

UC Santa Barbara

GIS Core Curriculum for Technical Programs (1997-1999)

Title

Unit 28: Editing Polygons

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Authors

Unit 28, CCTP
Del Pozzo, Pau Serra

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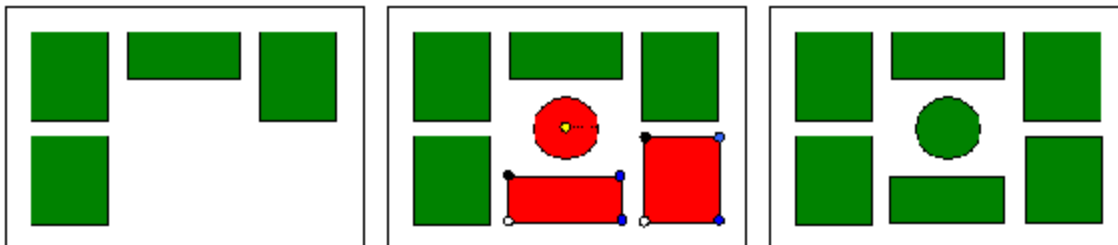
UNIT 28: EDITING POLYGONS

Written by Pau Serra Del Pozzo, Universitat de Barcelona

CREATING POLYGONS

We may add polygons to an existing polygons coverage. There are two types of polygons one may add: adding non-adjacent polygons (f.i., city blocks) and adding adjacent polygons (f.i., parcels)

1. ADDING NON-ADJACENT POLYGONS



It is simpler adding non-adjacent polygons than adjacent ones. Here is an example of an existing layer of polygons which may represent city blocks.

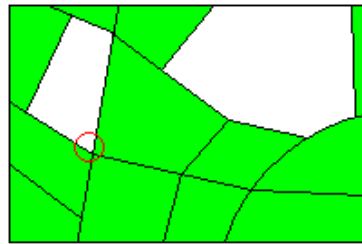
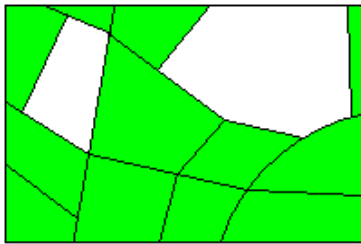
Radius of the circle
First vertex Penultim v.
Other v.
The circle is added by clicking a center, then dragging and dropping till the radius distance is reached. Other polygons are added by clicking the first and all other vertices, except the last one. To close the chain of vertices one has to double clicking in the penultim vertex, for instance.

Once the edition is finished, the layer is updated with the new polygons

2. ADDING ADJACENT POLYGONS

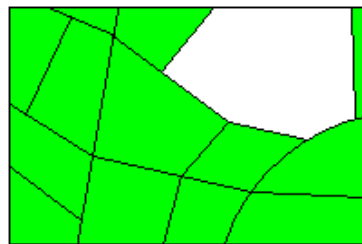
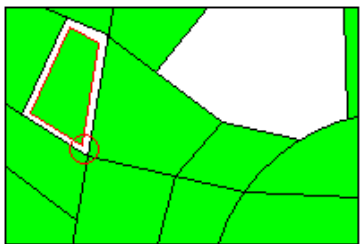
There may be several ways of adding adjacent polygons:

2.1. Adding polygons as such interactively. One way is setting a snapping tolerance to snap features (segment, vertex or node) of the existing polygons to the new polygons vertices that are added



Here is an example of a layer of polygons that has to be completed: some more polygons have to be added

The user picks up a snapping tolerance, under which any feature of the new polygon will get snapped with any feature of the existing polygons.



The vertices of the new polygon have been digitized. The vertices are under the snapping tolerance...

...therefore the vertices get snapped with the existing polygon nodes. Existing polygon nodes had been previously declared as the snap features before digitizing the new polygon vertices. Other snap features may be segments or vertices.

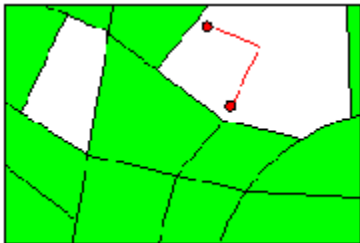
2.2. Adding polygons as lines interactively. The lines the user digitizes become polygon features once they snap existing polygon features. Actually this method is similar to add arcs to an existing layer of arcs, see ADDING ARCS AND NODES in the Unit 27.



The existing polygon layer.

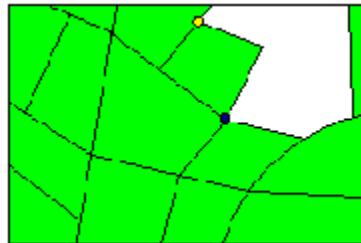


The user defines a snapping tolerance.



Endpoint

The user declares that the line he/she is going to digitize will become a new polygon. The user also declares which feature the endpoint of the line is snapping with (node, segment or vertex).



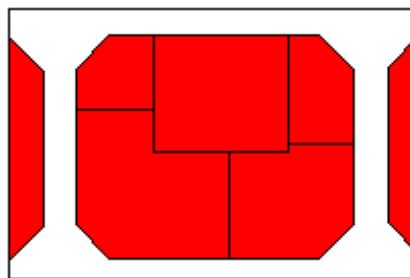
Endpoint snapped to a segment

Endpoint snapped to a node

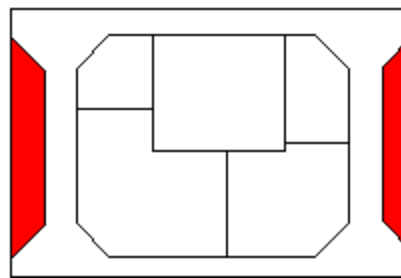
Since the endpoints of the digitized line are under the snapping tolerance, both snap some feature (a node and a segment)

2.3. Adding polygons as lines, and then re-building the polygon topology.

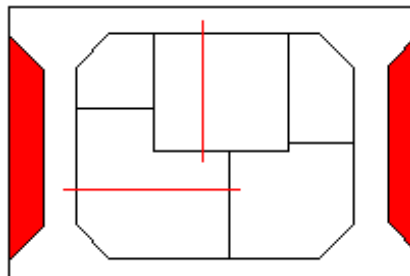
Here one loads the polygon coverage and specifies that the arcs or lines that make up the polygons are going to be edited. Add the new lines. Then, the polygon topology must be re-built so that the dangling arcs be deteted (for more detail about dangling arcs, see below REMOVING DANGLING ARCS AND NODES).



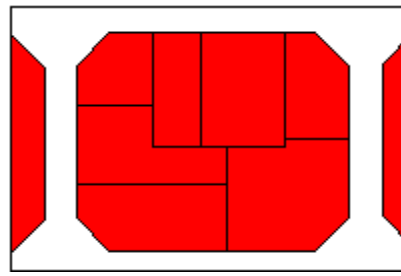
An existing coverage of polygons. Polygons may represent city parcels.



One has to specify that the lines that make up the polygons are going to be edited.



In red, new (overshooting) lines are being added.



Once the polygon topology is re-built, you get two more polygons.

REMOVING SLIVER POLYGONS

Sliver polygons are geometrical errors that consist usually on small polygons that should not show up in our polygons layer. They are caused by the intersection of three or more adjacent polygon lines. There may be several ways for getting rid of sliver polygons: remove the polygon nodes or remove the polygons themselves:

1. There may be two ways for removing the polygon nodes:

1.1. Setting up a fuzzy tolerance under which there can only be one polygon node.

1.2. Select and remove the sliver polygons. Then move and snap the nodes of the polygons adjacent to the removed polygon.

2. Likewise there may be two ways for removing the polygons with dissolve operators:

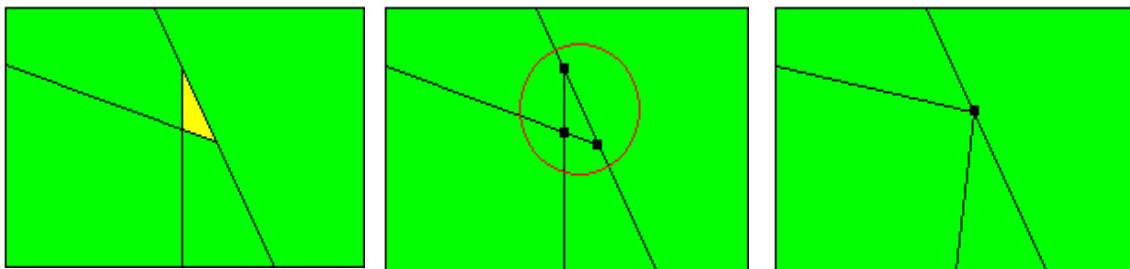
2.1. manually: one may select the sliver polygons (visually or with a query) and select manually the neighbor polygon one wants to union with.

2.2. or with a dissolve operators which uses some criteria, f.i., the sliver polygon getting dissolved with the neighbor polygon that shares its largest common boundary. Therefore, the line that bounds the two polygons is removed.

1. REMOVING THE POLYGON NODES

1.1. USING FUZZY TOLERANCE

One may select the sliver polygons visually, However, when there are too many or they are too small, one rather selects them through an area query.



The sliver polygon has been detected as such and has been selected (in yellow). Setting the fuzzy tolerance. One sets a radius of a circle, under which distance there will be just one node. Once the topology is re-built, the sliver polygon has vanished and there is also just one node.

1.2. REMOVE THE SLIVER POLYGON AND THEN MOVE AND SNAP THE POLYGON NODES

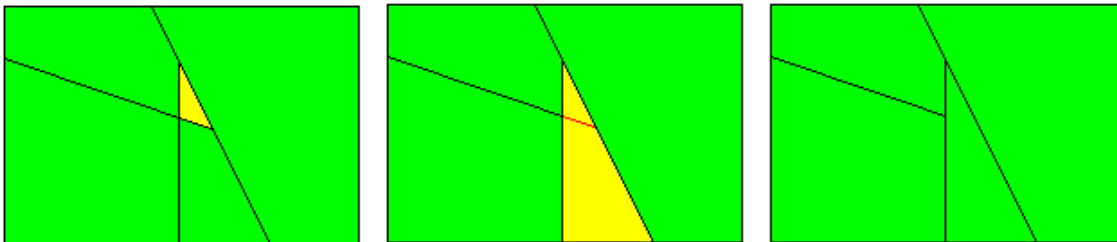
One has to edit the polygon nodes and vertices. Once you declare editing the polygon nodes and vertices the procedures are as if you were editing nodes and vertices of lines. So, see Unit 27, EXTENDING ARCS (Node Snap tolerance)

2. REMOVING THE POLYGONS

2.1. USING DISSOLVE OPERATORS MANUALLY

This is similar than to aggregate operations (see Unit ...)

In this case manual dissolve operators let the user to aggregate polygons that are adjacent, say have a common boundary.



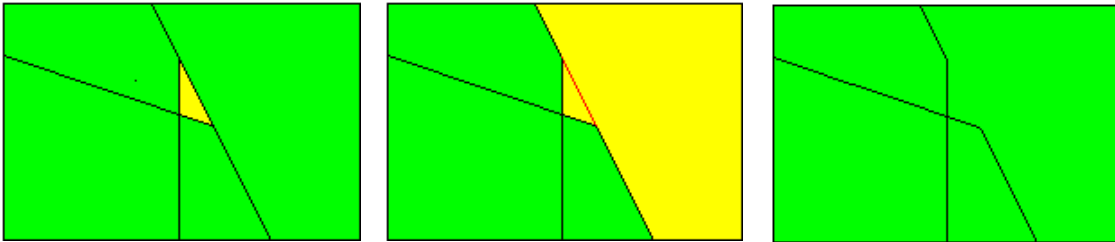
The sliver polygon (in yellow) is selected visually or using a query (f.i., polygons that have less than 177 square ft)

The polygon that will be dissolved with the sliver polygon is also selected (in yellow). The common boundary line is in red.

After running the dissolve operation, the line that bounded the two polygons is deleted. Therefore now there is just one polygon where there were two earlier.

2.2. USING AUTOMATIC DISSOLVE OPERATORS

Here the polygon that gets unioned with the polygon sliver is not picked interactively or manually like in the previous case. It will be chosen by the software because it follows some topological relationship with the sliver polygon. In this case it is chosen because it shares the largest common boundary with the sliver polygon.



The sliver polygon in yellow.

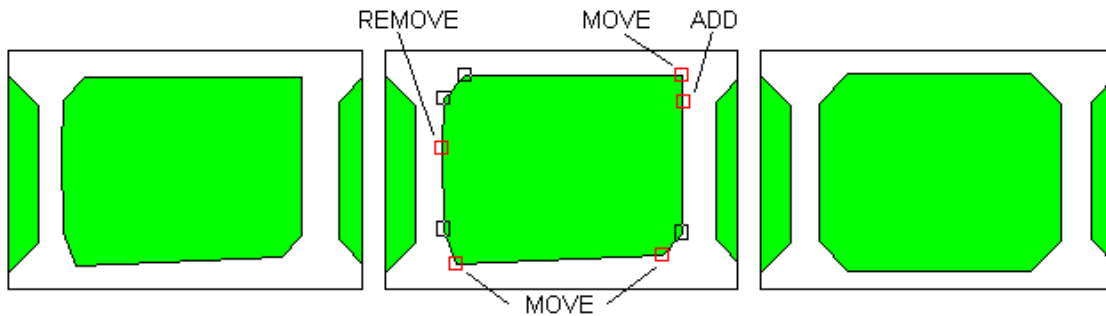
The user specifies the topological condition that the other dissolving polygon has to have (in yellow) . In this case, the largest common boundary (in red) of the two polygons.

The line that separated the two polygons is erased, becoming one polygon.

ADDING, MOVING AND REMOVING NODES AND VERTICES

One may find geometry errors in digitized polygons. In these cases it is advisable edit these errors adding, moving and removing the vertices the vertices of the non-adjacent polygons. For adjacent polygons one may also have to edit nodes that are common to two or more polygons

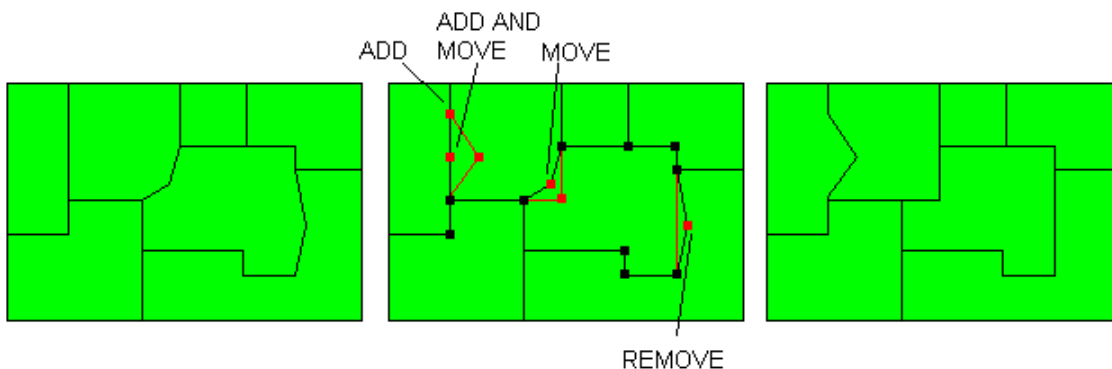
1. IN NON-ADJACENT POLYGONS



The census block has got Existing vertices may be After the edition the geometry errors. moved or deleted. A new geometry is all right. vertex may be added in a line segment.

2. IN ADJACENTS POLYGONS

One may edit nodes that are common to several adjacent polygons.



Some of these polygons have Geometry errors.

Some nodes have to be added, moved or deleted (in red).

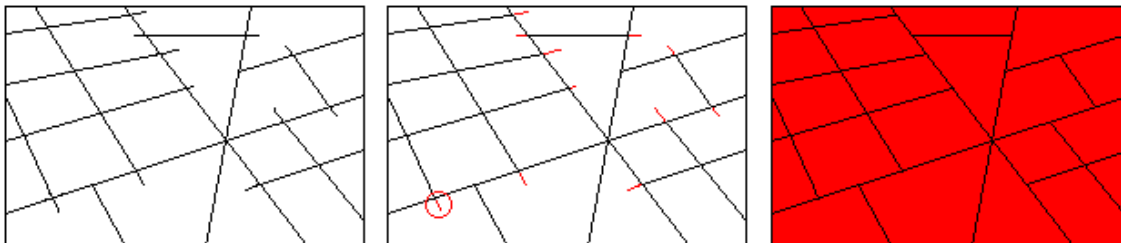
After the additions, the errors have gone.

REMOVING DANGLING ARCS AND NODES

Polygon features are often created out of digitized lines that cross each other. When the endpoint of a line does not fall exactly in the other line, that part of the former line is a "dangling arc", and its endpoint a "dangling node". Dangling arcs and nodes should or should not be deleted. For example, a census block may have a "cul de sac" street. In this case, one may want to leave a dangling arc. More often dangling arcs and nodes have to be deleted. They may be selected visually or through a querying the arcs that have some length or shorter. After selecting them they may be deleted.

Another way of getting rid of them is setting a dangling distance tolerance. In the examples below a dangling distance has been set. The arcs shorter than the dangling tolerance are eliminated once the topology is built.

REMOVING ALL DANGLING ARCS AND NODES

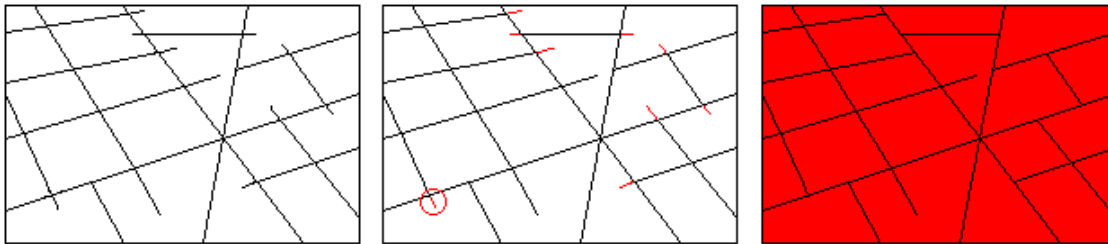


After having digitized lines that cross each other, many dangling short arcs are produced.

The dangling arcs are in red. A dangling distance tolerance has been picked interactively.

The dangling arcs shorter than the dangling tolerance have been deleted after building the polygon topology.

LEAVING SOME DANGLING ARCS



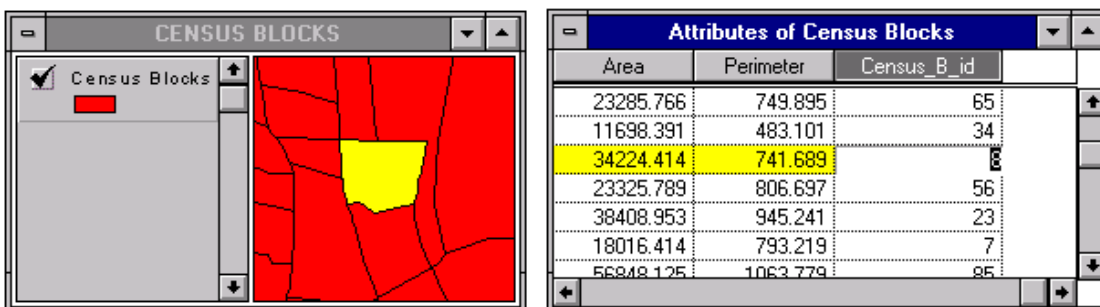
In this case there are also many dangling arcs. Some may be just overshoots and have to be deleted, some others may represent "cul de sac" streets.

However there are two dangling arcs (in black) that are longer than the dangling tolerance distance. When building the polygon topology the red arcs will be deleted, whereas the black arcs will remain.

The two dangling arcs (representing cul de sac streets) remain in this layer of polygons.

EDITING POLYGON ATTRIBUTES

The polygons layer always has a table features. The attributes of the polygons may be edited. There are some items in the table that may be edited, entering new data. New items may also be added in the table. The values of the items can be edited one by one. Other times one may perform operations with all or some of the records of the table.



Some data of the selected polygon are going to be edited. The user calls the table associated with the polygons.

The selected record is in yellow. The item which is edited manually here is the ID of a particular census block.

| Attributes of Stan_pol.shp | | |
|----------------------------|------------|------------|
| Perimeter | Census_b_i | Population |
| 749.895 | 65 | 1256 |
| 483.101 | 34 | 2452 |
| 741.689 | 9 | 1678 |
| 806.697 | 56 | 2102 |
| 945.241 | 23 | 666 |
| 793.219 | 7 | 994 |
| 1063.779 | 85 | 1005 |

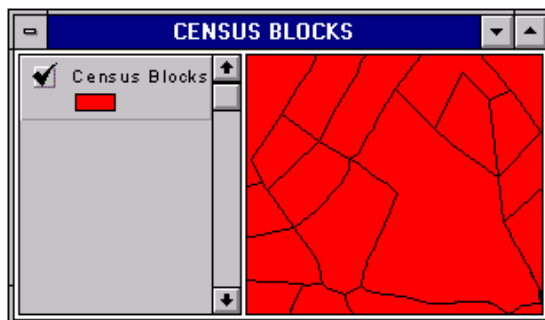
One may add more items or columns to the table and edit the data. Another possibility may be load a table in the GIS software that has got some items, so that it may be joined with the table that is associated with the polygons. The table we load and joined has to have a common item with the polygons table and carry the same values in this particular item.

| Attributes of Stan_pol.shp | | |
|----------------------------|------------|---------|
| Census_b_i | Population | Density |
| 65 | 1256 | 0.05394 |
| 34 | 2452 | 0.20960 |
| 9 | 1678 | 0.04903 |
| 56 | 2102 | 0.09011 |
| 23 | 666 | 0.01734 |
| 7 | 994 | 0.05517 |
| 85 | 1005 | 0.01768 |

One may calculate the values of a new item operating with existing items. In this case the values of the item "Density" have been obtained dividing the values of the "Population" item by the "Area" item.

ADDING, MOVING AND RENUMBERING POLYGONS LABELS

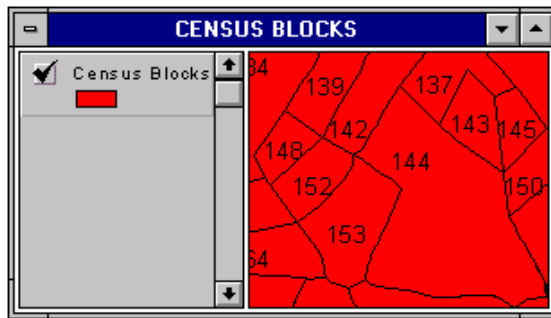
In GIS, polygon labels are often stored as values of an item in the polygon table.



In this layer of polygons...

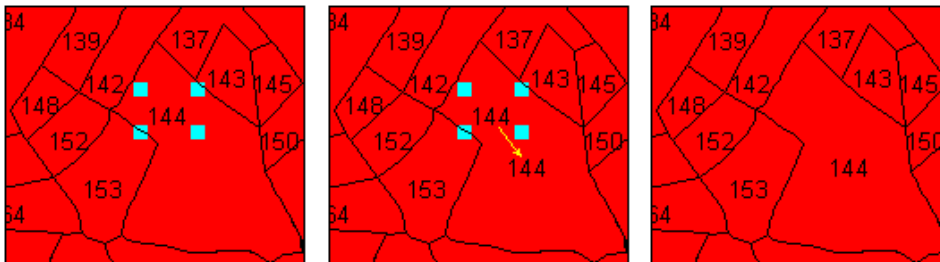
| Attributes of Census Blocks | |
|-----------------------------|-------------|
| Perimeter | C_Blocks_id |
| 291.939 | 151 |
| 348.788 | 152 |
| 511.002 | 153 |
| 506.662 | 154 |
| 614.069 | 155 |
| 501.663 | 156 |
| 434.212 | 157 |

...the values of the ID item



...are used as the polygon labels

The labels may be selected as if they were graphics and moved or deleted in the display.



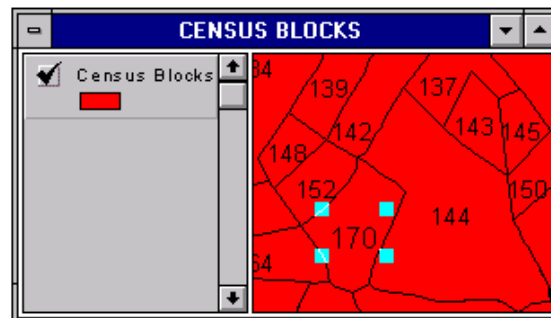
Here a polygon label is selected... then dragged and dropped ...so its location has been changed

There is a dynamic link between the label values in the table and the display.

| Attributes of Census Blocks | | |
|-----------------------------|-------------|---|
| Perimeter | C_Blocks_id | |
| 291.999 | 151 | ↑ |
| 348.788 | 152 | |
| 511.002 | 153 | |
| 506.662 | 154 | |
| 614.069 | 155 | |
| 501.663 | 156 | |
| 434.212 | 157 | ↓ |

| Attributes of Census Blocks | | |
|-----------------------------|-------------|---|
| Perimeter | C_Blocks_id | |
| 291.999 | 151 | ↑ |
| 348.788 | 152 | |
| 511.002 | 170 | |
| 506.662 | 154 | |
| 614.069 | 155 | |
| 501.663 | 156 | |
| 434.212 | 157 | ↓ |

If the user wants to edit a label item (in this case C_blocks_id)... one picks the record and changes the value



And then the change is updated in the display side.

BUILDING AND PROTECTING TOPOLOGY

Every time a polygon is added or edited the topology of the polygon layer changes. Once the edition of the polygons is done, the user must re-build the topology so that the GIS software validates the changes in the geometry according to the (defined or default) tolerances. Then, the user may query the topology attributes of the polygons such as the area and the perimeter. However the user should not edit these items on his/her own. It may be advisable that the items which depend on the geometry directly be protected by the GIS manager.

| Attributes of San_pol | | | | |
|-----------------------|---------------|------------------|-----------------|-------------------|
| <i>Shape</i> | <i>Area</i> | <i>Perimeter</i> | <i>San_pol_</i> | <i>San_pol_id</i> |
| Polygon | 79928.630000 | 2057.821000 | 2 | 801909154 |
| Polygon | 46605.090000 | 887.642800 | 3 | 801909153 |
| Polygon | 450961.600000 | 3949.990000 | 4 | 801909145 |
| Polygon | 24925.920000 | 881.492700 | 5 | 801909151 |
| Polygon | 15346.410000 | 749.296700 | 6 | 801909148 |
| Polygon | 15458.730000 | 598.462400 | 7 | 801909150 |
| Polygon | 16683.470000 | 687.264200 | 8 | 801909147 |
| Polygon | 24525.110000 | 722.892600 | 8 | 801909149 |

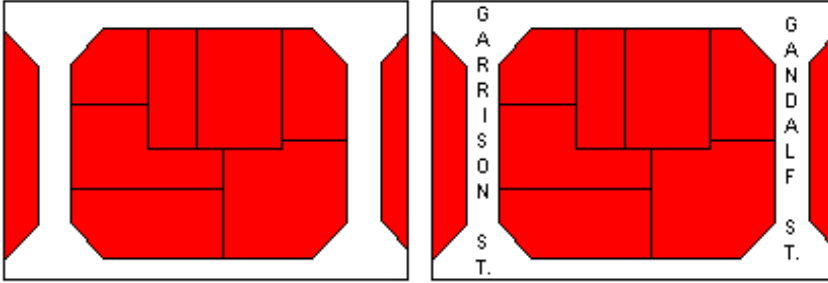
The area and perimeter items have been created and their values calculated by the GIS, according to the geometry. There is also the internal ID item (here the item *San_pol_*): the GIS gives a unique number to every polygon.

PROTECTING DATA AND DOCUMENTING ALTERATIONS

Besides protecting some items that should not be editable, the GIS manager may protect the data in a broader sense. In a corporate GIS, where there are many terminals networked, the users may have different access rights to the data: some may just visualize or query the data, other may download to the local computers the data, others may even update the data, modifying them. Therefore it may be necessary for the GIS manager to set the user privileges. For instance, a user working with the GIS software may be asked his or her login and password when trying to load some GIS data, or when trying to edit the data.

ADDING ANNOTATION

Annotations are usually texts used for mapping purposes. The texts are not attributes of some geometry features (typically polygons, lines or points) but go "independently" so to speak. They make clearer the map, giving some character or numeric information.



Here the polygons represent city parcels (in red). Between the city blocks there are streets, but they are not represented by any feature, one just sees the background, in white.

Therefore, annotations may be useful or the reader of the map. In this case the street names have been written in the canvas.

Created: May 14, 1997. Last updated: October 5, 1998.