

## How To Create Sloped Polys in SBuilderX - A Tutorial (detailed meanderings on the subject by Rod Jackson)

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Note: This tutorial assumes the reader has base knowledge of using SBuilderX (SBX) version 3.13 to make flat polygons etc.

Many times, when developing scenery in terrain areas that have been computer generated (e.g. ORBX terrain), you will find algorithmic anomalies. An example of this is a river meandering along and suddenly there is a 20 foot wall of water as the river gains altitude. Another example might be a large area of terrain that should be sloping upward slowly and all of a sudden you encounter a 40 foot ridge that shouldn't be there.

One way of solving these problems is with a sloped flattening hydro poly or a just a plain sloped AB flattening polygon. Let's talk about how to create a sloped poly (do you remember rise over run and slope mathematics in school?)....well.....one option is to do it manually....just create a flattening hydro poly and edit each vertex with a slowly rising altitude until you get to the end ----each line segment of the poly side between vertexes should be about equal to the previous one. This is easy if your poly only has 3 or 4 vertexes (points) on each side. However, if your sloped poly is also going to be a hydro poly and will have to trace a shoreline for a mile, while eliminating a 25 foot wave, then the manual process may take a lot of points to follow the curves. In addition, the hydro poly is going to have to have some length to it to reduce the rise over run number so the water doesn't ramp up too fast or it will still look a bit like a hill of water as you approach it from the low side.

A decision has to be made on how long to make the poly. So let's say you decide to make a hydro poly about 2000 feet long to limit the angle of the slope from a low side to a high side. And you will need about 80 points on each side to accurately trace the shoreline. Now you are starting to get the picture. Creating manual altitudes for all those points can be a herculean job. I knew my Math/Computer degree would come in handy someday.

So, let's make a automatically computed sloped hydro poly which SBuilderX is fully capable of doing. First thing you do is run a boat or float plane over the water and up to the wall of water on the low side. To mark it on you SBX display, create a little (throw away poly) that runs the length of the wave with the left side of that poly tracking the low side (at the wall) of the wave. Doesn't matter how far out the right side is since we are going to use the left side as a marker. You should already be familiar with determining the elevation altitudes of the terrain you are working with when doing non-sloped polys. First we need the High Side of the Water Altitude which is where we want the poly to end. That is the altitude readout just past the wall of water on the high side. Record that Altitude (in feet in the U.S.) less the height of the boat or plane in the worksheet on the next page which has a spot for High Side of the Water Altitude this is where the poly will end. A computed poly always runs from the low side to the high side. That is important because later will will need to determine the heading of the poly. Now we need the Low Side of the Water Altitude where you plan to begin the left side of the poly. You should also mark that spot with a little throw away poly because you need to know the location where the poly will start in case the water altitude continues to lower as it moves away from the wall of water. Record the Low Side of the Water Altitude (less the height of the plane/boat) in the worksheet on the next page.

Okay, it is time to draw a rough flattening hydro poly laying down enough points that you can move them as necessary to trace the shoreline. It would be really great if you try to have a left side line of the poly in the water be straight and at right angles to the coast on each side and butting up against your low water throw away poly mark. The right side of the poly (the high side) should be another line somewhat parallel to the left side and just a hair short of the marking poly we set up on the right side. Once you have the rough flattening hydro poly drawn, remove the two throw away polys that delineated where to put the left and right side of the hydro poly. Now you may wonder....what if you might need more points to trace a shoreline than you left behind....not to worry...you can add points later, and with a computed sloping poly, SBuilderX will automatically compute the proper altitude of any additional points you might add. This is only true for a computed sloping poly. As an aside, if you don't know how to add points, here is how: while in poly mode, you simply hold down the "i" key and left click on one of the borders of the poly where you want to add a point and behold it appears. You can also remove a point by holding down the "d" key and left clicking on a point. There is more on this technique and other interesting stuff in the "Working with

Points, Lines and Polygons section inside the Working with SBuilderX section of SBX Help. If you haven't read it yet...make sure you read that section.

Half the job is now done....a rough flattening hydro poly has been created. The next part, which will become quite easy using the automatic process, is determining what altitudes should each point of the poly need have (right now they are all 0). Again, you can manually edit each point trying to equally climb in value but then there is the problem that each point is not equidistant from the previous point....a real computational problem if you are trying to have a steady rise over the run ratio. And if you have 80 points on a side, this could be a huge job.

You have probably noticed that the left side of the Set Polygon Altitude pop up that comes up when you set the altitude of a poly has things like slope and heading etc. When you click on the little Help button it gives you a little info...just enough to cause panic.....it wants you to specify:

1. the altitude and index of one specific point (all the points on your polys are auto-numbered)
2. the heading of maximum slope
3. the maximum slope as the altitude increases in meters per one thousand meters of horizontal shift

Yeah, that was clear. Here is the translation.....

If you think of your poly laying on the water with the left end in the lower altitude part of the water and the right end stopping just past the edge of the wave, it kind of looks like a rectangle. What we need to do is feed SBX the info it wants and it will compute the correct altitudes for all the points to move from the low side to the high side in a fairly smooth slope. And, if you need to add some points later, SBX will auto compute their altitudes to fit right in with the slope. Great! So how we do we know what numbers to give it.

First, we need to know the distance of the poly from the left side (in this case) to the right side. There is a little tool provide by SBX for this. You can access it in the ribbon just above the SBX toolbar (when you are inside a project) where it gives you File, Edit, View, Select, Tools and Help choices. Choose Edit and then click on the Measure Tool. If the measure tool is not lit up, make sure you are in poly mode. Your pointer will turn into an arrow with a symbol....you can then click on a start point and click on an end point and get the length in feet (too bad it is not in meters). You also get a heading and Lat.& Lon. This information is displayed in a little box in the upper right corner of your project display. So, you use the measuring tool to get the length in feet of the poly... It is easy to draw a straight line from the start (low point) of the poly to the high point. Remember, you are always moving from low point to high point...so in this case...start the measure on the low side which is the left side of the poly (start at the middle of the left side) and then go to the right side of the poly (to the middle of the right side). Sometimes you have to click just inside or outside of the poly instead of on the exact edge...don't know why. In the worksheet, I have created below, find the correct line ["Run (Distance Measured...)] and write down the length of the poly in feet. Also, in the table below, write down the Heading (degrees). I always include 2 decimals for all the numbers that display with decimals. Make sure you drew the measuring line from the low side of the poly to the high side. The heading has to be from low to high!

Find a point on the left side of the poly (the low water side) ...preferably in the middle of the left side line that makes up the left side of the poly...you can always add a point if none is there. **Once you are done adding points**, write down the low side center point number (in this case the left side center point number) in the correct place in the worksheet below. Once the compute is done this point will end up being computed to be equal to the Low Side of the Water Altitude where the left side of the poly starts.

Now use the worksheet below to proceed.....

**Preparation Worksheet for data that SBX will want in order to Auto Set the Sloped Polygon Point Altitudes**

Note: Save your project before filling in the blanks of the Set Polygon Altitude pop-up and hitting the set button on the left side of the pop-up to compute. SBX has a habit of crashing if the numbers entered get out of bounds and you will have to reopen your project from the last save.

**(If your original numbers are in feet...must convert to meters...but fill in both blanks)**

	<u>Feet</u>	<u>Meters</u>
<u>High Side of the Water Altitude</u> (FSX display altitude readout less the height of the plane/boat)	_____	_____
<u>Low Side of the Water Altitude</u> (FSX display altitude readout less the height of the plane/boat)	_____	_____
<u>"Rise"</u> [(Compute net difference in altitude in meters (subtract low side from high side)]	_____	_____
<u>"Run"</u> (Distance measured from low water side edge of poly to high water side edge of poly)	_____	_____

**Polygon Altitude Pop Up Numbers:**

- Altitude: Low Side of the Water Altitude (in meters from above): \_\_\_\_\_ (meters)
- Point number: (This is the center point number on the low side of the poly): \_\_\_\_\_ (integer number)
- Heading: (as displayed by the measuring tool): \_\_\_\_\_ (degrees)
- Slope: (Compute maximum slope in meters) "Rise"/("Run"/1000) = \* \_\_\_\_\_ (meters)  
\*Divide the Rise in meters by the result of dividing the Run in meters by 1000

Put these numbers in the 4 blanks above into the left side of the Polygon Set Altitude pop-up and choose the "Set" button on the bottom left of the pop-up. This will compute a constant altitude number in the upper right side of the box and assign the correct altitude to all of the polygon points. That is it.

Now go back and interrogate the points on your poly and they should all have differing altitudes (where before they were zero)...the point in the center of the low side of the poly should be equal to the Low Side of the Water Altitude (meters). The far high side points at the end of the poly should have an altitude that is very close to the High Side of the Water Altitude (meters) you were targeting. If not, you may have entered something wrong. Also, the farther you polygon strays from being somewhat rectangular....the higher the possibility that the high side numbers may be a bit off. If you do get an error when you do the pop-up compute.....don't worry because you saved your project before you hit the set button to compute the constant altitude average in the pop up..... upon getting an error SBX gives you an option to keep going at that point at your own risk..... ..don't.....unpredictable things happen and you don't find out until your are another hour of work down the road.

Once you have a sloped flattening hydro poly on the water.....and the point altitudes seem to make sense....take a boat or seaplane through it and see how bumpy it is mostly paying attention to the start and finish. Stay in the center because you haven't fixed the edges yet. Sometimes you can fix little bumps by adjusting the altitude of a few of the points on each shoreline side of the poly to be a little smoother. If the start point (low point) of the poly has too much of a bump in it, you can change the points on the low side line to try to fit the water altitude at that point...watch out because in the U.S. the water altitude being displayed on the FSX screen is in feet so you will have to convert to meters to see how much, if any, you need to adjust the poly points at the beginning to smooth any start out bump. If everything is smooth and to your liking, now it is time to trace and reposition the shoreline sides of the poly to be an exact match to the shoreline. You should already have experience doing this on normal polys. If you need to add some points....do so....the engine will auto compute their proper altitude to maintain the slope....such is the power of having the points auto-computed for you.

Now that you have fixed the shorelines, your work is complete and you have just engineered and installed an automatically sloped flattening hydro poly. The same technique works for all sloped polys. Of course, the challenge on land is that you may be applying them to a rough surface with variable altitudes all over the place (hills, mountains etc.). In that case, a mesh clinging poly (no flatten) might be a better choice since you are probably not trying to fix mesh error anomalies. However, if you are putting a stream or river into a hillside, and you want it slightly sunk into the ground to create natural shoreline edges....then you will need a sloped flattening hydro poly...probably more than one.....believe me, that will be an even more "fun" and rewarding experience.

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