

of great use to the land surveyors and the highway department if their position is computed in reference to a rectangular system of coordinates constant for each county or convenient group of counties, and also if at each monument bearing or azimuth is read and recorded to one or more prominent objects, or to reference monuments from 200 to 500 feet distant. Such azimuths were read at each traverse monument. Where there were no existing suitable natural objects, reference monuments were set for this purpose.

There is some danger of discredit to the photo-mapping industry where such projects are attempted without proper direction and supervision by men trained in the use of aerial photographs and their application to mapping. Such work requires special training and experience, absence of which means either failure of the project or added expense in acquiring the training. In this connection, I would like to mention one proposed mapping project of this character where it was proposed to make a map of a county on the scale of one inch equals 400 feet, using aerial photographs, in which after putting on the property data, the contours were to be put on by enlarging the mile-to-the-inch U.S. Geological Survey map of the area and transferring the contours from this enlargement. Supervision of this project was to be by a man who had never had any previous mapping experience.

In conclusion I desire to express the belief that in the execution of mapping projects, the object of relief employment can be best served, at the same time insuring to the public a better product, if the Federal Agency in charge will have proper specifications drawn and let the work by contract to the existing qualified private mapping agencies. I believe such a procedure entirely practical and in the best interest of all persons concerned. I put forward this statement in the hope that it will arouse wide discussion of the reasons for and against such a proposal.

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LESSONS OF THE EXPANDED PHOTO-MAPPING WORK OF THE COAST AND GEODETIC SURVEY IN RELATION TO PLANS FOR ACCELERATED MAPPING

by O. S. Reading

(Paper read before the Society on September 25, 1934)

About a year and a half ago, I was ordered to New York City on what seemed at the time a rather doubtful mission. It was to organize a small photo-compiling party from unemployed engineers. After looking over the many applicants, the prospect seemed still more dubious, for there was not a single topographer or full-time surveyor among them. But I still have a hollow feeling around the diaphragm when I think of those men. Clean-cut, intelligent engineers who had been earning three hundred to a thousand dollars a month before the depression. There were also some youngsters, a couple of years out of college, with Phi Beta Kappa keys, all facing a world that had no use for their services. They did not say so at the time, but I learned from later questions that all had long since given up their telephones, and most had seen their

life insurance reserves dwindle away. Some had no other means of support for their families except twenty-five dollars every other week for relief "made work" furnished by the City of New York. Since none of the men were specially qualified, I finally selected those who needed the work most and could show by designs of bridges, yards, and building plans they had drawn up in previous years, that they were passable draftsmen.

I was pleasantly surprised to find how readily these men grasped the elements of photo mapping by the radial line method, and when my relief arrived a week or so later, I left for Washington with the hope that we were going to get some good maps for our money. We got the good maps all right; and I was still more surprised to learn, when the reports came in at the end of the fiscal year, that the costs compared very favorably with those of similar maps compiled by experienced cartographers in our Washington Office. As a result of this experience, there was no hesitation, when Public Works funds became available last fall, in starting up seven more such parties to map areas adjacent to the Intra-Coastal Waterway along the Atlantic and Gulf coasts. These parties are all turning in very good planimetric compilations at very reasonable costs at the present time.

As to the lessons we have learned in this work: First of all we prepared a set of notes which briefly described the elements of photo mapping and gave a very detailed description of the technique approved at that time for doing the work. These notes proved very useful in training new men, and a similar procedure is recommended for any large and rapidly expanded mapping program.

A second thing we did was to send each party a set of prints of very satisfactory compilations together with others that were not so good on which had been written in detail just why they were not satisfactory. Most draftsmen need examples more than the printed instructions.

A third point was to organize the parties in some town in the area to be compiled. One of the bottle-necks in an expanding program is to train men to locate the control stations on the photographs with the necessary accuracy and to mark up the photographs with sufficient notes in the field so that there may be no questions of interpretation during the office compilation later. Nearly always there are sins of omission or commission until the men learn through experience the high degree of accuracy and completeness necessary. If the party is located in the area, such difficulties can be remedied at low expense; but if not, there will be many cases of "office surveying" which we all have learned to abhor. As the draftsmen circulate about the country during holidays, they also absorb much that helps them to make their conventional signs depict the country better than would be possible if they had not seen it. By all means, the compiling parties should be established in the localities they are mapping for the equipment needed for radial line methods

can be shipped about readily.

A fourth point was to subdivide and specialize the work as soon as practicable. Ordinarily, a party starts with about eight green draftsmen to one experienced chief of party. After a week or so of organization and instruction, each man does all the work connected with compiling a map by the radial line method. By this time, the chief of party has a good idea of the special abilities of each man and assigns the future work accordingly. One man will do the field inspection and marking up of the photographs (with a laborer helper); another will make the projections, plot the control on them and with a third, make the radial plots. Several neat draftsmen will trace off the information from the photographs, adjusting it to the intersected points. Usually, there is a very careful man who reviews the work before the final review by the chief of party. As soon as such an organization is working smoothly, the party may be expanded safely to fifteen or twenty men, without sacrificing the quality or efficiency of the work. Such subdivision and specialization of the work, of course, promotes production to a marked extent.

Another point was to check and test the compilations in the field as soon as possible after they are made. One may lecture a draftsman for hours on the importance of carefulness, and he will think that he is doing perfect work, but nothing will put him on his toes or teach him to take the necessary precautions quite so well as having one of his sheets that he thought was about perfect come back from the field to be corrected. We are particularly fortunate in this respect in our work along the coast for practically all our compilations are used in connection with hydrography - often the shoreline is transferred to a boat sheet before the tracing of the detail is completed. If the hydrographer takes a position which plots over on the land, there is a howl to high heaven which is usually heard clear into the Washington Office. In fact, we who have been working with photographs in the Coast and Geodetic Survey purposely have been rather cocky about the compilations, bragging about picking up errors in control positions, exceeding the accuracy of plane table work, etc., etc., until most of the rest of the outfit is quite willing to show us up a bit. It seems to have worked well thus far, and we have a feeling that we learn about any errors, whether important or not.

To sum up, we have learned when confronted by a need to expand photo-compilation work rapidly, to get out a set of notes explaining just what to do and how to do it; to provide a set of satisfactory and unsatisfactory sheets with the reasons marked on them; to organize the compilation work in the area to be mapped; to subdivide and specialize the work as soon as practicable; and to test the compilations in the field as soon as they are made.

But the most important lesson of all is that, given the procedure just described, there are thousands of engineers walking the streets searching for work today who could make during the next few years a beautifully complete and accurate large-scale map of this country; a map we are not likely to have for decades to

come if this opportunity is wasted. Mr. Chairman, you may go as far as you like in your Committee on Map Planning. There are plenty of good capable men to put through any plan you make for accelerating the mapping of this country.

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THE AERIAL MAPPING PROGRAM OF THE SOIL EROSION SERVICE

by

Charles W. Collier

The Soil Erosion Service was established in the Department of the Interior shortly after August 25, 1933, for the purpose of administering Public Works funds which had been allotted to the control of man-induced soil erosion. An initial allotment of \$5,000,000 was made for the work, and from time to time additional allotments have been made, bringing the total funds available to \$20,000,000.

The magnitude of the problem with which the Soil Erosion Service is attempting to cope is indicated by the following representative statistics relative to the seriousness of erosion caused by improper methods of cultivation, forestry and grazing, and by man-induced fires: More than 55,000,000 acres of agricultural lands have already been essentially destroyed. Of the approximately 413,000,000 acres now susceptible to cultivation, all but less than 150,000,000 acres will have been virtually and permanently destroyed or severely depleted within the next fifty to seventy-five years unless some means can be found to combat and control the erosion responsible. The annual direct cost to the farmers of this destructive phenomenon is at least \$400,000,000 in soil values washed away. Incalculable additional losses are involved in the silting of reservoirs and stream channels, the abandonment of farms, the impoverishment of entire regional populations and in other indirect effects.

Reservoirs are silting at alarming rates. For example, the great Elephant Butte Reservoir will be silted to 70% of capacity within 60 years, at the end of which time the total water storage will be reduced to one year's draught, and thereafter irrigated lands under the project will have to be progressively abandoned, until at the end of 93 years the Reservoir will be completely filled and the capacity reduced to zero. Extensive grazing resources are being almost completely destroyed. Entire regions are headed for virtual abandonment.

The program of the Soil Erosion Service involves the establishment of a series of demonstration watersheds on agricultural lands ranging in area from 50 to 300 square miles, and the undertaking of control operations on approximately 24,500 square miles of the Navajo Indian Reservation and 22,000 square miles in the Gila and San Pedro watersheds in southern Arizona and New Mexico. In each of these projects, a strenuous attempt is being