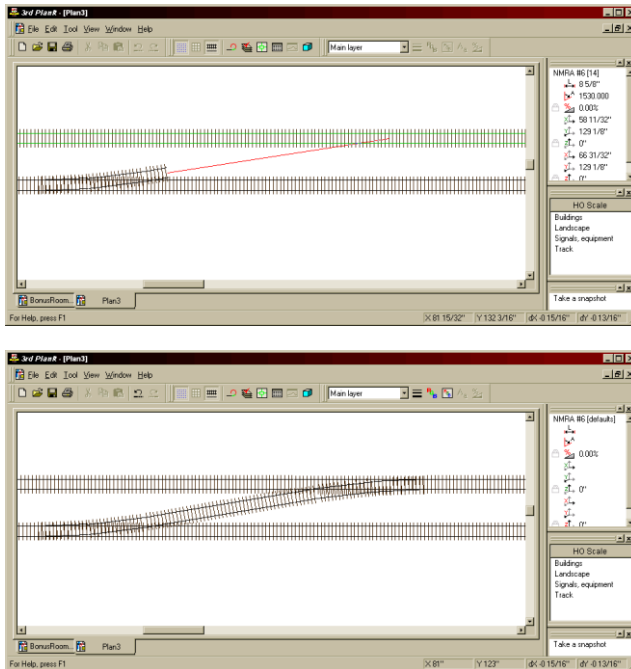
The connecting curve and the spiral easement are quite visible in this example. The **Alt+T** (Color By Object Type) display mode is used with endpoints highlighted to show the transitions from circular arcs to spirals and from spirals to tangent track.

When making connections such as this, the Connect Turnout Tool determines which direction to place the turnout based on where you clicked the mouse relative to the endpoints of the two objects. You may want to try this a few times, varying the line angle and length, to get a feeling for how the Connect Turnout Tool operates in large angle situations such as this.



4.11.2 The Connect Crossover Tool

This tool exists for one particular use, the creation and alignment of crossovers. First, lay out two parallel tracks separated by any reasonable distance. Insert one of the chosen turnouts on either of the two tracks using the Turnout Draw Tool as described above, and align it the way you'd like to see it end up. Then select the **Connect Crossover** tool as shown at the right.



Click the left mouse button while pointing at the first turnout near its routing (diverging) track, and move your cursor to touch the parallel track. The track highlights when you are pointing at its centerline. When you see your drawing look similar to that on the top left click the left button again. The second turnout is inserted automatically at the proper location, and the connecting tangent track is inserted at the proper length as shown in the bottom drawing.

You can make an “automatic crossover” between two parallel tracks, also. Simply choose the **Connect Crossover** tool, click one of the tracks at the location to center the first turnout. Then click the second track in the location you want the other turnout in the crossover. Two turnouts and a connecting track will create a crossover. The Default Straight Turnout is used in both instances.

4.12 The Zoom Tool

The last tool in the ToolKit is the Zoom Tool, used to change the display magnification of your track plan. Six zoom commands are available from the ToolKit:



Zoom In

Rubber-band the area you wish to have magnified, and 3rd PlanIt will perform a “best-fit” zoom, which ensures everything in your selected area is visible. This tool can also be accessed by typing **F2**.

Zoom Previous

Zoom to the previous zoom factor and location. A convenient short-cut is the **F3** key.

Zoom Return

Used after Zoom Back to return to a previous zoom factor and location. **F4** can also be used for this tool.

Zoom to Half Size

Make the drawing magnification half of what it currently is.

Zoom to Full Page

Show the whole drawing on the screen. This can also be accomplished by pressing **Shift+F3**.

Show All Objects

Zoom to the highest magnification that will show all the drawing's objects in the current view. This can also be accomplished by pressing **Alt+F3**.

Zoom to Favorite

Zoom to a view that you find useful at the present time. The zoom factor and position are saved using the next command.

Set Favorite Zoom Set the favorite zoom factor and position to the current view.

There are two alphabetic hot keys for your convenience in zooming. The **F** key zooms “forward” into the drawing centered on the cursor, and the **B** key zooms “backward” out of the drawing.

4.13 How Shift, Control and Alt Affect Tool Operation

When you are using the various 3rd PlanIt tools, the Shift, Control and Alt keys modify their operation in defined ways to make the tools even more useful. Although many of these features have been mentioned throughout this manual, they are summarized here for easy reference.

Tool	If Shift Pressed	If Control Pressed	If Alt Pressed
Draw tool	During draw Constrain to horizontal and vertical when drawing lines. During edit Frees line end point.	At beginning of draw Start from the defined starting position.	At beginning of draw Start object from the end of another object. During draw Snap the end point to another object.
Select tool	During move Constrains movement to horizontal and vertical. When selecting Adds or removes the object from the current list of selected objects.	During move Changes the move to a copy operation. When double clicking Opens the Properties Sheet for an object.	When selecting Select the object at its nearest endpoint. During move Snap the selected point to an object end point. Right-click to align. Shift key sets elevation.
Parallel Tool Right-click while moving to set parallel distance	No effect.	When selecting Extend selection to all connected objects.	No effect.
Align Tool	When button released Moves base elevation of object to elevation of second object.	When button released Uses the nearest point of second object rather than nearest endpoint.	No effect.
Connect Tool	No effect.	When connecting from circle Allow connect to any chosen point in drawing.	No effect.
Path Tool	When selecting Adds or removes the object from the current list of selected objects.	No effect.	No effect.
Zoom Tool	Shift, Control and Alt have no effect.		

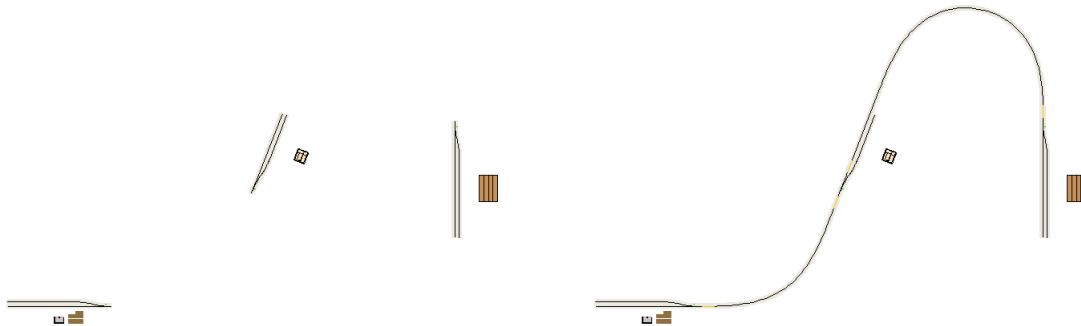
5. SoftTrak

SoftTrak is the most powerful design tool ever introduced to track planning. It lets you focus on the track routing, rather than the details of curves, easements and tangents that form the basis of track design. In addition to SoftTrak, 3rd PlanIt now offers Quintic Easements that allow smooth transitions in all three dimensions at the same time.

5.1 SoftTrak Basics

When working with SoftTrak, it is helpful to think about track design as the task of connecting a number of straight track segments with curves. Prototype railroads use straight track as much as possible to minimize energy consumption and wear of track and wheelsets. Thinking this way when you design your model railroad helps keep it in tune with the prototype, and SoftTrak works naturally in this paradigm.

We will therefore start with a design example that looks first at the elements of the layout, and second at the position of the track. In the image below-right, you will see a track plan that has a freight house and a corner café at the lower left, a packing house near the center, and a freight house on the right.



A few simple sidings were placed by the industries, made in the manner described in the tutorial. To connect them using SoftTrak, select the Connect SoftTrak tool as shown on the right. First, connect the lower-left turnout to the middle turnout, by clicking on the open entry legs of each turnout. The two will be connected by a SoftTrak curve that completes the connection without any other additional track.

The same process is repeated for the remaining connection. In this example, the radius of the resulting curve came out to $33 \frac{3}{8}$ ", using SoftTrak with a Maximum Radius of 60", as shown in the Object Data Window. To see one benefit of SoftTrak, we select the upper-right curve; then click on the "Maximum Radius" field in the Object Data Window.



The field will change to “Fixed Radius” after you click on it, with a default value of 30”. As a result, the curve is recomputed using a fixed radius rather than the maximum radius of 60” previously in use. Compared to the previous image, the curve is now longer and the radius has become smaller.

In this view, the curve’s internal structure is visible. You can see this by using command **View / Display Style / Type** (Alt+Y) twice. As you can see in this example, SoftTrak is comprised of tangents, easements and circular curves. All of the internal detail was generated by the program, and changed automatically when you changed the curve from “Maximum Radius” to “Fixed Radius”.

SoftTrak may be used without easements, as well. Simply select the curve and click the field in the Object Data Window that displays “Easements”. It will change to “No Easements”, and recalculate the track.

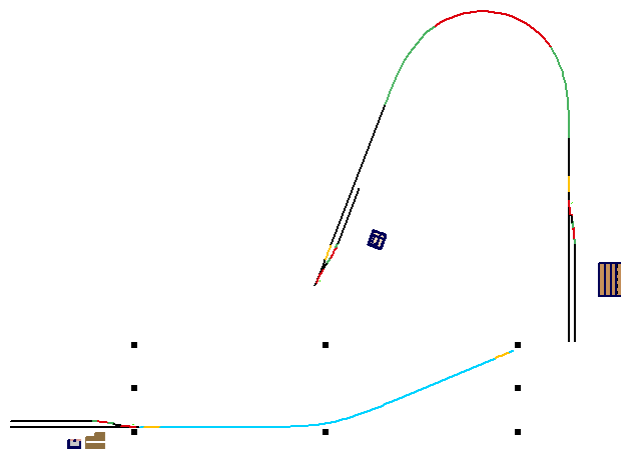
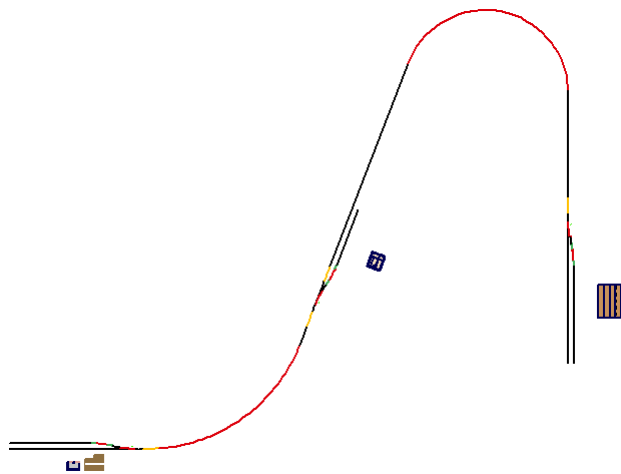
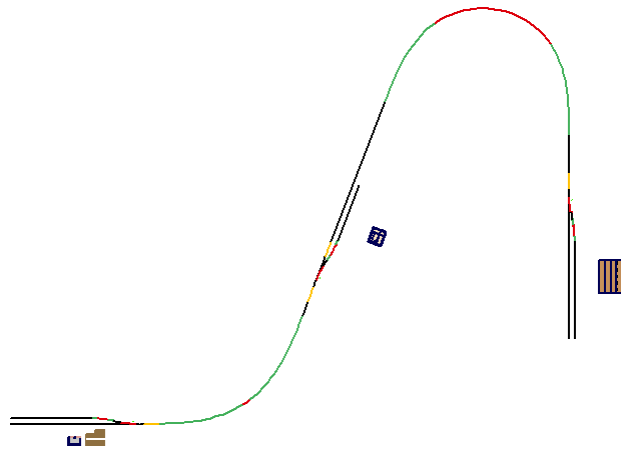
At the right we can see the result of this change. The upper curve, with a fixed radius of 30”, now extends a bit further to the north. The lower curve has no easements, and was set to have a fixed radius of 30” also.

Note how the SoftTrak extends from turnout to turnout. SoftTrak is defined as:

1. An entry segment of tangent track
2. An easement
3. A circular curve
4. An easement
5. An exit segment of tangent track

In any given piece of SoftTrak, one or more of these elements may not be present. Easements are optional, at the user’s choice. The circular arc may become very short or non-existent, depending on the angle of the connection and the spiral length settings. Finally, the entry and exit segments complete the track from the curve to an existing object.

SoftTrak is dynamic by its nature. Because you control characteristics of the curve and not the specific geometry of the objects, you may change a curve’s connection quite easily. Looking carefully at the examples above, you can see a yellow “tip” at each end of every SoftTrak object. Point your cursor to one of the tips, such as the top tip of the lower curve. Press the Left Mouse Button, then drag the tip around. It will flex as you move it, much as a piece of flex-track. Note that easements have been turned on again.



In the same manner, you can drag the tip to an existing track object, so that the object highlights to confirm your aim. The SoftTrak will align to the existing object, while maintaining alignment with the object at the other end. The track elements within the curve will change accordingly.

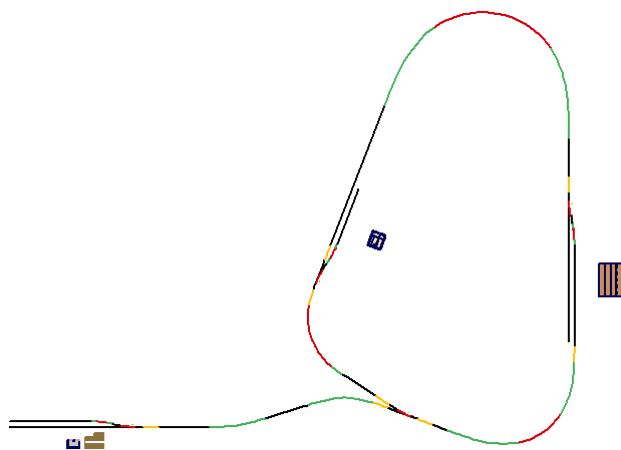
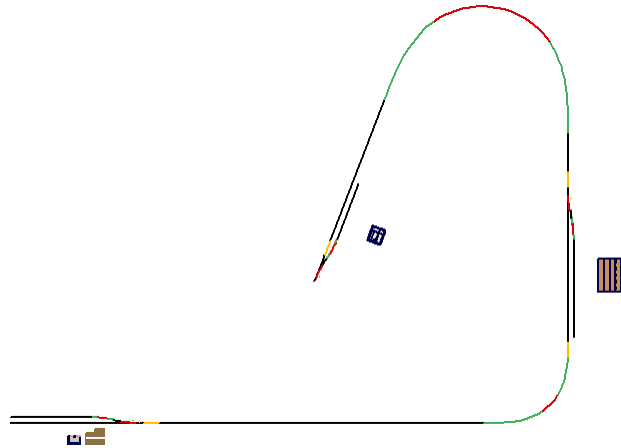
Changes to complex track are just that simple. For example, we can easily add a turnout and a branch route to the drawing at the right.

After placing the turnout, we drag the tip of the bottom curve from its present location to align to the new turnout. We use the Connect SoftTrak tool once again to connect each turnout to the other.

The image on the right shows the details of the design so far. Examining the lower curve, we can see that it is, in fact, an S-curve. Each part of the curve is made of a pair of back-to-back easements – the most efficient track design for shallow angles. They are nicely balanced, providing room and similar geometry for each part of the S-curve.

It's worthwhile to look back through the last few paragraphs. The track design has been changed substantially through the course of the discussion – but each change was simple and fast. If you want to change the location of an industry and it's siding, just select the

objects by rubber-banding (or group them temporarily), move them to the new location, then drag each track tip into alignment as you wish after the change. SoftTrak takes the drudgery out of layout changes, so you feel more free to “work the plan” into the best design possible.

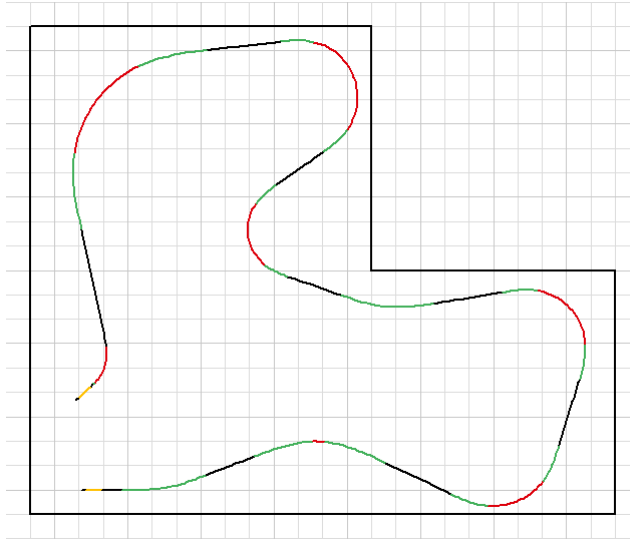


5.1.1 Changing SoftTrak to Objects

3rd PlanIt gives you many powerful tools that work with individual track objects: straight lines (or tangent track), curves (arcs of circles), and easements (transition track from curved to tangent). You can easily change SoftTrak to its constituent pieces so you can fine-tune the route, such as providing vertical easements. Select the SoftTrak you want to change, then issue the **Edit / Transform / SoftTrak to Objects** command, or right-click on the SoftTrak and select **Transform / SoftTrak to Objects** (or use the shortcut **Ctrl+2**). The resulting objects are exactly the same as those within the original SoftTrak.

5.2 SoftTrak as a Spline

Designed specifically to be used in railroad or thoroughfare planning, SoftTrak let you design long stretches of track as though they were a spline – a traffic spline, if you will. They are made of one or more SoftTrak curves, joined internally to form a contiguous track with multiple curves.

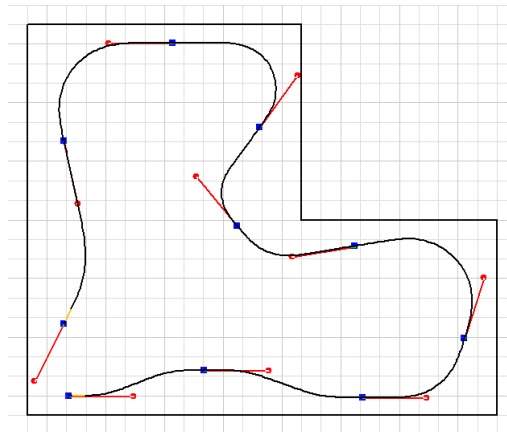
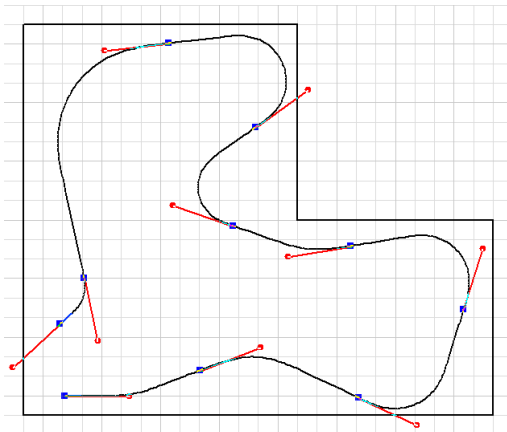


In this case, we will start with an L-shaped room and try to find a mainline for it. Our room has a door at the lower-left, so there must be an opening to allow people to enter the room. Select the tool **Draw / Spline / SoftTrak with Easements**. Point to a reasonable location near the lower left, then press the Left Mouse Button. Drag the mouse away from the starting point in the direction it should head, in this case, to the right. After a while, move the cursor north a bit, and a natural bend will form, in the same manner as adjusting SoftTrak by its tip. If you haven't released the Left Mouse Button, do so now.

This is the time to focus on the straight segments. Review the image on the left; each black segment is straight track, and each

has a vertex associated with it. (Note that S-curves can form between two vertices, but there is no vertex associated with the tangent track between the two curves.)

To see and manipulate the route's vertices, double-click the route. As you can see below-left, each vertex has a location and a direction, from blue to red.



Using the same technique as for editing a polygon, you can point to a blue vertex, press and hold the Left Mouse Button, and drag the vertex to a new location. Each vertex also has a red direction pointer with a diamond head. If you drag the red handle around its blue vertex, you adjust the direction of the track through the vertex. Note how the track parallels the walls at the top and bottom. By holding down the Ctrl key while adjusting a red direction diamond, you can “snap” the direction every 15 degrees to aid in establishing typical directions such as horizontal and vertical.

5.2.1 Changing SoftTrak to SoftTrak Segments

While you can transform SoftTrak to objects, you might also find occasion to transform SoftTrak into its constituent SoftTrak segments. Select the SoftTrak, choose **Edit / Transform / SoftTrak to segments** (Ctrl+F2), and it will be transformed to a number of SoftTrak segments.

5.2.2 Point-to-Point Layout with SoftTrak

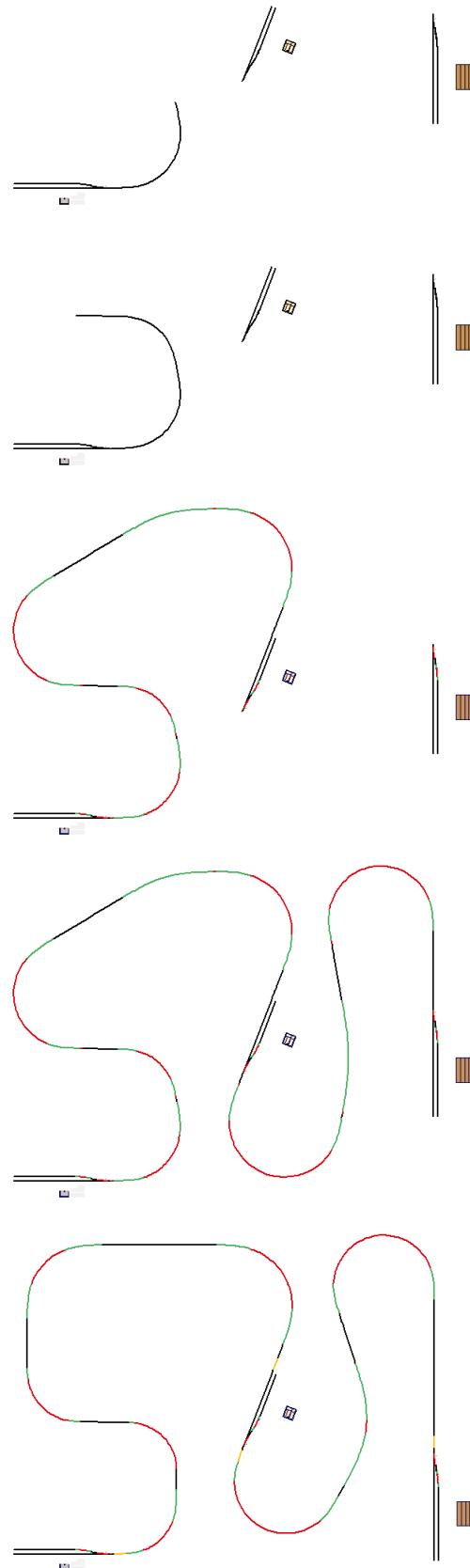
Let's return to the first example, where we began with a few sidings and industries. Choose the tool **Draw / Splines / SoftTrak With Easements** and point to the right end of the lower-left turnout. Hold down the **Alt** key, and the cursor will change to an arrow from a crosshair. This indicates the Snap to End mode, and it will cause the turnout to highlight when you point to it. Still holding the **Alt** key, press and release the Left Mouse Button, then draw it away from the turnout to the right and north, as you see in the example. Click the left mouse button to begin the next segment of the spline.

In the example, the cursor was dragged to the northwest after starting the second segment. Notice how the program treats each vertex of the spline as a definite location for straight track, then provides curves that are in conformance with AREA, European and other railroad and traffic design standards.

The route was completed by clicking (a) along the upper-left side near the center of the tangent, (b) at the top, between two easements, and (c) at the end. The final vertex was inserted by holding the **Alt** key (Snap to End), then clicking the left mouse button. This automatically completes the route, leaving the draw cursor available to create another route.

The second route was constructed in the same manner. It began from the lower end of the center turnout, using the **Alt** key to establish the alignment. Two vertices guide the track northward between the turnouts, then a final vertex was aligned to the top of the rightmost turnout. The loop from north to south was generated only from the two tangent tracks before and after it. You could easily move the yard to a new location, then drag the open tip to the turnout, completing the track changes in a matter of seconds.

SoftTrak let you explore possibilities that you might never consider. You get immediate feedback on the radii of your curves as you draw, letting you find a very efficient way to get from point A to point B. You can fine tune the route by double-clicking it, then adjusting the location and direction of vertices. The example plan was changed quite a bit between the last two images, yet the editing took only a minute or two to complete. In the end, when it comes to building your layout, you still have the traditional track elements used anywhere else: curves, easements and tangent track.

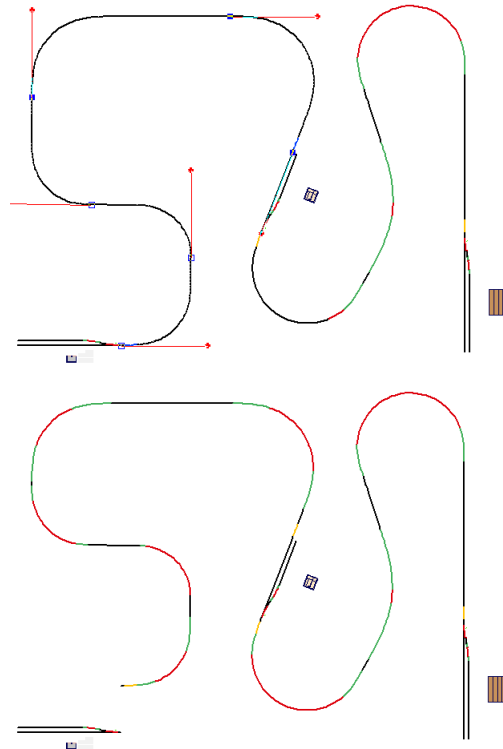


5.2.3 Moving Multiple Vertices while Editing

There are times when a section of track is designed just the way you want, but you'd like to move it intact while keeping it attached to its neighbors. You can easily accomplish this by selecting more than one vertex while editing SoftTrak.

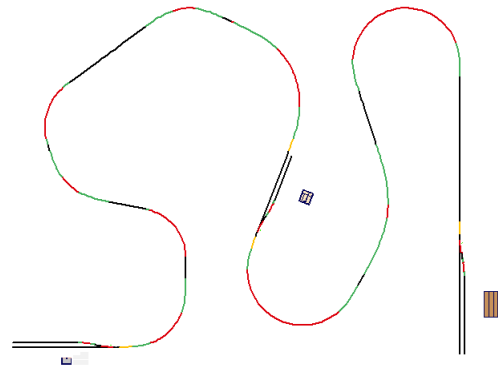
Starting with the example from the preceding section, we double-click the left route to bring up its editing vertices. To select more than one vertex, first, click on one vertex you want selected. It will change from solid blue to a blue box. Then, hold down the Shift key and select any other vertices you want to move. You can also use the rubber-band selection method to surround the vertices you want to move – only blue vertices are captured by rubber-band selection.

To move the whole selection, point to any of the selected vertices, press and hold the left mouse button, then move the mouse to move the vertices – and rebuild the route. In the example, holding the Shift key while moving the vertices forced them to move exactly north. You can see how all the features of the bottom part of the spline remain the same relative to each other, but they have all moved relative to the rest of the spline. It is truly that easy to change your mind about the location of the track, or of the industries and towns that determine its route.



5.2.4 Spline-Like Editing of SoftTrak

If you are looking for some creative ideas for your main line, you might like to use the spline-like qualities of SoftTrak to your advantage. Thus far, the vertices of the route have been locked into a given direction until you choose to change its direction. You can also let 3rd PlanIt generate some unexpected shapes by holding the **Ctrl** key while moving a vertex. This frees the direction of the vertex to follow a path of minimum-acceleration between the previous and next vertex. As you move the vertex around, the angle of the track through the vertex will change. You can extend this minimum-acceleration route generation further by holding both the **Shift** and **Ctrl** keys while moving a vertex. This frees the direction of the moving vertex, as well as its two neighbor vertices.



5.2.5 A Layer for Saved SoftTrak

There are times when you'll transform SoftTrak to curves or objects for detailed work. If you want to be able to come back to the route for further changes in the future, here's an easy technique. Create a layer to hold the routes you want to save, named "Saved SoftTrak" for example. Before you transform the route, select it, use **Ctrl+C** to copy it, **Ctrl+Shift+V** to paste it in place, then change its layer in the Object Data Window to "Saved SoftTrak". It's usually best if the layer is not visible until you want to find a saved route.

5.3 Quintic Easements

3rd PlanIt offers a design capability previously available only to full scale high-speed railroads. Quintic Easements have their roots in CAD software, based on mathematics not available until recently: quintic splines. Unlike cubic splines available in many drawing programs, splines based on a quintic equation allow the curvature at each endpoint to be specified. Quintic Easements can also be referred to as quintic transition curves.

5.3.1 Background

To better understand the role of the quintic in railroading, we can look into the role of the transition curve in general. If you'd like to simply use them, feel free to skip to the next section.

Before CAD design systems were available, both regular curves and transition curves (easements) were determined by "stationing". Surveying points, or stations, are located every 100ft along the track (in the United States). If one was laying out a curve of constant radius, at each station the surveyor would set out an angle of a few degrees, using the same angle at each station.

To transition that curve to a tangent (straight) track, the surveyor would subtract a small value from the angle at each station, until the angle between stations reached zero. This natural measuring process resulted in a curve that is represented by a cubic spiral. "Cubic" means that the distance from the tangent increases as the cube of the distance along the curve.

Quintic transition curves find their power in CAD systems by exploiting the mathematics of equations using the distance along the curve raised to the fifth power, rather than the third. What is special to us is that a quintic equation can calculate a curve with specified curvatures at each end. Traditional cubic splines must approach zero curvature at each end – which renders them ineffective for connecting curved track to tangent track or to another curve.

What new design capabilities are available with Quintic Easements? There are three major benefits. The first is the shape of the curve. It is very close to the same curve as a cubic easement, but it is optimized to provide a better transfer of lateral acceleration when entering or leaving a curve. This difference is critical to the operation of high-speed trains, as momentum is proportional to velocity. The second benefit is that the quintic curve operates in three dimensions, not just two. It can just as easily transition vertical grades as horizontal grades. One or both ends may have curvature, as well. Finally, it allows connection between two curves in situations that are difficult or impossible to accomplish with traditional easements, such as curves whose center of radius is concentric or closely spaced.

5.3.2 Vertical easements

If a track at one grade meets track at another grade, the simplistic solution appears at the right. The difference in grade between the flat segment on the left and the 10% grade to the right is made more noticeable here

by the use of terrain underneath the track. One never sees track like this in the real world, as there would be a huge bump changing from one grade to another. The track designer must provide transition track to smoothly change grades.



3rd PlanIt offers a connect tool to quickly add vertical easements to your design. Select the “Connect Quintic Easement” tool, shown at the right. This tool operates in much the same manner as Connect With Easements, and other Connect tools. The transition track is made by clicking first on the left track segment (press and release the left mouse button).

Next, point your cursor to the center of the right track segment. Press and hold the left mouse button, then move the mouse to adjust the length of the vertical easement. When you think the transition track looks reasonable, release the left mouse button to complete the connection.



Your track should look like the image on the right when you view it in 3D. You can see that the track now smoothly curves from the 10% grade on the right into the flat track on the left. The abrupt change in grade is still visible in the terrain below the track.



The image on the right was made after conforming the terrain to the new vertical easement and placing a short train on it. The train looks natural despite the huge change in grade, with each car's angle a bit more than the one in front of it. This not only looks better, but makes reliable operation possible.



Building vertical easements is easy. They are created naturally by gradual flexing of the track and roadbed, be it wood or foam. 3rd PlanIt gives you valuable reference points at each end of the curve, which can be transferred to your layout as you build it.

5.3.3 Vertical easements with a fixed radius

The Connect Tool also lets you create a vertical easement with a fixed radius. This provides regularity in your design and building. Select the tool “Connect vertical easement, fixed radius” as shown at the right.

Using the tool is much the same as using the adjustable radius version discussed above. There is no need to adjust the curve using the left mouse button, though. The length of the transition curve is set to achieve the fixed radius. You can set the value of the fixed radius by pressing the button with the lock and blue check mark.



5.3.4 Complex vertical easements

In the Background section of this chapter, it was noted that quintic equations allow us to specify curvature at both ends. This fact brings great flexibility to quintics, allowing track designs not possible otherwise. As an example, a tangent track with no grade is butted against a curve that has a 10% grade.

You can see the abrupt change in grade in the left image. On the right, a transition curve has replaced a few inches of both sections of track. The track transitions not only as a vertical easement; it smoothly connects the curve and the tangent while smoothing the change in grade. This design would be extremely difficult to achieve without quintic transition track.



5.3.5 Editing Quintic Easements

SoftTrak Easements may be simply edited, bringing new speed and flexibility to track design. Starting from the example above, each primary track segment was shortened using the double-click edit feature. A gap appears between the primary tracks and the easement, shown at the right.



Note the yellow tips of the Quintic Easements. These tips indicate a powerful new editing feature – flexible track that maintains smooth curvature from end to end. Before completing the broken trackwork, take time to experiment with the Quintic Easements. Choose the Select Tool and point your cursor to the left end of the easement, at the yellow tip.



As you move the tip, the whole track flexes from end to end. The curvature of the other end is maintained until you adjust it by its tip.

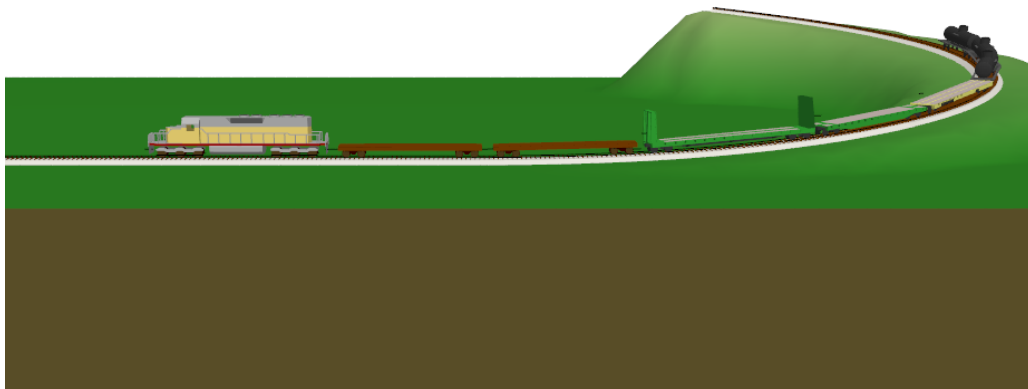


As shown above left, the left tip of the easement was dragged to the tangent track. When the tip hovers over the end of the tangent track, the tangent is highlighted in confirmation. At that point, the left mouse button is released and the easement is aligned to the tangent track.

To move a Quintic Easement, point your cursor near the center of the track segment. When it highlights, press and hold the left mouse button, then drag the easement elsewhere. If you double-click the Quintic Easement, you can move the editing handles without changing the curvature.

Note that there is a bit of an S-curve in the track on the left. An S-curve is not good track design in general. However, given the curvature and location of the easement's right end, the path with the least acceleration is accomplished as shown. You need to be aware of this when designing with Quintic Easements, and avoid unwanted S-curves by using good geometry. When the right tip of the easement is connected to the constant radius curve, the easement is adjusted for its new location and the curvatures in play. This longer easement allows a smooth transition from curve to tangent, absorbing the change in grade along the way.

After adding a train and swapping to 3D by pressing the Tab key, you can see the graceful results.



It's worth considering this connection in detail. The 10% grade of the curved track has been transitioned smoothly to a tangent track with no grade, while at the same time transitioning from curve to tangent. This kind of track planning power lets you design complex track in very little time.

5.3.6 Connecting with Quintic Easements

If you use easements in your designs, using quintic easements is much the same. In fact, the program computes the quintic curves with the same routines used for cubic easements. quintic easements replace cubic easements as the final step.

This implies that you can replace any cubic easements in an existing design with quintic easements. That's quite true. You'll find two versions of the tool, providing variable and fixed radius connections. The Toolkit shown at the right has the variable radius version checked; the fixed radius version lays to its right.

This example begins with two segments of tangent track at a shallow angle to each other. The "Connect Quintic Easement" tool is used in the same manner as the "Connect with Easements" tool, optionally with a fixed radius curve.



While it is only evident in this illustration by their colored tips, the easements are Quintic. You use the same procedures found elsewhere in the program to design with modern geometry. By printing your design 1:1, you can build your layout to the exact specifications you designed.

5.3.7 Connecting with a Single Quintic Easement

When connecting obtuse angles of 135 degrees or more, you might prefer having the connection made with a single Quintic Easement. This provides a very smooth curve, with lateral acceleration distributed evenly throughout the transition.

Although a quintic transition curve does not follow track design standards prior to the 21st century, this kind of transition is currently used on prototype high-speed rails on shallow curves. You might also find it useful in designs of an earlier era, where it can provide more attractive flow or let you achieve complex yard designs.

This example begins with two segments of tangent track at a shallow angle to each other. If the lines to be connected form an angle less than 135 degrees, a traditional easement-curve-easement will be automatically be produced, not a single easement.



5.3.8 S-curves with Quintic Easements

You might be wondering – if the quintic transition curve can have an S-curve, can it be used to solve an S-curve situation intentionally? The answer is definitely "Yes". A new tool is available to connect existing endpoints with Quintic Easements, as shown on the right.

Shown at the right is an arbitrary misalignment of track to serve as an example.



After selecting the “Connect Quintic Easement, between ends” tool, click on the end of the left track, then the end of the right track. A new piece of track is laid out between the ends, without repositioning the ends.

Even this artificial design situation is resolved smoothly with the quintic transition track. It would not only be difficult and time-consuming to perform a similar design with curves, easements and tangent track. It would not be possible to minimize the transitions as effectively, nor provide reliable operation in a small area. You will be able to make more compact and interesting designs by carefully using this new curve.



5.3.9 Connecting two circles

You will occasionally run into a situation where you wish to connect two curves that form overlapping circles, as in the example at the right. These nearly concentric circles are of 24” (on the left) and 36” radius (on the right). It would be nearly impossible to connect these curves using traditional design tools. However, the Quintic Easement makes it easy and customizable.



Start by slicing each curve at places that appear to provide reasonable transition opportunities, such as shown below on the left.



Use the “Connect Quintic Easement, between ends” tool to produce a very smooth curve that gradually eases one radius into the other. The transition curve that resulted is not a unique solution to the overall problem, though. Let’s try the same situation, with a slightly different end for the left curve.



You can decide which curve is preferable to your eye. Both will provide reliable and smooth operation when you build your layout. Use good judgment, though – you can also take things to an extreme.



If you consider the image above left, it does not appear that a smooth connection can result. It can’t, but the Quintic Easement will try its best to smooth the complex connection. The new track looks like it is in the mountains, but if the radii are large enough, it will operate reliably. The curvature from the left track is bled off as the S-curve begins, and curvature to the right track is worked in near that end. It is the best available solution to the complex (or inappropriate) starting geometry.

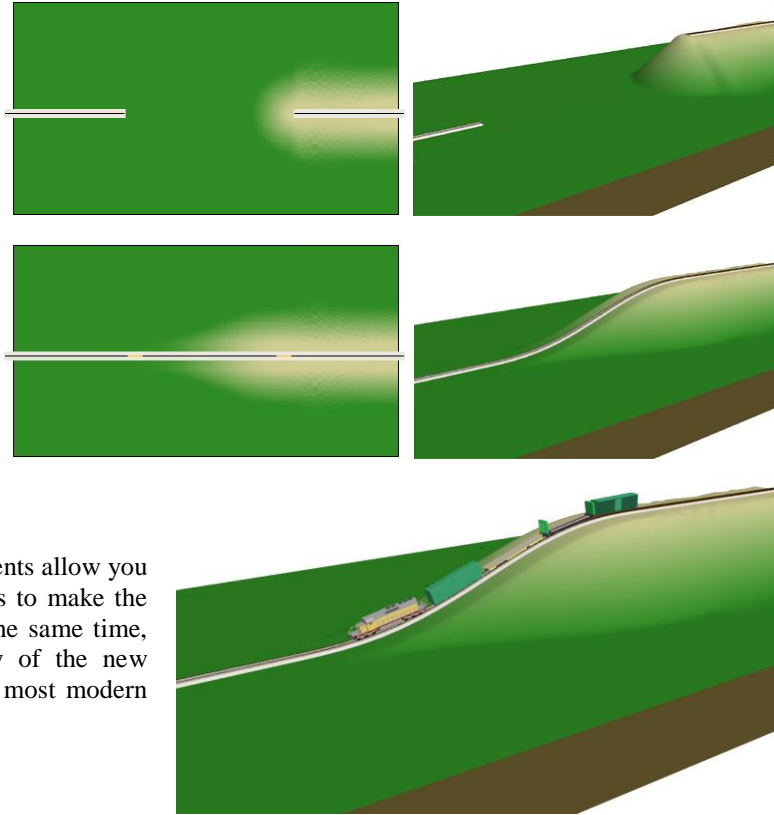
5.3.10 Understanding the vertical component

This example will help you understand the capabilities of the Quintic Easement. We start with a contrived design to make the nature of the curve more visible.

The track at the left has no grade and is at 0" elevation. The right track is at 10" elevation with no grade. The terrain makes this quite evident.

After using the "Connect Quintic Easement, between ends" tool and conforming the mesh to the track, a smooth roller-coaster track appears between the two original tracks.

3rd PlanIt's unique Quintic Easements allow you to create flowing, complex designs to make the best use of your layout area. At the same time, you will enjoy the subtle beauty of the new curve, knowing you are using the most modern design methods available.



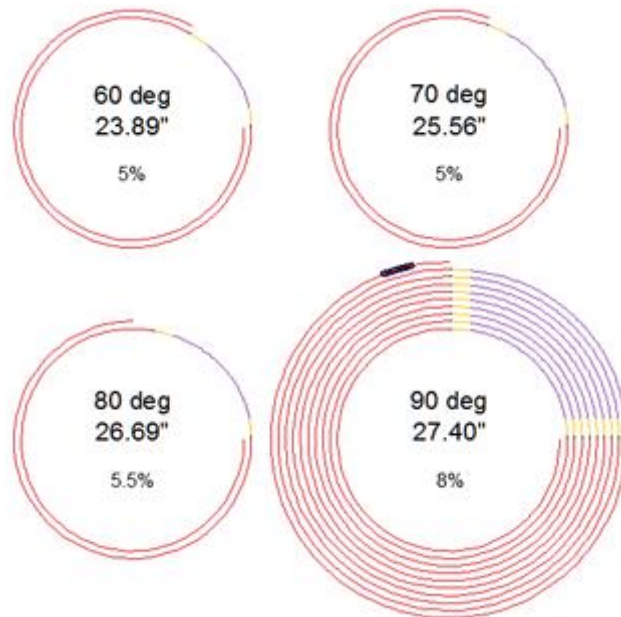
5.3.11 Concentric Circles

Connecting two concentric circles can be a particularly difficult problem. This most commonly arises when one is designing a dual-track helix, crossing from the inner to the outer helix.

At the right are four sets of two concentric circles. The radius of the inner circle is 30", and outer circle has a radius of 32". There are an infinite number of paths by which you can connect the two. It's up to you to choose the curve that will operate reliably with your equipment, and has a smooth flow throughout the curve.

Four examples are shown, with the transition length varying from 60 to 90 degrees of arc. The 60 degree example has a clear bulge at the bottom of the arc; the 70 degree is fairly good, and the 80 and 90 degree curves are both quite usable. The minimum radius in the curve is shown, and comes very near the 30" radius of the inner circle despite the bending required.

These smooth curves were accomplished using the **Straighten** feature of Quintic Easements. In most cases, you will only use Straightening with Minimum Acceleration (MA) splines, not Quintic Easements. However, in some cases such as this, it comes in very handy to adjust the location of the smallest radius.



6. SectTrak

You can have SoftTrak's design speed and flexibility when you use Sectional Track as well. Sectional Track is a collection of straight and curved segments in addition to turnouts and crossings offered by a manufacturer. Two well-known examples are Atlas and Kato. Both are offered in N scale and HO scale; each has its own radii and lengths. Kato includes faux ballast with each track segment, while Atlas provides only the track segments for placement on the modeler's roadbed or ballast.

Sectional Track pieces are snapped together to create a layout that can be changed or taken down when desired. SectTrak lets you quickly design original layouts with unprecedented ease. The straight and curved track segments of your chosen library will be selected to best represent the design of your SoftTrak curve. You'll be surprised how many possibilities are available when you don't have to position each piece.

6.1 Sectional Track Libraries

A document may have a number of Sectional Track libraries, but typically only one library will be needed. Sometimes it is desirable to mix manufacturers or product lines, such as Ross and Gargraves in O scale, or Märklin C and M track in HO scale. Most often one library is sufficient.

If you started a new Sectional Track drawing or opened the Sectional Builder with 3rd PlanIt v12, an entry for the Sectional Track library was added for you. If you want to add a new Sectional Track library, you can also right-click the library in the Library Bar and choose "Add to Sectional Track library list". You are now able to use the new ST library (Sectional Track library).

6.2 Drawing SectTrak

Let's use the Kato Unitrack library for HO scale as an introduction to SectTrak. Open a new flex track or sectional track drawing at startup, or use **File / New** if 3rd PlanIt is already running. It doesn't have to be a Sectional Track drawing that used with the Sectional Builder; you may use draw SectTrak in any drawing you wish. Look at the Library Bar, find the HO scale Kato Unitrack library, right-click on it, and add it to the ST library list.

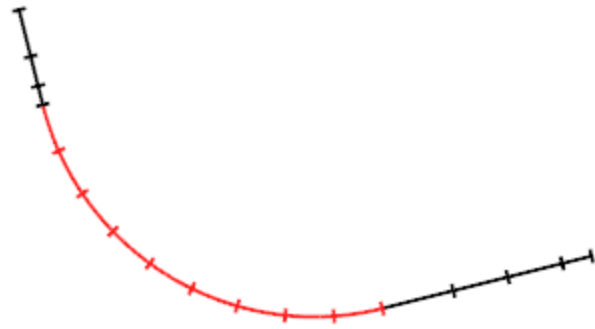
You will be asked if you would like to make the new library the default for SoftTrak. Answer "Yes" so that new SoftTrak will be created as SectTrak using the library.

To draw a SectTrak spline, choose **Draw / Various splines / SoftTrak** as seen at the right (if your ToolKit is docked, the icons may be arranged vertically). Do not choose **Draw SoftTrak with Easements**, as Sectional Track has no easements. Because you have a default ST library for SoftTrak, it will automatically be created as SectTrak. You can turn this off in an overall ST Manager dialog, discussed later.

Move your cursor to an open area of the drawing, click the Left Mouse Button, and pull your cursor down and to the right (towards 4:00). As you move the mouse, the curve will change in length and angle. If you find an angle you like, press and hold the Shift key to lock that angle into place. Try to achieve a curve that looks like this.



This is shown in Color By Type display mode (Alt+Y). The pieces in the curve are chosen dynamically as you change the endpoint of the curve, and happened to end up with this combination. 3rd PlanIt tries to connect each node in a SoftTrak spline with Sectional Track in the most efficient manner.



When using SectTrak, as for almost any phase of design, it is always wise to use Color By Type mode. When you want to review or display your design, other display modes are best. When you are laying track or connecting pieces, Color By Type makes curves more apparent and differentiates between tangents, curves and easements. There are no green easements at the ends of this curve as might be had with flex track.

Consider the task of designing freeform SoftTrak curves that are executed in Sectional Track. The angles are quantized – you can't have any angle, you can only choose from the angles in the library of objects. The choices of radius are similarly limited. This means that there will almost always be a difference, small or large, from where you want the track to go and where it is able to go.

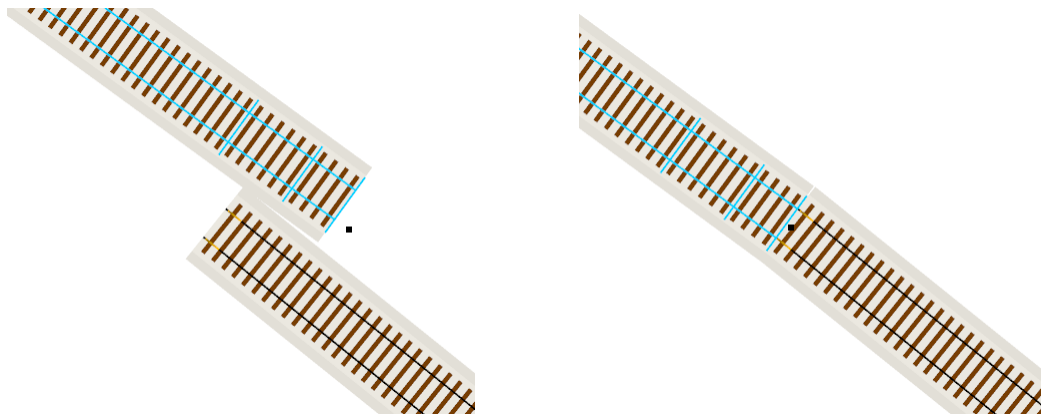
This is where a characteristic of Sectional Track that comes naturally with the real objects needs to happen in the CAD process: nudging the track into position. We know that, over a number of Sectional Track objects, there is a little give-and-take in the real world. The track can be nudged a bit off its natural path yet still work. The difference in position is spread out along the length of the track route. 3rd PlanIt does exactly the same thing.

6.2.1 Nudging SectTrak

While one might not expect it, many Sectional Track designs published in books, on the Internet, and by manufacturers, depend on the give-and-take of sectionalized track to make the design work. You just nudge the ends into alignment. It's easy to nudge SectTrak into place in the same manner.

Click on the menu bar **Tools** button and find the choice “**...Nudge SectTrak to target**”. In a new drawing, it is not checked, which means that SectTrak is not nudged to its target. In general, that is the best way to design. If you can make the lengths and angles of your ST library match perfectly on their own, it is obviously the best solution. At the same time, it isn't all that bad to nudge. In fact, it's hard to get a perfect alignment between pieces in any case.

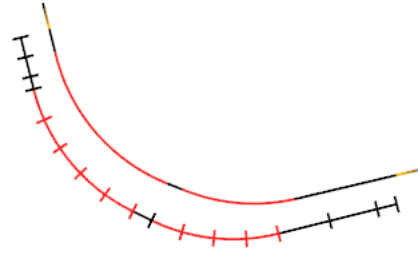
Your best strategy is to design with **Nudge** off, and turn it on when you want to complete that final connection. **Tools / ...Nudge SectTrak to target** has two modes. If nothing is selected, it shows the style that new SectTrak is created: Nudge On or Nudge Off. If SectTrak objects are selected, it shows the current setting of the SectTrak object and lets you toggle Nudge on and off. The **Nudge** status of SectTrak is preserved with the object so that it will or will not be nudged into position when a file is re-opened and when it is adjusted while editing.



The images before are an example of nudging. On the left is the end of a 37-object SectTrak spline with every piece aligned exactly: The endpoint does not align well at all; the angles of the curves and the length of the straight sections work out poorly. On the right, the pieces of Sectional Track have been nudged into place within 0.01". They could be nudged more closely if you choose. A slight angle is allowed between each piece, and the necessary change in angles is spread out over the entire SectTrak length. It works in 3rd PlanIt the way it works in real life.

6.2.2 SectTrak Limitations Compared to Flex Track

SectTrak considers thousands of possible track combinations from your chosen Sectional Track library to find the best match for your chosen path. However, there are some possible paths that can't be solved with the available track. In that case, you will see a different display of your SectTrak: one that has no highlights along the spline, as shown at the right.



Unlike the first example, this SectTrak spline is made of three vertices. The third vertex is near the middle of the SectTrak, resulting in a short tangent track mid-curve. This addition makes it more difficult to find pieces of Sectional Track that properly complete the desired curve. The two splines look very similar, but under examination one can note the difference in angle of the center tangent section. The change was made by double-clicking the SectTrak spline and changing the angle of the track through the center vertex.

Most two-vertex splines can be successfully constructed, although in some situations a slight change in angle can make the difference between a valid SectTrak spline and one that can't be built. It's important to remember that this is not a limitation of the program – it is sometimes not possible to build a specific path with the sectional track you have chosen. Often the only choices of angles through curves are at 22.5 degrees, limiting your track design options. This limitation is something you want to know during design, not after purchasing the track.

When you design SectTrak with more than two vertices, the path is more constrained. You are choosing the angles between segments, and if your choices are not compatible with your track library selection, you will need to similarly edit the SectTrak and adjust the track angles. This way you can achieve new, exciting designs that were almost impossible to envision without SectTrak.

6.2.3 Designing with SectTrak

Just like designing with SoftTrak, SectTrak lets you focus on the routing, not the details. While flex track can be tedious without SoftTrak, designing piece-by-piece with Sectional Track can be every bit as tedious. SectTrak lets you be creative, thinking about the path from here to there, not the geometry or the track pieces necessary to get there.

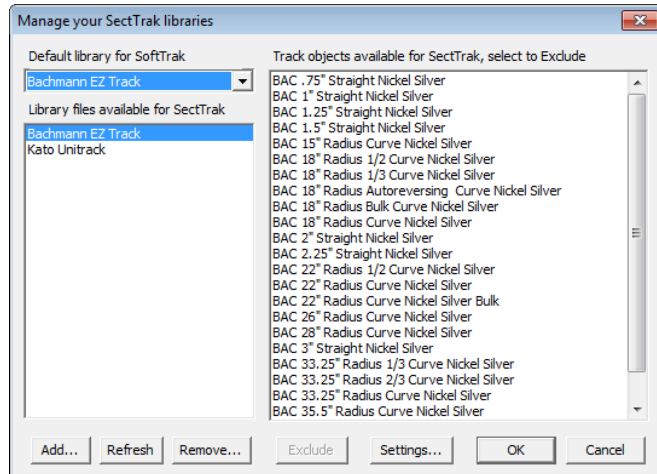
There are two powerful design modes. As multi-segment SectTrak, you create a spline defined by points and thinking about how to route your main line around the layout. Double-click SectTrak to edit its control points, setting their position and angle. Select several control points while editing and move a whole design area from place to place. You see where you can go with what you have available.

The other design mode is "Connect The Dots". Simple two-point SectTrak objects can make connections between turnouts and other SectTrak. It's easy to move a turnout then reconnect the SectTrak leading to it. Don't forget – when things don't align just so, **Nudge** can come to the rescue and get them aligned.

6.3 Managing Sectional Track Libraries

Your drawing may reference up to 15 Sectional Track libraries (although it's difficult to imagine the need for so many). Each of these contains only the curved and straight segments of a track library. You can manage these libraries using **Tools / Manage Sectional Track libraries...** from the main menu or **Ctrl+Alt+K**. The image to the right shows how a drawing with two ST libraries looks. The Bachmann EZ Track library is used as well as the Kato Unitrack library.

The upper-left field, **Default library for SectTrak**, lets you choose a default setting for SoftTrak. You can select a Sectional Track library or you can select **Flex track**. Designs can include both flex and sectional track.



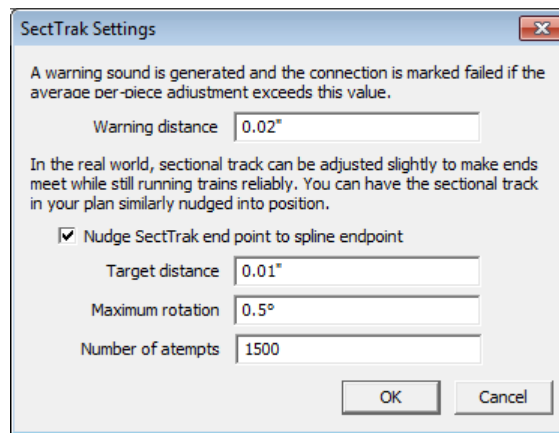
Below the default library is a list of the libraries included with the document: the ST Library List. It is important to know that every ST library is saved *with the document*. This prevents changes in your design if a library object changed in a recent update. It lets you send your drawing to another 3rd PlanIt user, who can interact with the drawing even if they don't have your particular object library on their system.

Below the ST Library List are three action buttons: **Add**, **Refresh** and **Remove**. **Add** lets you add a library using a file select dialog. **Refresh** instructs the program to apply updates from the Standard Object Library that may have been presented when you opened your file. **Remove** drops all references to the ST library and resets all SectTrak that referred to it back to flex track.

On the right of the dialog is the Track List. It contains all the objects from the track library available to use in SectTrak. By default, turnouts, crossings, and complex groups are not included, nor are any Groups marled **Exclude From SectTrak** in their Group Properties. There may be objects you wish to exclude for your own reasons, such as limiting choices to your stock on hand. You can Click, Ctrl+Click, and Shift+Click selections of objects to exclude, then press the **Exclude** button. They can be excluded from the drawing or extended to update the Standard Library file, so your exclusions apply to all files in the future.

6.3.1 SectTrak Settings

At the bottom of the SectTrak Manager is the **Settings...** button. Click it to bring up this dialog:



These are default settings for US measurements; similar values are provided for a metric preference. The **Warning distance** is measured by-piece along a length of SectTrak. If the offset between an endpoint with exact alignment between segments and the target causes a greater by-piece offset, you will hear a warning sound. If you want to override the warning, hold down the Shift key and realign the SectTrak.

Controls for the **Nudge** feature are provided. The state of **Ctrl+Alt+Shift+N (Tools / ...Nudge SectTrak to target)** is reflected in the check box. This field and **Ctrl+Alt+Shift+N** are the same. When **Nudge** is active, the next three fields control its action.

The **Target distance** has been tested as low as 0.0001” with a large **Number of attempts**. The closer your tolerance, the longer it takes to compute – but on many systems, this is not a problem. **Maximum rotation** is by-piece. It controls how nudging is spread along the length of SectTrak. The 0.5 degree setting is the most liberal that should be used, although in practice alignment to one degree is typical. The **Number of attempts** field works together with **Target distance**. The more restrictive your target distance, the more attempts will be required. Most current systems are capable of as many as 5-10 thousand attempts to converge on the best location.

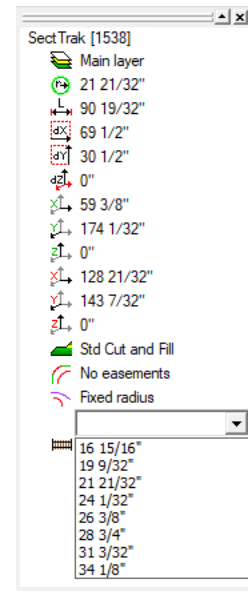
The default settings allow for responsive operation on any current system. It is quite reasonable to require alignment to 0.001” with 5000 attempts at 0.25 degree rotation. This produces a smooth curve distributed over a long distance, and conservative evaluation of the fit achieved by the Sectional Track.

Pay attention to the alignment angle between SectTrak and other objects when using **Nudge**. Sometimes it is possible to align endpoints at the same place but have a large change in angle between adjacent objects. While the **Nudge** feature is realistic and powerful, it gives real-world results that you need to evaluate carefully, as though you were building the track.

6.4 Setting the Characteristics of SectTrak

If you skipped the chapter on SoftTrak because you plan to use Sectional Track, please take the time to read the previous chapter on SoftTrak and learn its capability and controls. There are several fields in the Object Data Window that control the operation of SoftTrak and SectTrak. The Radius control field has a qualities specific to SectTrak, as seen on the right.

Since Sectional Track is only available in certain radii, the Radius field for SectTrak is a dropdown menu listing the radii offered by the ST Library you have chosen. You still have the ability to choose a maximum radius as well as a fixed radius, as there are cases where it’s desirable to have the program choose the largest radii possible for each SectTrak segment, and other cases in which all radii should be the same.



6.5 Conversion to Objects

The **Edit / Transform / SoftTrak to Objects (Ctrl+2)** command works with SectTrak as well as SoftTrak, as SectTrak is a derivative of SoftTrak.

Just as you can transform SoftTrak to its building blocks of tangent and curved track, you can use the same command to transform the SectTrak spline to its constituent Sectional Track objects. Each will appear in the drawing as though they were inserted as individual pieces from a Standard Library file. Even before transforming the SectTrak to Objects, the individual Sectional Track pieces are shown in the F8 Object List described in a later chapter. This lets you know how many of each piece is used in the drawing. If you provide a cost for each piece, you'll also know how much you would need to spend to build the layout you have designed.

7. Object Properties

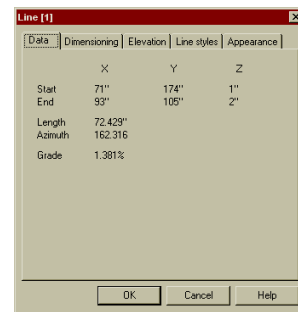
Every 3rd PlanIt object has properties associated with it. The properties determine everything about the object: where it is, its angle, color and width, and a number of other characteristics. Every object's properties may be examined through an interface that is very similar for every object type. There are several ways to display an object's property sheet: you may select the object and press **Enter** or use **Edit / Properties**, or right-click an object and choose **Properties**, or double-click an object with the **Select Tool** while holding down the **Ctrl** key.

7.1 The Line

7.1.1 Data

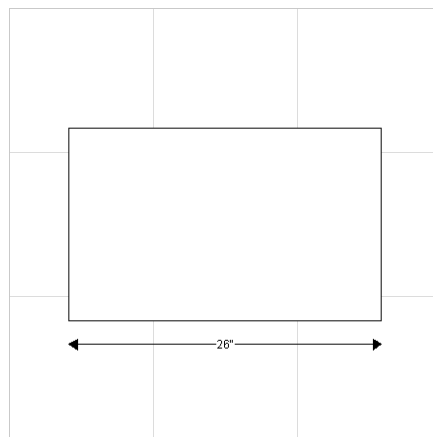
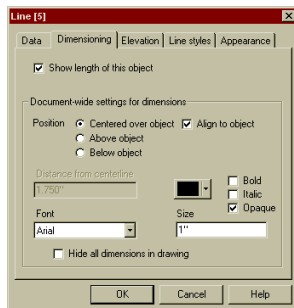
One of the most common objects in drawings is the line. This is the Line Property Sheet, showing the first page of information. There is a unique first page for each object type. The first page for a Circle would clearly need its center point and radius, while a group property page would list the members of the group. Some pages are the same for all objects, and are used in the same manner.

Here we can see all the significant numbers that describe the position and size of the selected line. The grade is included on the first page of an object's properties for convenience.



7.1.2 Dimensioning

Many times you will want to show the dimension of an object. These are typically indicated on mechanical drawings with a "Dimension line", that has arrows or tick marks at each end and the length in the middle.



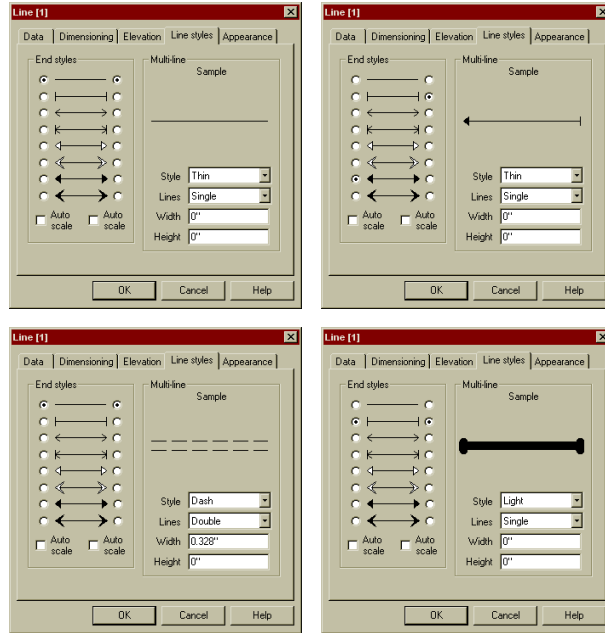
If you check the **Show length of this object** option, its length will be displayed in the middle of the line. On this page you can control the document-wide settings for dimension lines. Use the **Line Styles** page to select the style of the line ends. Filled arrowheads are used in this example.

7.1.3 Line Styles

Objects may be drawn in a number of styles. Those object with two ends, such as lines, spirals and circles may have End Styles as well.

The top left example shows the various styles of the line whose elevation we set in the previous section. As drawn, the line has no End Styles, is Thin, and is a Single line of Width 0 (a width of 0 means to draw the line one pixel wide on the current output device). A sample of the line is shown for reference.

The top right example shows the line with its End Styles modified. A solid arrow is at the left end of the line, and a tick mark crosses the right end of the line. The lower left example shows a double line whose line style is Dash, and the lower right shows a medium weight line. The **Native Width** of the line is 1/4". This thickness will be used when you have selected **File / Settings / 2D Display / Native Line Widths**.



Most typically, the Native Line Width only comes into play in 3D rendering, to make trees, buildings and the like appear as realistic as possible.

When an object is created, its Native Line Width is set to the equivalent of the current Line Style line width at the current zoom factor. In the case of hairlines, the Native Line Width is set to zero. It can be set to non-zero either from this page, or by changing the object's Line Style to a wider style.

Once set to non-zero, you can only change an object's Native Line Width from this menu. This allows objects with several line widths to be drawn using various Native Line Widths. Draw the components using regular line widths; this will set an appropriate Native Line Width. When all lines have been placed, you may change the Line Style for all the objects to a hairline for quick drawing in 2D mode. The Native Line Widths will be left at their chosen settings for effective 3D rendering.

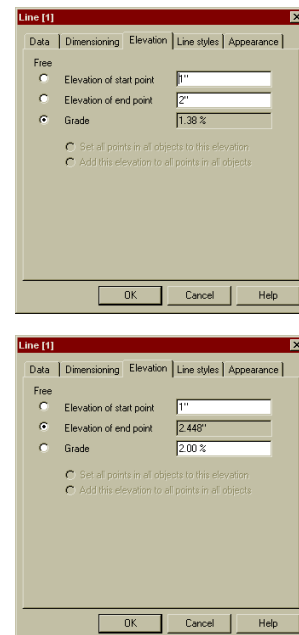
7.1.4 Elevation

All objects except text objects have an Elevation page. In addition, this page can be used to calculate the elevation along a Path when using the **Path Tool**.

The three elevation characteristics you would like to control are available on this page. As this example is shown, the user can change the Elevation of either the start or the end point. The resulting grade is calculated and displayed in the read-only Grade Field.

Sometimes you may wish to establish a grade, and calculate the resulting start or end points. In the second example, the designer has chosen a grade of 2.0%, and knows the starting Elevation of the line is 1 inch. Freeing the end Elevation to be the result of the other two fields and entering the 2.0% grade calculate the Elevation of the end point to be 2.448".

Two additional fields in the property page are disabled for lines. These options are only available for groups, and will be discussed in the section on group properties.



7.1.5 Appearance

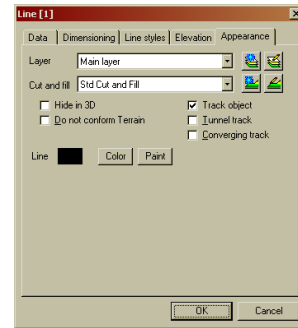
Several factors that control an object's appearance are available on this page. At the top of the page, the layer control allows you to change the layer in which an object currently is located. The buttons to the right create a new layer, and modify the object's layer, respectively.

The next field is the object's **Cut and Fill** selection. This determines how terrain is contoured around the line, as described in the **Terrain** chapter. You can create a new Cut and Fill parameter, or modify the current one.

The check box **Hide in 3D** lets you have objects visible when you're in the 2D plan view, but not while you are viewing in 3D. To its right is a check box that determines if this is a **Track Object**. If an object is a Track Object, when you zoom in on it, rails and ties will appear as magnification increases. When an object is first drawn, the Layer in which the object is being drawn determines its status as a Track Object.

If the line is a Track Object, the next fields will be active. Two control how terrain is conformed to the track. **Tunnel Track** indicates terrain should be conformed *over* the track, rather than under it. **Do not conform Terrain** is useful for track where the terrain should not be brought to the track grade, such as track on a bridge. The final check box, **Converging track**, is used to override clearance checking when you expect two tracks to be closer to each other than typically allowed.

Each object may have a unique color in 3rd PlanIt. For most editing, you will be using color by layer or color by object type (native colors take significantly longer to draw because each object is allowed to assume any color your system can display). As mentioned in the Tutorial, the Change Color button brings up the standard Windows Color Selection Dialog box. This dialog allows you to pick any of the standard colors you wish as a native color, and to create a palette of 16 additional custom colors, which is saved with the drawing. You must be in **Native Color Mode (Alt+N)** to see the color assigned here.

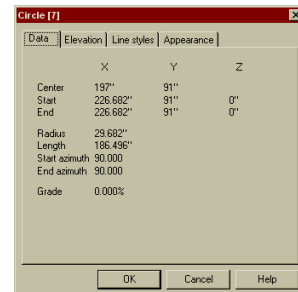


7.2 The Circle

7.2.1 Data

The Position and Size page of a Circle property sheet contains details similar to those found in the line Position and Size sheet. In the case of a Circle, the position of the center in two dimensions is provided along with the start and end positions. Also presented are the Circle's radius and length, given the boundaries of its arc.

A Circle's arc is always drawn counterclockwise from start point to end point. For ease of use, the Azimuth is used to specify a Circle's start and end points rather than an angle. (For reference, an Angle is measured counterclockwise from zero, and a line drawn at an Angle of zero degrees points exactly to the right of the (x, y) origin. An Azimuth is measured clockwise from zero; a line drawn at an Azimuth of zero degrees points straight up, or "due north." An azimuth of 90 degrees points "due east", and so on around the Circle in the same manner as a compass.)

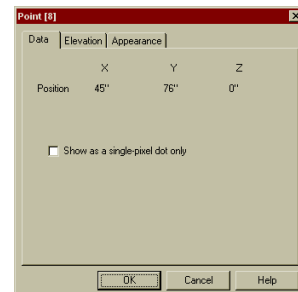


7.3 The Point

7.3.1 Data

As an object of infinitely short length and width, a point has few position characteristics and a consistent size.

Points are drawn in 2D with a small box around them to allow you to see them more easily. In 3D rendering mode, the points are drawn as dots and are generally not noticeable. Points are most often used as references for drawing other objects in a plan. When you need a Point in a drawing, but want it almost unnoticeable, select **Show as a single-pixel dot only**.

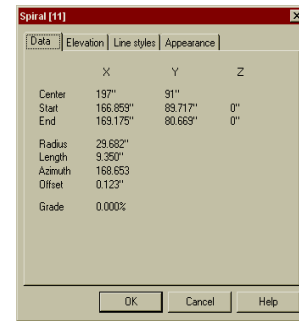


7.4 The Spiral Easement

7.4.1 Data

A Spiral Easement is an automatically generated object used to connect a circular curve to a tangent line. However, once a spiral is created, you can move it, align objects to it, and align it to other objects. You should do this with some discretion – it does no good to align a too-small spiral with a Circle just to “make it fit”.

Shown at right are two interesting values for the spiral: its Azimuth, measured in degrees at the tangent endpoint of the spiral, and its Offset, the distance from the extended Circle to the extended tangent line. John Armstrong’s fine book [Track Planning for Realistic Operation](#) offers an excellent discussion on the Spiral Easement, and presents several methods to lay one out on plywood when the time comes.



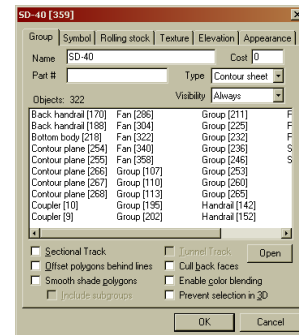
3rd PlanIt’s printing capabilities offer you the chance to plot the Spiral Easements you generate on any Windows-compatible printer. Your track plan can be plotted at 1:1 and spread over a number of pages for layout of any track segment. In testing this program on El Dorado Software’s HO Scale model railroad, we found it convenient to use pins to tack the pages in alignment on the sub-roadbed material. Once all were aligned, a dentist’s tool was used to poke rather significant holes into the sub-roadbed every inch or so. You could also use a “Ponce Wheel” from Micro-Mark. This device is a pointed roller wheel on a handle – you can simply run it along the track centerline, pressing down hard. When the track plan is removed, the holes are easy to see; the dots can be connected by pencil and the roadbed glued in place.

7.5 The Group

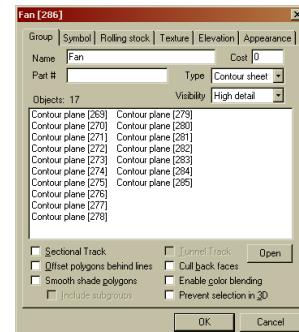
7.5.1 Unique Group Characteristics

Groups have many unique characteristics that make them different than other objects. The first page is much different than others; it is not a Data page. Instead, the Group page lists the member objects of the group and its name, part number and cost. The cost field shows up in the Object List, discussed in its own chapter.

Each member object retains all the characteristics of any typical Line, Circle, Group or other object, even though they cannot be selected independently from the group. From the Group properties page you can examine the specific placements and qualities of each object in the Group. Simply double-click any group member; in this case, Line [1] was double-clicked.



When you double-click a member object in a group, the member object is highlighted in the drawing and you are presented with the same properties sheet you would get if the object was not in a group. You can change any setting for the member object in its properties page, click OK to save the changes, and they will be incorporated into the group when (and if) you click OK on the group’s properties page.



If one group is embedded within another group, the group will show up in the object list as seen in the top example. You can double-click the group to get its group properties sheet, and double-click any of *its* member objects to view their property sheets. Groups can be nested to a depth of 64.

The **Type** field lets you designate the Group as a Contour Sheet. With this setting, any polygons in the group will have invisible outlines when viewed in 3D. The **Visibility** setting lets the group be hidden when the **Tools / Options / 3D Settings / Visibility** setting is low. This is typically used for groups within other groups, such as hiding the handrails on a locomotive at lower visibility settings.

The option **Offset polygons behind lines** is used only to control 3D appearance. Let's say you have grouped together a polygon as a wall, and a set of lines to indicate a door and window. If this option is *not* checked, the lines would blend into the polygon, since both are at the same distance from the viewpoint. Checking this option makes the lines clearly visible with no interruption.

Smooth shading also controls 3D appearance. One example where this would apply would be a sphere. Made of a group of polygons, the sphere takes on a very realistic appearance when smooth-shaded. This check-box lets you be specific about which polygons should smooth-shade with others. Only polygons within this group will be smooth-shaded together. If you want to include subgroups in the smooth shading, select the option **Include subgroups**.

The **Tunnel track** option is primarily used when working with sectional track. Tunnel track conforms terrain above it rather than below it, and is an option settable for all track objects. Since sectional track objects are made of Groups, this flag indicates all track within the Group is tunnel track.

Cull back faces improves 3D rendering speed, sometimes by quite a bit. If you have a closed object, such as a cylinder or sphere, the back faces of its polygons can be "culled", or prevented, from rendering. This can cause individual polygons to become invisible when viewed from the back, so use this with prudence.

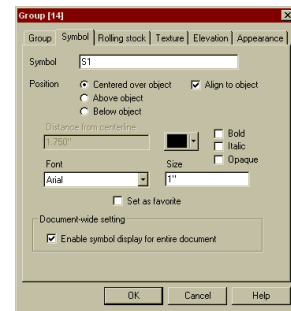
Enable color blending allows a smooth transition of color across adjacent polygons within a group.

Groups can be selected in 3D by holding the Shift key while clicking the Left Mouse Button. If you check the **Prevent selection in 3D** box, the group will not be selectable in 3D.

7.5.2 Symbol

You can assign any group a Symbol that can be displayed in the 2D view. This is frequently used for sectional track pieces – which are groups containing one track object. The Symbol can then be displayed next to (or above) the object for easy reference.

Each Symbol may have its own text font and size, and you can quickly enable and disable display of Symbols throughout the document from this page.



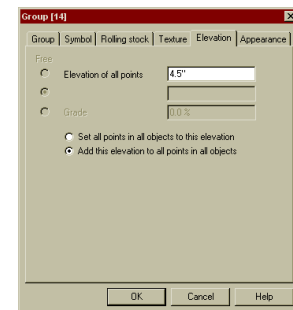
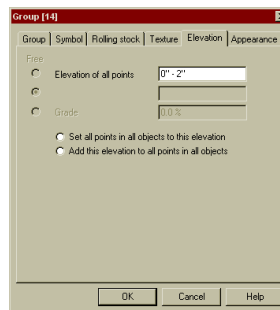
7.5.3 Rolling Stock and Textures

These pages let you designate the Group as a piece of Rolling Stock, and apply textures to the members of the group. Please see the **Rolling Stock** and **Texture** chapters for details on these powerful features.

7.5.4 Group Elevation

A group's Elevation needs different controls than an individual object requires. Because a group is a collection of objects, it is not possible to set an Elevation without knowing an awful lot about the nature of the group.

When you first see the elevation page for a group, the field **Elevation of All Points** will be set to the overall range of elevations in the object. In this example, the building is about 2 inches high, based at zero elevation.



The second example shows how an object can be shifted to a higher or lower Elevation. The Elevation of this building needs to be set to that of the terrain that supports it - in this case, 4.5 inches. The radio button **Add this Elevation to all points in all objects** has been checked. As a result, the building as a whole will be moved up 4 ½ inches when the OK button is clicked.

You may also change the overall Elevation of a group on-the-fly using the Select Tool. To do so, as you're moving an object, point the cursor at another object. Click the right mouse button before you release the

left mouse button, and the elevation of the group will be changed so that the lowest point of the group is at the same elevation as the nearest point of the second object.

7.6 Smart Turnouts

A Smart Turnout is a unique object that “understands” the geometry of railroad turnouts, crossings and slip switches. With this information, 3rd PlanIt can provide sophisticated connections with little effort.

7.6.1 Straight Turnouts

In the example to the right, an Atlas turnout is shown. The dimensions for this turnout (and all NMRA turnouts in 3rd PlanIt) were drawn from John Armstrong’s [Track Planning for Realistic Operation](#), Second Edition. The **Overall Length** corresponds to Armstrong’s dimension S on page 74 of the second edition. The **Routing Length** is dimension C, and the **Entry To Intersection** is the sum of dimensions P and Q. The **Rail Closure Radius** is also unique to a given turnout; the figures for NMRA turnouts were drawn from page 46 of Armstrong’s book. It is the radius of the curved segment of track and is provided in the data sheet for most manufactured turnouts. The **Switchstand** selection allows you to position the switchstand on either the Normal or the Routing side of the turnout. The **Symbol** page lets you custom-label each turnout, controlling the position, font and visibility of the turnout symbol.

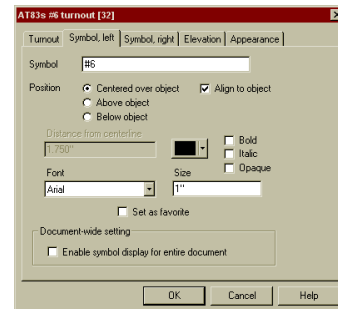
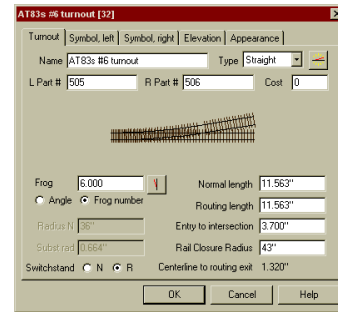
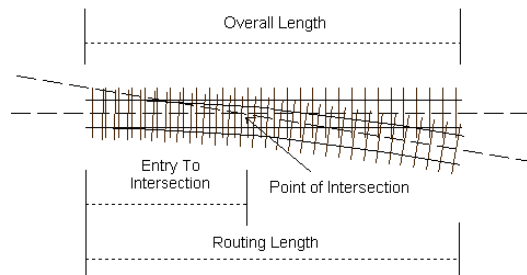
You can easily enter custom dimensions from manufacturers’ data sheets to define turnouts that are not in the Turnout Libraries, or to meet your needs if you are hand-laying the track or turnouts. Hand-layers will actually define these dimensions as part of their design process.

If you have a sample of the turnout you’ll be using, you can measure it to enter its dimensions. The best way to do this is with a piece of graph paper. A trip to an office or drafting supply store will yield many useful styles of “paper”. One long-lasting style is actually a thin plastic stiffener for a drafting surface; it has a very nice grid on its surface that meets our needs quite well. Another possibility is B, C or D size drafting paper. Whatever style you get, make sure you get the smallest grid spacing you can comfortably use. One excellent setting for spacing is 10 to the inch, giving a 0.1 inch grid. Since 3rd PlanIt lets you enter dimensions in any units, we’ve found that it is easiest to enter distances from a 0.1 inch grid... it’s much easier to estimate 6.77 inches, than to come up with the proper fraction for in-between distances.

Now lay your turnout on the graph paper. Align the entry of the turnout with any of the thicker lines on the grid, and align the centerline of the Normal track accurately along the grid. You can easily read the Overall Length, and the Routing Length. Please notice that the Routing Length is measured *along* the Normal track centerline, not in some imprecise manner along the curved segment. The Routing Length of most turnouts is the same as, or a bit less than, the Overall Length.

The Entry To Intersection length is a bit more difficult to determine accurately. This is the point where the Routing Track would intersect the Normal Track if the Routing Track continued straight. It’s close to the middle of the turnout on the centerline of the Normal Track.

We estimate the Point of Intersection using two people. One looks along the Routing Track with their eye at railhead height, holding a pen or pencil to mark the graph paper. The second looks down on the turnout from above. The first person moves the pen along the centerline of the Routing Track as viewed from the side, while the second notes the intersection.



When measuring a turnout, you will also need to determine the radius of the Closure Rail, or the radius of the two legs of curved turnout. This also can be a bit tricky. One method is to use 3rd PlanIt to draw a number of arcs of different radii and print them at 1:1. Lay the turnout on the arcs and pick the radius closest to that of the turnout.

Another method can be helpful for N or Z scale turnouts. Lay the turnout on a piece of paper and carefully trace the rails onto the paper. It's then easier to determine the centerline at several locations, and use a yardstick compass to sweep out the radius. If you trace the turnout onto tracing paper, you can lay that paper over the arc templates in the first technique to determine the radius.

7.6.2 Flexed Straight Turnouts

Turnouts such as those made by Central Valley and Pilz/Tillig allow you to flex them into curved turnouts. You can do the same thing in 3rd PlanIt. Simply press the **Flex this turnout** button on the turnout property page. The straight turnout will be converted to a special form of the curved turnout, in which you can control the radius of what was the tangent track prior to being flexed. This feature allows for very custom design of yards and very smooth, broad-radius turnout arrangements.

7.6.3 Curved Turnouts

Curved turnouts are actually quite difficult to measure and set up properly, but once you've got one correct the resulting layout is quite accurate.

The single most significant difference between defining a curved turnout and a straight one is the use of the **Entry To Frog Point**. In all other turnouts and crossings, the angle is defined directly or as a frog number. In the case of a curved turnout, the frog number can be very difficult to establish. Instead, the Entry To Frog Point measurement is used.

Realistically, the only way to accurately enter a curved turnout is to have a sample of the turnout itself, or access to mechanical drawings for the turnout. It is important that every dimension is accurate, especially if you envision having two or more curved turnouts in succession.

Print the turnout on your printer at a scale of 1:1 so you can verify its accuracy. Lay the turnout on top of the printout, carefully aligning the entry and exit of the larger radius track. Ensure that the intersection of the routing track appears correct, its endpoint is correct, and that the radii of both circles are accurate.

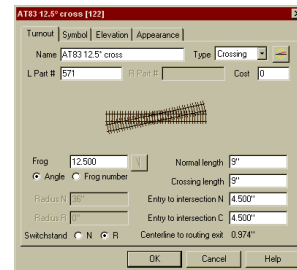
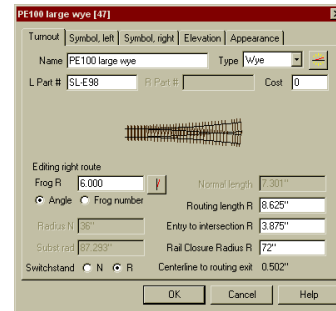
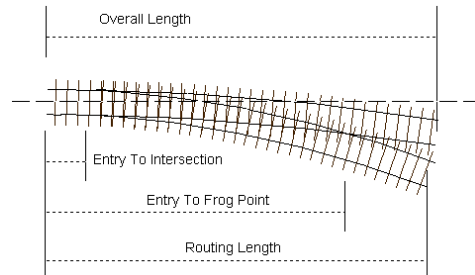
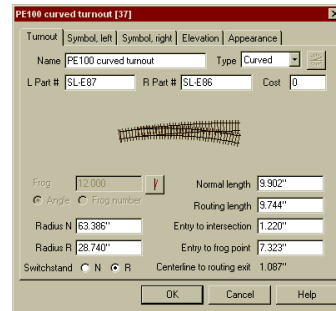
7.6.4 Wyes and 3-Ways

Defining a Wye or a 3-way turnout is pretty much the same as defining a straight turnout. The Left/Right button selects the left or right route and places its data in the fields. Make sure you press the **Lay Out Turnout** button before switching sides.

Wyes and 3-ways look symmetrical, but they usually are not. Carefully enter both the left and right side data for the component and if possible, verify it against a sample.

7.6.5 Crossings and Slip Switches

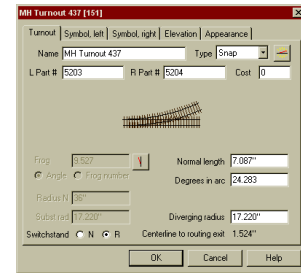
Crossings and slip switches are the most easily defined of the Smart Turnouts. All you need to know is the angle of intersection, the length along both tracks, and the distance to the intersection along both tracks.



Some crossings and slip switches are made with one leg longer than another. If such a crossing or switch is available in a pair, set up a different part for each member of the pair.

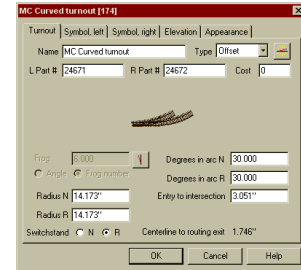
7.6.6 Snap Switches

A Snap Switch is very much like a standard straight turnout, except the routing leg is a true portion of a circle, with no straight segment. You can set the routing leg based solely on the radius and length of the curve.



7.6.7 Offset Curved Turnout

Many sectional track manufacturers offer a curved turnout that is made of two curves, both tangent to the angle of entry. The first starts at the point of entry; the second is offset by a specific distance. This type turnout can be set up directly from radius, length (in degrees), and offset.



7.6.8 Modifying a Turnout

You may change any of the turnout fields to your specifications, or to those provided by the turnout manufacturer. When you want to see the resulting turnout, press the **Lay Out Turnout** button.



7.6.9 Turnout Part Numbers

Part number fields are provided for all turnouts. When turnouts can be manufactured in a Left and Right orientation, such as straight and curved turnouts, two part number fields are provided. Enter the correct part number for each version of the turnout. When you look at the Object List the proper part number will be displayed based on the orientation of the turnout in the drawing.

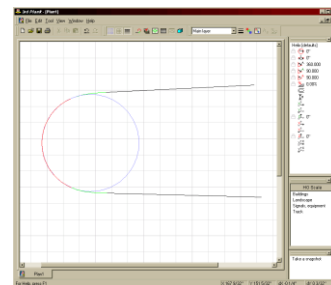
7.6.10 Turnout Symbols

Each turnout can be given two symbols, one for right and one for left. The symbols can be displayed in the 2D view for easy identification of the type of turnout. This is independent from the name of the turnout, and can be much shorter.

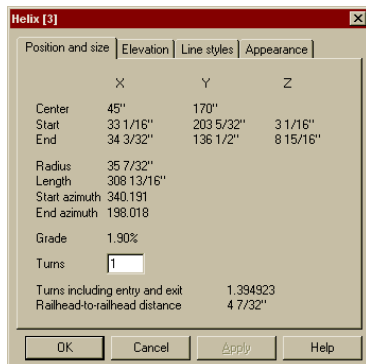
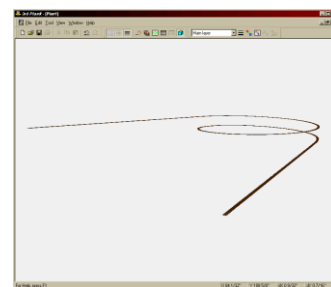
7.7 Helix Objects

The Helix is supported as a unique drawing object in 3rd PlanIt. It is derived from a Circle Object, and behaves in most ways as a circle does.

In the example at the right, a helix was drawn first. To create the entry and exit tracks, the Connect With Easements tool was used. The helix was clicked first, then the control key was held while clicking the second time, terminating the connection at the tangent. The same procedure was used on the other side of the helix.



The result is an entry and exit with easements, and a settable number of turns in the helix. For this example, the helix includes one full turn, beyond the entry and exit portions.



To set the Elevations and grade through the helix, use the Path Tool to select a path through the helix. In this example, if we assume the entry to the lower part of the helix is the top track in the drawing, one would click the top tangent track near the helix end. Clicking the lower tangent track completes the Path.

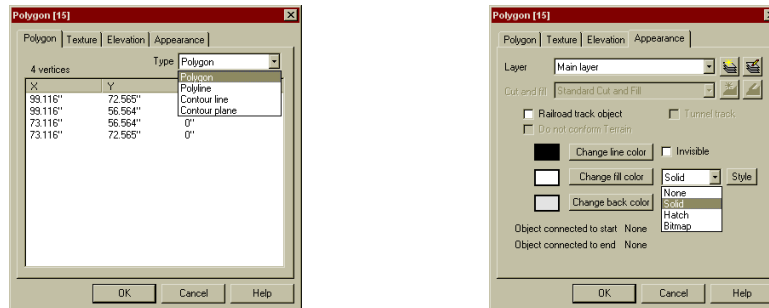
Setting the Elevation through a helix is no different than any other grade. Simply define the starting and ending points (or grade and one end point) and press OK. Viewing the helix in 3D confirms the grade is through the helix, easements, and both tangent tracks.

In the above-left drawing you can see the Position and Size page for the helix after completing this connection. It's about 1.4 turns long and has a railhead-to-railhead clearance of 4 7/32".

7.8 Polygons

Polygons, Polylines, Contour Lines and Contour Planes are all related: they each are composed of a list of vertices. Lines generally connect the vertices, although the lines may be turned off if desired.

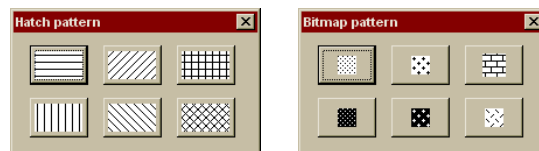
The Polygon property page for a rectangle is shown below. The four vertices are listed by coordinate, along with the vertex count near the top. On the right you can see a pull-down list with the four Polygon types. You can apply a Texture to a polygon on the **Texture** page; see the **Texture** chapter for more details.



IMPORTANT: Polygons are always “closed”, meaning the last point is automatically connected to the first point. Contour lines are “open”, unless you actually place the last vertex at exactly the same location as the first vertex. Contour Lines may be hidden in 2D or 3D using the **File / Settings / Topography / Invisible contour lines...** menu selection. Contour Planes are Polygons whose lines may be hidden by using **File / Settings / Topography / Invisible lines around contour planes...** menu selection.

In the above-right example you can see that polygons have an additional color setting: the **Fill Color**. Polygons lines may have different colors than the filled area within the polygon.

If you select a **Hatch** or **Bitmap** fill pattern, you can press the **Style** button to display the one of the selection dialogs shown at the right. Polygon elevations are treated in the same way as Group elevations. See the Groups section for details.

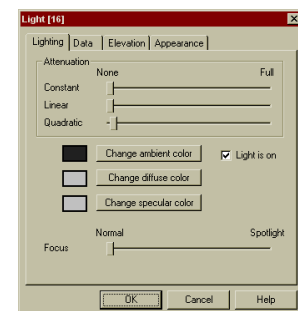


7.9 Lights

Lights control the appearance of terrain, buildings and other solid objects when they are rendered in 3D. The illustration at the right shows the various characteristics of a light that you can adjust.

7.9.1 Attenuation

These three slider controls adjust the rate that light dims with increasing distance from the light source. The **Constant** factor is like a dimmer control, decreasing the overall light from the source. The **Linear** control is based on distance from the light source; the farther from the source, the dimmer the object is. This factor is used to simulate pollution and dust, which decrease light linearly over distance. The **Quadratic** control adds a very realistic effect to lights. Have you heard of the “inverse-square law”, in which the available light decreases by the square of the distance? This slider control allows you to set the quadratic attenuation of the light to simulate what you see in your layout area.



7.9.2 Brightness and Color

These three settings tell 3rd PlanIt the color and intensity of the light source. The **Ambient Color** provided by the light illuminates all surfaces equally, regardless of their orientation to the light source. The **Diffuse Color** and the **Specular Color** control the amount of light reflected by Polygons surfaces, based on their orientation relative to the light source(s) and the viewer.

The **Diffuse Color** controls how much light is reflected in general from the surface of a polygon. For example, when you look at a leaf or a brick, you are seeing diffuse lighting reflected to you. The **Specular Color** controls the “shiny” part of the light. It’s like seeing the sun reflected in someone’s windshield, or watching the flashes from a mirrored ball as it turns.

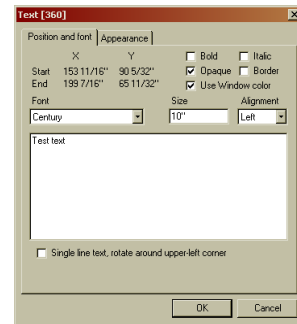
7.9.3 Spotlight Control

A light can be set up as a spotlight. It points downward from its location to illuminate whatever lies below it. As you adjust this slider control, you control the focus of the light. When at its leftmost point, the light will behave like a simple light bulb. As you move the control farther to the right, the light becomes more tightly focused on the point below the light.

7.10 Text

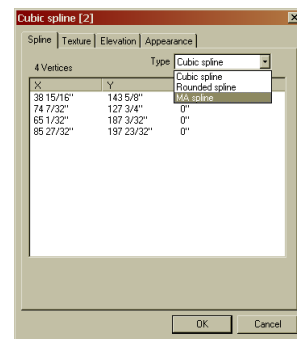
You can place text fields into your drawing. As seen at the right, you can control the font, size and characteristics of each text object independently. The check box **Single line text...** indicates the text object may be rotated.

Note that text size is measured relative to the drawing’s units, not in points. This lets you relate the size of the text to the size of other objects in the drawing. Text fields are also used for Elevation, Coordinate, Radius and Grade Markers, and may be similarly controlled.



7.11 Splines

There are three varieties of spline, as noted in the ToolKit chapter. You can change a spline’s type from the Spline Properties Page, as well as view the locations of each vertex.



8. Helix design

8.1 Introduction

When incorporating a Helix into a 3rd PlanIt design, it's important to remember that the Helix is only the means of getting from one track to another. The elevation, direction and location of the approach tracks at each end, together with the radius of the Helix and its number of turns, define the Helix in detail. The best way to get a feeling for designing with a Helix is to start with a simple example.

Before getting started, it's important to define "Curve", "Circle" and "Helix" as they are used in 3rd PlanIt. The definition of a **Circle** is fairly intuitive: it is a curving line of constant radius, always equidistant from a Center Point, which is 360 degrees in length so that its start and end points are located at the same X,Y position. It may or may not have a grade (a change in elevation). A **Curve** is a portion of a circle, less than 360 degrees, which may or may not have a grade. A **Helix** is a "Circle" of more than 360 degrees, which always has a grade.

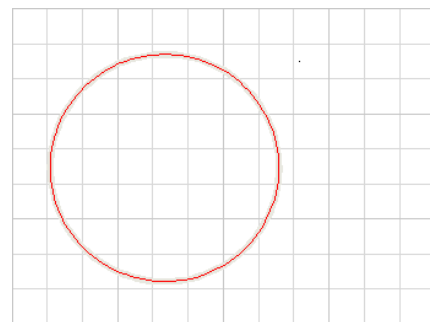
If you are designing a loopback curve that's less than or equal to 360 degrees, you must use a Circle or Curve. A Helix **always** is expected to have more than 360 degrees of curving track. With these definitions in mind, let's start learning how to use a Helix in your track plan.

8.2 Drawing the Helix



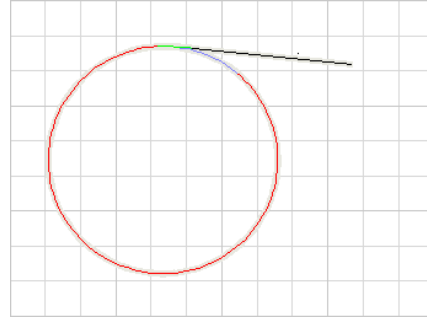
First, draw a Helix using the **Draw / Helix / Draw from center** tool. Place a helix of reasonable size in the center of a new track plan. The helix shown in this example has a radius of about 39 inches (1 meter) to ensure reliable operation with HO scale equipment.

For this example, the "Color by Object Type" mode is active (chosen by pressing **Alt+Y** on the keyboard). The helix appears red, like a circle would appear. That's because the default helix is made from a complete 360 degree Circle, plus an additional 360 degrees called a **Turn** in 3rd PlanIt. The track included in one or more Turns is colored a light purple, but it's not visible at this point because the entry and exit points have not yet been established. If you look at the Object Data Window at this point, the start and end points will have the same elevation. Ignore that for the moment; the program will determine the proper elevations for you in a later step.

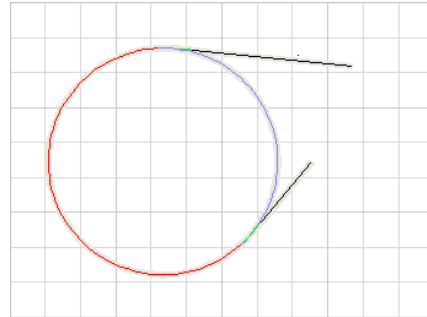


Now choose the **Connect with Easements** tool. You can use the **Connect Direct** tool, but I prefer to include easements in the approaches to a Helix. Point the cursor to the top of the Helix, making sure it highlights to confirm you are pointing at it. Click the Left Mouse Button (press and release it). After clicking the Left Mouse Button (LMB), move the cursor to the right. A red line will follow the cursor from the top of Helix. Should the red line happen to start at the bottom of the Helix, simply click the Right Mouse Button (RMB) and it will swap to the top of the Helix.

Although the Connect Tool is most frequently used to connect two existing objects, it can also be used to make a connection from an existing object and terminates anywhere in the drawing. We'll use that feature to design our Helix. Hold down the **Ctrl** key on the keyboard, and the Arrow of the Connect Tool will change to a Crosshair, indicating that you may now "Connect" to any point in the drawing. Hold the **Ctrl** key down and position the approach track. Still holding the **Ctrl** key down, click the LMB to achieve results similar to those you see at the right. You can now see a portion of the Turn of the Helix colored purple. The tangent approach track might be the higher level or the lower level... it does not matter. The details of elevation will be automatically set later in the process.

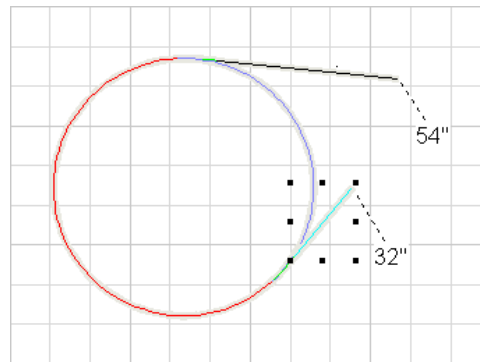
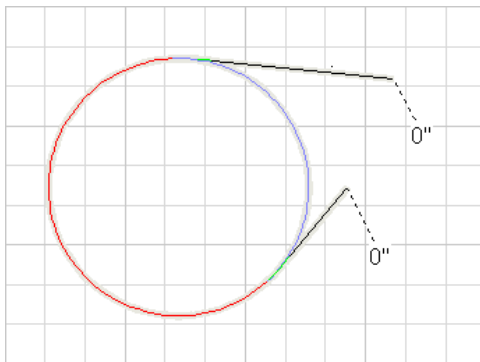


Using the Connect Tool in exactly the same manner, establish the other approach track. As you can see in the image to the right, more of the Turn of the helix is visible. Since 3rd PlanIt is in "Color by Object Type" mode, you can see the Tangent Track colored black, the curved track as red, the easements as green, and the visible Turn of the Helix colored purple. The "Color by Object Type" mode lets you easily select the desired track segment, even when the joint between two objects is not obvious, such as where the easement joins the tangent track and curved track.



Again, the elevation of the two approach tracks is unimportant at this point. The only important feature is the placement of the two approach tracks. Simply envision one track as the "upper" approach track and the other as the "lower", even though all track objects have the same elevation when you draw them.

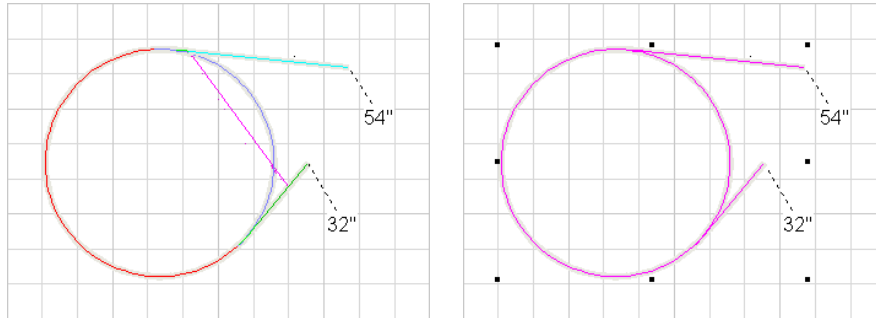
To help demonstrate this point, two Elevation Markers have been added to the drawing in the images below:



As you can see, all track objects were originally drawn at an elevation of 0 inches. In this example, we will choose to make the upper level at 54" and the lower level at 32". To do this, select one approach track and set its elevation to 54". This is most easily done in the Object Data Window, setting both Z values to 54" in one case and 32" in the other. Experienced users need only set the "most distant" elevation. When you click on a Z data value in the Object Data Window, a shrinking circle will appear at the end of the line corresponding to the Z value you selected. You need only set the elevation of the ends of the Lines farthest from the Helix.

Select the **Path Tool**, available in the ToolKit just below the **Connect Direct** button. Point to the upper tangent track near the end closest to the helix and click the LMB. Don't click while pointing to the green-colored easement, or the grade will not be properly designed. As shown in the left image below, if you have properly clicked the upper tangent track, it will highlight, first in magenta, then in light blue when the

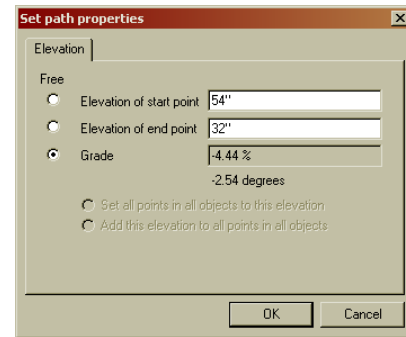
cursor points at other track objects. Point to the other tangent track approaching the spiral, make sure it highlights then click the LMB once again to establish a Path between the two tangent tracks. The whole Path will then appear in Magenta.



Setting the grade through the helix is easy. Simple press **Ctrl+E** to bring up the Elevation dialog box, or click the **Elevation and Grade** button in the Property Bar (shown at the right). The **Set Path Properties** dialog box will appear with the Elevation control page.



You can see the elevations you chose for the approach tracks have already been set up in the dialog box. The resulting grade is -4.44%, a negative number because the grade is computed from the higher elevation to the lower elevation.

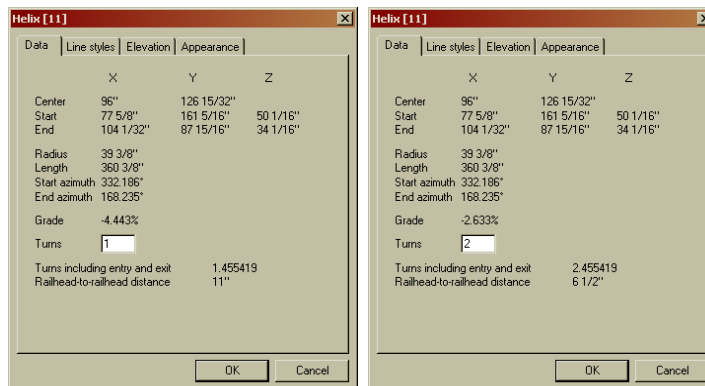


This grade is too steep for use in a real model railroad, but it is very useful in this design example. There's no need to change any values in the Elevation page, so click OK to establish a grade of 4.44% through all the track included in the Path. Swap to 3D using the **Tab** key or the **Render 3D** button in the Property Bar. You may need to adjust the view a bit using the Arrow keys, but in the end you will see a smooth grade through all the track highlighted in the Path, including the Helix. The results are shown at the right.



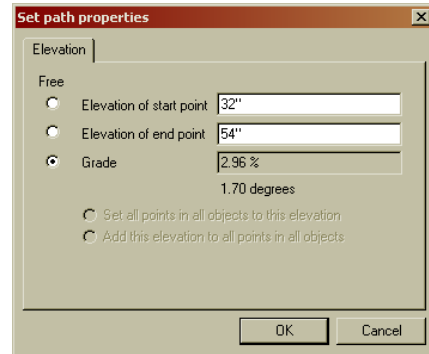
It looks good, but obviously a grade of 4.44% is not usable in a Helix that may be inaccessible when your layout is built. It is too steep, which may cause locomotives to lose traction, or in the worst case, the whole train might fall off the track to the inside of the Helix. There are several ways to adjust the grade of the Helix. The best place to start is to add a Turn to the Helix.

Swap back to 2D using the **Tab** key or the **Render 3D** button in the Property Bar. Choose the Select Tool from the ToolKit. Point to a blank area of the drawing and click the LMB to deselect all objects. Point to the Helix and click the LMB to select the Helix. Bring up the Property Sheet by pressing **Enter**, or choosing **Edit / Properties**. The Data page shows all the critical values of the Helix, including the **Railhead-to-railhead distance**. You can see that it is 11" in this example, far more than required for an HO scale Helix. Change the number of Turns to two, and note that the separation is now 6 1/2", sufficient for HO scale operation.



It's important to note that the *exact* number of turns, including the entry and exit segments of the Helix, is 2.455419 in this example. You can only adjust the number of complete "helical" turns as an integer value. The fraction to the right of the decimal point is determined exclusively by the geometry that connects the helix to the approach tracks. If you were allowed to change the decimal portion of the number of turns, the endpoints of the Helix would no longer be aligned to the approach tracks. This will be discussed in more detail below.

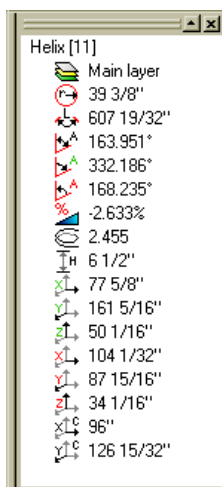
After changing the number of Turns from one to two, you have only changed the grade of the Helix itself. The approach tracks still have their original 4.44% grade. Press OK to set the number of Turns in the Helix to two then use the Path Tool exactly as you did before. Bring up the Elevation dialog box again, as before. The endpoint elevations will be the same as the first setting, in this case, 54 and 32 inches.



Note that the overall grade is -2.96% including the approach track, rather than -2.633% shown in the Helix data page. That's because the Helix endpoint elevations were originally established with a grade of 4.44 percent. This "compressed" the vertical space available to the Helix, compared to what is available when the Helix has an additional Turn.

Now that you have made a Path that includes both approach tracks, as you did originally, the overall grade through all track segments is now 2.96 percent. This will result in a Helix whose endpoints are slightly higher and lower than in the original attempt. Again, this is a matter of geometry, not a fault in the track design or the use of the Helix in the design. Simply press the OK button to establish a constant grade throughout all the track segments in the Path.

Swap to 3D to view the results. The Helix now has an extra Turn, and remains smoothly connected to the approach tracks. All track segments are at the same grade. To see the details of the Helix, swap back to 2D and select only the Helix. The Object Data Window will then show all critical dimensions and locations, as shown below.



Because the approach tracks have a lower grade than the first attempt, the vertical distance available for the Helix is greater. Therefore, the endpoints of the Helix are higher and lower, the grade is a bit steeper, and the Railhead-to-railhead distance is a bit greater. The resulting 2.6% grade and 6.5" spacing is quite reasonable, and this design could be built and operated successfully.

But what would you do if you couldn't achieve workable results by simply adding or removing Turns from the Helix? In the real world, there are only three ways to make more subtle changes to the grade or spacing of the helix: 1) change the upper and/or lower elevations, 2) change the geometry of the approach tracks, or 3) change the radius of the Helix.

Approach number one is the easiest. If you haven't locked-in the elevations of the upper and lower levels of your layout, simply change the elevation of one or both approach track endpoints. Use the Path tool and Elevation dialog as before until you find elevations for both levels that are comfortable for operation and result in a usable Helix.

Approach number two is accomplished by changing the location that the approach segments enter the Helix. You won't be able to make a large change in grade this way, but it may be adequate if your dimensions are only slightly out of tolerance. Delete one or both of the approach tracks, including the tangent track and easement. Use the **Connect with Easements** tool exactly as you did before, but relocate one or both approach tracks to change the length of track in the Helix. Again, use the Path Tool as before and see if you can obtain usable results.

Finally, you can change the radius of the Helix itself. Note that, if you change the radius of the Helix, it *by definition* changes the geometry of the approach track. The easements were originally created to transition to the radius of the original Helix, and the locations of the easements and tangent tracks were determined based on the Helix. Changing the radius of Helix necessitates changes to the approach tracks as well. The best way to do this is to delete the original Helix and draw a new Helix with a different radius. Move the new Helix until it is near the original approach tracks. Then delete the approach tracks, both tangents and easements, and redraw them using the Connect Tool in the same manner shown above. From experience, you may want to set the Number of Turns in the new Helix before using the Path Tool to set the grades. Next, use the Path Tool in the same manner to set the grade through the approach tracks and the new Helix. If you've chosen the new radius well, you should end up with a grade and spacing that meets your design goals.

With these techniques, you will never need to manipulate the endpoints or grade of the Helix directly. The Helix dimensions are set automatically with the Path and Elevation tools, based on the geometry of the approach tracks. You could even "flip" the Helix top-to-bottom, simply by swapping the elevations of the approach track endpoints and using the Path and Elevation tools in the same manner. If you find yourself tempted to change the values of the Helix directly, watch out! You'll need to change the approach tracks to correspond to the changes in the Helix, which can be very difficult and time consuming. It's always best to start with approach tracks that make sense, a reasonable radius and Number of Turns for the Helix, and use the Connect, Path and Elevation tools.



Think of the Helix as the result of the elevation and orientation of the upper and lower approach tracks, the radius of the Helix, and the number of Turns within the Helix. Focus on these variables, and use the Path and Elevation tools to automatically compute the proper Helix for the elevation, geometry, radius and number of turns you select. In fact, it's best to not even view the Helix in 3D until you have applied the Path and Elevation tools, or you might be concerned that something isn't right. Be confident that the Path and Elevation tools will compute a Helix that corresponds to the elevation of the approach tracks, considering the radius and number of turns in the Helix.

You can also use these procedures between Layers in the 3rd PlanIt track plan. You need to make sure that the **Allow only the Active Layer to be edited** checkbox in the Layer Enable Dialog is not checked, and the layers containing the track objects are not frozen. There is no difference in technique, whether the track objects exist in the same Layer, or more than one Layer.

9. The Object List

Each drawing is composed of hundreds or thousands of individual objects, and it is often helpful to be able to look at those from a different perspective. Using the Object List, you can examine objects based on their type and their characteristics. Your selections on the Object List and changes made in the Object List are reflected in your drawing. If you leave the object list open while drawing, the changes you make to your drawing are reflected in the Object List.

To bring up the Object List, press the **Object List** button on the Document Bar, as shown at right. You can also press **F8**, or select **View / Object List**.



9.1 Sample Object List

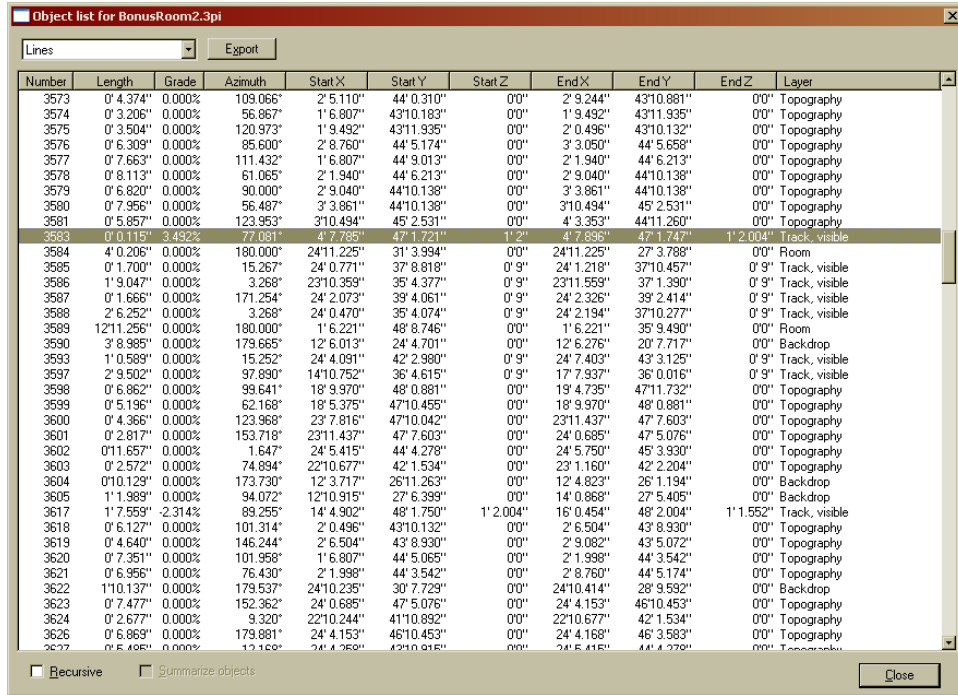
The Object List for the lines in the file BonusRoom.3pi is presented below. The Object List is resizable, and remembers the size and location you set for it. Also, you may resize all the columns; the column sizes are retained as well. These settings are stored in the Registry for you as a user, not with the document.

Number	Length	Grade	Azimuth	Start X	Start Y	Start Z	End X	End Y	End Z	Layer
3574	0' 3.206"	0.000%	56.867°	1' 6.807"	43'10.183"	00"	1' 9.492"	43'11.935"	00"	Topography
3575	0' 3.504"	0.000%	120.973°	1' 9.492"	43'11.935"	00"	2' 0.496"	43'10.132"	00"	Topography
3576	0' 6.309"	0.000%	85.600°	2' 8.760"	44' 5.174"	00"	3' 3.050"	44' 5.658"	00"	Topography
3577	0' 7.663"	0.000%	111.432°	1' 6.807"	44' 9.013"	00"	2' 1.940"	44' 6.213"	00"	Topography
3578	0' 8.113"	0.000%	61.065°	2' 1.940"	44' 6.213"	00"	2' 9.040"	44'10.138"	00"	Topography
3579	0' 6.820"	0.000%	90.000°	2' 9.040"	44'10.138"	00"	3' 3.861"	44'10.138"	00"	Topography
3580	0' 7.956"	0.000%	56.487°	3' 3.861"	44'10.138"	00"	3'10.494"	45' 2.531"	00"	Topography
3581	0' 5.857"	0.000%	123.953°	3'10.494"	45' 2.531"	00"	4' 3.353"	44'11.260"	00"	Topography
3583	0' 0.115"	3.492%	77.081°	4' 7.785"	47' 1.721"	1' 2"	4' 7.896"	47' 1.747"	1' 2.004"	Track, visible
3584	4' 0.206"	0.000%	180.000°	24'11.225"	31' 3.994"	00"	24'11.225"	27' 3.788"	00"	Room
3585	0' 1.700"	0.000%	15.267°	24' 0.771"	37' 8.818"	0' 9"	24' 1.218"	37'10.457"	0' 9"	Track, visible
3586	1' 9.047"	0.000%	3.268°	23'10.359"	35' 4.377"	0' 9"	23'11.559"	37' 1.390"	0' 9"	Track, visible
3587	0' 1.666"	0.000%	171.254°	24' 2.073"	39' 4.061"	0' 9"	24' 2.326"	39' 2.414"	0' 9"	Track, visible
3588	2' 6.252"	0.000%	3.268°	24' 0.470"	35' 4.074"	0' 9"	24' 2.194"	37'10.277"	0' 9"	Track, visible
3589	12'11.256"	0.000%	180.000°	1' 6.221"	48' 8.746"	00"	1' 6.221"	35' 9.490"	00"	Room
3590	3' 0.989"	0.000%	179.665°	12' 6.013"	24' 4.701"	00"	12' 6.276"	20' 7.717"	00"	Backdrop
3593	1' 0.589"	0.000%	15.252°	24' 4.091"	42' 2.980"	0' 9"	24' 7.403"	43' 3.125"	0' 9"	Track, visible
3597	2' 9.502"	0.000%	97.890°	14'10.752"	36' 4.615"	0' 9"	17' 9.937"	36' 0.016"	0' 9"	Track, visible
3598	0' 5.862"	0.000%	99.641°	18' 9.970"	48' 0.881"	00"	19' 4.735"	47'11.732"	00"	Topography
3599	0' 5.196"	0.000%	62.168°	18' 5.375"	47'10.455"	00"	18' 9.970"	48' 0.881"	00"	Topography
3600	0' 4.366"	0.000%	123.968°	23' 7.816"	47'10.042"	00"	23'11.437"	47' 7.603"	00"	Topography
3601	0' 2.817"	0.000%	153.718°	23'11.437"	47' 7.603"	00"	24' 0.685"	47' 5.076"	00"	Topography
3602	0'11.657"	0.000%	1.647°	24' 5.415"	44' 4.278"	00"	24' 5.750"	45' 3.930"	00"	Topography
3603	0' 2.572"	0.000%	74.894°	22'10.677"	42' 1.534"	00"	23' 1.160"	42' 2.204"	00"	Topography
3604	0'10.129"	0.000%	173.730°	12' 3.717"	26'11.263"	00"	12' 4.823"	26' 1.194"	00"	Backdrop
3605	1' 1.989"	0.000%	94.072°	12'10.915"	27' 6.399"	00"	14' 0.868"	27' 5.405"	00"	Backdrop
3617	1' 7.599"	-2.314%	89.255°	14' 4.902"	48' 1.750"	1' 2.004"	16' 0.454"	48' 2.004"	1' 1.552"	Track, visible
3618	0' 6.127"	0.000%	101.314°	2' 0.496"	43'10.132"	00"	2' 6.504"	43' 8.930"	00"	Topography
3619	0' 4.640"	0.000%	146.244°	2' 6.504"	43' 8.930"	00"	2' 9.082"	43' 5.072"	00"	Topography
3620	0' 7.351"	0.000%	101.958°	1' 6.807"	44' 5.065"	00"	2' 1.998"	44' 3.542"	00"	Topography
3621	0' 6.956"	0.000%	76.430°	2' 1.998"	44' 3.542"	00"	2' 8.760"	44' 5.174"	00"	Topography
3622	1'10.137"	0.000%	179.537°	24'10.235"	30' 7.729"	00"	24'10.414"	28' 9.592"	00"	Backdrop
3623	0' 7.477"	0.000%	152.362°	24' 0.685"	47' 5.076"	00"	24' 4.153"	46'10.453"	00"	Topography
3624	0' 2.677"	0.000%	9.320°	22'10.244"	41'10.852"	00"	22'10.677"	42' 1.534"	00"	Topography
3626	0' 6.869"	0.000%	179.881°	24' 4.153"	46'10.453"	00"	24' 4.168"	46' 3.583"	00"	Topography
3627	0' 5.485"	0.000%	12.168°	24' 4.258"	43'10.915"	00"	24' 5.415"	44' 4.278"	00"	Topography

You may sort on any column in the Object List. It's often very useful to find out the track segments with the highest grades... simply click the column header for the Grade column.

Everything looks OK, except for line 3583, which as a grade of 3.49%. It might be good to go back and check that line... perhaps it was drawn incorrectly, or perhaps the grade here is truly as steep as is shown and might need to be re-examined.

The **Recursive** checkbox shows all objects in the drawing, even if they are within Groups.



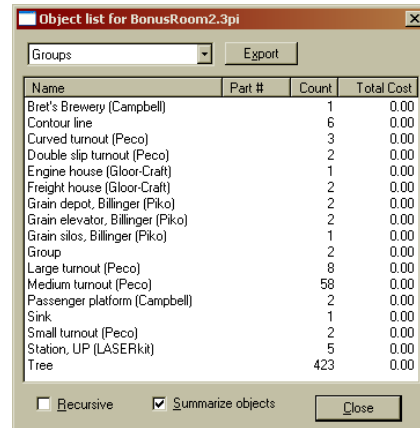
To find the line or other object you are interested in, simply click the row that includes the object as shown below. When you select the row, the object is highlighted in your drawing, and a large shrinking circle animation draws your attention to its location.

9.2 Groups, Turnouts and the Object List

The Object List treats groups and turnouts in a special way: they be summarized.

Although the costs have been eliminated from this example, the result of summarizing groups is still evident. Each group object having the same name is gathered into one row. The Count column shows the total number of groups with that name, and the Cost column shows the sum of all the prices of the group objects.

You can easily see the total cost of your layout using the **Summarize Groups** feature if you are using sectional track, as section track piece is a group and can have its cost set. If you are using flex track, you can use the Path Tool to find lengths of important track segments and get a good idea of your cost in flex track.



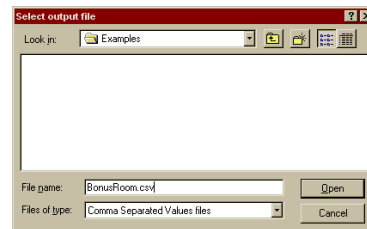
may

Total

each

9.3 Exporting Data

By pressing the Export button, you can produce a "Comma Separated Value" file (CSV file) for import into other applications. You can the file as you wish and place it in the directory of your choice.



name

10. Layers

You may set up a number of layers in your track plan and assign objects to be members of any layer.

10.1 Layer Enable Dialog

The Layer Enable dialog as would appear in BonusRoom.3pi is shown at the right.

The layers that are visible are checked in the boxes at the left. Each layer's data is drawn in the color of the layer, including the count of objects in the layer and the Active status of the layer. New objects are created in the Active layer.

You may set 3rd PlanIt to display your drawing in order of layer if you wish. If you have selected **File / Settings / 2D Display / Sort objects by layer**, the bottom layer in the dialog – in this case, the Room layer – will be painted first. The next painted layer in BonusRoom would be the Benchwork layer, and so on until the final layer to be painted is the Train Cars layer.

You can therefore control which objects are always visible in Sort By Layer mode by setting their position in this dialog box. Those on top in the list will be on top in the drawing. The buttons with Up and Down Arrows are used to adjust the position of a layer relative to the other layers.

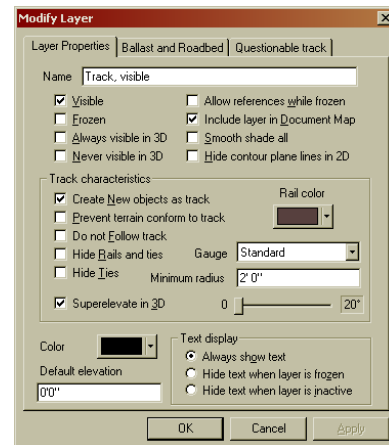
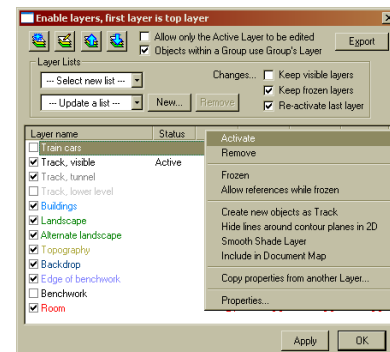
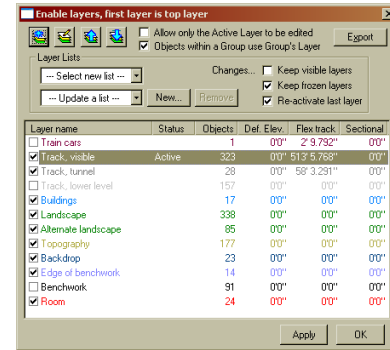
The leftmost button at the top creates a new layer; the button to its right modifies the currently selected layer (Track, visible). You may also modify a layer by double-clicking the row that includes the layer. You are presented with a property sheet for the layer. As shown in the second example, you can right-click any layer in the drawing to **Activate** the layer, **Remove** it from the drawing, and set other characteristics. Note that you cannot remove layers that contain objects.

10.2 Layer Properties

Through this property sheet you may adjust a layer's color, indicate whether the layer is **Visible** or **Frozen**, whether it contains track and determine if it will show in the Document Map. If the layer is not visible, none of its content objects will be drawn in the primary display. Frozen layers cannot be edited in any way. However, checking **Allow references while frozen** allows you to use objects in Frozen layers to be used as the base for drawing objects or measuring.

Marking a layer **Always visible in 3D** is used primarily for layers that hold lights. These layers can then be hidden in 2D, but will be active in 3D to light the layout as desired. The converse setting, **Never visible in 3D**, lets you view layers only in the 2D plan view.

If you check **Include layer in Document Map**, all objects in the layer will be drawn in the thumbnail map of the plan when it is visible. The **Smooth shade all** checkbox lets you select Smooth Shading for all



objects in the layer. This is typically used for topography layers. If you want to **Hide contour plane lines in 2D** when editing the plan, you can select that option here on a layer-by-layer basis.

Several options control track presentation. If you check **Create New Objects as Track**, all new objects drawn in this layer will be treated as track objects – rails and ties will appear as you zoom in. Note that objects from the library, or pasted from elsewhere, retain their track object status. **Prevent terrain conform to track** treats any track in this layer as non-existent; Tunnel Track is an example of a layer which should not conform.

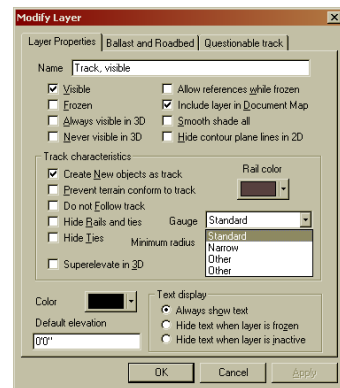
Do not follow track lets you create roads for cars based on their centerline, but have that centerline ignored by locomotives and rolling stock. Tramways embedded in streets are a typical example. **Hide Rail and ties** is generally used to create a path through a drawing that is followed by an invisible locomotive or the Engineer’s View. This lets you create a kind of guided tour through your layout in 3D. **Hide ties** is typically used for streetcars.

Text display is also related to the text object’s layer. The default is to **Always show text**, so any text will show regardless of a layer’s status. However, you may also choose to **Hide Text when layer is frozen**, or **Hide Text when layer is inactive** for your convenience.

3rd PlanIt allows you to mix up to four track gauges in a drawing. Each new drawing starts with two default gauges: **Standard** and **Narrow**. You can define two other gauges as well, perhaps for streetcar track or other gauges. Using the **Gauge** pull-down, you select the kind of track in this layer. When magnified, the rails and ties of track objects will be spaced as set in **File / Settings / Track**. You can define two extra gauges.

When a new object is drawn in the selected layer, it will be assigned to the **Default elevation**.

You can set the **Minimum radius** for each layer. If you draw a circle whose radius is less than the minimum for the layer, you’ll be presented a Warning Box. The minimum radius is also checked when circles are added indirectly using the Connect Tool.



By selecting **Superelevation** and choosing an angle of deflection, you can simulate the appearance of superelevated track in 3D. Clicking on the angle field at the right lets you control the range of the slider.

10.3 Other Pages

The **Ballast** and **Roadbed Profile** pages let you define automatic ballast and roadbed on a by-layer basis. See the chapter “Auto-Ballast and Auto-Roadbed”. The **Questionable Track** page sets the clearances and other values used for checking your layout, as shown in the “Verifying Your Layout” chapter. You can also adjust the maximum coupler angle allowed between cars during 3D operations.

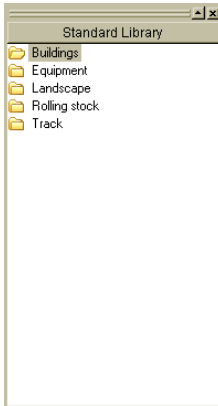
10.4 Suggestions for Layers

Layers can be used to your advantage in several ways. Here are a few suggestions that you may find helpful.

As in BonusRoom, keep logically related items together. The Room layer was drawn first and made absolutely perfect before continuing. The layer was then locked to prevent accidental changes. After the track was well along, the Benchwork layer was added to keep track of the specifics of the benchwork. This was important in BonusRoom, as it is multi-level and the lower layer trackwork needs to work its way through the legs that support the benchwork

In BonusRoom, the Landscape layer is green, the Edge of Benchwork and Topography layers are earth-colored, buildings are blue, and the track is black except in tunnels, where it is gray. These colors help the eye differentiate the objects while you are editing, and still paint at the highest possible speed.

11. The Library Bar



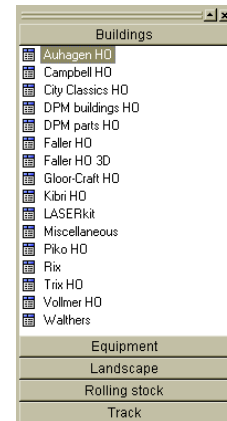
The Library Bar provides easy access to a large library of objects you can incorporate into your design. As shown at the left, each scale is grouped into five categories: Buildings, Equipment, Landscape, Rolling Stock and Track. By clicking a category, you will see a list of manufacturers. You can then click a manufacturer to see a list of available library objects.

To add an object to your drawing, click the object name in the Library Bar. It will appear centered in the screen ready for placement.

3rd PlanIt is defaulted to its Standard Library of objects. To select another library of your own creation, right-click in the Library Bar, select **Change Library** and press the “...” button. You will be presented with the **Tools / Options / Environment** dialog. Click the **Change** button to the right (three dots) to receive a standard directory browsing

window. The default Standard Library is generally located in the folder **C:\Program files \ 3rd PlanIt \ Standard Library**. This may be different on your system, for example, if you chose to install 3rd PlanIt on another drive.

You can change the presentation of the Library Bar to suit your preferences. Right-click on the Library Bar background and select **Group by category** to obtain the presentation seen on the right. If you would like to have the most possible space for the Library Bar, use **Tools / Options / Controls / Tabbed Data/Library Bar** to display the Info Bar with tabbed windows.



11.1 Adding New Library Files

You may easily extend the Object Library. All Object Library files are standard .3PI drawing files, placed within the Object Library. You can freely add files or folders to the Object Library structure at any point. If your Library Bar is set to **Group by category**, you can even put a favorite library at the “top level” and its name will appear on one of the Object Library bars for primary access.

You can add Object Library files of your own creation, or you can bundle current library objects in a new library. For example, you might be working with certain track and certain trees. You could make a .3PI file that contains all of the objects and save it in the Object Library. Selecting this single library could provide all the objects you need for most of your work.

Although it is possible to modify 3rd PlanIt’s Object Library files, it is not a good practice. New releases of 3rd PlanIt will update the library and cause you to lose your personal data. If you try to modify a 3rd PlanIt Object Library file, you will be warned that your changes will be lost when you next upgrade.

The best way to use the Object Library is to create a file to hold your library objects, such as “My objects”, and store it in the Object Library where you see fit. Right-click the Library Bar and refresh it, and you should see the name of your library file. If there are any groups or turnouts in the file, you can see them by double-clicking the file name like any other library member. *3rd PlanIt installation will not delete files you create in the Object Library, it only replaces its own files or provides new manufacturer’s data. If you avoid the naming conventions of 3rd PlanIt’s object library files no conflict should ever take place.*

11.2 Adding Objects to the Library

Once you have a personal Object Library, you will likely want to add new designs to it. This most important thing to remember when adding an object to the Object library: *you must add it to a file, not a folder*. If you haven't already created a file in the Object library to hold your objects, go back to the section above and create one.

There are two ways to do this, depending on what you'd like to accomplish. If you have a single object (a group or a turnout) that you'd like to add to the Library, right-click the Object and select **Add To Library**. You can also choose **Edit / Add to Library**. You will be offered a standard file browser window. Select the Object Library file you'd like to add the object to and press **Open**, or double-click the file name. The object will be added and the Library Bar refreshed.

The other way to modify an Object Library file is to edit the file directly. Simply select **File / Open**, and find the file in the Object Library. When you are done modifying the file, close the file (or save it) and refresh the Library Bar by right-clicking it and selecting **Refresh**.

11.3 Removing Objects from the Library

To remove an object, right-click the object's name in the Library Bar and select **Remove from Library**. You can also edit the library file, remove the object, close or save the file, and refresh the Library Bar.

11.4 Auto-scaling

When you insert an object into a drawing, the 3rd PlanIt Library Manager compares the scale of the library file with the scale of the drawing. If they are different, the object is automatically resized to the scale of the drawing. This allows you to use any building in the library in any scale layout – at least during the design process! If you've rescaled a building, you may need to scratch-build it to see it on your layout.

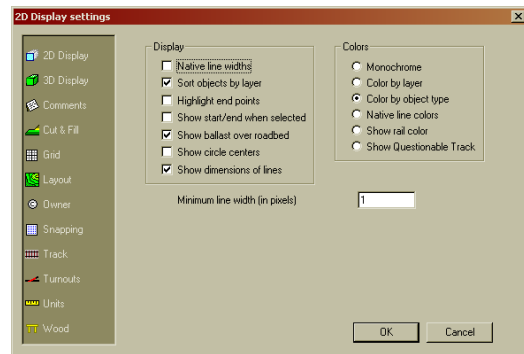
12. File Settings

Each file carries with it a number of settings that define how the file is measured and presented. They are available for review in **File / Settings**; the various pages of the file settings for BonusRoom.tpi are shown here.

12.1 2D Display

The first page deals with display characteristics, and offers different settings for 2D vs. 3D views. The options on this page not only control the display appearance, but how long it takes to display your plan.

Native line widths instructs the program to draw all lines with their exact width (as opposed to the closest standard width). **Sort objects by layer** control the order objects are drawn on the screen; if checked, the lowest Layer in the Layer Enable Dialog will be drawn first, and the highest Layer last. **Highlight End Points** causes all endpoints of each object to be drawn with a tick mark. It is helpful to determine the start and end of adjacent objects. **Show start/end when selected** is a helpful feature for editing objects. The Object Data Window frequently allows you to modify coordinates for the start and end of the object. When this option is chosen, if you select an object, its start is indicated by a green dot and its end is shown with a red dot. **Show ballast over roadbed** enables display of both ballast and roadbed. The 2D view will refresh more quickly if only roadbed is drawn. **Show Circle Centers** draws a dotted line from the start and end of each circle or curve, identifying the exact center of each curve. The radius is also shown. **Show dimensions of lines** is a document-wide setting to turn on/off the dimension numbers on lines.



The fields on the right allow you to select the style of color presentation you want. **Monochrome** is useful for some printers which do not support colors as input (although most monochrome printers do a credible job of producing gray-scale output from colors). **Color by Layer** is most useful in editing, or when you would like to have high-speed 3D rendering on a large drawing, and you still would like to have color.

Color By Object Type is very useful when editing. If you work with easements a lot, you'll notice it's difficult to tell where a spiral ends and where the Circle or line next to it starts. **Color By Object Type** colors each object type differently, making the distinction easy.

The **Native line Colors** selection is for when you want esthetics, as it shows the exact color assigned to each object. **Show rail color** shows rail in the color selected in the Layer of the rail object.

Show Questionable Track is a very powerful tool for ensuring your layout will operate properly, with adequate horizontal and vertical clearances. For a full description of the mode, see the Chapter "Verifying your Layout".

Minimum line width (in pixels) allows you to have lines wider than a single pixel. If you have a very high-resolution monitor and video card, you may find that single-pixel lines are too narrow to be seen comfortably. Here, you can set a width that is pleasing to your eye.

12.2 3D Display

This page controls the style and speed of 3D rendering on the drawing. There are other 3D rendering options in **Tools / Options / 3D settings** that apply to all files. These settings control only the current file.

Native line widths instructs the program to draw all lines with their exact width, rather than a thin line. In general, one should not draw wide lines with the intention of viewing them in 3D. They are best used to highlight items in the 2D view. If you want a good, wide area in 3D, it's best to draw two contour lines and use the **Connect Terrain** command to create the wide area in polygons.

Track display style affects rendering speed. The fastest setting is **Track as lines**. No ties will be shown, but on older displays or very complex drawings, this might be useful. **Track as two lines** is a nice, general-purpose setting that is reasonable realistic and relatively fast. If you select **Include ties as rectangles** and the 3D view will show every tie as a polygon with proper dimensions. However, you can dramatically speed up 3D rendering by selecting **Include ties as lines** and still have a very satisfying display. If you have a very fast video board, select **Include full detail** and the ties and rails will have thickness and detail.

The fields on the right control the presentation of object colors in 3D, independent from the **2D Display** settings. Please refer to the previous section for details of these settings.

The final two entries are distances. These distances control two display characteristics simultaneously. The fields **Do not display objects closer to / farther from the Camera than** settings limit the range of what can be seen. You want to limit the minimum Camera-to-object distance, so very close objects don't cover up the primary items of interest. Limiting the maximum distance can cut back the number of items to be rendered in 3D, speeding up the frame rate. The other characteristic these two settings control is the level of detail in 3D objects.

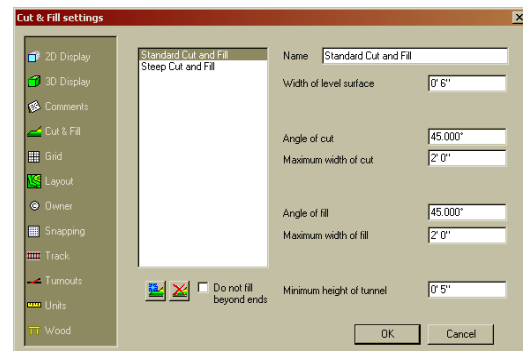
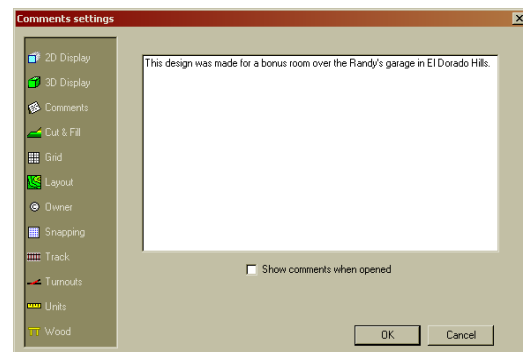
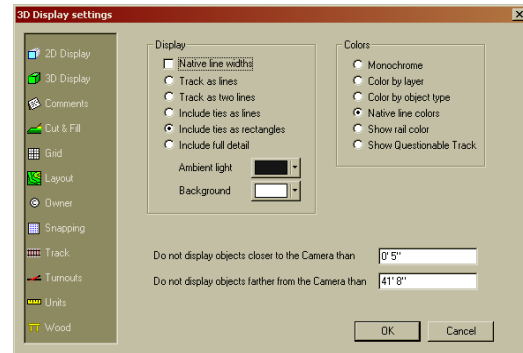
Your video board may have a 16- or 32-bit "Z buffer". This is a kind of list of what is closest to the camera and what is farthest away. Your video board gives you a number of chunks of distance that objects can occupy (16-bit is 65.536, for example). The greater the distance between the **closer to** and **farther from** settings, the less resolution is available in the Z buffer. For best performance, keep the near distance as large as possible, and the far distance as small as possible.

12.3 Comments

On the **Comments** page, you can make notes about your drawing that are passed along to others who view it. By checking the box **Show comments when opened**, the text from this page will be presented each time the file is opened. This is a good way to introduce viewers to the concepts behind your drawing.

12.4 Cut and Fill

You may define many different Cut and Fill settings for your document. Cut and Fill comes into effect whenever you have a Terrain Mesh and use the **Conform to Objects** command. If track is too high or too low, the Terrain Mesh will be modified based on these settings, either cutting into existing terrain or filling underneath the track by raising the height of the terrain. See the **Terrain** chapter for more details of Cut and Fill settings.



12.5 Grid

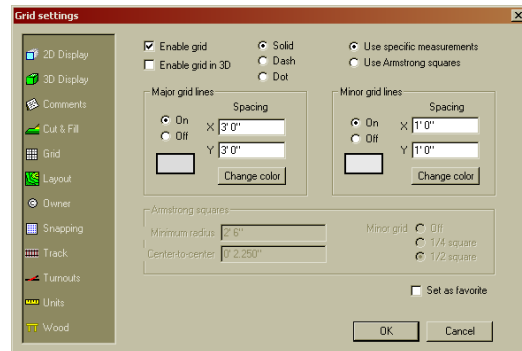
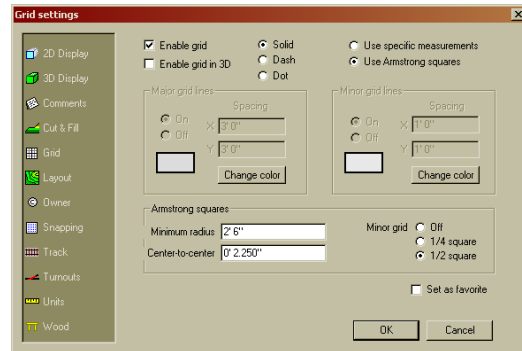
In this property page you control the style of the alignment grid presented in 2D display mode. There are two primary grid styles: based upon specific measurements for the document, or based on “Armstrong squares”. John Armstrong first defined these useful squares, which he explained well in his book [Track Planning for Realistic Operation](#). 3rd PlanIt provides direct support for Armstrong squares for your convenience.

In the top example, you can see fields to enable the grid, to set the line style, and to select the use of specific measurements or Armstrong squares. The top example has selected specific measurements, so the **Major Grid Lines** and **Minor Grid Lines** fields can be edited. This example shows a major grid at 3 foot intervals, and a minor grid at 1 foot intervals. The color for each Grid Line can be independently set.

In the second example, **Armstrong squares** have been chosen as the grid spacing unit. In this mode, you provide a **Minimum radius** you want established for the layout, and the **Center-to-center** track spacing for that radius curve when parallel track is to be laid. By definition, the length of the side of an Armstrong square is $(R + 2C)$, or the radius, plus twice the center-to-center spacing.

This measurement becomes the dimension of the major Grid Lines when using Armstrong squares. You may then select your minor Grid Line style: every $\frac{1}{4}$ square, every $\frac{1}{2}$ square, or turned off. You may switch back and forth from Armstrong squares to your specific measurements as your needs change.

To save the settings as your favorites, click the **Set as Favorite** checkbox. Each new document you create will be given the settings you choose as your favorites.

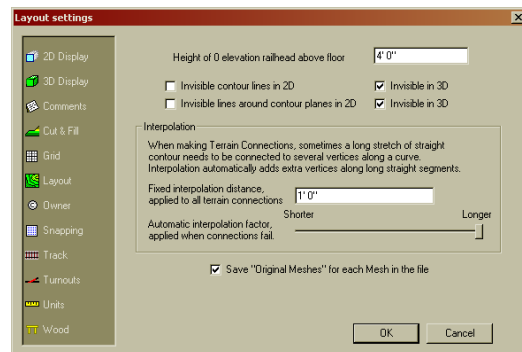


12.6 Layout

This is where you control various features of the layout and its topography in your layout.

12.6.1 Zero Railhead Height

In the first field you can set the actual height of the drawing’s “0.0” elevation as it will be built in your room. It’s most convenient to design your layout around a “0.0” elevation. However, if you would like Reference Points to reflect their true height above the ground, you can set this field appropriately.



12.6.2 Topographical Display

The next four check boxes control the display various topography features. You can make Contour Lines visible or invisible in 2D and/or 3D mode. You can also make the lines around Contour Planes invisible in 2D and/or 3D mode (the triangles in a Terrain Sheet).

12.6.3 Interpolation

When Terrain Sheets are made using the **Connect Terrain** tool, many connections can be made using the contour lines exactly as you entered them. However, there are times when there are just not enough vertices to make a successful connection between two contour lines.

Interpolation solves this problem. There are two stages of interpolation:

Make sure no excessively long segments are present. For example, a ballast contour may have frequent vertices through its curves and spirals, but none within the tangent tracks. This first stage of interpolation uses the **Fixed Interpolation Distance** to add vertices simply based on the distance between one vertex and the next. If any two vertices are farther apart than the Fixed Interpolation Distance, more vertices will be added to keep the distance between them less than the Fixed Interpolation Distance.

If the first connection could not be made, reduce the interpolation distance by the **Automatic Interpolation Factor** and try the connection again. This step will be repeated up to ten times, or until a successful connection is made. If you have a particularly tough connection, you can reduce the **Automatic Interpolation Factor** on this page and attempt the connection again.

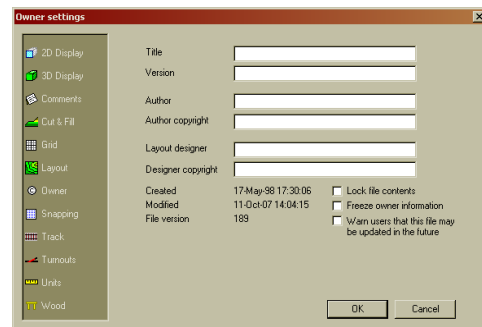
These settings will be different for different scales and personal styles in contour line layout. With the auto-interpolation capabilities of 3rd PlanIt, you can successfully connect virtually any contour lines.

See the chapter “Terrain” for more specific details of these fields.

12.7 Owner

These fields allow you to identify the drawing, its author, and copyright information. It also gives a brief look at the history of the file, noting its creation and most recent modification date.

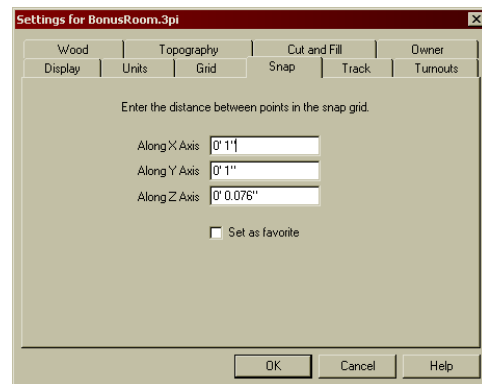
The **Freeze Owner Information** field locks the owner data to what is in the fields when you press OK. The field **Warn users that this file may be updated in the future** is used primarily if you’re distributing an object library, such as the Object Library of 3rd PlanIt. If this field is checked, a user will be warned if they attempt to add an object to the file using the Library Bar.



12.8 Snapping

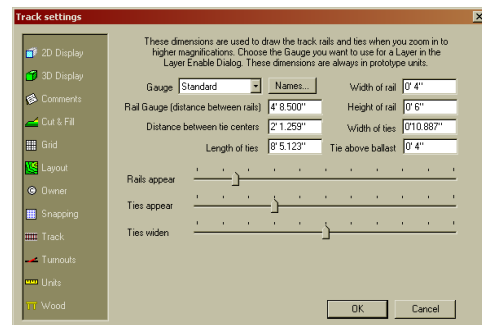
You may set the number of snap positions per foot (or meter) using this page. When drawing objects, the starting and ending points will snap to the nearest snap position. When moving objects, the object will snap to the nearest snap position as you move it.

IMPORTANT NOTE: If you are in **Auto Align** mode, the snap grid *will not* affect movements of track objects. That’s because you want to be able to precisely position a track object in relationship to another, letting the Auto Align feature provide final positioning and alignment.



12.9 Track

This property page defines the dimensions of the track in the layout for use when drawing the layers containing track. All track dimensions are entered in prototype units. 3rd PlanIt uses scaled sizes calculated from the prototype sizes entered here when rendering track in both 2D and 3D modes.



Using the **Gauge** pull-down, you can display the dimensions for each Gauge the drawing supports. Press the **Names...** button to define the names of each gauge. Please note: this page simply defines the characteristics of each kind of Gauge. The Layer a track object is in determines the actual gauge used for a piece of track. Use the Layer Properties to choose from the four Gauges you set up in this location.

At the bottom of the page, three sliders let you control the magnification at which rails appear, ties appear as lines, and ties widen to their prototypical shape. The farther a slider is to the right, the more magnification is required to show the feature.

12.10 Turnout Settings

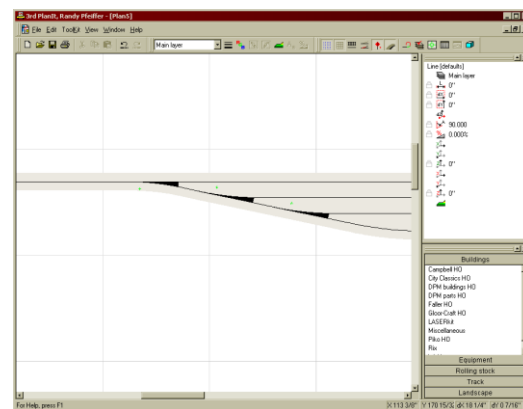
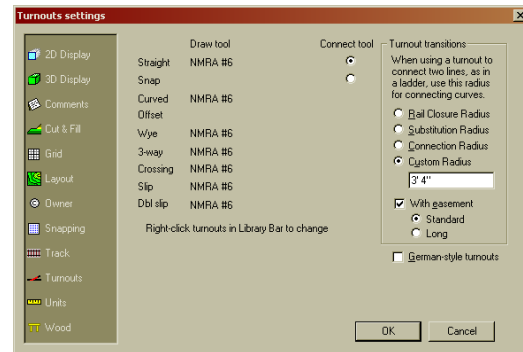
You may see the current defaults for drawing turnouts and set the defaults for the Turnout Connect Tool on this page. The boxes at the left show the kind of turnout that will be created when drawing each kind of turnout that is available in 3rd PlanIt.

The column on the right defines characteristics of the Turnout Connect Tool. If a turnout requires a connecting curve to successfully connect two tangent lines, the radius of the curve will be as selected here.

The **Rail Closure Radius** and **Substitution Radius** are both characteristics of the turnout, and will change as you select different turnouts. The **Connection Radius** is selected using Connect Tool, Set Fixed Radius; choosing this selection keeps all your connecting curves consistent. Finally, you may enter a **Custom Radius** that is unique to turnout connections.

You may check **With Easement** to have 3rd PlanIt insert a transition easement whenever a connecting curve is inserted. If the connecting curve is very short, the easement may be eliminated to provide a proper connection.

The option **German-style turnouts** fills in a small triangle at the frog of each turnout, as is typical in German and other European drawings.

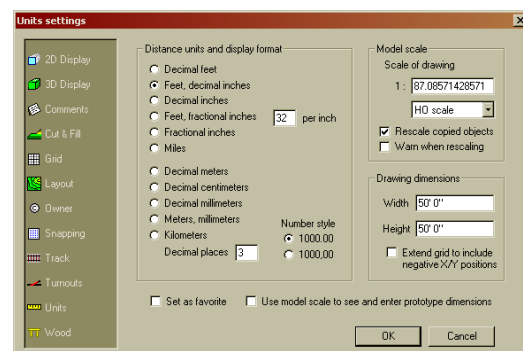


12.11 Units

This important property page lets you choose the units in which your track plan is measured, and the Model Scale you are using.

The left box, **Distance units and display format**, lets you choose between the American and Metric systems. Within each system, you can choose your preferred means of formatting a measurement.

The upper right box contains the **Model Scale** of the drawing. This convenient scaling factor is applied to a drawing's measurements when they are displayed, or when you type them. If you are laying out trees or buildings, or if you are measuring the length of your main line, it's helpful to use Model Scale so you can work in familiar units.



The upper right box also controls the behavior of the file if it is part of the Object Library. In the chapter on the Library Bar, you will see that objects are automatically rescaled when they are placed into a drawing from a library. Using the check-boxes in the upper right box, you can control this behavior. If you don't want objects rescaled at all, disable the top check-box. You can also warn the user that an object is being rescaled; this is appropriate if your library file contains buildings only made in N scale, for example.

To switch to and from Model Scale, use the check box in the lower center, the **View / Use Model Scale** pull-down or **Ctrl+M**. The **Drawing Dimensions** show the width and height of your plan in the selected units and scale. If you want the (0, 0) origin to be at the center of the drawing rather than the lower-left, check the **Extend grid to include negative X/Y positions** field. If you select the **Set as Favorite** check box, new documents will be created with these styles.

Whenever you are presented with a field for you to enter a measurement, you may type the measurement in any valid format. You may enter fractions one time and decimals the next; as long as your number is a recognized format, it will be properly interpreted.

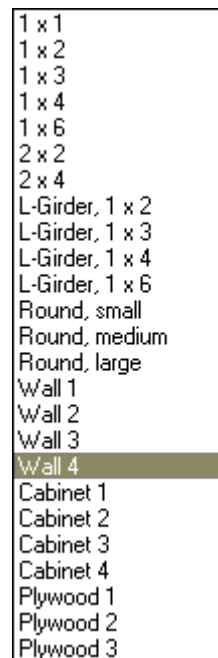
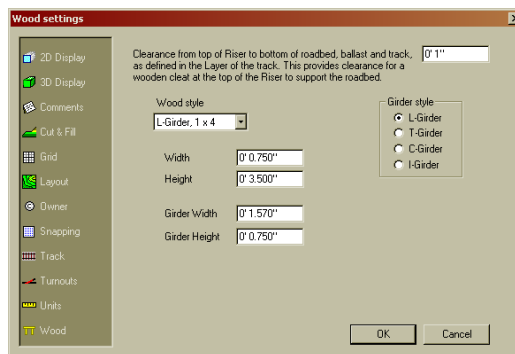
Remember, 3rd PlanIt assumes you are entering numbers in feet, inches, meters, millimeters – the units you've chosen in this page. If you're in Decimal Inches but want to enter 2 feet, you'd need to enter **2'** to override the Decimal Inches setting. You can mix Metric and American formats freely. If you're in Decimal Inches and enter 2.54cm, you'll get a distance of 1 inch.

Valid American formats	2.25 '	2.354 '
	2' 4 1/4"	2' 4.25"
	2' 3"	27"
	28 1/4"	28.25"
Valid Metric formats	1.03m	1030mm
	1 1/2m	55 1/4 mm

12.12 Wood and Wall Settings

This dialog lets you control the dimensions and style of wood and walls in your drawing.

The first field, **Distance from top of riser to railhead**, is used when slicing wood used as a riser. Select a piece of wood that's vertical and issue the **Slice at Intersection** command (**F5**). Then click the nearest track segment to the riser, and the riser's top end will be trimmed so it lies below the track railhead at the specified distance.



Styles **1 x 1** through **L-Girder, 1x6** are all “Dynamic size” styles. This means, if you change the dimension of any of these items, **ALL ITEMS IN THE DRAWING** of the same style will change to the new dimension also.

Styles **Round, small** through **Plywood 3** are “Fixed size” styles. When you set a new size in this dialog box, you are only setting the size for *future* objects of this style. Existing objects with these styles will retain the size at which they were drawn.

You can also indicate whether you want to build using “L-Girder” or “T-Girder” style joists.

13. Tools and Options

You may select various application-wide preferences using **Tools / Options** or pressing **Alt+O**. If you are using Windows NT or above, these preferences are saved in the section of the Registry assigned to you as a user. Each user has a personal set of 3rd PlanIt preferences. Windows 98 users are provided a single set of preferences.

13.1 3D Settings

3rd PlanIt uses the OpenGL subsystem for 3D rendering. Specific settings for 3rd PlanIt and its interaction with OpenGL control the speed of the 3D rendering on your system. You may turn on and off various features to find the best compromise of realism and rendering speed on your system.

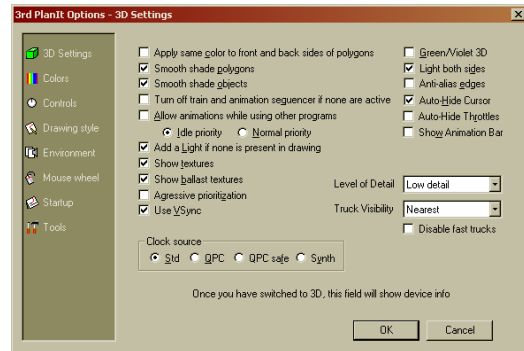
The **Apply same color to front and back sides of polygons** option determines if the user sees a difference between the color of the front and back surfaces of each polygon in the drawing. **IMPORTANT:** If you are designing a 3D object, you should *always* have this option switched off. When enabled, the boundaries between adjacent polygons in boxes and other such objects are less visible. It takes longer to render if different colors are applied to front and back, but it ensures accurate results. **Lights both sides** should be turned on to best see different front and back colors.

Smooth shade polygons instructs OpenGL to vary the lighting across the surface of each polygon. On older/slower video boards, turning this off might greatly improve performance. **Smooth shade objects** controls the overall use of Smooth Shading between polygons within objects. Even if an object or layer is marked for Smooth Shading, if this option is not checked, the object will not be smooth-shaded. Rendering time is much faster without Smooth Shading.

Anti-alias edges causes lines to be drawn slightly wider than normal and their edges smoothed. **Green/Violet 3D** is chosen when wearing green/violet glasses, rather than red/blue, for anaglyphic 3D. You should generally leave **Add a light if none is present in drawing** checked. You can **Show textures** and **Show ballast textures** independently. Each adds overhead in 3D rendering. **Aggressive prioritization** is generally not needed, unless 3rd PlanIt seems to stop and start in 3D. **Use VSync** can improve the smoothness of screen-to-screen transitions on some video boards, at a price in frame rate.

You can control the operation and priority of animations, which includes the movement of trains when in 3D. **Turn off train and animation sequencer when none are active** is a power-saving setting for laptop computers, and is usually left unchecked. **Allow animations when running other programs** can generally be enabled if you have a fairly powerful computer. Otherwise, other applications may bog down when trains are running in 3rd PlanIt. It's best to use **Idle priority**, the lowest priority, but if you have a dual-processor system, you might choose **Normal priority**. If you wish, you can **Auto-hide cursor** and **Auto-hide throttles** independently. When you stop moving the mouse, they will disappear, and will reappear when you move the mouse or press a key.

Groups created in 3rd PlanIt can be marked with a Level Of Detail setting, so you can easily switch from high-speed real-time detail to slow rendering with complete detail. The overall setting is controlled with the **Level of Detail** field. **Truck visibility** actually removes trucks from rendering when they are so far away you generally can't see them. This helps keep 3D operations fast.



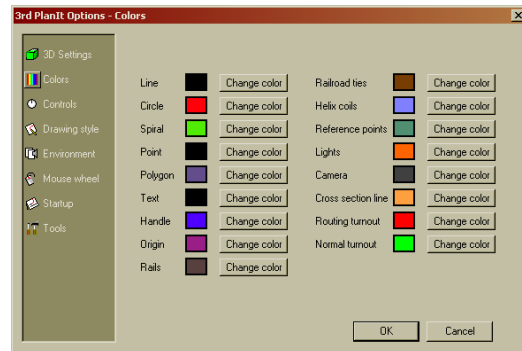
Finally, there are four clock settings. The first, **Std**, uses a high-resolution 64-bit clock for timing. If your system doesn't have this feature, you can select **QPC**, for "Query Performance Counter", a technique for determining timing. On some computers, there is a hardware fault that can make QPC unstable. In this case, **QPC Safe** may provide the best timing. Finally, for laptops that vary the speed of their clocks in response to battery and temperature conditions, the **Synth** setting may provide the smoothest operation.

13.2 Colors

This page allows you to select the colors used when your document is in **Color By Object Type** mode (set within the document, using **File / Settings / 2D/3D Display**). The colors for switchstands are also set here, along with the color to use when drawing the railroad rails and ties in track objects.

The 3D Background setting controls the color of the screen where there are no objects in 3D mode. You may find that a black background is esthetically pleasing when your drawing contains a light. The default setting allows a simple drawing with no lights to be rendered well.

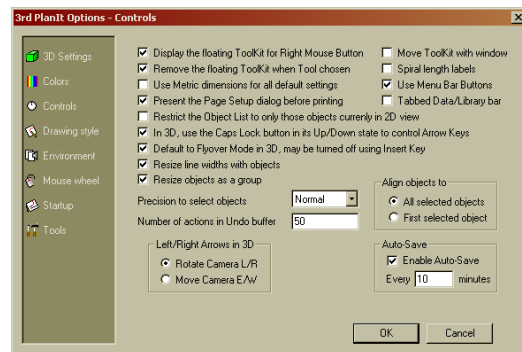
The colors for "Routing turnout" and "Normal Turnout" are used for the turnouts' switchstands, to indicate the setting of their points. This controls color in both the 2D and 3D modes.



13.3 Controls

The first check box determines if a right-click displays the ToolKit. If not, a right-click brings up the document context menu. If so, you can double-click the right button to get the document context menu. The second check box causes the ToolKit to disappear after a command is selected if the toolbar is not docked. You may have the ToolKit move with the main window using **Move ToolKit with Window**.

If you prefer Metric settings, select **Use Metric dimensions for all default settings**. It's usually best to select this option if you have Windows itself set to metric measurements. You can also control the style in which numbers are displayed to meet your personal preference.



Present the Page Setup dialog before printing is a default setting. If you always use the same printer from the same document, you can disable this screen, thereby making printing more direct.

The next check box allows you to **Restrict the Object List to only those objects currently in 2D view**. This is a helpful option, especially when drawing a large plan. You can zoom into a small area, disable a few layers if you like, and restrict the Object List. When you display the Object List, it will only contain the visible objects. This is usually a lot less information to manage, allowing you to find specific objects more quickly.

Default to flyover mode in 3D, may be turned off by Insert key is a default setting. You can navigate the drawing in 3D, smoothly flying over the drawing area, by pressing and holding mouse button while dragging the mouse. You can disable/enable the feature using the **Insert** key in 3D. You can also control the nature of the **Left / Right Arrows in 3D**. They can rotate the view (the default setting), or move from side-to-side if you choose.

Two resizing options allow for specific control when resizing Groups. **Resize line widths with objects** ensures the line widths stay proportional to the object size. However, if your intention is to increase the size of an object while leaving its line widths intact, you may disable this setting. **Resize objects as a group**

controls the way resizing works when more than one object is selected. By default, the objects are treated as if they were grouped.

The field **Precision to select objects** controls the sensitivity of the cursor when selecting objects. If you feel it is too difficult to highlight an object, you can change this option to expand the cursor's active area.

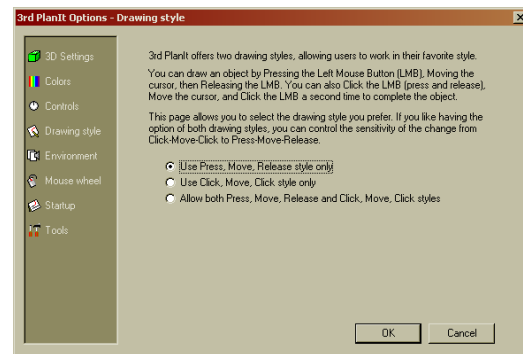
3rd PlanIt comes with an adjustable Undo buffer that stores the last few changes you've made to the drawing (Ctrl+Z performs the Undo function). By default, 50 changes are stored. You can increase this value to store more changes, but be aware that this will require more memory, as each changed object is stored until the Undo buffer "wraps around" and re-uses the memory.

Auto-save provides a backup to your drawings, should something happen while using the program that causes an abnormal shutdown. If you have Auto-save enabled, a copy of your file will be written out every few minutes. This file can then restore your work to the point it was last saved when 3rd PlanIt is restarted.

13.4 Drawing Style

3rd PlanIt lets you control the drawing and editing style of its user interface to meet your personal preference. Users of other CAD systems may be most familiar with the "Click-Move-Click" interface. In this style, one draws a line by pointing at a location, clicking the left mouse button, moving the cursor to the final location, and click the left mouse button once again.

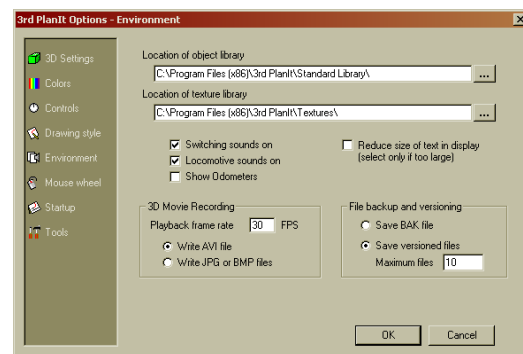
In the Press, Move, Release style typical of popular current CAD and consumer products, a line is drawn differently. The user points to the starting location, presses the left mouse button and holds it down, moves the cursor to the final location, and releases the mouse button. As first installed, 3rd PlanIt allows you to use either style. You can also confine its behavior to one of the two.



13.5 Environment

This page allows you to define the relationship between 3rd PlanIt and the files on your computer.

The first setting lets you select the location of the Object Library. You can press the "..." button to use a standard directory lookup dialog to specify the Object Library root directory. Only files and folders within this directory are shown in the Library Bar. You can also change this value by right-clicking the Library Bar and selecting **Change Library**. There is also a Texture Library associated with 3rd PlanIt, whose location can be chosen in the second field. Both of these library folders are generally found within **C:\Program files\3rd PlanIt**, although your installation may vary.



If you prefer to have coupling and uncoupling sounds disabled when viewing in 3D mode, uncheck the **Switching sounds on** option. You can independently disable the locomotive sound, as well. There are scale odometers built into rolling stock, which you can display with **Show Odometers**.

Due to variances in graphics presentation on some computers, if text does not display at the size indicated in its properties, try checking the box **Reduce size of text in display**.

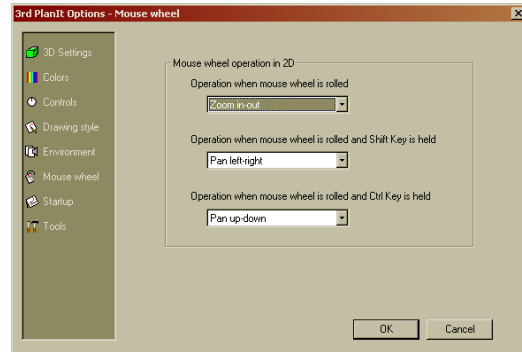
The default frame rate for creating AVIs or frame sets from 3D operations is 30 FPS. This produces very smooth and fairly large animation files. You can lower the frame rate, typically choosing 20, 15 or 10 FPS. You can also choose to write AVI files directly, or a set of individual frames that you paste together into an animation using a 3rd party tool.

13.6 Mouse Wheel

If your computer is equipped with a mouse that has a “Scroll Wheel”, you can control the reaction of 3rd PlanIt to mouse wheel movements.

The first field lets you pick the standard reaction to the mouse wheel from one three choices: **Pan Up/Down**, **Pan Right/Left**, and **Zoom In/Out**. The default action is to Pan Up/Down, but another very popular selection is Zoom In/Out.

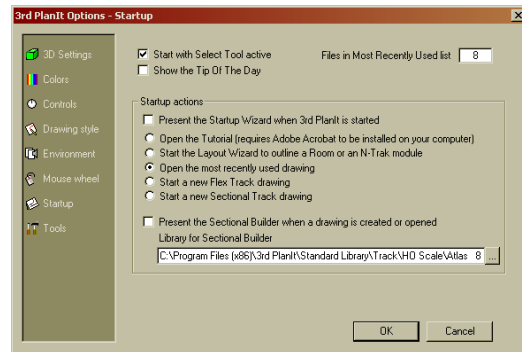
You can also set the action performed when the mouse wheel is rolled while holding down the **Shift** or **Ctrl** keys. Together, the combinations let you pan in all directions and zoom in/out by rolling the mouse wheel.



13.7 Startup

3rd PlanIt offers many options to customize its startup to your preference. Typically, 3rd PlanIt starts with the Line Drawing tool active; you can change this to the Select Tool if you wish. You can also choose to show a “Tip of the Day” as part of the startup procedure. The number of **Files in Most Recently Used list** can be set here.

If you frequently start new drawings, you can have the Startup Wizard come up each time you start the program so you can select a drawing type. If you choose not to have the Startup Wizard shown, you can choose the action to be taken at startup.

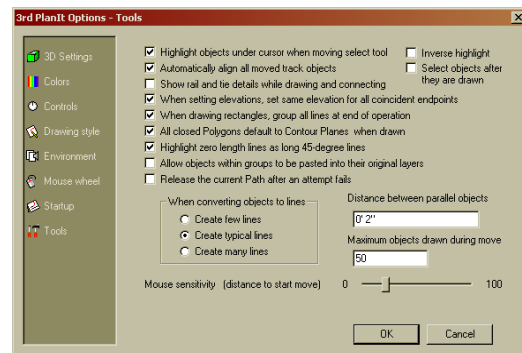


You can also choose have the Sectional Builder presented whenever a drawing is opened or created. This tool assists in making layouts with sectional track. The default library for the Sectional Builder can be selected in the bottom field.

13.8 Tools

You may determine whether the Select Tool highlights objects under the cursor. This verifies a target object for use in subsequent operations. Using **Inverse highlight** makes this process even faster. If you wish, objects may be “selected” automatically after they are drawn.

You may enable and disable the Auto Align feature by setting **Automatically align all moved track objects**. This feature aligns all track objects to each other when they are moved to ensure accurate alignment of track segments. Remember that Auto Align only applies to Track Objects. Track objects are typically drawn as lines when you are drawing or connecting objects; you may have them drawn with rails and ties if you wish using the next check box.



An important Elevation Tool characteristic is controlled by the field **When setting elevations, set same elevations for all coincident endpoints**. When enabled, whenever you set Elevations, the endpoint(s) of any objects that are coincident to an endpoint you are setting will be set to the same elevation.

The next option controls the grouping of four lines drawn as a rectangle using the **Action / Draw / Line / Rectangle** tool. **All closed Polygons default to Contour Planes** is the best setting for drawing structures and rolling stock, but illustrating a drawing might be better served by disabling this setting. The next checkbox is for “garbage collection.” By highlighting zero-length lines you can remove them from the drawing. You can set the default distance between parallel objects using the field at the lower right. This is the distance used when you click the right mouse button during a parallel operation.

Allow objects within groups to be pasted into their original layers is a powerful feature if you work with groups that contain objects in different layers. You can paste them between drawings, and the appropriate layers will be created if they don't already exist. **Release the current path after an attempt fails** maintains operation consistent with earlier releases of the program.

The top “Edit Box” allows you to set the distance between parallel objects. This is the distance that pops up when you click the right mouse button during parallel operations. The bottom Edit Box helps you manage your machine's speed vs. the style of move operations. As set, if more than 50 objects are going to be moved with the Select Tool at one time, the move will be displayed as a Bounding Rectangle. When in this mode, the single object you are pointing to (within the selection of moving objects) is shown for reference when using the Alt key. The Alt key behaves the same regardless of how the move is displayed.

The box at the bottom contains radio buttons to choose a characteristic of 3rd PlanIt's tilt-up construction feature. In order to tilt up a group, all of the embedded Circles and Spirals must be converted to lines. You select the resolution of the lines in this box. When making your choice, balance drawing speed and number of lines with the need to draw the curves precisely.

Mouse sensitivity (distance to start move) help tune 3rd PlanIt's drag-and-drop characteristics to your working style. If you find yourself selecting objects and accidentally moving them, increase the value of this slider bar. On the other hand, if you start a drag-and-drop and you feel you need to move objects a bit too far until the real move/copy operation begins, move this slider to the left.

14. 3D Rendering

3D Rendering offers several benefits, and they are both esthetic as well as functional. Perhaps you've heard the expression "Let's look at this problem from all angles." That saying reflects something quite natural for us as humans, our ability to build a mental image of something by simply looking at it from different perspectives.



Whether it's an antique, a sculpture or even a pet, people will pick something up and turn it around and around to see it all. When we want to take in something as large as a model railroad, we "turn it around in our hands" by walking around the room.

3rd PlanIt gives you an unprecedented tool for drawing model railroad layouts: the ability to change the rotation and elevation of your track plan in real time.

14.1 Controlling the 3D View

In the tutorial, you were introduced to the manner in which **Arrow Keys** allow you to "walk around" your track plan as shown in Table 1. You may also remember that you can use the Arrow Keys while holding the Ctrl Key down to rotate the track plan. There is one more flavor to the Arrow Keys in 3D mode, used by holding down the Alt Key and pressing any of the Arrow Keys.

When used with the Alt Key, the Up and Down Arrow Keys adjust the height of the viewpoint (Camera). When the Alt Key is pressed the Left and Right Arrow Keys move the viewpoint right and left without changing its viewing angle. The **Focal length** of the camera is adjusted using the numeric keypad +/- keys.

HINT: You can hold down the Shift Key during any of these operations to briefly make the increment of movement larger.

	Up Arrow	Down Arrow	Left Arrow	Right Arrow
Normal	Move forward	Move back	Turn left	Turn right
With Alt Key	Raise viewpoint	Lower viewpoint	Move viewpt left	Move viewpt right
With Ctrl Key	Rotate viewpoint about 3D Origin. Appears to rotate track plan in view.			
With Shift Key	Increases the increment used in any of the commands. May be used with Ctrl and Alt.			

Table 1: Arrow Keys in 3D Mode

Depending on your personal preferences, layout scale and display size, you may find the standard increment of movement too large or too small. You can adjust the movement size using the **Page Up** and **Page Down** keys. The **Page Up** key increases the movement size, while the **Page Down** key decreases the step size. Unlike the Shift key, these changes remain in effect until you change them again using one of the Page keys.

14.2 Flyover Mode

Along with navigation in 3D using the arrow keys, you can also use 3rd PlanIt's **Flyover Mode** to easily move about your drawing. In 3D, press and hold the left mouse button, then move the cursor upward on the screen. You'll begin to accelerate in the forward direction. If you move the mouse left or right, you'll turn in that direction.

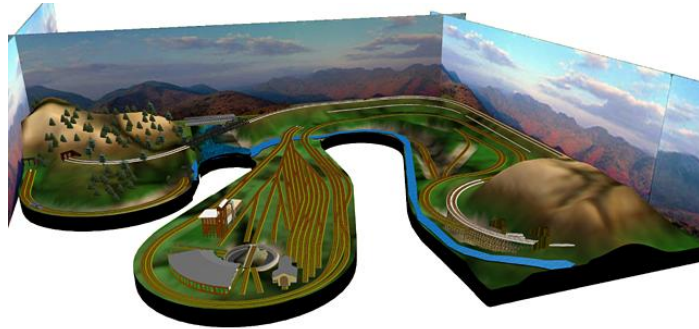
You can also slide left/right and up/down by pressing and holding the right mouse button at the same time as the left mouse button. The two modes allow you to position yourself precisely or to move rapidly around a large drawing, intuitively and smoothly. If you choose (in **Tools / Options / 3D Settings**), you may restrict Flyover Mode to be active only when the **Insert** key is pressed.

14.3 Transferring 3rd PlanIt Views to Other Programs

You can exchange the 2D and/or 3D rendering of your layout in several ways.

14.3.1 The Clipboard

One method starts by copying the 3D image to the Windows Clipboard. This standard Windows technique allows you to bring the 2D or 3D track plan image into any other Windows program. Set up the 2D or 3D image as you'd like it. Then hold down the **Alt** Key and press the **Print Screen** key. This action copies the 3rd PlanIt window to the clipboard.



Switch to another program, such as Microsoft Word or the Windows Paint utility (**Start / Programs / Accessories / Paint**). Select **Edit / Paste**, or press **Ctrl+V** to paste the 3rd PlanIt image in the program's document.

The manual you're reading was made in just this manner. In some cases, the contents of the Clipboard were pasted directly into the file, then resized and positioned. The illustration above was made in this manner.



14.4 Exporting the Current View

In both 2D and 3D, you can select **File / Export / View to file**. With this feature, you can save the screen image as you see it, pixel for pixel, or scaled as you wish. You will be given the opportunity to select an alternate height and width. If you select **Lock aspect ratio to view**, the image that results will be exactly the same proportions as what you are viewing, even if you select a different height or width. If selected, when you change the height, the width will change, and vice versa.

14.5 Move the Camera and Origin in 2D

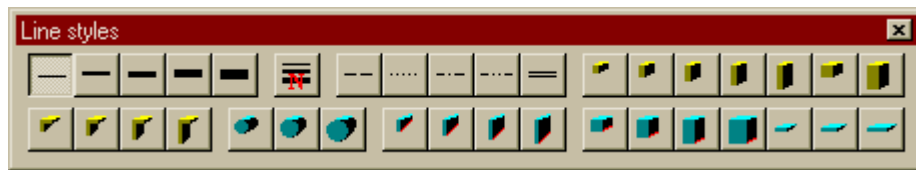
Sometimes you will want to simply move the view from one place on the layout to another. Walk-around mode can be used to get there incrementally, but there's a faster way. Simply switch to 2D (**Tab**), move the Camera and/or Origin to new positions, and switch back to 3D mode by pressing **Tab** again.

15. Wood and Walls

Wood and Walls are actually just lines with special line styles. This allows you to design with simple lines to control location and orientation, but have 3D solids result. This unique combination lets you create and modify wood, benchwork and wall objects very quickly.

15.1 The Line Style Bar

3rd PlanIt's Line Style Bar presents a wide variety of styles in 2 and 3 dimensions. Let's look at each of the features in some detail.



The first 11 entries control standard line characteristics as described in the ToolKit chapter. The next 11 entries, all yellow, control wood and L-Girders. The final 14 buttons, all blue, control dowels, walls, cabinets and plywood.

15.1.1 Wood and L-Girders

The rightmost 7 buttons in the top row are basic wood shapes – 1x1, 1x2, 1x3, 1x4, 1x6, 2x2 and 2x4 (please note that lumber differs in size from place to place, so do verify that 3rd PlanIt's dimensions match those of your lumber). The leftmost 4 buttons in the bottom row are L-Girders. These initially are set to a combination of a 1x2 with a 1x2, 1x3, 1x4 and 1x6.

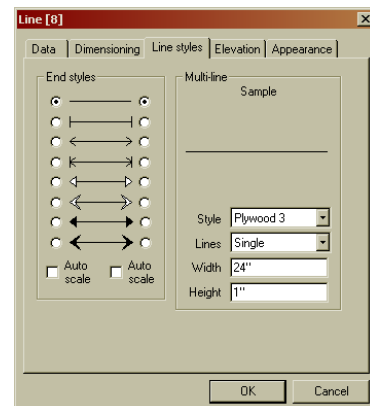
Wood and L-Girders, controlled by yellow buttons, always fetch their width and height from the **Wood Dimensions** table associated with each 3rd PlanIt document. If you change the values in the table, all the wood in the drawing will be updated to the same size. Please note, this doesn't mean 3rd PlanIt will automatically re-locate all the wood if you change the width of a 1x4 by 1/4". Use the elevation tab to set the vertical top and bottom points for the wood, such as legs and risers.

15.1.2 Dowels, Walls, Cabinets and Plywood

These are all related to each other by their ability to have custom dimensions that do not change when the **Wood Dimensions** table changes. In the **Line Style Bar**, the buttons are colored blue to indicate this quality. When you draw a line with custom dimensions the first time, the settings from the Wood Dimensions table are copied to the object and used from that time forward.

You can change these settings in the Object Properties dialog. The example on the right shows a 24" wide piece of plywood, set to a thickness of 1". Either of these fields may be modified and the object will be updated to reflect the new settings.

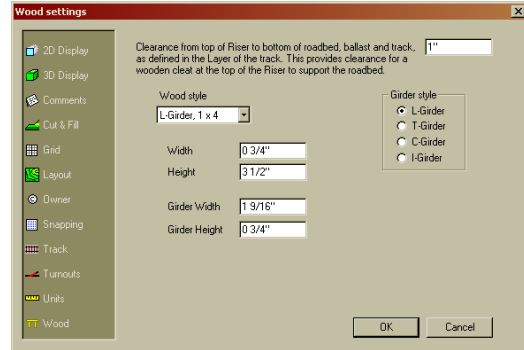
Important: Walls and Cabinets are measured from the bottom up.



15.2 Wood Dimensions

Each 3rd PlanIt document carries with it a table of **Wood Dimensions** that can be set to your specific needs. In the example at the right you can see the dimensions for an L-Girder based on a 1x2 and a 1x4. Every Wood Dimension selectable with a Line Style can be modified on this page.

Important: Basic Lumber and L-Girders always get their dimensions from this table – even after they have been drawn. Custom-dimensioned pieces (see previous section) copy this value when they are created and retain it thereafter.

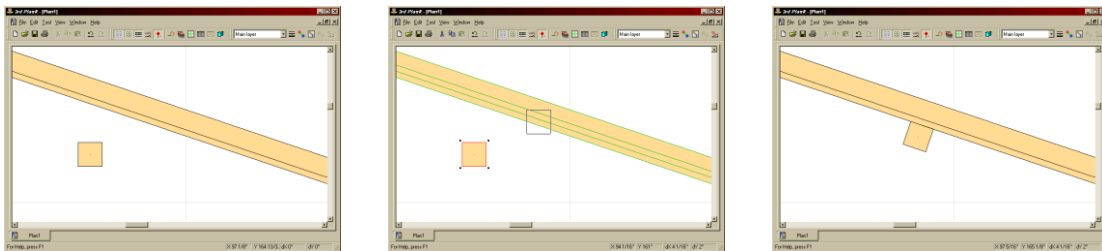


Important hint: since Custom-dimensioned pieces keep their dimensions, you can use and reuse the entries in the **Wood Dimensions** table. Simply use the selection buttons to provide a list of popular sizes for the construction you're doing currently, and change them as your needs change. *Only Basic Lumber and L-Girders always get their dimensions from this table.*

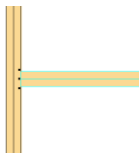
3rd PlanIt allows you to select between T-Girders and L-Girders on your layout. T-Girders are similar to L-Girders, but they provide screw mounting locations on both sides.

15.3 Positioning Wood

You can move one piece of wood to another; the moved piece of wood will be aligned with the side of the stationary piece of wood. At the right you can see an L-Girder next to a vertical 2x2 used as a leg for the benchwork. The 2x2 is a vertical line with the 2x2 line style. Use elevation to set the top and bottom points.

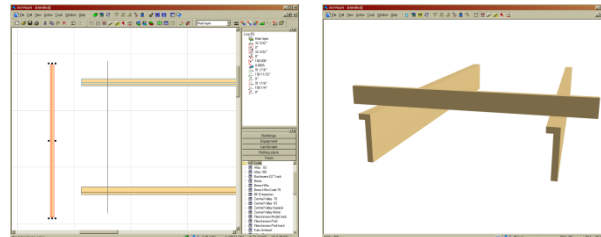


In the second example, the 2x2 has been moved to the L-Girder. Note that the center of the 2x2 is slightly on the lower side of the centerline of the L-Girder. This indicates that the 2x2 should be positioned below the L-Girder. When the left mouse button is released at the end of the drag-and-drop operation, the 2x2 is snapped into position along the side of the L-Girder



Important note: You can align the butt end of a piece of wood to the face of another piece of wood. Hold the Alt key while selecting the first piece of wood. Drag it to another wood object, which will highlight. Position the mouse on the desired side of the centerline. When you release the mouse button, the dragged piece will be rotated at a right angle to the fixed piece.

There is also a helpful tool to align one piece of wood to the *top* of another piece of wood. In the example to the right, two L-Girders are set up to support a series of 1x2 joists. To align the 1x2 to the top of the L-Girders, use the Select Tool to drag the 1x2 to one of the L-Girders, so that it highlights. While still holding the Left Mouse Button down, click the Right Mouse Button, and then release the Left Mouse Button. This ends the move operation and aligns the 1x2 to the L-Girder.



16. Auto-Ballast and Auto-Roadbed

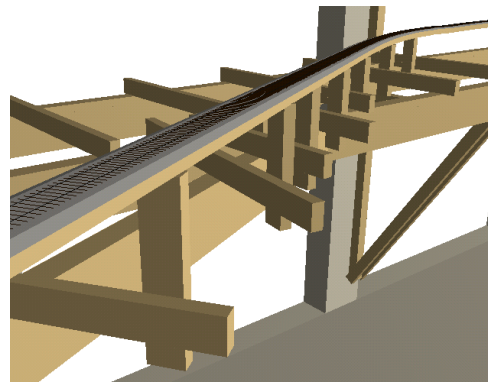
This version of 3rd PlanIt contains a new feature that automatically draws ballast and roadbed underneath the track as you plan. The Auto-Ballast view is available in both 2D and 3D, and can be turned on and off using the Auto-Ballast button on the Document Bar.



16.1 What is Auto-Ballast and Auto-Roadbed?

When a prototype builds a railroad, they usually employ one or two layers of **ballast** to firmly seat the railroad ties and provide good drainage. As modelers, we usually want to model at least one layer of ballast to achieve a realistic appearance. In addition, we mount the ballast on some form of roadbed, usually made of plywood, splines, or other materials.

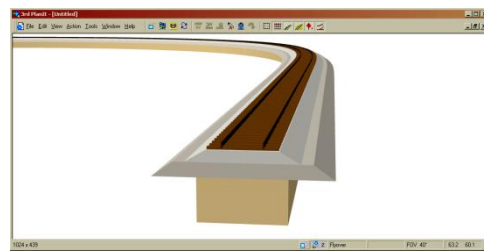
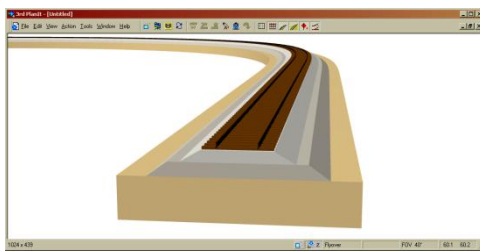
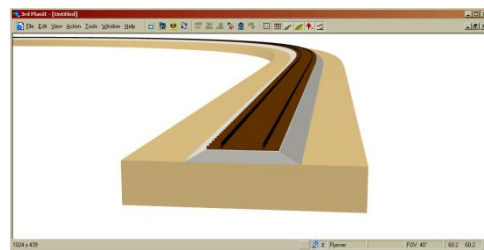
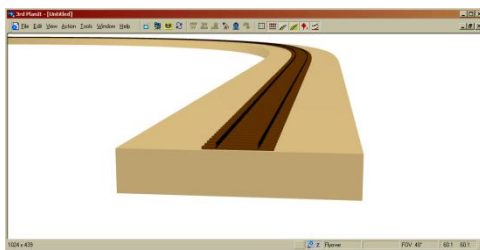
As can be seen in the example at the right, Auto-Ballast and Auto-Roadbed give you a very accurate view of the model you will be building. In this example, the model was built using spline construction, resulting in a roadbed slightly less wide than the ballast. The splines are supported by 1x2 risers glued to the cross-members.



The ballast and roadbed you see in the illustration are drawn automatically by the program underneath the track you place. As you change trackwork, the ballast and roadbed change accordingly.

16.2 Styles of Ballast and Roadbed

You may select different combinations of ballast and roadbed, as seen here in **Full detail 3D** style.

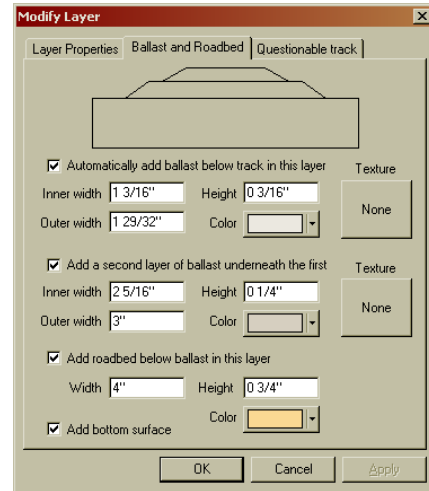


The only differences between the pictures were check-box settings to enable the ballast layers, and the width of the roadbed. The first three roadbeds are typical of plywood roadbed; in this case the width is set to 4 inches. The final roadbed represents a spline design 1.5" in width.

16.3 Controlling Ballast and Roadbed Styles

The layer of the track determines the ballast and roadbed characteristics. For example, the Main Track layer could use two-layer ballast on roadbed, while the Staging Track layer uses track directly on the plywood roadbed.

To set ballast or roadbed styles, access the Modify Layer dialog using the button on the Document Bar or by entering **Ctrl+Shift+D**. Choose the **Ballast and Roadbed** tab.



As seen at the right, you can turn Auto-Ballast on and off using the check box at the top of the page. If Auto-Ballast is enabled, you can also check the second box to include a second layer of ballast underneath the first.

You can select a different color for each layer of ballast. On the prototype it is common to see different types and colors of gravel for each layer of ballast on the main line. You can simulate that appearance by mixing colors appropriate to the prototype you're modeling.

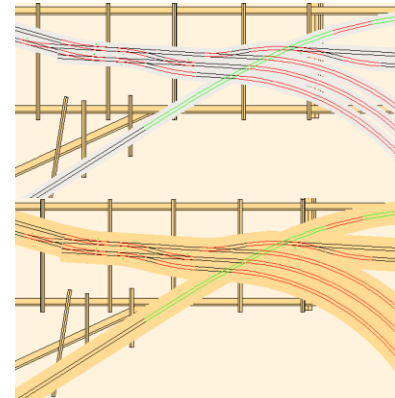
You can also control the appearance of the roadbed or spline that supports the track or ballast. If you wish, you can add a bottom surface, so the 3D rendering looks realistic from any angle.

16.4 Rendering

In the 2D Plan View, only the widest layer underneath the track is drawn. The first example is a ballast-only view as it is built on a spline roadbed less wide than the ballast.

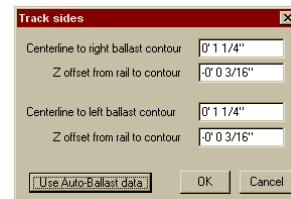
The second example shows the 2D Plan View when the roadbed is widened to 4.5 inches. This view provides an excellent template for cutting plywood sections when you are building the layout.

The 3D view shows every ballast and roadbed section you have enabled. This can use quite a bit of processing time, so if you are going to run a simulation on a large layout it can be helpful to disable some or all of the ballast and roadbed.



16.5 Terrain

You may easily connect track with Auto-Ballast to the surrounding terrain using the same techniques outlined in the **Ballast Contouring** section of the **Terrain Contouring** chapter. Select the desired track using the Path Tool, then choose **Edit / Transform / Create ballast contours from path**. When presented with the dialog box at the right, press the **Use Auto-Ballast Data** button. The exact distances appropriate for ballast in the track's layer will replace the old data. Press OK, then continue as usual with Terrain Contouring.



17. Terrain

The realism of the layout you build is established by its overall setting: the hills, valleys, rivers, cuts, fills, and other features that together bring the model to life. 3rd PlanIt's **Dynamic Terrain™** tools allow you to quickly plan the terrain for your layout and view it in 3D from any angle.

You can enter any level of detail you wish, from broad flat areas to a narrow creek wandering down a hillside. You can apply a texture to the terrain to give it a natural appearance. There are a number of ways of building your terrain, and you will undoubtedly come up with your own unique ideas.

17.1 A Hill and a Tunnel

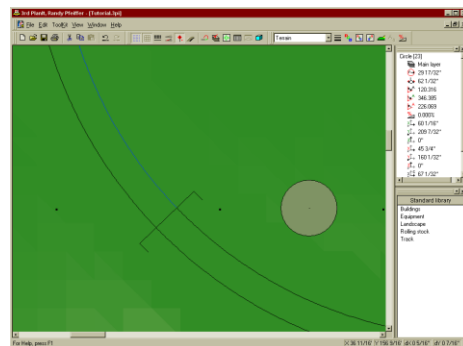
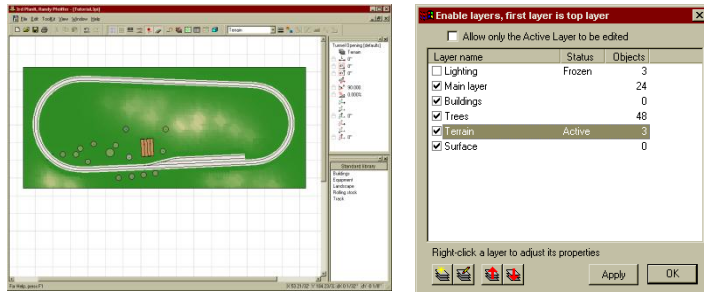
Let's start with a simple oval track plan, designed with flex track. It looks like the layout would be better if the upper-left area was a hill with a tunnel through it. The process of making a hill and tunnel is quite easy.

First of all, it's quite important to have a layer dedicated to Terrain. If you don't have one already, create the Terrain Layer and make it the active layer. The Terrain Layer should be positioned below the Track Layer in the Layer Enable Dialog, so it is drawn underneath the track. If your Mesh is not in the Terrain Layer, select it, then click on its layer icon in the Object Data Window to change its layer.

Start by zooming in to the area where you want to place one of the tunnel openings. You can press **F2** and click a location, or press **F2** and surround the area to be enlarged. If you have an Intellimouse™ (or similar) mouse with a wheel, you can point to a location and roll the wheel to zoom in and out, centered on the location.

Choose **ToolKit / Draw / Tunnel Opening / Perpendicular to object** as shown at the right. This tool creates a Tunnel Opening marker that is visible in 2D, but not in 3D. The Tunnel Opening marker makes it easy to see the opening and it provides the details to cut a Tunnel Opening in the terrain. The height of the opening can be set in the Properties field; select the opening and choose **Edit / Properties**.

To draw the Tunnel Opening, point to an existing piece of track so that it highlights. Press and hold the left mouse button, then move the mouse to expand the width of the Tunnel Opening. As you change its width, it remains centered over the selected track. If you have more than one track, as in this example, move the mouse until the far side is properly positioned. Then hold down the **Shift** key, which locks the far side into position. You can flip the open side by clicking the right mouse button. Adjust the near side until it looks right, then release the left mouse button. The original track is cut into two pieces at the Tunnel Opening. The upper-left piece is automatically marked as **Tunnel Track** for future use.



To similarly slice the outer track into two pieces, select the outer curve and choose **Edit / Slice / Slice at Intersection** or press **F5**. With the Scissors cursor, point to the Tunnel Opening. When it highlights, click the left mouse button to cut the curve.

Mark the upper-left segment of curve as Tunnel Track by selecting the track segment and choosing **Edit / Properties / Appearance / Tunnel Track**. When track is marked as Tunnel Track, the terrain will be automatically conformed above the track. The height of the terrain over the track is set in the Cut and Fill description for the track. This is found using **File / Settings / Cut and Fill** or pressing **Alt+S**.

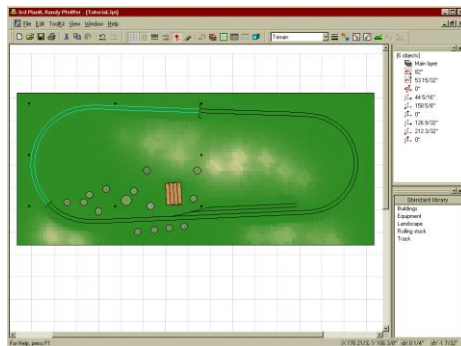
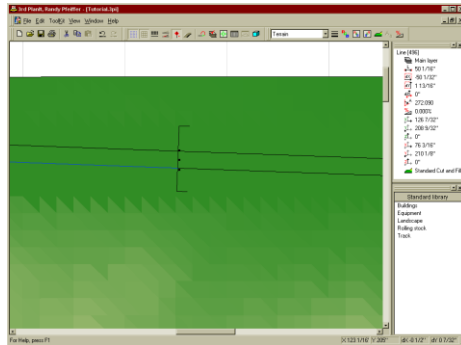
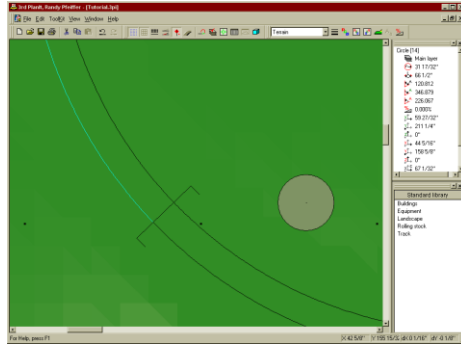
Now move to the top of the drawing and draw a second Tunnel Opening for the other end of the tunnel. In this example, the opening was placed on the straight track in a location that would make sense with the existing hills.

Notice how each tunnel marker is oriented so its open side points toward the flat area. This is in keeping with traditional published track plans, and helps you interpret the drawing when viewing it in 2D.

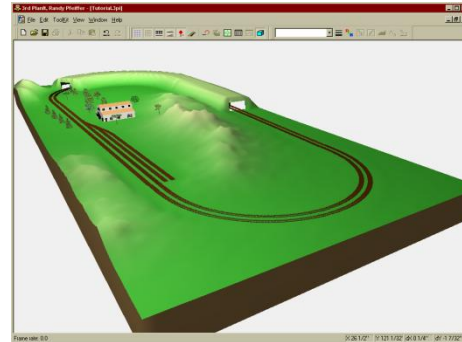
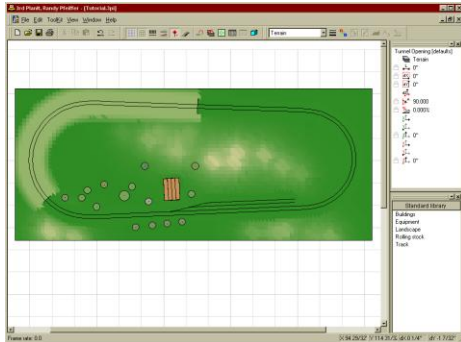
At this point, press **Alt+F3** to zoom out and see the whole drawing. Select one of the track segments that will be in the tunnel. Now, hold down the **Shift** key and select each of the other track segments until all are selected. To quickly change all of the to Tunnel Track, press the **F9** key to Group the selected track segments (or use **Edit / Group**).

Bring up the Group Property Sheet by pressing the **Enter** key (or **Edit / Properties**) and choose the **Appearance** page. Click the **Tunnel Track** check box, then click **OK**. Now, **Ungroup** the object using **Shift+F9** or **Edit / Ungroup**. Each track object is now marked as tunnel track. This same technique – Group :: Modify :: Ungroup – is useful for changing various properties of several objects at the same time at other times in your use of 3rd PlanIt.

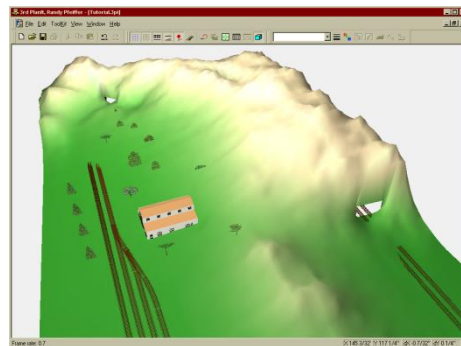
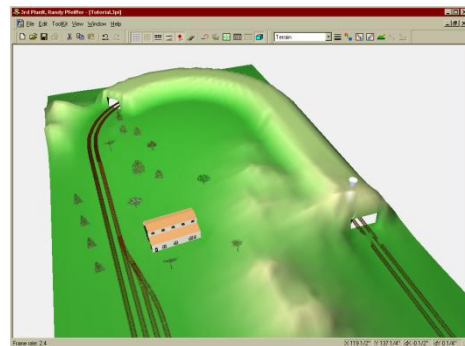
To actually cut the openings into the terrain, select each Tunnel Opening and choose **Edit / Mesh / Cut Mesh below Tunnel Opening**. You won't see much change in 2D - perhaps just a few triangles of slightly different color – but in 3D the change is quite apparent.



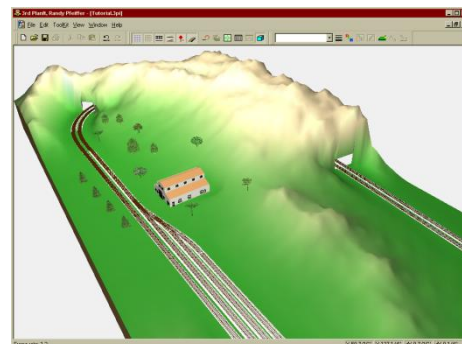
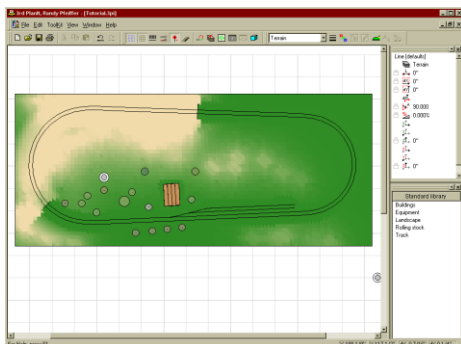
You can now select the Mesh and choose **Edit / Mesh / Conform Mesh to Objects**. Then switch to 3D to see a basic tunnel that simply covers the existing track. However, it makes a good starting point for 3D editing. To edit the Mesh, go back to 2D, point to its boundary and double-click the left mouse button. You can also select the Mesh and choose **Edit / Mesh / Mesh Editor** if you prefer.



Use the Editing Cone to adjust the terrain, pressing the mouse button when you want to change the elevation of an area. As noted in the Tutorial chapter, the **Ctrl** and **Shift** keys narrow and widen the affected area, respectively. As shown below, you may want to tilt the view (**Ctrl + DownArrow**) to get the cone into tight areas.



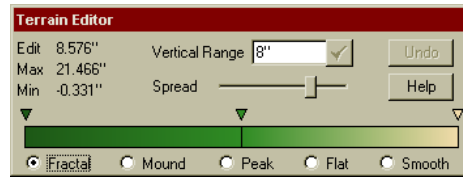
Keep working with the terrain until you are pleased with what you see. As seen above, the track will be covered and the trees will get buried while editing the terrain. That's not a problem – when you're done editing, hit the **Tab** key to swap back to the 2D view. Select the Mesh, then choose **Edit / Mesh / Conform Mesh to Objects**. Reselect the mesh and choose **Edit / Mesh / Align Plants to mesh**. The 3D view is really quite nice.



Note the very steep cliff above the right tunnel entrance. Typically, the **Conform Mesh to Objects** command would change the slope of the cliff. Since we wanted the tall cliff, the **Standard Cut and Fill** definition was changed to **Do not fill beyond ends**.

17.2 The Terrain Editor

Several Editing Modes are available using the Terrain Editor, as well as complete control of the **Color by Height** feature.



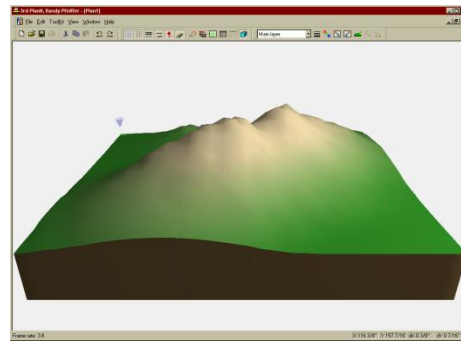
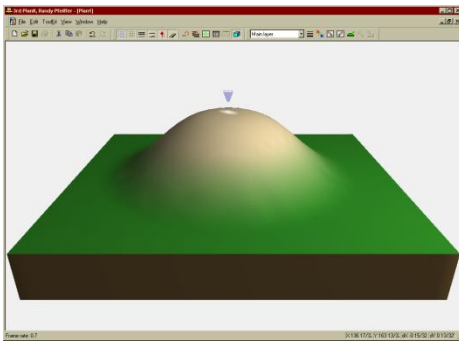
17.2.1 Editing modes

17.2.1.1 Fractal Mode

There are five Editing Modes. The **Fractal** mode creates the bumpy, somewhat random terrain shown in the previous example. By moving only one vertex (a point on the Terrain), you will see a radial pattern around that vertex in the 2D view. To make realistic mountains, such as those in the example, you'll need to manipulate the terrain "here and there" a number of times to achieve the look you want. The hill above was created using about 30 mouse strokes, about one-quarter of which were made with the **Shift** key held down to spread the effect.

17.2.1.2 Mound Mode

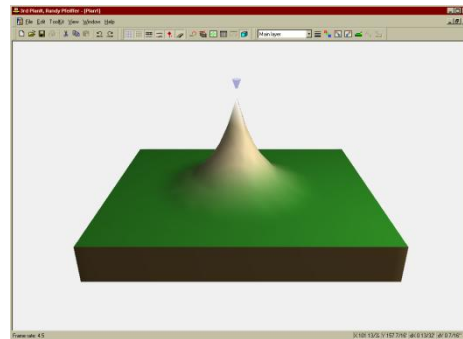
The **Mound** mode forms very smooth, rounded changes in the terrain. The left image shows the result of a single lifting action within Mound mode. Taken by itself, this doesn't really resemble natural terrain, just as a single Fractal manipulation doesn't create a complete effect. The image at the right shows the combination of several Fractal changes, followed by several wide Mounded changes.



17.2.1.3 Peak Mode

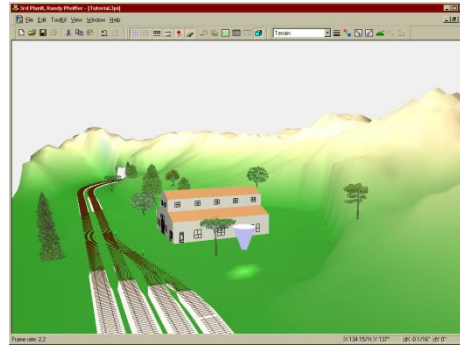
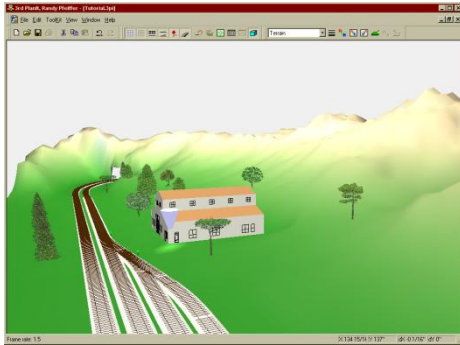
Peak mode lets you manipulate individual vertices, with very little effect to surrounding vertices. A small amount of smoothing is applied around the selected vertex.

Peak mode is generally used to touch up areas of terrain, not as a primary editing tool. If a particular vertex in Fractal Terrain looks too high, the Peak mode can be used to push it down into a more attractive position.



17.2.1.4 Flat Mode

The very useful **Flat** mode editing tool is best demonstrated using the Tutorial developed earlier in this chapter. Looking closely at the area around the building, there really isn't much room for equipment, cars, people or anything. If you look carefully at the left image, you can see the Editing Cone placed just to the left of the building. At this point the terrain is aligned with the bottom of the building.

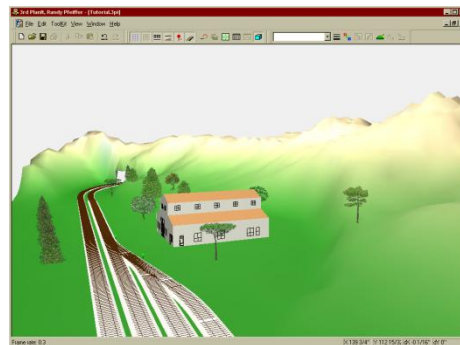
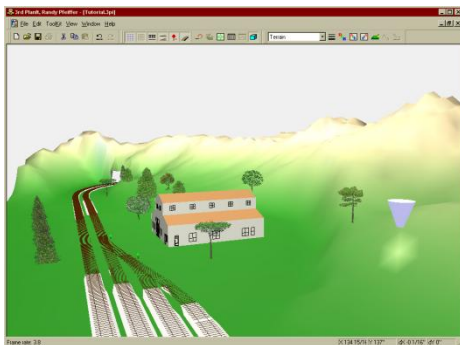


To flatten an area of terrain, point to the vertex at the desired height; in this case, the vertex that's right next to the building then Press and hold the left mouse button, and move the Editing Cone around. As you move, an area around the cone will be set to the same elevation as the starting point. To narrow the effect of the Flat mode tool, press the **Ctrl** key while moving it.

As always, don't be concerned if the track becomes obscured while you are editing. After the next set of changes, the **Conform** command will align the terrain to the track properly.

17.2.1.5 Smooth Mode

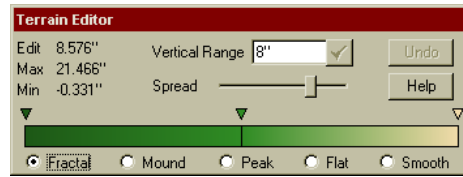
You can use the **Smooth** mode to make the change in elevation between vertices more gradual. When you are in Smooth mode, the **Spread** field of the Terrain Editor controls the amount of "bumpiness" that is left in the terrain. It also hides the "triangle-based" nature of the computer's representation of the terrain.



Illustrating this effect, the image made previously using the Flat mode was polished with the Smooth mode. To do this, point to the flat area near the house, press and hold the left mouse button, and move the Editing Cone around the areas you want smoothed. As with other editing operations, track can be covered or trees can appear buried or floating. Simply switch to 2D and issue the **Edit / Mesh / Conform Mesh to Objects** command. Reselect the mesh and choose **Edit / Mesh / Align Plants to mesh**.

17.2.2 Statistics

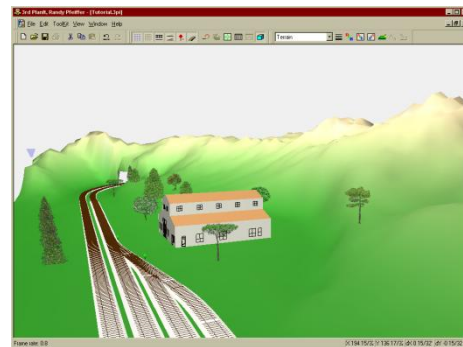
The upper-left area of the Terrain Editor dialog box shows three values. **Edit** shows the elevation of the vertex directly under the Editing Cone. **Max** shows the elevation of the highest vertex found anywhere on the mesh. Similarly, **Min** shows the lowest elevation of the mesh.



17.2.3 Vertical Range

The **Vertical Range** field links the **Color Bar** in the Terrain Editor to the height of the terrain. In the previous examples, the height has been left at its default value of 8". Looking back, the boundary between green and tan is rather stark.

Looking at the Statistics, we can see the **Max** height is about 21.5 inches. The Vertical Range is set to 8", which means that the left end of the color bar starts at -8", ending at +8" on the right end. For this mesh, most of the terrain is higher than 8" and therefore colored tan.



By changing the vertical range to 16" results in the green now transitions much more smoothly into the tan, resulting in a more pleasing appearance as in the example above.

17.2.4 Spread

The **Spread** field controls the amount of mesh affected by the Terrain Editor when using the Editing Cone. Moving the slider farther to the right causes a broader spread. In the case of the **Smooth** mode, the **Spread** field controls the amount of bumpiness allowed in the resulting terrain. As you move it farther to the right, it tolerates more bumps in the underlying terrain.

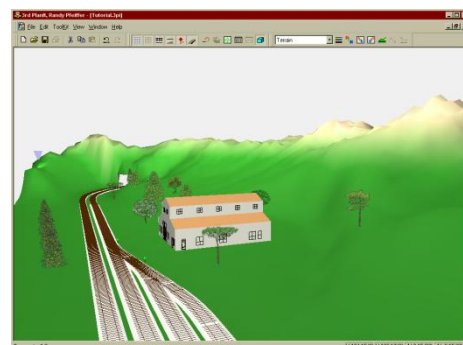
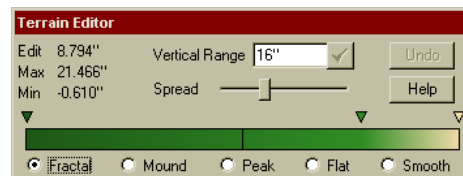
If you press the **Ctrl** or **Shift** key, the width of the affected area changes relative to the current **Spread**. Using the **Shift** key with a small Spread will still only affect a small area.

17.2.5 Color Bar

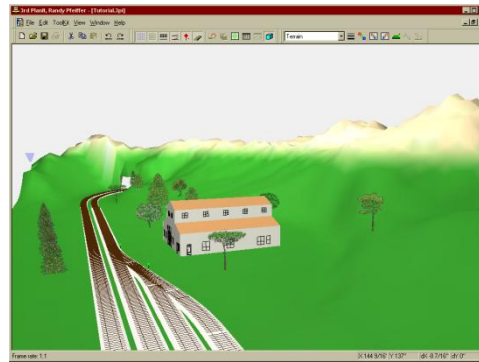
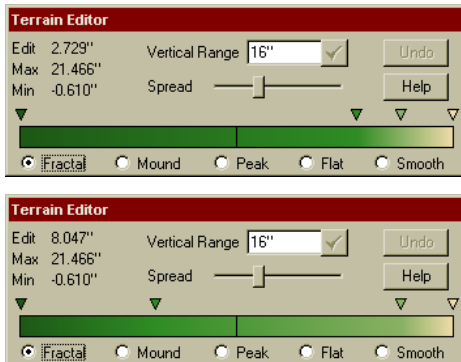
The **Color Bar** lets you control the **Color by Elevation** feature. The three inverted triangles above the Color Bar are known as **Color Markers**, and define a change in color. You can point to a Color Marker, press and hold the left mouse button, and drag it to a new position in the Color Bar. In the example at the right, the center Color Marker has been moved to the right of center. Compared to the previous image, the change from green to tan occurs at higher elevation.

The center of the color bar is marked with a black vertical line – this is the **Base Elevation** of the mesh. When you first drew the mesh, it was all at the Base Elevation. As you edit the terrain, some parts rise above the Base Elevation while others fall below it. As a terrain changes elevation, its color changes to match the description in the Color Bar.

You can add and remove Color Markers to create custom effects. To remove a marker, point to it, click the right mouse button and select **Delete Marker**.

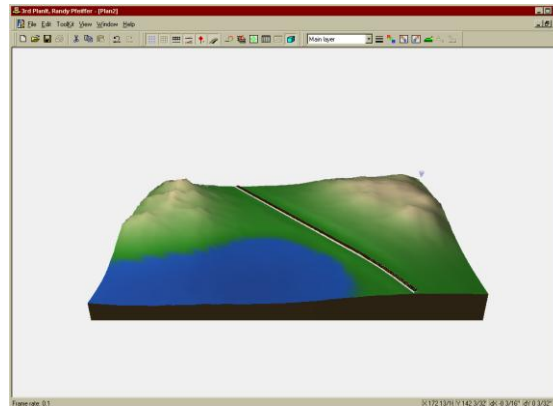
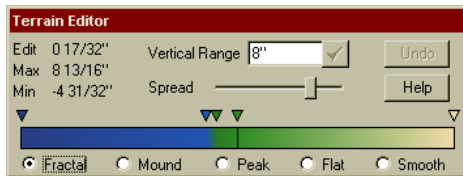


To add a marker, point to the location where you want it placed and double-click the left mouse button. A new Color Marker appears, assigned the color directly below it in the color bar. The new Color Marker provides a new “change point” for the color bar. Now, the light green is “locked in” below the tan marker



at the right end. Moving the second Color Marker to the left now spreads the change in green color over a larger change in elevation. The effects are seen in 3D as the grass is now a lighter color, but the elevation at which the color changes to tan has not been affected.

You can change the color of a Color Marker; point to it and double-click the left mouse button. Creative use of colors and placement of Color Markers can let you automatically create lakes in low areas of the terrain. The two left markers, colored shades of dark blue, define a sharp transition from green to blue, then a gradual deepening blue as the elevation gets lower.



17.3 Conform to Contour Lines

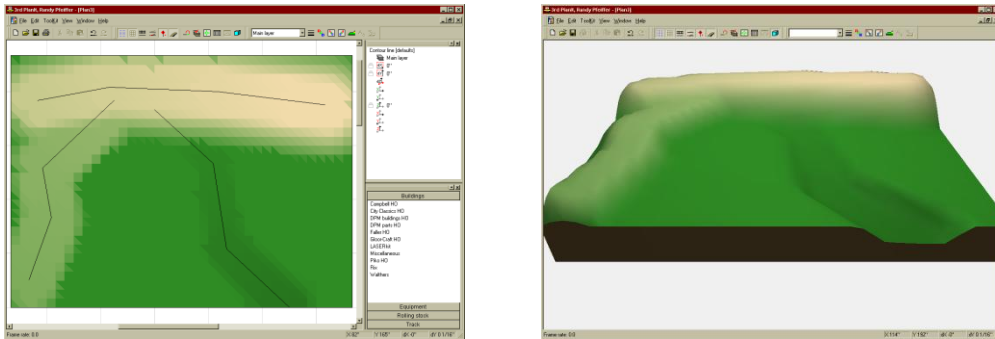
You can also make terrain using Contour Lines to define the terrain elevation. To draw a Contour Line, select **Toolkit / Draw / Contour Line**.

17.3.1 Drawing Contour Lines

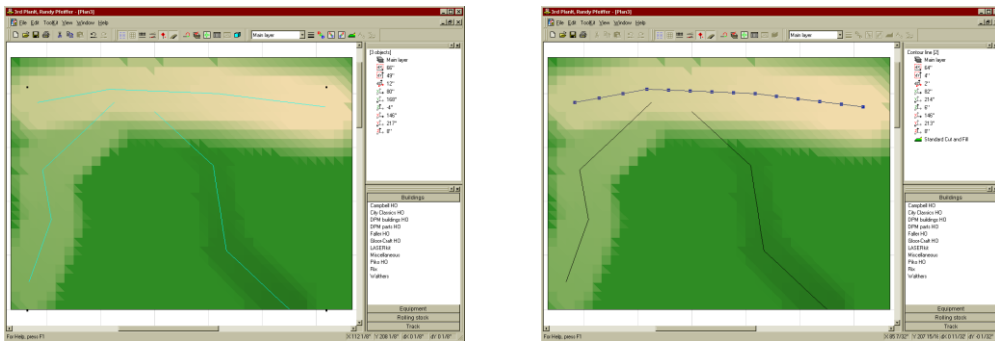
For this example, three contour lines were drawn. The elevations for the top contour were set to 6” and 8” by clicking on the values in the Object Data Window. The contour on the left was set to 4” and 3”. The contour running down the center defines a valley; its elevation was set to 0” to -4”.



To conform the terrain to contours, select the Mesh and choose the **Edit / Mesh / Conform to Contours** command. The example results are present here in 2D and 3D.



In many ways, the results reflect exactly what is defined in the contour lines. But it does not look very realistic – nature is not so simplistic. What we need is more structure, and more randomness. The first step is adding more points (vertices) to the contour line.



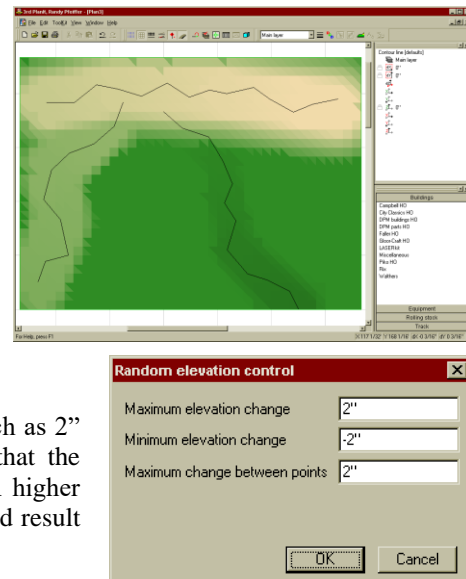
Select one of the Contour Lines, then hold down the **Shift** key and select the other two contour lines. Choose the **Edit / Change / Interpolate Vertices** command, and accept the default 6” spacing between vertices. All three contour lines will have extra vertices added between the ones you originally drew. The upper line is shown in **Edit mode**. There are now many more vertices available to make the terrain more complex.

17.3.2 Editing a Contour Line

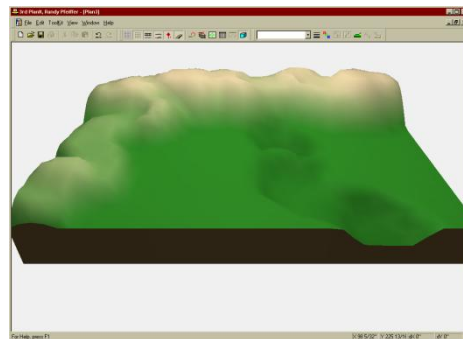
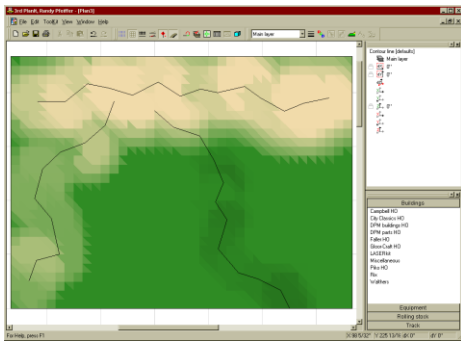
To edit a contour line, point to the line and double-click the left mouse button. Point to a vertex box, press and hold the left mouse button. Shift each vertex around a bit by moving the mouse. You may find it most convenient to turn off **Snap mode** so a vertex can be positioned anywhere (**View / Snap / Off** or **Shift+A**). The example on the right shows the result of such editing.

To add randomness to the vertical dimension of the contour lines, select them all and choose the **Edit / Change / Randomize Contour Line Height...** menu choice. For this example, the values on the right were chosen.

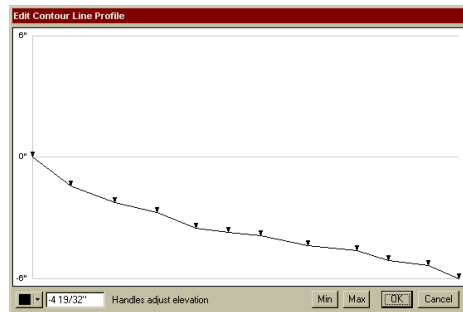
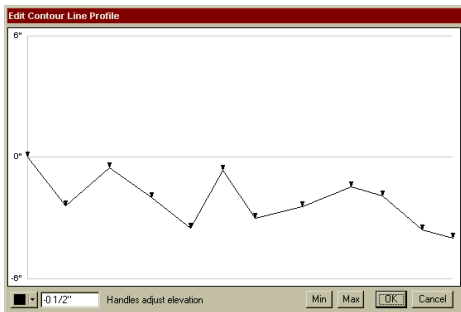
These values allow the terrain to be changed in elevation as much as 2” in either direction, from its current location. It also indicates that the greatest change between vertices should be no more than 2”. A higher value would allow more jagged terrain, while a lower value would result in smoother terrain.



Now select the mesh and choose **Edit / Mesh / Conform to Contours**. You will see a message box asking if you want to revert to the Saved Original. In this case, we certainly do, as the goal is to have new terrain shapes created from the modified contour lines. Select **Yes** to revert to the flat mesh we started with.

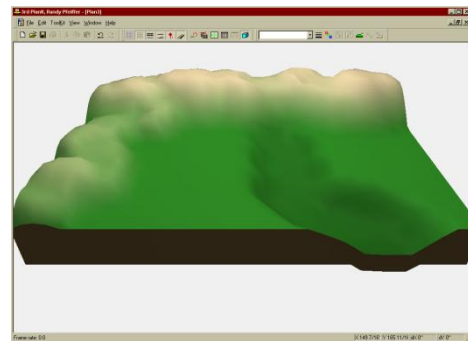


The results are starting to look much more natural. However, there is a high spot in the valley that does not belong there. It is possible to edit the *vertical* position of contour line vertices, using the **Contour Line Editor**. In the 2D view, select the valley contour line and choose **Edit / Change / Adjust Contour Line Height and Color...** from the main menu. You can resize the dialog box to suit your preferences.



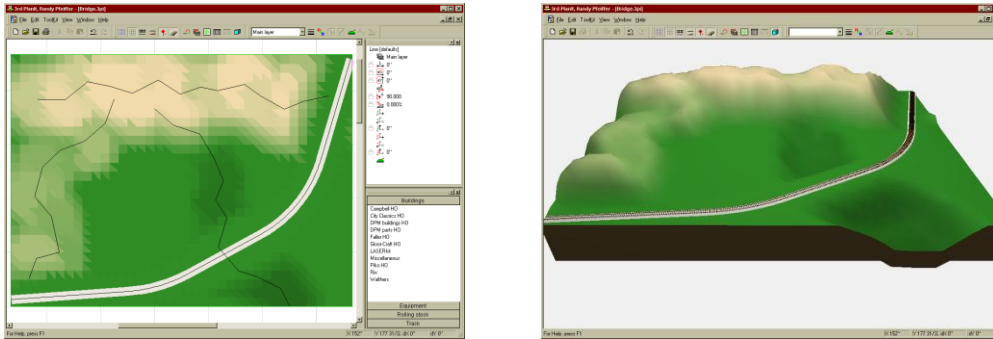
It is easy to see the elevation of each vertex. As you point at a vertex, its height shows in the display at the lower left. If you point to a vertex and click the left mouse button, a **Shrinking Circle** appears in the 2D view at the vertex that you selected. Since water must run downhill and this contour line represents the center of the valley, each vertex is made lower than the previous one, but in varying increments.

After a similar edit to the left contour line, the Terrain Mesh was again Conformed to Contour Lines, reverting to the Saved Original. The resulting terrain now is much more realistic. If you want, you can use the Terrain Editor to add complexity to the scene.

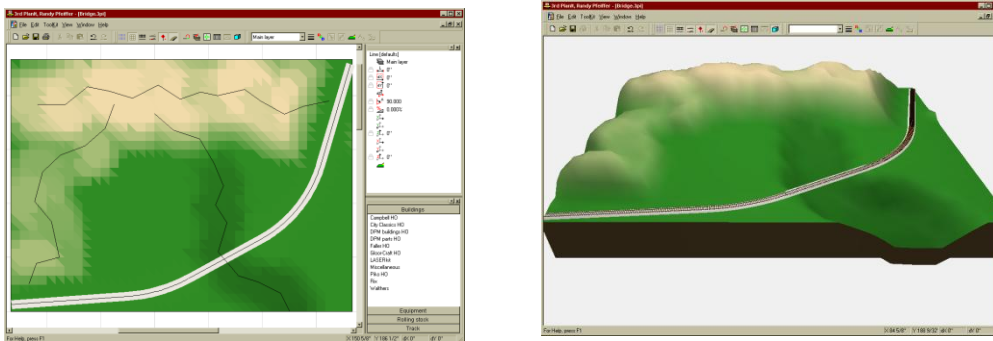


17.4 Bridges

Starting with the example from the previous section, some track was drawn across the narrow section of the valley and out the top and left side. These three sections were connected with the **Connect Direct** tool; then the Terrain Mesh was conformed to the track, *without* reverting to the Saved Original.



This is a nice fill over the valley, but it would look much better with a bridge. Choose **Edit / Undo** or hit **Ctrl+Z** to undo the conform operation. The Mesh will be selected and therefore on top of all track, so deselect the Mesh. Select the straight track segment that crosses the valley and hit **Enter** or choose **Edit / Properties**. On the Appearance page, select the **Do not conform terrain** option.

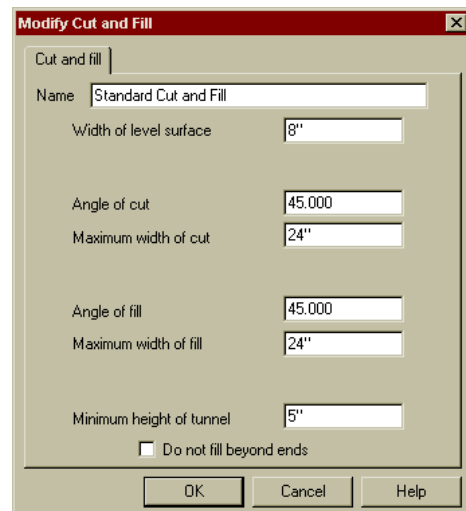


After performing **Edit / Mesh / Conform Mesh to Objects** this time, there is no fill in the valley. You can now go on to design the kind of bridge support you feel is appropriate for your era and taste. You can also use the Mesh Property Page to set the **Fascia Height**, and the **Minimum Fascia Height**. The Minimum Fascia Height ensures fascia appears below the lowest terrain at the edge of a mesh, such as shown above.

17.5 Cut and Fill Definitions

Whenever a **Conform to Objects** or **Conform to Contours** command was issued the cuts and fills were not arbitrary. They were defined by a **Cut and Fill Definition**, which can be found in **File / Settings / Cut and Fill**. You can also select an object and press the **Cut and Fill** button in the Property Bar to see the dialog box shown here, or click the **Modify Cut and Fill** button in the object property Appearance page.

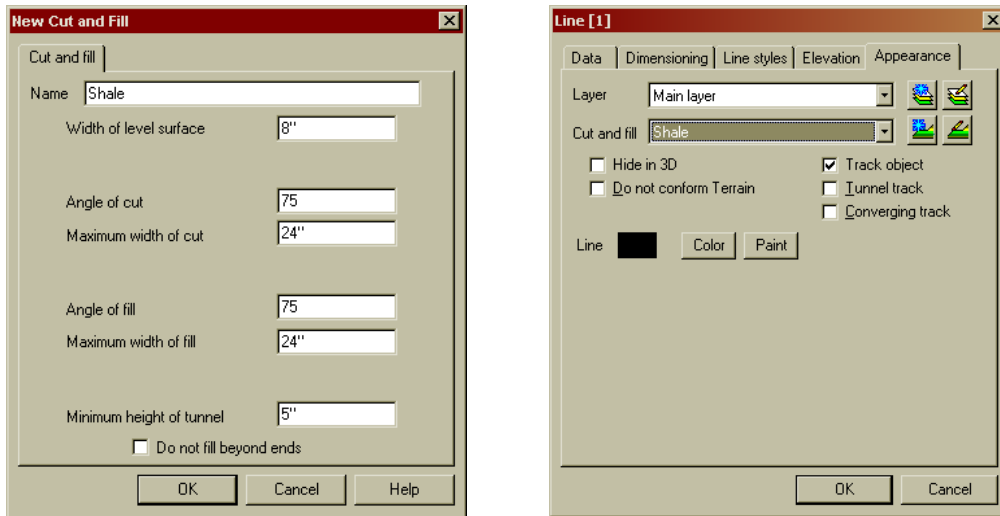
Each drawing has a set of Cut and Fills that can be assigned to objects that conform terrain. The object may be a piece of track, a building or any other group, another mesh or a contour line, and it can be assigned to any Cut and Fill in the document.



17.5.1 Cut and Fill Angles

Using the previous example to demonstrate the use of Cut and Fill definitions, let's assume the hill at top of the 2D view (in the background of the 3D view) is made of shale. Therefore, it can be cut almost vertically without risk of sliding.

In the 2D view, select the straight segment of track that cuts through the hill and hit **Enter** (or choose **Edit / Properties**). From the Appearance page, press the **Create Cut and Fill** button to the right of the Cut and Fill name field. Name the Cut and Fill **Shale** and set the **Angle of cut** and **Angle of fill** fields to 75 degrees.



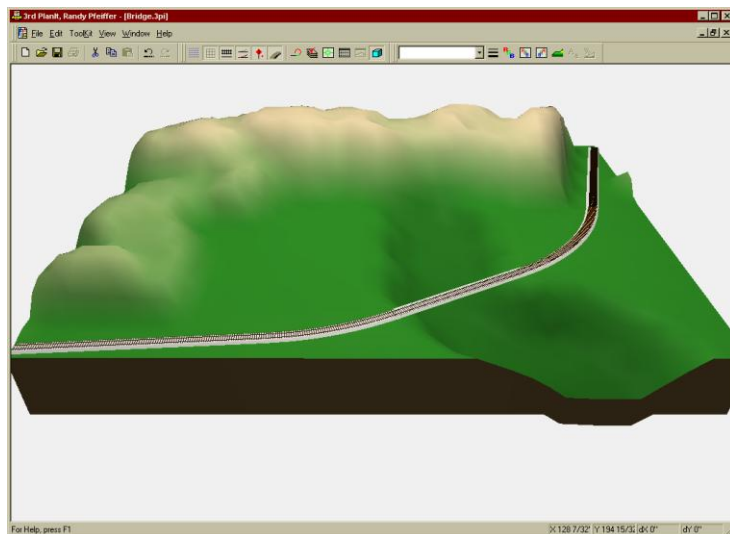
While on this page, notice that you can limit the effective width of the Cut or Fill. That's important, because in model railroading we often put very different scenes back-to-back, divided by a backdrop. You can make sure one Cut and Fill does not interfere with scenery on the other side of the backdrop.

Cut and Fill definitions also apply to tunnel track. You can adjust the minimum clearance between railhead and terrain with this field. Finally, you can select **Do not fill beyond ends** for the times track enters a nearly vertical cliff face. In this situation, you don't want the terrain Cut beyond the end of the track.

Choose OK to add the new Cut and Fill to the document. Ensure it is selected in the Line Property page as shown here, and select OK to assign the new Cut and Fill to the track.

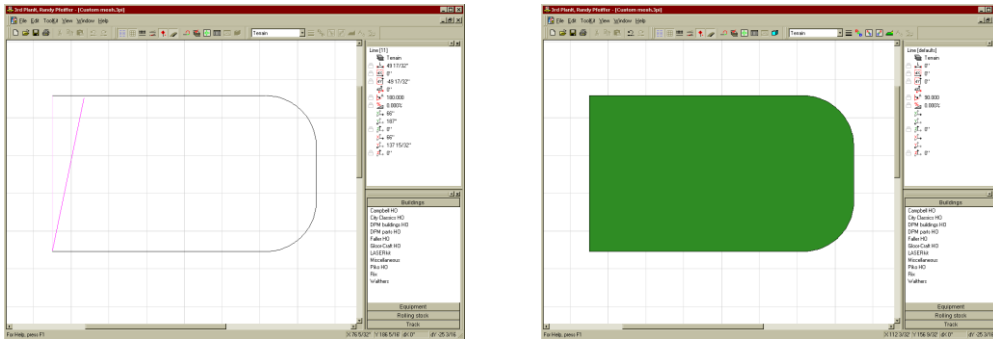
Select the Terrain Mesh and choose the **Edit / Mesh / Conform to Contours and Objects** command. You do not need to revert to the Saved Original, as the contour lines will reform the land, then the track objects will cut and fill it. Your results should look like the example to the right.

The Cut to the left of the track is now much more vertical - consistent with the shale in which it is cut.



17.6 Custom Terrain Meshes

You can easily make meshes whose outlines fit a specific shape, such as a peninsula. In this example, four lines were drawn in a rectangle. The two corners were smoothed using the **Connect Direct** tool.



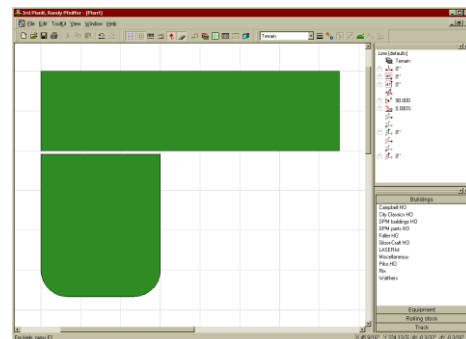
As shown above, the **Connect / Crooked Path** tool is used to create a Path around all the segments. If you only get two segments in your Path, the Path went the wrong direction. Try again, and notice the **Shrinking Circle** when it appears. It is drawn at *the junction of the first and second objects to be in the path*. The example shows the Path tool after it was clicked near the bottom of the left line, then pulled to the top line. Point to the top line until it highlights, then click the left mouse button.

With the Path colored magenta, choose **Edit / Transform / Change to Mesh** from the main menu. The Mesh will be trimmed to the shape you defined. Note that the trim may be attempted two or more times, as the program tries to reduce the number of triangles necessary to represent your outline.

17.7 Dynamic Terrain

It may be desirable to design your layout with more than one Terrain Mesh. If you have a large layout, it will make terrain editing more responsive. You can also create Meshes with different colors to simulate changes in the underlying rock or vegetation. In this example, an L-shaped layout is drawn as two separate Meshes.

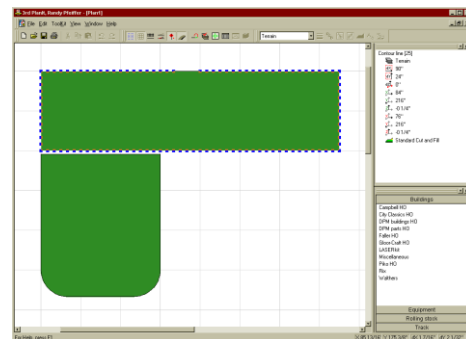
Dynamic Terrain™ lets you create a **Terrain Sheet** between two Terrain Meshes. The Terrain Sheet is automatically updated in elevation and color whenever you edit either Mesh it joins.



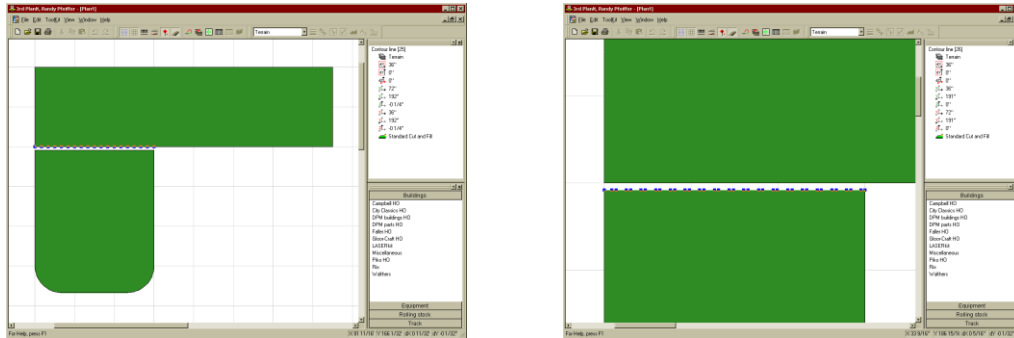
17.7.1 Dynamic Contour Lines

A Terrain Sheet is made by connecting two contour lines. If either side of the Terrain Sheet is created from **Dynamic Contour Lines™** associated with a mesh, changes to the mesh automatically change the Terrain Sheet. To create a Dynamic Contour Line for a Mesh, select the mesh and choose **Edit / Mesh / Create Contour Line surrounding Mesh**. The contour line will surround the whole mesh, and will be “closed”, meaning it is one continuous path.

First, open the Contour Line by pointing to its top line, clicking the **Right Mouse Button**, and selecting the **Change / Open Polygon** command. A Contour Line is a special case of a Polygon, one that is not filled with a color. After opening the Contour Line at its top, point to the Contour Line and double-click the left mouse button to edit it. You will see many small squares, each representing a vertex on the Contour Line.



Delete almost all the vertices. You can delete several at a time; point to the drawing background, press and hold the left mouse button, and drag a Bounding Rectangle to surround the unwanted vertices. Release the left mouse button and all enclosed vertices are selected. Press the **Delete** key to remove these vertices. Continue until the only ones that remain are those few directly across from the peninsula. Double-click the left mouse button while pointing at the background to end the contour line edit session.



Similarly, create a Contour Line around the peninsula. Use the **Right click / Open Polygon** command to open the Contour Line at its bottom. Double-click the Contour Line to edit it, and remove all vertices except those along its top edge. Note in the example that the blue **Editing Handles** are not evenly spaced this time. That's because this mesh was created from a custom perimeter. To do this, the various triangles around the edge of the mesh were cut into pieces. You are seeing the result of that cut.

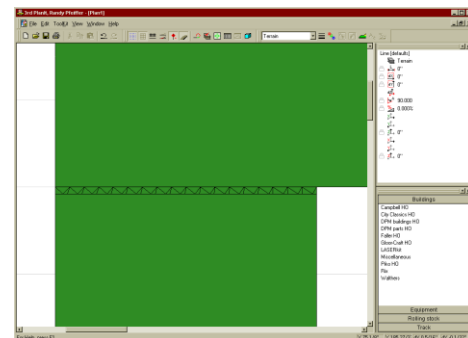
17.7.2 Dynamic Terrain Sheets

You can make a **Terrain Sheet** by connecting two Contour Lines with the **Connect Terrain** tool. If one or both of the Contour Lines is a Dynamic Contour Line made from a Mesh, the Terrain Sheet becomes a **Dynamic Terrain Sheet**[™] – one that changes when either mesh changes.

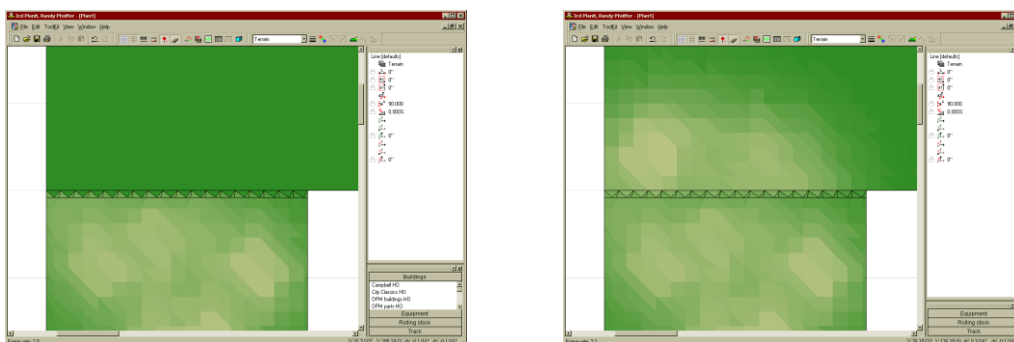


After selecting the Connect Terrain tool, point to one of the Contour Lines near an endpoint. Click the left mouse button to start the Connect process then point to the other Contour Line at a position nearly opposite of the first. Click the left mouse button a second time to complete the connection.

A Terrain Sheet now appears between the top and bottom Terrain Meshes. The image below-left shows how the Dynamic Terrain Sheet has had its elevation updated to align with the lower Terrain Mesh. The lower row of triangles is lighter in color, indicating their new elevation.



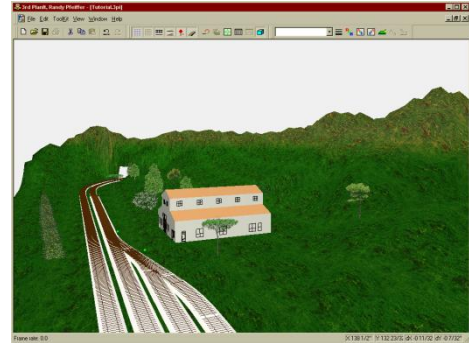
After editing the top Mesh, the Dynamic Terrain Sheet joins the two Meshes seamlessly.



17.8 Applying a Texture to a Mesh

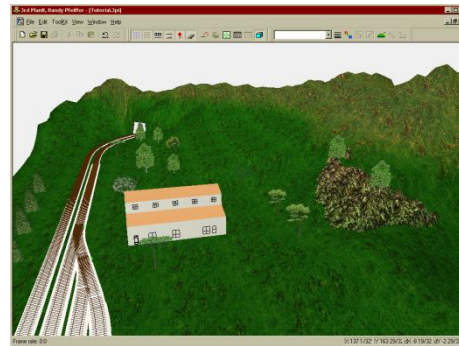
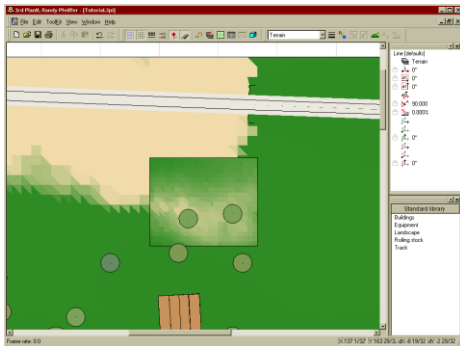
It's easy to apply a texture to a Mesh. Using the Tutorial example, select the Terrain Mesh and choose **Edit / Properties**. On the **Texture** page, select **Use a texture for the surface of this object**. From the Texture Library select a Grass texture and close the dialog boxes using the OK button.

You can adjust the Scale in the Texture page of the Mesh Properties Sheet so the size of the pattern is appropriate for the terrain it's applied to. In the example at the right, the **Replace color** option was chosen. That way, the color of the terrain is mixed with the color of the texture, in relationship to the height of the terrain.



17.9 Using Several Meshes Together

To mix terrain textures, you can create smaller “sub-terrains” within the main mesh, as shown below.



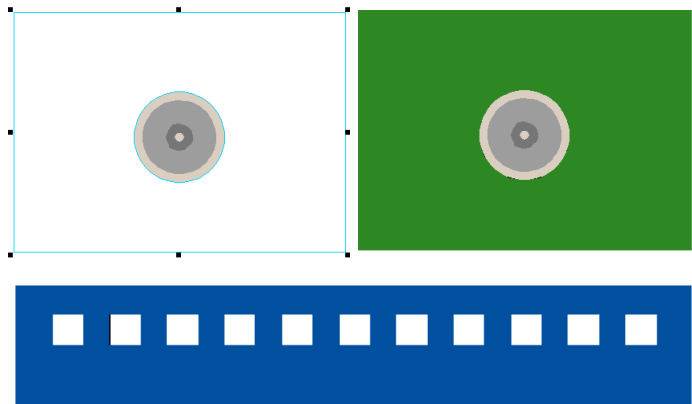
It is usually good to create the smaller mesh with a smaller spacing (set using **ToolKit / Draw / Mesh / Set Mesh Defaults**). Edit the sub-terrain mesh by double-clicking its edge and using the **Fractal** mode to pull it above the existing terrain. *Note: sometimes your Editing Cone may not be visible, covered by higher terrain. Just pull up the terrain until it becomes visible.*

It can be helpful to keep the edges of the sub-terrain from rising above the main terrain. Select the sub-terrain, choose **Edit / Properties**, select the **Mesh** page and check the option **Lock top of fascia at current elevation**. You can do this before you edit the sub-terrain, or any time thereafter. For example, you could edit the sub-terrain until its boundary is just slightly below the main terrain, then lock it in position. Then you are free to edit the sub-terrain without concern of its edges showing.

17.10 Holes in Meshes

If you'd like to have a turntable or an access hole in your mesh, or even more than one, it's easy to do. If you have a contour line left from designing the turntable choose it. If not, you can draw a new Freehand Contour Line, and snap it to the perimeter vertices of the turntable.

Draw another contour line for the outline of the mesh. Select both contour lines, then use **Edit / Transform / Change to Mesh** to create a mesh similar to the one on the right. You can embed as many polygons as you wish, for example, to create windows in the side of a piece of rolling stock.



18. Textures

Textures bring detail to surfaces. When you apply a texture to a surface, it's as though you were gluing a photograph to the surface. In fact, a texture is a digital image, saved as a file in a format such as JPG, TIF or BMP. 3rd PlanIt comes with a wide assortment of textures, or you can add your own to the Texture Library and your drawings.

18.1 Applying a Texture

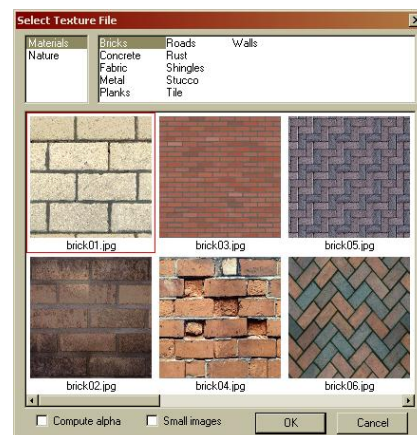
You can apply Textures to Polygons, Terrain Meshes and Groups. To learn how to use Textures, start with a new drawing, and draw a rectangular Polygon. Select the Polygon, then choose **Edit / Properties**. Change to the **Texture** page. Click the check-box **Use a Texture for the surface of this object**, found at the top of the page. After you click the check-box, you will see the Texture List dialog box.



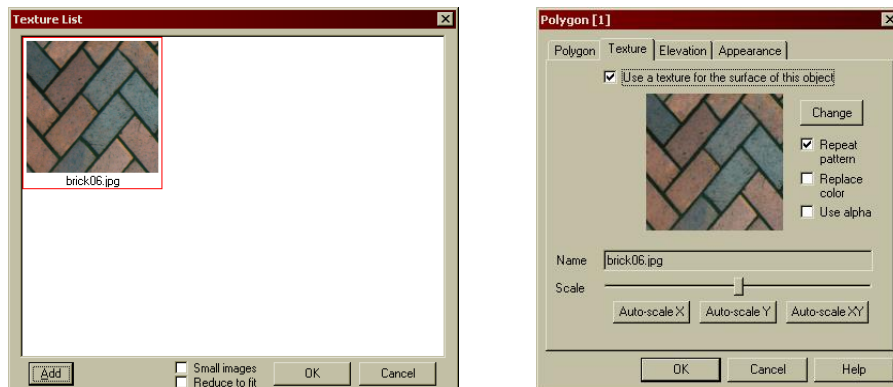
The Texture List shows all the textures associated with the current drawing. In this example, the file was created just before drawing the polygon, so no textures are shown in use. Click the **Add** button to add a Texture to the Texture List for the current document.

This brings up the Texture Browser, a convenient way to view your Texture Library and select a Texture. 3rd PlanIt's basic texture library comes with two major categories: **Materials** and **Nature**. Feel free to look around the library, then select any texture you'd like. For this example, we will select a brick pattern, then press OK. You could also double-click the texture of choice.

There are two options you can select, at the bottom of the box. The **Small images** option reduces the size of each image and removes the file name, letting you see many more textures at the same time. **Compute alpha** is used to control transparency of the Texture and should generally not be checked; this is discussed in more detail later in this chapter.



After selecting the texture, your document's Texture List will now show one texture – the one you selected. Once a Texture is in your Texture List, you can use it repeatedly on other objects in the document. A red box surrounds the selected Texture. Press the OK button to apply the selected texture to the Polygon.



The Properties Sheet for the Polygon now shows the texture you selected, including the name of the file from which it came. The various options associated with the texture are now available for use. Let's look at each of the options in detail.

18.1.1 Repeat Pattern

The texture image can be adjusted in size relative to the surface it is applied to. It can be made much smaller, and repeated in a grid-like manner across the surface. If the texture is carefully made, the seams between copied images can be made invisible, such as in this brick pattern. When repeated many times over the surface of an object, the resulting brick appearance is quite realistic.

This option is best used for surfaces such as roads, walls, rocks, ballast, grass, water and other such materials. If you are applying a photograph of a boxcar to the side of a boxcar, you do not want to select the Repeat Pattern option.

18.1.2 Replace color

A texture can either replace the usual color of the surface, or it can “modulate” it – mixing the color of the surface with the colors in the texture. One good place to use modulated color is when making a Terrain Mesh. The Mesh changes color as its elevation changes. Modulating a texture with the terrain color helps define different elevations.

18.1.3 Use alpha

The Alpha of a Texture image controls its transparency. If your texture has an Alpha Mask and you want parts of it to appear transparent, select this option. If you want the Texture to be opaque, do not select this option. (See the Controlling Transparency section in this chapter for further information).

18.1.4 Scale

The Scale of an image is its magnification, compared to the surface it is applied to. There is a wide range of sizes available when you apply a texture to a surface – or to a Terrain Mesh. This sliding Scale control is most often used to adjust the appearance of grass, water, rock or other repeating textures.

18.1.5 Autoscale X, Y and X-Y

If you are covering a surface with a photographic texture and you want to have it match 1:1, these controls provide the means. This situation happens with the sides of buildings, rolling stock, billboards, signs and other similar objects.

When you apply a texture to a surface, you will almost always want it “flat in the X-Y plane”. For example, the four vertices of the example polygon are all at a Z value of 0. The polygon could also be “flat in the X-Y plane” if all of its Z values were 4, 10 or any other value. If the polygon is not flat, the texture will appear distorted on the polygon – which can create unusual and desirable effects in certain situations.

Let’s use for an example the task of applying a texture to the side of a boxcar. A photograph can be scanned, or a digital camera can produce the image file directly. This file is edited in image processing software (such as Adobe’s PhotoShop) to a size of 64 x 128 pixels. At the top of the image, four rows of pixels are black, due to the proportions of the boxcar.

When applying this texture to the side of the boxcar, you would want to press the **Autoscale X**. That is because the texture fills the bitmap image from side-to-side (the X direction), but does not fill it top-to-bottom (the Y direction). If your texture was complete from top-to-bottom, but the right part of the image is not complete, use the **Autoscale Y** button. If your texture is able to fill the bitmap image both horizontally and vertically, you can use the **Autoscale X-Y** button. Since both the X and Y dimension are scaled independently with the command, the texture could appear distorted.

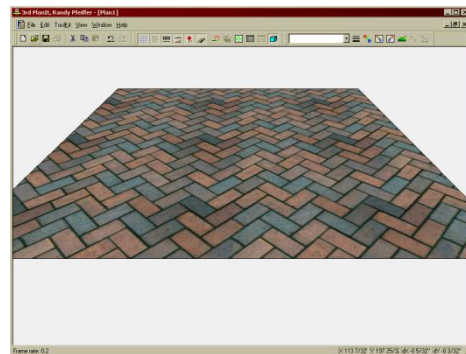
Press OK to apply the texture to the Polygon.

18.2 Viewing the Texture

When a texture is applied to an object, the texture is only visible in 3D. Many people find it helpful to assign the dominant color of the texture to be the surface color of the polygon. This helps identify objects that might otherwise appear to be similar shapes.

Press the Tab key to switch into the 3D view. You may need to adjust the view direction using the arrow keys to bring the textured polygon into view. When you see the polygon, you should see the pattern of the texture repeating across its surface. Move through the drawing until you are close enough to the polygon to assess the appearance of the texture. If it is too small or large, change back into 2D, select the object’s Property Sheet, and adjust the Scale control until it appears appropriate for the surface.

You will see the Polygon has a black outline. This is characteristic of Polygons used in 3rd PlanIt. To change to an invisible boundary, switch in 2D, bring up the Polygon’s Property Sheet and switch to the Polygon page. Under **Type**, change the value from **Polygon** to **Contour Plane**. A Contour Plane is the name for a 3rd PlanIt polygon that has an invisible boundary.

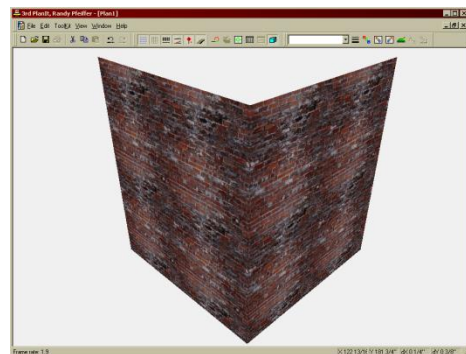


18.3 Editing Textured Objects

When you edit a textured object, such as rotating it or resizing it, the texture is edited in the same way. If you tilt a textured object, the texture will tilt with the object.

In the example at the right, a brick pattern was applied to a Polygon. The Polygon was then tilted up, and a copy was made. The copy was rotated 90 degrees to form the second wall.

The **Select Tool** is used to align the second wall. First, hold the **Alt** key and point to the second wall near one of its ends, so it highlights. Still holding the **Alt** key, press and hold the left mouse button and drag the second wall to the first so their corners come together. When you are pointing to the first wall, it will highlight to confirm the alignment and the second wall will snap to its end. While still holding the **Alt** key, release the left mouse button and the second wall will be perfectly aligned to the first. Confirm this by switching to 3D using the **Tab** key.

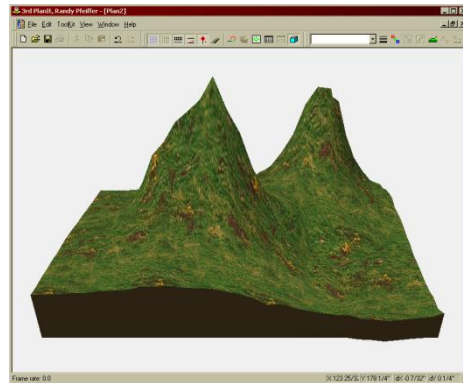


18.4 Applying Textures to Terrain Meshes

Terrain Meshes are almost always used to represent undulating terrain (terrain that is not flat). Overall, a Terrain Mesh is considered flat in the X-Y plane, but portions of it rise and fall across its surface.

When Textures are applied to surfaces that are not in the X-Y plane, the texture is slightly distorted. In a Terrain Mesh, this distortion reinforces the 3-dimensional feeling of the terrain. Parts of the terrain that are highly vertical will have greater distortion, while flat areas have no distortion.

Be sure to try different scales for the texture you select. The proper scale for the terrain is essential for a realistic look.



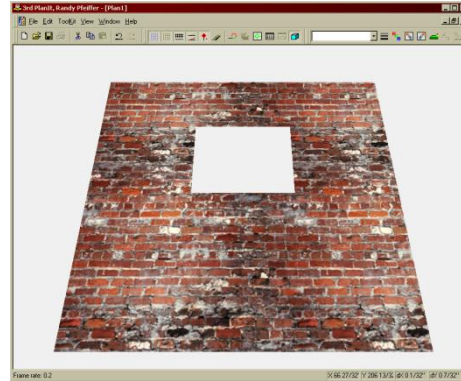
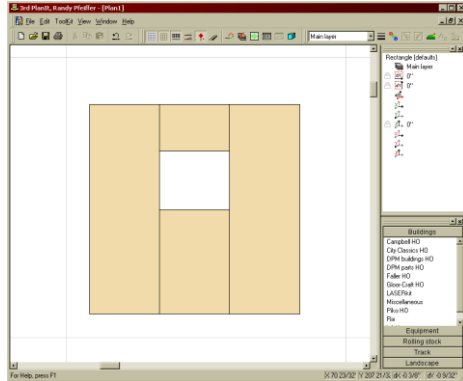
18.5 Applying Textures to Groups

A Texture can also be applied to a group of objects. The same texture is applied to any Polygons or Meshes in the group. The texture is aligned to the lower-left corner of all objects in the group.

18.5.1 Groups That Are Flat

One obvious and useful example of this is to make walls for buildings – walls with holes for doors and windows.

To make a wall with holes for doors and windows, you need to make a group of polygons. These will usually be square or rectangular polygons, aligned precisely to one another. Note... use the **Alt** key while drawing or moving to snap to the nearest endpoint. This ensures good alignment and makes the process go more quickly.



Once you have a wall made, select all the Polygons and press **F9** to make them a Group. Select the group and enter **Edit / Properties**, choosing the Group page. Change the **Type** from Group to Contour Sheet to eliminate boundary lines in 3D. Now select the Texture page. Select **Use a texture for the surface of the object**, and then follow the dialog boxes to select a brick texture for the wall.

When you view the wall in 3D, the brick texture will be continuous across the wall, ignoring the boundaries of the polygons. The window area is totally open and will show any objects behind it.

18.5.2 Groups That Are Not Flat

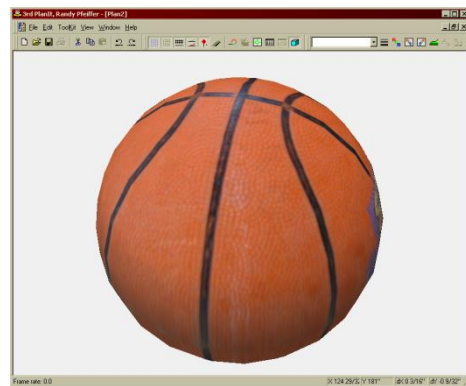
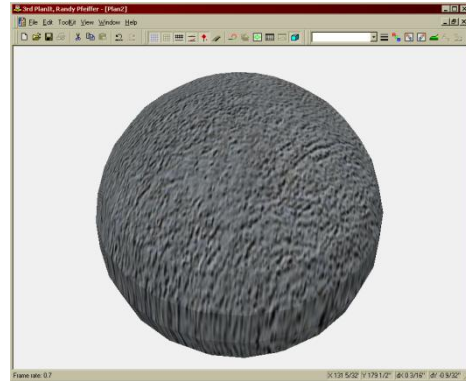
A sphere is an excellent example of a group that is not flat in the X-Y plane. In fact, not one polygon in a sphere is flat in the X-Y plane, as the sphere is originally drawn.

In the example at the right, a Stucco texture was applied to a sphere. The texture is set to repeat across the surface of the group. While the polygons on the top and bottom 2/3 of the sphere look reasonably good, those near the middle of the sphere are noticeably distorted.

However, there is a consistency to this distortion that we can use to our advantage. When you take a photograph of an object that is spherical, the sides are compressed into the 2D plane of the photograph – the exact opposite distortion.

If an image of a spherical object is applied to a spherical Group in 3rd PlanIt, these two distortions cancel each other out. In the lower example, the sphere was given the texture from a digital image of a basketball. The image was Auto-scaled in both X and Y so it fit the ball perfectly.

This same technique can be used to apply the texture to any curved surface, such as the front of an F7. Make a texture of a head-on view of the locomotive, preferably taken with the camera centered on the locomotive in both width and height. Make a group of the polygons that form the nose of the locomotive, and “tilt it onto its back” so that the headlight is pointed up, in the Z direction (out of the screen). Now apply the texture, and in 3D the nose will be textured properly.



18.6 Controlling Transparency

The **Compute alpha** option lets you control the transparency of a texture. You can make all of it partially transparent, parts of it completely transparent, or any combination. This is accomplished using an **Alpha Map**. To understand an Alpha Map, it's important to review what a texture is.

All textures are an array of “pixels”, or picture elements, each of which has its own color. One of the brick patterns shown above was enlarged to create this example. Some pixels are dark, some are light, some are reddish and some are bluish.

When all the pixels are much smaller, our eyes see what they are accustomed to seeing: a pattern of bricks. The pattern of the pixels is too small to be noticed.

Each of the pixels' colors result from combining different amounts of Red, Green and Blue. Red and blue combined make a pinkish color known as Magenta. Red and green combine to form yellow. Other colors result from other combinations. This scheme of creating colors is called RGB.



3rd PlanIt has an additional “channel” for each pixel, **Alpha**, to control the transparency of the pixel. This is known as RGBA color. If a pixel's alpha is zero, it means the pixel is completely transparent, and contributes no color to the scene. If a pixel's alpha is as high as possible (typically 255), the pixel is completely opaque, so nothing behind the surface is visible. The transparency changes linearly between the lowest and highest values; a value of 128 would mean that the object is partially transparent. The resulting

color of the pixel would be 50% from the texture, and 50% from the object behind the textured surface in the drawing. A water texture made partially transparent would show the terrain beneath the surface.

18.6.1.1 Using Your Own TGA Files with Alpha

The TGA file format supports the RGBA pixel coloring method. Various picture processing programs, such as Adobe's PhotoShop™, let you edit the Alpha channel directly, then include it in a TGA format file. If you create such a file, you can add it the Texture Library to import it into 3rd PlanIt (see below). When using a TGA file with Alpha stored with the color information, you **do not** want to choose the **Compute Alpha** option. This would compute a new Alpha for each pixel, replacing the Alpha value saved in the file.

18.6.1.2 Computing Alpha from Color Information

If you check the **Compute Alpha** option, when you press OK you will see the **Alpha Setup** dialog as shown here.

With this, you can choose the way transparency for each pixel is calculated. If the method is based on a color, you can select the color using the lower button. The Transparency Methods available are:

Brigheest is clear – transparency goes from 0 to 1 smoothly, making the brigheest pixels in the image the clearest in the Alpha Mask.

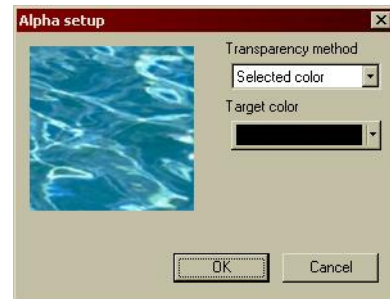
Darkest is clear – transparency goes from 0 to 1 smoothly, making the darkest pixels in the image the clearest in the Alpha Mask.

Selected color – only pixels with exactly the Target Color will be made transparent. All others are opaque.

Brighter than color – pixels brigheer than the Target Color are made transparent. All others are opaque.

Darker than color – pixels darker than the Target Color are made transparent. All others are opaque.

The best setting for the water texture in the example would be **Darkest is clear**. Since no water color is black, no area will be transparent. The darker areas will show what lays beneath them in a natural way.



18.7 Using Your Own Textures

Since a Texture is simply a digital image, it's easy to create your own textures. You can make a library with your favorite rolling stock or architecture, complete to the car numbers. The first thing to do is to set up your own Texture Library component. In a typical installation, the Texture Library is located in **C:\Users \ Public \ Documents \ 3rd PlanIt \ Textures** and contains two folders: **Materials** and **Nature**. Create a new folder along with Materials and Nature, perhaps named **Personal**. Then create a Category within **Personal**, such as **Cabooses**. You would then store all your caboose textures in that folder.

Sometimes it can help to design the object directly to the texture, so the proportions match exactly. To do this, use the **Toolkit / Draw / Place Image** command and place the texture as a 2D image in the drawing. After carefully resizing the image to the scale of the drawing, draw the polygons directly over the image. Then apply the texture to the polygons and it should align perfectly.

18.8 Changing Textures

When a texture is first applied to an object, or when you press any of the **Autoscale** buttons, the texture is applied in the X-Y plane as discussed previously. However, when you change a texture, the scales and direction references are left the same. This allows you to revise a texture without needing to return an object to its original orientation in the X-Y plane.

For example, if you have made a boxcar and put textures on its sides, they will be vertical and appear as lines in the 2D view. You can choose a side, select **Edit / Properties / Texture**, and press the **Change** button. Select a new texture for the side of the boxcar, and press OK. Do not press any **Autoscale** buttons, and do not change the position of the **Scale** slider. Simply hit OK and close the properties sheet. The new texture will appear in the 3D view, retaining the scale and position of the previous texture.

19. Layout Splines

Layout Splines are a revolutionary new method to convert your digital track plan into a full scale layout. Instead of printing your layout onto paper to transfer to plywood or other roadbed material, Layout Splines can be digitally cut using CNC cutters, laser cutters or other similar digitally driven machines. They can be used to determine placement of the track and track centerline or to create spline-like roadbed. When Layout Splines are generated, they take into account all changes in elevation along the path to provide highly accurate results in all situations. CNC routers and laser cutters are becoming more accessible to the general public, or you can have El Dorado Software produce Layout Splines from your drawing file.

19.1 Varieties of Layout Splines and Materials

Two types of Layout Splines can be produced: Track Splines or Roadbed Splines. Track splines are used to help lay out your track onto roadbed material of your choice by fitting between the rails of flex or sectional track, letting you install this track and accurately match the complex curves and designs possible with 3rd PlanIt. Roadbed Splines are usually as wide as or wider than the track and ties, and can be used as actual roadbed support for the track.

19.1.1 Track Splines

Track Splines can be built with centerline slots if you choose. You place the Track Splines on your layout surface, position them as you intended, then draw centerlines on the layout surface through the slots to guide placement of cork or foam roadbed. You can also use a tool available from El Dorado Software that holds two mechanical pencils to trace both sides of the roadbed onto your layout surface. This is most useful when you're using foam roadbed that is full-width, rather than half-width cork roadbed.

After you've installed your roadbed and want to lay track, you can use your Track Splines again. This time you'll place them within the rails of the track. The Track Splines will guide you as you flex the track into its planned shape. Track Splines are fabricated using Expanded PVC (XPVC) or, in some cases, a wood product as the material. Expanded PVC is a durable, closed cell, free foam PVC sheet material that combines a rigid exterior and matte finish.

If they are made with XPVC, they have a slight flexibility that lets you smooth the track curvature and adjust its placement from your original plan, as sometimes can be desirable. You can choose Track Splines made with 1/8" or 1/4" thick XPVC. 1/4" XPVC flexes less than 1/8" XPVC. While either will provide good guidance for drawing centerlines, you may wish to have 1/4" material if you want the least accidental deviation from your plan. 1/4" material costs more than 1/8" material, so, in general, 1/8" is the best choice for most situations. To achieve the highest faithfulness to your drawing, 1/8" Track Splines made from a wood product such as Masonite or MDF (Medium Density Fiberboard) flex the least.

19.1.2 Roadbed Splines

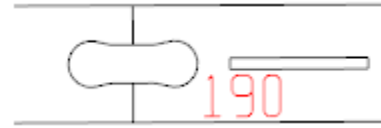
Roadbed Splines are made to support your cork or foam roadbed. They may be set to Roadbed width specified in the 3rd PlanIt Layer Properties for each track layer, or may be set to a Custom width of your choice. Roadbed splines are typically made of plywood, Masonite, or other wood products.

Roadbed Spline material may be 1/8" to 1/2" thick for most purposes. If you have changing grades in your layout, the Roadbed Spline must be able to flex vertically to make a smooth grade transition. While it is possible to cut 1" or thicker Roadbed Splines, they will not flex sufficiently to make a change in grades. For that reason, Roadbed Splines are typically 1/8" or 1/4" thick.

You may also cut Roadbed Splines into MDF (Medium Density Fiberboard) or HDU (High Density Urethane) foam. Both products offer superior temperature stability and excellent workability. HDU is a wonderful material that can be sanded like wood or trimmed with a vibrating cutter. Typical thickness is 1/4", but can be milled to 1/8" for better flexibility at additional cost.

19.2 Notching of Layout Splines

As it is not possible to cut splines of great length on either CNC routers or Laser cutters, the splines are built with Notches and matching tabs as shown in the image to the right. The image shows a junction of two Track Splines, including the Spline Label and one of the centerline slots.



Notches and tabs allow you to build Layout Splines of any length. You may glue together adjacent splines until you have the spline length best for you. There are practical limitations to the longest usable Layout Spline. While it is possible to glue together your whole layout as one huge spline set, you won't be able to move it when you need to or conveniently store it. Remember that splines can be temporarily attached without glue. If you are working with Track Splines, it's best to have one complete spline for each track path between turnouts, assuming the length is manageable.

If you are working with Roadbed Splines, you will be adding them to your layout as you build it. In this case, it works well to glue together a 4- to 8-foot section on a flat surface with wood glue or construction adhesive, and then glue that section onto the end of previously installed Roadbed Splines. A good strategy is to glue together yards or turnout groups as one section, position the most critical element on your layout, then glue additional segments to that and work your way along the track paths.

While building your layout with Roadbed Splines, you will want to support it with Risers as typically found for hand-made splines (see www.TrackPlanning.com/splines.htm). It's far faster to build a layout with Roadbed Splines than to hand-craft splines from poplar and glue or hand-cut them from sheets of plywood, yet gives you the same freedom of placement with built-in accuracy. It's good practice to leave an occasional junction without glue until you've positioned the Roadbed Spline end-to-end, in case you need to slightly adjust the path along the way. However, make sure all junctions are glued prior to installation where a change in grade is found, or the grade change may not have a smooth vertical transition.

19.3 Building Layout Splines from your Track Plan

Now that you have some background in the use of Layout Splines and various materials, it's time to build a set of splines from an existing track plan. We'll use a simple point-to-point example made from SoftTrak as well as individual track objects (curves, easements, tangents and a turnout).



All track objects are in the Main Layer, as typical of many small track plans. However, Layout Splines can be built from more than one layer in a complex design. Before building your Layout Splines, make visible any layers for which Layout Splines should be built.

It's always good practice to save your file before generating Layout Splines, especially when you are first learning how to generate and edit them. You can easily revert to your known-good document should something go wrong during the process.

To begin, select Tools / Build Layout Splines or use the shortcut F12. If the shortcut is not active, select Tools / Shortcuts and click Reset All. After issuing the Build Layout Splines command (F12), the Layout Splines Build Information dialog appears:

While there is a lot of information presented, it is broken down into related fields that do not change frequently. Let's review each area, starting on the right side.

19.3.1 Track analysis

This is perhaps the most important field in the dialog. If you have open ends, you really should not build Layout Splines without reviewing your plan in **View / Display style / Questionable track** (Alt+Q). You'll often come across a mismatch in elevation at ends that appear connected in 2D, or an open connection that is only apparent if you zoom in deeply. To get good Layout Splines, start with a good track plan!

If isolated objects are detected, decide whether they are intentionally isolated, such as the radial track around a turntable. They may also be hidden lines underneath other lines and other drawing errors that should be resolved prior to building Layout Splines.

19.3.2 Material

In these fields you select the **Length** and **Width** of the material based on the capacity of the machine which will be used to fabricate the Layout Splines. The **Thickness** field is used to set the engraving depth for labels when the splines are fabricated on a CNC router. Make sure to set Thickness to match the material you plan to use. **Edge Clearance** allows you to provide enough "wobble room" for positioning the splines for fabrication.

19.3.3 Cutting tool

You may choose **CNC router** or **Laser cutter**. A CNC router needs to use two cutting tools to fabricate Layout Splines: one to cut the edges and another to cut centerline slots for Track Splines and labels if selected. The field **Add offset for tool** provides a basic tool path for the chosen cutting tool. For example, a CNC router using a 1/8" (0.125") diameter end mill needs to run the center of the tool offset outside the

spline by half its diameter (1/16" or 0.0625"). You will not need to use this field if you submit your job to El Dorado Software or another commercial vendor. In-house CAM (Computer-Aided Manufacturing) software generates the optimal tool path for the cutting machine from the edge outlines provided in the exported DXF file generated in your final step to production.

If you have access to a machine that does not have CAM software to generate the necessary tool offset, **Add offset for tool** will be handy. If you select **CNC router**, two diameter fields become active: **Cut Diameter** and **Engrave Diameter**. The end mill discussed above is entered as the Cut Diameter, and will typically be either 1/8" or 3mm. If you select Laser cutter, only one size field is active: **Cut diameter**. This will be the beam width at the least focused extent. The default value is 0.003" as found on a commercial laser cutter. Hobbyist laser cutters will typically have a beam width of 0.006" or a bit more, depending on the optics of the system. Although a laser cutter has only one diameter available, it also can engrave material as well as cut. Isolating lines to engrave from lines to cut is discussed in **Spline properties**, below.

19.3.4 Splines

These fields control the specifics of how Layout Splines are built by 3rd PlanIt. **Maximum spline length** helps you control the length of the splines in concert with other limitations. Above all, Layout Splines are limited by the specified size of the material less the specified edge clearance along each side. In the 40x30" example with 1" edge clearance, the size of splines is constrained to 38x28". You can further reduce the maximum spline length to a chosen value if you wish.

Width of splines determines whether you are building Track Splines or Roadbed Splines. The example builds Track Splines because its width is set to **Rail Spacing**. The value field shows **By gauge**, because the width of the spline is computed from the gauge information in the **File / Settings / Track** dialog and the model scale set in **File / Settings / Units**. Similarly, if you choose Roadbed for Width of splines, the roadbed defined in each objects layer is used (**Action / Modify Layers / (Main layer) / Ballast and Roadbed**). You can also select **Custom** width and enter a specific value.

Notches on ends lets you choose **All ends flat**, **Open ends flat**, or **All ends notched**. This is typically set to Open ends flat. Unless you select All ends flat, turnouts are built with notches on open ends as well as connected ends. This lets you add track in the future and easily connect it to the existing turnout end.

Maximum arc helps you control spline length in special situations, such as a helix. You want to make best use of the available material, and later in the process you will position Layout Splines within a material outline. If your helix spline is generated until it would intersect itself, you'll have a few very large round splines that don't pack nicely onto material. This may be OK – you may choose to have fewer junctions and give away some excess material. If you prefer to use material more efficiently, try setting **Maximum arc** to 120-180 degrees. You'll find it much easier to arrange splines on the available material.

Maximum arc (degrees) controls the accuracy of cut compared to the curvature of the track. Curves are provided to the cutting machine as a sequence of lines that approximates the curve. The value of 0.5 degrees keeps the lines within 0.005" and 0.25 degrees keeps the lines within about 0/002". The smaller the value, the larger will be the generated data file sent to the cutting machine.

19.3.5 Spline properties

Here you can control the content of your splines and provide information to the cutting machine to fabricate them properly. The **Lines** color field is often used to control the beam power of a laser cutter, and could be used to select a tool on a CNC router. The **Lines / Weight** field controls the thickness of the Layout Splines in the 3rd PlanIt view.

You can choose to **Include centerlines** if you wish. If so, you can select a color appropriate to what you are making and the fabrication machine. If you are making Track Splines, you'll want to trace a centerline with a 0.6mm mechanical pencil. If a laser cutter will be used, this should be set to the same color as the Lines color. If you're making Roadbed splines on a laser cutter, the color should be appropriate to engraving, as you want to lay roadbed direction on the spline. You can also choose the width of the centerline, which in the example is a value appropriate for the mechanical pencil.

Include labels generates a numbered sequence of labels with a chosen **Prefix** and **Start** number. You'll almost always want to generate labels – it is far more difficult to recognize a specific spline than you would expect! Labels help greatly by showing you what connects to what. Along a path of splines, the sequence number always increments by one until reaching the end or a turnout. Since labels will always be engraved, you can set the color as appropriate for power setting or bit selection on the cutting tool.

Centerline and labels export to different layer can help the operator of either style cutting tool. Some CAM packages work most naturally if the mill or power setting is made by-layer rather than by-color. Choosing this option creates a DXF export file with a layer named **Layout Splines** and an extra layer named **Layout Splines Ext**. Spline outlines export to the Layout Splines layer, while labels and centerlines are exported to the Layout Splines Ext layer.

19.3.6 Selected layers will be included

This list box will be populated with all layers in your track plan that contain track. Layers holding terrain, rolling stock and other non-track objects are not included. All layers selected in this list will be included in the Layout Spline build list.

19.3.7 Checkboxes

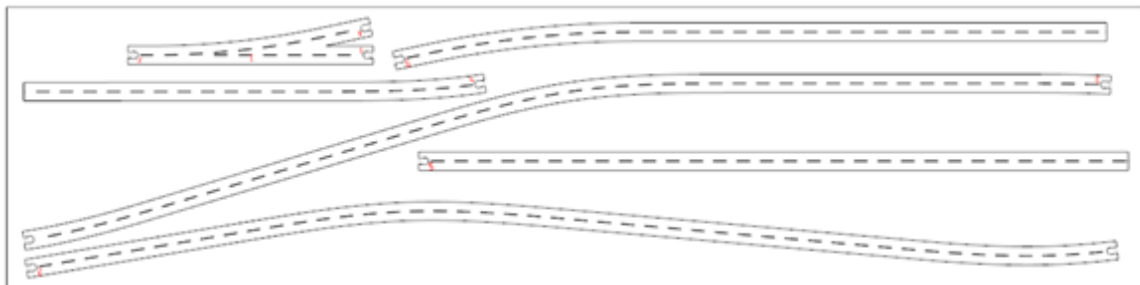
Include turnouts is almost always checked, but you may want to generate splines for turnouts separately from the rest of the track. **Include isolated track** is disabled if the drawing contains no unconnected track objects. You have the option of making splines for these “outlying” pieces if you check this box. **Save as favorites** stores the values in this dialog to be your default values in newly created documents. You can also disable a notification window displayed after the build process once you get comfortable building Layout Splines.

19.4 Building Layout Splines

With all the values set appropriately, press the **Build** button. Here's the output for the example settings.



The large box is the size of the material than can be handled by the cutting tool. We also see the Track Splines that have been built. Note that only the Layout Splines layer is active and displayed. It's easy to toggle **Layout Splines Only** mode: View / Show / **Layout Splines Only** (Ctrl+F12). With the select tool, move the splines into the material box in a compact arrangement.

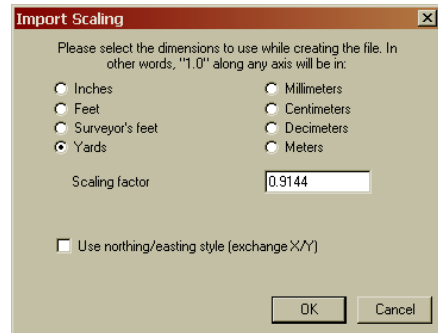


This is a nice, efficient arrangement of the pieces. The bottommost spline was rotated about 160 degrees from its original position to make good use of material. The less material you use, the less you'll pay for your Layout Splines. Make sure to leave at least 1/8" between adjacent splines for the cutting tool.

19.5 Exporting to DXF

If you will be submitting your file to El Dorado Software for fabrication, you can save your file as it is. We'll open it with 3rd PlanIt and create the DXF file. While still in 3rd PlanIt format, we can easily make small changes that may make production more effective. Once the file is in DXF format, the locations are more-or-less fixed. If you are submitting this to another vendor or using your own machine, you'll need to have the Layout Splines stored in DXF format.

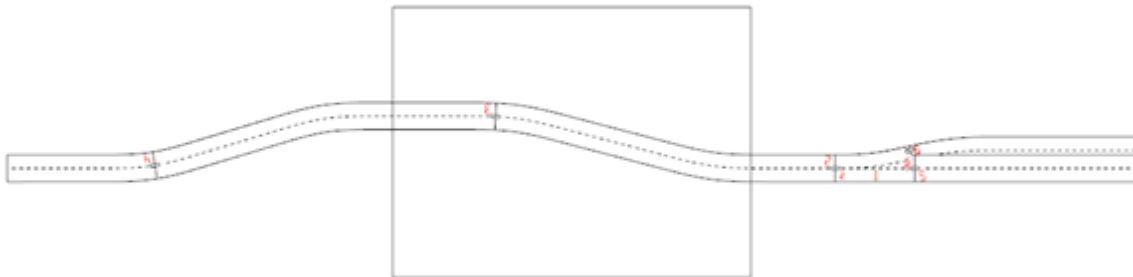
Choose **File / Export / DXF** from the main menu. You must be running the 32-bit version for this option to be active. Choose the location and name for the export file and press Save. You will see the dialog shown at the right. In America, you will almost always select **Inches** for units. Elsewhere, you'll choose **Millimeters** or **Meters**, depending on your vendor's preference. The **Scaling factor** field will be updated to reflect your choice of output units.



Press OK to complete the process.

19.6 How to Work with Wide Splines

There is a significant difference between Track Splines and Roadbed Splines: their width. Consider for a moment that Track Splines always fit within the rails. They can never overlap each other. On the other hand, Roadbed Splines can be any chosen width. If you have track spaced at 2" and generate Roadbed Splines at a 3" width, the overlap is apparent. Here is the sample layout again, this time with Roadbed selected for the Spline Width.



The difference in width is obvious when compared with the Track Splines built previously. The splines in the open area on the left are fine, but the area around the turnout needs attention. What should be done?

19.6.1 Connect / Add Polygons and Connect / Subtract Polygons

Two new editing tools are part of 3rd PlanIt to support Layout Splines. They are not limited to Layout Splines, however; they can be used on any polygons in the drawing. Let's take a look at their operation using two simple rectangular polygons.



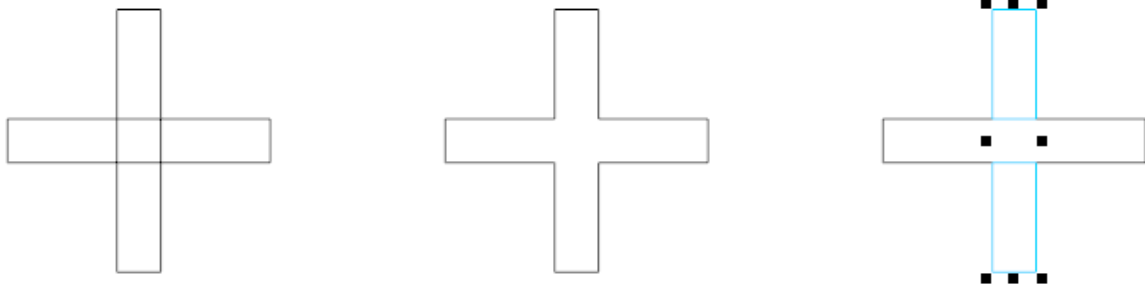
The **Connect / Add Polygons** tool joins two polygons or polylines that overlap each other. The result is one polygon or polyline whose outline is defined by the union of the two original objects. It doesn't matter which order you click the two objects when connecting.



The **Connect / Subtract Polygons** tool subtracts the second polygon or polyline you click from the first polygon or polyline you click. Sometimes this can result in the first object being divided into two or more pieces.



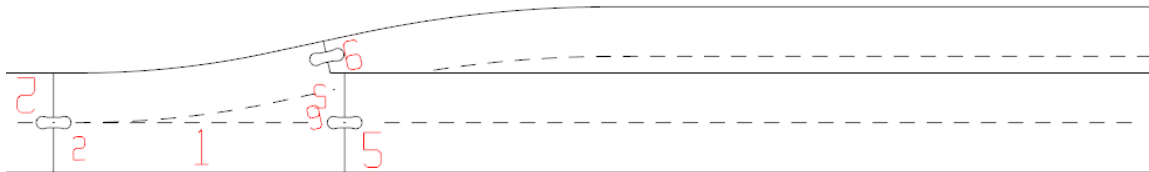
The operation of the tools can be understood by using them on two crossed rectangular polygons.



The original pair of polygons is shown on the left. It was copied twice to the right before using the Connect tools. The center example shows the result of **Connect / Add Polygons**. Only one polygon remains after the operation, shaped like a thick Plus sign (+). The right example shows how the **Connect / Subtract Polygons** tool can produce more than one result polygon. The vertically oriented polygon was clicked first, followed by the horizontal polygon. Think of it as “subtract the second polygon from the first. The result shows two highlighted polygons, made from the top and bottom portions of the vertical polygon.

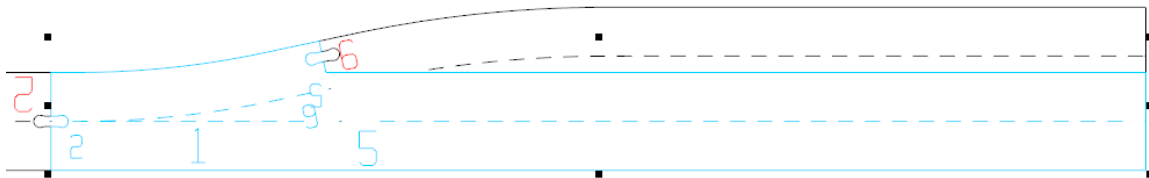
19.6.2 Adding Adjacent Layout Splines

Let’s look closely at the results of the Roadbed Splines build on the right side.

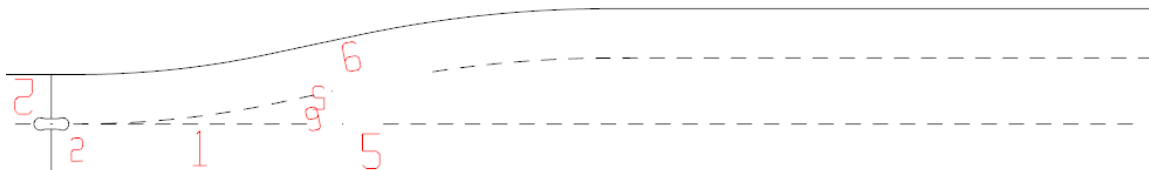


The build process recognized the two splines attached to the turnout overlapped. It trimmed the splines so that the spline proceeding from the non-routing side of the turnout was left intact at its assigned width of 3”. During the build, the turnout spline (Spline 1) and Spline 5 were subtracted from Spline 6. While this could be built by gluing the three pieces together, it is possible to make a composite Roadbed Spline that simplifies building.

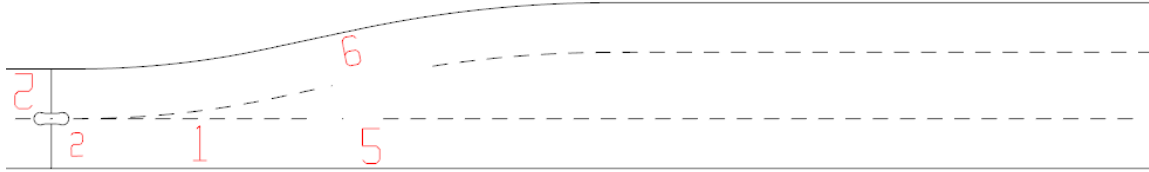
By selecting the Splines 1, 5 and 6, we can see their overall length is slightly less than 34”. This can easily fit on either CNC or Laser material as one piece. We’ll choose **Connect / Add Polygons** and click Spline 1 followed by Spline 5.



A merged Roadbed Spline results from the Add operation. We can do this again to include Spline 6.



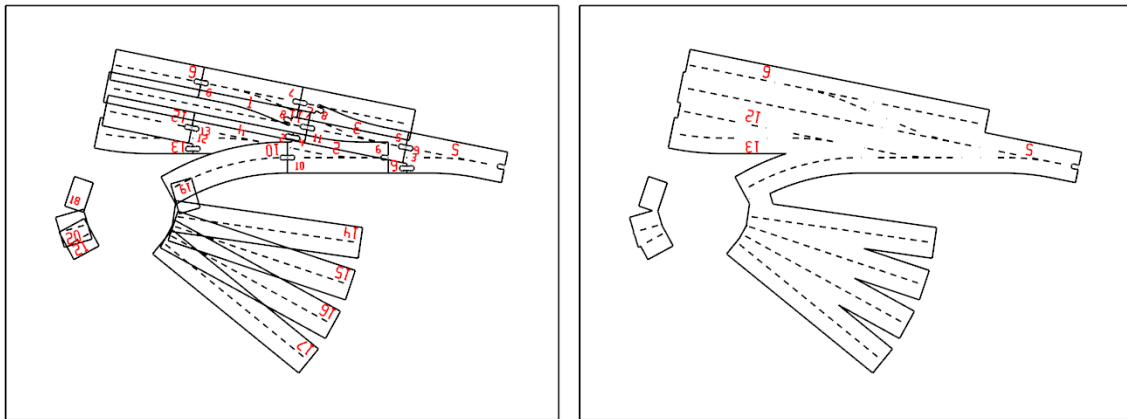
This composite spline can easily connect to Spline 2 at the left, but does not need to be glued together as an assembly while building. It is easily fabricated on either cutting device. We notice that two labels are now unnecessary – the 5 and 6 that originally indicated which splines were adjacent to the routing and non-routing turnout endpoints. Layout Splines are groups that contain the cutting outline as a polyline, as well as optional labels and centerlines. It's easy to double-click the Roadbed Spline group to “drill-down” edit its contents and delete the redundant labels.



When you are working with Roadbed Splines or Custom Width Splines larger than the Rail Spacing, it's always important to review the output and simplify sections that can be joined as one piece and still fit on the material size determined by the cutting tool.

If you're building splines near a roundhouse, yard or other complex and closely-spaced set of track, the Connect / Add Polygons tool can save a lot of build time. We'll examine an excerpted set of track from a complete layout design to learn how.

This example was set to a Custom width of 2.25" to allow roadbed to fit nicely on the Roadbed Splines while leaving room for terrain to be attached along the sides. The wide splines look like quite a mess at first glance.

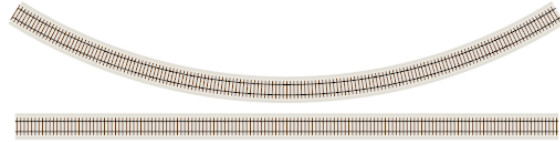


It's obvious that these splines can't be assembled as they stand. Notice that the whole group of Roadbed Splines fit within the material box – they can be joined together and still fit on the cutting tool. The **Connect / Add Polygons** tool was used in several successive operations to create the more pleasing, easily fabricated and constructed spline group on the right. There are only two pieces of material at the end of the process, and the unnecessary labels within the two spline groups were removed. Less than 60 seconds of editing saved about 60 minutes of gluing and alignment while building the layout.

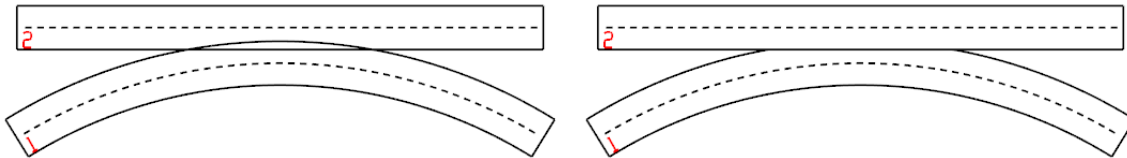
It's important to note a certain drawback to the result. There are several places where a narrow V-shaped cut is required; in particular, between the radial track segments extending from the turntable. If this shape is cut on a CNC router, the Vs cannot come to a sharp point. Even with a 1/16" end mill, there will be a 1/32" radius at the point of each V. This may not be an issue in many situations, but depending on your needs and preferences, you might want sharp points on the Vs. In that case, you want to cut the splines on a Laser cutter. With a typical beam width of only 0.003" or so, the effective radius is only 0.0015" – as close to a point as can be achieved. Due to the lifespan of the expensive CO2 laser in a Laser cutter, production will always cost a bit more than with a CNC router. This is a good example of the trade-off between the two.

19.6.3 Subtracting Adjacent Layout Splines

The **Connect / Subtract Polygons** tool is used in many situations. Here's one that commonly occurs on model railroads. The track snippet at the right shows a curve passing near a tangent track. We see this all the time, often planning for track to be as close as reasonable to make the most of our space.



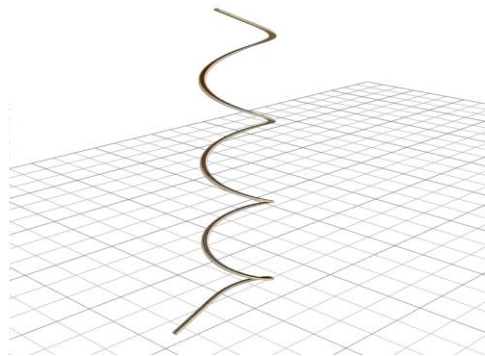
But what happens if we build Roadbed Splines? Here, the width setting **Roadbed** was chosen, using the Main Layer roadbed width of 3" as the spline width. The output of the build is shown in the left image.



As generated by the Layout Spline Build operation, although the track spacing was quite sufficient, the 3" wide Roadbed Splines overlap. They could be joined together as in the previous example, but these are only portions of what might be quite long splines. If added, they may not fit on the available material. In this case, it's better to subtract the top spline from the bottom. With **Connect / Subtract Polygons**, click the bottom piece first, then click the top piece to subtract it from the bottom. They can both be positioned in the material box, as both splines fit the material box when first generated.

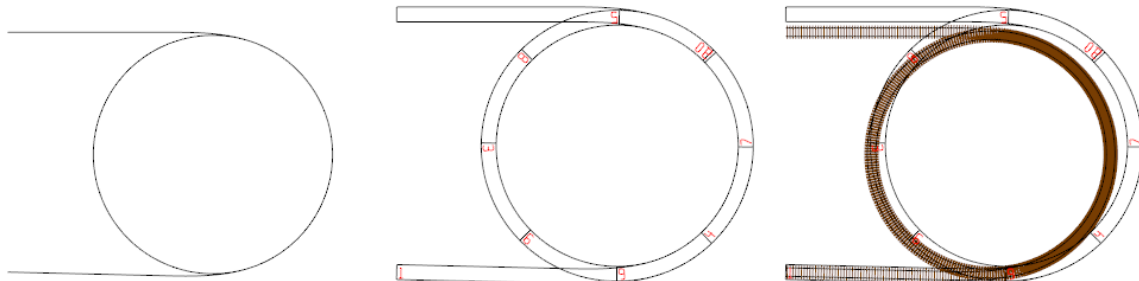
19.7 Grade Changes with Layout Splines

Layout Splines are built to compensate for changes in grade along the spline. Simply projecting an outline of the 2D view of track will not suffice – it's important to remember that a spline will need to be longer than its 2D appearance if it climbs a steep grade. One of the easiest places to see this is in a helix.



This example uses a helix with a grade that could not possibly work on a model railroad, as shown at the right. The purpose of the example is to show the grade compensation performed when building Layout Splines and the appearance of splines built on grades when viewed in 3D. With typical grades, the differences will be far less pronounced.

The next sequence of images demonstrates the "grade stretching" resulting from the example track.

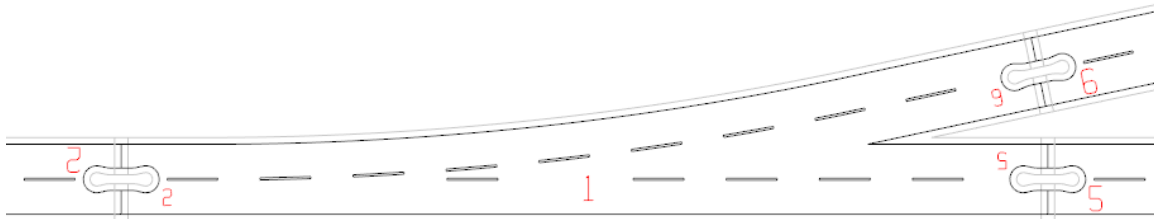


The original track centerlines are shown on the left. The center image shows 3" Roadbed Splines built from the track and the right images shows the track with rails and ties superimposed on the Roadbed Splines. Note now the splines do not overlay the track as one might expect. That's because the very steep grade had to be accounted for when building the splines. Without compensating for grade, the splines would be too short and serve no purpose.

Despite the apparent incorrectness of the result, when you build your layout with Layout Splines, you can be assured that they will be the correct length considering the grade. They will also end up with proper X/Y alignment, even though the image suggests the splines do not end on the track endpoints. After you work with Layout Splines for a while, this will become second nature.

19.8 Tool Offsets

During the discussion of the Layout Splines Build Information dialog, the field **Add offset for tool** was reviewed. Since it's necessary to position the Layout Splines on the material with some knowledge of the tool location, 3rd PlanIt presents splines with tool offset as shown.



The light gray outlines show the tool path. When you position splines in the material box, ensure that tool paths do not overlap each other.

19.9 Where to Order Layout Splines

You may order Layout Splines directly from El Dorado Software. We can produce splines made from any of the listed materials using on-site equipment. You can submit your 3PI file directly (almost always the best choice) or you can export the Layout Splines to a DXF file for submission. Simply send an email to 3pi@TrackPlanning.com to ask questions or submit a file.

El Dorado Software can provide Layout Splines on material up to 40x30" on the CNC router, or 36x24" on the Laser cutter. If your project requires larger material, we can use equipment and services from partner vendors, but be aware that larger material is considered "oversize" by shippers and costs quite a bit more. Splines made of XPVC must be run on the CNC router, as PVC gives off hydrogen chloride gas when heated. Splines made from wood products (plywood, MDF, etc.) and HDU may be run on the CNC router or the laser cutter. Although laser-cutting is a bit more costly, its accuracy and ability to engrave labels in highly visible dark letters often outweighs the slight increase in cost. If your design has a large number of V-shaped corners in the Roadbed Splines, you may wish to have them laser cut to avoid sanding required to mate splines against V-shaped corners.

You may also use an exported DXF file to work with a vendor of your choice or on a CNC router or Laser cutter you can run yourself. If you choose an independent vendor, make sure to discuss the job carefully, as vendors are not familiar with Layout Splines. If you choose to do the job yourself on a machine you own or rent time on, always make sure that your material choice is compatible with the chosen tool! Both tools can be dangerous if not used properly! If you are new to these tools, seek guidance from a knowledgeable friend or published guidelines. *El Dorado Software assumes no responsibility for results, problems or complications resulting from personal use of any manufacturing tool.*

The Notches and tabs have been designed for cutting with a 1/8" or 3mm end mill on a CNC router for HO scale and larger and a 1/16" end mill for N and smaller. A larger tool will not fit within the Notch of a Layout Spline, while a smaller end mill can break more easily. Carbide mill bits are almost always the best choice – they are strong and keep their edge longer than hardened steel. It is generally best to process engravings before cuts.

20. Designing and Building Your Layout

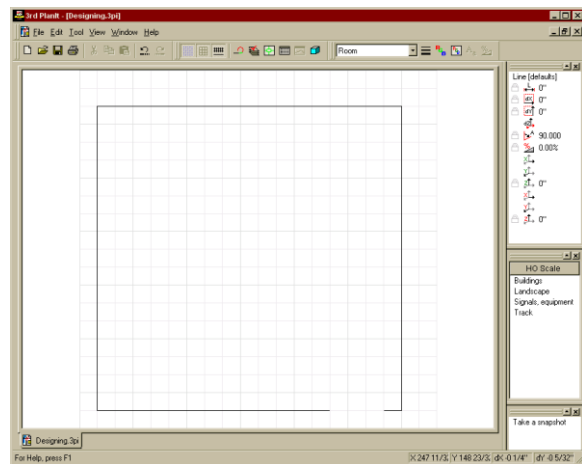
20.1 Designing Your Layout

Now you have this wonderful tool for designing your railroad... but where do you start? Fortunately, every layout has a few fundamentals that are the same in most design processes.

20.1.1 Enter Your Layout Area

This is the least creative phase of the process, but it is the most important for one reason: if you don't enter your room, basement or other layout area correctly, your whole design will be wrong. And, since you just might fudge on the too-large side, the design may not even fit. **NOTE:** *If you wish, you can use the **Layout Wizard** to automate the process described below, using **Tools / Layout Wizard**.*

The “2D Origin” of a 3rd PlanIt drawing is at the lower-left corner of your drawing. The 2D Origin is where the X and Y axes are both zero. From there, X increases to the right and Y increases to the top of the screen.



First, measure the space in which you'll build the layout. Create a 3rd PlanIt drawing and use **File / Settings** to set the dimensions of the drawing a little larger than your area in both dimensions. Think about how you will be looking at the screen and how the drawing will print, and select the dimensions with this in mind.

Use Enable layers to create a new layer named “Room”. Select a color for the layer for the Color by Layer option and return to the drawing.

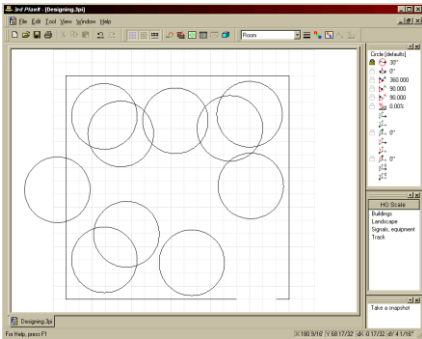
Pick a corner of the room to be the 2D origin – the lower left of the room as you will be drawing it in 3rd PlanIt. Pick a point somewhere in your drawing (1, 1 is very convenient) to start your first wall. Select the Draw Tool and start drawing a line to the right or up. Hold down the shift key to cause the line to be exactly horizontal or vertical. Watch the length of the line as you draw it, and stop drawing when it is the length you measured for that wall. If you'd like, you can use the fields in the Object Data Window to exactly set the length of the line.

Draw the second line of the room from your room origin now. To ensure this line starts exactly at the end of the first line, hold down the Alt key and press the left mouse button while pointing to the first line near the desired end. The shrinking circle will show you have selected the exact end. Draw the line holding the shift key down so it is exactly vertical or horizontal and stop drawing when it is the right length.

Do this with the remaining walls and you are done outlining your room! To insert a gap for a door, use the Slice Here option to cut the correct wall into two segments where the door belongs. Double-click each new segment and adjust its endpoint so the door is properly positioned and the correct width.

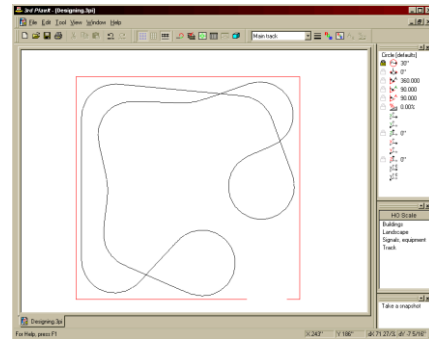
Once you have your room dimensions accurate and have verified them to your satisfaction, use Enable layers again to mark the Room layer “Frozen” and you'll never accidentally resize your room.

20.1.2 Laying the Main Line



This is *definitely* the fun part. Change back to the Main Layer for your track. In our example, it was named “Main track”. Having chosen your minimum radius, place Circles at strategic locations in the room where the curves in your main line will be. Use a Fixed Radius by locking the radius in the Object Data Window and simply draw and move them into the proper positions.

Once they are all in place, use the Connect Tool to connect them to each other. You’ll get something like the example below.



3rd PlanIt is a very productive tool. This track plan has easements between every Circle and every tangent, although a design without easements would have been just as easy.

The time it took to place these Circles and make the connections: less than a minute. This rapid rate of design allows you to try literally dozens of layouts before you invest any time in refining or building the design.

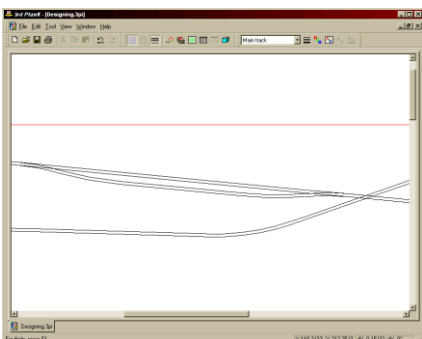
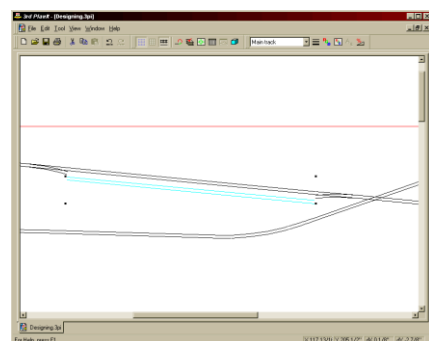
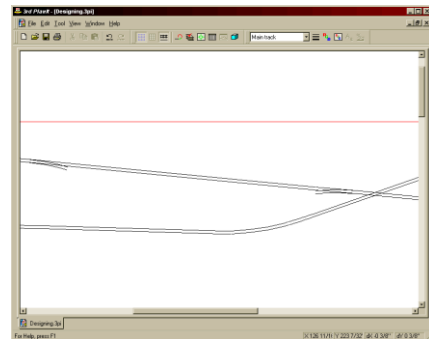
20.1.3 Yards, Industries and Sidings

It’s important to have some idea of the kinds of industries you will locate on the layout, and the size of the yards, industries and sidings. You should lay out your main line taking into account the best location for each design element.

Once you have a sound main line, it’s easy to add turnouts. Zoom into the area you wish to edit. Select the **ToolKit / Draw / Turnout** tool and the Straight Turnout. Move your cursor to the point on the line where you’d like the turnout added (the line will highlight), and press and hold the left mouse button.

While holding the mouse button down, you may move the turnout along the line. As you move the mouse from one side of the line to the other, the turnout will flip side-to-side to follow your cursor. To switch the entry and exit ends, click the right mouse button while still holding the left mouse button.

When you release the left mouse button, the turnout is inserted in the line and the line segments are trimmed.



Add the second turnout in the same manner. You should end up a drawing something like the top example. The next step is to place a parallel track for the siding itself.

Use the **Parallel Tool** to create this track spaced appropriately from the main line as shown in the second example. Then, use the **Connect Tool** (easement or non-easement version) to connect the turnouts to the siding track as shown at the left.

20.2 Trees and Plants

Trees add lots of detail and esthetic value to the layout, even on the computer. Use the **Toolkit / Draw landscape object / (plant)** tool to place them in realistic settings. You can easily resize the trees (they resize in three dimensions) to vary their appearance or bring them to your scale. Select the tree(s) in 2D, then swap to 3D. Press **Shift+Backslash** to increase their size or **Ctrl+Backslash** to decrease their size.

If you have many landscape objects in a drawing, its rendering will slow down. For this reason, always place trees and plants in a Landscape or Trees layer. You can turn them off when you're working and want to be productive, and turn them on when you want to sit back and see how it looks.

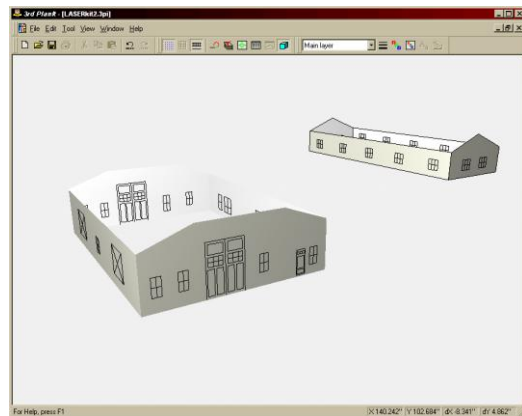
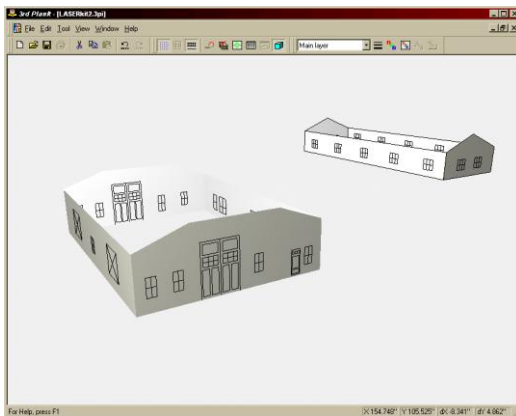
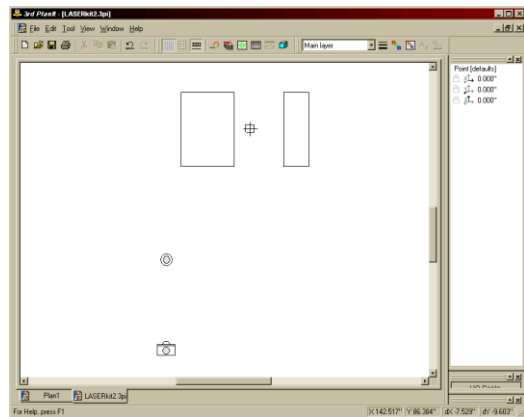
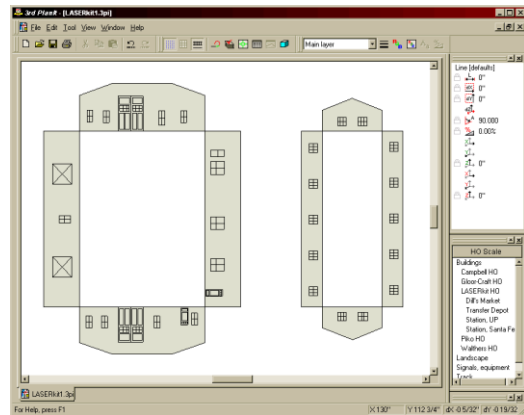
20.3 Buildings and Tilt-Up Construction

3rd PlanIt simplifies building input so you can quickly create very good representations of your chosen buildings. In this example, we drew a LASERkit model by measuring each of the pieces in a kit. Each piece was drawn with the wall "laying on the ground". Once the walls were drawn, including the windows and doors, they were grouped so each wall can be treated as a unit.

The shaded wall backgrounds are Polygons. They were drawn using the **Toolkit / Draw / Polygon / Rectangle** tool. The end pieces with sloped top edges were modified by double-clicking the left mouse button while pointing to the wall Polygon, then using **Add Vertex** to add one or two vertices as appropriate. The new vertices were then moved into the correct position.

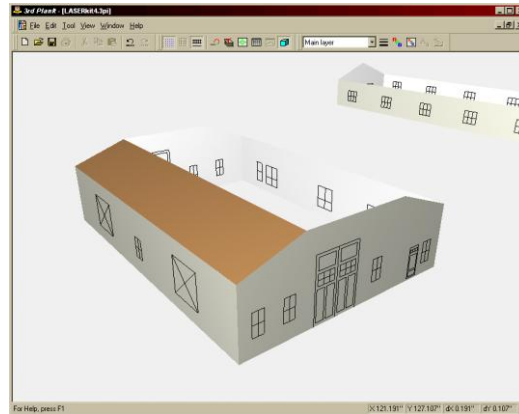
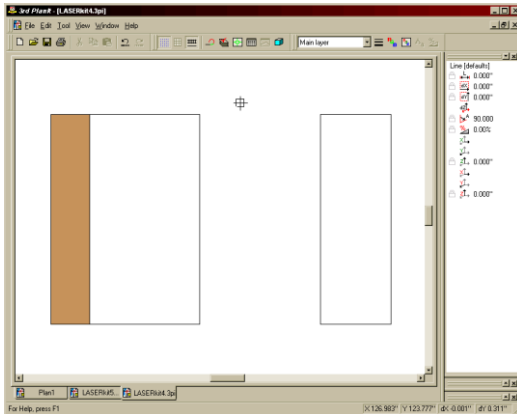
To tilt a wall, group all of its constituent objects. Then select the group on the line that will be used as the axis for tilting. You can right-click the axis line, as well. Then select **Tilt / Tilt around selected line / 90°** to tilt the wall into position. Drag each wall into position using the **Alt** key so their corners are exactly aligned.

IMPORTANT: Viewed in 3D as shown below left, we can see that the front surface (the colored surface) of one of the top walls is backward. Using **Edit / Change / Change front surface**, the right example shows the corrected wall.



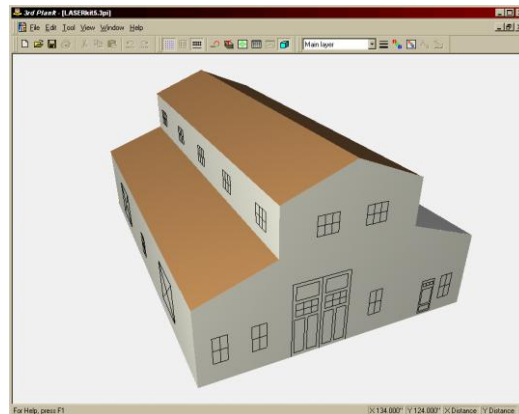
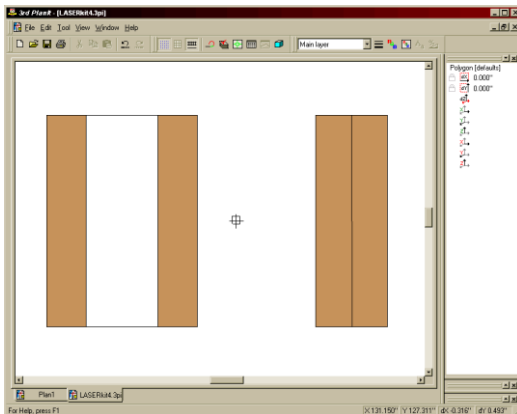
Note the difference between a Polygon and a Contour Plane. Each polygon in the building's lower section was changed to a Contour Plane prior to this rendering. The polygons in the upper section were not. You can see the bounding lines only present around Polygons.

The roof surfaces were drawn using the **Draw Polygon Freehand** tool. Note that when you use the **Draw Polygon Freehand** tool, the resulting object is set to be a Contour Plane, not a Polygon. That's because the tool is most often used in this manner and it saves a step.



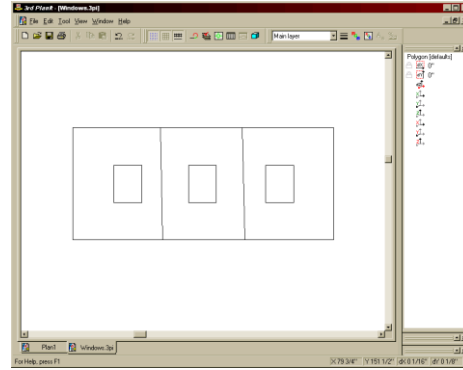
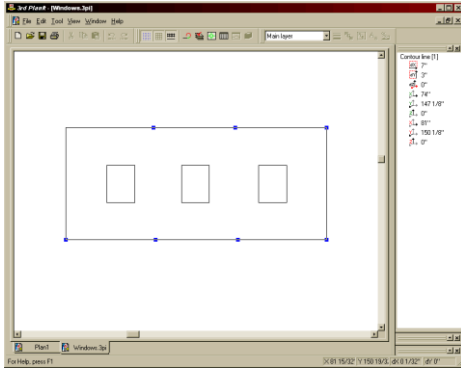
After selecting the tool, hold down the **Alt** key and point to the left wall near the upper end. Click the left mouse button to start drawing the roof. Move the mouse to the right, still holding down the **Alt** key (you can hold it down throughout this whole draw operation). When you near the corner along the top of the wall, the highlight line will snap to the end point. Click the left mouse button and move straight down to the lower wall, about the same distance from the left as you were at the top wall. Click to place the third vertex and move the cursor to the lower left corner. Still holding the **Alt** key, double-click the left mouse button to place the final vertex.

The results are shown above in 2D and 3D. The roof corners were snapped to the top vertices of the walls, resulting in accurate alignment with the tops of the walls. This same procedure was repeated for the right roof segment of the bottom section, and the two roof segments of the top section. The top section was grouped and moved into alignment using **Alt+Move**. The results are shown below. You can now insert this building into any 3rd PlanIt drawing.

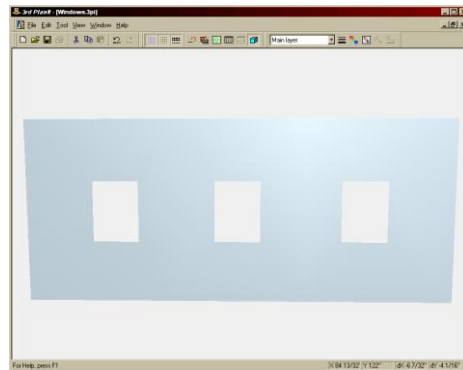
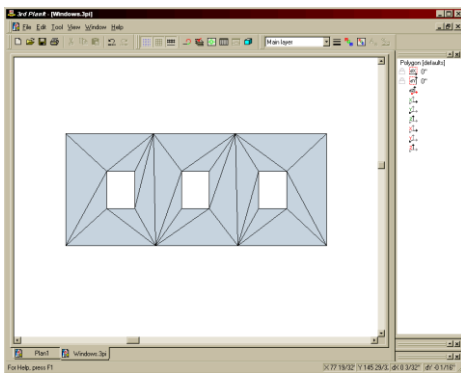


20.4 A Building with Windows

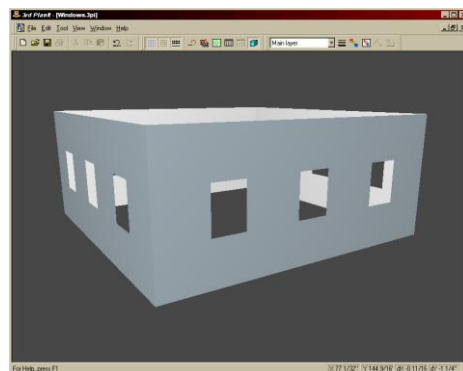
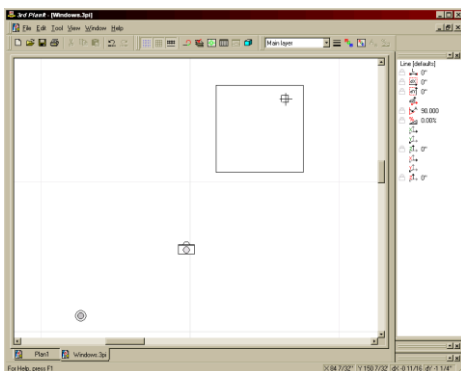
You can also design a building with “see through” windows rather than line-based windows. It takes a bit more work to set up and more time to render, but there are many esthetic benefits to see-through windows.



This example was started by drawing the outline of the wall as a Contour Line. Three windows were drawn as Contour Lines within the wall area. Then, as shown in the upper left example, the wall outline was double-clicked and two vertices were added along the top and bottom edges. As seen in the above right example, three Contour Lines were drawn *around each window*, snapped to the vertices in the wall outline. The wall outline was deleted after the three contour lines were drawn.



The above left example shows the result of performing a Terrain Connection between each window and the Contour Line surrounding it. When tilted up and viewed in 3D, the wall is seen as shown on the right. Below, the same wall was duplicated three times. Each wall was aligned to the next to create a square room with four similar walls. When viewed in 3D, the see-through windows are quite evident. **NOTE:** If you are designing a group object in which you *do not* have lines “in the walls” as in this example, turn off the flag **Object / Properties / Group / Offset Polygons...** so wall junctions are made cleanly.



20.5 Building Your Layout

When you've completed your design and want to start building the layout, the first problem that comes to mind is "How do I position all the track in the middle of this room"? While 3rd PlanIt allows you to design your layout to very precise levels, that is of little value if you can't locate the track in your room or on your module. However, 3rd PlanIt introduces a valuable new tool for building your layout: **Reference Points**.

20.5.1 Reference Points

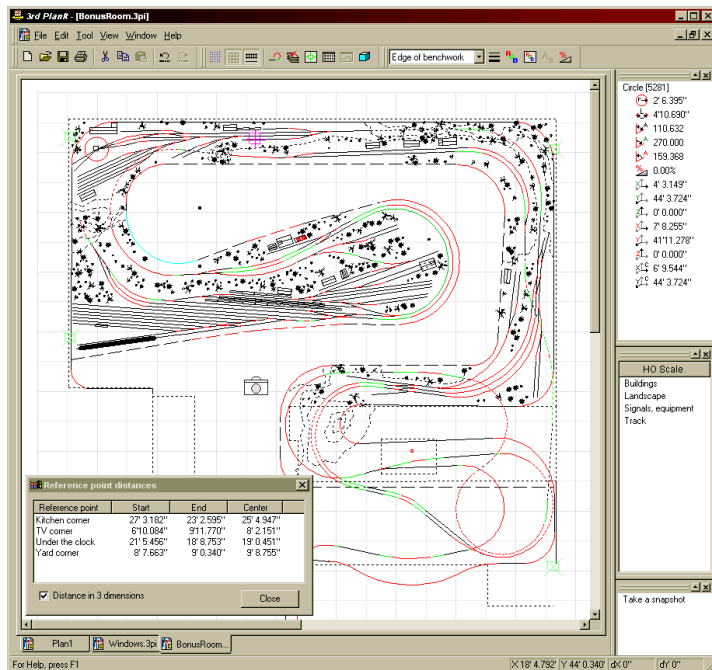
To make building easy and accurate, 3rd PlanIt has building aids called Reference Points™. A Reference Point is quite simple: it represents the fixed end of a tape measure.

When it comes time to build your layout, find three or four easily accessible and sturdy mounting locations. Attach the zero end of a tape measure long enough to reach corner-to-corner in the room to each of those points. Now carefully enter the actual locations of each tape measure mount as a Reference Point in your Room Layer. Be sure to include the elevation of the point, measured the same way your other elevations are measured.

To create a Reference Point, select Draw / Point / Reference Point, and draw as though it were a regular point.

This view of BonusRoom shows four Reference Points, located pretty much in the each of the four corners of the drawing. A box with a large X through its center represents each Reference Point. Each point was given a name corresponding to the location of the point in the room.

At the lower left of this example you can see the Reference Point Distance window (**View / Toolbars / Reference Point List**) for a selected Circle. The distance from each Reference Point to the three primary locations of an object is shown. The check box is set to display distances in 3 dimensions, which is the typical setting. This is important.



When set to Distance In 3 Dimensions, the actual length of the tape measure from the Reference Point to the object location is given. This will be longer than the distance in two dimensions, as it includes the extra distance the tape measure travels going from the elevation of the Reference Point to the elevation of the object location.



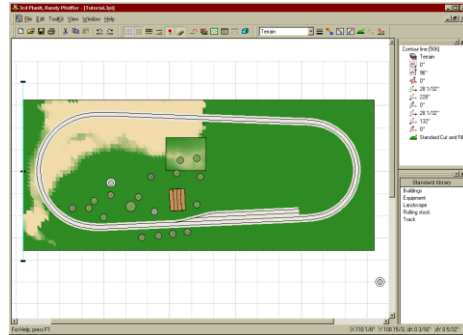
To precisely locate any point in the room, simply choose any two Reference Points whose tape measures cross at an angle near 90 degrees (definitely greater than 45 degrees). This provides an accurate triangulation from the two Reference Points. Cross the tape measures at the proper distances, then pull both tape measures tight. When both are pulled tight, the point defined by their intersection may be located with great accuracy and repeatability.

20.5.2 Terrain Templates

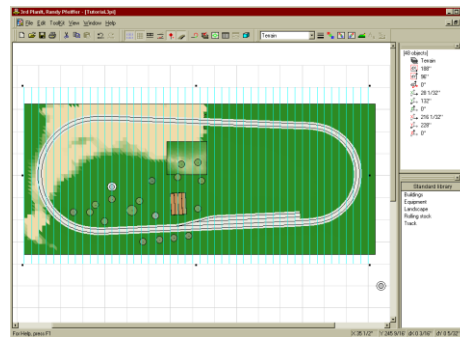
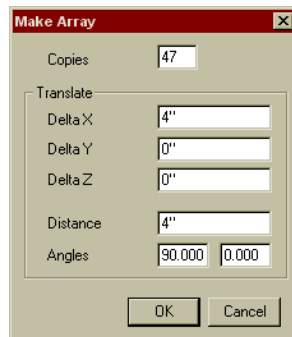
An important part of building the model railway, is building the model terrain. It can be difficult to translate the terrain seen in the plan to the actual model using just your eye, or by checking terrain elevation in a number of places. 3rd PlanIt contains special tools to help with this process – the **Array** command, and the **Conform Contour Line to Terrain** command.

It's quite common to build model terrain by making a series of particle board “ribs” or “bulkheads” every few inches. Screen, chicken wire, or newspaper is then laid over the bulkheads, and plaster or polyurethane foam is applied to it.

Returning to the Tutorial example as expanded in the Terrain chapter, we start by drawing a single, two-point Contour Line vertically at the left end of the terrain. In the example, the Contour Line is selected – it shows in light blue and has resizing handles around it. Keep the contour line selected, and choose **Edit / Transform / Array**.



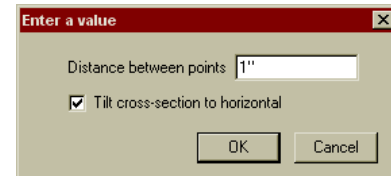
The **Array** command lets you make multiple copies of an object, offset from the object by a selected distance. Here, 47 copies repeated at a 4-inch spacing create an array of Contour Lines that cover the terrain.



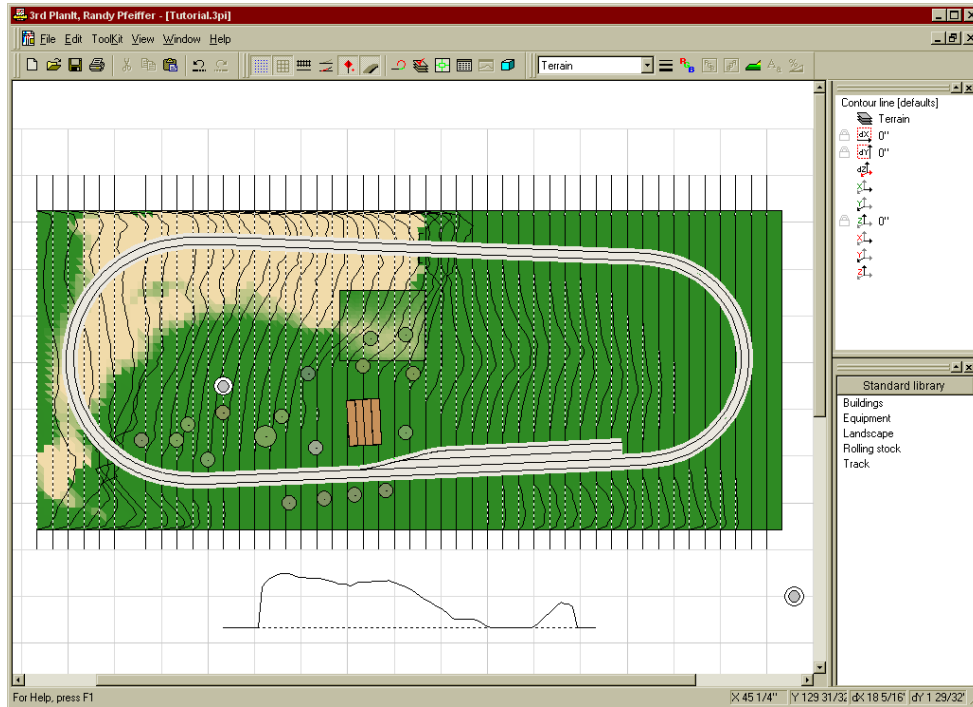
After you press OK in the **Make Array** dialog box, the 47 copies are added to the drawing, and all 48 Contour Lines are selected – the original and all the copies. You can now issue the command **Edit / Change / Conform Contour Line to Terrain** and the command will affect all 48 lines.

When you issue the command, you'll be presented with this dialog box. The first parameter, **Distance between points**, lets you control how closely each Contour Line follows the terrain below it. If you reduced the distance to 0.1” the Contour Lines would very closely follow the terrain, but would take ten times as much time and memory. You can also choose to **Tilt cross-section to horizontal**.

After you Conform the Contour Lines, each line will be a cross-section of the layout underneath the line. Selecting this option tilts the cross-section so you can easily see it; you generally will want this option selected.



After the **Conform Contour Line to Terrain** command finishes, you will have an array of Cross-Sections spaced evenly across the drawing. Each is a group, made of a dotted line showing the original Contour Line's location, and a solid line that follows the terrain underneath the original line. The 7th line from the left has been moved to the bottom of the drawing and rotated -90 degrees so you can see this more clearly.



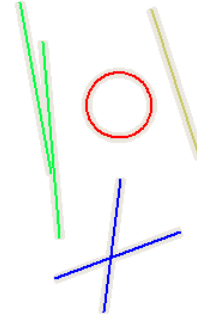
If you print the Cross-Sections at a scale of 1:1, you can use them as cutting templates for Masonite or particle board bulkheads used to support the terrain.

21. Verifying Your Layout

One valuable use of Computer Aided Design in the process of railroad design is to ensure that your railroad can be built and operated reliably. The feature **Show Questionable Track** compares what you have designed to a number of criteria you establish. You can switch to this display mode in one of two ways: **File / Settings / 2D/3D Display / Show Questionable Track** or by pressing **Alt+Q**.

When you switch to **Show Questionable Track** mode, a dialog box appears to track the progress of the clearance checking. If you want, you can abort the clearance checking by pressing **Cancel**. If you press cancel during the clearance check, the program still performs Minimum Radius Checking and Grade Checking.

Track that is not questionable is drawn in a gray color adequate to trace the route of the track. Other colors drawn wider than normal are used to show track that has questionable characteristics. Red dots are shown over open ends that should be investigated; blue dots are shown where endpoints meet but their elevations are not the same.



Color	Meaning
Red	Radius is below minimum for the Layer
Dark Yellow	Grade is above maximum for the Layer
Green	Track is too close to neighboring track; both segments are colored green
Blue	Insufficient vertical clearance between intersecting tracks

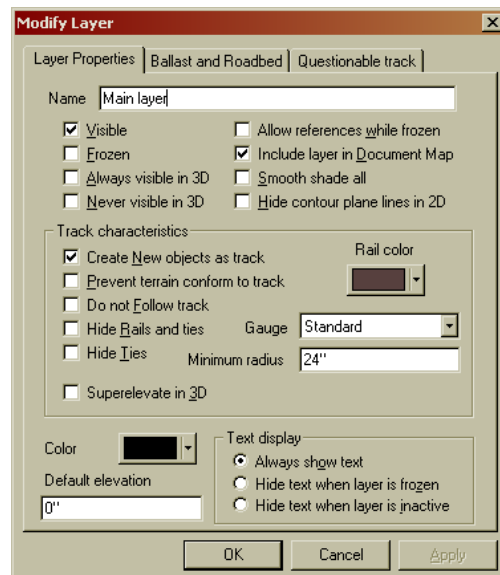
21.1 Verification by Layer

Since many modelers mix branch lines, main lines, gauges and even scales, it is necessary to have the Verification process check the trackwork using values unique to each layer. To modify or examine Layers, bring up the Layer Enable Dialog using **Toolkit / Layers** or by pressing **Ctrl+D**. Double-click the Layer you wish to work with to bring up the **Modify Layer** dialog box.

21.1.1 Minimum Radius Checking

The **Minimum radius** specification is found on the **Layer Properties** page of the **Modify Layer** dialog. This value is also used when drawing circles - drawing the circle in red if it's below the minimum radius, or black if it's at or above the minimum radius.

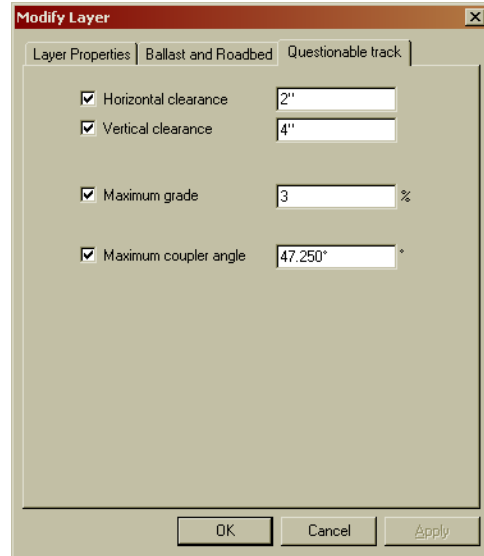
When you are viewing your layout in **Show Questionable Track** mode, any curves or circles that are marked as Track Objects are checked. If an object's radius is less than the minimum for its Layer, it is drawn in red.



21.1.2 Grade Checking

All specifications for Verification other than the minimum radius are found on the **Questionable** page of the Modify Layer dialog.

Grade checking ensures that the grade through each track segment does not exceed the value in the **Maximum Grade** field. If a track segment is too steep, it is drawn in the color green. Additionally, it is drawn using a wide line style so that even short segments are identifiable, and for the benefit of color-blind users.



21.1.3 Clearance Checking

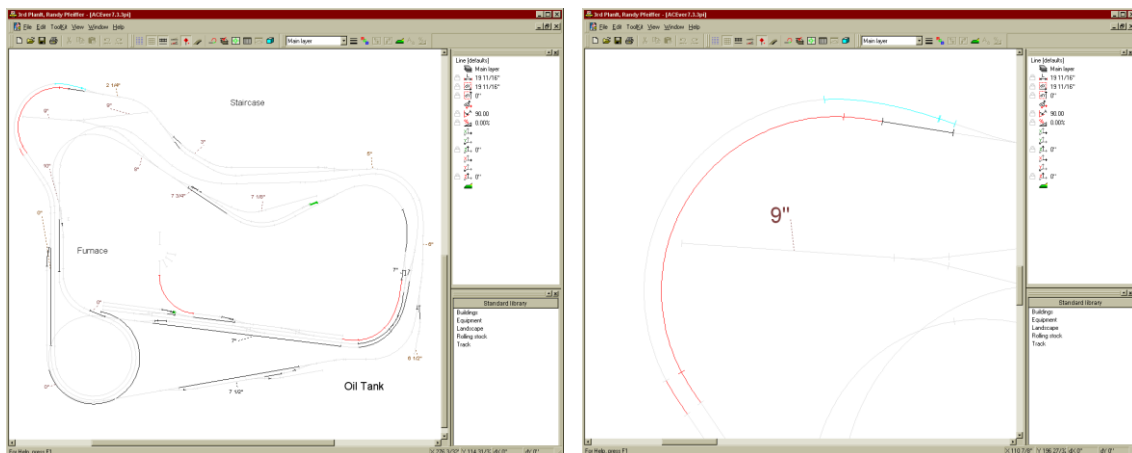
3rd PlanIt performs both horizontal and vertical clearance checking for you. Larger layouts will require more time for this checking, as all track is verified against its nearby neighbors in three dimensions at several points along the length of the track.

The **Questionable** page of the **Modify Layer** dialog contains the **Horizontal Clearance** and **Vertical Clearance** fields. The **Horizontal Clearance** specifies the amount of distance that must exist between the centerlines of adjacent tracks. If two tracks are closer than this distance (without sufficient vertical clearance), they will both be drawn in black.

The **Vertical Clearance** specifies the amount of open space you want over track in the Layer. Make sure to include any “comfort margin” you want to have. When 3rd PlanIt checks vertical clearance between two tracks, it requires the railhead to railhead spacing to be the total of **Vertical Clearance** for the Layer of the lower object, plus the **Ballast Thickness** for the Layer of the upper object, plus the **Roadbed Thickness** for the Layer of the upper object.

21.2 How to Verify Your Layout

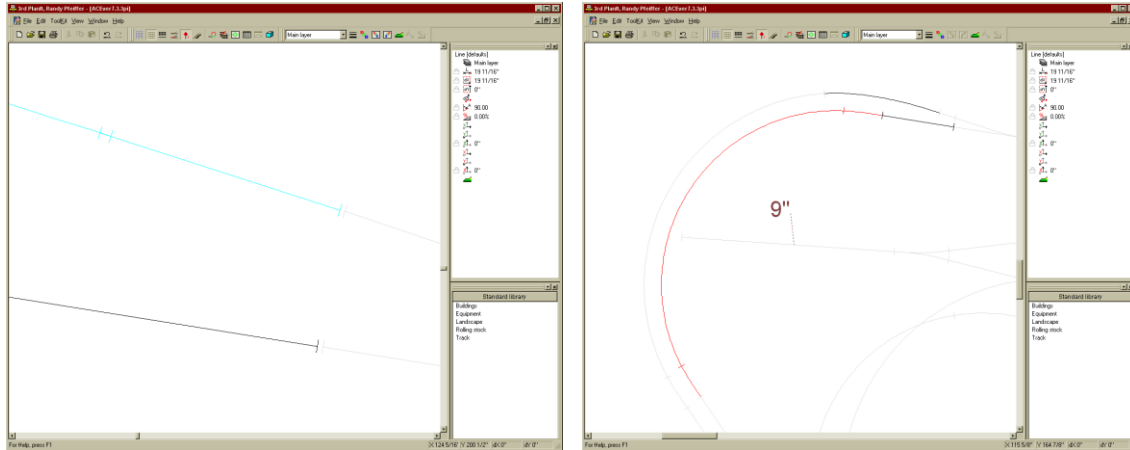
The **Show Questionable Track** mode has been selected in the image shown below left. A number of potential problem areas have been identified. After zooming into the upper-left area, we can examine the questionable track in detail.



First, at the lower left one can see a spiral easement all by itself, with a radius that’s too small. It’s hard to tell how this came to be... perhaps it was copied from the easement above it? Nonetheless, you can correct it by deleting the incorrect easement and using the **Connect with Easements** tool to join the curve and tangent track with a new easement.

Near the top of the view we see two objects colored blue. This is the color of intersecting track with insufficient clearance. Why is this track blue when there is clearly no intersecting track?

The answer lies in the details. Zooming closely into the right end of the objects in question, we can see the reason why. The right object is drawn incorrectly, overlapping the left object. There is also a gap between the right object, and the gray object to its right.

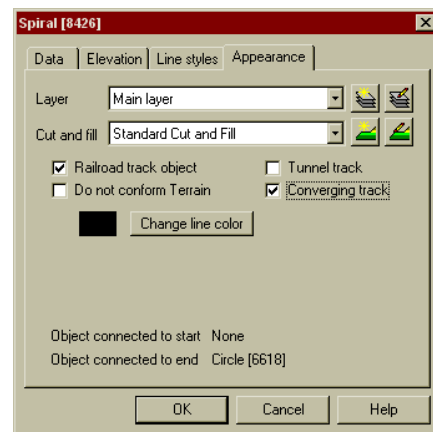


To correct this problem, delete the top line entirely. Use the **Connect Ends** tool to simply connect the easement to the turnout with tangent track. At the same time, we notice a small gap between the objects below it. Zooming out to see the whole existing tangent track, we delete the track and use the **Connect Ends** tool once again to repair the gap. (Note: the **Connect Ends** tool does not align the track. It should only be used when the track is known to be in proper alignment, as was the case in this example.)

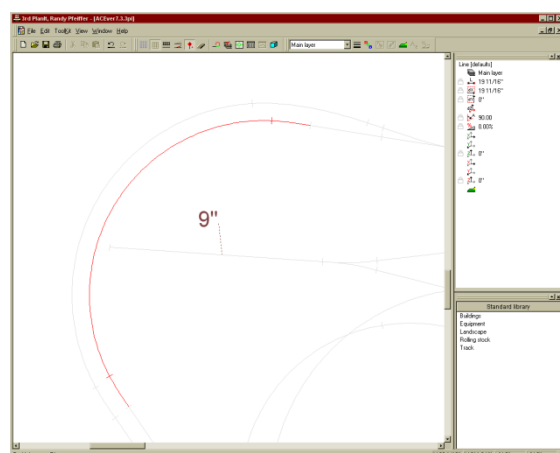
After making these corrections, press **Alt+Q** to verify the trackwork again. As you can see to the right, the improper spiral has been corrected and the blue segments are also changed. But they have been changed to black, as is the track below them.

That's because these tracks converge as they approach the turnout. In this case, the tracks are "too close to each other" by design. However, you can instruct 3rd PlanIt to disregard these converging tracks, because you know they are properly close to each other.

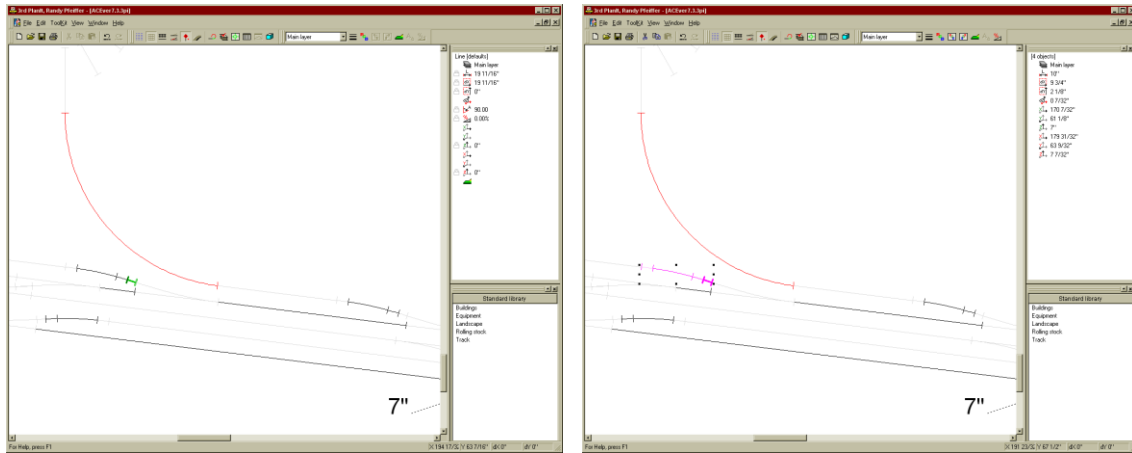
All track objects can be marked as **Converging track** in the **Appearance** page of their Property Sheet. In this case, the upper track (a spiral easement) was selected.



Press **Alt+Q** to re-verify the layout. As you can see below, the only remaining questionable track is the inner curve and its associated easements. This shows the value of 3rd PlanIt's track verification. The inner track is designed as the main line, as the turnout's points divert traffic to the outer track and main lines typically do not follow the points through a turnout. The designer must decide whether to choose a main line that follows the routing direction through a turnout, or must redesign the area to remain consistent with the desired minimum radius.

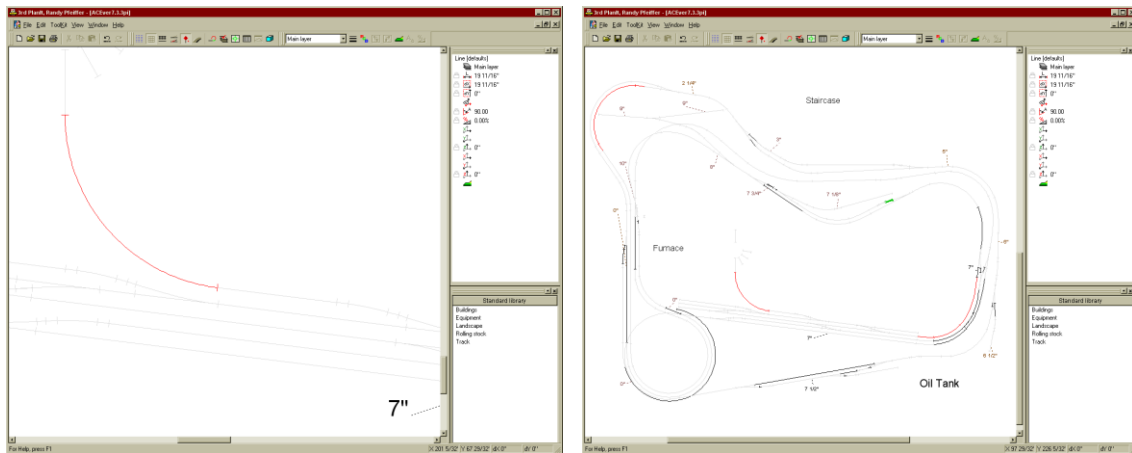


Just below and left of center lies another problem area. We can see three questionable areas: the first, a thick green segment that has too much grade, the second is the curve leading to the turntable, and the third is the various convergences.



Selecting the thick green segment, we notice it has a grade of 14%, the unusual result of climbing 3/16” over such a short distance. As shown above-right, the Path tool can be used to spread the grade change out over several pieces. After changing the grade using the **Elevation** tool, the segments in the path all have a 2.14% grade – much more reasonable.

We see several convergences that are to be ignored. Since all of them involve two curved segments and one tangent segment, it’s quickest to set the **Converging track** flag on the three straight segments. Select each one and choose its **Edit / Properties / Appearance / Converging track** flag.



After pressing **Alt+Q** to re-verify the track, this area has only one remaining issue – the curve below minimum radius. After zooming about (above, right), we see a number of convergences that can similarly be ignored, but we also see track spaced too closely at the lower right. This is another design issue that the user must resolve by suitably modifying the trackwork. There is also a grade problem just above and to the right of center, which can be resolved in the same manner as the first grade problem.

Important Note: You can reset all **Converging track** flags in the entire drawing with a single command: **Toolkit / Reset all Converging Track selections**. After choosing this command, if you are in **Show Questionable Track** mode, the drawing will be rechecked. Any intentional convergences will reappear, but so will any unintentional clearance problems that have been introduced into the drawing since it was last checked in detail. Note that **Maximum coupler angle** applies to 3D train operations.

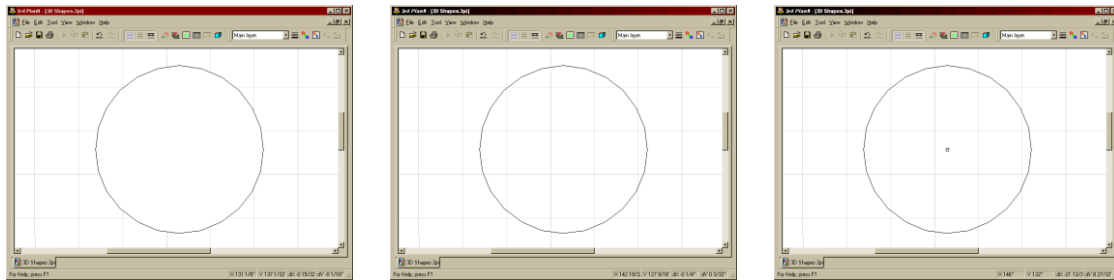
22. 3D Object Design

3rd PlanIt offers you the opportunity to build custom objects that can be grouped together and used in your designs. You can create components and group them into assemblies, which can be used as is or in other assemblies. This chapter illustrates a few different 3D solids and the steps required in making them, as well as a sample of making an assembly. The illustrations are grouped in rows of three pictures. The text describing an operation follows the row of images so you can naturally follow the sequence of development without needing many “above left” references. This chapter assumes you have several hours of experience using 3rd PlanIt, and that you will be issuing commands through the ToolKit.

VERY IMPORTANT: Always design 3D objects with Front and Back Surfaces in different colors! This is controlled in **Tools / Options / 3D Settings**.

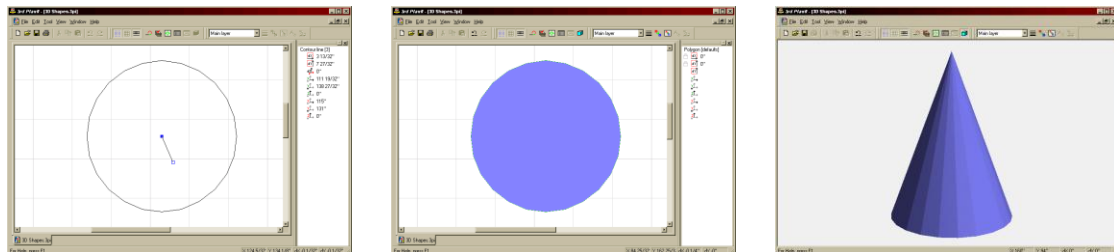
22.1 A Cone

A cone is useful in different situations. For example, a kiln is an example of a cone, although a kiln is a cone with the point cut off. A kiln could be made using the same technique described below – you would simply use a circular polygon as the central object rather than a single-point polygon.



To create the cone, first draw an N-sided Polygon, or a “N-gon”. Bring up the Property Page for the N-gon (**Ctrl + Double-click** the N-gon, or select the N-gon and choose **Edit / Properties**). Change it from a Polygon to a Contour Line and press **OK**. Then use **Draw / Point / Center of object** to put a Point at the center.

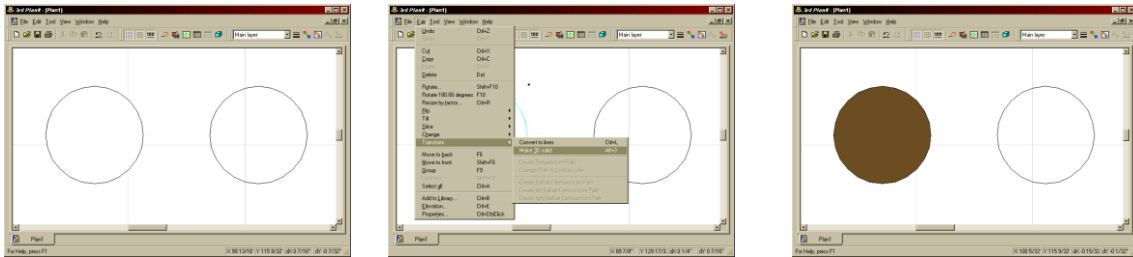
There is no way to directly draw a single-point polygon, but when you need one for a special purpose, here’s how to make one. In this case, a Contour Line was drawn, Alt-clicked to the central Point. The



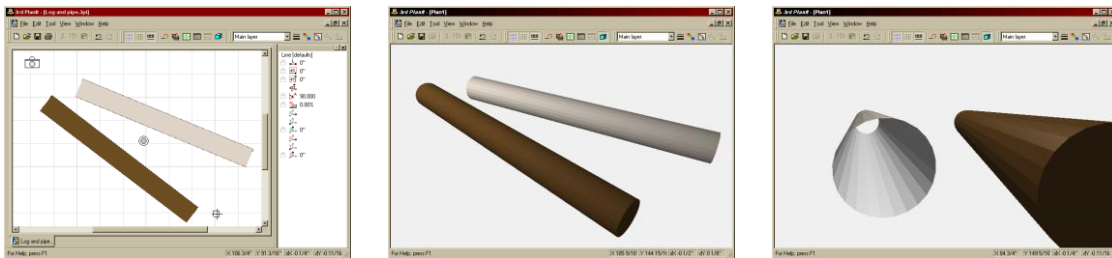
second and final vertex can be placed anywhere. Delete the central Point after drawing the Contour Line. Double-click the Contour Line, select the non-central vertex and delete it. Double-click to end the contour line edit. Set the desired elevation of the center vertex. Use the **Connect Polygons** tool to connect the N-gon to the center vertex.

22.2 A Log and a Pipe

Logs and pipes are common in railroad culture. Here’s how to make either.

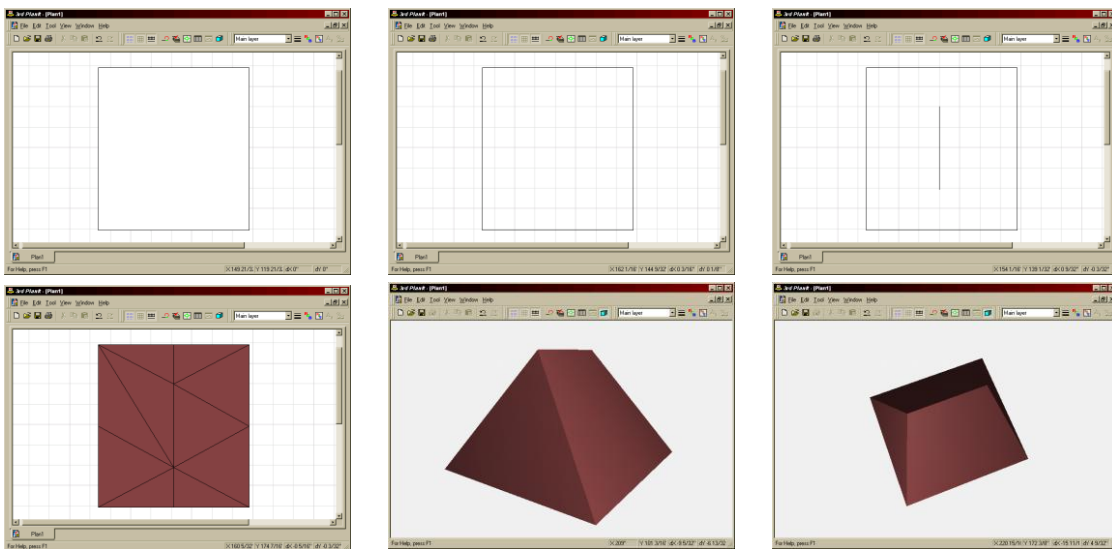


Draw two N-gons. Change one to a contour line; in this case, the N-gon on the right is a contour line. Select **Edit / Transform / Make 3D Solid** and enter the height of the log and pipe. Remember the height of these objects will be their length when you tilt them down. Note the different appearance of the log and the pipe in 2D when they are standing on end, then tilt them down.



22.3 A Peaked Roof

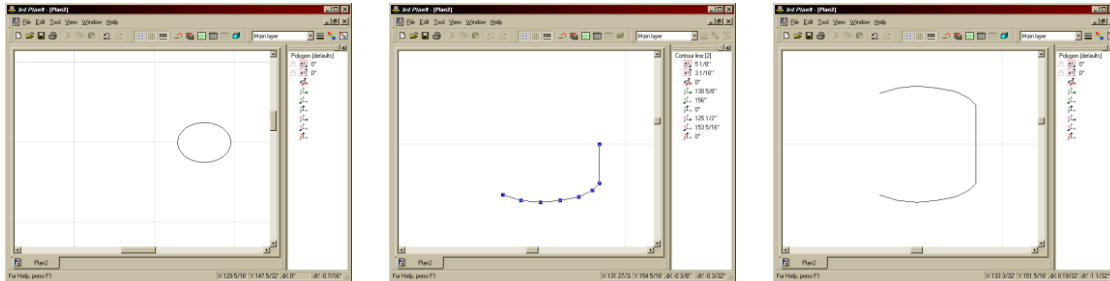
Roofs of different shapes are needed for every building. Draw the outline of the roof using a Polygon, then change it to a Contour Line. Of course, you can draw a Contour Line directly if you prefer.



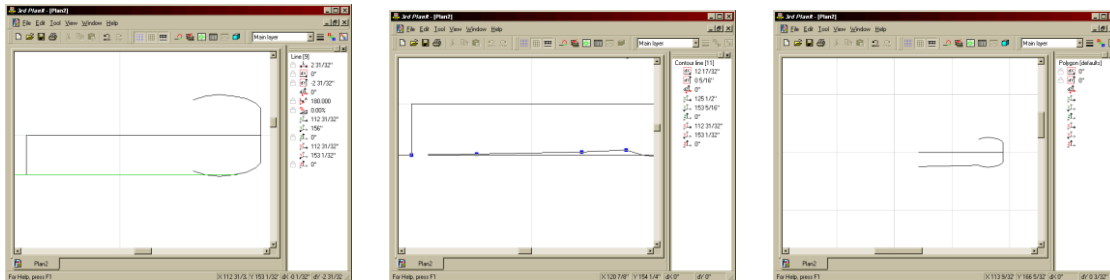
Draw a second Contour Line down the center of the roof, and connect the two using the **Connect Terrain** tool. Note that the center Contour Line had two vertices in this example; yours may have more if you prefer, or if you are making a more complex roof shape.

22.4 Tires and an Axle

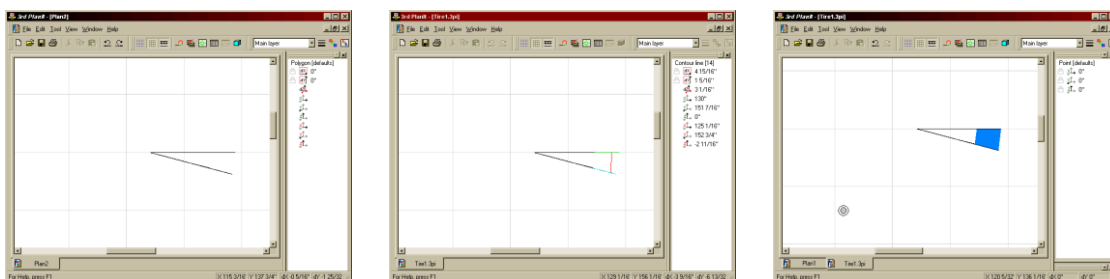
This is the most complex example of 3D design in the manual. Although there are a number of steps, an experienced user can create this design in about five minutes.



Start by drawing an elliptical N-gon and change it to a Contour Line. Double-click it to edit its vertices, and remove most of them. Only the lower-right quadrant of the ellipse was retained in this example. Change the location of the vertices slightly to simulate the proper profile of a tire. End the edit session, copy the object, flip it and align it to the original Contour Line.

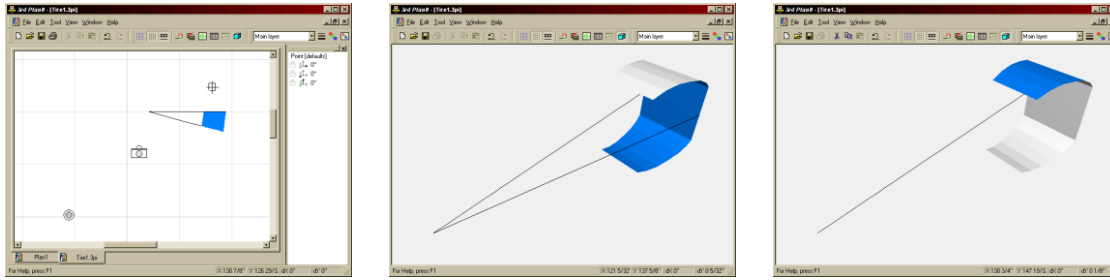


Draw a centerline leftward directly from the center of the tire profile using **Alt+Draw** and the Shift key. Draw another horizontal line directly leftward from the outside of the tire profile to aid in creating the hubcap. Draw a perpendicular line so the center of the tire and the center of the hubcap are aligned. Create a four vertex Contour Line and edit it so it makes the profile of a domed hubcap.

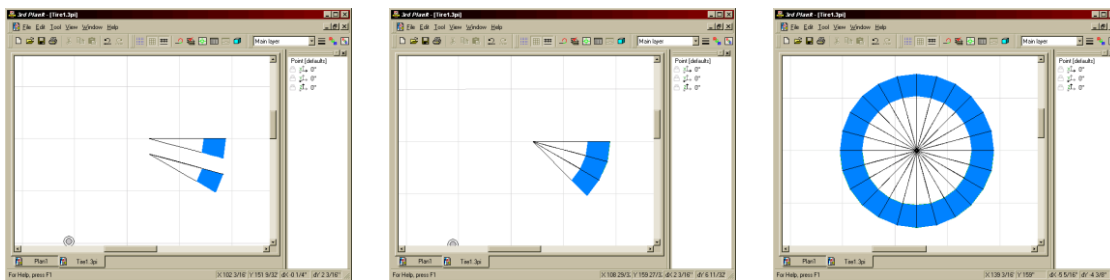


Group all these objects. Using the Centerline, tilt up the group. Copy it and rotate it 15 degrees. Align the center points of both groups. Select both groups, and ungroup both of them simultaneously. Using **Connect Polygons**, connect two of the contour lines. Use **Connect Polygons** again to connect the other two contour lines, noting they will be in exactly the same 2D locations as the first contour lines. Rubber-band both resulting Contour Sheets and set their fill color to something that is not white, gray or black.

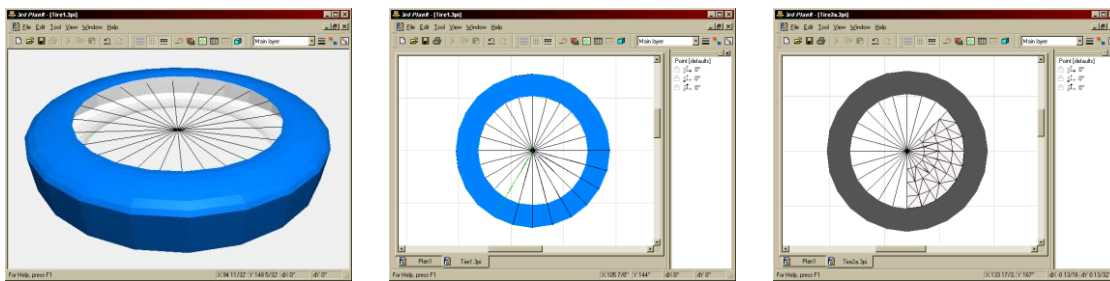
It's important to use a non-gray color, as we will see below. All polygons have a front surface that is colored and a back surface that is not.



View the created Contour Sheets in 3D. You may find one or both of them with the front side on the wrong side as shown here. Use **Edit / Change / Change front surface** to change the front surfaces of each Contour Sheet, and check it again in 3D to make sure the front surface is on the outside of the tire.

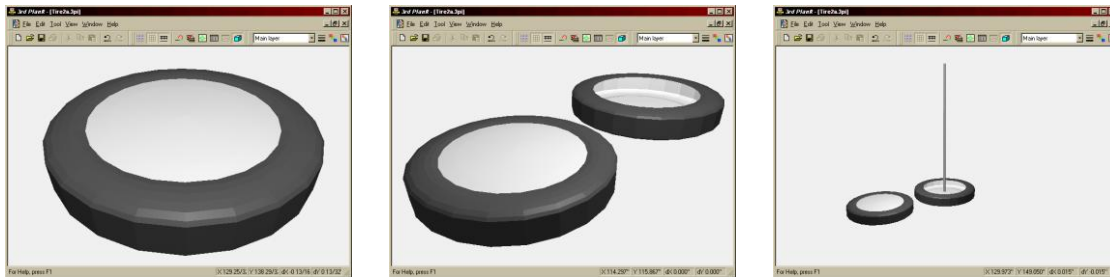


Group the objects. Duplicate the group, rotate the copy 15 degrees and align it to the first group. Do this again to have three sections together. Select all of them, duplicate them, and align them to complete the first 90 degrees. Select all of *these* groups, duplicate them, rotate them 90 degrees and align them to complete the first 180 degrees. Select all of these objects, duplicate them, rotate them 180 degrees and align them to complete the tire.

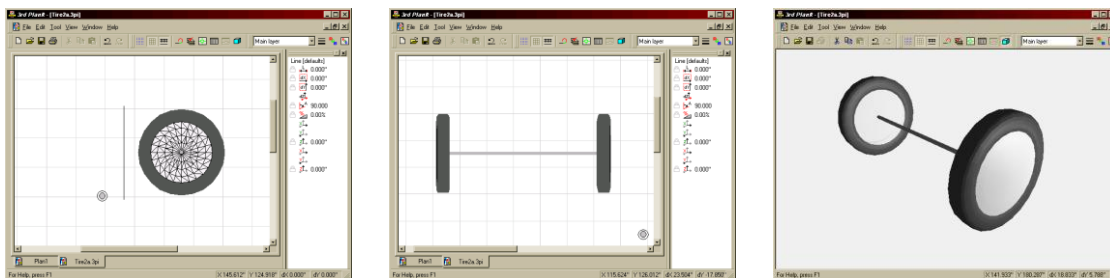


Viewed in 3D, the tire looks good. Return to 2D, select everything and ungroup it repeatedly until no more groups remain. Select each of the Centerlines and delete them, leaving only the hubcap contour lines. Connect these using the **Connect Terrain** tool. You could also use the **Connect Polygons** tool to get four-sided Contour Planes rather than triangles.

Finish connecting the hubcap, and set the color of the hubcap to a light gray or white. The tire should be a darker gray color, not black.



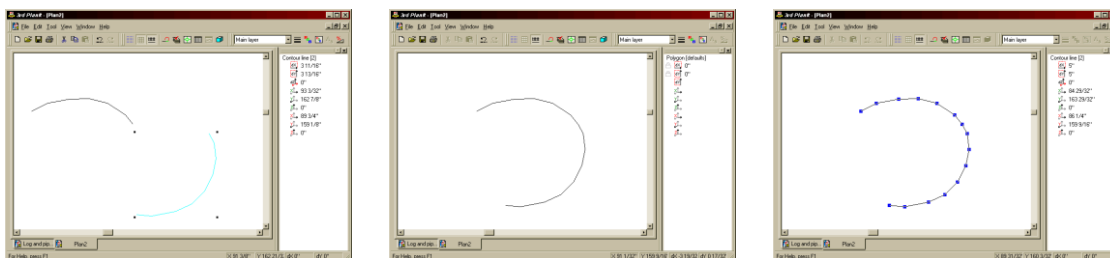
The tire now looks just right in 3D. Duplicate the tire, then tilt it 180 degrees so it is upside-down relative to the first. Draw a N-gon about 1.5 inches in diameter for the axle. Color it gray and use **Edit / Transform / Make 3D Solid** to make it an axle. Move the axle to the center of the upside-down tire. Make sure the lower Z dimension of the axle ends up in the middle of the tire's Z range.



Move the right-side-up tire and center it over the other tire. Adjust its elevation so the center of its Z range is at the top of the axle. Group the two tire assemblies and the axle into a tires-and-axle assembly. Draw a vertical line for easy tilting. Group the assembly and the line. Tilt down 90 degrees, ungroup the tilting group and remove the tilting line. You may leave the tires and axle grouped together as an assembly.

22.5 Stitching Contour Lines

There may be times when you want to slice a Contour Line and then reassemble it. You may also want to join two Contour Lines to form a single Contour Line.



These two contour lines need to be stitched. Point to the lower right contour line, point to the upper end of it, and drag it towards the other contour line. Point at the end of the second line and click the right mouse button while still holding the left button down (much like “Tree Planting”).

Editing the resulting Contour Line, you can see that the two contour lines were joined at their end vertices. Only one vertex remains at the point the two were joined.

22.6 Polygon Count and Rendering Speed

When it comes to rendering a 3D image, the number of objects directly affects the rendering speed. From the Tires and an Axle example you could imagine drawing railroad wheels, trucks, frames, car sides, windows, mullions, and on and on. 3rd PlanIt will certainly let you draw all this, but remember your computer limits the speed of working with the drawing.

As you build assemblies, be judicious in the use of polygons and other objects. For example, in Tires and an Axle, the hubcap could have been connected with **Connect Polygons** to reduce the polygon count with only a small difference in rendering quality.

Be conscious of these limitations as you design to keep your object counts conservative. Also, place objects in different layers that you can turn off and on when they aren't needed. With some good judgment, you'll find you can realistically simulate many exciting objects and complex topography.

Finally, remember that a very fast video card with hardware support for OpenGL will provide the highest level of performance on your computer. Beyond that, the next most important component is memory. When you start to make a very complex layout with many buildings, you may find the 64 Mb isn't as large as it once seemed!

23. Rolling Stock

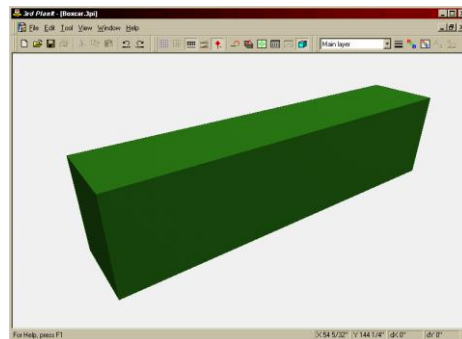
Rolling Stock in 3rd PlanIt is simple and versatile. Simply add Pivot Points to a Group, mark it as Rolling Stock and it's ready to run. You don't even need to use trucks if you want to save time or run very long trains.

This section presents construction of a boxcar. A locomotive is really no different; in fact, the boxcar could be marked as a Locomotive if you'd want to and it would faithfully pull trains and MU with other Locomotives.

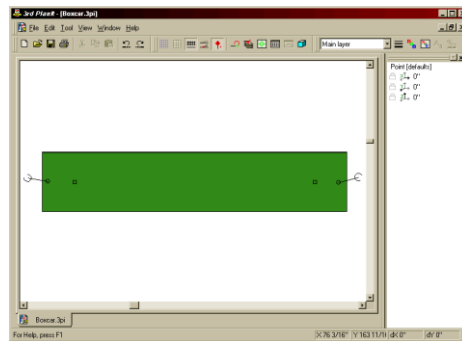
23.1 First Steps in Rolling Stock Construction

A boxcar was chosen for this example because it's body is simple. You can create very detailed bodies if you wish... just remember there's a tradeoff between complexity and rendering speed. The more things to draw, the longer it takes to draw each frame of animation when a train is moving.

To create a box like the one at the right, first draw a rectangular polygon the length and width of the boxcar. This polygon will be the floor of the boxcar (a 50-foot prototype was used for the example). After drawing the floor polygon, select **Edit / Transform / Make 3D Solid** and enter the height of the boxcar. That completes the body in just 6 polygons for optimal drawing speed; you could even consider removing the floor polygon if you wanted.



Here's the first step in changing a Group to Rolling Stock. You might notice that, when making a 3D Solid, you end up with a group of polygons. That's a great start for Rolling Stock.



Double-click one of the polygon edges to edit the boxcar body group. Place two Points at the exact locations you find them on the prototype (or model piece). To place them on the exact centerline, select the boxcar body and both points and perform the **Edit / Align / Middle** command. Using the ToolKit tool **Draw / Line / Coupler**, draw a coupler at each end with its pivot point properly located. Center the couplers as before so the couplers and pivot points are all on the exact centerline. End the group edit by double-clicking the drawing background.

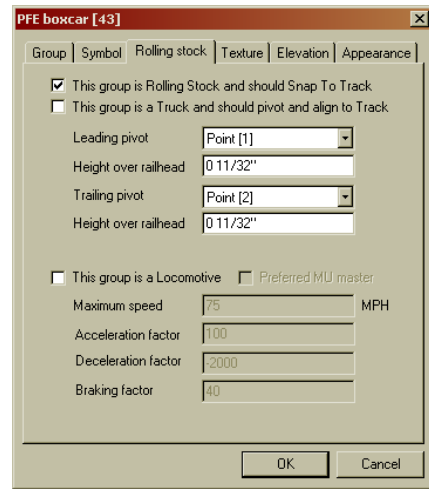
The boxcar as it currently stands is a perfectly adequate piece of Rolling Stock for 3rd PlanIt. In fact, folks who like long trains might want to consider what we fondly call "The Magnetron Line". This is a set of train cars and engines that don't have trucks. There are times when it's nice to just run a long train and the wheels aren't that important.

To change the Group into Rolling Stock, select it and choose **Edit / Properties**, or hold the control key down and double-click the group. Change to the Rolling Stock page. Click the check box at the top to enable the rolling stock fields below it.

You can now select the two pivot objects. You are able to choose either a line or a point; if you choose a line, the lines' **start** end is used as the pivot point. This way, you can use a line that's vertical or horizontal, as long as the start point is in the right location.

For each pivot object, you need to set the height of the pivot point above the railhead. This all depends on where you've located the pivot points in the group. In this example, both pivot points are located on the floor of the boxcar. The floor of the boxcar should be .350" over the railhead according to the sample I have on hand. This height is selected for each pivot point.

Important note: When choosing pivot objects for a Locomotive, Pivot Object 1 is the front and Pivot Object 2 is the back. This controls the direction when you're using a throttle. Rolling Stock that is not a locomotive is not affected in this way.

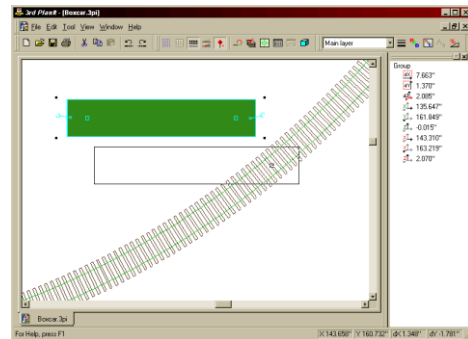


The boxcar is now ready to run on track as part of a train.

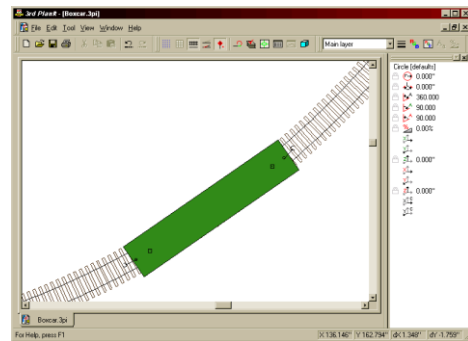
23.2 Manipulating Rolling Stock

A piece of Rolling Stock is a 3rd PlanIt Group and retains all the capabilities of a group. You can move it, copy it, cut and paste it, and treat it in every respect like any other Group. The main difference you will see is when you move a piece of Rolling Stock to a track, or to another piece of Rolling Stock.

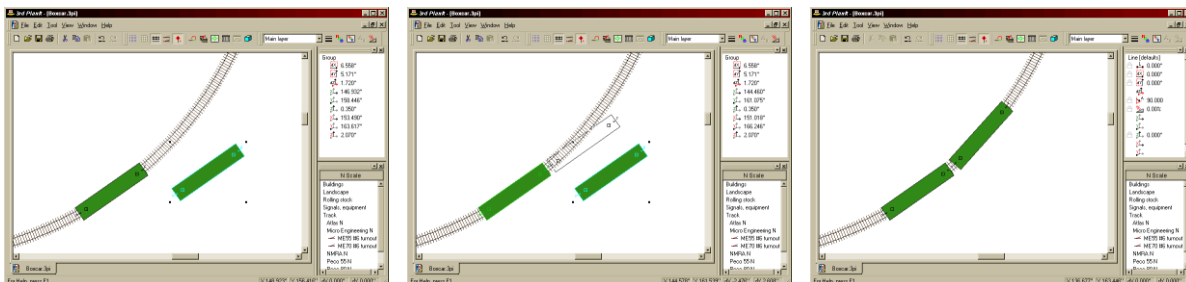
At the top right you can see the boxcar being moved to a curved section of track. The car is being moved using the pivot point, and the curved track is highlighted as the target object.



When the left mouse button is released, the car snaps into position as shown below right. Each pivot point is located directly above the targeted track object, or one connected to it. The height of the pivot points is set above the railhead as defined in the Rolling Stock properties, effectively setting the whole car at the right height.



To couple one car to another, simply drag and drop it. Below, you can see how the boxcar was duplicated (**Control+Drag**) and placed to the right of the first. The copy was moved using its coupler, although you could move it using the pivot point or any object near its end. When you are dragging Rolling Stock and the target object is another piece of Rolling Stock, the car automatically couples to the target and snaps to the track.



23.3 Trucks

You can add two trucks to each car to complete the rolling stock. As you can see at the right, 3rd PlanIt's trucks are quite minimalist. That's so they can run in real-time as quickly as possible.

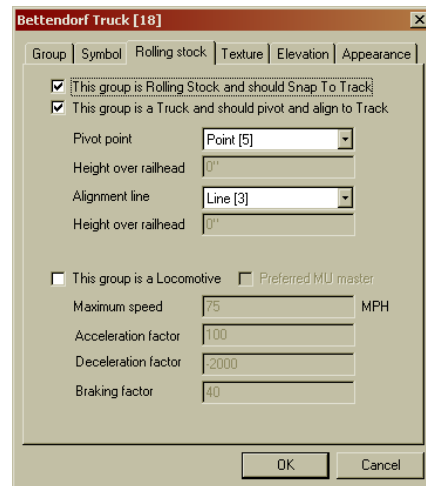
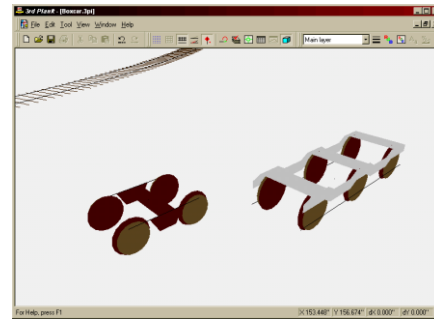
Each wheel is simply two 16-sided polygons, one behind the other. The back polygon is the size of the flange and the front is the size of the wheel. Each "Bettendorf" truck is made of four such wheels, two side polygons, one top polygon, two lines and one pivot point. That's it.

The SD-40 wheelset is more complex. Each side frame is made of 11 polygons and there are three connecting polygons. Two lines and a pivot point complete the truck.

In its own way, a truck is a piece of Rolling Stock itself. As shown at the right, you should select the **Rolling Stock** check box as well as the **Truck** check box.

When you designate the group as a Truck, the Pivot Object fields change to a **Pivot point** and an **Alignment line**. In this case, you need to choose a true Point as the pivot. The **Alignment line** is made parallel to the track by 3rd PlanIt; either of the lines in the two trucks are suitable candidates for alignment lines.

You can design your own trucks, or you can copy them from an existing Object Library element. Double-click a piece of Rolling Stock with the desired truck so you are editing it. Select the truck and copy it to the clipboard, then follow the procedure in the next section.

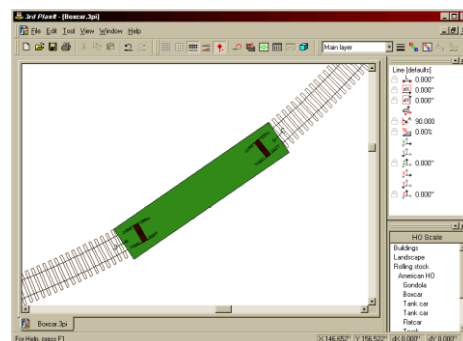


23.3.1 Adding a Truck to Existing Rolling Stock

To add a truck to the boxcar or any other piece of Rolling Stock, first get the desired truck in the Clipboard. You can copy it from existing Rolling Stock as in the previous section, or have a few "template trucks" in a drawing or library.

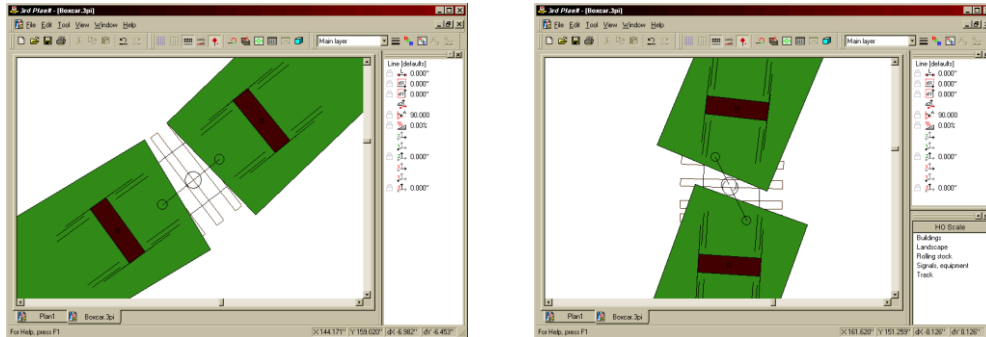
Double-click the piece of Rolling Stock to begin editing it. Paste the truck from the Clipboard; it becomes a member of the group. Use the Alt key to select the Truck by its pivot point and, while holding the Alt key down, align it to a pivot point in the boxcar. Do the same for the second Truck, then double-click the background to complete editing the group.

When you place a car on the track, its trucks will both be aligned to the track as shown at the right.



23.4 Coupling and Uncoupling

Earlier it was shown how one piece of rolling stock can be moved to another, causing them to couple. 3rd PlanIt actually aligns the couplers and correctly spaces the cars based on the dimensions of the rolling stock and the track on which it rests.



Zooming in to the couplers as shown at the left, you can see how they are properly aligned and their ends touch precisely. What happens on an S-curve?

The same thing that happens on the prototype: the drawbar breaks. The right example shows the two boxcars placed at the most awkward point of an S-curve between two small-radius circles. The misaligned circles and the gap between couplers shows this track arrangement won't work with this size rolling stock.

Uncoupling cars is performed in one of two ways. You can move a piece of Rolling Stock that's coupled to another location in the drawing; it is uncoupled as part of the process. You can also right-click one of the cars near the junction for uncoupling and select **Uncouple**.

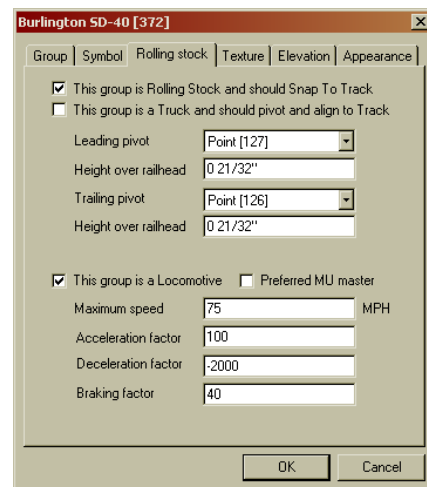
23.5 Locomotives

Any piece of Rolling Stock can be designated to be a Locomotive. A Locomotive is simply self-propelled Rolling Stock that presents a Throttle control when viewed in 3D.

The properties of the SD-40 are shown at the right. **Maximum speed** is set to the maximum operational speed of the prototype locomotive. 3rd PlanIt scales the speed appropriately for the model scale you're working with.

When a locomotive is at rest and you move the throttle to a higher position, the speed of the locomotive is gradually increased according to the **Acceleration factor**. If the locomotive is moving and you lower the speed on the throttle, the speed is gradually decreased according to the **Deceleration factor**. All speed changes occur similarly, simulating the prototypical behavior. Typically, deceleration is much higher than acceleration.

Finally, you can select your **Preferred MU master**. When you place more than one locomotive in a consist, 3rd PlanIt will automatically combine all their controls into a single throttle. By choosing Preferred Masters, you can select the speed profile in use when MU'd and the first locomotive name to be shown in the Throttle's Title Bar.




24. Train Running and Operations

You can run trains in 3D on your layout and perform switching operations just like you would on a real layout. This chapter gives you an overview of 3D setup and operations.

24.1 Setting up the Train

To run trains on a layout, place the desired rolling stock and motive power on the track. You can get library Rolling Stock from the Object Library, if you wish. The cars can be placed anywhere on the track in 2D to prepare for train running. You may couple them if you wish, and they will remain coupled in 3D. You may also couple cars while running in 3D if that's your preference.

You can set up your turnout routing in 2D if you prefer. The **Show turnout routing** button in the Document Bar causes turnouts to be drawn with black track to indicate the current route through the turnout. Gray track indicates an inaccessible route. 

24.1.1 Performance

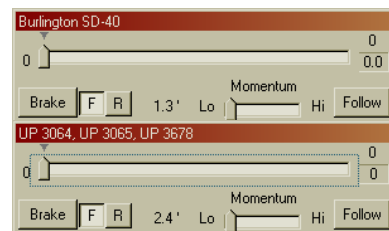
It's important to remember that Train Running requires computing the location of each part of the train each time the screen is redrawn. The longer the train, the slower it runs. The more detail in each car or locomotive, the slower it runs.

Fast systems can pull trains of many cars at excellent frame rates. Settings in the **Tools / Options / 3D Settings** dialog let you tune the drawing to your system's capabilities.


24.2 Controlling the Train

When you switch into 3D, you are provided a Throttle for each consist on the layout. If you have a consist with MU'd engines, there will be one Throttle to control all the locomotives; each locomotive name will be listed in the window's title bar.

To run a train, slide its throttle control to the right. The train will accelerate to the speed you have set, then maintain that speed. You can control forward and reverse using the controls at the upper right. If you click the **Follow** box, the camera will follow the locomotive as it moves around the track. You can easily switch from one locomotive to another in this way.



24.3 Controlling Turnouts

You can change the routing of a turnout in 3D by simply clicking the turnout. In addition, Switchstands are provided so you can control turnouts from low viewing angles. The **Switchstands On/Off** button in the Document Bar allows you to turn them on and off. 

Switchstands are colored Red to indicate the turnout is Routing; they are colored Green when the turnout is set to allow a train to pass through without routing. You can change these colors in **Tools / Options / Colors**.

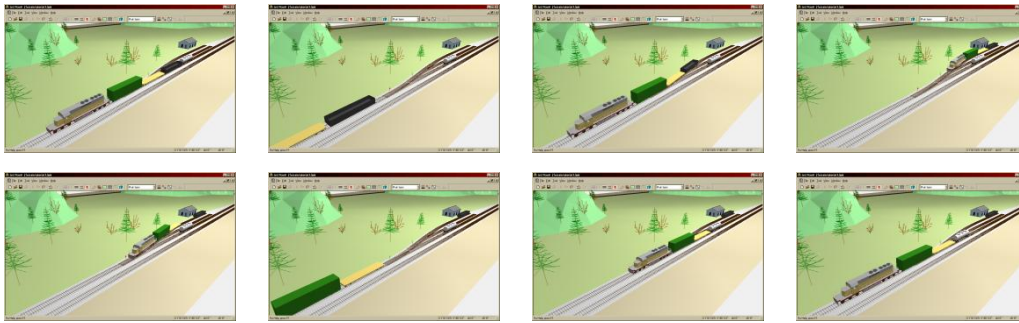
24.4 Operations

You can perform the same switching operations in 3rd PlanIt that you would on your layout or on a prototype. You can even design 3D switching puzzles with buildings and landscape.

To couple, drive one piece of rolling stock into another just like you would on the layout. You'll hear a distinct sound to confirm to coupling (you can turn sounds off in **Tools / Options / Environment**). At that point, the car (or cars) to which you have coupled become part of the consist and you can drive away.

To uncouple, point your cursor to the junction of the two cars you want to uncouple, or to either car near the desired end, and click the left mouse button. You'll hear an uncoupling sound, and, if you're moving, the cars you cut from the consist will be left in position on the track. If you are stopped, you can drive away after uncoupling, leaving the cars behind.

This sequence demonstrates dropping off a car at an industrial spur, then continuing on.



24.5 Viewpoints

As mentioned in above in “Controlling the Train”, you can click **Follow** in the Throttle for any locomotive or MU'd consist. The 3D Camera will then follow the selected locomotive as it moves through the layout, as though it were flying alongside the locomotive in a helicopter.

You can use Viewpoints to set up “Camera locations” in various places in your drawing. When following a locomotive (or any object selected for Following), the camera will snap to the nearest Viewpoint to the locomotive. It will remain at the Viewpoint, panning to follow the locomotive as it crosses by the camera. When the locomotive moves closer to a different Viewpoint, the Camera is moved to that Viewpoint to continue following the action. The result is rather like watching a skier going down a hill at the Olympics with eight different camera locations.



To place a Viewpoint in a drawing, use the selection **Draw / Point / Viewpoint**. Point to the location for the viewpoint, the press and release the left mouse button. The Viewpoint will be drawn at the current default elevation. This may put it at railhead-height, so you'll want to select the Viewpoint and give it a height that looks attractive in 3D. Sometimes it looks nice to view a train going by at “eye level” with much of the train above you. Other nice lookouts are higher than the track, looking from a side or through some scenery. You can even locate a Viewpoint directly above the track and watch the train go beneath you.

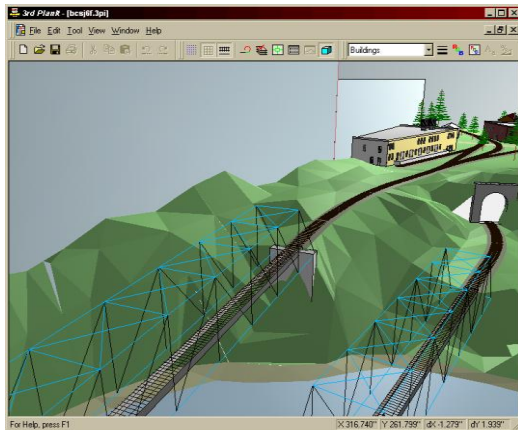
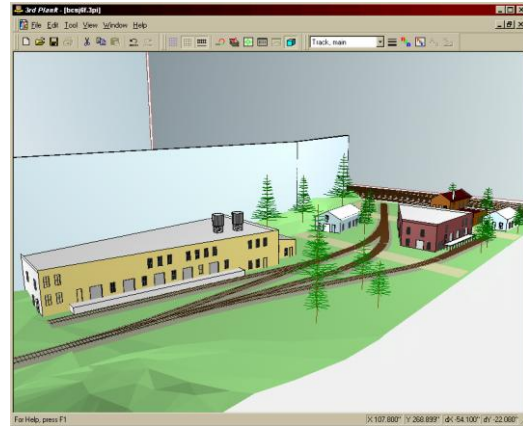
In the Properties page for the Viewpoint you can set a Maximum and Minimum Height for the Viewpoint to be effective. This is important, for example, if you have a multi-level layout and/or a staging area. If you want to have a variety of Viewpoint setups, you can put different setups in different Layers, and enable or disable layers to enable or disable the Viewpoints in that Layer. You can also turn off Viewpoints totally using **View / Use Viewpoints (Ctrl + Space)**, after which the Camera will follow the locomotive like a Helicopter again.

It's important to remember you must be in **Follow Moving Object** mode (**Alt+1**) for Viewpoints to be effective at all. If you are not in **Follow Moving Object** mode, the Camera remains stationary, controlled by the Arrow keys or mouse wheel movements.

25. The Engineer's Perspective

3rd PlanIt allows you to view your layout from the perspective of an engineer in a locomotive. Simply select **View / Engineer's View of Track**, and the Camera will center itself directly over the nearest track. The perspective will be from a few inches or cm over the track, configurable in **View / ...Set Cab height**.

Here we can see a model town known as Parkdale from two perspectives. To the right is the view a modeler might see while running the train set. Below is a view of Parkdale from over the bridges.



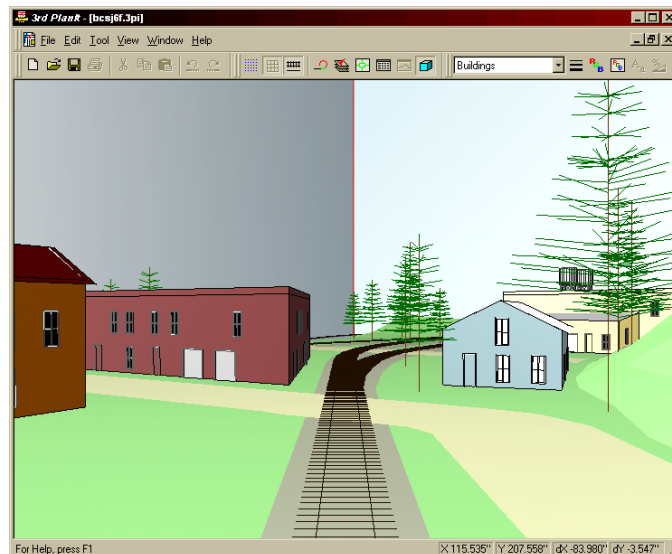
Switch to 3D mode (**Tab**) and you will see a view much like that below. In this case, the Camera (or locomotive) was placed at the farthest end of a terminal track in Parkdale.

You can see a number of features from this new perspective – the buildings as they relate to one another, the track curving off in the distance, and the trees and hills that define the surroundings.

To move your train forward, press the **Up Arrow** key. When 3rd PlanIt is set to “snap to track” you are in “Driving Mode” and will follow curves in the track as they appear. You can back up by pressing the Down arrow key, or reverse direction by pressing **Ctrl-F** (for **F**lip directions).

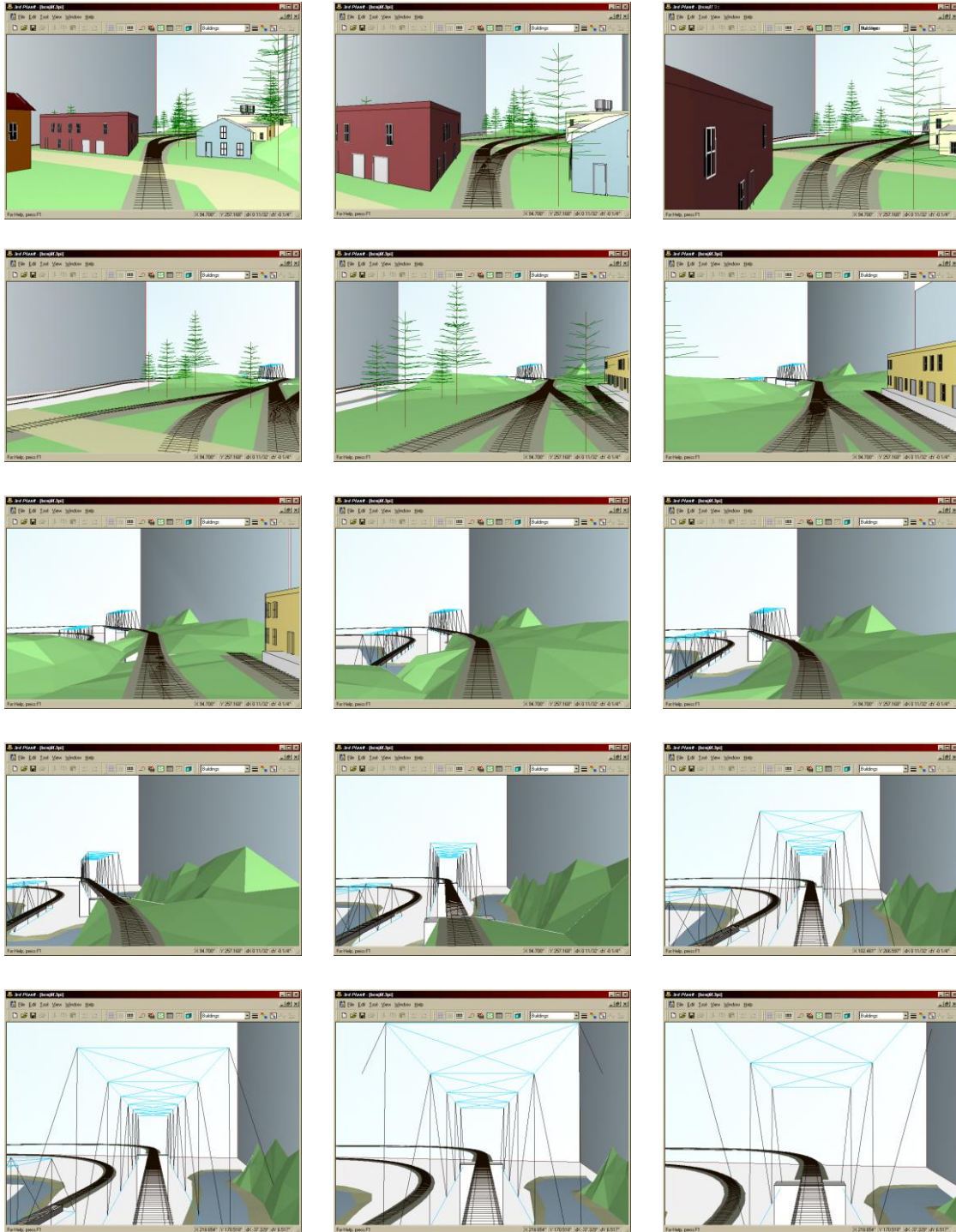
When a turnout is approaching, you can click the turnout or switchstand to indicate the direction you want to turn.

If you press **Home** 3rd PlanIt will continue to move the train without further keystrokes. To stop the train, press **End**. If it reaches the end of a track, the train will flip and head back the way it came from.



25.1 The Parkdale Sequence

Many thanks to Charlie Comstock for his track plan used in this chapter, and for his tireless efforts in testing and refining 3rd PlanIt.



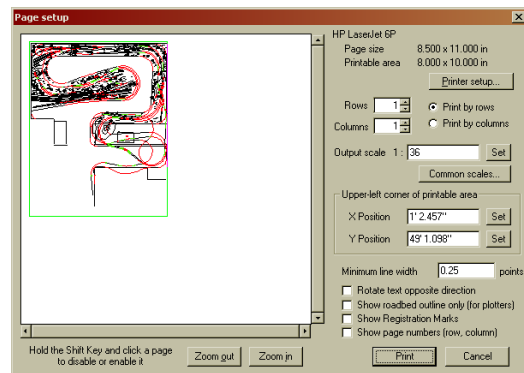
26. Printing

3rd PlanIt provides a complete suite of printing capabilities for your layout. You may select the magnification, the number and position of pages, and the margin size to meet your changing printing requirements through the layout design process.

26.1 Page Setup

The Page Setup screen defines how you want your layout printed. This is the full view of BonusRoom in the Page Setup screen. In order to print BonusRoom on a single 8.5 x 11 sheet of paper, it is necessary to choose a scale of 1 inch = 3 feet.

You can see the actual scale of 1:36 has been computed. You may select any printing scale you wish in the Scale field. The Quick Scale field simply fills in the Scale field with some common scales. If you wish to set a specific scale, type that scale into the Scale field and press the Set button to the right of the Scale field.

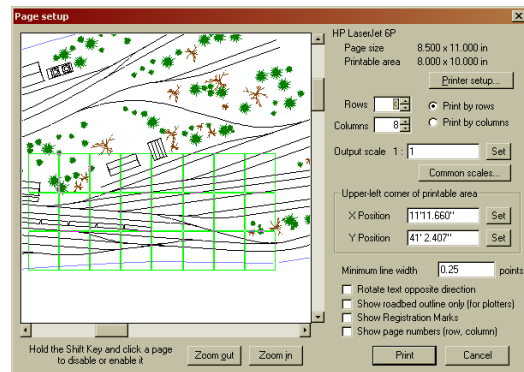


You may also select the exact upper-left position of the printing area by entering the position similarly to entering an exact scale. However, it's far easier to just drag-and-drop the green print area rectangle to the proper position.

26.2 Actual Size Printing (1:1 Scale)

The Page Setup screen allows for many different scales and areas to be printed. Previously we printed a fairly large layout on a single sheet of paper. However, several times during the construction of this layout it was necessary to print areas of the drawing at 1:1 scale. These printouts were transcribed to the sub-roadbed to precisely lay the track.

In this view we can see the more complex trackwork at the throat to the main yard in BonusRoom. To transcribe this to the actual layout requires 24 sheets, in 3 rows of 8 columns.



To set up the location for the printout, it was necessary to Zoom In to the document. The Zoom buttons at the bottom of the dialog box provide this capability. Once zoomed in, the scroll bars surrounding the image are active and can be used to position your view within the drawing. Each page can be individually disabled or enabled by holding the Shift key and clicking the page. Use this to eliminate blank pages from output.

The **Minimum line width** field sets the smallest line width that 3rd PlanIt will produce when printing. This is useful for high-resolution output devices, in which a single-pixel-width line is so thin it is barely visible.

Rotate text opposite direction is used when your printer shows text incorrectly, rotated 180 degrees away from the intended direction.

Show roadbed outline only (for plotters) is a special mode designed for printing roadbed templates on plotters. By selecting the proper options for Layers that contain track, you can display the simulated roadbed in both 2D and 3D. When you print on an ink-jet printer, the roadbed will print in a wood color. However, this takes a long time if you are using a plotter and your goal is to print templates for cutting wood. With this option selected, only the outlines of roadbed will be plotted, saving time and ink.

26.2.1 Registration

It's quite difficult to print several pages and cut-and-paste them successfully. Here's the key: keep the Grid Lines turned on when printing multi-page output and select **Show Registration Marks**. After cutting two edges off each sheet (except the right/bottom edges), each page's Grid Lines can be aligned to the corresponding lines on the next-door neighbor pages. Use a long straightedge to align chosen Grid Lines in both the horizontal and vertical directions across several (or all) pages. You can **Show page numbers (row, column)** to aid in assembling the numerous sheets you can produce when printing 1:1.

26.2.2 Transcribing to the Sub-Roadbed

Everyone has their own style, but we found a trick that works well for us. After carefully aligning (and checking!) your output on the sub-roadbed, use a sharp instrument like an awl or a dental tool to poke through the paper on the centerline of the track. Do this every 1-3 inches along each track you're interested in. When you remove the paper, the series of holes will guide your track placement... even after painting.

26.2.3 Margins

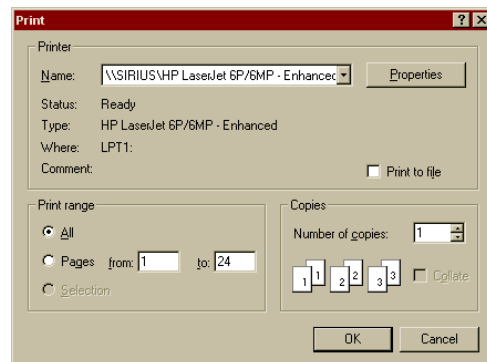
In the example above, the top and bottom margins are one-half inch and the side margins are 0.25 inches, resulting in a printable area of 8 x 10 inches. Margins are set using the Printer Setup button, where you can also select your desired printer.

Remember every printer has an area at the outside of a page that is unprintable. Your margins must be large enough to provide for the unprintable area, or you will be missing some of your drawing. Inadequate margins will keep you from properly aligning multi-page output.

26.3 Page Numbers and Row/Column Printing

If you are printing multi-page output, you can select to Print by Rows or Print by Columns. This controls the order pages are numbered and printed: Print by Rows prints each page on the top row, from left to right, then does the same for the second and following rows. Print by Columns starts in the left column, printing from top to bottom.

You may select which pages you want printed, as well. When you select File/Print, you are presented with a screen to provide printing information. This example shows the Print dialog box for the BonusRoom page setup shown above (3 rows of 8 columns). As you can see, there are 24 resulting pages numbered one through twenty-four.



Because Print by Rows was selected for BonusRoom, the top-left page is numbered one, counting up to page eight at the upper right. Pages 9 through 16 are the middle row and pages 17 through 24 are the bottom row. This can be very important. If you are printing a large Circle, Spiral Easement and tangent track, there can be quite a few blank pages in the page grid. Note which page numbers contain track, and use this dialog box to print only the pages you want. You'll need more than one pass to get all the groups of pages you desire, but it sure does save paper and time!

27. Importing and Exporting

27.1 Export and Import of STL files

STL is a file format that allows you to send designs for 3D printing to companies such as Shapeways.com or to your own 3D printer. Complete designs of railroad cars and equipment have been successfully printed and built using 3rd PlanIt. While all the details of designing objects for 3D printing are beyond the scope of this manual, you can find many good references starting at Shapeways.com. To export an object for 3D printing, select a grouped object, then choose File / Export / STL. You can also import STL files.

27.2 Importing DXF/DWG Files

Using the DXF/DWG option, you can directly import DXF and DWG R13 and R14 files into your 3rd PlanIt design. Simply select **File / Import / DXF-DWG** and browse for the desired file. The layers present in the DXF/DWG file will be created in your 3PI document, then all the DXF/DWG objects will be placed in their designated layers. Please note that the DXF and DWG file formats only allow for triangular solids. If you export a square from another program, it will be converted to a pair of triangles and that is what will be imported into 3rd PlanIt.

27.3 Importing Cadrail Designs

Users of Cadrail version 5 or 6 may directly import their designs into 3rd PlanIt for a quick upgrade (Cadrail is a trademark of Sandia Software). Simply create a new 3rd PlanIt document and select File/Import. Choose the Cadrail drawing you wish to import. The process is thorough but there are some limitations.

27.3.1 Spiral Easements

Most significantly, there are differences between Spiral Easements under 3rd PlanIt and Cadrail. 3rd PlanIt computes spirals using the “Clothoid” curve, which results in the cubic spiral algorithm as mentioned by John Armstrong in his book [Track Planning for Realistic Operation](#).

A Clothoid is a curve whose radius changes from a finite number (like 30 inches) to an infinite radius in a linear fashion. A straight line – or tangent track – can fairly be thought of as a “curve of infinite radius”. A good Spiral Easement makes for clean entrance and exit of curves by long rolling stock, and just looks great. It also changes the horizontal acceleration (or centrifugal force, if you will) from zero on a tangent to the value in the fixed curve in a linear fashion, which feels right to any small passengers who may be riding your trains.

In Cadrail, you could draw a spiral of your own dimension and align it to a curve or tangent. Because there are so many possibilities to create spirals in Cadrail that differ from the standards chosen for 3rd PlanIt, it does not import Cadrail spirals.

This really is not much of a problem. Simply use the Connect with Easement Tool to connect spirals where they are needed. If you get a message “line is too far from Circle” or “line crosses Circle”... you have some re-thinking to do. Usually the proper solution is shrinking (or enlarging) the offending Circle’s radius so a proper spiral can be drawn. Sometimes repositioning the Circle is effective.

If you have a situation where you have a long Circle with spiral entrances and exits, there is a better approach. Versions of Cadrail did not allow you to have spiral/Circle/spiral connections greater than 180 degrees, so many users placed Circles and then did a “Fit to Tangent”. If you have this situation, or indeed almost any spiral/Circle/spiral connection, you may find that recreating the trackwork (deleting the old Circle and spirals) gives more pleasing results.

You can also choose the length of your spiral segments, giving you fine control over the look and feel of a section of track. This also helps fit spirals into tight areas without violating good design principles.

27.3.2 Multi-Line Segments and Text Fields

In Cadrail, multi-Line Segments and text fields (in v5) did not scale their width as you zoomed in and out. An approximate spacing between double and triple lines is made at import; you may want to adjust the spacing of lines once you view them at various magnifications.

Cadrail v5 did not have “box text”, text which word-wraps within a box of your chosen size. 3rd PlanIt creates a box of reasonable size for the text, but you will want to go to each text object and tune its font size and box size for optimal presentation. Please note that the text object receives the point size assigned in Cadrail, but because 3rd PlanIt doesn’t know what magnification you were using when you assigned the point size, it doesn’t know the proper size in your new drawing. 3rd PlanIt uses the point size used in the Cadrail drawing, but you may want to adjust font sizes for appearance.

27.3.3 Track Objects

3rd PlanIt allows you to mark objects to be “Track Objects”. When you zoom into them or view them in 3D, the rails and ties are displayed. This feature did not exist in Cadrail. One effective way to set a large number of objects to be track objects, is to display a single layer with track in it. Use **Edit / Select All** to select all the components in the layer. If you want to remove some objects from the selection, use **Shift+Select** to remove them.

Next, group all the objects, using **F9** or **Edit / Group**. From the **Edit / Properties / Appearance** dialog box, set the **Track object** check-box. Then **Edit / Ungroup** the group to complete the action.

27.3.4 Hints

Don’t be too concerned about preserving the details of your Cadrail import. Use the critical objects as base locations for using 3rd PlanIt design tools. 3rd PlanIt performs different connections than Cadrail, so it is often the case that you will end up with a more pleasing layout by eliminating some existing objects and reconnecting.

For example, versions of Cadrail cannot connect two tangents at narrow angles “around the outside”. This would occur if you were laying out a figure 8 by starting with two crossed lines. 3rd PlanIt can connect the crossed lines with or without easements, resulting in a smooth and satisfying connection.

V6 and previous versions of Cadrail could not connect using turnouts. Therefore, crossovers and general intersections with turnouts had to be carefully hand-positioned and could rarely be precisely correct. It is best to eliminate one of the turnouts and use the Turnout Connect Tool to provide a new and precise connection.

27.4 Import CSV to Contour Line

You can create a contour line with very specific vertex locations using this feature. For example, you might have the cross-section of an object (such as a fuel tank or a wing) described in a spreadsheet. You could export the cross-section to a CSV file, resulting in something like this:

```
1.00000, 0.00000
0.99666, -0.00011
0.98657, -0.00023
...
0.97290, -0.00233
0.98767, -0.00121
0.99682, -0.00033
1.00000, 0.00000
```

Using **File / Import / CSV file as Contour Line**, this data can generate a contour line of very specific dimensions. This can then be transformed to a 3D object, or otherwise manipulated to achieve an accurate representation of the desired object. You can also include a “Z position” in addition to the X and Y positions as shown in the list above.

27.5 Import 3DS

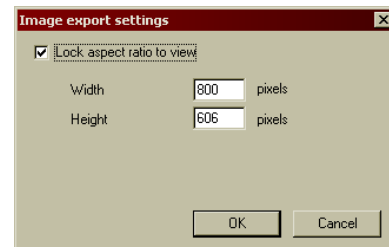
Files in the general-purpose 3DS format originated by *3D Studio Max* can also be imported. This is a convenient way to populate your drawing with generic objects such as people, cars, animals and such.

27.6 Export DXF/DWG

Use **File / Export / DXF** or **File / Export / DWG** to export your 3rd PlanIt design as a DXF or DWG file. As mentioned in the import discussion, due to constraints in the DXF file format specification, all polygons will be converted to triangles for export. You can choose the file format in the file browser dialog.

27.7 Exporting 2D and 3D Images

You can directly export a rendering of your plan in either 2D or 3D to a BMP, DIB, JPEG or TIFF file format. To start the process, select a view in either 2D or 3D mode. Select **File / Export / View to file**. The upper-left corner of the view on the screen will appear in the upper-left corner of the output file. The output image will contain either the complete width of the view, or the complete height of the view, or the exact view depending on the settings in the dialog box shown at the right.



If you select **Lock aspect ratio to view** in the dialog box, the output image will contain the entire view. As you change one dimension, the other will change proportionally to make sure the entire view is shown in the output file. If you do not select **Lock aspect ratio to view** in the dialog box, the output image will be trimmed at the right or at the bottom in order to achieve the aspect ratio you provide.

After setting up the image size, you will be given an opportunity to select the location to save the file, the file name and the file format you desire.

File / Export / Screen to file is available in 3D, and transfers the current screen image pixel-by-pixel to the file, without redrawing by OpenGL and without any resizing or scaling.

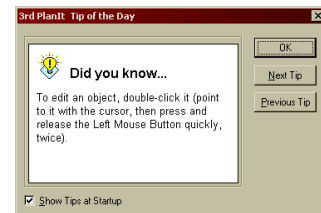
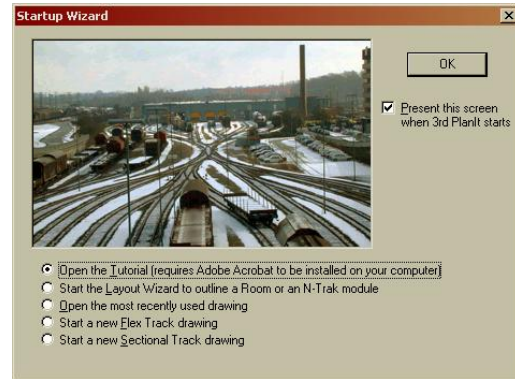
28. Tutorial

28.1 Starting 3rd PlanIt

Once you have installed 3rd PlanIt on your computer, you can begin using it by pressing the Start button on the Windows task bar, then selecting 3rd PlanIt. You may also start 3rd PlanIt by opening a file with the extension “.3pi”, once you have created and saved a track plan.

When you start 3rd PlanIt you will be shown the Startup Wizard. Here you are given a choice of viewing this Tutorial, starting the Layout Wizard (a tool to help you design a room or an N-Trak module), or starting a new Sectional or Flex-Track drawing. To begin a new drawing for this Tutorial, select **Start a new Flex Track drawing**, and press **OK**.

You’ll also see a Tip-of-the-Day dialog. This contains hints on using 3rd PlanIt that change each time you start the program. You can also move through them one at a time. You can disable the feature using the checkbox at the bottom.

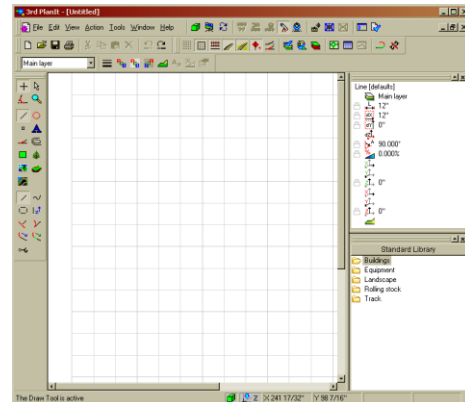


28.1.1 Lower-Resolution Displays

If you are using a lower-resolution display, such as 800x600, you may see a display similar to the example at the right.

You can customize the appearance of 3rd PlanIt in many ways to provide the best working area for your particular needs. First, you’ll want to resize the docked toolbars on the right side of the screen. Point to the border between the toolbars and the drawing grid until you see a double-ended arrow appear, then press and hold the left mouse button, then move the border until the toolbars have a pleasing size.

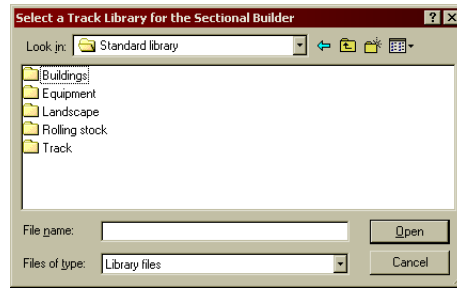
You may also turn the various toolbars at the top on and off as you wish, or move them so they are floating. To turn toolbars on and off, use the **View / Toolbars...** menu selection. To “float” a toolbar, point to the pair of lines on its top or left side, press and hold the left mouse button, and drag the toolbar elsewhere. You can prevent it from re-docking by holding the Ctrl key down while you drag it. After you change toolbars, you can once again fill the drawing area with the Grid by selecting **View / Zoom / Full Grid** or by pressing **Shift+F3**.



At the bottom of the drawing window, you can see a tab marked “Untitled”. This “Workbook view” allows you to select from several open documents quite easily. You can reclaim this space by disabling the **Window / Workbook Style** menu selection.

28.2 A Sectional Track Plan

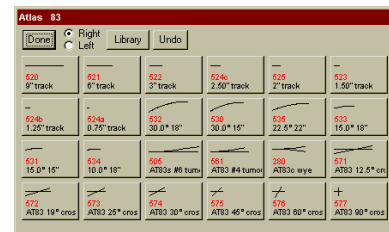
You may remember that you selected **Start a new Flex-Track drawing** when you began this Tutorial. Even so, you can use the **Sectional Builder** to add Sectional Track to any drawing at any time. To use the Sectional Builder, select **Tools / Sectional Builder**. You will be presented with this File Selection dialog, allowing you to choose the Sectional Track library. (If you don't see "Standard Library" at the top, use the pull-down to select the **C:** drive on **My Computer**, then **Program files \ 3rd PlanIt \ Standard Library**). Double-click on **Track**, then double-click on your scale, then double-click on the library you want to use. In this case, the Atlas code 83 library was chosen.



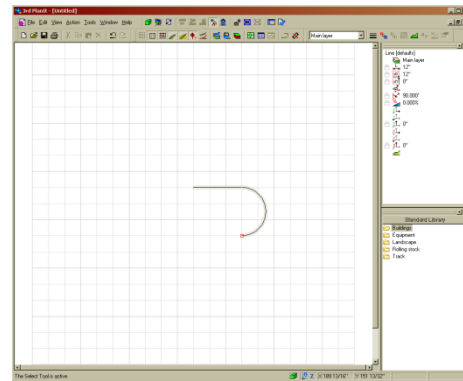
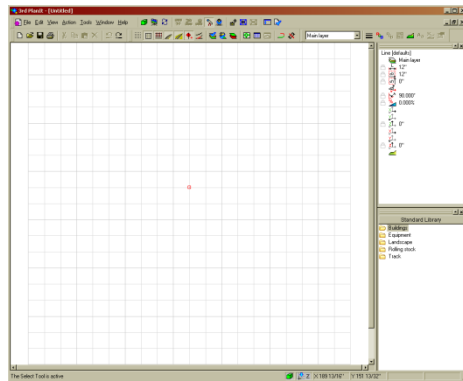
28.2.1 Laying the Track

The Sectional Builder will appear. You can point to its frame with the cursor and adjust its size. The buttons will resize within the frame to provide as much information as possible for the size you have chosen.

Here you can see a symbolic representation of each part, its part number, and a description of the part (or its common name). You can choose a new library with the **Library** button, **Undo** changes, and set the direction of the next curve or turnout.

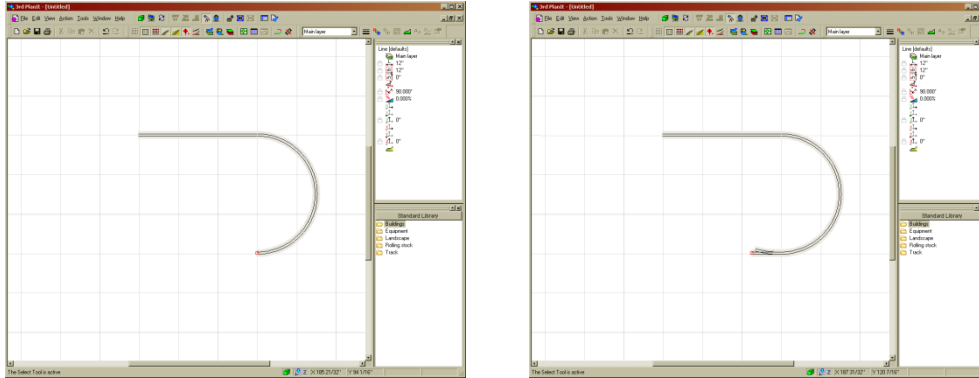


Whenever you are using the Sectional Builder, you will see a small red box, the Guide Box, displayed on your layout. In this case, with an empty drawing, the box is placed at the center of the grid. The Guide Box indicates the location that the next piece of track will be placed.



To place a piece of track, press its button in the Sectional Builder one time. The piece will be added to the drawing at the location of the Guide Box, and the Guide Box is advanced to the open end of the new piece. To produce the drawing above right, the **9" track** button was pressed four times, and the **30.0" 18"** button was pressed 6 times.

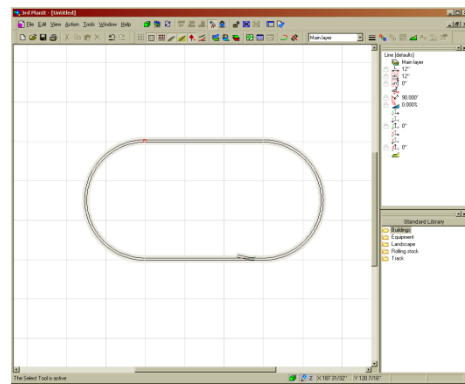
It's difficult to see the drawing at this magnification, so let's increase the magnification. Select **View / Zoom / In using box** or press the **F2** hot key. You will see a **Zoom Cursor** used to outline the area you want to see in more detail. Move the Zoom Cursor to the upper-left of the track that's been laid, press and hold the Left Mouse Button, and drag the bounding box to the lower right. When you've surrounded the track, release the mouse button and the area you surrounded will be enlarged.



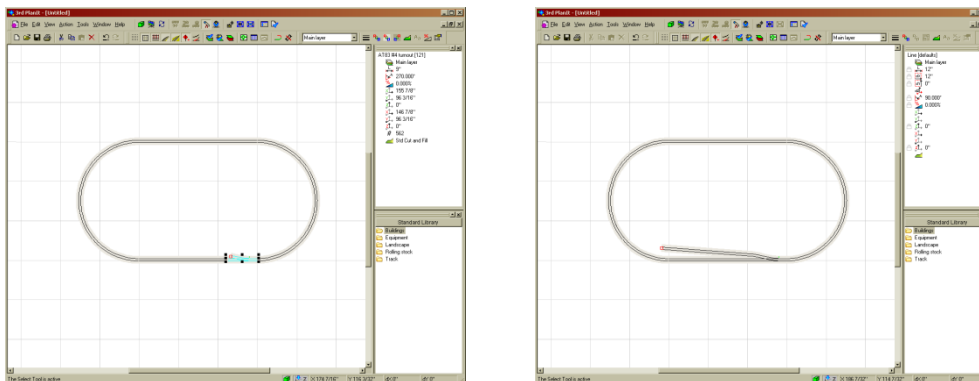
If you've zoomed in far enough, the track will change from a single-line to a two-line representation. Pressing the **Track On/Off** button shown at the right will change to a single-line display regardless of your zoom magnification.

If you have a mouse with a wheel, you can roll the wheel to zoom in and out, centered on the cursor. This behavior is controllable in **Tools / Options / Mouse wheel**.

Let's add a turnout to the drawing at this point by pressing the **#4 Turnout** button. Note that the divergent exit of the turnout will be on either the right or left side, depending on the setting in the Sectional Builder. If you want the exit on the other side, simply press the **N** key (on the keyboard). Add three more **9" track** segments and 6 more **30.0° 18"** pieces to complete the loop. Your drawing should look much like the example at the right.



To add track to the divergent exit of the turnout, point the cursor to the free end. The turnout will highlight by turning green when you are pointing at it exactly. Click the Left Mouse Button to place the Guide Box at the free end of the turnout.



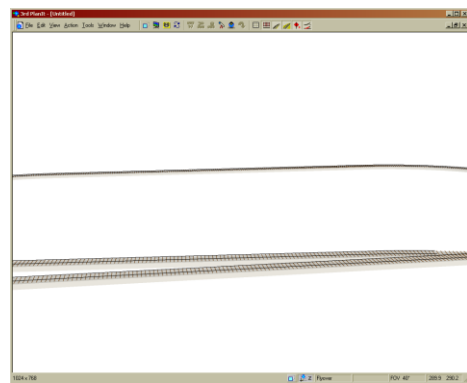
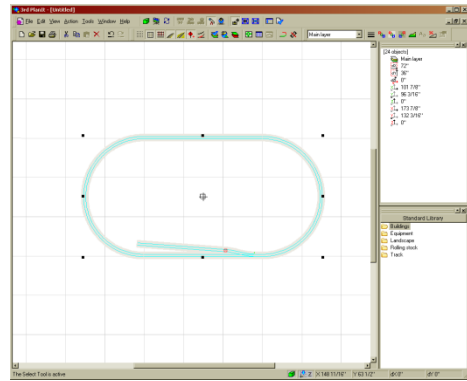
Now click the **10° 18"** curve button to make a siding track. Oops! The curve continues to the right because the Sectional Builder was still set for Right Turns. Simply hit the **N** key to reverse the curve of the turnout and make it somewhat parallel to the main line. Click the **9" track** button 2 or 3 times to extend the siding.

28.2.2 Viewing in 3D

Let’s look at the track plan in 3D. 3rd PlanIt’s three-dimensional view centers on a 3D origin that you may place anywhere on the drawing. In this case, it will be best to center the 3D origin in the center of the oval. Choose **Edit / Select All** or press **Ctrl+A** to select all your track objects.

Use the menu command **View / 3D Origin and Camera / Move 3D Origin To Center Of Selection** to position the 3D origin in the exact center of the track plan. As seen in the example at the right, you will be shown the 3D Origin centered in the oval, with the Camera below it (it may be outside the viewing area, if so, press **Alt+F3** to show all objects, then **F3** to return to this view). This setup determines the initial 3D view of the track plan – the view is always from the Camera to the Origin. You can move either the Origin or the Camera to adjust the view, including their Z positions to control the angle at which you view the drawing. You can press **Alt+C** to hide the Origin and Camera from the view if you wish.

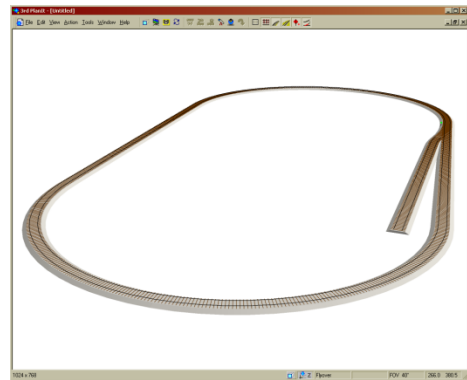
You may turn on 3D View using the menu choice **View / 3D View**, by typing **Tab**, or by pressing the **3D** button in the Document toolbar on the top.



You will see the track plan in 3D from the viewpoint of the Camera looking at the Origin. If your drawing was set up similarly to the example, you’ll see a 3D view much like that at the right. You can see you are indeed looking across an oval width a siding. Neither end of the loop is visible – the camera is too close to the scene to see the ends of the loop.

One quick way to see more of the track plan is to rotate the track plan itself. Hold down the Ctrl Key and press the Left Arrow Key. The track plan will rotate about the 3D origin. If you continue to press the Left Arrow Key while holding the Ctrl Key down, the track plan will continue to rotate (you can hold the Left Arrow Key down to repeatedly rotate the plan).

IMPORTANT: The various Arrow Keys can be used to “walk around” your track plan as shown in Table 1. The Up Arrow Key moves your viewpoint forward as though you were walking towards the far end of the track plan. Conversely, the Down Arrow Key is used to back up away from the track plan. The Left and Right Arrow Keys turn your viewpoint right and left, just as if you were standing in a location and turned to the right or left.



HINT: You can hold down the Shift Key during any of these operations to make the increment of movement larger.

	Up Arrow	Down Arrow	Left Arrow	Right Arrow
Normal	Move forward	Move back	Turn left	Turn right
With Alt Key	Raise viewpoint	Lower viewpoint	Move viewpnt left	Move viewpnt right
With Ctrl Key	Rotate viewpoint about 3D Origin. Appears to rotate track plan in view.			
With Shift Key	Increases the increment used in any of the commands. May be used with Ctrl and Alt.			

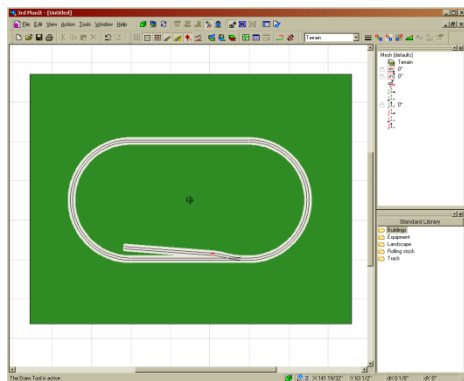
Table 1: Arrow Keys in 3D Mode

28.2.3 Terrain

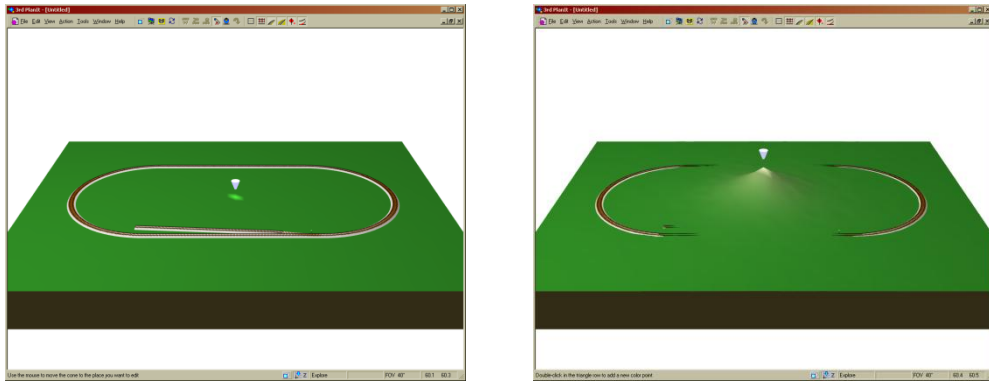
3rd PlanIt's **Terrain Mesh** features let you quickly add realistic terrain to your plan, and will automatically "Cut and Fill" the terrain to your track, buildings and Contour Lines (described in the Terrain chapter of the User's Manual). If you are still in the 3D view, switch back to 2D by pressing the **Tab** key. Click the **Done** button in the Sectional Builder to close it.

Create a new layer for the terrain by pressing the **Enable Layers** button, pressing **Ctrl+D**, or by choosing **Action / Modify Layers....** From the Enable Layers dialog box, press the **New Layer** button, then change the name of the layer to "Terrain". Note that the **Create new objects as track** check box is not checked, then accept the new settings by pressing the OK button. The Terrain layer becomes your active layer for all new objects. *Note: to change an object's layer, click on its layer in the Object Data Window and select a new layer from the pop-up list.*

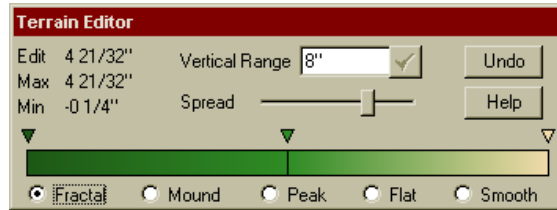
If you floated the ToolKit, bring it up by pointing the mouse cursor to the background and clicking the Right Mouse Button. Select the **Action / Draw / Mesh / Rectangle** option. Point to an area above and to the left of your track oval, press and hold the Left Mouse Button, drag the cursor to a point below and to the right of your track, and release the left mouse button. The rectangular Terrain Mesh will appear behind the track you drew.



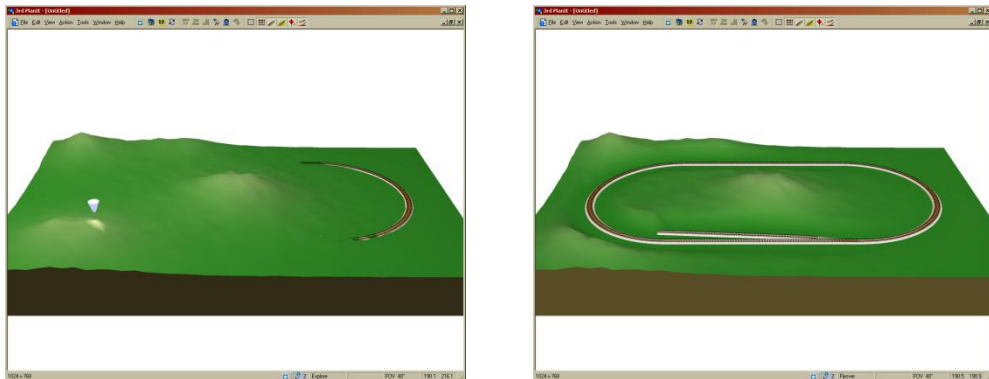
To edit the Mesh, point to one of its edges and double-click the left mouse button. The Terrain Editor will become active, letting you design the Terrain in full 3D. As you move your cursor about the drawing, the **Edit Cone** will follow your cursor. Point to a place where you'd like to raise the terrain, press and hold the left mouse button, and move the cursor up. The terrain will follow, changing color as its elevation changes.



The image above right shows the result of one editing action, using the default **Fractal Mode**. This editing mode is selected in the **Terrain Editor** shown to the right, and is one of several available options. You can select different shapes to result from the edit action, control the spread of the affected area, and see the numerical results of your editing. You can also control colors by editing the existing color markers or adding new ones of your own.

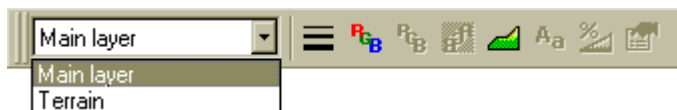


Apply several more edits to the terrain, until you achieve realistic looking results. Don't worry if the track gets hidden while you are editing... simply make realistic terrain that looks appropriate for a railroad right-of-way. When you are satisfied with the look of the terrain, select **Edit / Mesh / Conform Mesh to Objects**. The terrain is automatically conformed to the track, using realistic Cut-and-Fill profiles.

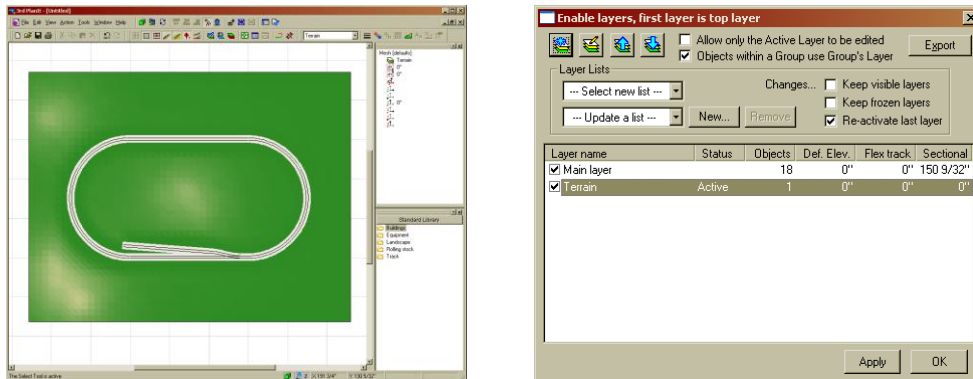


28.2.4 Modifying the Design

Let's explore the editing facilities of 3rd PlanIt, now that we have a start at the track plan. Return to the 2D view by pressing **Tab**. At the top of your screen you will find the Properties Bar as shown here. The "pull-down box" allows you to change the **Active Layer** – the layer in which new objects are placed. Note that each layer has its own **Default Elevation**, the elevation at which new objects are drawn. Since we will be modifying the track, click the small arrow at the right of the box and choose **Main Layer**.



The 2D view will now show the track you built and the elevation changes made in the Terrain Editor. Higher terrain appears lighter in color in a mesh of small triangles. You can clearly see the cuts made for the track right-of-way.



If you'd like, you can hide the terrain layer; use the **Layer Enable Dialog** by pressing **Ctrl+D** or selecting **Action / Modify Layers...** from the Main Menu. In the Layer Enable Dialog you will see the two Layers in the drawing, accompanied by boxes with Check marks. If a box is checked, the layer is visible in 2D and 3D mode. If you want to edit without seeing the Terrain layer, click the box to remove the Check mark and select OK. You will see only the track pieces on the grid.

28.2.4.1 Selecting Objects

Let's explore different ways of selecting track using the various tools. The first way to select objects is with the Select Tool, a basic arrow pointer. You may either choose **Action / Select / Select** or press the **Select Tool** and **Select Mode** buttons in the ToolKit.

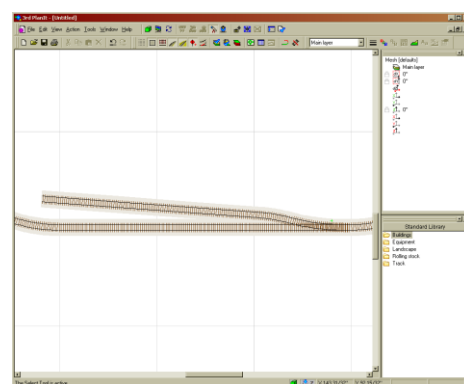
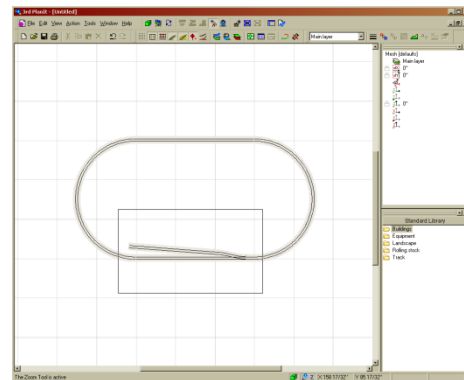


IMPORTANT HINT: There is another great way to get the Select Tool: double-clicking. If you point at the background (*not an object*) and double-click the left mouse button, the current tool will be replaced with the Select Tool. If you double-click the Select Tool while it is pointing at the background, your original tool will again become active. By repeatedly double-clicking the left mouse button, you can switch back and forth between the Select Tool and your most recent tool.

With the Select Tool, point to any object in the oval and click the left mouse button. The object is selected, turns color and is surrounded by a resizing box. This is the typical way single objects are selected. You can select more than one object similarly; hold the Shift key and click another object. It is added to the list of selected objects. You can Shift-Click selected objects to deselect them.

If you want to select several objects, you can use the Select Tool to "rubber-band" the desired items. Press the left mouse button and hold it while moving the mouse. Any objects fully enclosed in the bounded box will be selected when you release the mouse button.

To **Deselect** all objects, point to the drawing background and click the Left Mouse Button. All objects will be deselected and return to their normal colors. To continue with this exercise, use **F2** to zoom into the siding area as shown at the right.

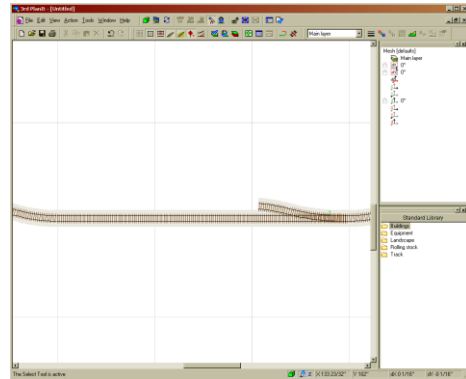


28.2.4.2 Deleting Objects

To delete one or more objects, select them using any method described above. Press the **Delete** key to remove them from the drawing.

If you accidentally delete an incorrect piece, you can undo the previous command(s) by pressing **Ctrl+Z** or selecting **Edit / Undo**. The Undo command can be reversed using **Ctrl+Y** or **Edit / Redo** if desired.

For this exercise, the three straight track segments after the turnout and curve were deleted.

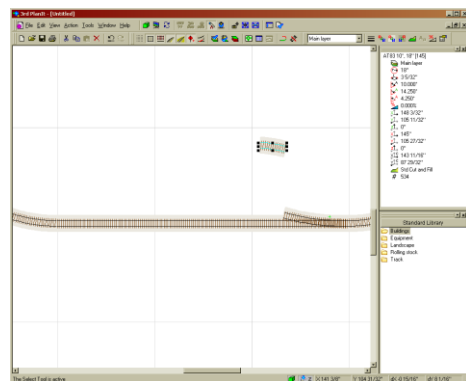


28.2.4.3 Moving Objects

You can move objects with the mouse, or by using the **Arrow** keys. To use the mouse to move an object, point to the centerline of the track object and the object will highlight (turn green) when you are positioned directly above the object.

Point to the small curved segment in the siding, and with the curve highlighted, press and hold the Left Mouse Button. Drag the curve to another location as shown in the example. Note while you are moving the curve, it appears to “jump” from place to place. That is because the **Snap Grid** is turned on.

To turn off the Snap Grid, press the **Snap on or off** button in the Document Bar, or select **View / Snap** and click the on/off menu choice. If you move the curve around after turning off the Snap Grid, you will find it now moves smoothly from place to place. Leave the Snap Grid off for the remainder of this exercise.

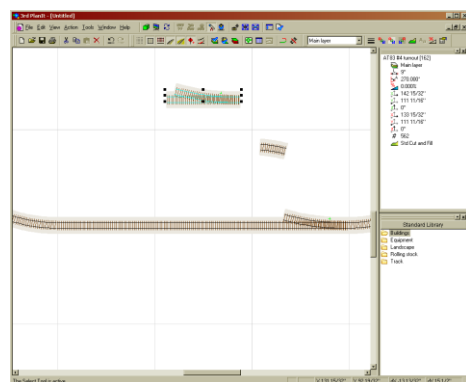


You can also move objects using the **Arrow** keys. With the curve still selected, press the various arrow keys to “nudge” the piece in small increments. If you hold the **Shift** key down when pressing an arrow, the objects will move a larger distance. If you hold the **Ctrl** key down when pressing an arrow, the objects will move a predetermined amount set in **Action / Set Custom Fixed Distance**. If you hold the **Alt** key down when pressing an arrow, you can enter the exact distance to be moved.

28.2.4.4 Copying Objects

To add another track to the siding, we need to add another turnout. It would be possible to bring up the Sectional Builder, position the Guide Box to the outlet of the turnout, and continue from there. It is also possible to make these changes using the standard Toolkit.

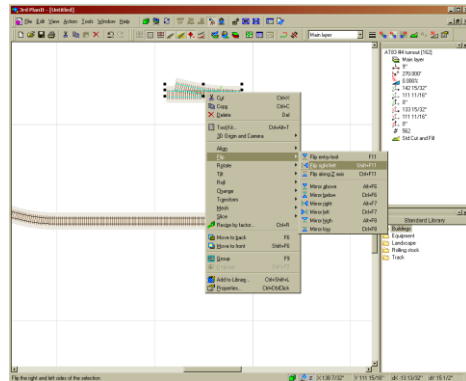
With the Select Tool, point to the existing turnout so that it highlights. Press and hold the Left Mouse Button, and drag the turnout upward. While moving the turnout, press and hold the **Ctrl** key on your keyboard. This indicates you want to make a copy of the object(s) you are moving. You can press the **Ctrl** key at any time while moving the object – as long as it is pressed when the left mouse button is released, a copy is made.



28.2.4.5 Using the Context Menu

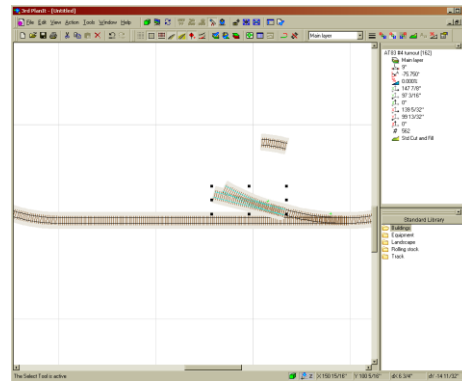
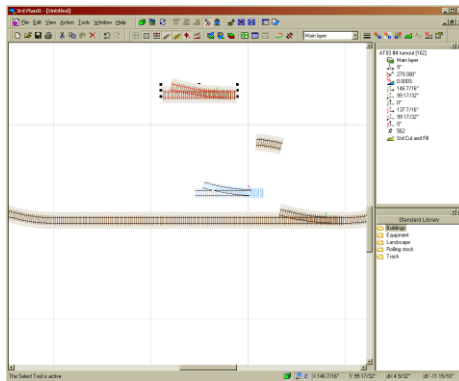
The turnout is oriented in the wrong direction to make a yard. It can be “flipped” from left to right in a number of ways. You could select **Edit / Flip / Flip Right/Left** from the main menu bar, but there is a more convenient way.

Point to the turnout so that it highlights, then click the **Right Mouse Button**. This brings up a context-sensitive menu that contains choices specific to the object you’ve selected. In this case, the **Flip / Flip Right/Left** option is chosen to change the divergent exit from the right to the left.



28.2.4.6 Auto-Alignment

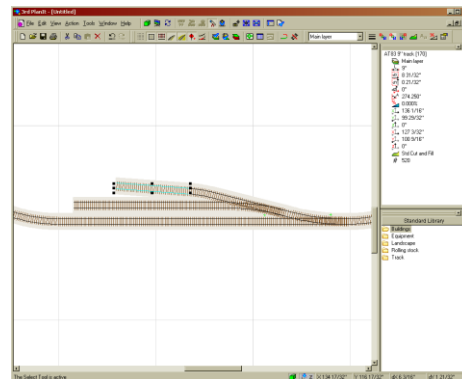
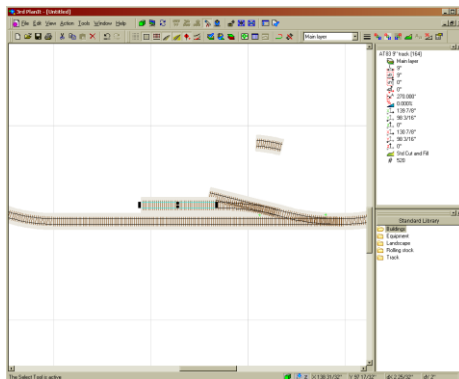
In 3rd PlanIt, track objects automatically align with one another when you move them using the Select Tool. In the left picture, you can see what this looks like while you are using the tool. To begin the operation, point the Select Tool to the “points end” of the turnout, press and hold the left mouse button and begin dragging. A red “shadow” of the original object remains in position while you move the turnout.



When you drag the second turnout to the original one in the main line, the original will highlight when you are pointing exactly to it. The object you are moving “snaps” to the nearest end of the target object. When you release the left mouse button, the moved object is automatically aligned to the existing object.

28.2.5 Fast Design Using Existing Pieces

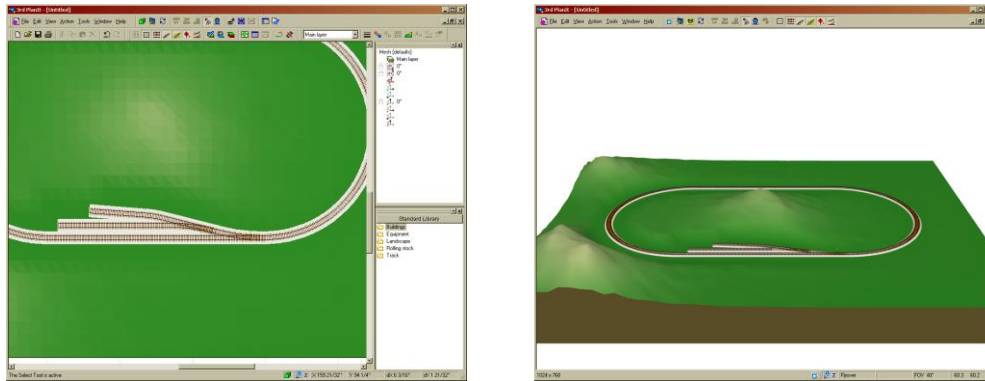
All the pieces you need to complete the double siding are already placed in the drawing. With the **Ctrl+Drag** copy capability, you can quickly copy existing pieces for use in other areas. What’s more, they will Auto-Align when they are positioned at the endpoint of an existing track object.



Point to a straight track segment in the main line until it highlights. Press and hold the left mouse button, and drag it to the exit of the turnout as shown. *Hold the **Ctrl** key down prior to releasing the left mouse button* so that the straight segment is copied instead of moved. You can repeat this operation several times to extend the siding. Move the curve into position at the free exit of the new turnout and copy two straight segments to it, as well. In just seconds, you have designed a yard.

28.2.6 Conform Terrain to New Track

Use the Layer Enable Dialog (**Ctrl+D**) to turn the Terrain layer back on. Even in the 2D view, you can see that the new track interferes with the terrain. You can quickly Conform the terrain to the new track while still viewing in 2D. Point to the edge of the Terrain Mesh, and click the right mouse button. The Terrain Mesh becomes a “foreground” object, covering all other objects so it can be seen completely.

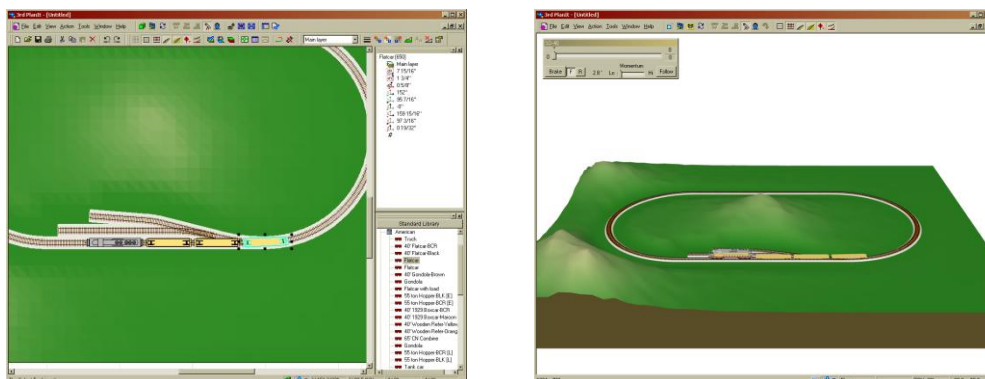


Choose **Mesh / Conform Mesh To Objects**. You will then be asked if you want to “Revert to the Original Version” of the mesh. This can be very helpful if you’re moving track around during a design. Whenever you conform a mesh, the program lets you save the current version of the mesh as the Original Version. You could make a nice hilly terrain, and successively conform it to different track designs using the Original Version each time. This way, no trace of earlier track work is noticeable in the Terrain.

After the Conform operation is complete, deselect the Mesh. There will now be more visible room around the tracks, and the 3D view will confirm the cut in the terrain is correct. While in 3D, note that there is an automatic Fascia placed around the outside of the Terrain Mesh. This can be disabled in the Mesh Properties page if you wish.

28.2.7 Running a Train

In the 2D view, select a piece of track on which the locomotive will be placed. Expand the **Rolling Stock** area of the Library Bar by clicking the on the field. Click the **American** library, then click **SD-40** to place the locomotive on the selected track. It will appear near the center of the drawing. Using the Select Tool, drag the SD-40 to the main line until one of the track segments highlights. Release the mouse button and the locomotive will align to the track. Click on the back end of the locomotive to indicate the next car should be coupled to that end.



Now click the Flat Car entry in the Library Bar. It will appear at the back end of the locomotive, coupled and aligned to the track. You can continue to add pieces of rolling stock to the consist by clicking pieces of rolling stock in the Library Bar. If you now switch into 3D, you can see the train and control it with the Throttle dialog that is presented.

That's it! It's easy to design a model railroad in 3rd PlanIt. The next exercise introduces you to Flex Track.

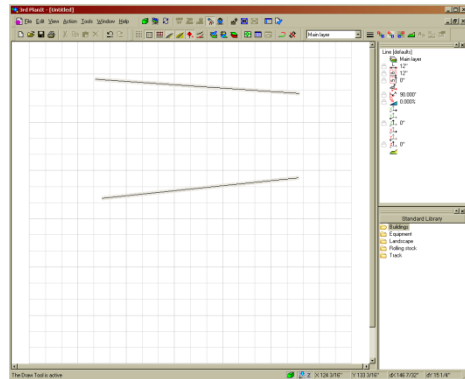
28.3 Using Flex Track in an Oval Track Plan

The previous exercise taught you how to use 3rd PlanIt with Sectional Track. Many model railroaders prefer to use Flex Track, as it gives you much more freedom in your design. You can choose any radius you want, and design with Transition Curves, or Easements, as prototypes use. Let's start the learning by laying out a traditional oval... but we'll make it a bit more interesting by designing it with two parallel tracks.

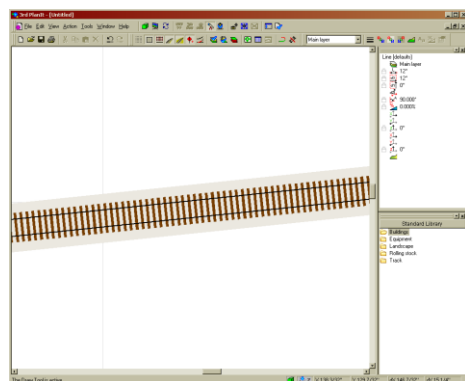
28.3.1 Laying the Main Line

Start the oval track plan by drawing two somewhat parallel lines as shown above. You can draw a line by pointing to the starting point of the line, and pressing the left mouse button. While holding the mouse button, drag the mouse to draw the line. When you have the line where you want it, release the mouse button and the line is complete. Do this twice to create a drawing something like this illustration.

As you can see, 3rd PlanIt has added the outline of ballast to the two track lines you drew. You can turn on and off the Automatic Ballast feature using the **Show Ballast** Button at the top of the program window.



You can see more of the track details by “zooming in”. To zoom in to a particular area, press the **Zoom** Button in the ToolKit or press **F2**. Point the cursor to the upper left corner of an area you want to see more closely. Press and hold the left mouse button, then drag the mouse to surround the desired area with a dotted line. When you release the mouse button, you will see the enclosed area in greater detail.



To return to the previous zoom setting, press the **F3** button, or select **View / Zoom / Back**, or use the zoom buttons in the ToolKit.

If you have a mouse with a wheel, you can roll the wheel to zoom in and out, centered on the cursor.

28.3.1.1 Connecting Track Objects

It's simple to create the curves at each end of the track plan. We will use the Connect tool to automatically connect the two lines. And, since all trains run better when their curves are connected to their tangent tracks with spiral easements, we will choose to include easements in these track plans.

From the **ToolKit**, select the **Connect Tool** and the **Connect With Easements** option using the button sequence shown at the right.



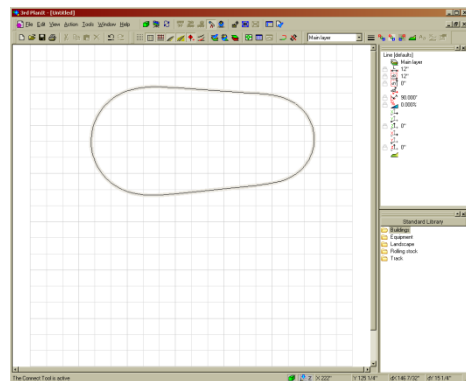
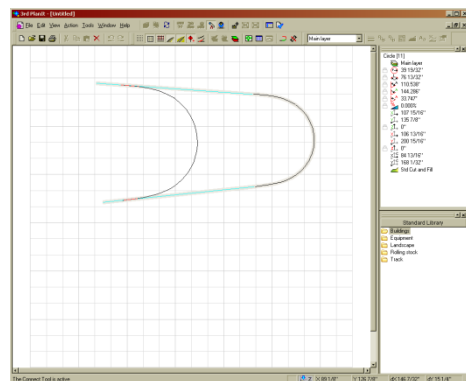
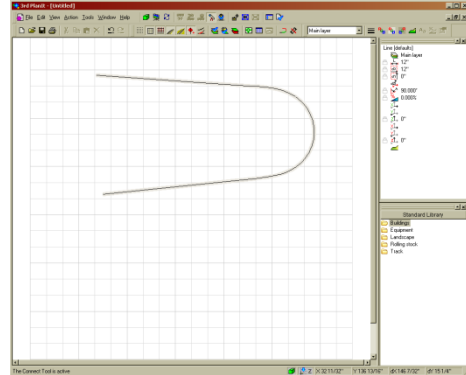
You are now presented with a cursor that indicates you are in Connect mode. Click one of the two lines near an end to begin the connection process. Now move the cursor towards the second line. It will **highlight** (turn green) when you are pointing at it. To continue the connection process, press and hold the left mouse button. **THIS IS IMPORTANT:** although you clicked the first line, you want to point to the second line then PRESS AND HOLD the left mouse button.

While still holding the left mouse button down, move the mouse to adjust the size and placement of the connection. When it looks the way you want it to, release the mouse button and the connection is made. The two spiral easements, the circular arc connecting them, and the lines are all properly trimmed and aligned automatically. Your drawing should now look like the example at the right.

You may complete the oval by repeating the same actions on the other ends of the lines. When you start the connection, you may see the circle “pointing the wrong way” as shown here. If so, simply click the right mouse button (*while still holding the left mouse button down*) and the circle “flips” to the other orientation.

Release the left mouse button when you have the connection placed as you like it, and the oval is complete. There are four easements connecting the two curves with the tangent tracks, all endpoints are precisely trimmed with each other, and the objects have been “connected” internally by the program, as will be seen when drawing parallels.

You can clearly see the easements, curves and tangent tracks by selecting **Color by Type** mode, using **Alt+Y**. For those reviewing this document in a color presentation, the example at right shows curves as red, easements as green, and tangent track as black. You may return to **Color by Layer** mode using the **Alt+L**



IMPORTANT: If you make a mistake while working, press **Ctrl+Z** or **Edit / Undo**. To “Undo an Undo”, press **Ctrl+Y** or **Edit / Redo**. You can Undo (and Redo) thousands of changes, so you can actually Undo this whole track plan when you finish, and Redo it to completion once again.



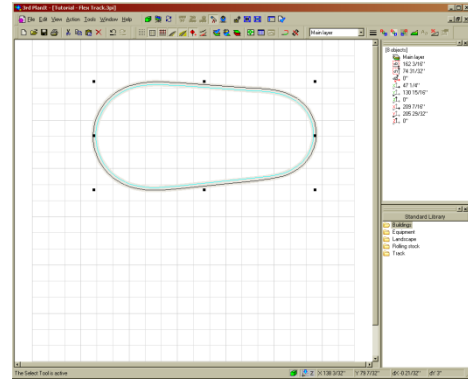
28.3.1.2 Making Parallel Track

Using the “rubber-band” method, select the whole oval track plan. Then choose the **Parallel Tool** from the Tools menu, or with this two-button selection:



Point at any object in the oval. Press and hold the left mouse button, then drag the object to the place you'd like the parallel track. Note that the whole oval moves at the same time - it appears the track will cross incorrectly. Don't worry; the program will correct this.

When you get the object where you'd like it to be, you can either release the button to create the parallel track, or you can press the right mouse button while still holding the left button. The right button brings up the Parallel Distance dialog box, where you can enter the exact distance between parallel tracks. Please note that this distance is always used as the parallel distance until you change it again. When you drag an object parallel, you tell the program where you want the parallel object in relationship to the original object. The program then applies the exact distance you have selected when actually creating the parallel object. The first time you use the Parallel Tool in a document, the parallel distance is set to 2 inches.



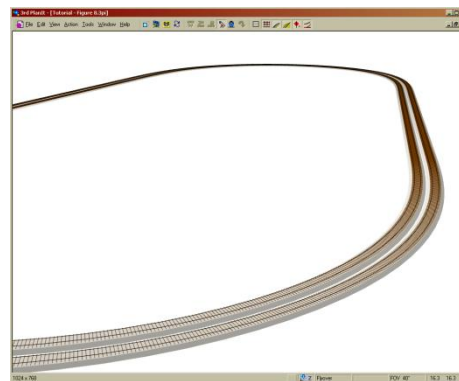
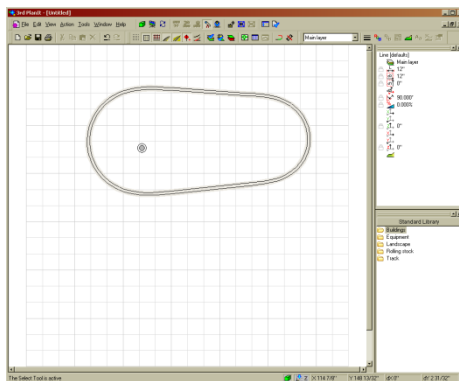
Once you've completed drawing the parallel track, your track plan should look like the example to the right. As you can see, the entire oval has been double-tracked! Again, all circles, easements and lines have been carefully sized and trimmed for perfect alignment... in almost no time.

Using the Select Tool (or the Parallel Tool, a variant of the Select Tool), you may click the various objects in the plan to see information about them. The Object Data window shown in these examples contains relevant information about whatever is selected. The information is shown in units most convenient for you and the drawing; in these examples, feet and fractional inches have been selected. There are several American and metric display options available. You can enter dimensions in whatever units you prefer, regardless of the display option you have chosen. They will be properly converted for you automatically.

IMPORTANT HINT: At times you may see objects on the screen that look like they don't belong. If you want to make sure the display reflects your drawing exactly, you can use **View / Refresh** or press **F7** to redraw the entire display.

28.3.2 Using Lights in the Drawing

You can add lights to the drawing to control the shading of objects in the track plan. If you don't add a light to the drawing, one is added automatically above the center of all objects. To add a light, return to 2D by pressing **Tab**, then choose the **Actions / Draw / Point / Light** tool from the ToolKit. Point to the drawing in the place you want the light and click the left mouse button. Press **Tab** to see the 3D view with the ballast lighted.



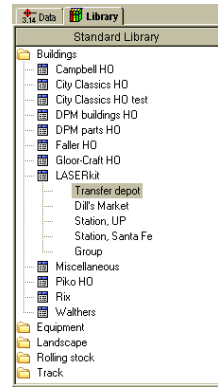
28.3.3 Adding Buildings

Let's add a building to the track plan. Return to the 2D view by pressing **Tab**. Create a new layer for the buildings by pressing the **Modify Layers** button. From the Enable Layers dialog box, select the **New Layer** button, then change the name of the layer to "Buildings". Note that the **Create new objects as track** check box is not checked and return to the drawing by pressing the OK button. The Building layer becomes your active layer for all new objects.



Note: to change an object's layer, click on its layer in the Object Data Window and select a new layer from the pull-down list you are presented.

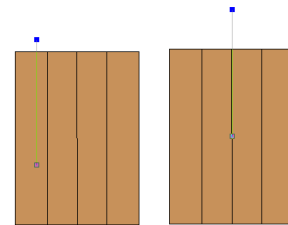
You can quickly place a building on the drawing by selecting one from the Object Library. You can To do so, you use the Library Bar on the right side of the screen. It appears as shown in the example to the right in the standard object library. You can double-click a category such as Buildings to expand the category and see its contents. To place an object in the drawing, simply double-click the left mouse button on any object. For this example, we have chosen the LASERkit HO Transfer Depot.



When you double-click the object name, the object is placed in the center of your view. You may move it wherever you like with the Select Tool; simply point at one of the building's lines, press and hold the left mouse button, then drag the object to its new location. Release the mouse button to complete the operation... or press Escape to return the building to its original location.

Note: The Esc key (Escape) can abort almost any operation you are performing.

To rotate the building into alignment with the track, make the Select Tool your active tool. Point to the building, hold down the **Alt** key, and double-click the left mouse button. Prior to starting a rotation, you can move the point of rotation from the center of the object to any point you desire. The **Alt** key can be used to snap the point of rotation to an endpoint. To rotate the building, point to the top handle with your cursor, press and hold the left mouse button, and rotate into position. To end rotation mode, double-click the left mouse button.



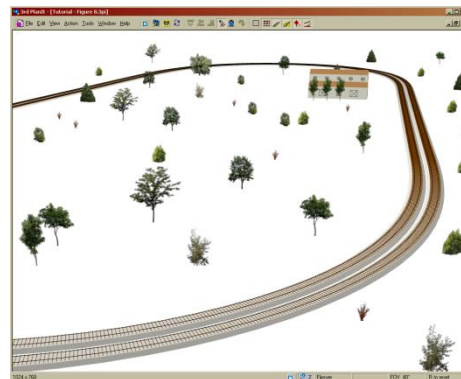
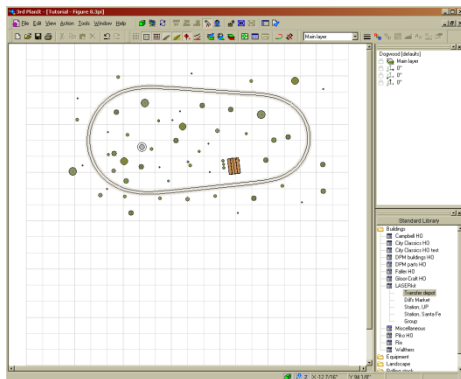
28.3.4 Landscape and Plants

A few trees would spruce up the drawing. Add another layer named "Landscape" as you did above with the "Buildings" layer. It is always good to group similar items in their own layer, so they can be disabled and enabled all at once when desired.

3rd PlanIt provides "Bitmap Plants" to provide quick design of realistic looking scenery. From the ToolKit, the **Draw / Draw landscape object** menu provides several different plant types for you to choose from, including trees and bushes. To draw a plant, simply point to the location of its trunk and click the left mouse button. You can resize a plant using the resizing handles, like any other object.



Your drawing should now look something like this:



You can quickly swap back and forth between 2D and 3D mode by pressing **Tab**. Your existing 3D and 2D settings are saved and the drawing appears from the same perspective as your previous view.

A number of plants are available from the Toolkit, as shown here. You can also add from a wide selection of Trees from the Object Library. Within the category Landscape, the files Trees1 and Trees2 contain more than 60 trees and bushes at higher resolution than those in the Toolkit.

28.3.5 Adding Turnouts and Trackwork

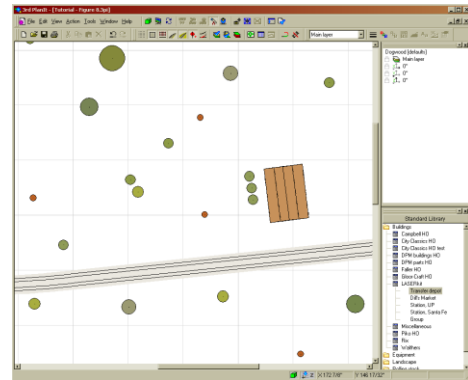
A building like this should have a nearby turnout. Change back to the **Main layer** to add this trackwork. This layer is marked so that all new objects are created as track objects - objects that have rails and ties when you zoom into them or render them in 3D.

It would be difficult to do accurate trackwork at low magnification, so let's "Zoom in" to the drawing and get a better look at things. To Zoom in, press the Zoom tool button in the ToolKit on the left side of the screen or press F2. You will see the Zoom Cursor; you use this to outline the area you want to see at higher magnification.



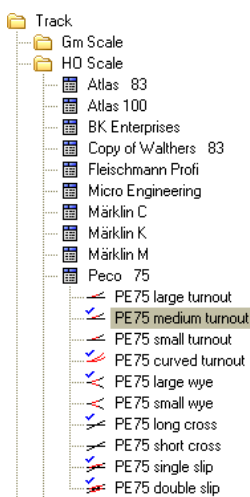
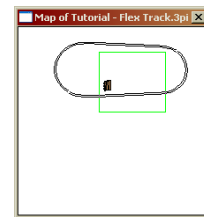
Point to the grid near its upper left corner, then press the left mouse button and hold it. While holding the button, drag the mouse to the lower right to surround the area you wish to examine more closely. When you release the left mouse button, the area you outlined will be enlarged to fill the view.

Depending on your zoom magnification, you may notice that as the magnification becomes larger, the objects drawn in the Main layer begin to look like tracks. You may find it easier to connect track if it were showing as a line instead of rails. To accomplish this, press the **Track On/Off** button at the top of the screen. This will turn off the track draw feature of 3rd PlanIt.



When zoomed in, the scroll bars on the right side and bottom of the screen change size to reflect the enlarged view. You may move the scroll bars to slide the drawing through your view. The entire drawing document is accessible at any magnification.

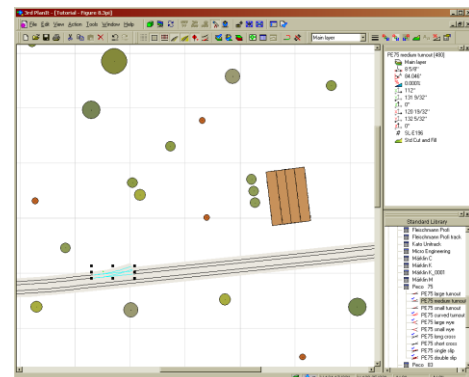
When working on a large track plan, it is useful to turn on the **Document Map** by pressing the **Document Map** button at the top of the display ("Document" refers to the area outlined by the grid). The Document Map is very useful when you zoom, as you can see the entire plan and your location within it. A green-bordered box indicates the region that is currently in your regular display window. As you use the scroll bars, the location of the box changes; as you zoom, the size of the box changes. You can also move the box itself to change your view location rather than using the scroll bars.




Select the Draw Turnout Tool from the ToolKit. The default turnout for drawing is a Peco 75 medium turnout. You can easily select another turnout using the Library Bar. Click the **Track** category in the Library Bar, then click a manufacturer of your choice. To choose the default drawing turnout, point to the turnout name and click the right mouse button. Select **Use with Draw Turnout Tool**. A checkmark is drawn next to the turnout name, indicating it is the drawing default. You can set the default for each type of Smart Turnout that can be drawn.





The easiest way to place the turnout in this example is to draw it directly into the existing tangent track. With the Draw Turnout Tool selected, point the cursor over the track closest to the building. The track line will highlight to indicate your cursor is directly above it. Press and hold the left mouse button. The turnout is drawn directly on the track, properly aligned but still movable.

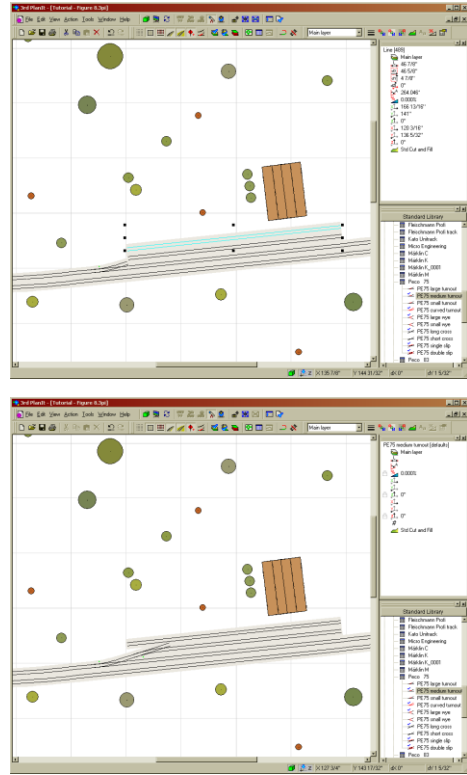


You may slide the turnout along the track until it is properly positioned, holding the left mouse button down. The routing exit of the turnout will be drawn on the same side of the tangent track as the cursor. If you want to flip the entry and exit of the turnout, click the right mouse button while holding the left mouse button. When you release the left mouse button, the turnout is inserted into the line as you left it, and the tangent track line is trimmed to align with the new turnout.

Now let's add two spurs to the plan. Choose the **Parallel Tool** using the buttons in the ToolKit.  Point to the tangent track just to the right of the turnout, press the left mouse button, and drag the copy of the track upward. Release the left mouse button. Repeat the process with the new track, resulting in two parallel spurs.

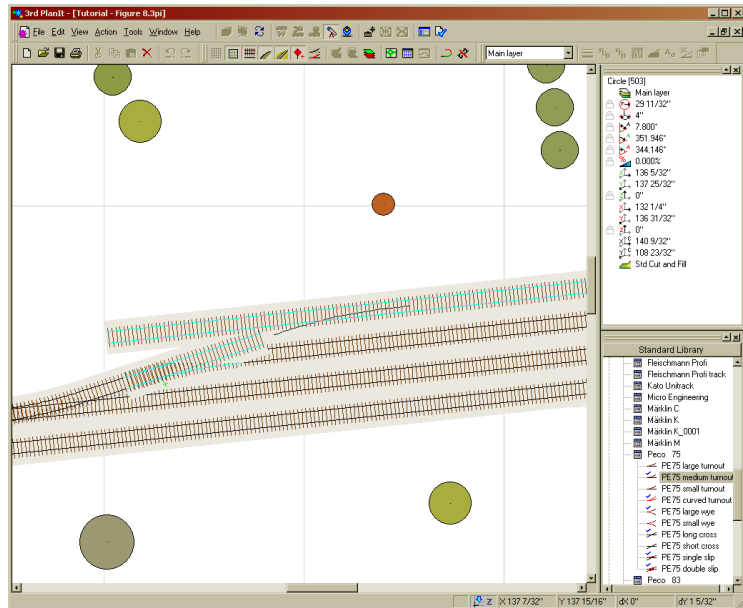
To position the second turnout required for this track arrangement, select the **Connect Turnout**  tool from the ToolKit. Click the diverging track of the first turnout near its end. Move the cursor until the first yard spur highlights, then click again. A turnout will be properly positioned, and all track lines will be added or trimmed if needed.

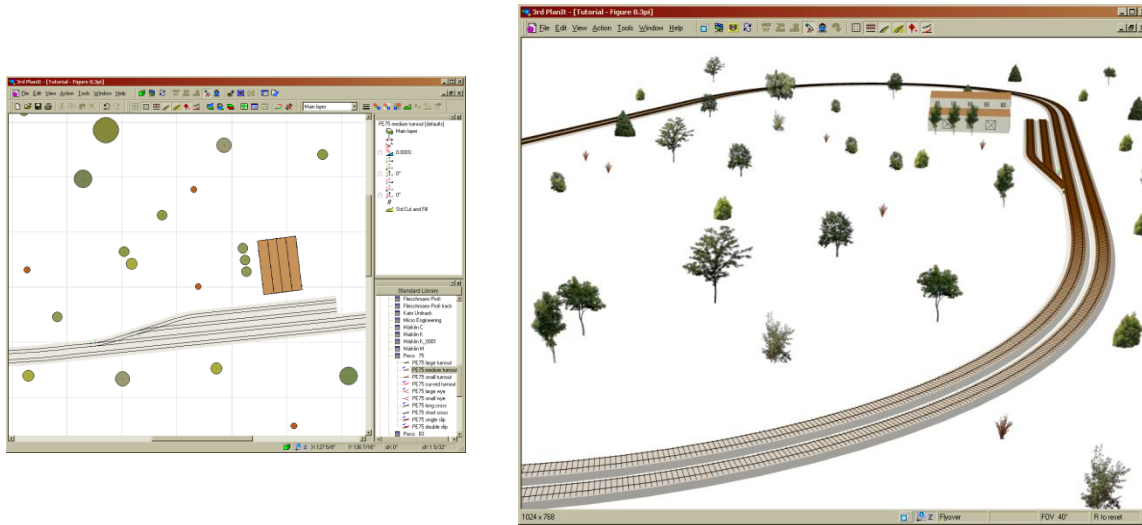
Next, use the Connect Tool with no easements  to connect the switch and the parallel track. Point to the exit of the turnout and click the left mouse button to begin the connection. Move the cursor to point to the line and verify the line is highlighted. **PRESS AND HOLD** the left mouse button, adjusting the curvature until the arc does not touch the turnout.



IMPORTANT NOTE: When connecting track to a group or a turnout, make sure the connection does not touch the group or overlap the group. There must be a gap between the connection and the group as shown at the right. 3rd PlanIt will properly fill the gap and trim it for you, resulting in a drawing that looks quite nice. Note the gap between the turnout and the arc as it is being drawn in the example to the right.

The zoom in 2D is independent of the view in 3D, so you can easily edit at any magnification and quickly return to the 3D view to see the results.

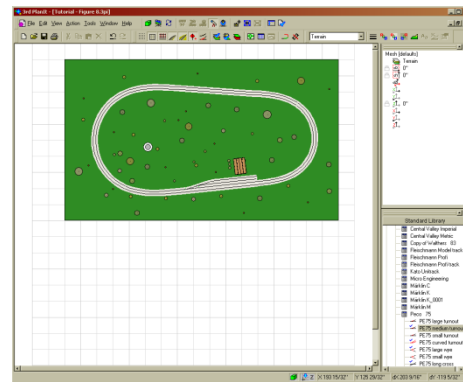




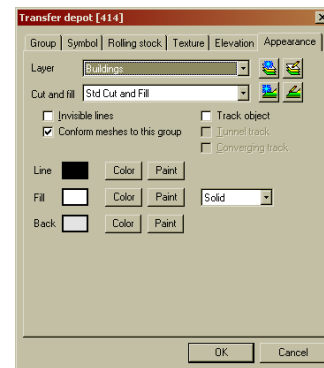
28.3.6 Adding Terrain to the Plan

Bring up the Layer Enable Dialog (**Ctrl+D**) and create a new Layer named Topography to hold the Terrain Mesh. Using the ToolKit **Draw / Draw Mesh / Rectangle** or, from the Menu Bar **Actions / Draw / Mesh / Rectangle**, surround the track with a Terrain Mesh.

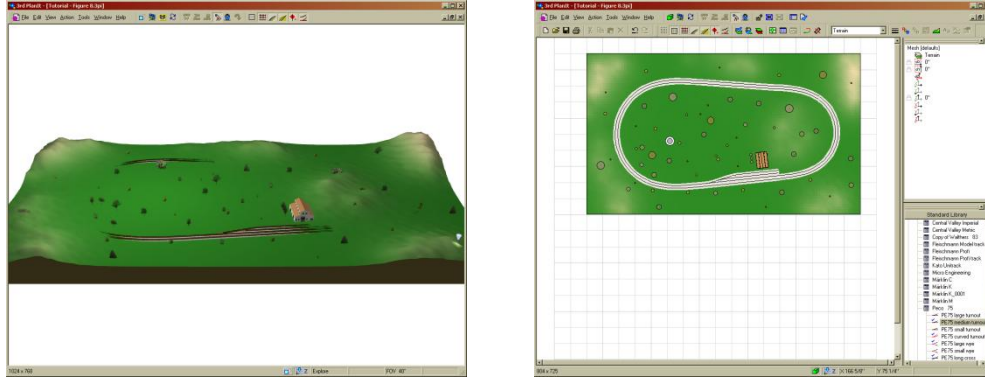
3rd PlanIt can automatically contour terrain around buildings, as well as track. Let's make sure terrain is contoured around the Transfer Depot. Bring up the Properties Sheet for the Transfer Depot in one of several ways: select it and use **Edit / Properties**, right-click it and choose **Properties**, or hold down the **Ctrl** key and double-click the left mouse button while pointing at the building.



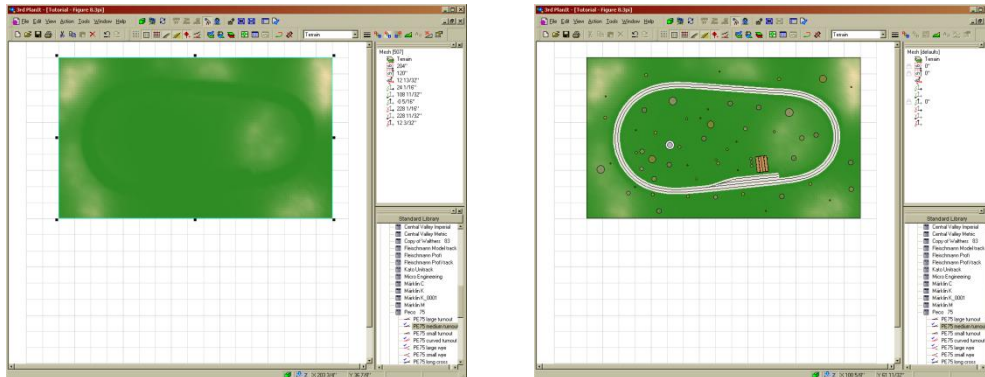
Choose the **Appearance** page and select **Conform meshes to this group**. This will cause any Mesh to conform its terrain using the selected **Cut and Fill Definition**. You can define several Cut and Fill entries in the **File / Settings / Cut and Fill** property page. We will use the standard Cut And Fill setting, so press **OK** to close the dialog box.



Double-click the edge of the Terrain Mesh to start the Terrain Editor. Add a few hills to the terrain as before. Don't worry when the trees and building get embedded in the terrain, since the Conform operation will fix this. When you are finished making the hills, hit **Tab** to return to 2D. You may be asked if you want to **Save this mesh as the Original Copy**. Since this mesh has not been conformed, select Yes to save the hills as they are drawn.

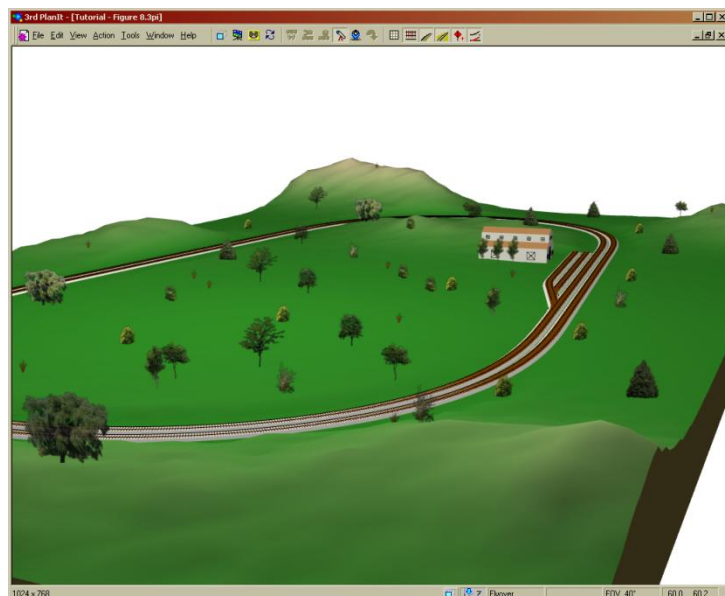


In 2D you can see the change in shading that represents the terrain height at different locations. Select the Terrain Mesh by pointing to its edge and clicking the left mouse button – the selected Mesh will cover all objects. Now choose **Edit / Mesh / Conform Mesh to Objects** from the Main Menu. The path for the track will be quite evident, as will the clearing for the building.



Now select **Edit / Mesh / Align Plants to Mesh**. This sets the base of every plant to the elevation of the terrain below it. As you can see, the track and trees are all visible now.


To continue developing this track plan, including a tunnel and textures, please turn to the **Terrain** chapter.

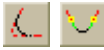


28.4 A Figure-8 Track Plan

Let's start a figure-8 track plan by drawing two circles. This is very representative of practical model railroad layout, as it is usually a good practice to start a track plan by placing the circles for the main line first.

28.4.1 Drawing the Main Line

Select the **Draw Circle** tool, drawing a circle from the center outward. Point to the  location you'd like to have as the center of one of the circles. Press the left mouse button and hold it as you move the mouse. The circle will grow larger and smaller as you change the radius from the established center point. Release the left mouse button when its size is similar to the illustration above. Repeat the same procedure for the second circle.

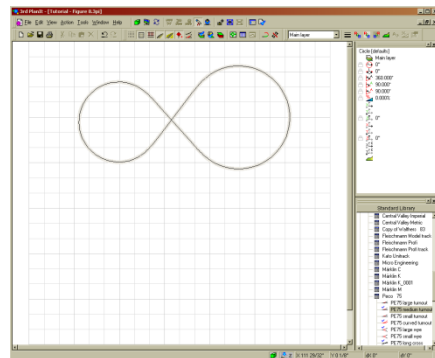
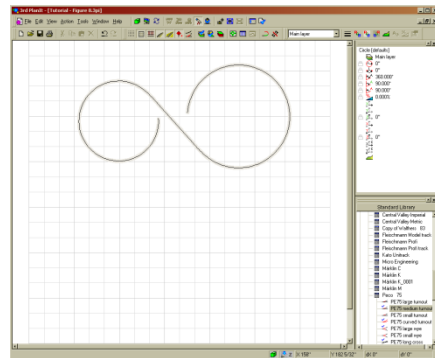
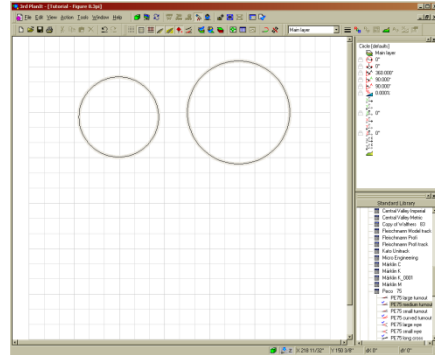
The circles are connected using the **Connect With Easements** tool used in the first exercise. 

This time, select one of the circles and start drawing the line to the other circle. As you move your mouse around the screen, a "guide line" is drawn from the first circle to your mouse. The guide line shows you approximately where the connection will take place.

Draw the guide line across the center of the space between the two circles. Place the pointer over the second circle on the side you'd like to be connected, causing the circle to highlight. Click the left mouse button to complete the connection. The connection is made, including spiral easements at each end of the curve (you can make connections without easements by choosing the **Connect Direct** tool).

To complete the figure-8, perform the same kind of connection starting with the other side of the first circle. Point at and highlight the first circle, click the left mouse button, point at the second circle, and click the left mouse button again. Your figure-8 main line is complete.

IMPORTANT: As in the first exercise, it is possible that the guide line will be on the "wrong side" of the first circle. If so, click the right mouse button *while holding the left mouse button down* to switch the line to the other side of the circle.



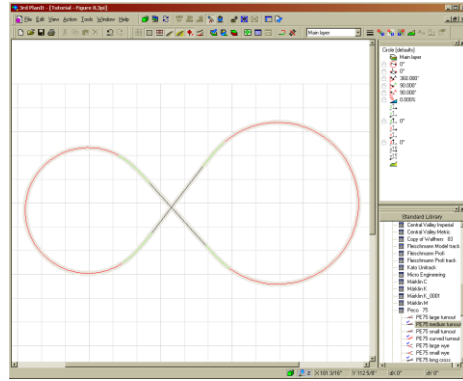
28.4.2 Setting Elevations and Grades

The figure-8 looks fine from above, but all the track is at the same elevation – zero. In the center, the tracks cross each other. To make this an over-and-under figure-8, it's necessary to define the elevation of the track so there's plenty of room for trains to go over and under at the crossing. As in the previous example, it is critical to know where objects begin and end. Here are two ways to see the individual nature of each object.

IMPORTANT HINT #1: You can mark the endpoint of each object using **File / Settings / 2D Display / Highlight End Points**.

IMPORTANT HINT #2: You can display each object type in a different color using **View / Display style / Type** or by entering **Alt+Y**. To return to Color-by-Layer mode, enter **Alt+L**.

It will be easiest to work on this design if the view is zoomed, so press **Alt+F3** to zoom in as tightly as possible. Note the ends of the various track objects. In this example, the options **File / Settings / 2D Display / Highlight End Points** and **Object Type Colors** were used for clarity in publication. In the illustration at the right, tick marks cross the track at the endpoint of each object.



Looking at the design, it seems practical to have the up- and down- grades occur through the easements and curves at both ends. Each line (tangent track) will be level, with one tangent track at zero elevation and the other at an elevation of five inches.

To set the elevation of several track objects, use the Path Tool to select the track. The Path Tool is used to select all track objects connected to each other between two end objects. Point to the lower right spiral easement, near the end that's touching the rightmost curve. Click the left mouse button, highlighting the spiral easement in magenta. Point to the top right spiral easement and click the left mouse button to complete the Path.

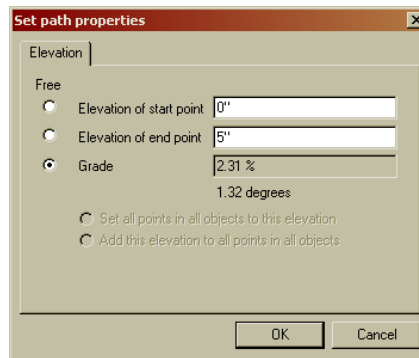
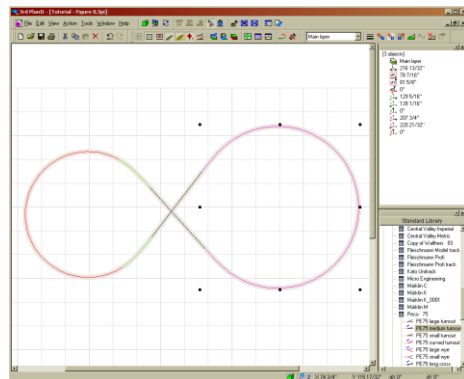


IMPORTANT: Watch the “shrinking circle” when you click the first object in a Path. It shrinks *at the junction of the first and second objects in the path*. If your path goes the wrong way around the figure eight, you’ll need to click at the other end of the first object.

You may now select the elevation using the Elevation Button or the **Action / Set Elevation and Grade** menu choice, or by right-clicking the path and selecting **Elevation**. Since we’ve paid no attention to sizes up till now, you may find that a 5-inch clearance at the crossing results in a very large or small percentage grade. That's fine for a tutorial, though!

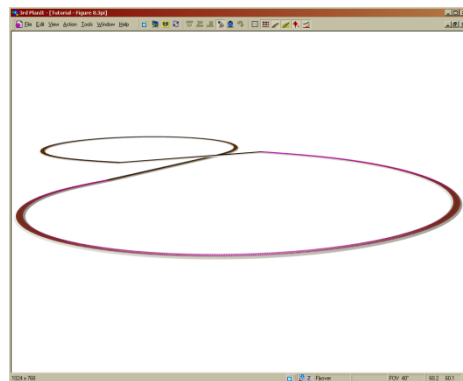


Here’s what happened on the tutorial drawing created for this manual:



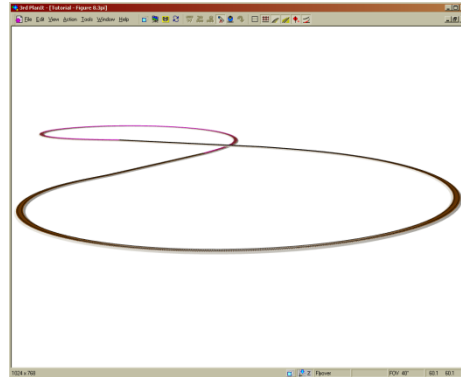
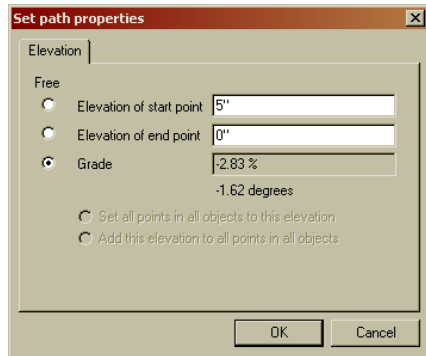
You can see the grade worked out to 2.31% (1.32 degrees) for a 5-inch clearance on this figure-8. Your results will be slightly different as your layout will be a different size.

Let’s take a quick peek at the drawing in 3D and see if the elevation change really took place. This view shows the track grade dropping sharply through the tangent track that crosses on top. The tangent track’s endpoint was automatically set to the same value as the last spiral easement as part of the connection process.



To set the elevation of the left curve, perform the same set of commands you used to set the elevation of the right track. This time, start the path with the lower left spiral easement, ending with the upper left spiral easement. Make sure you set the *start point* elevation to 5 inches, as your track is going downgrade as it moves along the Path from start to finish. A downgrade from start to finish will display as a negative value.

As shown below, the grade in this direction is -2.83% . The difference in grade results from the left circle's smaller radius. Switch to the 3D mode using **Tab**. Note that the track is now smooth in grade, climbing through the right circle and easements and descending through the left circle and easements.



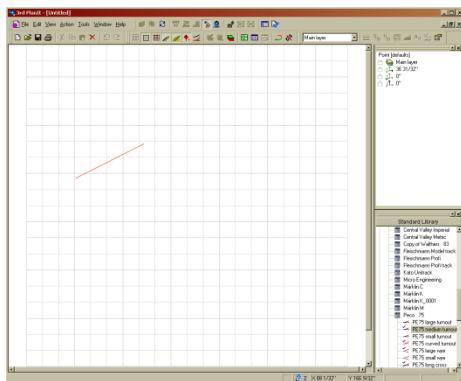
28.5 Drawing Track Point-to-Point with the Connect Tool

The Connect Tool offers a feature that lets you quickly lay out main and branch lines, using a single tool from start to finish. For this exercise, choose the **Connect with Easements** tool as shown at the right. Create a new drawing by pressing **Ctrl+N** or by choosing **File / New**.

Move the cursor around the screen to see the **Connect Cursor**. In its usual condition, it is shown as an arrow with a curve connecting two lines. The arrow indicates the cursor must be pointed at an object, such as a line, circle or curve.



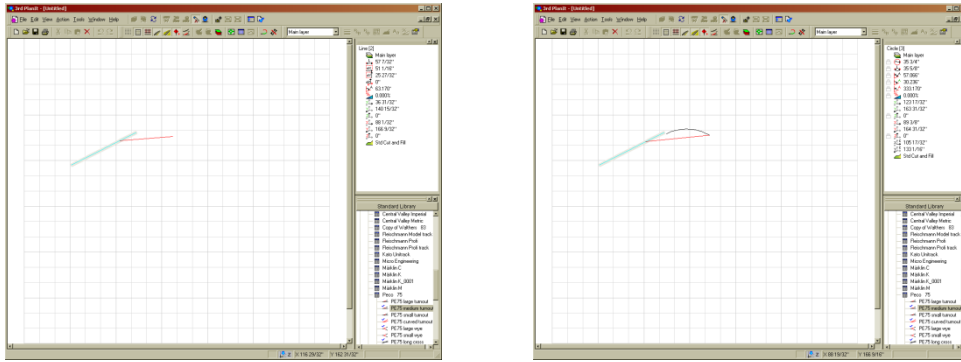
If you press the **Ctrl** key while moving the **Connect Cursor**, it will change to the **Connect to Point Cursor** shown here. This allows you to connect to any point in the drawing, from an existing object or even from a selected point.



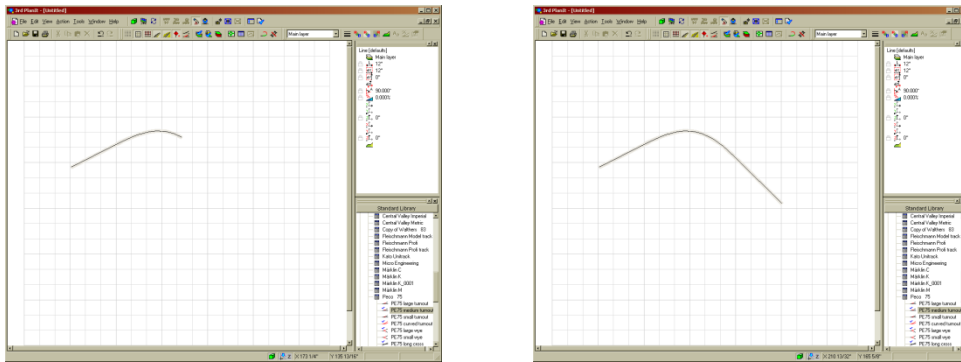
When you have selected the **Connect with Easements** mode, point to any location on the drawing, then press and hold the **Ctrl** key and click the Left Mouse Button.

Move the cursor to the right, and a red line will be drawn from the first point to the cursor. When you get the first segment of track drawn as you'd like it, hold the **Ctrl** key and click the left mouse button. This will complete a connection between two points, leaving a single piece of tangent track as a result. Now release the **Ctrl** key and point the arrow of the **Connect Cursor** to the right end of the first segment of track. Click the left mouse button to begin a connection – this time, between the existing line and another point on the drawing. When you connect between a line and a point, 3rd PlanIt uses a curve to make the connection.

After you've clicked on the first object, as you move the cursor you will see a Reference Line drawn in red. This indicates a point that the new track will pass through, and the object from where it will start.



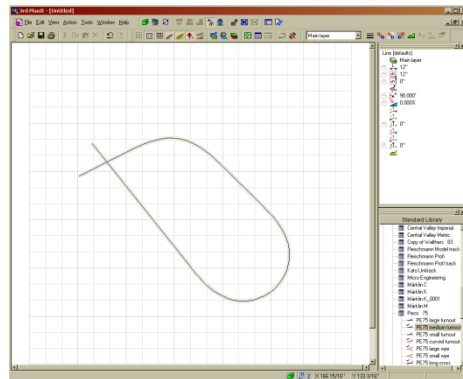
Once again, press the **Ctrl** key so you can connect to a selected point. Press and hold the left mouse button, then move the cursor to adjust the new curve. If the curve is smaller than the minimum radius for the layer, it will be drawn in red as a warning. When you release the left mouse button, the existing track will be trimmed to align to the new track, forming a smooth path.



With the **Ctrl** key released, point to the curve and click the left mouse button. This begins a connection from the curve, which can again be connected to a selected point. To place the track and complete the connection, press the **Ctrl** key and click the left mouse button.

You can continue this process, connecting from one object to a selected point, until you have a complex track built. Remember, when connecting from a curve to a selected point, you can click the right mouse button to change the direction of the tangent.

This method lets you very quickly build track plans that run through chosen locations, automatically including easements and producing smooth, flowing lines.



28.6 In Conclusion

These three exercises have acquainted you with many of the techniques used to design track plans with 3rd PlanIt. Its many tools let you design your layout in great detail, as described in the rest of this manual. The key to a good design is to try a lot of ideas. That is the value of 3rd PlanIt. Experiments with different main lines, branch lines, buildings and landscape will help you design a layout that is reliable and rewarding

29. Helpful Hints

This chapter is a compilation of hints from users that you may find useful as you design with 3rd PlanIt.

Use Color By Object Type (Alt+Y). This may be the most important hint for people who design with easements. It clearly identifies each end of easements, which is difficult to determine without **Alt+Y** because they flow smoothly into the adjacent objects.

Switch frequently between 2D and 3D view. If you are laying out a multi-level pike this is especially useful. The 3D view confirms that your drawing and your mental image are evolving together. It also forces you to resolve clearance problems early before changes become time-consuming.

Use the floating ToolKit. Set it to disappear when a command is selected and reappear on a right-click, the default settings. You will find this very quick and available when you need a tool.

Think stick shift and steering wheel. For ease of use, 3rd PlanIt groups the most frequently used hot-keys on the left side of the keyboard. You can keep your right hand on the mouse and your left hand on the keyboard most of the time.

Use lines to measure distances. You can use freehand lines to check the distance between two objects. Both the Position Data Bar and the Object Data Window display the line length while drawing. You can also draw a perpendicular line from a Circle or another line to check distance at a known 90 degree angle.

Watch the shrinking circles. This is especially important when using the Path Tool, as the shrinking circle shows the departure end of the first object. The object attached to the first object at the shrinking circle will become the second object in the path.

Use lots of layers. You can use an extra layer to hold dimensions for a room layer, and turn them off when not wanted. Parallel helixes may be placed in different layers to simplify editing. Electrical wiring and accessories can have a layer. There is no limit to the number of layers you can use.

Use groups to align several objects, such as in yards. Let's say you've designed a nice yard, but then want to rotate all of it 5 or 6 degrees after a change to another area. You can group the whole yard using the Select Tool, then align it to a new track or rotate it as a unit. Ungroup the yard when you're finished if you wish.

Use "Set As Favorites" in File / Settings. This allows you to set the default settings for all new documents you create.

What caused that loop-de-loop? This results from connecting two Circles with easements, when one of the two Circles is already connected with an easement. If you are using long easements, they can overlap, requiring a nearly complete Circle to connect them. See Chapter 4, "A Special Case – Connecting a Circle to a Random Point" for a technique to achieve the desired results.

Draw buildings and trees in Model Scale. Whenever you have prototype dimensions to work from, switch to Model Scale and enter prototype units.

Turn off landscape layers in 3D. Trees contain dozens or hundreds of lines, which each must be positioned and rendered in 3D. This can make rendering and rotation slow on even fast computers. Turn off landscape layers when your goal is viewing your track in 3D using real-time rotation. Turn the trees back on for esthetic evaluation from a few viewpoints.

Is your terrain “flashing”? As you move your mouse around, when you cross over the edge of a Terrain Mesh with highlighting turned on, the mesh will be redrawn. The objects associated with the mesh will also be redrawn when the mouse clears the edge of the mesh. This can slow down drawing and get annoying. To stop it, **Freeze** the layer holding the mesh. You’ll still see it, but it won’t flash any more.

Edit using track centerlines rather than rail-and-ties. If you are doing detailed work at higher magnifications, it can be tough to locate the track centerline when rail-and-ties mode is selected. You might try **Highlight End Points**, or switch to centerline display to make editing most comfortable.

CAD likes a powerful computer. For best performance, have lots of memory and a high-end video card. Over the years, video boards from NVIDIA have proven themselves best for 3rd PlanIt and other CAD programs. Large drawings also benefit from Solid State Drives with their fast access times.

Exchange 3rd PlanIt drawings with friends. Anyone is free to load the 3rd PlanIt demo from the El Dorado Software web site, <http://www.TrackPlanning.com>. E-mail a copy of your track plan to a friend and have them download the demo to see it. They can print it, Zoom in on areas, view it with you on the phone, and even edit it to some degree with the demo package. Or post your drawing on a web page... feel free to provide the above link as a service to those who might load your track plan.

Borrow a plotter with continuous-feed paper. You can temporarily install 3rd PlanIt as a demo package on a computer that has a plotter. This way, you can get very long, wide 1:1 printouts to guide construction.

Use 3rd PlanIt for many applications. 3rd PlanIt is a great general-purpose CAD package, useful for yard and landscape planning, home improvements and additions, electronic schematics, flowcharts, organization charts, and many other drawings. Make the most of your software investment!

30. Selected Hot Keys

Colors

Layer determines object color	Alt+L
Monochrome	Alt+M
Native object colors	Alt+N
Questionable Track Display	Alt+Q
Rail colors	Alt+R
Type of object determines color	Alt+Y

Display

3D view or 2D view	Tab
3D Origin and Camera on/off	Alt+C
Armstrong squares on/off	Ctrl+Q
Snap on/off	Ctrl+G
Grid lines on/off	Alt+G
Model Scale on/off	Ctrl+M
Native line widths on/off	Ctrl+W
Refresh screen image	F7
Track details on/off	Ctrl+K

File

New file	Ctrl+N
Open file	Ctrl+O
Print	Ctrl+P
Save file	Ctrl+S
Settings	Alt+S

Object manipulation

Add object to Library	Ctrl+Shift+L
Convert object to lines	Ctrl+L
Copy to clipboard	Ctrl+C
Cut to clipboard	Ctrl+X
Flip right/left	Shift+F11
Flip top/bottom	F11
Elevation and grade	Ctrl+E
Group objects into single object	F9
Ungroup objects	Shift+F9
Move object to back	F6
Move object to front	Shift+F6
Paste from clipboard	Ctrl+V
Paste into same position	Ctrl+Shift+V
Paste into selected group	Ctrl+Alt+V
Resize by factor	Ctrl+R
Select all objects	Ctrl+A

Polygons, Polylines and Contour Lines

Change polygon front surface	Alt+Shift+C
Contour line profile adjustment	Ctrl+H
Interpolate vertices	Alt+Shift+I
Make object into 3D Solid	Alt+3
Randomize contour line height	Alt+Shift+H

Rotate, Tile and Roll

Roll selection, prompt for angle	Shift+G
Roll selection, use last angle	G
Rotate, prompt for angle	Shift+R
Rotate using last value	R
Tilt selection, prompt for angle	Shift+T
Tilt selection, use last angle	T
Tilt down	Ctrl+I
Tilt up	Ctrl+U

Slicing Object

Slice at end of another object	Shift+F5
Slice at intersection of an object	F5
Slice into segments	Ctrl+F5
Slice where selected	Alt+F5

Tools

Double-click of left mouse button	Space
Right-click while left button down	Space
Draw Freehand Line	L
Draw Perpendicular Line	Q
Draw Tangent Line	D
Draw Freehand Circle	O
Draw Freehand Point	P
Draw Text	A
Connect	C
Connect with Easements	E
Path	U
Crooked path	W
Options	Alt+O

Undo

Undo	Ctrl+Z
Redo after Undo	Ctrl+Y

View

Center 3D Origin in view	Alt+F12
Center Camera in view	Alt+F11
Center 3D Origin on selection	Shift+C
Center view on 3D Origin	Shift+F12
Center view on cursor	V
Center view on selection	F12

Windows

Document Map on/off	Alt+D
Layer enable dialog	Ctrl+D
Library Bar on/off	Ctrl+Alt+I
Object Data Window on/off	Ctrl+Alt+O
Object List on/off	F8
Profile view on/off	Shift+F8
Reference Point List on/off	Ctrl+Alt+R
Snapshot List on/off	Ctrl+Alt+N

Zoom

Fill window with grid	Shift+F3
Half of current magnification	Alt+F2
Previous zoom setting	F3
Return from previous zoom setting	F4
Set current view as favorite	Ctrl+Shift+F4
Set to favorite view	Shift+F4
Show all objects	Alt+F3
Zoom in using rubber-band box	F2
Zoom Forward	F
Zoom Back	B




























31. Cursors

Following is a description of the function for each cursor in 3rd PlanIt.

	Standard Cursor	Normal cursor.
	Alignment Cursor	Auto alignment is enabled.
	Copy Cursor	Copy mode is enabled.
	Slice Cursor	Slice mode: click object to be sliced.
	Parallel Cursor	Parallel mode is selected for drag and drop.
	Path Cursor	Select a path through objects whose endpoints align precisely.
	Crooked Path	Through objects whose endpoints touch at any angle.
	Circle Attach Cursor	Start drawing circle from nearest endpoint of selected object.
	Line Attach Cursor	Start drawing line from nearest endpoint of selected object.
	Multi-line Attach	Start drawing multi-line object from nearest endpoint of selected object.
	Perpendicular line Attach	Start drawing perpendicular line from nearest endpoint of selected object.
	Rectangle Attach	Start drawing rectangle from nearest endpoint of selected object.
	Tangent Attach	Start drawing tangent from nearest endpoint of selected object.
	Z-Line Attach	Start drawing vertical line from nearest endpoint of selected object.
	Point Attach	Draw point at nearest endpoint of selected object.
	Point Attach Center	Draw point at the center of selected circle.
	Connect Tool	Form a connection between two objects.
	Connect endpoints	Connect two endpoints.

	Connect Crossover	Connect turnout routing exit to parallel line, inserting new turnout
	Connect Turnout	Connect two tangent tracks with a turnout and optional connecting curve and easement
	Draw Circle	Circle drawing mode.
	Draw Line	Line drawing mode.
	Draw Multi-line	Multiple line drawing mode.
	Draw Perpendicular	Perpendicular line drawing mode.
	Draw Rectangle	Rectangle drawing mode.
	Draw Tangent	Tangent line drawing mode.
	Draw Vertical Line	Z-axis (vertical) line drawing mode.
	Draw Point	Point drawing mode.
	Draw Point Center	Place point at center of selected object
	Draw Text	Text mode.
	Zoom Tool	Magnify to fill screen the area of drawing selected by tool










32. Icons in the Object Data Window

	Length of a line or path
	Length of a circle, helix or arc
	Radius of a circle, helix or spiral
	Azimuth of a line or spiral in degrees
	Overall angle of an arc, circle or helix in degrees (note black letter)
	Start angle of an arc circle or helix in degrees (note green letter, drawn counterclockwise)
	Start angle of an arc circle or helix in degrees (note red letter, drawn counterclockwise)
	Grade of an object or path in degrees
	Number of turns in a helix
	Railhead-to-railhead clearance in a helix
	Radius of spiral at its least curved end
	Radius of spiral at its most curved end
	Spiral offset; distance between arc of curve and tangent
	Delta X, the distance between two ends in the X-axis
	Delta Y, the distance between two ends in the Y-axis
	Delta Z, the distance between two ends in the Z-axis
	X coordinate of object start point (note green letter)
	Y coordinate of object start point (note green letter)
	Z coordinate of object start point (note green letter)
	X coordinate of object end point (note red letter)
	Y coordinate of object end point (note red letter)
	Z coordinate of object end point (note red letter)
	X coordinate of object center point (note black letter)
	Y coordinate of object center point (note black letter)
	Z coordinate of object center point (note black letter)
	Cut and Fill of object
	Part number






33. Icons in the ToolKit

+ Draw an object






/ **Draw a line**

-  Freehand between any two points
-  Several lines in succession
-  Rectangle made of lines
-  Vertical line
-  Perpendicular to another object
-  Tangent to another object
-  Projecting line
-  Transition curve and projecting line
-  Coupler






○ **Draw a circle**

-  From the center outward
-  From outside toward the center
-  Tangent to another object
-  Projecting curve
-  Transition and projecting curve


□ **Draw a point**










-  At cursor location
-  At center of object
-  Reference Point at cursor
-  Light at cursor
-  ViewPoint at cursor

▲ **Draw text**




-  Draw bounding box then fill with text
-  Elevation Marker
-  Coordinate Marker
-  Radius Marker
-  Grade Marker


+ Draw an object, continued
















 **Draw a turnout**

- | | | |
|--|---|---|
|  Straight |  Snap |  Wye |
|  Curved |  Offset curved |  Three-way |
|  Crossing |  Single slip |  Double-slip |














 **Draw a helix**


-  From the center outward
-  From outside toward the center
-  Tangent to another object

 **Draw a polygon**





- | | | |
|--|--|--|
|  Triangle |  Rectangle |  Pentagon |
|  Star |  Hexagon |  6-sided star |
|  Octagon |  8-sided star |  Sphere |
|  Terrain sheet |  N-sided circle polygon |  Set sides in N |
|  Freehand polygon |  Polyline |  Contour line |


 **Draw landscape object**

- | | | |
|---|--|--|
|  Oak |  Birch |  Pittosporum |
|  Weed |  Pine |  Willow |
|  Bamboo |  Gingko |  Cherry |
|  Juniper |  Honey locust |  Dogwood |
|  Redwood | | |

 **Place an image from an external file**









 **Draw a mesh**

- | | | |
|---|--|--|
|  Rectangular |  Elliptical |  Freehand |
|  Set mesh defaults | | |













 **Draw a tunnel opening**

- | | |
|--|---|
|  Point to point |  Perpendicular to object |
|--|---|









**Selection tools**

-  Select one or more objects; shift-click or rubber-band for multiple objects
-  Copy objects when moving
-  Make a parallel copy of the object or objects; right click during move for distance
-  Align object to another during move
-  Eyedropper; sample color from a single pixel
-  Paintbucket; deposits sampled color onto object lines
-  Paintbucket fill; deposits sampled color onto object front faces
-  Paintbucket back; deposits sampled color onto object back faces

**Connect two objects**

-  Connect directly with no easements
-  Connect with easements
-  Connect using fixed radius with no easements
-  Connect using fixed radius with easements
-  Set the fixed radius for future connections
-  Find a Path between two objects; requires alignment between each object
-  Find a Path between two objects; allow angles in Path
-  Connect the endpoints of two objects
-  Connect two tangent tracks with a turnout
-  Make a crossover between two tracks and an existing turnout
-  Connect two contour lines or polygons vertex-to-vertex
-  Connect two contour lines or polygons using triangular patches in Contour Sheet

**Zoom controls**

-  Zoom in; rubber-band desired area to increase magnification
-  Reduce magnification factor to half its present value
-  Set Favorite settings to current magnification and position
-  Zoom to Favorite magnification and position
-  Change back to previous zoom magnification and position
-  Return to next zoom magnification and position; used after changing to previous
-  Set magnification so Grid fills the available view
-  Set magnification so all objects in drawing can be seen

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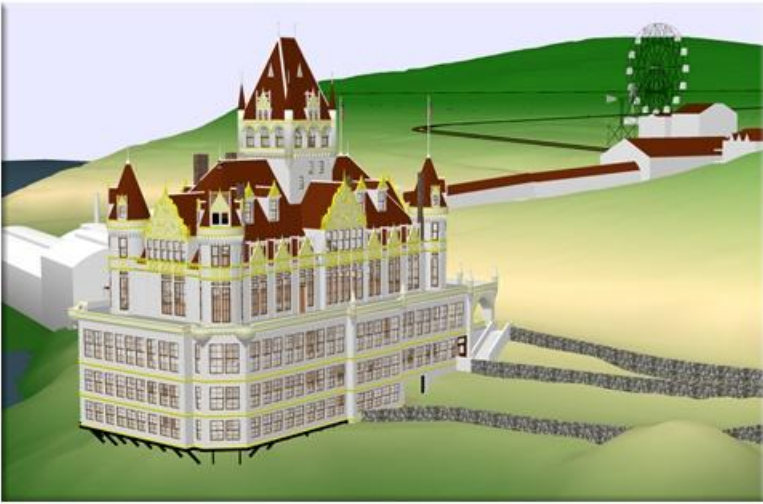
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3rd Planttm

