

Mapping Historical Information Using GIS

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ABSTRACT

The City of San Luis Obispo, California, is rich with history. It is one of California's oldest communities that began with the founding of Mission San Luis Obispo de Tolosa in 1772 as the fifth of twenty-one California missions. Most historical information exists as paper documents, but they are not easily accessible. Scanned historic maps are georeferenced and scanned documents are referenced as a link in the GIS layer to easily access and manage the historic information.

INTRODUCTION

The City of San Luis Obispo, California is located midway between Los Angeles and San Jose. The community began with the founding of Mission San Luis Obispo de Tolosa in 1772 as the fifth of twenty-one California missions. The City is regarded as the epicenter of government, commerce, education, and culture. The prominence of the City is apparent as the County shares same name. The citizens of San Luis Obispo are proud of their heritage and put great value on historic information. However, most of the historical information exists as paper documents that are not easily accessible. When paper document is checked out, others have to wait till it is returned. In many cases, historical documents are locked in vault or file cabinets; access is limited to few individuals. As paper documents age, they are hard to read due to fading ink and changing of paper colors. They are also very fragile.

The City of San Luis Obispo needed a solution to provide historical information digitally to allow multiple people to access the data easily and quickly. Paper documents were scanned and converted to PDF files. Since most of the documents are associated with locations, GIS

application was used to hyperlink the PDF files to various GIS layers. This paper showcases several examples of how some of the historical information is being managed by the City of San Luis Obispo.

MATERIALS AND METHODS

The City of San Luis Obispo did not have any funding or human resources to do the time-consuming tasks of scanning the documents and creating GIS layers. The decision was made to use California Polytechnic State University students who are taking GIS classes to do the project. Due to overwhelming amounts of documents, the tasks had to be assigned in phases. Tasks were generally assigned so that students can accomplish it in 10 weeks. Students first scanned the documents into PDF files. The PDF file format was chosen since it can be opened by virtually all devices. If the document was a map, it was saved in PDF and JPEG file format for georeferencing purpose. Scanned documents are organized by types and placed in City's network storage for internal use and in web server for the public access. Significant time was spent to associate the document to specific location on the map. This involved creating a GIS layer with hyperlink field that will open the PDF files. Finally, applications were developed for easy access. If user was proficient in ArcGIS Desktop program, they accessed the files directly from map document (.mxd). Public and those who do not have the ArcGIS Desktop application used ArcGIS Online maps to access the files. Fortunately, City had all necessary hardware and software to do the work. There was no cost except for one to two hours of GIS Supervisor's time per week.

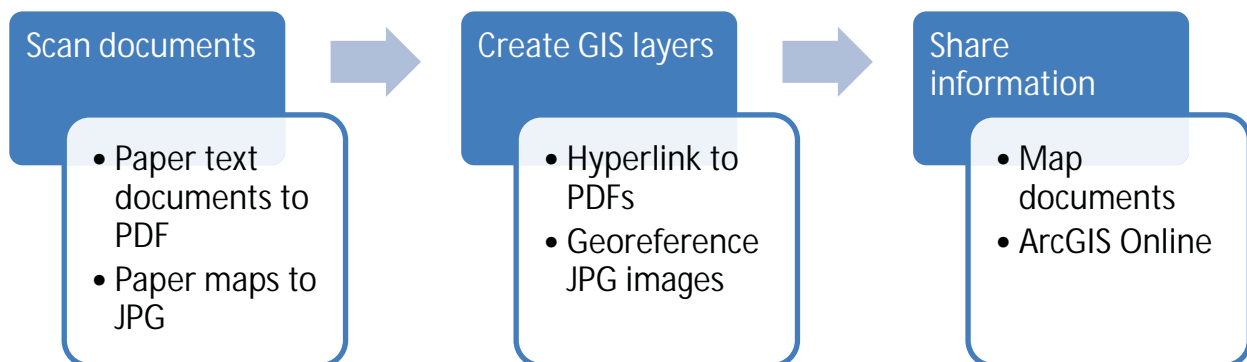


Figure 1. General workflow diagram

CITY BOUNDARY AND RECORD OF SURVEYS

The City and the County staff had difficult time accessing the annexation document. The original signed copy was located at the Local Agency Formation Commission (LAFCO) office. Some of the old documents were filed away in the storage place that required several days to retrieve it. There was strong desire to turn all annexation records into PDF and have it publically available by many governmental agencies. A special request of checking out all available LAFCO documents was approved by the LAFCO staff. Documents were scanned using the LAFCO file number as the identifying file name. Students spent many hours digitizing the annexation areas as described in the document and entered searchable information such as document number, recorded date, size, and annexation name into the GIS layer's attribute table. This allowed user to search the document based on attribute values. Hyperlink field with file location information allowed user to open the document by simply clicking on the map feature.



Figure 2. Annexation layer with hyperlink to PDF document



Figure 3. Example of scanned document that is hyperlinked from GIS layer.

Another very common request was looking up the tract/parcel maps and record of surveys. Students mapped over 1,700 parcel maps and record of surveys with hyperlink to PDF files. This simple point GIS layer saves tremendous amounts of time for City staff in accessing the information. City can now search the document spatially. For example, selecting all record of surveys within 500 feet of certain road or parcel is very simple “search by location” function in the ArcMap application. This is not possible without the GIS layer that represents the record of surveys.

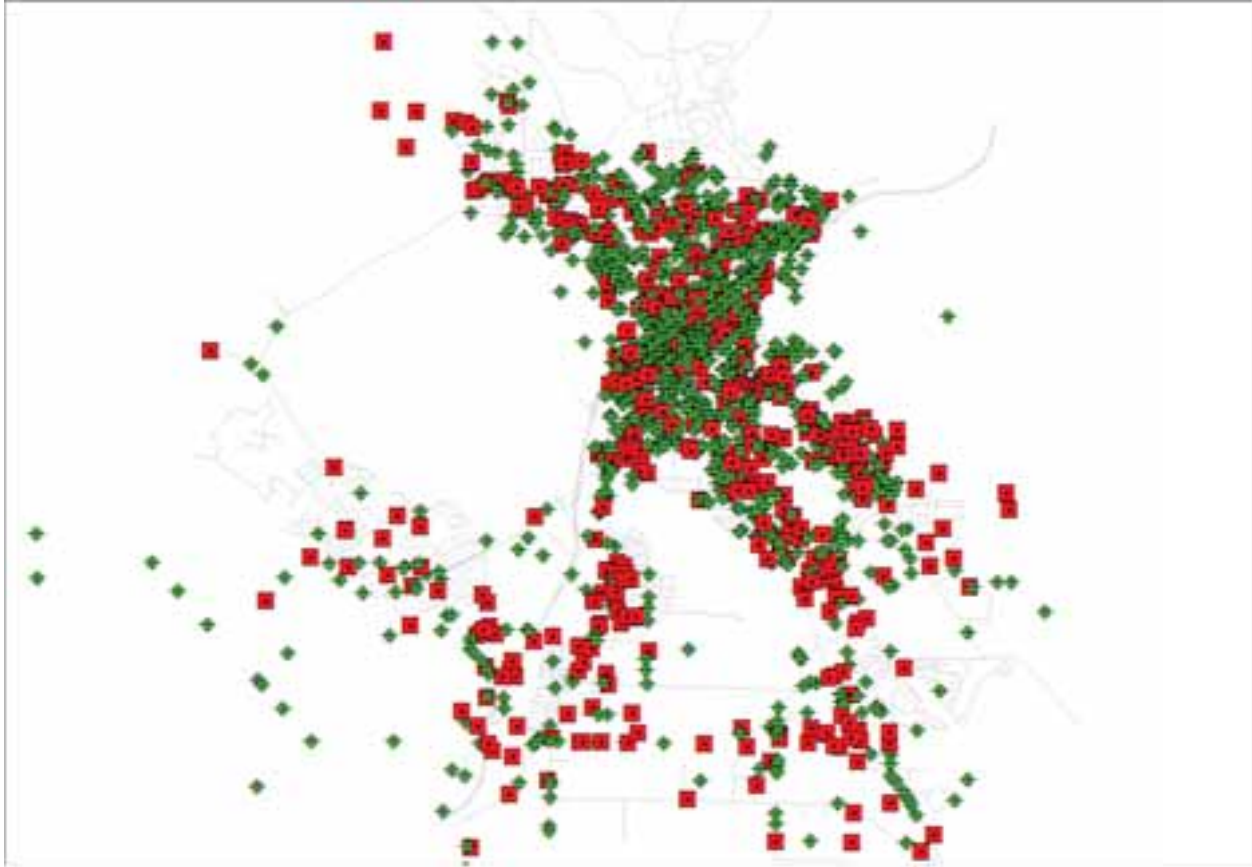


Figure 4. GIS layer showing locations of scanned record of surveys and parcel maps.

HISTORIC HOUSES

In 1905 and 1950, the Sanborn Map Company mapped the city of San Luis Obispo showing parcels, streets, creeks, and buildings in a series of maps. The maps were converted into JPEG files and georeferenced so that images are placed correctly over current GIS layers. Due to nature of raster dataset, many map images overlapped each other. The image on top would hide all images located below it. Each overlapping areas are carefully evaluated and layers are reordered to show the best image. Some part of the map images contained unnecessary information such as page number or north arrow. The unnecessary information was hidden by using masking technique in the ArcMap. As a result, clean seamless mosaic of Sanborn maps was created.



Figure 5. Georeferenced image, street layer, and mask layer.



Figure 6. Clean georeferenced image with GIS layer

Every closed-walled building shown in the Sanborn maps were digitized with building type attributes. The digitized information was compared with the historic buildings list maintained by the Community Development Department to identify the potential structures that are of historic age but not on the list. This greatly enhanced City staff's ability to manage the historic houses list.



Figure 7. Building digitized using georeferenced Sanborn map.

Digitized historic building layer was incorporated into City's geodatabase. City staff trained in ArcGIS Desktop software used the data directly in map document. ArcGIS Online maps and applications are created for those who do not have ArcGIS Desktop software and for the public. For example, ESRI's "Storytelling Compare" application template was used to display historic Sanborn maps of 1905, 1950 and the current aerial photo. A webmap showcasing the existing historic houses and potential historic houses were created for everyone to review the analysis result. All historic houses are individually mapped with photos and comments in the storytelling map template made by ESRI.



Figure 8. ArcGIS Online application showing historic maps of 1905, 1905, and current aerial image.



Figure 9. ArcGIS Online webmap showing the potential historic houses.

RESULT/DISCUSSION

This project demonstrated managing historical documents in GIS is very effective in managing, analyzing, and distributing the information. The general work process is simple: scanning the document, creating a GIS layer to hyperlink the document, and sharing the document. However, this is a daunting task as it involves scanning thousands of documents and mapping them in GIS. This would not be possible without the help from California Polytechnic State University students since City did not have any funding. Most universities now teach GIS classes and are very likely to take on community service based projects. This was mutually beneficial project for the City and the Students. City received free labor and students experienced real GIS project. Students also expressed satisfaction of knowing their work is being used by the community.

City staff and students soon realized this was just the beginning. Just about all things can be tagged with location information: historic photos, videos, drawing, and anything that can be converted into digital file format. City plans to start another project of mapping historic pictures and videos.