

The Importance of Geodatabases in a Geographical Information System

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Abstract. This paper presents the main procedures used to create a geodatabase of a geographic informational system. Once settled the database scheme for a city, the data maintenance becomes much easier and getting information on the land is faster. Also, using editing in ArcMap makes possible the highlighting of the geodatabases advantages over coverages and shapefiles.

Keywords: geodatabase, ArcInfo, domain values, merge policy, split policy.

INTRODUCTION

Within the new economy taking over in the competitive societies, the informational systems created for data and information management are becoming elementary with regard to the processes of decisions making and elaborating development strategies. Besides the classical types of data used in the information systems, the geospatial data have strongly developed in the recent years. These data refer to the geographic localization of certain objects on the planet, their shape and size. The spatial data represent the central part of a GIS and they include digital maps. These data are materialized by means of files added up into a geodatabases.

In this paper we will build a geodatabase for a city (South Dakota – Rapid City) and we will present some procedures available for geodatabases in ArcGis. Also, we will illustrate the advantages of using geodatabases.

MATERIALS AND METHODS

The city geodatabase contains three standalone feature classes: landuse, boundary, parcel and two feature datasets: Commerce including the tourists attraction points and Transportation including the roads features (Fig. 1). The description of all the objects in this geodatabase can be stored and saved without any actual data and then used to generate multiple geodatabases with the same structure for developing large complex databases with a tested scheme. In this geodatabase, the feature classes all share the same coordinate system (NAD 1927 UTM Zone 13N). The entire dataset, including features, attribute tables and coordinate system is transferred into the database during the import process.

The geodatabase also contains one empty linetype feature – Routes. Using editing in ArcMap is possible to add features for several types of routes.

One advantage of using geodatabases lies in setting up the default values for attributes. For example, using this favor we will digitize some routes between the most important tourists attraction. The most common type of the route is "by car access", involving five

tourist attractions and has the cost equal to 100 euro. In this order, we will set default values for each of these fields (Fig. 2).

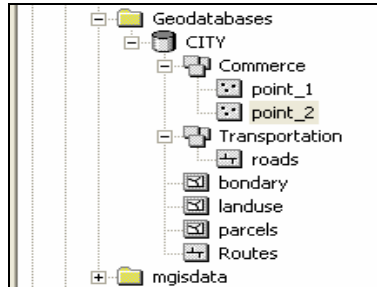


Fig. 1. General structure of our geodatabase

When we digitize a different type of route (for example pedestrian route) it is not necessary to create a different linetype feature. It is enough to change the defaults values for the field properties (Fig. 3).

New Feature Class	
Field Name	Data Type
OBJECTID	Object ID
SHAPE	Geometry
Linetype	Text
Point	Short Integer
Cost	Short Integer

Fig. 2. Entering the fields for the Routes

Field Properties	
Alias	Linetype
Allow NULL values	Yes
Default Value	car access
Domain	
Length	10

Fig. 3. Setting up default values for attributes

Another great advantage of geodatabases includes using domain for attributes. An attribute domain constrains the values that may be entered for a particular attribute which eliminates incorrect or extraneous values. In this respect we will create some attribute domains for the Roads in City database: type of road, number of lanes, direction and the streets type abbreviation (Fig. 4). We use two types of domains: range domain which specifies the lowest and the highest possible values and coded domain which allows only certain values taken from a list. Also, we will create the attributes in the Roads file and, at the same time, we will assign the domains and set the default values (Fig. 5). We will use this convenience when we edit the properties for the Center Street and we will test for attribute errors by using the validation function.

Each attribute domain has associated two policies: merge and split. Setting up these policies correctly can save much time during editing. Considering the benefit brought by these policies it can be possible to manage some Parcel attributes during editing.

The merge policy setting for a domain and the Sum policies assigned to Area and Values fields offering the possibilities to combine two parcels into one. The result is one parcel with the new values of the fields as the sum of the input features.

The split policy is acting in the same way as merge policy, but it is necessary to assigned also the Geometry Ratio policy for the Area and Values fields.

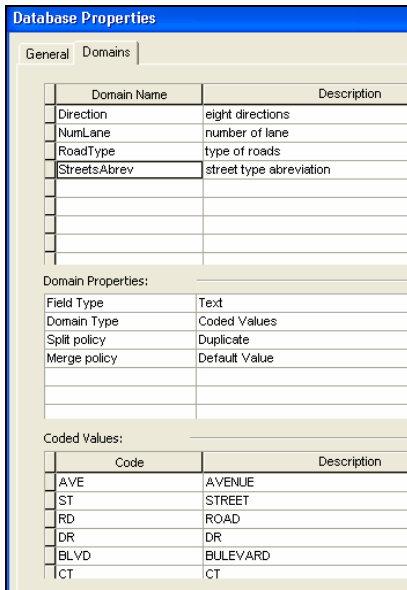


Fig. 4. The Roads domains

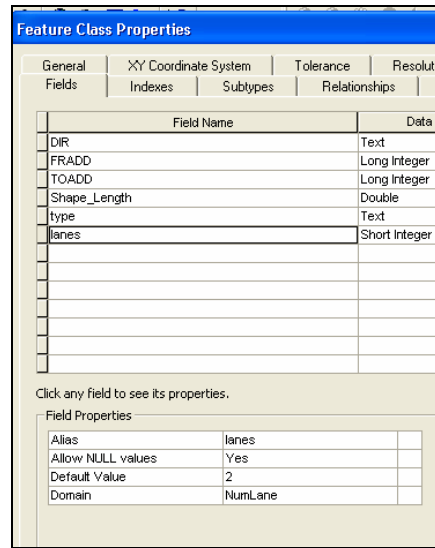


Fig. 5. Setting the domains and the default values for lanes field

RESULTS AND DISCUSSION

Once the geodatabase is created, the next step is the graphical representation using Arc Map. In Fig. 6, the digitizing process result can be noticed: two types of routes are represented in the same feature classes by changing only a default values for the field. This approach saves editing time and helps reduce attribute errors.

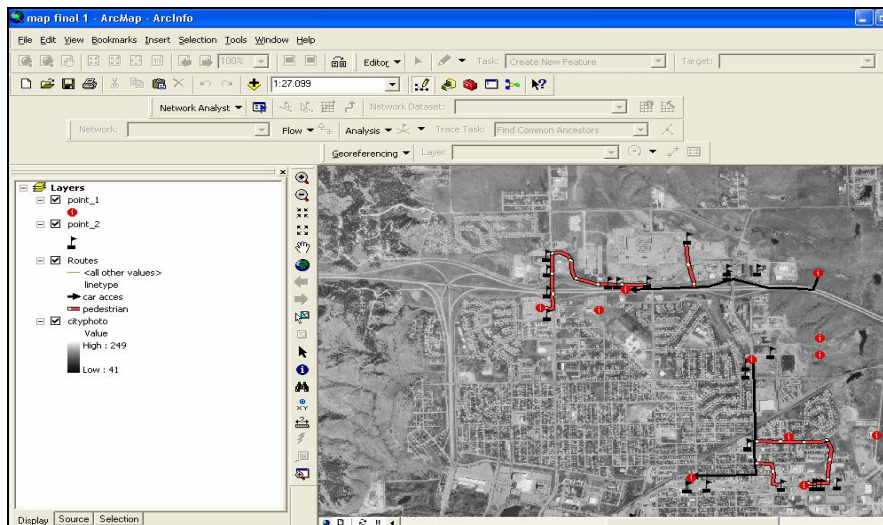


Fig. 6. The result of digitizing process: two types of routes

The advantage of using domains for attributes in the database gives the possibility to edit the attributes for the Centre Street (Fig. 7). The constraints imposed by domains eliminate the incorrect entry values. Using the validation function, the result can be noticed in Fig. 8, the errors were found by establishing the value 44 for the number of lane, a value that does not fit into previously established field.

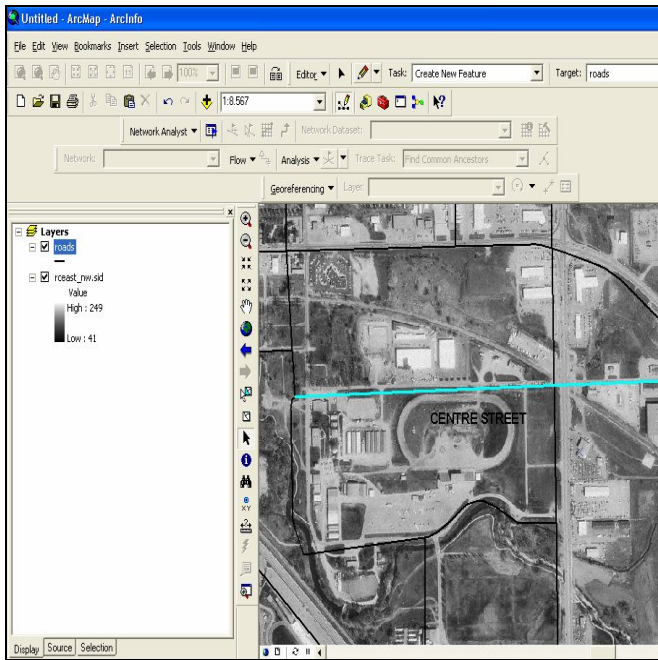


Fig. 7. Editing the Centre Street

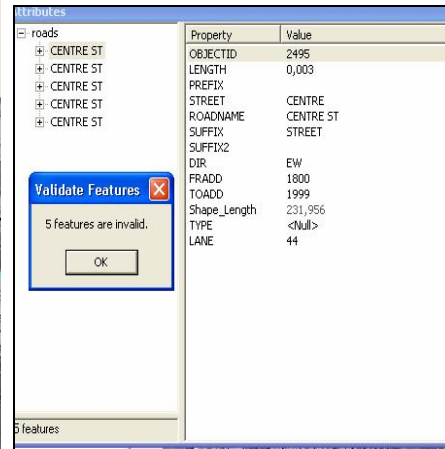


Fig. 8. Using the validation function

The map given in Figure 11 is representing the result of using the two policies (merge and split) described above. In coverages or in shapefiles, the merged parcel will contain the attributes of the first feature selected. In geodatabases, after the merge, the new feature will be assigned an area equal to the sum of the areas in the original polygons (Fig. 9). In the case of split policy, if the Geometry Ratio is used, the new value is assigned based on the relative size of the original and split features (Fig. 10).

Selected Attributes of parcels								
OBJECTID *	Shape *	Id	Parcel ID	Area	Zoning	ParcelValu	Shape Length	S
11	Polygon	8	8-453922	8818	low	137000	137,249323	
10	Polygon	8	8-453921	10227	low	143000	142,712096	

Fig. 9. The Merge Policy applied for parcels 10 and 11

Selected Attributes of parcels								
OBJECTID *	Shape *	Id	Parcel ID	Area	Zoning	ParcelValu	Shape Length	S
11	Polygon	8	8-453922	19045	low	280000	172,34014	

Selected Attributes of parcels								
OBJECTID *	Shape *	Id	Parcel ID	Area	Zoning	ParcelValu	Shape Length	S
35	Polygon	8	8-453934	17438	low	174000	173,830073	

Selected Attributes of parcels								
OBJECTID *	Shape *	Id	Parcel ID	Area	Zoning	ParcelValu	Shape Length	S
35	Polygon	8	8-453934	10723	low	107000	133,612041	
39	Polygon	8	8-453934	6715	low	67000	112,343695	

Fig. 10. The Split Policy applied for parcel 35

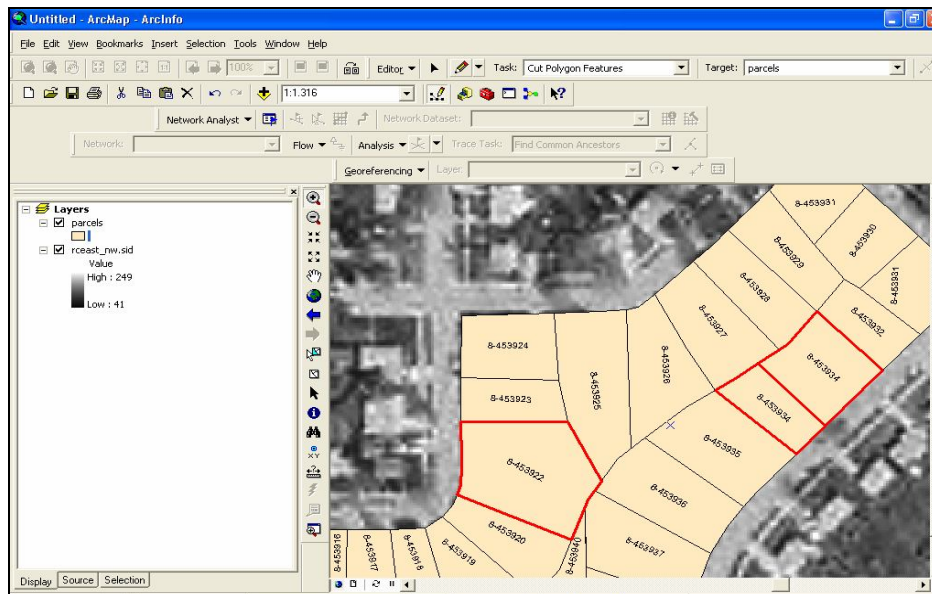


Fig. 11. Digitizing the parcels

CONCLUSIONS

Using geodatabases in a geographical information system offers several advantages over both coverages and shapefiles and provides many more benefits.

- The design and structure of a geodatabase can be used to generate other geodatabases by importing shapefile or coverage of existing data.
- An important role for geodatabases is the sharing of common data among a large user community.
- Geodatabases also provide validation rules that control how features behave.
- Advanced and powerful features of the geodatabases are available by using ArcInfo.

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