

## E. Georeferencing methodology

The georeferencing procedure used to obtain the base map for each city in order to perform the remote survey using Google StreetView and IDCT is presented in the following step. This is performed using ESRI ArcGIS 10.2. The procedure is the following:

- Set the WGS 1984 global coordinate system in ArcGIS. This can be changed in the *Properties* option in the base layer of the ArcGIS project, see Figure E.1.

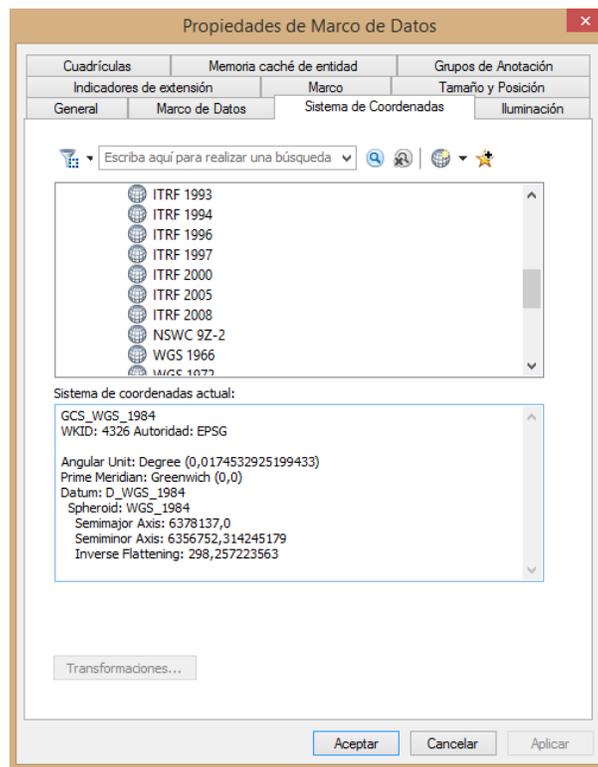


Figure E.1: Global coordinate system setting in WGS 1984 in the base layer at ArcGIS project

- Go to *Add base map* in the *Add Data* menu of the project, and select the base map corresponding to *Images*.

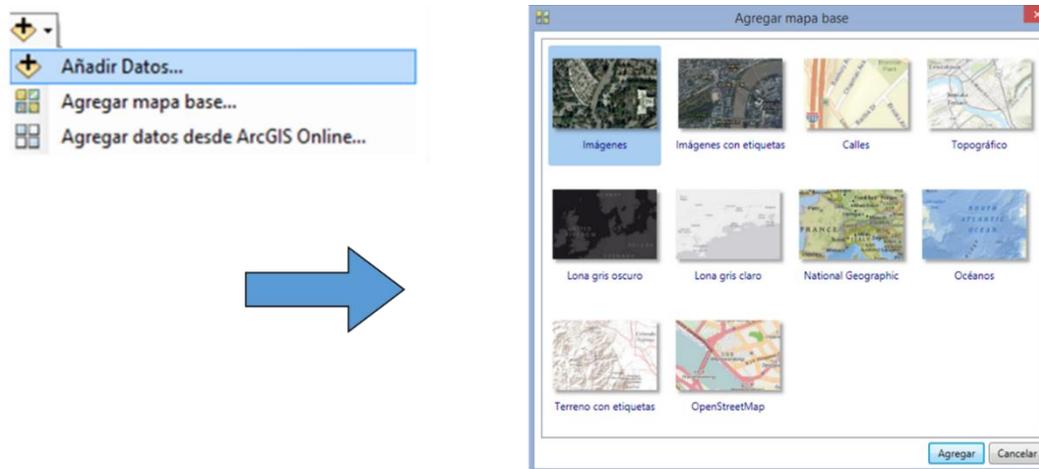


Figure E.2: Add base map function

- In the image displayed, go to the study area, see Figure E.3.



Figure E.3: Study area in the base map

- Select a scale that allows recognizing the elements under study. For this case, streets and houses needed to be recognized, so a scale of 1:2500 was used. See as an example Figure E.4.



Figure E.4: Zoom to the study region

- For each image, four control points must be used. These points will be used later to georeference the image, and to create the mosaic of the city by merging different georeferenced images. Control points must be drawn on the four corners of the image, at reference points such as roads intersections or similar. Points are added from the *Drawing* menu.

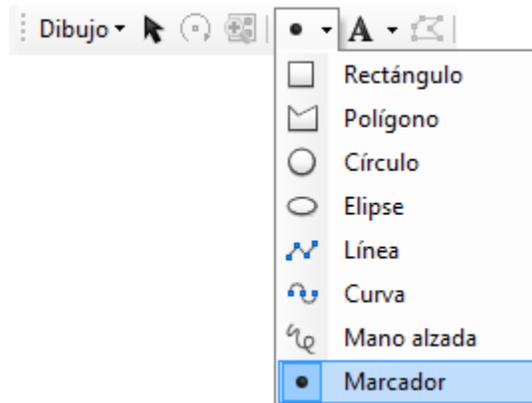


Figure E.5: Drawing menu

- The coordinates of the control points should be saved separately in a spreadsheet. They can be obtained deploying the properties of each point, at the *Save Location* tab, as shown in Figure E.6.

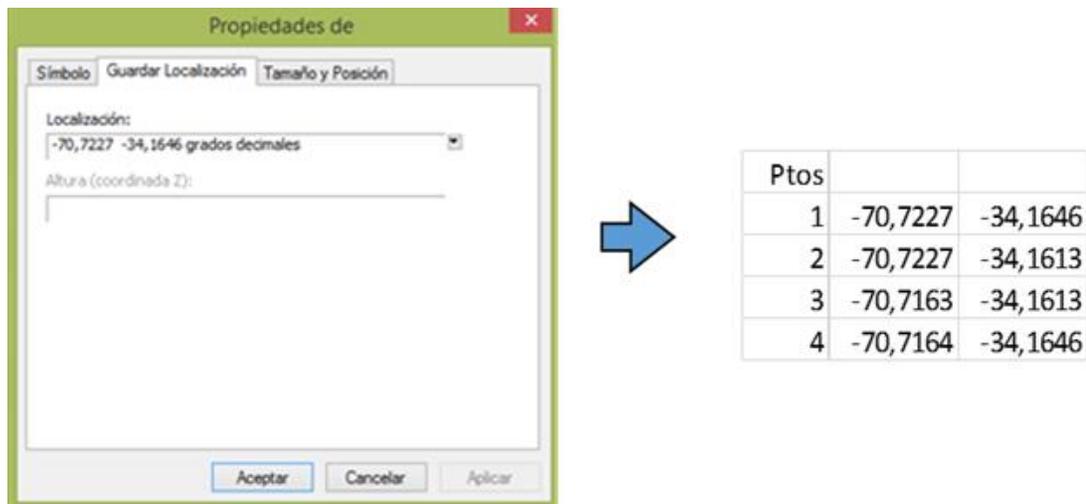


Figure E.6: Example of coordinates of control points

- Save the image as JPEG with the control points using Print Screen or a cutting tool.
- The image in JPEG format must be added to the ArcGIS project as a layer. Use *Add Data* and add the saved file, see Figure E.7.

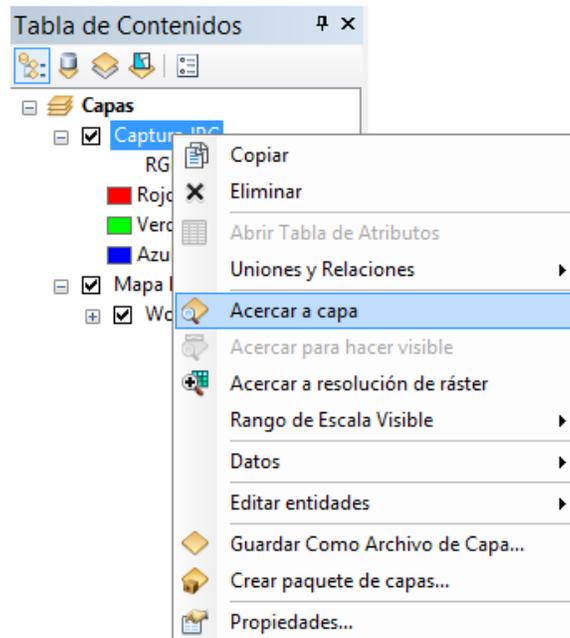


Figure E.7: Adding the JPEG image to the project as a layer.

- It is necessary to georeference the added image, since its dimensions and location can be different of the real properties. To georeference the image, it is necessary to zoom one of the four control points drawn before. Click at the center of the control point and use the *Add Control Points* command to enter the real coordinates previously saved on a spreadsheet (X for Latitude, Y for Longitude), see Figure E.8.

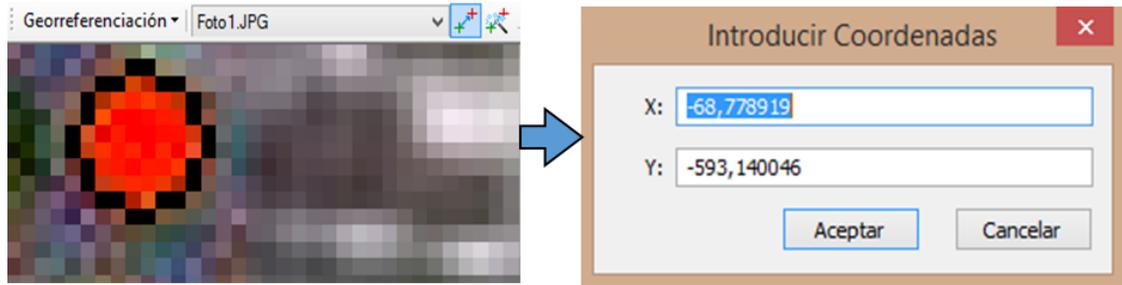


Figure E.8: Introducing longitude and latitude to the point

- After georeferencing the four points, use the *Update Georeferencing* command in the *Georeferencing* tool. After this, the image is correctly georeferenced in ArcGIS.
- Apply this procedure for every image needed to create the mosaic of the city. It is highly recommended to use images that overlap between them, like in Figure E.9, to make sure the mosaic will not leave areas of the city uncovered.



Figure E.9: Example of overlapped images

- To merge the images and create the mosaic, it is necessary to create a raster layer for the mosaic using the *Mosaic to new Raster* tool (ArcToolbox → Data Management Tools → Raster → Raster Dataset → Mosaic to new Raster).

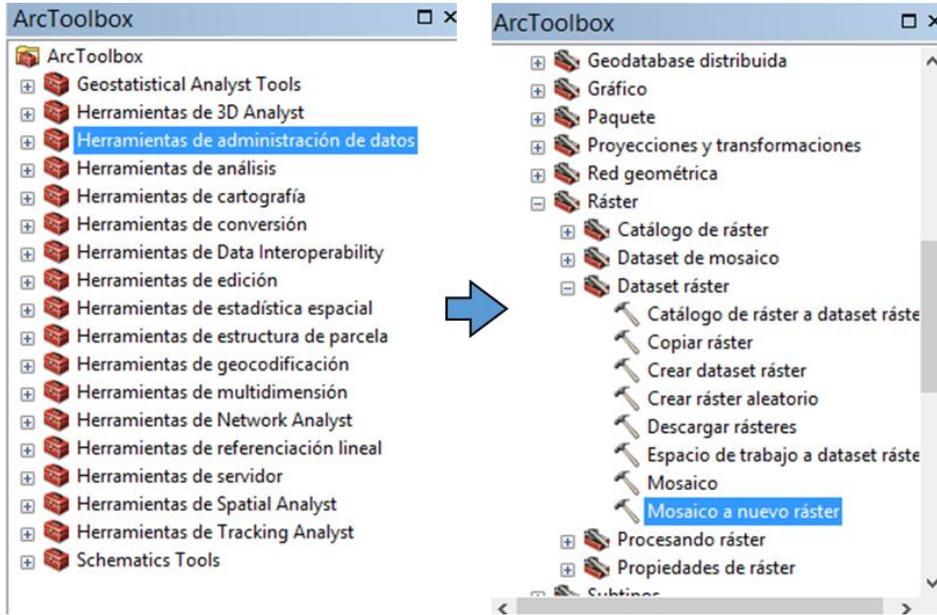


Figure E.10: Application of tool to create a new raster from a mosaic

- Finally, the *Mosaic to new Raster* window is displayed, which has to be edited as follows:

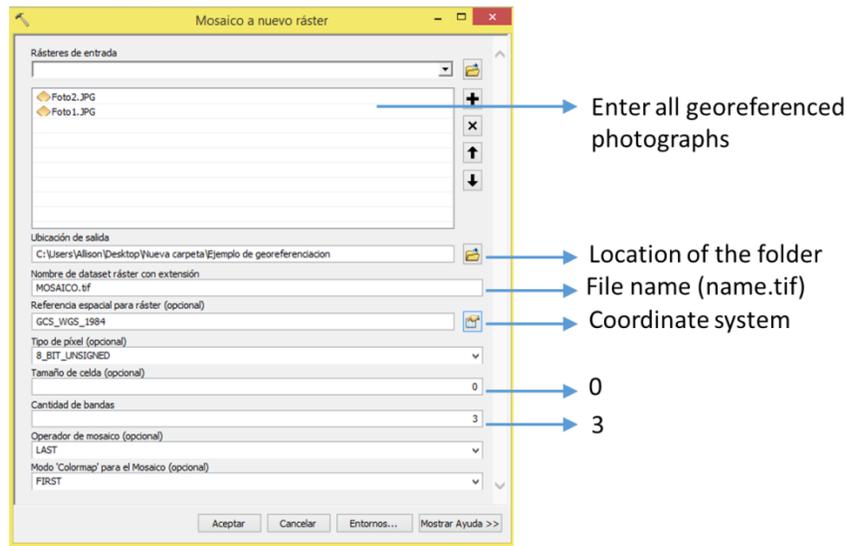


Figure E.11: Mosaic to new raster window