**Extracting Bridges Using Lidar**

1. Go to this address and download the 3D Basemaps Project by clicking “Get Now” <https://www.arcgis.com/apps/solutions/index.html?sortField=relevance&sortOrder=desc#home>
2. Find the compressed folder where 3D Basemaps was downloaded and decompress the folder.
3. Open the Pro project called “3Dbasemaps”
4. Within Pro, go to folder where the LAS points are stored.
	1. Right click on the folder and under New select LAS dataset
	2. Right click on the LAS dataset and under the LAS files tab, click add files and select all the LAS points
5. Open the tasks bar in the left contents pane and expand “Publish Bridges”
6. Double-click the “Extract bridge surfaces” task
7. Skip the first task of creating a las dataset



1. For “Extract bridge surfaces from lidar” task, input las dataset for the input, and name your output.
2. Select *17* from the “Class Code” dropdown
3. Leave the sampling value as is and change bridge area to 10.



1. After this is finished, move on to the “Create bridges” part in the tasks pane and follow the instructions.
2. Open the “Add Surface Information” tool and use your bridge footprints as the input features, use the las dataset as the input surface, select *Minimum Z* from the “Output Property” dropdown, leave the Method as *Linear,* and click “Run”
3. Spot check at least 5 bridge footprints and their associated Z\_Min values. Compare the values to the county DEM by using the *Explore* tool and clicking on both ends of the bridge right before the bridge starts. Make sure not to click where the bridge is because structures have been removed from the DEM so it only shows ground elevation.
4. Convert bridge footprints to raster using “Polygon to Raster” tool.
	1. The input features should be your bridge footprints, the value field should be Z\_Min, name your output, leave “Cell assignment type” as *Cell Center* and “Priority field” as *None.* Change “Cellsize” to 1 and click “Run”
5. Change the height projection of the bridge footprints to match the flood depth layer using the “Define Projection” tool.
6. Then convert the height values from meters to feet using the “Times” tool. Use *3.2808399* as the *Constant Value 2.*
7. Convert your output raster to integer using the “Int” tool.
8. Convert the flood depth layer to integer using the “Int” tool.
9. Subtract your raster bridge footprints from the flood depth layer using “Raster Calculator”
10. Convert your output raster to a polygon using “Raster to Polygon”
	1. Make the output from the raster calculator your input raster, keep field as “Value” and name your output. Keep “Simplify Polygons” checked and “Create multipart features” unchecked.
11. Go through the attribute table of your new layer and identify the footprints that have multiple gridcode classifications (i.e. one part of the bridge may be 1 ft under the flood surface while another part is 2 ft)
	1. You can do this by clicking on each polygon in the attribute table and zooming into it.
	2. Make a copy of your raster to polygon result for merging
	3. Once you find one, merge the polygons into one and write down the object ID for the polygon you specified to keep the attributes for.
12. Create a buffer for your bridge footprint layer to intersect DOH bridge points. Some points may not be directly over the bridge so go through each bridge footprint polygon to find the point that is the largest distance away from a bridge polygon.
	1. Use this distance for your buffer
13. Now use the intersect tool to find DOH bridge points that fall within the buffer you just created.
14. Go through the polygons to make sure the buffer did not capture more than 1 bridge point. This may happen if multiple bridges are close to each other.
15. Identify which bridge polygons did not have associated DOH bridge points and export them from the bridge footprint layer.
16. Join the intersected point layer to the bridge polygons layer that does not have the bridges without points. This will add the DOH bridge attributes to the polygon layer.
17. Through ArcCatalog, right click on the polygon layer that now has the DOH attributes and click add data. Select the bridges without points exported layer and add it.
18. Remove any unnecessary fields and add a *BridgeDeckElev\_ft,* *classification, and Inundated* field.
19. Rename the gridcode field to *FtBelowOrAboveFloodSurface*
20. In the *BridgeDeckElev\_ft* field, right click and calculate field using the Z\_min values \* *3.2808399.*
21. In the *classification* field, leave as null if the *FtBelowOrAboveFloodSurface* value is below 1, input 1 ft for values of 1, 2 ft to 3 ft for values of 2 and 3, and Above 3 ft for values above 3.
22. Populate the inundated field with yes or no. Yes are for *FtBelowOrAboveFloodSurface* values of 1 or above and no is for values under 1.
23. Convert the bridge footprint polygon layer to a point layer using the Feature to Point tool.