PLANIMETRIC MAPPING IN FLORIDA

Jon S. Beazley, Photogrammetrical Engineer, Florida State Road Department

THE State Road Department of Florida, in cooperation with the U. S. Public Roads Administration, is currently remapping each of the State's 67 counties. These planimetric maps are published as blueline prints at the scale of one inch equals one mile, and as lithographic reductions at the scale of one inch equals two miles. The B&W maps show all public roads, hydrography, railroads, all rural homes and other buildings such as churches, schools, stores, etc., as well as communities, air fields, government lands, and corporate limits. In addition, public land lines, coordinate and geographic ticks, magnetic declinations, survey control monuments, abandoned logging railroads, historical sites, swamps, etc. are included.

In 1936, the State Road Department completed mapping the State in accordance with a Federal participating program made possible by the Hayden-Cartwright Act. During this project, the maps were compiled by plotting roads and buildings on a base map of township data surveyed by the U. S. General Land Office. Within the past decade, the development of Florida has been very rapid, and consequently the maps need to be revised. For the revisions, it was decided to use the existing maps only as references and to compile the new maps from aerial photographs in order to make them more detailed and accurate.

Photogrammetry was the most logical method, since the State is nearly completely covered by aerial photography, flown for the U. S. Department of Agriculture's farm mensuration program. The remaining areas have been photographed by or for other federal agencies. All this photography is available at the cost of printing.

The U. S. Coast and Geodetic Survey, Florida Geological Survey, and others have established thousands of high-order control monuments throughout the State. Thus, nearly all the control needed is furnished. In only a few instances are ground survey control lines anticipated.

Time, economy, and personnel present our most difficult mapping problems. The schedule calls for all of the counties to be completed in five years, which means approximately 11,000 square miles of planimetric mapping per year—a relatively simple assignment for a cartographic organization with trained workers. However, because of numerous post-war engineering studies embracing all phases of highway requests, locations and designs, few funds are available for mapping. Consequently, economy is foremost and indirectly controls equipment, personnel, and time.

Before the new program got underway, many mapping methods were investigated. Consideration was given to costs, time limits, map accuracies, workers required, and resulting details. Each investigation pointed toward photogrammetry. After it was decided conclusively that this system was the most practicable, a method of adaption was next undertaken, and again consideration was given to the above mentioned conditions as applicable to the accuracy requirements established by the Public Roads Administration. Since the maps were urgently needed, a method was devised to strip photogrammetry to the bare essentials and to proceed immediately.

Actual mapping was underway before all details of procedure were ironed out. Also the mapping of the first counties served as training projects. With close supervision, these maps were completed to acceptable standards without the loss of time for learning or practice. Many changes have been made in the

methods of compilation and it is believed that we are now producing the maps in the most economical and fastest way possible.

With the exception of the first three counties, the mapping procedure is relatively uniform. Prior to mapping a county, all existing map information and photographs are obtained. Selected control points and land section corners are recovered in the field and identified on the photographs. As a safety factor, about a third more control points than are actually needed are located, and also at least two widely scattered section corners in each township are recovered.

In order to utilize to the fullest the benefits of the state system of plane coordinates, all control points and projections are plotted on this type grid. Thus uniformity is assured, and the time for computations and construction of projections is reduced.

A projection board of white painted plywood is used for the radial line plot. Since the photography scale is usually $1''=1{,}667'$, the projection is made to the scale of $1''=1{,}760'$, this being the most convenient scale to use with the automobile odometers during the completion surveys.

Selected control points recovered in the field are plotted on the projection board to serve as base control. Points of questionable accuracy, and selected others are labeled and are later compared with their plotted positions on the manuscript to check the accuracy of the work. Additional points, not plotted on the projection, are also used to check the map accuracy.

After the radial line plot is complete, another grid is drawn on the projection board. This grid interval measures $18''\times28''$. Over this rectangular grid is laid $22''\times30''$ acetate sheets on which are picked up all photo points, control stations, and grid lines.

While the plot is in progress, the photographs are delineated and intensified by the use of colored grease pencils. Next, by use of the sketch-master, the desired photograph data are compiled on the acetate sheets. The rectangular grid assures butt matching manuscripts. All compilation is done with opaque pencils. This includes, in addition to features that will appear on the final map, information such as marsh and forest outlines, citrus groves, and prominent firebreaks. All rural buildings, regardless of classification, are also located. These data have been found very helpful in locating land lines and in orientation during the field work. As the sheets are completed, they are turned over to another draftsman, who, with references to existing maps, Land Office plats and allied data, completes the manuscript sheets.

This completion drafting consists of checking detail, adding omitted features, naming desired features such as rivers, etc., locating section and land-grant lines, and doing the many other detailed jobs necessary to make a complete map. Upon completion of all manuscript sheets, a thorough edit is made. Also a title sheet containing the legend, information sources, a key map and credit lines, is drawn, completing the manuscript of that particular county.

Direct reproduction B&W prints are next made of the manuscript, and previously designated county roads are outlined by use of colored pencils on one set of prints. This set, plus the photographs, is sent to the field engineer. A comprehensive report is made regarding every public road. Each is given a number and identified on the manuscript, in addition to a complete word description. All buildings are located by types on the manuscript. During this road inventory, the maps are checked for completeness and errors.

When the data are returned to the office, all necessary corrections are made and the manuscript sheets are photostatically reduced to approximately $1''=1$ mile. A grid, with the same footage intervals as the manuscript is constructed

to the scale of 1″=1 mile on a heavy white board that measures 36″×60″. Again, by uses of the sketchmaster, the data needed for the final map are compiled from the photostat sheets. Orientation is done by means of the grid ticks. All work on the board is with a light blue pencil.

The blueline board is next turned over to a draftsman who, by use of type stickup and black India ink, compiles the final map. After a final edit, this map is photographically reproduced at contact scale, on sensitized tracing cloth. This map is also reproduced as litho prints at the scale of 1″=2 miles.

A record is kept of the man-days spent on each phase of the work, and although it is complete, the report is misleading. As the personnel gains in experience, nearly all steps are being speeded up.

For an average size county of some 750 square miles, it can accurately be estimated that we spend one week gathering and sorting the necessary information, prior to mapping a county. It usually takes from ten days to two weeks for the field engineer to locate the control and land line corners. About two weeks is necessary for photo control, and an additional two weeks or less for the radial plot. For a county of average population, one man operating a sketchmaster can compile about 45 square miles per day, which adds up to approximately three weeks for delineation and compilation. Manuscript completion and edit is usually finished a week later. Field completion and road inventory takes from three weeks to a month, and final drafting about a month.

Except for the writer, none of the five members of the cartographic section had had any previous mapping experience. However, experience itself is a wonderful teacher, and we anticipate reducing the above estimate about one-fourth within six months.