U.S. Coast and Geodetic Survey

DIVISION OF GEODESY

==========

GEODETIC LETTER No. 9 --- SEPTEMBER 1, 1934

==========

HISTORY OF THE LOCAL CONTROL SURVEYS PROJECT
by H. W. Hemple

In the fall of 1933 this Bureau was asked by the Federal Emergency Relief Administration to administer as a work relief measure, a surveys project having for its primary object the employment of needy engineers and others. It was expected that some fifteen thousand people might be employed. This Bureau accepted this assignment with some reluctance for it was realized:

(1) That because of the augmented operations in connection with our regular surveying program there would not be available a sufficient number of our own personnel to give adequate supervision to such a project.

(2) Instruments of the type needed for efficient operation could not be obtained on short notice, and in time to be used during the period designated for field operations.

(3) The problems of transportation of personnel and equipment could not be met by purchasing automotive equipment because most of the funds were to be used for wages and a limit was placed on the amounts to be used for purchase of equipment and materials.

(4) The field work was to be carried on in every state of the Union during the severe winter months which would not make for economical results in the northern states.

This Bureau was interested in such a project from an altruistic motive because of the vast employment possibilities which could be offered to fellow engineers but was faced with the problem of carrying on field operations, in spite of the difficulties mentioned, so that the results obtained would be in accord with the strict standards of accuracy prescribed for our regular surveying program and could therefore be included in the national net of horizontal and vertical control.

The arrangements finally made with the Federal Relief Administration were that this project should be a part of the Civil Works Administration program. Formal approval of the project was granted on November 27, 1933, and employment of the personnel and operations of field parties started as soon thereafter as possible. All wages of personnel were to be paid through the channels of the C.W.A., but all other expenses would be charged to an allotment of $563,120.00 (F.P. 84) made by the Public Works Administration to this Bureau for this specific purpose. The personnel were to be selected through C.W.A. channels, would be paid in accordance with the wage scales, and would be subject to the rules and regulations regarding employment, as prescribed by that agency. Except for the above restrictions, the project was under the control of this Bureau.

This Bureau was given to understand that while the funds available would last only until February 15, 1934, there was every possibility that the Congress would advance additional funds, and the project would almost certainly continue beyond that date.

Employment of personnel proceeded uninterruptedly until Janury 19, 1934, when the Civil Works Administration issued orders that no further additions were to be made to the pay-roll. This hampered our project, becuase in some states the selection of personnel and organization of parties were proceeding slowly and the maximum number of employees authorized had not yet been reached.

On February 15, 1934, Congress passed the law providing for the continuation of the Civil Works Administration program and substantially prohibited participation of Federal Bureaus in such a program after that date. At that time more than 10,000 men were employed throughout the states on these surveys. Each state after February 15th could continue this survey project under its own C.W.A. program if the State Civil Works Administration so desired. As an evidence of the wide-spread approval of this work, only four states decided not to do so. Our connection with the project after February 25th has been to set in an advisory capacity to insure that the results obtained will be of an acceptable standard. In those states which are continuing, this Bureau assumes the salary of the State Representative and also pays his travel expenses while on official business away from headquarters.

All records are, or will be, sent to this Office so that the control may be included in the national net.

On March 31, 1934, the program of the Civil Works Administration ended, and relief measures thereafter were continued under the Work Relief Plan of the State Emergency Relief Administration. Restrictions regarding employment under the new Plan were such that a man to be employed had to be absolutely without resources. Further restrictions limiting the number of hours work authorized to six and eight hours per week were imposed, so that field work could not be carried on efficiently. As a result, in most states the Local Control Survey project was definitely discontinued after this date.

In fifteen states, however, the work has continued subsequent to March 31st, and at the present time operations are still being carried on in these states although in most of them upon not nearly as large a scale as at first authorized. There are about 1500 men still employed. In some states the project will continue until October 1st, and in Tennessee where work is being done in regions requested by the Tennessee Valley Authority the project will continue until January 1, 1935, with a complement of 320 men. In many of the states still operating, the key employees (that is the instrument men and supervisors) are classed in a supervising status and are not subject to the restrictions regarding employment and small number of hours of work authorized per week, as apply to other employees under the State Emergency Relief.

This Bureau selected a man in each state who acted as our Representative and had general charge of the project in his state. This man was an outstanding engineer, usually a professor in one of the leading engineerning schools. He was supposed to devote but part of his time to this project, and it was expected that he would carry on his regular activities at the same time. These men took an active interest in the project, worked hard and put in long hours to make these surveys a success. To them was delegated the job of contacting the State C.W.A. authorities to obtain the necessary personnel. They also made arrangements for borrowing instruments and trucks. The organization of parties was entirely in their hands. They also decided where the surveys were to be undertaken. Too much credit cannot be given to these officials who gave so unsparingly of their efforts, in many cases at considerable sacrifice to themselves, in order that their fellow engineers might be benefited.

To assist our State Representatives, a number of Supervising engineers were selected by them through C.W.A. channels. In general one supervising engineer had charge of the field work of from five to six parties. These men were usually high grade engineers capable of giving adequate supervision to the field parties.

In each state an office was established where administrative details in connection with the project could be handled. A force of computers, stenographers, clerks and accountants, selected through the C.W.A., were employed in this office.

Each state representative was bonded as a chief of party in order that he might make expenditures of Government funds in connection with this projects in his state. His accounting force prepared payrolls for transmission to the C.W.A. offices, where the pay checks were drawn. Vouchers for other expenditures were prepared in his office, certified by him, and forwarded to the Washington Office for administrative examination and payment.

An estimate was prepared for each state of the number to be employed, together with the amount to be expended for the payroll and the amount needed for purchases of equipment and materials. Each State Civil Works Administrator was notified of the number to be employed in his state as soon as this project was approved by Mr. Harry L. Hopkins, Federal Civil Works Administrator.

In order that the project might be of maximum benefit to the employees, work was carried on in localities where the men could live at home and be subject to a minimum of travel. The program of surveys best adapted for such a condition was the subdivision of the twenty-five mile spacing of our first order control by means of traverse and leveling. Some triangulation was accomplished in the western states, but most of the horizontal control was established by traverse.

Had time permitted, it would have been advisable to purchase a suffficient number of theodolites, graduated to ten or twenty seconds, and also tilting levels, so that these surveys could have been expedited and the results obtained much more economically. There is a dearth of high grade instruments available in this country and as a consequence it was necessary to adopt plans to make use of such instruments as could be borrowed from interested concerns and individuals.

Because of the depression there were many surveying instruments owned by railroads, construction concerns, highway deparments and municipalities which were not in use. It was decided that an appeal would be made for the loan of such idle instruments for use on this project. The Survey accepted the responsibility for these instruments while on such use, and agreed to return them to their owners at the expiration of the field work in as good condition as when received. The response to this appeal was very gratifying, and it was unnecessary for this Bureau to purchase any major surveying instruments. Such special instruments as Abney and Locke levels, spring balances, and thermometers, were purchased however. It was also found necessary to purchase a number of 100-foot steel tapes and also a quantity of level rods, as equipment of this nature satisfactory for high-grade work was not available.

Since the transits commonly used by engineers are graduated to 1 minute, or at best 30 seconds, and since these were to be used on this project, specifications were prepared in the Washington Office whereby second-order accuracy could be obtained with such instruments, in connection with the 100-foot steel tape. Forty-eight tapes were standardized at the Bureau of Standards and one was sent to each state to be used as a master tape for comparison with the tapes actually used in the field on the measurements. Taping was usually carried on over portable tripods under a definite tension, and corrections applied for grade and temperature. Four sets of readings were specified for the angular measurements with the criterion that accepted results should agree within eight seconds of the mean. The repetition method was used, and one set consisted of six measurements of an angle with the telescope direct followed by six with the telescope reversed for each angle, including the one to close the horizon. An analysis of the results forwarded to this office shows that acceptable horizontal angle observations in some cases could be obtained with a smaller number of sets than four but in most cases it was found that this number was required. Had theodolites graduated to ten seconds been available, the required accuracy could easily have been obtained by two sets of 6 D & R. A fair observer can measure one angle 6 D & R in twelve minutes. The consequent saving in time which would have resulted from better instruments is evident. In general no difficulty was experienced in obtaining traverse closures of 1:10,000 when the rigid specifications were followed.

Leveling was carried on mostly with the ordinary Wye level. An accuracy of .05 feet distances in miles was specified and obtained without trouble. Had tilting levels been available, this work could also have been done more accurately and expeditiously.

It was realized that many of the engineers out of work owned automobiles which they would furnish for transportation facilities on this work, providing employment were offered to them. Arrangements were made so that these cars would be kept in repair by this Bureau while on such use and whereby this Survey accepted the responsibility for accidents to the cars while in official use, providing such accidents were not due to careless driving. The adoption of this plan made it unncessary to purchase motor equipment.

Bronze disks somewhat smaller in diameter than the regular marks used by this Bureau were sent to all parties. These disks had the legend "U.S. Coast and Geodetic Survey and State Survey" cast on the face. North Carolina and Pennsylvania had disks cast with legends peculiar to their respective states only. The disks were set in concrete monuments, of a size similar to that specified for our regular operations, or in permanent structures. On the traverse work these monuments were established at intervals not greater than two miles.

Marks were established in pairs with the two marks about 1/4 mile apart, so that an azimuth would be available at each station for future use. Levels were run over the same lines as the traverse.

Insofar as possible connections were made to first-order work of this Bureau at the beginning and ending of the traverse lines. Where no monuments of this Bureau were available for such connections, it is expected that at some time in the future our regular field parties will connect to such local control work.

The final computations for the horizontal control established in the various states are being placed on the plane coordinate system. The use of this system simplifies the computations for the supplemental control, once the first-order stations of this Bureau to which connections are made are expressed in similar terms. Projection tables and instructions for transferring from geodetic to plane coordinates were prepared in the Washington Office and sent to each state office. The preparation of these projection tables ranks as no mean accomplishment. It was estimated that under our regular program this work would have taken a year or more to accomplish. Upon the inception of the C.W.A. program these computations were expedited and these tables completed for each state in a few months's time.

Statistics to June 30, 1934, show 14,000 miles of traverse, 20,000 miles of levels, and 1,200 miles of triangulation completed. A number of monuments have been set in some states over which no work has been done because of the abrupt termination of the project. Should further funds not be forthcoming to continue these surveys as a separate project, it is planned to have our own parties run levels over such marks, so that no monuments will be set for which descriptions and data are not available.

The work done and the monuments established will be of permanent value to those communities where such surveys were carried on. Frequent requests come to this office for information regarding the marks established. Much publicity was given to these surveys through numerous newspaper articles and, as a result, a more wide-spread knowledge of the utility of these marks was disseminated throughout the country.

The project has been of value in acquainting the engineer with the fact that accurate surveys can be obtained when using ordinary surveying instruments. Heretofore many engineers have had the idea that geodetic surveys could be accomplished only with the use of special surveying equipment. This project has taught these men that if certain precautions are adhered to when making surveys, results of a high degree of accuracy can be obtained.

The many letters received at this office from engineers who were employed on this project expressing gratification that they were able in a time of need to work at labor for which they were fitted by training and experience, shows that as a measure to relieve unemployment among a class not reached by other work relief measures, this project was a success. Statistics show that about 75% of those employed were men of college training. These were not necessarily all civil engineers, as mechanical, chemical and electrical engineers and other college men, were employed as rodmen, chainmen, computers, etc. As an indication of the high type of men employed, the following is quoted from a letter addressed to the Director from Mr. John S. Bates, State Representative for California:

"We have as our motto that the good name of the Coast and Geodetic Survey must be maintained and that our privilege to represent the organization carries an obligation to insure good public relations and absolute accuracy of all work done".

For professional engineers, who through no fault of their own, have been without employment, some of them for several years, the Local Control Surveys Projects was Godsend, and was of assistance in keeping up their morale in a time of stress.

CONNECTIONS TO CWA SURVEYS

During the course of the surveying operations under the Civil Works Administration, an attempt was made as far as possible to start triangulation, traverse, and leveling from existing survey marks of this Bureau. Plans were adopted which permitted the members of the field parties to live at home. In some cases this arrangement did not permit making connections with existing work. Chiefs of parties should make frequent inquiries along the lines of their field work as to whether any operations have been carried on by parties working under the Local Control Surveys and should make connections to such work wherever possible. It would be well for each chief of party to contact the State Representative who had charge of the C.W.A. Surveys in those states where our regular operations are being carried on to insure as far as possible that connections are being made to such work. Complete reports have not yet been received at this office from all State Representatives and it is therefore impossible to advise each chief as to the marks it is desirous to connect to. Prompt attention to this matter will obviate the necessity of sending in a special party to make such connections at some future time.