

Aligning Parcels Using the Spatial Adjustment Toolbar

ISTC Topic:

7.21

In this Chapter you will learn

- How to use tools on the Spatial Adjustment Toolbar to create links and move parcels or other polygon features.
- Strategies for tackling parcel adjustment: adjusting all the parcels at once and refining it by adjusting subsets of parcels

1. Aligning parcels in GIS

It is not uncommon that parcels, or for that matter any point, line or polygon feature, do not line up with other GIS layers on a map. For example in figure 1 you can see that the red parcels do not line up very well with the underlying 2011 NAIP imagery especially where red parcels extend well into adjacent streets. The black lines in figure 1 show the same parcels, except that they have been moved in a north westerly direction and are now better aligned with the imagery.

There are a number of important considerations before you start adjusting your parcel database. For example, *do you want to show parcels in a location that most closely matches its location in the real world?* In other words, if someone reads the coordinate for the center of a parcel on your map, and then drives to those same coordinates outside in the real world, should they stand exactly in the middle of that same parcel? This is often a good goal, and assuming that other data such as roads and aerial imagery strive for the same goal, then data should align nicely in your maps.

However, what if your main goal is to *map your parcels according to their legal descriptions?* So for example, a parcels edge may need to, according to its legal description, match a section line. If your parcels and section lines were both correct at the time a legal description was described that is great, but what if a new survey updates a section line? Also, legal descriptions frequently include bearings and distances. Given that a map is inherently distorted because a map is flat, but the Earth is round (yes, this even matters on a County-sized map) you cannot preserve all distances and





-  Better alignment between parcels and aerial photo
-  Parcels are poorly aligned with aerial photo

Figure 1. The black parcels have better alignment with the aerial image than the red parcels.

angles in a flat representation. Additionally, any parcels on a mountain slope will be larger “in the real world” than on a map as demonstrated in figure 2.

Finally, anytime you are aligning two layers you need to ask yourself which one has more accurate locations. For example, in figure 1 we saw that the parcels and the imagery do not line up. This could be because the parcels are located in the wrong location; the imagery is in the wrong location, or both the parcels *and* the imagery are in the incorrect location. The first question to ask is which layer has the best locational accuracy that other layers can be adjusted to.

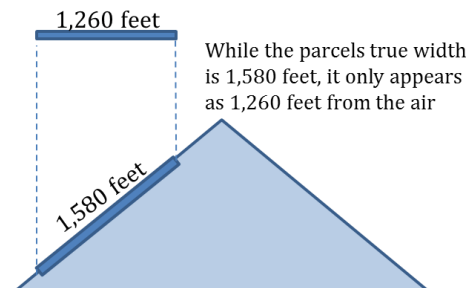


Figure 2. An example that demonstrates that preserving true linear distances on a map may be difficult, especially in mountainous areas.

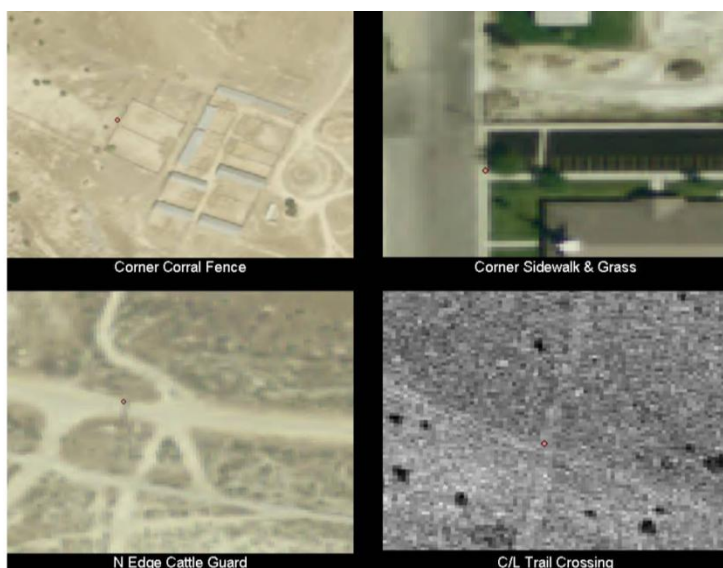


Figure 3. Examples of control points that have been used for the 2011 NAIP. Note the small red point in each image and a description for its location below the image. *Source: Acquiring Control for Inspection: NAIP Control Point Requirements, page 5.*

Typically, surveyed locations hold the highest degree of locational accuracy. For the example displayed in figure 1 you should determine which layer has better positional accuracy by consulting the metadata for both the parcel and the aerial image layer. For example, the methods used to ensure positional accuracy for the NAIP 2011, which is the imagery in figure 1, has been described in http://www.fsa.usda.gov/Internet/FSA_File/naip_cpr_final.pdf.pdf which states that positional accuracy is based on surveyed locations that can be easily identified from the air.

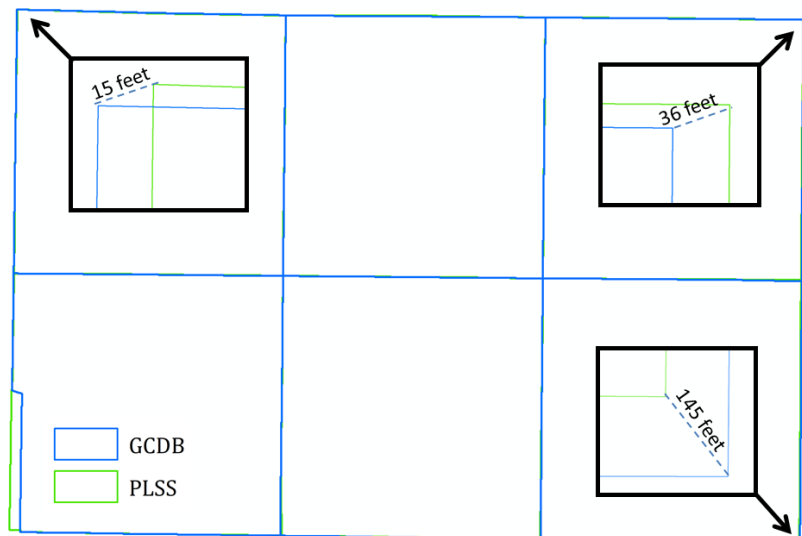
Figure 3 shows examples of such control point locations used for the 2011 NAIP. Based on the methods used to determine the location of the parcels layer you should determine which of the layers has the higher positional accuracy and should be held in place. As a practical consideration it is good to realize that it is in your power, if you choose to, move your own parcels whereas you do not have the power to change the location of the 2011 NAIP, ESRI Basemaps and many other layers that are authored and published by other entities.



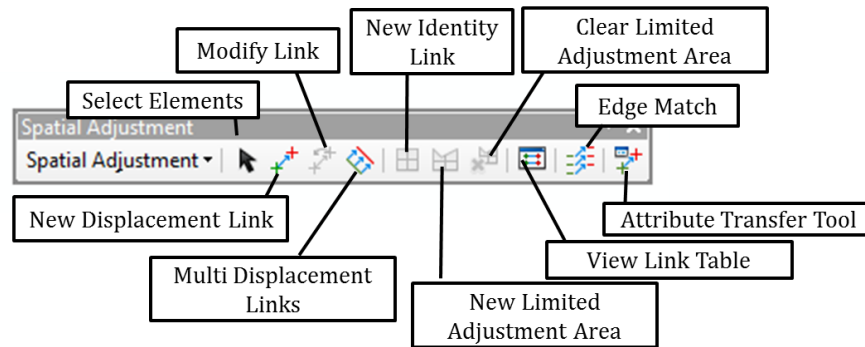
VIDEO
7.21: Aligning parcels using the Spatial Adjustment Toolbar

Exercise 1: Using the Spatial Adjustment Toolbar to align an entire parcels shapefile (Internet required)

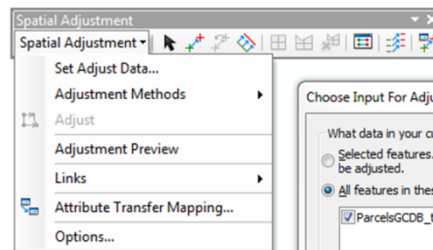
1. Start ArcMap and open the ArcCatalog tab. Browse to the Start folder for this exercise.
2. Right-click on the Parcel shapefile and choose "Copy". Then right-click on the start folder and click Paste. Rename the new ParcelsCopy.shp to ParcelsGCDB_to_PLSS.shp. It is always a good idea to have an extra copy of your parcels shapefile as a backup in case you are unsatisfied with your alignment.
3. Drag the ParcelsGCDB_to_PLSS.shp from the ArcCatalog tab to the table of contents in ArcMap. Symbolize the parcels so that they are hollow with a red outline.
4. Also add the GCDB_Townships and PLSS_Townships layers from the Start folder to your map. Make the GCDB_Townships hollow with a blue outline and the PLSS_Townships hollow with a green outline.
5. Turn off the parcels in the Table of Contents and zoom to the corner of a township to see how the GCDB and the PLSS align with each other. The GCDB layer is older than the PLSS layer used in this exercise. Some counties may have used this GCDB layer as the base layer to which their parcels have been adjusted.
6. The figure on the right shows some of the discrepancies between the GCDB and the PLSS. In the first part of this exercise we will assume that the parcels were aligned to the older GCDB and move them so that they align with the newer PLSS layer.
7. Turn off the ParcelsGCDB_to_PLSS.shp layer in the Table of Contents. You should only be able to see the GCDB and PLSS townships.
8. Add the Spatial Adjustment Toolbar (hint: click on Customize along the top of your screen and then on Toolbars. Click on Spatial Adjustment to add the toolbar to the ArcMap interface).
9. Start an Edit session (hint: Click on the Editor > Start Editing). Ignore the warning that states that the spatial reference of the 2011 NAIP layer does not match the dataframe. This is OK since we are not planning on editing the 2011 NAIP.



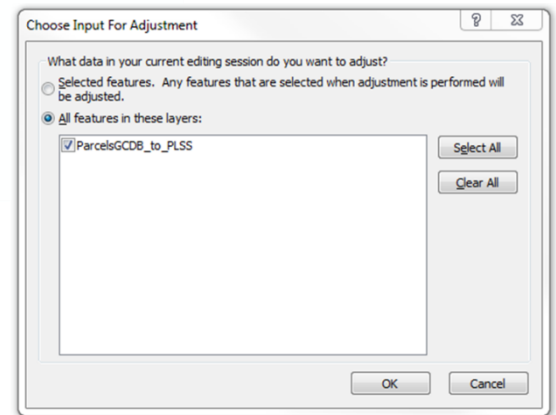
- Once your edit session has started, the buttons on the Spatial Adjustment toolbar should be activated. Those buttons are labeled in the figure below.



- In exercise 1 we are planning to adjust *all* the parcel data. Make sure no features are selected and then click on Spatial Adjustment > Set Adjust Data as shown on the right.



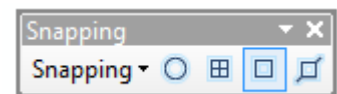
- In the “Choose Input for Adjustment” dialog box choose “All features in these Layers” and make sure there is a check mark in front of ParcelsGCDB_to_PLSS to indicate that we are planning to adjust this parcels layer.



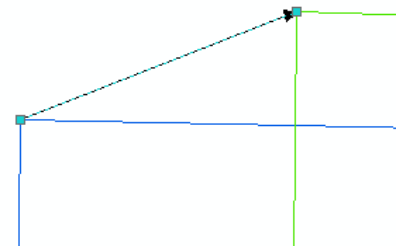
- Click on the Link Table button and assure that there are no pre-existing links. If you see any links, they are probably from a previous attempt to use the Spatial Adjustment tool. Delete the links by clicking on them and then choosing the Delete Link button inside the Link Table dialog.

- Zoom to north-west corner of the PLSS and GCDB layers.

- On the Editor Toolbar click on Editor > Snapping > Snapping Toolbar. Make sure only the Vertex Snapping is turned on as shown on the right.



- Click on the New Displacement Link button and click on the NW corner of the blue GCDB layer. Then click on the same corner of the PLSS layer. You should now see an arrow showing the displacement link as shown on the right.



17. Create 10 more displacement links for the locations shown in the image on the right. Note that you just created the link marked “Done” in the north-west corner. For each displacement link click on the blue GCDB first, and then on the green PLSS.

18. Note that if you make an error you can use the Modify Displacement Link button to move the links. Since the displacement links are added to your map as graphics you

can always select them with your select elements tool and delete them.

19. Click on the Link Table button and note that you have 11 links. Close the link table.

20. Next choose your adjustment method by going to Spatial Adjustment > Adjustment Methods > Rubbersheet as shown on the right.

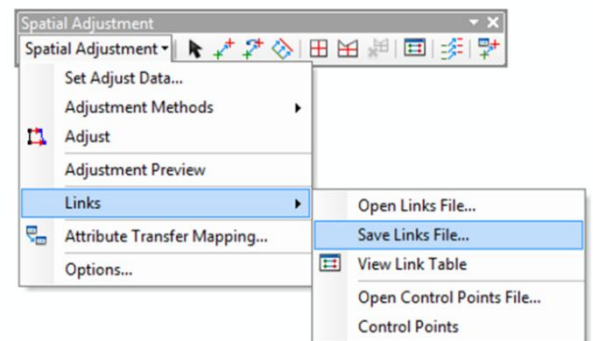
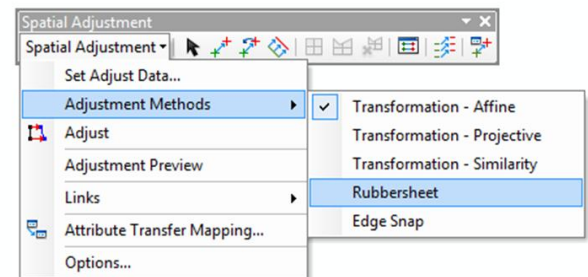
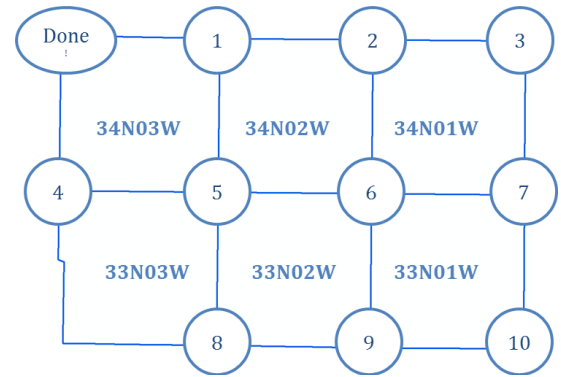
21. Save the links you just created by going to Spatial Adjustment > Links > Save Links file. Save the links as Ex1_Links.txt in the Start folder (or Intermediate folder, if that folder exists). Click “Yes” when asked to save the link ID along with coordinates. In the future, if you wish to make the same transformation you will not need to recreate all the displacement links since you can import the links file you just created (using Spatial Adjustment > Links > Open Links file). This is especially useful if you want to adjust multiple GIS layers in the same area.

22. Click on Spatial Adjustment > Adjust.

23. Save your edits.

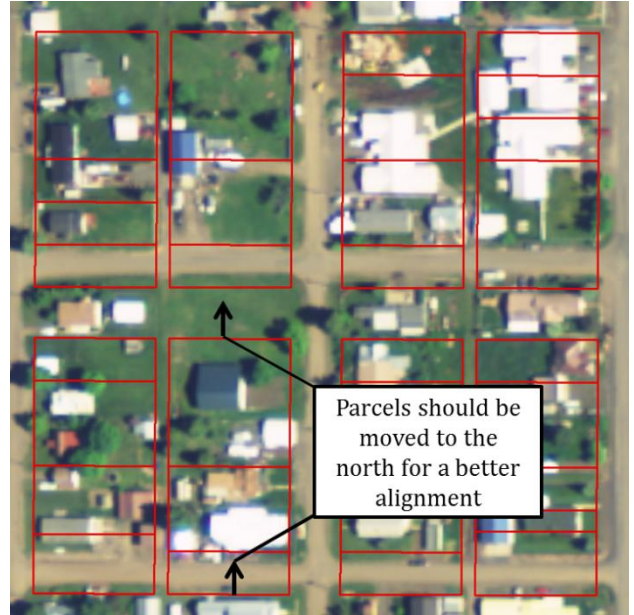
24. Turn on the ParcelsGCDB_to_PLSS layer to see the effect of the adjustment. Zoom to an area inside one of the two towns on the map and add the 2011 NAIP imagery to your map. You may want to add the Parcels shapefile from the Start folder to compare “before” and “after” the transformation.

At this point you would make further decisions on whether the adjustment met your needs, and what further adjustments may be required. For example, you may find that the adjustment you just completed provided an improvement, but that some areas are still poorly aligned. In those cases you may choose to apply a transformation to some of your parcels, but not others. Exercise 2 explains how to do that.

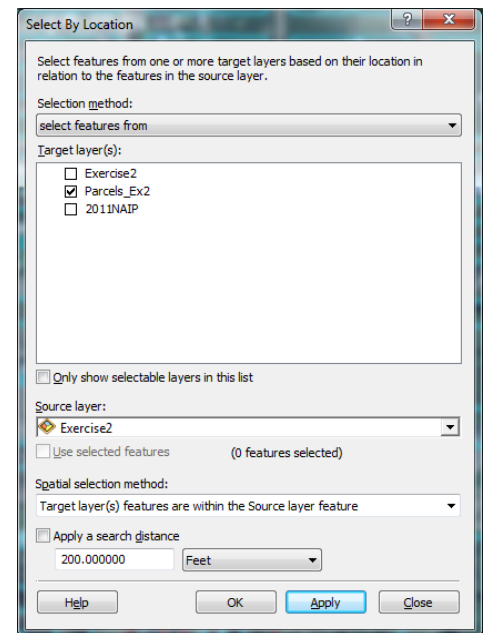
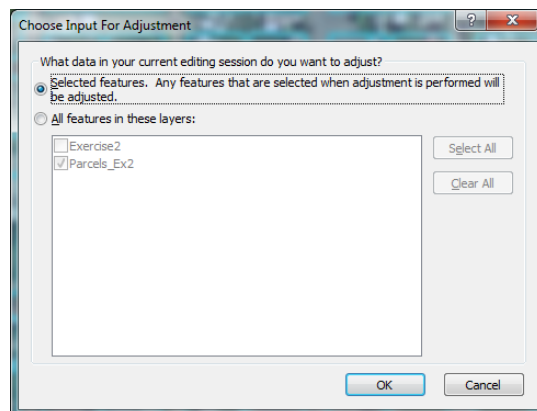


Exercise 2: Using the Spatial Adjustment Toolbar to align a portion of a shapefile (Internet required)

1. Open a new map document and add Exercise2.shp. Then also add the Parcels_Ex2.shp and 2011NAIP.lyr
2. The Parcels_Ex2.shp is the same as the adjusted parcels shapefile you created in the first exercise. Exercise2.shp is the area that you will adjust again.
3. Symbolize Exercise2.shp so that the polygon is hollow with a thick yellow outline and Parcels_Ex2.shp so that the parcels are hollow with a red outline.
4. Zoom to Exercise2.shp. Note that the parcels seem to align reasonably well in the east-west direction, but seem to fall a little too far south as shown in the figure on the right. In this exercise we will move the parcels that fall within Exercise2.shp to the north.



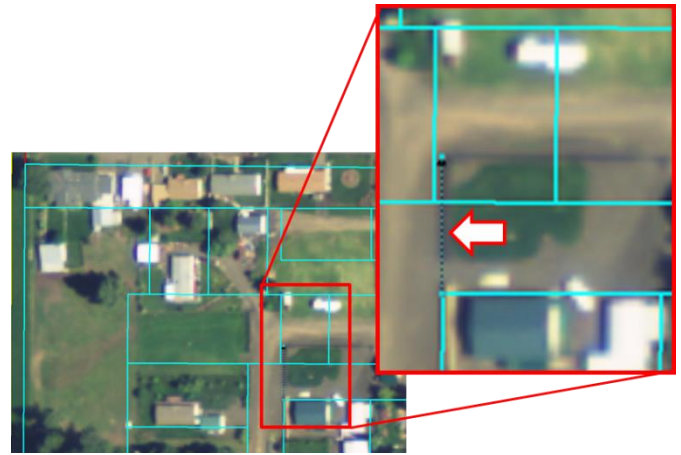
5. Add the Spatial Adjustment Toolbar.
6. Start an edit session
7. Click on the Link Table button to make sure there are no existing links. Since you just started with a new map document there should be none. If there are any you should delete them now.
8. Select all the parcels inside the Exercise2.shp polygon. One way to do this is by using the “Select by Location” as shown on the right.
9. Click Spatial Adjustment > Set Adjust Data. Make sure your setting matches those shown below (hint: you may need to click on “All features in those layers;” to unselect Exercise 2, and then going back to “Selected features...” near the top).



10. Click OK.

11. Zoom to the NW corner of the yellow polygon and click on the “New Displacement Link” button to create a link. Click on the corner of an existing parcels and then click on a location north of this corner where you think the corner should be located. For example the link shown on the right.

12. Zoom to the NE corner of the yellow polygon and place another set of displacement links. Repeat for the SE and SW corners for a total of four displacement links.



13. Click Spatial Adjustment > Links > Save Links File. Save as “Exercise2_Links.txt”.

14. Click Spatial Adjustment > Adjustment Methods > Rubbersheet

15. Click Spatial Adjustment > Adjust

16. Save your edits. Zoom around the yellow polygon to inspect your work. How do you like the alignment between the parcels and the 2011 NAIP? It would probably appear that the parcels line up better with the imagery than before, but you may find that some of the parcels that used to be rectangles are now somewhat curved. If we had only used only one displacement link instead of four in this exercise the parcels would still be more rectangular, but not placed as closely to the correct location on a map.

17. Note that if you are aligning your own parcels you would need to edge match along the boundaries of the yellow polygon so that the parcels we adjusted in exercise 2 match well with neighboring parcels that were not adjusted in this exercise.