World Editor 1.0

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USER'S GUIDE

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INTRODUCTION

Welcome to World Editor, the scenery creation and editing tool for the X-Plane Flight Simulator. World Editor is a radical departure from the previous X-Plane scenery editor, World-Maker. With a major shift in the structure of X-Plane scenery from Version 7 to Version 8, A new tool was necessary to create and edit scenery in a graphical manner comfortable for average users. At the moment, World Editor's capabilities are limited to editing airports only and all those entities contained in the apt.dat 8.50 specification (see reference section). World Editor is currently NOT used for placing objects or editing terrain or terrain textures like ortho photos or photo based scenery. These features will be added at some time in the future.

CHAPTER 1: Overview & Concepts

World Editor was designed to take a graphical CAD-like approach to creating airports. Airports are made up of a collection of entities. Each entity is of a specific type, i.e. runway, taxiway, taxi sign, windsock, etc and each entity has a set of attributes. A runway has length, width, surface type, lighting and a taxisign has text and a direction it faces, etc. The toolset of World Editor (called WED from now on) is organized to create and edit each of these entites on an individual basis. For instance, when you add an entity, you then can edit it's attributes and move onto the next entity, or in the case of editing existing entities, you select an entity and then edit it's attributes. Most of these operations are done in an intuitive "drawing" type of methodology. The graphics in the map view will update accordingly as entities are created and edited. Eventually, all your entities together will make up an airport.

WED file vs. apt.dat

X-Plane draws airports by reading a special file called 'apt.dat'. In the past, World-Maker was the tool used for creating airports and editing the apt.dat file directly. WED does NOT use apt.dat files in any way other than importing and exporting them. WED uses a dedicated text file with the extension *.wed to hold all the information about scenery during the editing process. This file is generically referred to as the 'WED' file. When existing airport data files (apt.dat) either Version 7 or 8, are imported into WED, that information is translated into the *.wed file for WED to use. Now since X-Plane only reads the airport data file called 'apt.dat', WED will export to the apt.dat format. The data format for airports changed considerably with the introduction of X-Plane 8.50 and WED will only export apt.dat files in the 8.50 or greater format. Apt.dat files before version 8.50 can be imported into WED for editing, they'll just be converted to the latest format during export.

TIP:
The apt.dat file used by X-plane is a very large file over 15MBs and contains all the airports that x-plane uses...many thousands of them. If you want to import only one airport into WED for editing, then create a new, empty text file and then copy and paste ONLY the data for that airport you want to edit. Name this new file apt.dat also and then you can import this much smaller apt.dat file into WED for editing.

CHAPTER 2.   USER INTERFACE

Figure 1. below shows the interface of WED. The total interface is comprised of 3 primary panes, a option bar, a toolbar and the menu commands. Each pane is resizable by grabbing the bar separating the windows and dragging them. The MAP PANE is the primary pane and is where a good majority of graphical editing takes place.   The HIERARCHY pane contains a running list of all objects in the WED file, be it runways, taxiways, helipads, taxisigns, or anything else the airport data format supports. The ATTRIBUTES PANE is where the attributes of selected objects are displayed and edited.
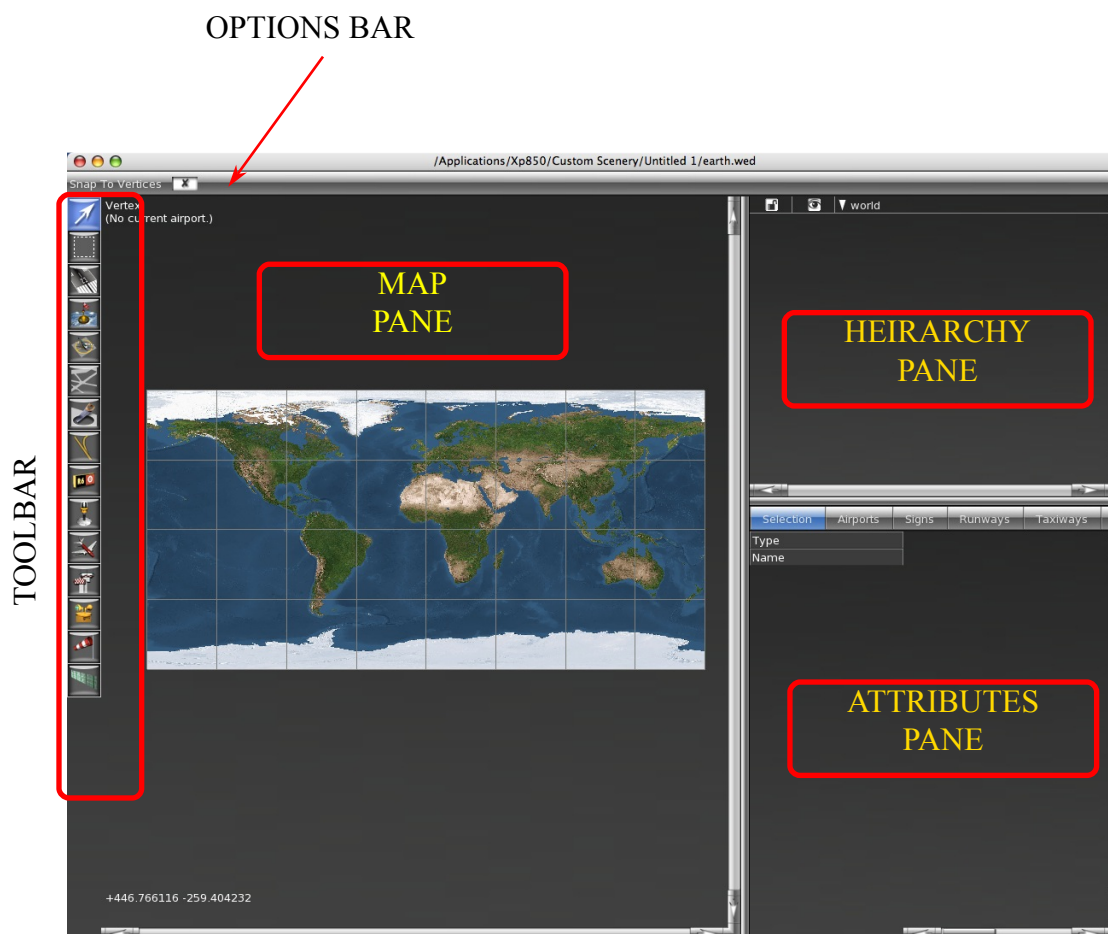
OPTIONS BAR

TOOLBAR

MAP
PANE

HEIRARCHY
PANE

ATTRIBUTES
PANE

Figure 1. World Editor User Interface

MENU SUMMARY

## FILE MENU
. New Package - Creates a new Folder and *.wed file in the custom scenery folder.
. Open Package - Opens an existing *.wed file inside the custom scenery folder.
. Change X-System Folder - Used to select your x-plane root folder.
. Close - Closes the *.wed file
. Save - Saves the *.wed file
. Revert to Saved - Reverts back to the last saved state of the wed file.
. Validate - Checks the WED file for
. Import apt.dat - Imports any version of apt.dat file
. Export apt.dat - Exports data in *.wed file to apt.dat 8.50 format
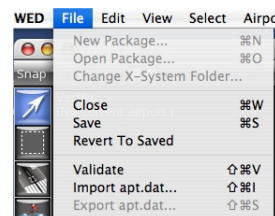
## EDIT MENU
. Undo - Undoes last action. NOTE: Some actions cannot be undone.
. Redo - Opposite of "undo"
. Cut - Deletes selected items. Used for text
. Copy - Copies selected items to memory. Used for text
. Paste - Pastes text from the clipboard.
. Clear - Clears an item from the heirarchy. 'Think CUT'
. Duplicate - Duplicates entities in the heirarchy. 'Think CUT and PASTE'
. Group - Groups entities together for moving / rotating, etc.
. Ungroup - Ungroups entities.
. Split - Splits a segment (Adds a bezier point between two selected bezier points)
. Reverse - Reverses the direction of a curve or shape.
. Crop Unselected - Deletes anything that is not selected.
. Move First - Moves selected item to the "top" of the heirarchy
. Move UP - Moves selected item "UP" one level in the heirarchy
. Move Down - Moves selected item "DOWN" one level in the heirarchy
. Move Last - Moves selected item to the "bottom" of the heirarchy
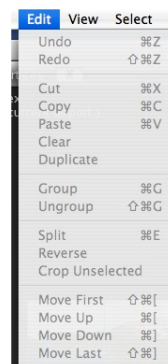
VIEW MENU

. Zoom World - Zooms the graphic window to encompass the whole world
. Zoom Package - Zooms the graphic window to encompass all "entites" in the *.wed file..or "package"
. Zoom Selected - Zooms the graphic window to encompass the selected item
. Feet - Sets the units to be in feet.
. Meters - Sets the units to be in meters.
. Show Line Markings - Toggles the actual markings of a linear feature on/off as opposed to only showing a line
. Pavement Transparency - Sets the transparency of the pavement so you can see the boundaries of overlapping entities
. Pick Overlay Image - Allows you to select a bitmap file to be used as an overlay
. Toggle World Map - Toggles the World Map bitmap on/off
. Toggle TerraServer - Toggles the terraserver image on/off. Images are downloaded automatically with this on.
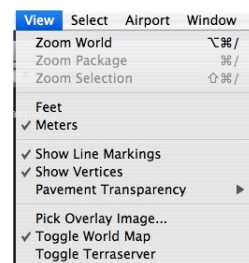
SELECT MENU

. Select All - Selects all entites in the *.wed file
. Select None - Deselects all selected objects
. Select Parent - Selects an objects "parent" based on the heirarchy menu (one level up)
. Select Children - Selects an object's "children" based on the heirarchy in the object window (one level down)
. Select Polygon - Selects the parent polygon of a selected verticie.
. Select Verticies - Selects individual verticies of a selected parent polygon.
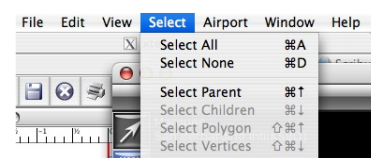
AIRPORT MENU

. Create Airport - Creates a new airport in which to add object to
. Create ATC Frequency - Creates the primary frequency for an airport
. Edit Airport - Used to set the "Current Airport" to be edited.
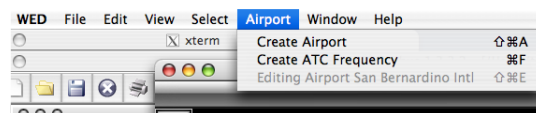
WINDOW MENU

. Minimize - C'Mon now
. Zoom - C'Mon Now
. Cycle Through Windows - C'Mon Now
. Bring All to Front - C'Mon Now

HELP MENU

. X-Plane Scenery Homepage - You should be slapped if you don't know this
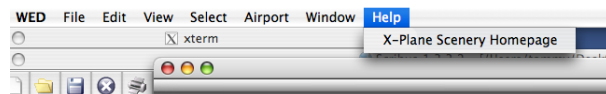
TOOL SUMMARY

VERTICIE TOOL - Used to select and manipulate vertices or any type of "point".

MARQUEE TOOL - Used to drag a rectangle to select an entity OR click on an entity to select it. Result is a bounding box

RUNWAY TOOL - Used to graphically add runways, blastpads and displaced thresholds

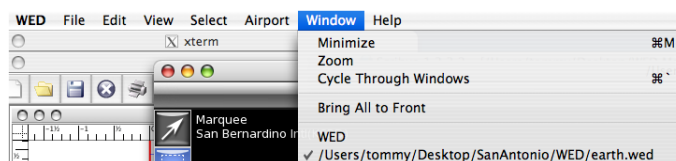SEALANES TOOL - Used to graphically create sealanes with buoys

HELIPAD TOOL - Used to graphically create Helipads

TAXIWAYS TOOL - Used to graphically create/edit taxiways via closed Bezier Paths

HOLE TOOL - Used to create/edit "holes" in bezier taxiways

TAXLINE TOOL - Used to graphically create / edit taxline paths

TAXISIGN TOOL - Used to graphically place/edit taxisigns

LIGHT FIXTURE TOOL - Used to place light fixures such as PAPI/VASI or wig-wags

RAMP START TOOL - Used to locate/place starting points for aircraft

TOWER VIEWPOINT TOOL - Used to locate / place Control Tower "viewpoints"

AIRPORT BEACON TOOL - Used to locate/place Rotating Airport Beacons

WINDSOCK TOOL - Used to graphically add windsock locations

BOUNDARY TOOL - Used to graphically add "fencing" via bezier polygon

3. EDITING AIRPORTS

When you launch WED for the first time, you'll see the splash screen shown in Figure 2 at right; however, there will be no custom scenery packages listed. You must select "choose x-system folder" and navigate to your root level x-plane folder. WED will then look in your custom scenery folder and list all the custom scenery packages that you have available. This is a one-time step unless you move your x-plane folder, in which case you'll have to relocate it.

With the root folder located, You'll now have the option to either select and open an existing scenery package or create a new one. If you opt to select an existing scenery

Figure 2. Opening Splash Screen

package and open it, WED will create a new, empty *.wed file inside that scenery package and open it for editing. If you opt to create a new scenery package, then you will assign a name to the scenery package and WED will create that custom scenery folder for you and then add it to the list of scenery packages. You then select that new package and select "open scenery package" at which point WED creates a new, empty *.wed file and opens it for editing. Remeber that for now, WED only edits airport data, so even though you have a new wed file in your custom scenery folder, there won't be anything in it until you create something or import something. (More on that later).
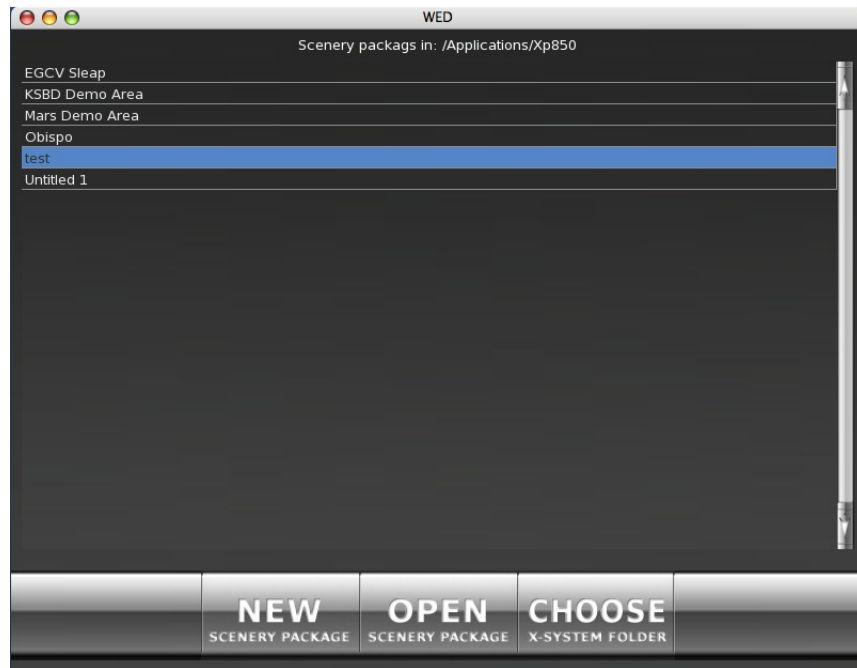
CREATING AIRPORTS & CURRENT AIRPORT CONCEPT

Whenever WED creates a scenery package for the first time, there will be no airports in the *.wed file. You can confirm this by looking in the hierarchy pane and seeing no entities in this list (See Figure 1. as an example). As such, none of the entity creation tools will work until an airport is created as WED must associate every newly created entity with an airport. Airports are created in WED by two methods. 1.) Creating a new airport from scratch using the "Create Airport" menu command or 2.) Importing an existing apt.dat file. Keep in mind that an apt.dat file can also contain multiple airports, so that if you import such a file, multiple airports will be created in the *.wed file. WARNING: If you attempt to import X-Planes default apt.dat file, you will be attempting to import thousands and thousands of airports, which will probably end in a "force quit" situation. Once an airport exists in WED, the airport tools can be used.

An important concept in WED is that of the "current airport". The current airport is clearly listed in the upper left corner of the map pane (see figure 3). If there are no airports, this will say "no current airport". Any new entities created will be added to this current airport, so if you import multiple airports into the *.wed file for editing, you want to ensure that the airport you're adding new entities to is the current airport. It is possible to be drawing a taxiway or runway on what appears to be one airport, but actually have that taxiway or runway be associated with another airport.

IMPORTANT: It is the hierarchy; however, (see below), that ultimately establishes what entity belongs to what airport...so if you happen to create an entity in the wrong airport, you can drag that entity to the proper airport in the hierarchy window.

If you're creating an airport from scratch, the act of executing the "Create Airport" menu command will cause that newly created airport to become the current airport. It will be called "unnamed entity" and you should select it in the hierarchy window and rename it. When you import an existing apt.dat file into an empty *.wed file, it will automatically be set as the current airport. If you import an apt.dat file with multiple airports in it, the first airport in the apt.dat file will be the current airport.   To set an airport to be the current airport, you select the airport in the hierarchy window and execute the menu command "edit airport"

(CTRL+SHIFT+E). The name of the airport will then appear in the upper lefthand corner of the map pane. As a short cut, you can also click on the "airport" tab of the attributes pane to quickly display all the airports in the file. These tabs are essentially quick filters.

HIERARCHY

The hierarchy pane contains a comprehensive list of every entity within the *.wed file and every entity belongs to a given airport. In figure 3. below, note that the only airport in the wed file is "San Antonio Intl". All the entities listed underneath this belong to San Antonio Intl. All entities can be renamed by clicking on the name in the hierarchy window. Regarding the order of items in the hierarchy, WED will always export in a specific type order at a minimum to keep things working right, i.e. the runway type will be exported first, ATC frequency type last, etc; however, within each type, the order things are listed in the hierarchy will be the order of the export. For example, within the runway type, if you have multiple runways, you can set the order of the runways such that one runway will be on top of another. This also pays dividends when you need for one taxiway to be on top of another. You can grab an item in the hierarchy window and drag it to a new position or you can select an item in the map window and execute the menu commands to move entities up or down. When you use the menu commands to move items up/down, this will be reflected in the hierarchy pane. The easiest method though is to drag items in the hierarchy window. You can also drag an entity from one airport to another in the hierarchy window...which is very helpful if you accidentally create an entity at the wrong airport. You may select any entity by clicking on it's name in the heirarcy window.
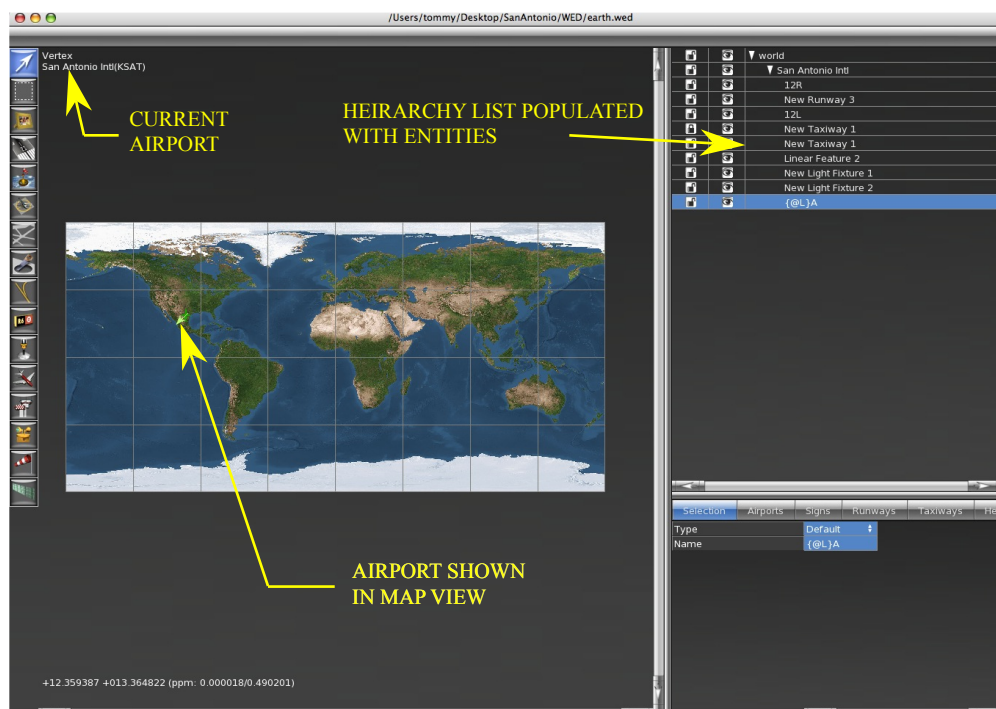

Figure 3. WED after importing existing apt.dat file

USING TERRASERVER (U.S.A. Only)

Using Terraserver images for reference couldn't be easier. Just execute the menu command " Toggle Terraserver" and the images will be automatically downloaded and displayed in the background a la Google Earth. You need to be reasonably zoomed in to display the images, so don't zoom out to encompass the whole USA and expect to see the terraserver images. As you zoom in though, they'll load and display automatically. If you have a slow internet connection or stone age computer, you'll have to be patient.
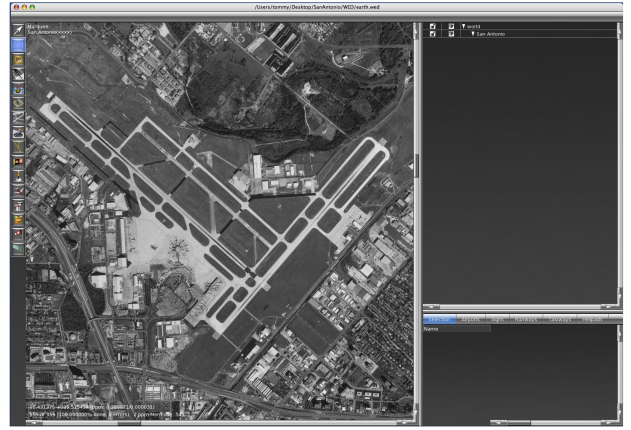

Figure 4. TerraServer Underlay

OVERLAY IMAGES

Overlay images are images you can import into WED and then trace over them. Acceptable image formats are TIFF, JPG, PNG and DDS. A typical overlay image might be an image from Google Earth, a diagram or aerial photograph. The key to successfully using an overlay image is to possess an image of sufficient resolution and secondly, to accurately identify the equivalent latitude and longitudes of the corners of your reference image. In the figure below is shown an image captured from google earth. The four corners of the image (highlighted in red) each have a latitude and longitude value for that corner as shown. It is up to you to determine these coordinates. For purposes of this example, the coordinates for each of these points were estimated from the image and are given below.

P1 = 30.0100N, -95.3635W
P2 = 30.0100N, -95.3269W
P3 = 30.0002N, -95.3269W
P4 = 30.0002N, -95.3635W
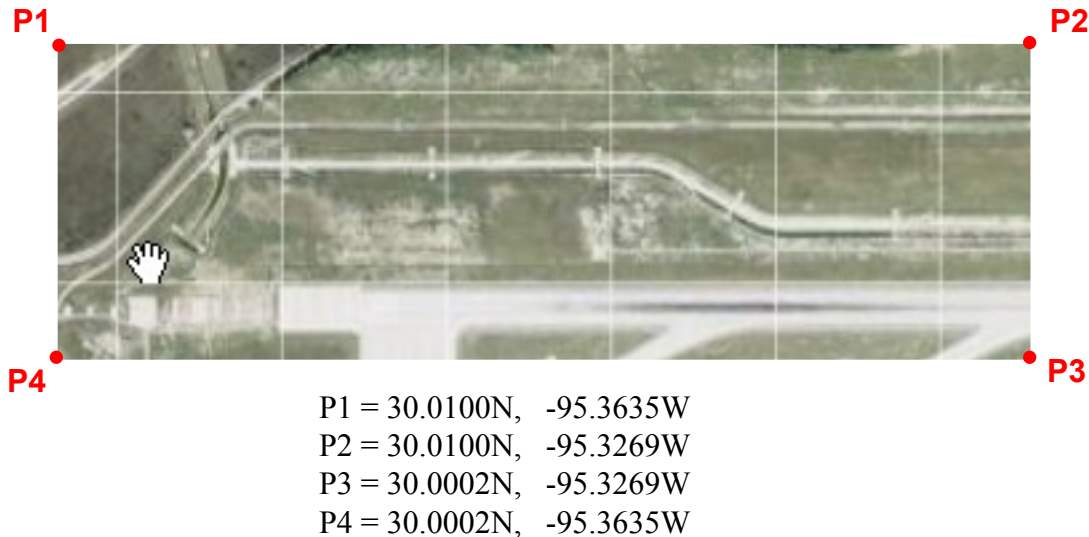
Once we have these coordinates, we can import the image into WED using the menu command "Pick Overlay Image", which is found under the view menu. When you import the image, it will be scaled to fit into the map view. You may scale the image graphically by selecting a corner and dragging the image or if you hold the SHIFT key will dragging a corner (with the vertex tool), the image will scale proportionately. A better method of sizing the image properly is to select one corner of the image using the vertex tool (see Tool section further in the manual) and then you can enter the latitude / longitude coordinates of that corner manually in the attributes pane. As you enter the infromation for each corner, that corner will move, distorting the image accodingly until all four points are properly located. Figure XX on the following page shows the results of manually entering the coordinates given above. In this example, the terraserver imagery is turned on, but this is not necessary to use the overlay image feature.

IMPORTANT: After importing your image, it will be found in the heirarchy pane near the very top of the heirarchy. This means that anything you draw when tracing the image will be UNDER the image and unable to be viewed. You must drag the image to the bottom of the heirarchy in the heirarchy pane OR selecting the image and using the "Move Last" command, found under the EDIT menu item.

4. WED TOOLS

SELECTION TOOLS

1.) SELECTION TOOLS

When working with WED, you will be doing lots of selecting. There are two tools used for selecting entites. The "Vertex Tool" and the "Marquee" Tool. Both of these tools can select entities by two means. 1.) By single-clicking on an entity and 2.) By click-dragging a rectangle around an entity. Selecting things with the marquee tool will result in a bounding box onscreen which can then be manipulated, that is scaled, moved and rotated using modifer keys in combination with cursor movements. Try holding down the option key with some items selected with the marquee tool. (more to follow). Selecting things with the vertex tool will allow you to edit entities on a point level, that is you can move vertices and bezier handles, or maybe one end of a runway.   There is some overlap in these tools depending on what you are selecting and what you want to do. For instance, you can use the vertex tool to select one end of a runway and move it...but you may also select that same end of a runway using the marquee tool. In a similar manner, you can select a single vertex of a taxiway with the marquee tool and move it, but not edit it's shape via bezier handles...for that, you'd use the vertex tool.   A good rule of thumb is that you use the marquee tool to move, rotate and scale selected items, and you use the vertex tool to manipulate individual points and entites.

ENTITY CREATION TOOLS

Because most of the remaining WED tools can be classified as one of three types as outlined below, we will present tool use based on type rather than giving a tool by tool explanation. The methodology used by one type of tool can also be applied to other tools of the same type. The three types of tools are:

1.)   POINT TOOLS
2.)   LINEAR TOOLS
3.)   BEZIER PATH TOOLS

Before we begin, some consistent terminology needs to be clarified:

Single Click - A single click in the map view, the mouse does not move during the click
Click-Drag - Pushing the left mouse button down and then moving the mouse while the left button is held down.
Double Click - C'mon now!

POINT TOOLS - DIRECTIONAL

|	
HELIPAD	
TAXI SIGN	
LIGHT FIXTURE	
RAMP START	
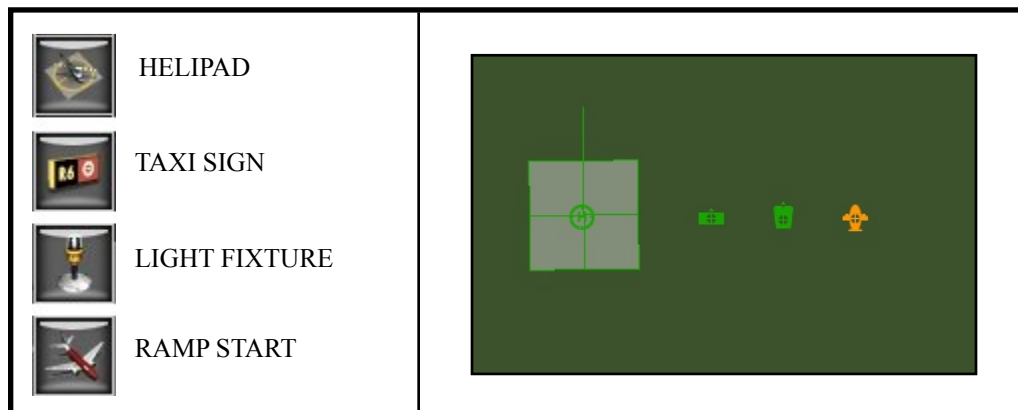
A directional point tool, when used, will allow you to place an entity and set it's direction by click-dragging when placing the entity. If a single click with no dragging is used to place a directional entity, the entitiy will be placed with a heading of 0.00 degrees. The heading can be changed by either 1.) Selecting the entity and typing a numerical heading in the attributes pane or 2.) Using the marquee OR vertex tool to select and graphically rotate the entity by holding down the option key and click-dragging on one of the corners of the bounding box. Non directional entites are simply placed by clicking in the map window where you want the entity to be. Each type of entity has it's own set of unique attributes viewable and editable in the attributes pane. NOTE: The orange entities shown indicates that the entity is currently selected and can be edited in the ATTRIBUTES pane. The helicopter pad isn't quite a point entity in that it can be resized and stretched. Stretching to anothing other than a square shape is not recommended as it would result in a distorted texture.

POINT TOOLS - NON DIRECTIONAL

|	
TOWER VIEW	
AIRPORT BEACON	
WINDSOCK	
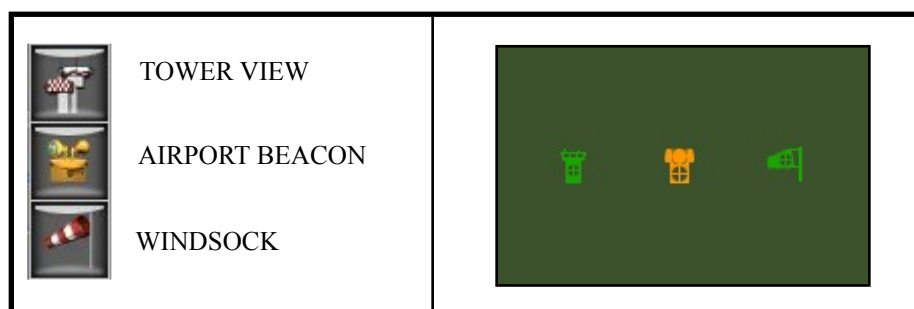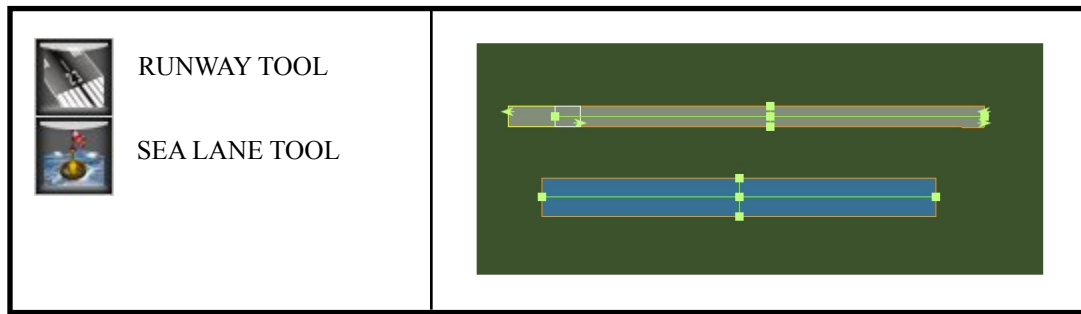
LINEAR TOOLS

2.) LINEAR TOOLS

A linear tool is defined by two points. The two linear tools are runways and sealanes. Placement of linear entites can be accomplished with either 1.) two single mouse clicks, one for each end of the entity, or 2.) a single mouse click to establish one end and then click-dragging the second end graphically. If you click-drag for the first point of a linear entitiy, a little cross hair cursor will appear which can then move around for exact placement of the first point. Releasing the mouse button will then allow you to click for the second point or click-drag with a rubberband line.

RUNWAYS:

While all runway attributes can be set numerically in the attributes window, there is a graphical method to set the blastpad length and/or a displaced threshold. When the runway is selected AND the verticie tool is selected, there will be two small triangles at the end of each runway. (See screenshot above) Simply click-drag these triangles to set the length of the blastpad/displaced threshold attributes. Since the blastpad and displaced threshold distances are usually very specific numbers, it would probably be better to type the value into the proper field in the ATTRIBUTES window.

RUNWAY NUMBERING

The runway numbers displayed in x-plane are taken from the "NAME" field of the runway in the attributes pane See highlighted field at right. When runways are created, the runways will automatically be assigned a name (and therefore a number) based on the direction they were drawn, you will see this in the attributes pane after creating a runway; however, they will retain these initial numbers if the runway is adjusted or moved. So if a runway is drawn and rotated any significant amount, then you should rename the runway appropriately in the 'NAME' field to display the proper numbers in x-plane. It is recommended that you draw runways beginning at the low end. If you do rename the runways, be sure to enter the lower numerical value first, i.e. for runways 09 and 27, this would be entered 09/27 and for runways 30 and 12, this would be entered as 12/30. For runways that are parallel, simply add the appropriate left or right suffix to the number, i.e. 03L/21R.
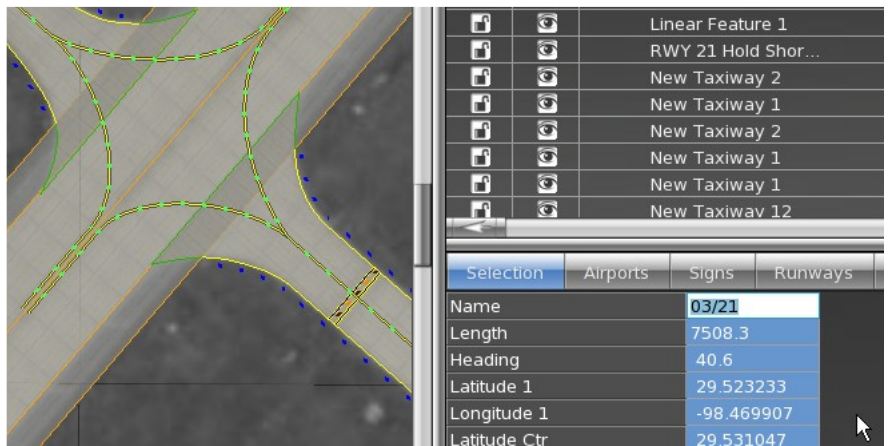
BEZIER TOOLS

TAXIWAY TOOL

HOLE TOOL

TAXILINE TOOL

BOUNDARY TOOL

The bezier toolset of WED are used to create freeform shapes. These shapes are commonly called bezier curves or bezier paths, but all the names are acceptable and refer to the same thing. Drawing bezier shapes for the unitiated may seem a bit foreign, but you'll get the hang of it with some practice. There are some important concepts to know in order to successfully work with bezier shapes. The first is that a bezier shape may be opened or closed. Figure 5. below shows an example of open and closed bezier paths. In WED, the closed bezier path is used for the taxiway tool and the hole tool. The open bezier path is used for the taxilines and airport boundaries. A closed bezier path is also called a "ring". This term will make more sense when you use the TAXIWAY tool for the first time. Another important concept is that a closed bezier path may not cross over on itself. Figure 6. shows two closed bezier paths. You'll notice that the path that crosses over itself has no fill (is not solid), so make sure your bezier paths do not cross over themselves. Now in order to learn and work with bezier paths, you need to know the pieces that make a bezier path. Figure 7. shows the primary parts of a bezier path. The most fundamental part of the path is the NODE. In WED, these are represented by the round 'dots'. Attached to these nodes are CONTROL HANDLES. A node can have 0, 1, or 2 control handles. The control handles have triangles on the end of them. The path between the nodes are called SEGMENTS. The location of the control handles determines the shape of the segment between the nodes. For
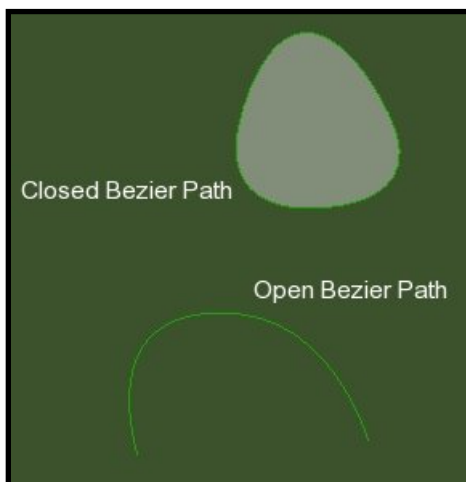
Closed Bezier Path

Open Bezier Path
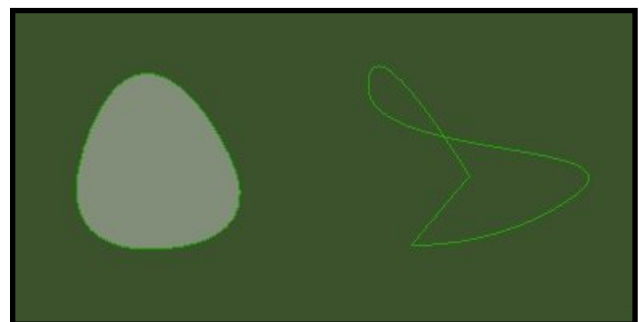
Figure 5. Open & Closed Bezier Paths

Figure 6. Crossing Paths

NODES

CONTROL
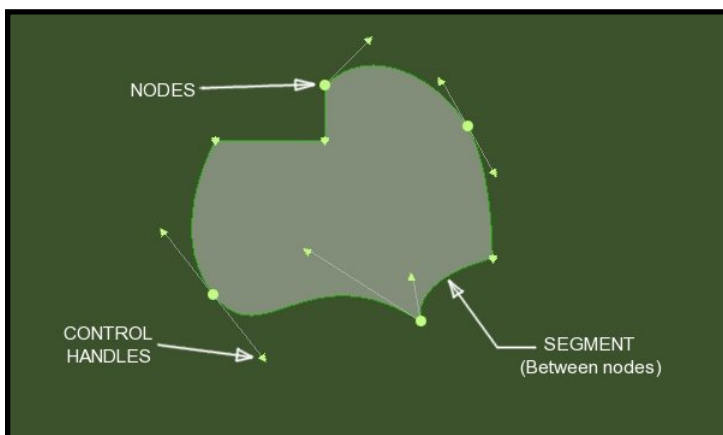HANDLES

SEGMENT
(Between nodes)

Figure 7. Parts of a Bezier Path

example, two nodes with no control handles would have a straight segment between them. All the segments together make up the bezier path.

A NODE can have four possible configurations with regards to control handles. Figure 8. on the following page shows the possible configurations.

PLAIN NODE:

A plain node has no control handes and is primarily used for sharp corners. It is represented by an upside down triangle.

SINGLE HANDLE NODE:

BEZIER TOOLS

A single handle node has a control handle on only one side of a node. It is generally used at a node where the segment on one side of the node is straight and the segment on the other side is curved.

NORMAL NODE:

A normal node has two control handles which are exactly opposite one another. Moving one control handle causes the other to move also. The lengths of the control handles will always be the same length also. This is a common node to use in the middle of a curve.

SPLIT NODE:

Figure 8. Four Possible Node Configurations

A split node is also called a "broken" node. A split node has two control handles but each handle can be moved independently of the other. Moving one handles does not cause the other to move. The control handles may also be different lengths. If you have a situation where you need the control handles to be exactly opposite of one another but you need one handle to be longer than the other, then a split node is the solution.

CREATING SHAPES:

With the knowledge of the four node types, the next step is then to string together those nodes and control handles in such a way as to create the shapes you want. A bezier path is created by selecting a bezier tool, either the taxiway or taxiline and adding a node for each click or click-drag operation. A bezier path may have as many nodes as needed to create the shape. There are two ways to "complete" or finish the shape. 1.) Double click to create the very last node or 2). Change to another tool, in which case the last node you added will be the last point. Once the shape has been completed, you can edit it with the verticie tool.
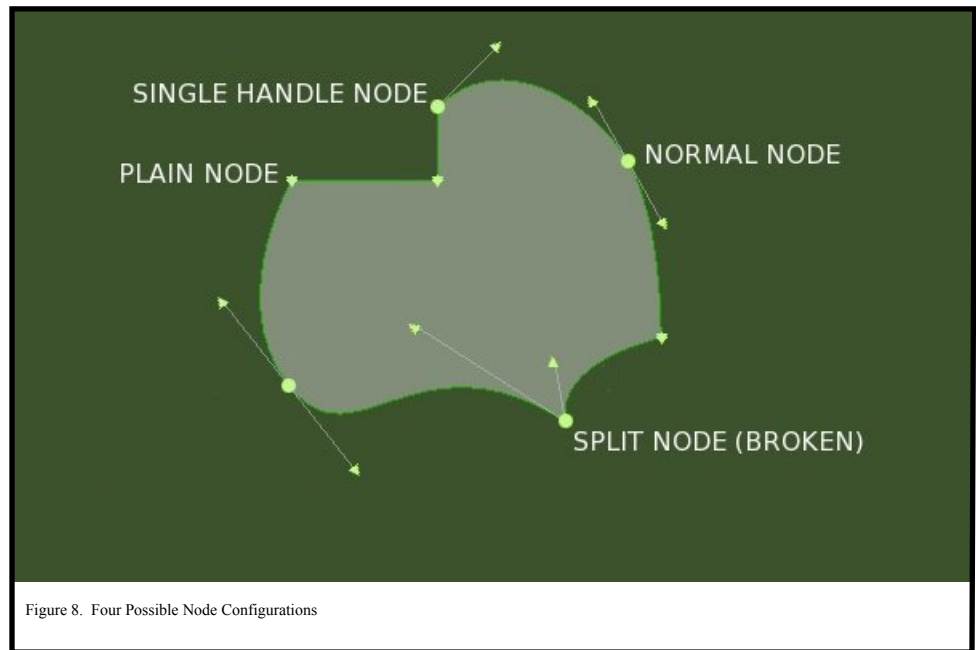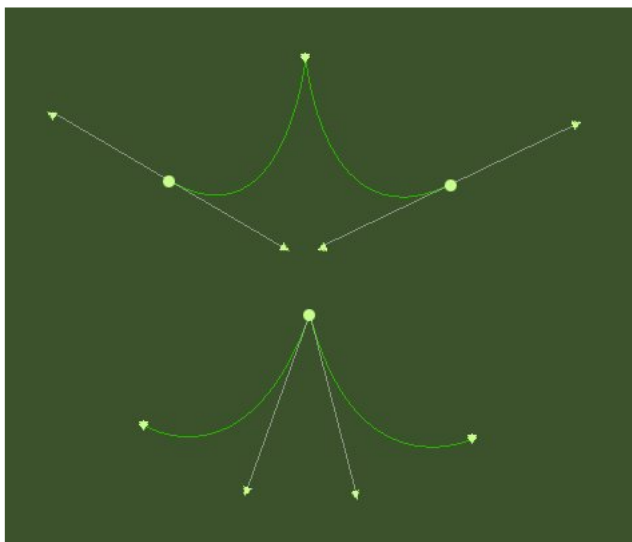

Figure 9. Same Shape Using Different Configurations

It is very common when drawing with bezier paths to work with all the node types. There is no one particular way to draw a path. Figure 9. at left shows two similar shapes drawn with different combinations of nodes. With a little practice, you'll soon get the feel for how you want to create your shapes.

IMPORTANT: When drawing curves, it is extremely common to convert between node types while in the middle of drawing a path. When in the process of drawing a path, you may only create plain nodes (by single clicking) or normal nodes (by click-dragging). You must place either of these two types of nodes first and then you may CONVERT them to plain or split nodes and then continue on drawing the path. Note that you cannot convert a node to a single handle node while in the act of creating a path. Once a path has been completed, you can convert between all the types. You convert from one type of node to another by using the modifier keys, that is the SHIFT, CTRL and ALT keys in combination with single clicks or click-drags. The table below shows the keystroke combinations to

BEZIER TOOLS

convert between the various node types. It just takes a bit of practice to get comfortable with the process.

ADDING NODES

Once a closed path / shape has been drawn, you may want to add some additional nodes. To do this, use the vertex tool and select the two nodes on either side of the point where you would like to add a node. With the two nodes selected, execute the command "Split" found in the edit menu item OR just hit CTRL-E. A new node will be created in the middle of the selected nodes.

	TO CONVERT FROM	TO	ACTION
1			ALT + (mouse click-drag)
2			SHIFT + (mouse click)
3			ALT + (mouse click-drag)
4			SHIFT + ALT + (mouse click)
5			SHIFT + (mouse click)
6			COMBINE STEPS 1 & 4
7			COMBINE STEPS 1 & 3
8			COMBINE STEPS 5 & 2
⭕ ENTITY TO OPERATE ON	(mouse) SINGLE CLICK	(mouse) CLICK-DRAG	

TABLE 1. Keystrokes and Mouse Actions for Converting between Node Types

BEZIER TOOLS

<u>HOLES:</u>

The hole tool is a bezier type tool and is used to create holes inside of existing bezier shapes. The most important thing to know about the hole tool is that the bezier shape must be entirely contained within its parent shape. Figure 10. below shows an example of this where moving the hole outside of it's parent entity will cause the shapes to lose their fill. A hole must be associated with another shape and this is done by selecting the parent shape before using the hole tool. You may select a shape using either the vertex tool or marquee tool. When the shape is outlined in orange, you may use the hole tool.

Since the hole is attached to a parent shape, moving the parent shape will move the hole also; however, you may select the hole with the marquee tool and move it within it's parent shape to relocate it, or select it with the vertex tool to reshape the hole.
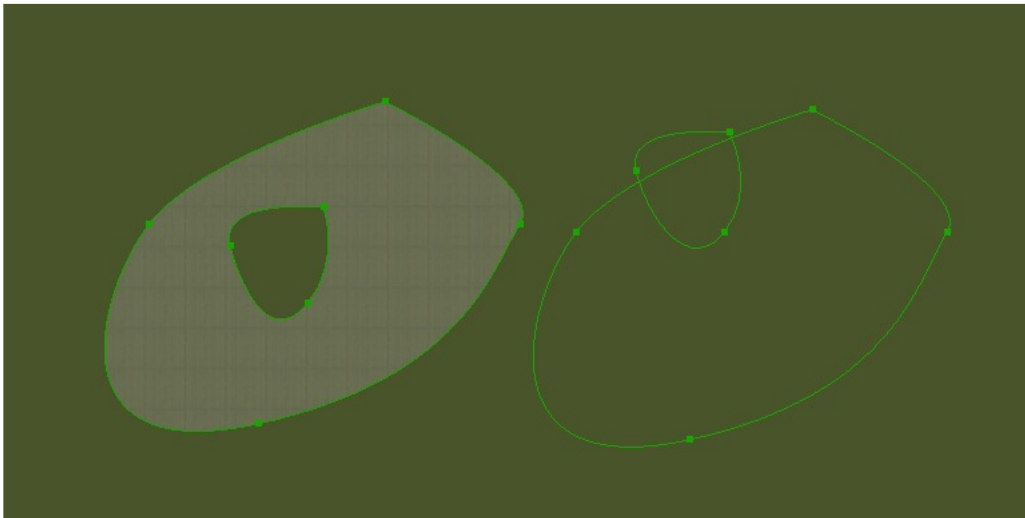
Figure 10. Results of Hole Placment

<u>TRANSFORMATIONS & ROTATIONS</u>

Once shapes are created using nodes, the overall shape can be manipulated, that is it can be stretched, scaled and rotated. To do so, use the marquee tool and click on the entity. Figure xx below left shows the bounding box that appears around an entity when selected with the marquee tool. you can grab any of the eight bounding box nodes to stretch the shape. Holding down the ALT key will cause the bounding box nodes to change to rotation nodes (Figure xx lower right) and you can click-drag on any of the bounding box nodes to rotate the shape.

SPECIAL NOTE: When you hold down the ALT key and the bounding box nodes change to rotation nodes, you can click-drag in the texture region of the shape and a copy of that shape will be created as you drag. Only by clicking directly on the rotation nodes themselves will the shape rotate.
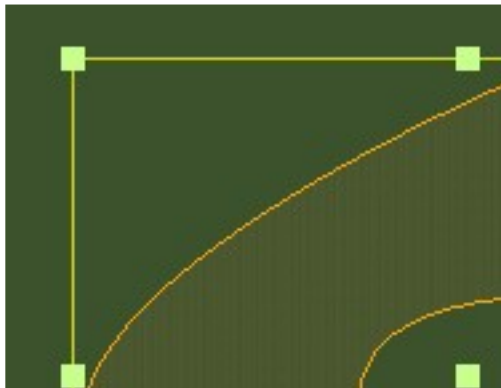

Proportional scaling of a shape is not available as it is when scaling overlay images. Proportional scaling of shapes is not generally necessary to achieve success.
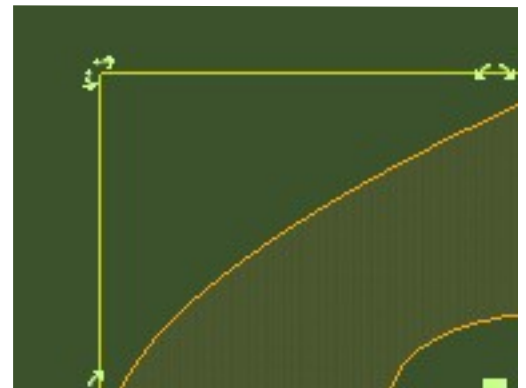
TEXTURES AND TEXTURE DIRECTION

Once a shape is created, you'll need to specify what kind of surface the shape is. A surface has two properties, type and direction. The type of texture is specified in the attributes pane using the pull down menu for the "Surface" field. Typical surfaces are asphalt, grass, dirt, water, etc. Use the pull-down menu to see the complete list. The next field in the attributes pane is the texture/surface heading. Texture and surfaces are common terms interchangeable in this case. You can set the surface direction manually by typing in the 'heading' of the texture or you can adjust the texture heading graphically in the map pane.
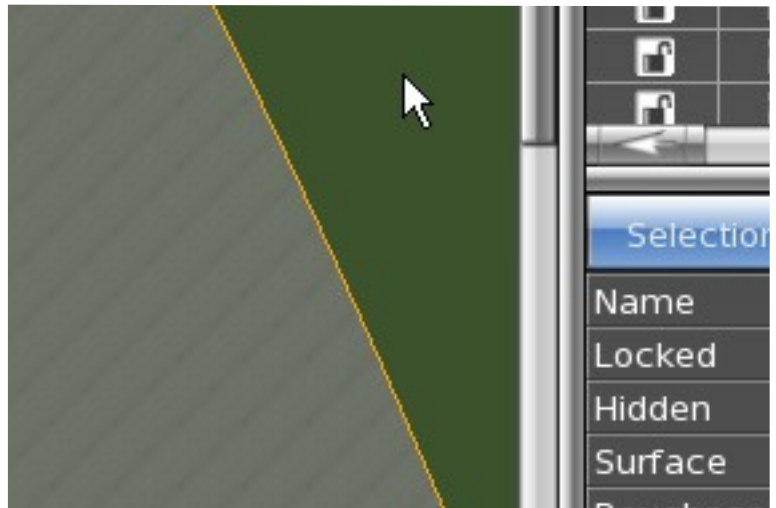
To adjust the texture/surface heading graphically, select the shape using the vertex tool and once the shape is selected, hold down the SHIFT key and then click-drag within the texture/surface. As you drag the mouse around, the texture will update in real time and you can visually align the texture how you like.

TROUBLESHOOTING:

In some instances, you may have what appears to look like a closed shape that does not cross itself, yet the shape has no fill. The most common cause of this are two nodes which are very close together and appear as one node. When nodes are very close together, they're handles are too small to notice yet the shape will cross itself and not contain a fill pattern. The solution is to use the vertex tool and move each node individually to identify nodes which are close together or on top of one another. A trick here is to move a vertex and if that vertex does not have another vertex on top of it, hit CTRL-Z to undo the operation and the node will move back to where it was. Then you can do the same for each node until the offending node is found.

Also, when resizing a shape using the marquee tool, the shape may appear to spontaneously lose its fill. This usually occurs when the shape has somehow become reversed numerically. The solution is to execute the "REVERSE" command under the EDIT menu item. The fill should return when this is done.

The two previous scenarios will account for over 99% of unfilled shapes.

5. MARKINGS & LIGHTING

Once you have your shapes created for taxiways, taxilines, hold shorts and the like, you'll need to add markings to them. Markings come in two varieties. 1.) Perimeter markings around the outline of taxiways and 2.) Overlay markings, like taxilines, ILS and hold short markings. Note that whenever you select a tool that supports markings i.e. the taxiway and taxiline tools, you'll notice some options appear at the top of the MAP pane. One of these options are markings. When you select a marking in this pull-down menu, that marking will be applied to that tool until you change it. So if you were going to draw taxilines, you'd select the taxiline tool, then set the Markings to Double Solid Yellow (Black) and begin drawing the shape. You can; however, draw the shape first and add the markings later. This is easily accomplished by selecting the entity, with either the verticie tool OR the marquee tool, then going to the ATTRIBUTES pane and setting the line attributes or light attributes or both to the entity. When you do this, the markings will be applied to the entire shape. This is generally not what is desired though and you'll need to remove the markings from some of the segments for taxiway intersections and the like.

In the previous section we stated that a segment is a line or curve between two nodes and that a path is composed of as little as one segment or as many as you care to add. Markings and lighting in WED are applied to the shapes and curves on a "per segment" basis. When you apply markings to a whole shape as described above, WED is actually applying the markings to all the individual segments at once. So if a taxiway shape is made of 50 segments, then the markings are applied to all 50 segments in order to have a continuous marking around the shape. The implication of this is that you can select individual segments and remove the markings from those segments, or converesely, add new or different markings. Since you cannot select a segment directly but only select verticies, a basic understanding of segments is needed to create exactly what you want.

When a bezier shape is created, WED keeps track of the order the nodes are added and each node is given a number. Figure 4 below shows the nodes and their corresponding number. NOTE: WED does NOT display the numbers of the nodes in the map view, you must select a node to see it's ID number in the attributes window. The white numbers were placed on the drawing for illustration only.

To apply/remove a marking to/from a segment, you select the node at the beginning of the sement. For example, if you want to have a solid yellow line (or any marking) on the segment between nodes 2 and 3, you would select the beginning node, node 2. Once the node is selected, it will appear in the attributes palette and you can apply a marking or lights using the pull-down menu in the "ATTRIBUTES" row and that marking will be applied to that segment. Figure 05 on the following page shows the pull down menu of markings and you can also find a graphic guide to markings in the reference section. Note that you can not only
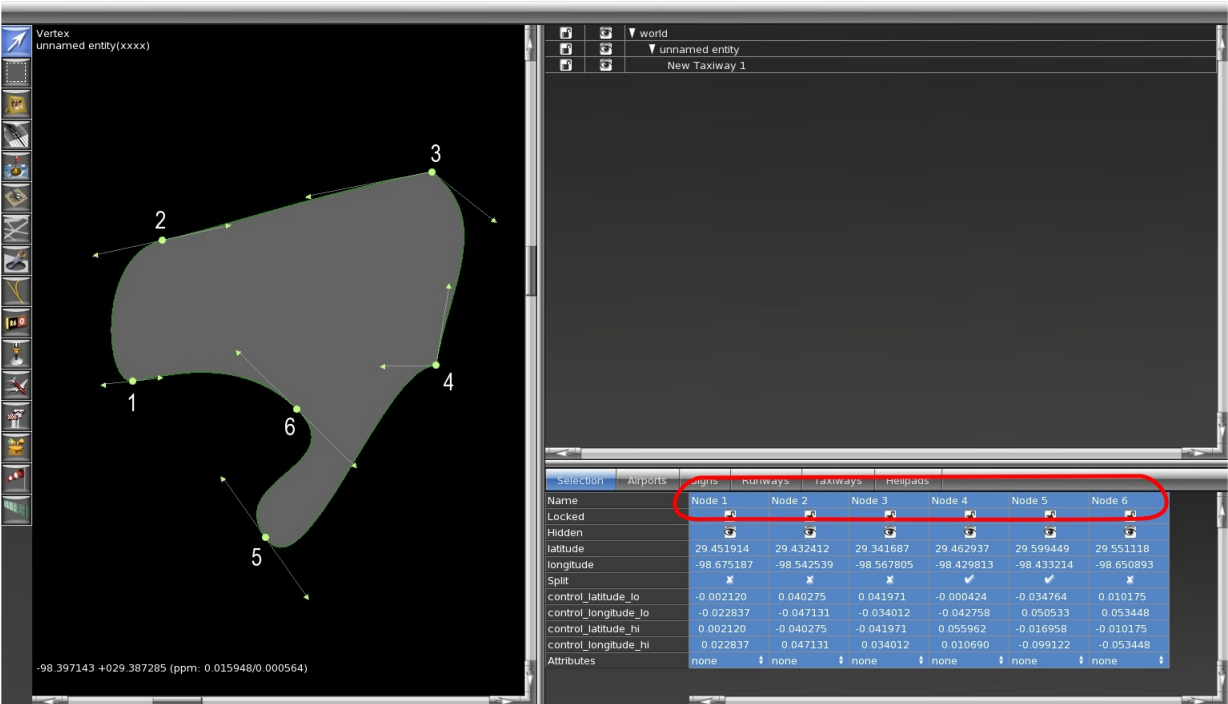

FIGURE XX. Node ID Numbers

apply a different marking to every segment, but that you can put markings on top of one another. When you use the pull-down menu of markings, you'll see check marks that indicate which markings are applied to that segment. This is a toggle setting so you select an item to apply a marking and then you select it again, to remove it. There are several tips and tricks to be used when setting markings. See the tips and tricks section.
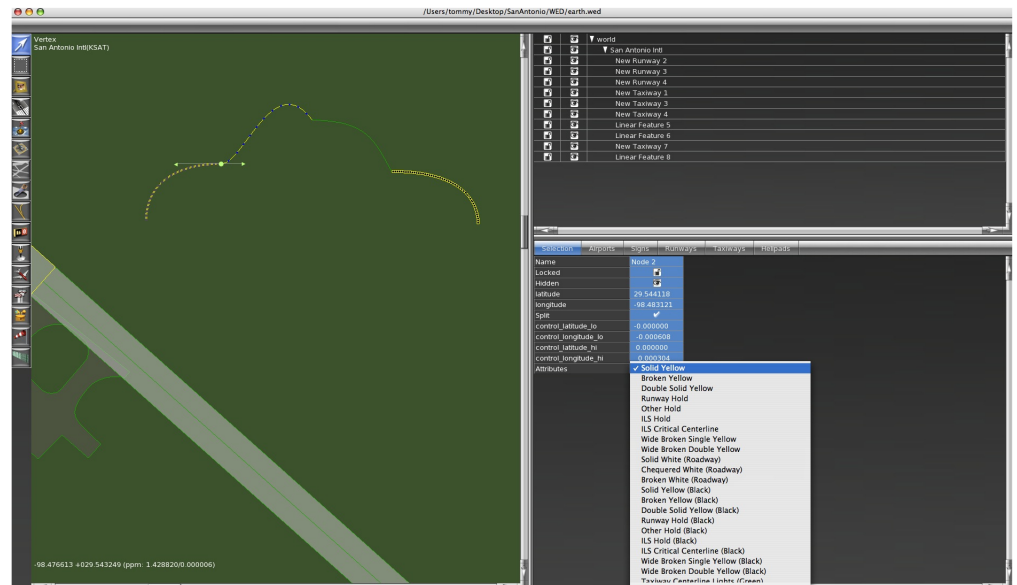
In the path shown above, Node #2 was selected and then the "SOLID YELLOW" marking was applied. Also applied was the blue taxiline lights (not visible in the pull down menu). The other segments had various markings applied to them also.
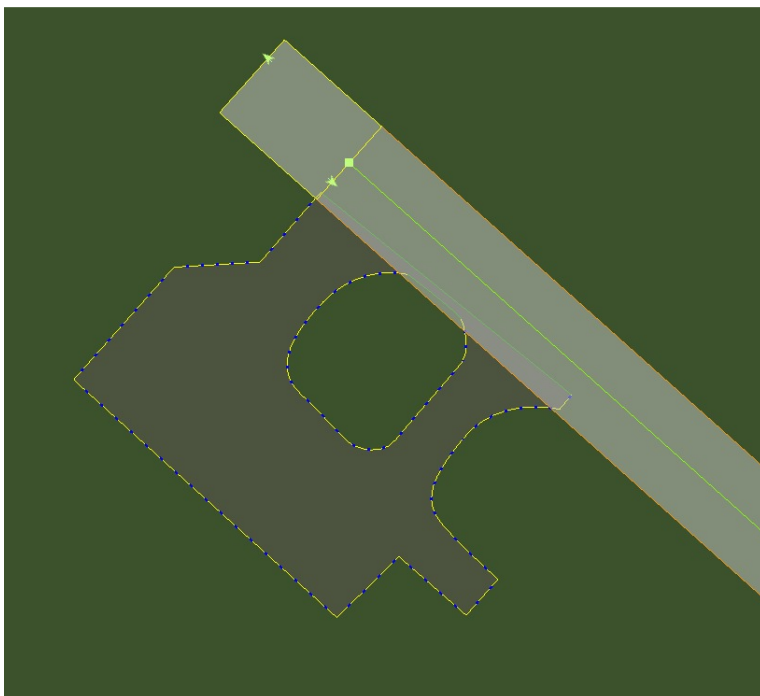
In the figure at left, The "SOLID YELLOW" marking was applied to all the segment as was the "BLUE TAXILIGHTS". Then the segments underneath the runway had the markings and lighting removed so they would not show on top of the runway. It is helpful to place nodes at locations where markings and lighting will end. The particular taxiway shown here is a drawn sloppy and would show markings and lighting partially on the runway. The nodes should just be against the edge of the runway..or very slightly overlap to avoid "cracks" in X-Plane.
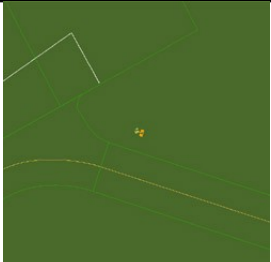
TAXI SIGNS

After laying out a series of taxiways and aprons and providing them with markings, an airport layout can be completed by providing taxi signs which identify the different taxiways and runways and provide directions and warnings to pilots. Creating a taxi sign in WED generally involves two stages. First is the physical placement of the sign and, secondly, defining what the sign actual says. You can also have some say in the size of the sign but, generally speaking, X-Plane takes care of all the 3D and visual depiction of the sign so you just decide what it says and where it says and X-Plane knows how to display this in the sim so that it conforms to real world taxi sign standards. The sign specification used by X-Plane is that of the FAA and this is largely in line with all aviation authorities worldwide.
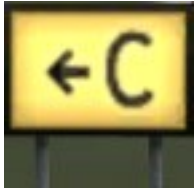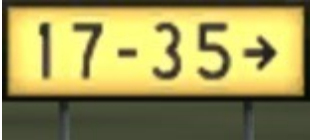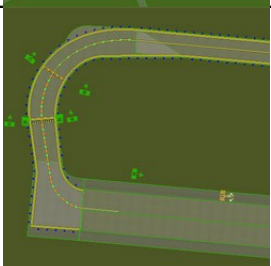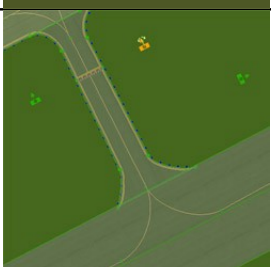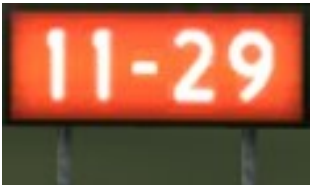
As stated earlier, a taxi sign is simply a directional point entity and is placed and then rotated in the same manner as other such entities. To place a new sign, select the Taxi Sign tool on the toolbar (click on [icon] or press the 'G' key), then click on the map pane where you want the sign to be located. The new sign is represented by a rectangular icon with an arrow emerging from one side indicating its heading ([icon]). The front side of the sign which will display the content is that with the arrow emerging from it so you need to rotate the sign so that it is facing the direction from which pilots approaching the sign will be able to read it. You can rotate the sign as you create it by continuing to hold down the mouse button and dragging out the heading to the desired direction. Or, to change the heading after the sign is created, change to the Vertex tool (click on [icon] or press the 'V' key), click on the sign's icon in the map pane to select it and then click and drag the green curved arrows that appear at the tip of its heading indicator. You can also type a new entry in the heading field in the attributes pane.
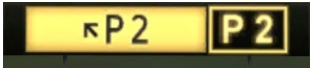
Having placed a sign at the desired location and direction, the next step is to define what it says. This is done using a single line of text that is put in the name field of the attribute pane for each sign. The text uses a simple language to indicate the colour of the lettering and background for each component of the sign and to insert special symbols, particularly arrows. This language has been developed for use in two separate flight simulators, X-Plane and Flightgear, and is defined in full on its own website:

http://wiki.flightgear.org/flightgear_wiki/index.php?title=Sign_Specification_Proposal

Rather than repeat the extensive information on the webpage linked above, there follows a series of typical sample signs of increasing complexity that will illustrate how to create taxiway signs for most requirements.

Name attribute / description	WED map	X-Plane rendering
{@L}A **Taxiway identification sign** "You are entering taxiway A"		

Name attribute / description	WED map	X-Plane rendering
{@Y}{^l}C **Taxiway direction sign** *"Turn left ahead for taxiway C"*		
{@Y}17-35{^r} **Runway direction sign** *"Turn right to get to Rwy 17-35"*		
{@B}1 **Runway distance remaining sign** *"1000 metres left until the end of the runway"*		
{@R}11-29 **Runway hold mandatory sign** *"Runway 11-29 ahead. Hold here for clearance to enter/cross"*		
{@L}B7{@R}10CAT{r2}/{r3} **Combined taxiway id and runway ILS hold mandatory sign** *"You are on taxiway B7. Runway 10 ahead. Hold here for clearance to enter during ILS Category II or III operations"*		
{@Y}{^lu}B{@L}C{@Y}C{^u}|F{^r} **CombinedTaxiway id and direction sign for complex junction** *"You are on taxiway C. Turn slight left ahead for taxiway B, straight ahead for taxiway C or turn right for taxiway F"*		

Name attribute / description	WED map	X-Plane rendering
{@Y}WEST_APRON{^r} **_Verbose direction sign_** "Turn right ahead for the West Apron"		WEST APRON→
{@L}P2{@R}16-34CAT{r1}{@Y}{@@} {^lu}P2{@L}P2 **_Combined taxiway id and runway hold mandatory sign with taxiway id and direction sign on reverse side_** _Front: "You are on taxiway P2. Runway 16-34 ahead. Hold here for clearance to enter/cross"_ _Rear: "You are on taxiway P2. Turn left for taxiway P2 ahead"_		Front: P2 16-34CATI Rear: ↖P2 P2

Notes:

- There is a bug in X-Plane v8 that may cause the colour from the front of a sign to 'bleed' onto the start of the reverse of a two sided sign if the reverse side is using a different sign type. To avoid this, enter the command for the reverse side's sign type immediately before the command to change sides. The last example above does this correctly. The colour-bleeding will occur if you used the following name: {@L}P2{@R}16-34CAT{r1}**{@@}{@Y}**{^lu}P2{@L}P2 . This bug does not affect X-Plane v9 – both examples of the name will display the sign correctly.

- WED provides you with five standard sign heights. The first three are appropriate for location, direction and mandatory signs and the default setting is for the middle of these three sizes which should suit most purposes. The only time you'll usually want to change sign size is when you create a runway distance remaining sign which should be assigned one of the two largest sizes (they need to be legible from further away). You can select a different sign size in the attributes pane.

- When making a runway hold sign that includes a CAT I, II or III portion, always use the {r1}, {r2} or {r3} commands to produce the Roman numerals as these are distinct in appearance from the capital I letter in the sign standards. The numerals have serifs (bars at top and bottom) while the letter does not.

- In fact, you will notice that, in the real world, using the letters I, O and X is avoided for naming taxiways as they can be confused with numbers or other symbols.

- Tip: Even a moderately sized airport can have dozens of signs. If you intend to populate an airport with all of its signage, work methodically from one extremity of the layout to the opposite side, completing all the signs for each junction as you go. If you use a random approach and start plonking down signs here and there, it can become very hard to spot where you have omitted any as you near completion.

- At large airports, place signs far enough away from the taxiway centreline, usually away from the edge, so that they are not an obstacle to the outboard engines of four-engined aircraft.

- After you have created a new set of taxisigns for an airport, check for errors. Load the airport up in X-Plane and taxi around all the taxiways in each direction to check the visual effect is what you want and that all signs are visible from the pilot's viewpoint. After you exit X-Plane, check the log.txt file in it's root folder as this will list an error line near the end for each loaded sign in which if found a syntax error. Even if you become very adept at using WED, it is all too easy to mis-type the contents for one or two signs.