USING GIS TO ASSESS PRESERVATION LEGISLATION

By

Daniel Mackay, Preservation League of New York State
And
John J. Knoerl, Ph.D.

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ABSTRACT

A Geographic Information System (GIS) is most often thought of as a tool for managing resources at the local and state levels of geography. Business, real estate, health services, education, natural and culture resource management applications are fairly commonplace and are being used to good effect. The use of GIS as a tool in the arena of public policy and legislation is not as widespread as more traditional applications, noted above. Legislators, their staff, advocates and opponents rarely use GIS to analyze the impact of preservation legislation. Yet many parts of preservation laws are replete with spatial provisions. If GIS were used to evaluate or predict the intended (as well as the unintended) effects of such proposed laws, then the legislative process would be well served and possibly better legislation and preservation would result.

In support of a continuing campaign to secure a New York State income tax credit for rehabilitation of historic residential structures, the Preservation League of New York State launched a recent Geographic Information System (GIS) -based initiative to quantitatively assess the impacts of two tax credit proposals before the New York State Legislature. A systematic comparison of the impacts of these legislative proposals was required in order to focus attention and generate additional legislative support for this program. With partial funding secured from the National Trust for Historic Preservation, the League employed the services of KEI Maps to create and manage the GIS database at the core of this work.

Such a comparison would have been impossible using anecdotal data. However, by employing GIS as a tool, quantitative data on who would benefit from each proposal was clearly determined and brought into the debate. GIS analyses elevated the discussion from the realm of anecdotes and speculation to the quantitative. In turn, this quantitative analysis provided critical information that informed the legislative outreach conducted by the League on a day-to-day basis.

Using the GIS database, which included Census Tract data, many important questions were answered. For example, how many historic homes would qualify under the proposed legislation? How many of these homes are located in each Assembly, Senate, and Congressional District? How many structures are located in urban and rural areas? How many qualified homes are owner-occupied? What is the racial and ethnic diversity of neighborhood having qualifying historic homes? What is the average median value of homes in neighborhoods having qualifying historic homes? What are the median monthly mortgage costs, and what is the Median Family Income for neighborhoods having qualified historic homes? Creating this database allowed the League to peer into the demographic heart and soul of New York State's 700+ National Register Districts for the first time ever, and provided the League with a unique tool to inform and advance preservation policy.

Our report will detail the technological challenges and requirements behind creation of this database, its use and effectiveness for enhancing and advancing a public policy agenda, and a vision for expanding the database and its applications in support of a broader statewide and specific local preservation policy agendas.

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1.0 INTRODUCTION

The Preservation League of New York State (PLNYS) has long been involved with advocating governmental policy that is sensitive and supportive of historic preservation. Through advocacy, technical assistance, grants, and support the PLNYS has successfully changed governmental behavior at both the statewide and local levels.

Increasingly, the PLNYS has come to realize that to be successful in its advocacy role it must develop a strategy that relies on the use of comprehensive data as opposed to antidotal data to support its policy agenda. The critical importance of the proposed New York State Neighborhood Reinvestment Act of 2002 provided an excellent opportunity to begin to develop a comprehensive database of information about historic properties in New York State which could be used to argue for passage of the legislation.

As it turned out, the Governor had an alternative version of the bill, which he had introduced to the New York State Assembly. The comprehensive database was immediately put to use to draw comparisons between the two versions of the bill. This facilitated discussions that were are more detailed and meaningful had this database not been available. Both advocacy meetings and meatiness with legislators and the governor's staff were able to refer to the same set of information. Tables and maps were generated in what may be closely described as "real time" given the fast paced setting of the legislative process.

How was this database created, what were the technical challenges that presented themselves throughout the project, and how will the database be improved and used in the future, is the subject of the balance of this paper.

2.0 BUILDING THE GIS DATABASE

The data for this project was developed in a Geographic Information System or "GIS." Many historic preservationists have heard about GIS but only a few have actually used it. GIS is a computer-based tool for analyzing and mapping things that exist and events that happen on Earth. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. GIS goes beyond simple cartography. In a GIS data are represented as different layers such as roads, land cover, or the locations of historic buildings. Each layer holds information about a particular feature such as the name of the road, forest type, or architectural description of a historic building. Each feature is then linked to a position on the graphical image of a map. Graphic display techniques in GIS make relationships among map elements visible, heightening a person's ability to extract and analyze information. This information can then be used to generate statistics, measure distances and areas, develop new solutions or options, propose new sets of research questions, or design and print hard copy maps. These abilities distinguish GIS from other information systems and make it valuable to a wide range of public and private enterprises for explaining events, predicting outcomes, and planning strategies.

A Geographic Information System (GIS) is most often thought of as a tool for managing resources at the local and state levels of geography. Business, real estate, health services, education, natural and culture resource management applications are fairly common place and are being used to good effect. The use of GIS as a tool in the arena of public policy and legislation is not as widespread as the more traditional applications noted above. Legislators, their staff, advocates and opponents rarely use GIS to analyze the impact of pending legislation. Yet many parts of proposed laws are replete with spatial provisions. If GIS were used to evaluate or predict the intended (as well as the unintended) effects of such proposed laws, then the legislative process would be well served and possibly better legislation would result.

In advocating the passage of *The New York State Neighborhood Reinvestment Act of 2003*, the PLNYS believed that GIS could be a useful tool in arguing the merits of this legislation. Through the use of spatial overlays, quantitative data on who benefits from the bills passage was clearly determined and brought into the debate. GIS analyses elevated the discussion beyond the realm of antidotes and speculation.

To build the GIS database we organized the project into four phases: data acquisition, data preparation, analyses, and reportage.

Data Acquisition

Data acquisition involved establishing the objectives of the analyses, identifying the data needed to conduct the analyses, identifying the sources for acquiring the data, and acquiring the data itself.

The three objectives of the analyses were:

1 to determine the number of potentially Qualifying Historic Homes for each version of the New York State Neighborhood Reinvestment Act of 2003

2 to determine where these potentially Qualifying Historic Homes were located with respect to Targeted Area Residences, State Empire Zones, Zones of Equivalent Areas, Qualified Census Tracts, Urban Areas, New York State Assembly Districts, New York State Senate Districts, New York State U.S. Congressional Districts, New York State Democratic Assembly Districts, New York State Republican Assembly Districts

3 to develop a profile of the neighborhoods within which these potentially Qualifying Historic Homes are located by using Census 2000 housing variables of percent home ownership, racial and ethnic diversity, average median value of housing units, average median monthly owner costs of housing units, and median family income

Table 1 identifies the data acquired for the project and its source.

Data preparation

The raw data received from the various sources was examined, projected into UTM Zone 18 using North American Datum 1983, merged with stand alone database tables, and in certain instances, manipulated to achieve the appropriate data categories for the analyses.

Table 2 identifies the final data sets that were prepared using the data acquired.

There were two parameters used in creating the QHH.shp layer:

- Estimating the number of contributing residential properties in historic districts
- Locating the contributing residential properties within their historic districts

Estimating the number of contributing residential properties in historic districts.
The allnr.shp (the map layer of historic properties provided by the New York State Historic Preservation Office) did not include the number of contributing properties within historic districts. However, by joining the nris.dbf to allnr.shp this number was obtained.

Unfortunately this number was not broken down by current function e.g. residence, commercial, industrial etc. To estimate the number of residences in the historic district the following procedure was followed:

- a statistically valid random sample of 18 historic districts in New York State was drawn from a population of 488 historic districts that were coded as residential.
- The original physical file of the National Register nomination was reviewed and a count of the number of contributing residential properties was made for each historic district drawn in the sample
- When all 18 of the nominations were reviewed and tallied, an average of 76 percent of contributing properties were residential was obtained
- Therefore, for each historic district coded as residential, the total number of contributing properties in that district was multiplied by .76 to obtain the estimate of residential structures in that district

Locating the contributing residential properties within their historic districts.

The allnr.shp did not plot the point locations of each contributing property within an historic district. However, it was important to make an estimate of where these contributing properties are located in order to determine if they are located in a TAR. To make this estimate three procedures were used:

- randomly placing each contributing property within the district but constrained to within 10 feet of the streets within the district
- address matching or geocoding
- creating a centroid point for individually listed properties

Random Placement Method

The random placement method employed the following procedure for each historic district that was not geocoded:

- All streets that intersected the historic district boundary were selected
- A buffer ring was created around the selected streets at 1 foot from the street center line out to 10 feet on each side of the street
- The buffer ring was clipped using the historic district boundary to eliminate buffer areas outside of the district
- The ArcView extension "AlaskaPak" developed by the National Park Service Alaska GIS Technical Support Center was used to randomly generate the locations of the contributing residential buildings within the buffer developed for the historic district

Geocoding

Geocoding is a procedure that creates a new map layer of points representing the location of a street address. The following procedure was employed for each historic district that was geocoded:

- the original National Register nomination form was reviewed and the street address for each contributing residence was entered into an Access database
- the database was matched up against the street layer for New York State which contained the address ranges for each street segment in the layer
- when a match was found the street number for the contributing property is interpolated between the address range for the street segment with which it was matched
- a new point shape file is created for the matched addresses
- a geocoded historic district was used only if more than 90 percent of the addresses of its contributing properties were matched
- if a geocoded historic district did not achieve a 90 match then the locations of its contributing buildings were determined using the Random Placement Method

Centroid Placement Method

The centroid placement method was used to convert individually listed properties that were originally digitized as polygons into point features. This conversion was necessary because the geocoding and random placement methods generated points and compatibility was required to conduct the analyses.

The centroid placement method employed the following procedure for each individually listed property:

- The ArcView extension "True X,Y Centroid" was used to add the X and Y coordinates of the center of property's polygon to its attribute table
- The ArcView "Add X, Y Event Theme" function was used to create a point layer using the X and Y coordinate fields in the property's polygon attribute table
- The event theme was then converted into a new shapefile of points

Table 3 identifies the method used in plotting QHHs for each historic property used in the analysis

Data analyses

GIS analyses can be generically categorized into three types of operations.

- Geometric modeling such as calculating distances, generating buffers, and calculating areas and perimeters e.g. a map layer of Revolutionary War battlefield boundaries could be used to calculate the average acreage of these battlefields.
- Coincidence modeling discovers or establishes relationships among two or more map layers that are overlaid upon each other e.g. a FEMA 100 year floodplain map layer might be overlaid onto the a map layer of historic buildings to determine how many historic buildings are at risk for flooding.
- Decision support modeling identifies optimal locations, establishes optimal regions, or best paths based upon a set of criteria e.g. optimal places for siting a sewage treatment facility can be identified using criterion for soil, slope, population density, sewerage grid etc.

The GIS analysis for this project used coincident modeling as the main approach to identifying the impact of the legislation. There were four main coincident modeling GIS operations employed in the tables presented in the project report:

- Selection by location: features from one map layer are selected if they are spatially coincident with the features of another map layer e.g. QHHs that are within a TAR, Urban Area, Assembly District etc.
- Selection by attribute: features are selected from a map layer which meet the criteria of a query e.g. Census Tracts whose Median Family Income is between 41 and 50 percent of the State's Median Family Income
- Joining attribute tables based on attribute values: the attributes of one table are added to the attributes of another table based on matching values of a field common to both tables e.g. the attributes of the NRIS attribute file are added to the allnr attribute file based on the Refnum (the unique id for each property listed on the National Register)
- Joining attribute tables based on spatial location: the attributes of one table are added to the attributes of another table based on the spatial coincidence of the map layers to which these tables belong e.g. attributes of U.S. Census Tracts can be added to the attribute table of the Qualifying Historic Homes. In this case a given QHH will obtain all the Census Tract attributes of the Census Tract in which it is located.

Table 4 identifies which operations were carried out for each table in the report.

Map 1 illustrates a typical select by location operation of an historic district onto a TAR map layer to select out those Qualifying Historic Homes than fall within a TAR.

Reportage

Tables
Twenty-nine tables were generated for the report. These tables were initially begun in ArcMap using the report tool to create the initial format. They were then exported into a Word Rich Text document and brought into Word for final editing and formatting. The only exception was a table that was developed using Excel and then exporting as a tab delimited text file. This file was then brought into Word and then converted into a table for final editing and formatting.

Maps
Twenty-four maps were generated for the report. A template was developed and used consistently in the generation of the maps. In numerous occasions an inset map of the New York City area was required in order to display the data in that area. The maps were formatted in ArcMap and exported as a pdf image.

A CD was created containing the following items:

- THE NEW YORK STATE NEIGHBORHOOD REINVESTMENT ACT OF 2003: A GEOGRAPHIC INFORMATION SYSTEM ASSESSMENT as a Word document
- map images in pdf
- tables as Rich Text Files
- shapefiles: qhh, NYHistoric Properties, tar, sez, zea, qct, assembly, senate, congress, urban, tr36_utm00, allnr, counties
- dbf files: DIVERSIT, HOUSEINC, HOUSEVAL, MEDFAMIN, OWNERSHI, OWNERCOS
- ArcExplorer GIS viewer software to view the shapefiles and dbf files

3.0 IMPROVEMENTS AND FUTURE USES

Given the initial success of the GIS database in the context of the New York State Neighborhood Reinvestment Act of 2002, what is PLNYS' vision for improving and using it in the future? The most immediate improvement is to more accurately locate the contributing historic properties both residential and commercial within the state's historic districts. One potentially promising approach is to link the locations of contributing historic buildings to the New York State Office of Real Property's GIS database. Their database has a point for every tax parcel for most of the counties in New York State. The database also contains the street number and name for each tax parcel point. The latter data can be used to match up the street addresses of the contributing properties. Their data is likely to be accurate to the extent that it is based on tax parcel maps, which are usually drawn to 1:2400 scale or better.

Not only will the locations of contributing properties be more accurate but by linking to the Real Property database, all of the information contained in that database will now become part of the GIS historic properties database as well. Information such as the assessed value of the property can be used by the PLNY to assess the dynamics of change in historic neighborhoods for example. Other types of information include date the house was built, owner of the property, property code (e.g. single family, two family dwelling etc.), and tax parcel id.

The second priority to improving the database is to add data on locally designated properties and historic districts. This data is key to developing and advocating preservation policy that is relevant to the local level of historic preservation. As is likely to be the case, the quality of data will be variable from one locality to another. This is primarily due to the fact that older data was less rigorously recorded and the absence of standards on locational accuracy, projection, datum, and other parameters.

We believe that this database is in good enough shape at this point to begin to use it beyond the NYNRA context. Six future uses immediately come to mind. First, the database can be used to set up a monitoring program to assess the impact the NYNRA should it become law. Since every law eventually comes up for

reauthorization, the PLNY will be in a strong position to assess the strengths and weaknesses of the law and be able to make suggestions for amending the law during the reauthorization process.

Second, the database can also be used to model the impact of the Historic Homeowners Assistance Act on historic properties in New York State. The bill was again reintroduced in the U.S. Congress this year. This assessment could prove key to convincing the New York State Congressional delegation to support the bill. Currently support is not strong among the New York delegation.

Third, wind energy generation is quickly gaining attention in New York State. With support of the State, energy companies are mapping out where the high-energy wind areas are located across the state. Using the GIS database of historic properties, the PLNYS will be able to steer the plans of these companies away from the more sensitive historic areas. Not on case by case or crisis induced basis but rather on a comprehensive statewide bases. The latter will provide both parties with more options because the larger picture will be available to them to assess alternatives.

Fourth, on another front, New York State will be reforming its building codes in the near future. The current code makes it difficult to redevelop historic downtown, commercial, or residential neighborhoods. Using the GIS database proposed changes in the code could be modeled for their impact on such redevelopment. The PLNYS will be in a strong advocate position in seeing to it that the revised code is sensitive and supportive of preserving these historic places.

Fifth, each year the PLNYS selects seven historic places to save. The "Seven to Save" program draws attention to important preservation issues such as abandonment, disinvestment, demolition, and development through the selection of seven properties that reflect these problems. In the future the GIS database could play an important role in making the selection with an eye toward the geographic distribution of these selected properties. It would also be possible to use the GIS database to extend the concept to saving whole historic neighborhoods. The database would be used to identify potential candidates neighborhoods using Census data that reflect the demographics and housing variables. Census data can be tied to preservation issues such as gentrification, ethnic diversity, accelerated ownership turnover, housing values, or ownership costs. The historic neighborhoods selected to save would be a rallying point for local leaders and residents alike.

Sixth, on a long-term basis, the PLNYS could use this database to set up a monitoring program across the state. Such a program would continually monitor the vital signs or health of historic properties and provide early warning on developments that potentially could be detrimental to the preservation of these properties. Additionally, summary statistics could be generated quickly when needed as well as on an annual basis such as a end of year report on the state of historic properties. The database could be used to establish criteria that would define areas across the state that are conducive or not conducive to preserving historic properties. Such targeted areas could be prioritized for PLNYS intervention thus making the most of the available preservation funds

There are to be sure, many other applications that the GIS database could develop and the PLNYS will explore these over time. But for the moment we are just beginning to exploit the possibilities. We started the project by applying GIS to model the impact of legislation. To do that we needed to assemble a GIS database of historic properties along with other data themes in order to make the relationships needed to highlight statistics that were relevant to the debate about the impact of the legislation. The process of acquiring the data and then preparing it for the analyses constituted a large part of the protect. However, once the data was in proper order, the analyses flowed quite easily thus allowing for its quick dissemination to those who needed it. This process has encouraged us to look to the future in terms of improving the database and applying it to other areas of preservation policy. We are confidant that our situation is not unique and that other preservation advocacy groups could benefit from using GIS like we did.