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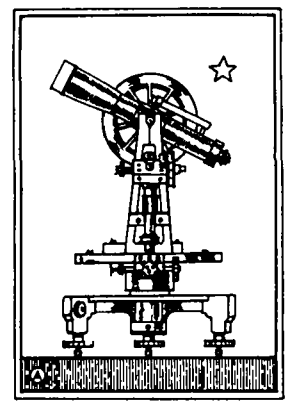

U.S. COAST & GEODETIC SURVEY
ARCHIVES
JUL 20 1935
Acc. No.

No. 6
Vol. 2

JUNE
1935

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DIVISION • OF • GEODESY
UNITED · STATES · COAST · AND · GEODETIC · SURVEY ·
WASHINGTON D.C.

R.S. PATTON · Director

M-115

G E O D E T I C L E T T E R

Volume 2 JUNE, 1935 Number 6

C O N T E N T S

Editorial 2
Letter from the Governor of New Jersey. 3
The geodetic work of the Coast and Geodetic Survey and its uses. 4
Comments from home and abroad 13
Tennessee Valley Authority adopts state plane coordinate systems 14
Suggestions for reconnaissance. 16
Solar observations on reconnaissance. 17
Geographic and other proper names 18
Suggestions of an office man to the field 20
Survey monuments do not mark buried treasure. . . . 22
Deformation of earth's surface due to weight of Boulder Reservoir 24
Land surveys and national welfare 25
Truck accident damage claims. 28
Excerpts from party papers. 29
Circular letter to chiefs of triangulation parties . 30
Warning against danger of forest and prairie fires. 31
Notes and notices 32
Cuban gravity expedition. 34
Report of progress. 36

EDITORIAL

It is truly remarkable how well the field and office work of the Division of Geodesy has been carried on during the past few years, with the great expansion in personnel that has occurred. It is only by good organization, planning, and a clear picture of what was needed that such excellent results were obtained.

There are still a few weak spots. Records come to the office that are not quite complete, and sometimes erroneous data or information are given. This applies especially to the descriptions of stations and the measurements of directions and distances to reference and azimuth marks. A number of items have appeared in Geodetic Letter calling attention of chiefs of parties, observers, and others, to the necessity of checking all measurements and other data before the records are sent to the office.

The names of chiefs of parties and observers who have been at all derelict in having accurate data furnished this office have been withheld. It has been thought that a statement of the problems involved would lead to their solution. Of course, if the records received from any one observer should continue to be unsatisfactory, undoubtedly the Director will communicate with the chief of party with a view to having the results of the particular observer improved or in the absence of ability to furnish correct information, the chief of party would be directed to relieve the observer from his duties and give him a less responsible assignment.

The observers are imbued with a fine spirit and the desire to get a great amount of work done in a given time in order to avoid holding back the other units of the party. Rapidity of observations and low unit costs are most important; yet about all that we have to show for field and office work are the monuments left in the field and the data for the stations. If the data, including the descriptions of stations, are not complete and accurate, then the results are not all that can be desired. Accuracy and completeness of data must be obtained even though the party is somewhat slowed down in progress and unit costs increased in consequence. The data secured by triangulation parties should be good for all time to come unless the stations are destroyed by the works of man or the forces of nature.

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STATE OF NEW JERSEY
EXECUTIVE DEPARTMENT

April 18, 1935.

Passaic County Engineering Society
North Jersey Country Club
Hamburg Turnpike
Paterson, New Jersey

Att: Mr. Vincent J. Scanlan.
President

Gentlemen:

I have just learned of the occasion of your annual meeting and of the importance the engineers of this State attach to the successful passage of Assembly bill #209. Remembering my visit to your Chapter about a year ago and mindful of your cordial reception, it gives me pleasure at this time to send you my sincere greetings.

I desire also to hand you herewith, in recognition of the splendid work accomplished by your group, particularly on behalf of Professor Philip Kissam, Head of the United States Coast & Geodetic Survey in this State and the men who worked so hard with him to secure passage of the above legislation, the pen with which this writer, as the Executive officer of the State, made your bill a law of this Commonwealth.

Accept my congratulations for your enterprise and my sincere felicitations upon this, the fiftieth anniversary of your original organization.

Sincerely yours,

Governor

REFERRED TO
1 Gen. Allen
2 P. S. FRIEND
Kissam
m:

LETTER FROM THE GOVERNOR OF NEW JERSEY

The letter given on page 3 requires no comment. A photographic copy of Assembly bill #209, to which reference is made in the letter, was published in the May number of this journal. This Act establishes a system of land-boundary descriptions for the State of New Jersey, the base of which is the system of plane coordinates established over that State by the Coast and Geodetic Survey. Governor Hoffman's letter is a splendid expression of commendation and appreciation for the work done by Professor Kissam and his associates.

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THE GEODETIC WORK OF THE COAST AND GEODETIC SURVEY AND ITS USES

By

William Bowie
Chief, Division of Geodesy

(Delivered at a meeting of the Iowa Engineering Society and the Engineering Extension Service.)

I really can not talk about the geodetic work of the Coast and Geodetic Survey without including many other things. Probably the most important of the other things is the topographic map. The map is a graphic representation of the earth's surface. By it we can secure more information in a brief time than could be gotten by months or years of travel, interviewing or reading.

Let us assume that each of a hundred men wish to engage in some activity between the cities of Philadelphia and New York. They must have a complete knowledge of the lay of the land, the highway systems, the railroads, rivers, streams, forests, villages, cities and other things. If there were no maps between those two cities, each of those hundred men would have to get this information himself. He could do this by traveling over the area, making notes as he went along; or by interviewing others who were familiar with the country between those points; or he could use a third method of reading books and reports on the country between Philadelphia and New York. The chances are that if he used any one of these three methods, he would have a very distorted idea of what really lies in that area. If, on the other hand, he had a topographic map, made with accuracy and kept up to date, he would be able in a very few minutes or hours, to learn just what he needed to know in order to plan and execute his projects.

The topographic map can not show everything, of course. If all details were given on it, the map would be so cluttered up

that it would be almost unintelligible. On the other hand, overprints can be made for each of a variety of data, such as forests, condition of crops, fertility of the soil, density of population, character of highways, and perhaps other things.

The map cannot be made with accuracy without good geodetic or control surveys. These control surveys consist of triangulation and traverse for the determination of positions, distances, and directions and leveling to furnish elevations.

There is no mystery about geodetic work. An engineer can go to a triangulation party for a few months and receive intensive training and can then make observations that will be satisfactory. The same is true of training in leveling. I do find that engineers have difficulty in performing a satisfactory job using geodetic instruments and manuals if they have only a short time of practice. We, in the Coast and Geodetic Survey, have been carrying on geodetic surveys for 118 years and no doubt have made every mistake that human beings could make in carrying on this class of work. We have tried to improve our methods and instruments with a view to eliminating the possibility of making mistakes and blunders. The engineer visiting our parties can see just how our engineers handle the instruments, equipment, etc., and in a comparatively short time can do a real job. Of course, with added experience he can improve his technique. As a matter of fact, even after a decade or more of doing geodetic surveys the engineer can still improve his work. The improvements would not involve big things but perhaps just minute details of operating the instrument.

The Coast and Geodetic Survey is now following a plan which calls for the spacing of arcs of triangulation and lines of levels at intervals of about 25 miles over the entire country. It is expected that by June 30 the 25-mile spacing of the lines of leveling will be completed. It will require about two and a half years at the present rate of progress to finish the 25-mile spacing of the arcs of triangulation.

There are now 76 leveling units and 51 triangulation units in the field. The instruments for these units are being operated with few exceptions by engineers who have been employed by the Coast and Geodetic Survey within the last two or three years. These engineers have been given training in all classes of the work. They act as lightkeepers, recorders, perhaps even truck drivers, and they are trained in the use of the instrument.

For a number of years the Coast and Geodetic Survey has been working on a very definite plan for its triangulation and leveling. Funds were low but it was realized that eventually geodetic surveys would be recognized as public works of importance. We thought that the best way of proceeding was to have great arcs of triangulation

and long lines of levels across the wide open spaces of the control survey nets. With a few of these great arcs and lines as the starting points for other arcs and lines, it was possible to break down the area into smaller pieces. This went on for some years at a comparatively slow rate of speed. The unit cost of the work was low, the engineers highly trained, and in consequence of this when funds became available in larger appropriations, starting in 1930, we were able to expand our parties quickly. We had anticipated greater activity in geodetic surveying and, in consequence, had been purchasing the necessary high-grade instruments, a few at a time.

The appropriation for geodetic surveys, which was $88,600 for the year 1929, was increased to $327,000 in 1930. Then, in 1932 we had an increase of some half million dollars by an appropriation in the so-called Wagner Bill. We were able to expand in such a way as to utilize that increased money. Then, in the late summer of 1933, we had an allotment of two and one-half millions from the Public Works funds. Even this great increase did not seriously disturb us. Of course, it meant more work, and more planning, but all of this was efficiently accomplished and we are today spending at a rate of more than $200,000 per month where five years ago the total appropriation for the year was less than $90,000.

At first we thought it would be a great accomplishment if we could eventually have the lines of levels and arcs of triangulation spaced at intervals of 100 miles over the entire country. This was a dream which we hoped might come true in the far distant future. Today, we have a plan which has been approved that calls for the spacing of the lines of levels and arcs of triangulation at intervals of 25 miles. Within the next five or six months the 25-mile spacing of the lines of levels will be completed. Already we are beginning a break down of the 25-mile net with subsidiary lines of levels. The triangulation net is now about half completed and, if we can maintain the present rate of progress, three years from now the 25-mile spacing of the arcs will be finished.

It is an ill wind that blows no one any good. So, while the country has been in the throes of an industrial depression worse than anything our people have ever experienced, geodetic surveying has been benefited by the depression as indicated by the great progress that we have made during the past few years. We have now on our pay roll approximately 500 engineers on our geodetic parties. In addition, we have more than a hundred engineers computing and adjusting the observations and preparing the resulting data for the printer.

It has been estimated that we must have horizontal and vertical control surveys spaced approximately seven miles apart in order

to furnish the basis for maps. Those who are conversant with photographic mapping say that with a spacing of 7-1/2 miles for the horizontal control points, the compiler can accurately transfer to the map the information shown on the photograph taken from the air. This brings up a very interesting question. How can the control survey stations be made to show on the aerial photograph? As a matter of fact, no attempt need be made to show them. It is far better to wait until the area has been flown over and photographed, and then have two men in an automobile with a transit and a tape go out to the field, visit the triangulation and traverse stations and tie in, by angle and distance, features that show on the photographs that can be identified on the ground. A two-man party should be able to tie in several stations per day. It is better and less expensive to do the work this way than for the triangulation and traverse parties to attempt to tie in many objects that the observers believe will show in the photographs. Of course, many features such as fence corners, crossroads, houses, and other objects may be very close to the triangulation and traverse stations and these can be tied to the station at the time the observations are made. Even if these objects do not show well in the photographs, they make splendid reference points for the survey stations.

The Board of Surveys and Maps of the Federal Government has outlined a plan calling for the completion of the topographic map of the United States within ten years. This plan has been adopted by the National Resources Board and is contined in a report that Board made to President Roosevelt. It is reasonably certain that the President will take steps to expedite the mapping of this country. He realizes that in making plans for the utilization of the land, water, forests, and other things a complete knowledge of the terrain must be available.

Only about fifty per cent of the area of the United States is now topographically mapped and hardly half of the existing maps are of any value in detailed planning. Either they are very old or they were done in such a sketchy way that they do not satisfy modern needs. We may, therefore, say that 75 per cent of this country is unmapped.

The plan of the Board of Surveys and Maps divides the country up into three classes of areas called first, second and third priorities. These areas were selected by the Board after every possible effort had been made to secure information as to the needs of federal, state, and other agencies. This priority map will undoubtedly be modified from time to time as needs increase for one area and decrease for another. Of course, everyone of us would like to see the country mapped within six months or a year but this is impossible. It can easily be done within ten years and if the necessity arose the country could be mapped within five years. The unit costs would be increased if the shorter period

were used. More equipment would be needed and there would be less average efficiency, but the work could be done.

The geodetic surveys of the Coast and Geodetic Survey are now so far along that it will be possible to supply the seven-mile spacing of the horizontal and vertical control survey stations in any area to the topographers and map compilers well ahead of their requirements. All we need is a few months notice that a certain area is to be flown and mapped and a geodetic party can go to that area and have the work done in time for the mappers.

Late in 1933 there was started in each one of the states what is called the Civil Works Administration local control project. The employment of fifteen thousand people was authorized by the relief administration for this job. The Coast and Geodetic Survey was allotted a fund for certain administrative purposes connected with these surveys. Representatives were selected in each state and in a remarkably short time many men were at work. By February 15, 1934, there were about 10,300 men on the pay roll of the CWA local control surveys. Of these, 5,000 were engineers or men who had had some engineering education. There is no job in the United States of which I know, where the percentage of engineers employed is larger. If that work had continued, the Director of the Coast and Geodetic Survey would undoubtedly have requested funds for the purchase of high-grade transits in order that the angles of the traverses could be measured with accuracy and speed. In actual practice the instruments used on the CWA work were borrowed from universities, colleges, technical schools, railroads, cities, highway departments of states and from individuals. The response to the request for the loan of instruments was remarkable. While many of the instruments were not in the best of shape, yet by following special methods, accurate results were obtained with them.

The work on the local control surveys in some of the states stopped on February 15, 1934, but for others it continued and is still going on. At present there are 23 states carrying on these surveys as relief measures and approximately 2,900 people are employed on them. Of these 2,000 are engineers or men who have had some engineering education or college work.

Professor J. S. Dodds of Iowa State College was selected by the Director of the Coast and Geodetic Survey as his representative on the CWA project in Iowa. He was exactly the right man for the job. He accomplished much in a very short time. I am sure that if the work had not stopped in Iowa on February 15, 1934, he would by this time have many thousands of miles of traverse and leveling of high degrees of accuracy that would be of inestimable value to the people of your state.

If the President adopts the plan proposed by the Board of Surveys and Maps for the mapping of the country, it is expected that approximately five millions of dollars will be made available to the Coast and Geodetic Survey for control surveys for the first year of the program. In six years, the horizontal control surveys will be completed and in seven or eight years the leveling will be done. Necessarily, the control surveys must precede or should precede the topographic mapping.

In addition to the control with the seven-mile spacing for the aerial photographs there is much other control work needed in this country. In triangulation the stations are spaced at intervals of 7 to 10 miles along an arc but these stations are in many cases, especially in rugged areas, on ridges and hills which are not readily accessible to the engineer engaged on a local project. He wants his control stations somewhat closer at hand. I am in favor of continuing the local control surveying that was started in the different states more than a year ago. Around every city there should be a network of lines of levels and traverse. Close to the city the lines might be spaced only a mile apart, while at a distance of 10 or 15 miles from the center of the city, the spacing might be three miles. The net might be somewhat like a spider web with circles around the city and radial lines extending out along the highways and railroads. The stations along these lines should be closely spaced at intervals of not more than a mile. They should be set in pairs in most cases in order that the engineer wishing to use the data can set up his instrument on one station and sight on the other for azimuth. Eventually, perhaps ten or twenty years from now, these detailed control surveys could be extended out into the sparsely settled areas. The data secured would be invaluable in making cadastral surveys. Property lines should be tied into the horizontal control stations of the country. When this has been done, there will be no difficulty at any future date in recovering the boundary with exactness.

It may be said by some that these surveys are expensive. That is true, but when we balance the cost of the surveys against the benefits that are derived from them, I think we can conclude that the spending of the money on good surveys is an investment that will bring large returns ever afterward.

The Coast and Geodetic Survey has been working on plane-coordinate systems to facilitate the use of triangulation data on local projects. Publications of the Bureau explain the use of plane coordinates for a city or a county. More recently we have realized the need of plane coordinates over a whole state. To make a plane-coordinate system cover a large area involves a number of problems, which, however, we believe we have solved.

It has been found that a strip of the earth's surface not more than 158 miles wide can be flattened out without causing a distortion of more than 1 part in 10,000. We believe that this scale factor, as it is called, is so small as not to interfere with the use of triangulation and traverse data. In local survey work, of course, 1 part in 10,000 is six inches per mile and there are many surveys that have to be better than that. Where high-grade surveys are to be made and based on a plane-coordinate system, scale factors can be used which will make the plane-coordinate system just as accurate as the spherical-coordinate one. Simple rules enable the engineer to apply these factors.

Plane-coordinate systems have been devised for every state in the Union. Some states are narrow and one system can be used for the whole state. This applies to such states as Connecticut, Rhode Island, Delaware, New Jersey, Maryland,Tennessee and some others, while in the State of Iowa it was necessary to have two systems. In Texas there are five systems and in California six.

It has been thought by many that the plane-coordinate systems devised for the states should be used in cadastral surveys. If this were done it would be necessary to have the legislature in each state legalize the use of the horizontal control system of the county and the state plane-coordinate systems as the bases for cadastral surveys. Already thought has been given to the preparation of bills to be submitted to state legislatures legalizing the use of the control survey stations in cadastral work.

Another piece of legislation should be enacted in each one of the states, to protect survey monuments of all kinds, whether established by agencies of the Federal Government, states, counties, cities or individuals. Authority should be granted to engineers to go on private property and occupy with instruments survey monuments that have been established. It is impossible to have all the survey stations of the control nets on public lands, that is on right-of-ways or highways. Sometimes it is necessary to establish them on hills or other points outside the right-of-ways. In such cases the engineer must go on private land to get his starting point. Provision, of course, should be made in the legislation to protect the property owner against damages if trees are cut to open lines or if crops are destroyed by men walking over the fields. In such cases property owners should have compensation for their loss, but usually engineers are exceedingly careful, with the property of others and little or not damage is done. The engineer should always settle immediately with the property owner for any damage that is done.

I am very much in favor of the use of inscribed metal tablets for station marks. In the early years of the Coast and Geodetic Survey, blocks of stone or concrete were used as station marks with perhaps a copper plug in the top. Letters, such as U.S.C.S. were sometimes cut or moulded into the top of the monument. Years afterward the finder of such a monument often had visions of buried treasure being at hand and would dig up the mark and destroy the station. We have lost hundreds, perhaps thousands, of stations along the southern coasts of our country because the discoverer of the marks did not know just what they represented. Now-a-days, with a tablet in the top of the mark telling just what it is, there is no further curiosity about it and no one will take the trouble to dig it up. Of course, marks are occasionally destroyed by people with malicious intent and other marks are destroyed thoughtlessly in industrial expansion. The road scraper has destroyed many bench marks and the steam shovel has lifted many of them out of place. Today, however, the highway engineers of the states and counties appreciate the value of control survey stations. They warn their employees to protect the marks as construction proceeds. In many cases new stations are set off to the side of the widened road.

In addition to what the Federal Government has done in extending the control surveys of the country, some fine work has been done by other organizations. Some of the states and counties have made splendid control surveys of their areas, but much remains to be done. I should like to see the highway departments of all states and counties do their surveying with greater accuracy. This can be accomplished with little added cost, provided modern types of instruments are obtained. A survey made for a special purpose, if well done and permanently monumented, will serve many other purposes for years to come. It is wasteful to do the work only well enough for the immediate object in view.

I have been astounded to find much poor equipment used in surveying by Federal, state, city and county organizations and by private corporations and individuals. In most educational institutions the number of modern instruments is exceedingly small or such instruments are not found at all in the stock rooms. In every class of engineering except surveying and mapping the engineers insist upon the very finest and most up-to-date instruments and equipment. In construction engineering, accurate apparatus is used for testing structures for strain. Instead of the pick and shovel we use steam shovels, tractors and great trucks for moving material; we mix concrete by machinery instead of by hand; we carry concrete, bricks, mortar, etc., to the tops of skyscrapers in elevators instead of by the old method of the hod carrier. But in surveying and mapping we seem to be content to use the same kind

of instruments that were supposed to be up-to-date at the time of our grandfathers. Why is this so? I do not know, but I must say it is a wasteful way of doing things. We have had engineers come to the Coast and Geodetic Survey from bridge companies, asking us to lend them theodolites and engineers to do some triangulation and base measuring for the location of bridge abutments and piers. They say they have no instruments adequate for the job and they have no engineers who are skilled in triangulation.

Is this situation regarding instruments due to the attitude of the professors of civil engineering or is it because so little surveying and mapping is done that the engineers in charge of projects feel that the old equipment will be adequate? In any event, I think it is only just to the students of civil engineering that they have access to the very finest and most up-to-date theodolites, levels and other surveying instruments in their courses. I believe that any corporation can well afford to buy some modern instruments. Those instruments should be serviceable for thirty or forty years or longer and the jobs done with them will have lower unit costs than if the work were done with poor instruments. Some of the theodolites used in the Coast and Geodetic Survey are seventy or more years old. Four of them, made in the early '90s, have been constantly in use for forty years. Surely, a corporation or city or highway department of a state can afford to buy a ten-second transit for use on its surveying work. In leveling, tilting levels should be employed, for with them far greater accuracy can be obtained and the work can be done very much more rapidly. We must balance the cost of the pay roll against the cost of a good instrument.

Surveying and mapping are coming to the front. No longer is an engineer engaged on surveying considered a boob. There is no branch of engineering where keener intellect or more ingenuity are needed than in surveying and mapping. I am sure that if a student is given a very fine course in surveying and mapping he will be a better designer and construction engineer than if he did not have the surveying and mapping education. I am not in favor of more surveying in the curriculum of the civil engineering department of a university or college, but I am in favor of the best education in these lines. I believe that if the student is told of the high-grade work that is done by engineers in surveying for the Federal Government, in tunneling mountains for railroads, in surveying street railways, in tunneling cities and in many other lines, he will realize what a great field this is for the engineer. It is rather remarkable that surveying and mapping have furnished employment for more engineers during the depression than has any other line of engineering. Today, the Federal Government wishes additional engineers to be employed in order to keep them in their professions for use when prosperity returns. There is nothing better to do than to open up more surveying jobs.

Perhaps every county should have its boundary properly surveyed and monumented and the surveys tied into the horizontal control net of the country. In any event, surveying and mapping are now recognized as very highly technical branches of engineering and they are, in consequence, given the respect that is due them.

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COMMENTS FROM HOME AND ABROAD

The excerpt given below is from a letter to the Director, U. S. Coast and Geodetic Survey, from Associate Professor Earl Church of Syracuse University.

"I have just received my copy of the February number of the Geodetic Letter. I have already read it from cover to cover, as I have each preceding number. I wish to express my gratitude to your bureau for being so kind as to include my name on the mailing list for this periodical.

"In these days when the profession of surveying and mapping seems to be coming into its own, as it were, and when the interest of surveyors and engineers in general is being directed more and more to geodetic surveys and their uses in connection with property surveys and countless other kinds of surveys, this little periodical indeed comes to have considerable value. If it is not out of place for me to advance the idea, I would like to venture the suggestion that it would be a splendid thing if this Geodetic Letter could actually be published in magazine form and given a wider circulation. I feel certain that it would meet with wide-spread interest and approval.

"With best wishes for the continued eminent success of your bureau in which my own interest will never cease to be very profound indeed, I am . . ."

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The following is quoted from a letter dated March 20, 1935, addressed to the Chief of the Division of Geodesy by Dr. J. J. A. Muller, President of the Geodetic Commission of Holland. It should interest the readers of Geodetic Letter.

"It is a splendid work you are performing now to complete the geodetic operations in the United States in so short a time. I do not doubt that with your energy you will reach the happy end and obtain a well merited success. I receive regularly the Geodetic Letters which I read with great interest. It is a

happy idea to give the whole personnel of the Survey an opportunity to express their ideas on technical or scientific matters and give their meanings about improvements. It makes them clear that they are mot merely human machines but real cooperators. Nothing could be more suited to stimulate their zeal, particularly in a period when every one must strive to give the outmost of his forces."

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Colonel Sir Gerald P. Lenox-Conyngham, Professor of Geodesy at the University of Cambridge, England, and formerly Superintendent of the Trigometric Survey of India, wrote a letter dated January 8, 1935, to the Chief of the Division of Geodesy, U. S. Coast and Geodetic Survey, in which were the following statements which it is believed will be of interest to the readers of Geodetic Letter:

"I have been interested in the geodetic letters which you have so kindly caused to be sent to me. Especially in some passages which showed signs of an awakening of appreciation of the value of good maps and good leveling on the part of local surveyors, engineers and municipal bodies. It has often surprised me to see how little use is made of trustworthy maps by people whom one would have expected to appreciate their value.

"Your situation in having an expanding programme of geodetic work as a part of a cure for economic difficulties is very interesting and surprising. The usual thing is to see survey activities cut down and surveyors discharged as soon as there is felt to be need of retrenchment."

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TENNESSEE VALLEY AUTHORITY ADOPTS STATE PLANE COORDINATE SYSTEMS

George D. Whitmore, Chief of Surveys,
Engineering Service Division,
Tennessee Valley Authority

After thorough consideration of the future usefulness and advantages of state-wide plane coordinate systems, the Tennessee Valley Authority has adopted the policy of basing all of its horizontal survey computations upon these plane coordinate projections, as originated by the U. S. Coast and Geodetic Survey. This is a matter of considerable importance to the Authority, as it so happens that the surveys of four large reservoir areas have already been largely completed and results calculated upon local coordinate systems. These four reservoirs total perhaps 2,000 square miles in area covered by control surveys, include more than

1500 miles of traverse control already completed and computed, not to mention numerous topographic, hydrographic and cadastral maps plotted upon these local coordinate bases. Another reason why such a change had to be thoroughly considered is that some of these reservoir areas fall in more than one state. For example Pickwick Reservoir originates in Tennessee, the lake extending into Mississippi and Alabama. Wheeler Reservoir area, about 100 miles in length and all in Alabama, nevertheless requires the use of two systems, one for western Alabama and one for eastern Alabama.

It is recognized that in order to gain the advantages of a state-wide plane coordinate system it is necessary to lose some of the advantages of the smaller local systems. The matter of greater scale distortion because of the larger area covered is, of course, already well recognized. The small local systems have had one other advantage, however, not so widely recognized, and that is they can be projected to a datum plane which represents the average elevation of the area covered by the local system. For example, the city of Pittsburgh in 1923 adopted a local plane coordinate system which was based upon a projection at elevation of about 1000 feet above sea level, this elevation representing the average for the Pittsburgh metropolitan area. Obviously it is not practical to adopt such a datum plane, or reference spheroid, for the plane coordinate projection for an area as large as a whole state.

The reasons which make it advisable to change from local plane coordinate systems to the state systems are, briefly:

1. It is felt that the use of these state coordinate systems by the Tennessee Valley Authority will tend to give them an official status sooner than might otherwise occur.

2. The state systems appear to be sufficiently accurate for all purposes except possibly cadastral surveys of city areas. In special cases of this sort it may still be advisable to use purely local coordinate schemes.

3. It is desirable that the surveys executed by the Tennessee Valley Authority be in agreement with and quickly convertible to surveys which are being made or will be made by other large organizations, such as U.S.C. & G.S., U.S.G.S., state highway departments, U.S.Corps of Engineers, railroads, and others. It is our firm conviction that it is only a matter of a few years until all of these and similar organizations will be using these state coordinate systems. If that is so, then any survey by any organization will be immediately available to all of the others, without the trouble and bother of converting from one origin to another.

4. It is highly desirable to get surveys of local property tracts, by local surveyors, upon a permanent and recoverable basis. Local plane coordinate systems would accomplish this result, but they lack the official standing which the state systems will soon acquire. Geographic positions would also accomplish the same result,

but the somewhat involved mathematics makes the average engineer shy away from their use. State-wide plane coordinates seem to be the means to this end.

The changing over from local plane coordinate origins to state systems will necessarily have to be done at the most convenient opportunities. It is now expected that some time during the present calendar year all of the local-origin surveys will have been recomputed. In the meantime all new surveys which are being made in new areas, such as the Aurora Reservoir area in western Tennessee, Guntersville Reservoir in northeastern Alabama, Chickamauga Reservoir extending upstream from Chattanooga, and others, are being computed immediately upon their respective state coordinate systems.

Surveys along the Hiwassee River in southwestern North Carolina are being computed upon the Tennessee plane coordinate system as well as that of North Carolina. This particular area is a great deal closer to the central meridian of Tennessee than that of North Carolina. Further, the Tennessee system has less scale distortion, and the developments in this area logically will be connected to projects in Tennessee. There are many similar areas where it will be advisable to compute more than one set of plane coordinates, as in the case of Guntersville Reservoir which lies mostly within Alabama, but the head of the lake extending perhaps 15 miles into Tennessee; Pickwick Reservoir, extending into three states, etc.

- O -

SUGGESTIONS FOR RECONNAISSANCE

The following suggestions for reconnaissance for 7-1/2 -mile spacing of level lines is given by A.C. Thorson:

"In the short time that I have spent in preparing for this program, I have learned quite a bit about obtaining information about feasible routes. To run over all the lines would require a long time and most of the information can be obtained with a minimum loss of time in the field if all sources of information are exhausted.

Maps may be obtained from the following:

Geological Survey	-	Quadrangles
U.S.Engineers	-	Quadrangles Flood Control Sheets
U.S.Forest Service		Forest Reserves (Important as many new roads are being built by CCC camps.)
State Highway Departments		
County Highway Departments		
Abstract Offices -(County and Local)		

U.S.Post Office Department State maps showing location of Post Offices and rural mail routes
Coast and Geodetic Airway Section Maps (If flight checked)

"In inland areas where road information is difficult to obtain I have used the following method:

A sketch was traced from the lines projected from all existing maps of the particular area in doubt. These sketches were sent to a Postmaster of a town located in the center of the area explaining that information is desired as to what roads are passable by truck, team, etc., and also to change the roads to their approximately correct location and to add any roads not shown and specify what roads are not in existence. When the data was transferred from old maps, many changes have been made.

"This type of reconnaissance has been necessary here as continued rains and swollen streams have made a large number of the country roads impassable.

"If the 7-1/2-mile spacing is to become general, I am offering this as it may help expedite reconnaissance in other sections of the country."

- 0 -

SOLAR OBSERVATIONS ON RECONNAISSANCE

H. M. White

When reconnaissance for a scheme of triangulation is being run in unmapped or inaccurately mapped territory the problem of locating the positions of points selected for stations is sometimes rather difficult. Often, existing maps are so sketchy that when stations are located with reference to roads, rivers, hills or towns as shown on the maps, the progress sketch prepared upon completion of the triangulation is likely to differ decidedly from the reconnaissance sketch. The difference may be so great that the figures will be seriously weak. Sometimes the positions of the stations as shown on the reconnaissance sketch will be so inaccurate that lightkeepers and observers will be materially delayed in picking up their lights.

In the process of reconnaissance, when certain prominent objects have been located with reasonable accuracy, it is often possible to locate other points with reference to them by compass bearings, three point fixes, etc. But when the country is flat and heavily wooded so that even from the tops of the tallest trees nothing can be seen that will be of use in locating one's position, a traverse of compass bearings and speedometer distances is often run to some known point. In many cases, however, traverses eight, or ten. or twenty miles in length are required, and

such traverses, if the roads followed are very crooked, consume a great deal of time.

Under such circumstances solar observations for latitude and longitude have been found to be both satisfactory and expeditious. The requirements are clear weather and accurate time, and since one second in time corresponds to fifteen seconds in longitude or almost a quarter of a mile, the latter is almost as important as the former. Latitude, of course, can be obtained without accurate time by an observation at noon. It is rarely convenient to make one observation at noon for latitude, and another observation at the same station for longitude, as the latter should be made as much as two hours before or after noon. But if the observer has checked his watch against Western Union time in the morning and can check it again that night, one set of observations during either the morning or the afternoon will be sufficient to give both latitude and longitude, with a fair degree of accuracy. When the latitude can not be determined by a separate observation at noon, an approximate latitude may be estimated and used in the formula for computing the longitude, then the computed longitude may be used in the formula for computing the latitude. The time spent in the field for such an observation need only amount to a few minutes though more time is required on the computation.

In recent reconnaissance operations in the heavily wooded coastal plain of South Carolina where no maps of any kind were available for certain counties, such observations were frequently employed to locate the positions of stations. Experimental observations made over previously established stations showed that results thus obtained checked the true latitude and longitude to within about half a minute of arc.

- O -

GEOGRAPHIC AND OTHER PROPER NAMES

In a recent letter sent out by the Director, emphasis was placed on the importance of paying a great deal of attention to obtaining and verifying geographic names which are placed on topographic and hydrographic sheets. This need is no less apparent in connection with such names when they occur in triangulation records, observations of horizontal direction, and descriptions of stations. In such records, however, it may often be more important to have proper names well authenticated, as for instance, those of land owners and tenants.

No one can foresee how far-reaching an error may become when the records show a certain station is said to be on the property of Mr. Blue when in reality it is just over the line on the property of Mr. Green, or when a station is given the name of Blue, implying that it has been so named after the owner of the land on

which it stands, when, according to custom, it should be given the name of Green. No immediate effects may result from such an error, but when a generation has passed away, and the land has become so valuable that the heirs of Blue and Green resort to the courts to determine the actual location of the property line between their lands, a published report issued by a Federal bureau some 20 years earlier in which it is stated that such-and-such a station was at that time on the land of Mr. Blue, or was named Blue (with the implication that it was on Blue's property), will be very important evidence before a court interested in determining the ownership of land nearby.

This difficulty might be overcome by ignoring or avoiding anything that would serve as evidence in later years. But to do this would be to neglect an opportunity of making a station of considerable value to a community through service to its taxpayers. It is far better to secure and give accurate data as to the ownership of the land on which the station stands, and if possible, to relate it directly to such ground evidence of boundary lines as survey monuments, fences, hedges, etc. But such data should be made as nearly correct as possible without undue research. Simple inquiry and a careful statement of the result thereof will usually provide all the data that may be required for future reference.

If the owner of the land is unknown, say so; if the name of the occupant of the land is unknown, say so. But see to it that what is said is reasonably correct.

Great care should be taken in determining the correct spelling of a proper name used in a triangulation record. And it will greatly simplify the task of the office editor who may be charged with preparing such records for publication, if the original record shows a consistent spelling of such a name when it occurs more than once.

As regards geographic names, our records should be as accurate as reasonable care and effort can make them. Having the name of a geographic feature correct may not always be as important as having the name of a property owner truly given, but often the difficulties attending the former will be the greater. This is particularly true when stations established a half-century or so ago are recovered and redescribed. Sometimes the name is based on original ownership of the feature, as Miller's Point, and the possessive form was at one time correct; but with the passing years and changing ownership the possessive form may have been dropped and the name changed to Millers Point or Miller Point. But this is not always the case, and there are examples where the possessive form has been retained, due to local usage, continued ownership, or for some other reason. There is no rule to follow in such cases, but the evidence of local usage, particularly as expressed on maps, is valuable.

Sometimes, in mountainous country, at the time a station was established, one name was used to designate quite a large region, as a ridge with a number of summits on it, and the station established on one of these summits was given that general name. Later, as the country becomes more settled and separate names are given to the various summits and other features, it may be found that the name given the station is attached to a summit some distance therefrom, and a wholly different name given the summit on which the station is located. A little inquiry will discover the history of these names, and a simple statement in the description of the station make the matter clear. If this is not done, the office editor is confronted with the task of harmonizing a station of one name with its location on a feature having a different but well-recognized local name.

Sometimes there may be a choice between naming a station after a person(owner or occupant) and giving it the name of the land or geographic feature on which it is located. As a general rule the latter is to be preferred; it will have greater value as an aid in the future mapping of the region; in placing old maps in correct position with reference to new maps; and in other studies pertaining to the geography of the region. And of course, the name of the owner or occupant of the land (or of both) may be incorporated in the description of the station with full value resulting therefrom.

- O -

SUGGESTIONS OF AN OFFICE MAN TO THE FIELD

The story about the battle being lost for want of a horseshoe nail was probably meant to convey the importance of little things that count a lot. Little details, which on the surface seem unimportant, can increase the efficiency of a large organization working at high speed if given proper attention.

Triangulation and level parties are in keeping with the times by breaking all speed records for work produced. As a matter of necessity, the rate of reconnaissance for triangulation has also been increased. In short, the progress of geodetic surveys is moving forward faster on a broader front.

In order that the machinery will work smoothly, the office personnel who supply data to the field parties, welcome any suggestions pertaining to the supplying of the said data.

They would also like to make a few suggestions on their own account. Recently, during the migration from the south to the north, data were prepared and sent to the address of a field party in the south the day before a telegram arrived requesting

that the data be sent to the new field of operations in the north, as the party was leaving the south that day. The telegram received in Washington shortly before closing time, reached the proper person the next morning. The data were on their way south and the party was on its way north. There was nothing to do but for the party to wait until the data could be forwarded. A chief of party usually knows at least a few days in advance of the time he is ready to travel to a new working area, and should immediately notify the Office of the contemplated move especially if he is expecting material to be sent him.

An attempt is being made to furnish data to the parties in such form that each party may easily determine if it has everything necessary. The writer makes no excuse for having omitted an important portion of data the absence of which was discovered several months later just as it was needed. The Office would appreciate immediate notification of any necessary, missing data.

About twice a year each party "cleans house" by returning its accumulated maps and data to the Office. If these data were returned by the reconnaissance parties as soon as they are no longer needed, it would save assembling duplicate data for the triangulation party, which, in a number of cases, follows on the heels of the reconnaissance party, and it would make the truck load a few ounces lighter in weight and a few cubic centimeters less in volume.

At least one photostat copy of the description of each bench mark and triangulation station must be made in order to guard against possible loss of the information. Until the information is published, or provided in some other more economical form, further photostats must be made to supply the official and public demand. This involves certain problems in photography that may be lightened by observing the following rules:

Use new typewriter ribbons.
Use black and not blue ink.
Take care in making check marks so that they will not be confused with nor obliterate original cipers on a photostat.

A number of descriptions received recently indicate that worn-out ribbons were used on typewriters. They could not be photographed and new typewriten copies had to be made. False economy is obvious.

Check marks on the original are rarely confused with other matter, because they are made in pencil or in colors. Such is not the case with photographic copies. A check mark appears with the same weight (for certain colors) as for the other matter. They should be made small, entirely detached from the thing checked, and preferably in colors at the blue end of the spectrum.

The colors in order of their effect in photography are: red, orange, yellow, green, blue, violet. This is not the same as the effect on the eye; for yellow, which is faint to the eye, affects the plate in almost the same degree as red and black.

Sketches of triangulation reconnaissance must be on a scale large enough to be useful to the observing parties. While the standard scale is approximately 4 miles to the inch, the final sketches of the triangulation do not need to be so large. Eight miles to the inch would be sufficient. We do have a few sketches of completed triangulation on the large scale of 2 miles to the inch but as there is not enough room in the files nor working area on our desks for such huge sketches, the smaller ones showing completed triangulation are desirable.

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SURVEY MONUMENTS DO NOT MARK BURIED TREASURE

(Press release of April 20, 1935)

Recent reports from Coast and Geodetic Survey engineers at work in Virginia, state that many survey monuments are being used to form chimneys for oystermen's shanties, according to Captain R. S. Patton, Director.

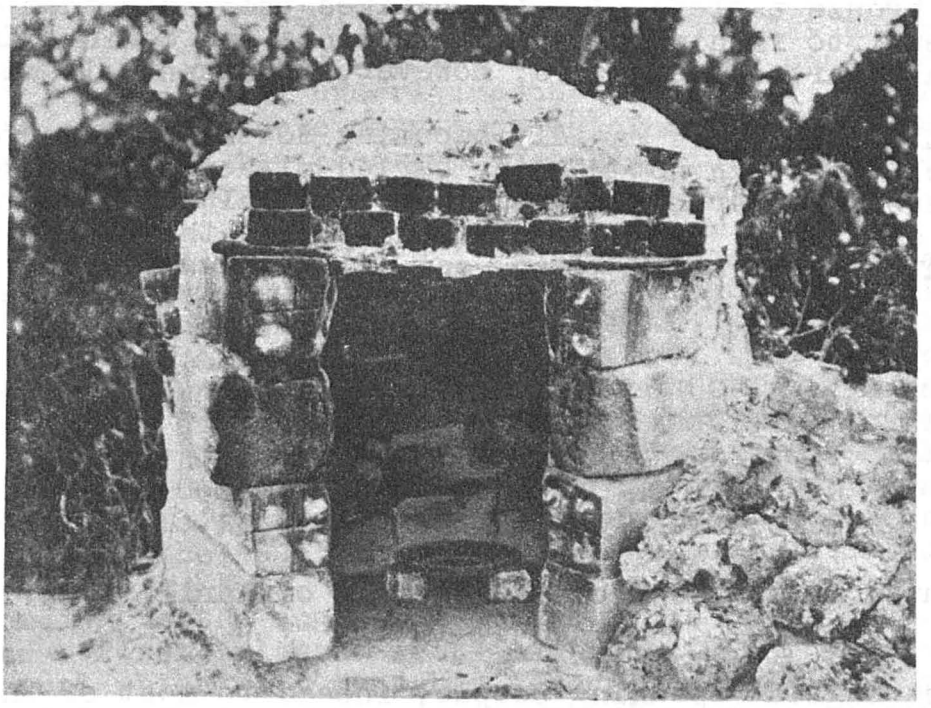
These monuments, marking survey stations established many years ago, are all as valuable for reference points today as the date they were placed. The oystermen, while not malicious, were in need of the drain tile used at that time for station marks and dug them up for what they considered a more practical use. Persons little realize that such removal completely destroys a station, necessitating its replacement at considerable expense by the Federal Government, it was stated.

The Coast and Geodetic Survey engineers in making their surveys always bear in mind the normal uses to which these stations are to be put, namely: as a basis for charts and maps; for the location and perpetuation of boundary lines of states, counties, cities, parks, and private property; and for many other engineering operations. While these engineers thought they know most of the uses for such station marks, they are forced now and again to add to their list.

A review of the files in the Washington office discloses instances where station monuments consisting of large stones or blocks of concrete weighing 100 or more pounds, have been dug up and used to anchor boats off shore or as weights for fish traps and lobster pots.

Going still further in his ingenuity, man has utilized these monuments as headstones for the graves or as steps to his cabin.

Even here his inventiveness did not stop: Years ago when indoor cooking was not so universal, it was not uncommon to find outdoor bake ovens constructed from triangulation station monuments, according to official records. (See picture shown below.)



Until the last few decades, such station monuments have been inconspicuous objects, partially hidden to reduce their mortality. They were usually set flush with the top of the ground and the letters "C. & G.S." (Coast and Geodetic Survey) cut into the stone or concrete. A nail hole or the projecting end of a nail marked the exact point over which the instrument had been set. But the very inconspicuousness of the marks rendered them more exciting to the finders. Persons stumbling upon them accidentally, at once became convinced that they had discovered Captain Kidd's buried treasure boxes. Along the southern coasts in particular, where pirates were supposed to have operated extensively, the station marks have been dug up and carried away in great numbers, according to Captain Patton.

A better system of marking the stations is now employed. Into the top of the stone or concrete a bronze tablet is set bearing an inscription reading in part: "For information write to the Director at Washington, D. C.". Information is thus disseminated, and many are now proud to have a station of the national control survey net in their vicinity. On each of the tablets is stamped the name of the station and year of its occupation. The latitudes and longitudes of the stations and the bearings between contiguous ones are computed by the mathematicians at the office in Washington, and as

rapidly as possible these data, including descriptions of the stations, are printed, so that engineers and others may make use of the products of this great national survey.

It has been necessary in the Philippines to discontinue the use of the bronze tablets, for the natives there dig them out and melt the metal to fashion personal ornaments and bowls. In this country, this particular hazard, however, is absent, it was stated.

Thus the country is rapidly becoming dotted with survey monuments which, although not marking buried pirate hoards, do indicate points on the earth's surface directly valuable to planners, surveyors, engineers, and property owners, and therefore, indirectly important to every man, woman, and child in our country.

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DEFORMATION OF EARTH'S SURFACE DUE TO WEIGHT OF BOULDER RESERVOIR

(Reprinted from "The Reclamation Era" of April, 1935)

To most English speaking people, indeed to most of the peoples of the earth, such expressions as "eternal as the hills" or "as solid as a rock" mean what they say. Such expressions convey one's ultimate thought as to things firm and substantial. On the other hand, the interest of the geophysicist, structural geologist, and engineer is not in the rock's permanence and immobility but rather in its impermanence as it is broken down by climatic influences and in its movements as it continually adjusts itself to the various loads imposed. On a knowledge of these factors do the permanence and safety of the more monumental of man's work depend. It is true that for most structures their life and size are such that the popular view of the earth as rigid and eternal may be accepted. But in the case of the Boulder Dam the loads involved are such that the rigidity and permanence of the rock cannot be taken for granted without investigation.

The study, at present being reviewed, is one of several dealing with possible rock deformations caused by the building of Boulder Dam. It concerns only the possible general settlement of the land under and surrounding the Boulder Reservoir due to the huge weight of the new lake which will be formed, a weight of 41,500,000,000 tons. While the bending of the earth's crust under the weight of the dam and reservoir proves to have little bearing on the security of the dam as the bending over the length of the dam will be so slight that it will be difficult or impossible to measure, it is computed that the maximum settlement of the territory over a large area will be appreciable. This fact is of great interest to the geophysicists in connection with their study of isostasy.

Among geophysicists it is tolerably well established that the granitic continental shields, which popularly may be understood to mean the surface of the earth as we know it, floats upon a heavier lower material which is probably in a plastic state. The condition is much like a woven raft of logs floating in a lake. If a heavy weight be placed on a portion of such a raft it partially submerges. Similarly it is thought that the weight of mountains partially submerges the bottom of the granitic shield in the plastic material underlying the crust. If, therefore, a new weight of appreciable magnitude be placed on the earth at any point, according to the theory of isostasy the crust will give until the submergence restores the equilibrium.

It is evident that ordinarily no weight added by man to the earth's surface is great enough to give measurable settlement since it is probable that the crust is 12 to 75 miles thick so that most weights are insignificant compared with that of the crust itself. Therefore, the truth of the theory has had to depend on indirect evidence. Now for the first time possibly direct evidence may be obtained. Careful bench marks will be established by the Coast and Geodetic Survey over the area which is expected to settle. After Boulder Reservoir is filled new levels will be run and the results compared with previous calculations.

According to the engineers, three types of settlement may take place - first, elastic settlement due to compression in the earth's crust which will probably take place in 2 or 3 years; secondly, settlement in accord with the theory of isostasy, the time required being unknown; and third, settlement due to plastic flow in the crust. Maximum elastic settlement is estimated to be 0.6 foot over an area of 12 square miles; the isostatic compensation may be 2.0 feet over an area of 150 square miles.

To the ordinary person these computations may seem to have little practical value except for the immediate problem investigated. However, it is only through greater knowledge of all physical phenomena within our reach that advance in civilization is possible. Who knows but that the results of these measurements may not lead to a better prediction of the cause of earthquakes or to a clearer understanding of structural geology which will directly benefit mankind?

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LAND SURVEYS AND NATIONAL WELFARE

Roy M. Buck

This is a story of precise land surveys made in the Philippine Islands. To an engineer who has seen the wild and wooly insurrecto turn into a prosperous and neatly shaven farmer, the talk of better land surveys has more than a passing significance. Such metamorphism is a good testimonial to the American form of government. However, the credit is really due to a wholesale method of quieting titles which was invented by Americans but has never been officially adopted in any state in the Union.

The feeling of insecurity in the mind of the adverse occupant of land is so inescapable that he cannot be a good citizen. Whether he be white or black or brown, he cannot behave like a member of the firm unless he has a share in the business. On the other hand a man who is secure in his real property rights, secure in the knowledge that whatever he saves to improve his property will be safe unto himself and his dependents,will generally be the kind of citizen to keep the boat of democracy on an even keel.

A good example of the above principle is found in the experience of Uncle Sam in the Philippines. As an example, not only the malady but the cure is demonstrated. The writer was connected with the Philippine Bureau of Lands for ten years and entertains the belief that this country is getting into a condition with respect to its land titles that the Islands were in at the time they were ceded to the United States by Spain.

It is a peculiar feature of land title that to be valid it must properly identify the boundaries of the property. Spain in her government of the Islands failed to provide a system wherein the common people might be secure in their ownership of land. There was, however, no scarcity of titles. A great many people had "royal grants" but they were so weak on boundary descriptions as to be a source of continual irritation. And there are still in existence a great many such grants that fail to indicate where the land may be found.

In the United States, the old monuments and corner markings of original surveys were established from 40 to 200 years ago and in many cases are lost without a trace. Another 25 years will see a large percentage of them here in the West permanently obliterated. This situation is further aggravated by the fact that everybody and anybody is conveying titles to land based on descriptions wholly inadequate to identify the properties intended. Such deeds are made of record in the county where the land is located and there is no one at present with authority to insist upon definite, sufficient and accurate descriptions.

Since the customs of the country gradually change to meet existing conditions, and customs weight heavily into the interpretation of law, the condition approaches in which the mere possession of land will have undue weight before the law in determining ownership. Under such a condition the strong oppress the weak and therefore, the very basic purposes of government becomes confused. It was this kind of confusion that Spain ceded, with other things, to the United States.

The first thing to bring peace to the Islands after subduing the rebellion and establishing schools was to set up local units of government including the courts. And the next was the establishing of more courts; everybody seemed to have a job for the courts. An analysis of the situation showed that a high percentage of the cases were either boundary disputes or trouble growing out of adverse possession of land. In many cases the courts were

a year behind schedule. Without surveys the courts have nothing to work on. Even when court was held on the disputed ground, without surveys there was nothing to tie a decision onto. This condition made recourse to law generally a futile consideration. The result was general unrest.

In dealing with conditions vacated by the Spaniards it must be stated that Americans had some advantage that they do not have in their own country. They had a clean slate in some respects and were able to start some things right instead of stumbling along with prejudices and premature ideas of things. The metric system was retained. School children are not retarded by having to remember whether a rod is 16 or 66 feet.

In line with the idea of starting right there was established a system of guaranteed titles under what is known as the Torrens system. Such a title was made available by the government to anyone who would bear the expense of survey and who could establish certain requirements of ownership. The potency of this measure was so plainly evident that after a few years a law was passed providing for the cadastral survey of the Islands. The cadastral law required the land claimants to bear the expense of the survey and adjudication of titles. Therefore, it has not been made in the sparsely settled areas. But it covered most of the densely populated areas from which most of the litigation came. A feature of the cadastral law was that it did not cost the government any money but the greatest peculiarity was its legal aspects. The action was started by the government under the presumption that the land occupied was public land. Land occupants were therefore, forced into a defensive position, regardless of whether they had, or had not, valid titles, regardless of whether or not they wanted the survey. Strangely enough the beneficent results of the survey were never questioned, but that is explained in part by the fact that the general survey was not started until petitioned by a large percentage of the owners.

The Bureau of Lands was charged with making all cadastral surveys. The problems incidental to fitting a plane surface onto the surface of a spheroid were readily solved. Each project covered a taxing unit about the size of an average county. A central meridian was established through the principal town of each project and the grid system used. The line of normal scale coincided with the central meridian. There was not much distortion on the smaller areas but what there was fell in the eastern and western extremities of the projects.

The survey in each case was founded on a precise control of triangulation and primary traverse. The primary traverse encircled the project. Secondary traverse lines crossed the project at intervals of about every two miles while tertiary traverse between secondary points completed the network. All corners were shot from tertiary stations and grid coordinates of each corner figured from the coordinated tertiary stations. Technical descriptions for court use and as embodied in the title did not show coordinates,

it being considered preferable to compute bearings and distances from the coordinates. Each town and village was provided with location monuments in pairs intervisible so that the grid azimuth was subsequently available to surveyors. Grid coordinates of these points as well as of all lot corners were available in the Bureau of Lands to licensed surveyors.

Upon conclusion of the field and office work of the cadastral survey, a special land court opened in the project to settle adverse claims and issue titles, neatly engrossed certificates to those who met the requirements of ownership. Such a title could not be indorsed and recorded as a means of conveyance. The buyer must get a new certificate with a technical description checked by the Bureau of Lands.

At the present time the Islands have a very effective means of quieting title to land and it is inexpensive and could be adapted to the United States with no reasonable grounds for opposition.

The plan to have special legislative sanction to the grid system of surveying is a step in the right direction. It might be possible to include with such a bill a provision requiring all title conveyances to be checked for description deficiencies by the county surveyors at a nominal fee where no field work is required.

A law providing a sound establishment of land titles is urgently needed in connection with the program because new surveys and new monuments are without bearing in old titles. Owing to their greater economy and absolute effectiveness the program at the proper time, should include cadastral surveys. Titles based on such a survey would save us a great deal of trouble that may well be expected in another generation.

- O -

Truck Accident Damage Claims

Since all claims for damage as a result of accidents involving trucks belonging to this Bureau have to be submitted to the office of the Solicitor to determine their validity, it is requested that the following points be noted:-

1. Chief of party or man in charge of immediate unit operating truck involved, should make <u>thorough</u> investigation and report findings to the Office at once.
2. Signed statements from all witnesses together with their names and addresses should be secured.
3. Form No. 27 is to be filled out by investigating officer.
4. Form No. 26 is to be filled out by the truck driver.

- O -

EXCERPTS FROM PARTY PAPERS

"SPUR LINE"

WHEN IS A MAN A SUCCESS?

When is a man a success? He may be a failure financially, but when is he a success? A man is a success:

When he refuses to slander even his enemies.
When he does not expect to get good pay for poor service.
When he spends more time on fixing his own faults than on trying to mend the mistakes of his neighbors.
When he does not wait until tomorrow to do the things that should be done today.
When he is loyal to his employer and not false to the ones with whom he works.
When he intelligently cooperates with the other members of the organization.
When he is studying and preparing himself for a higher position with better pay.

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"HOOFERS EXCHANGE"
Seventh Edition.

RECORD

One record established the past month made history. One observing unit under the able leadership of Joe Lyman, ran 22 miles of levels in 8 hours and 24 minutes. The personnel of that unit are heartily congratulated not only by the chief of party, but by all members of our organization. That was a pretty piece of "track work". Call Taylor recording.

Not to be overlooked was Gibson's 220 miles for the month which was made with road and weather conditions for the most part in the negative.

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"HOOFERS EXCHANGE"
Eight Edition.

SETTING OF BENCH MARKS

There have been some unfavorable comments on location of posts. The LOCATION of the bench marks is the FIRST consideration for well executed work. They are all that remains when we are gone. It is better to set fewer posts and set them well than

to set a large number of poorly located posts. There are so many considerations for proper placing that the bench mark parties must often do some reconnaissance to find the proper spot. When setting marks in highway bridges, especially on the guard rail, place them at the far end of the bridge in the direction of traffic. This is so that if someone runs into the bridge the mark will not be endangered. In going over the lines that have been set I have found that for the most part the bench marks are well located. However, in some cases they are exposed to danger. Observers should also note the locations and cooperate with the bench mark parties by constructive criticism.

- 0 -

CIRCULAR LETTER TO CHIEFS OF TRIANGULATION PARTIES

Reports reaching this Office indicate that a number of the triangulation parties are encountering difficulties particularly in the mountainous regions where instrument stands are usually all that are required. It is possible that a number of the difficulties may be caused by lack of proper attention in preparing the station for the observations.

When using low, wooden stands it is particularly important that the stand be so prepared and the instrument mounted on it as to prevent any possibility of it being disturbed during observations. A good procedure is to require that each observer follow a definite program, somewhat as follows:

1. Inspect the stand to see that it has been set into the ground at a sufficient depth to give it stability. Usually an 8 to 12 inch depth will suffice unless the soil is very sandy, in which case it should be considerably more--as much as 2 or 3 feet. The soil immediately surrounding the legs should be dug away so that there is no possibility of pressure being transmitted by the observer to the stand while making his observations. Ordinarily, the tripod legs should be set from 8 to 12 inches into the ground, and the hole up to within about 5 inches of the surface should be carefully filled in and the earth well tamped.

2. All of the nails should be well set up and, if necessary, additional nails should be driven in order to make the stand rigid throughout.

3. It has always been considered good practice to have the stand loaded with rocks, bags of sand or other material, so as to hold it solid on its footings.

Of course, platforms serve a very useful purpose and are the most certain means of preventing disturbances to the stand while observing, but in mountainous regions where the stations cannot be reached by truck, there is a considerable amount of additional work for the lumber has to be carried to the station. In fact, where the country has sufficient relief to permit the use of stands, it is rather common to have stations where it is impossible to drive the trucks.

There is nothing new in these suggestions and undoubtedly you have them in mind right along. However, the main point is to see that they are not overlooked by the various observers in your party and that they receive constant attention at each station visited.

Undoubtedly, you have other points of view on this subject and we at the Office would be very glad to have letters or short items from you or your observers giving us your reaction to the above, also calling attention to any procedure which you practice or recommend for other observing parties.

- 0 -

WARNING AGAINST DANGER OF FOREST AND PRAIRIE FIRES

As the parties move north and the dry summer season approaches, it is perhaps not inopportune to sound a note of warning against the danger of fire.

Such a warning is unnecessary to many of the members of our field parties, for they realize the damage that can be done by a small spark from a cigarette or from a camp fire not entirely extinguished. But our present parties are considerably enlarged and many of the new members are not experienced woodsmen. It is mainly to them that this warning is addressed.

It requires only a moment to satisfy oneself that a match is put out or that there is no spark of fire left on a cigarette. The best practice however, is to throw away no burned matches or cigarettes but to put them in some receptacle which can be emptied later in some safe place.

Camp fires should be carefully put out either by throwing water on the ashes or covering them with fresh earth.

In burning rubbish or garbage, a hole should be dug large enough to contain the refuse which is to be consumed and the ground around the hole should be cleared of brush and grass to avoid a fire being started from possible sparks. Upon leaving the camp site, all fire in this hole should first be quenched and then the hole filled with earth again.

Great care should be taken upon leaving camp that no stumps, logs or other rubbish be left smoldering for when a wind comes up they may burst into flame and cause serious damage.

These few simple precautions may save a great loss of timber or even life in the wooded or prairie sections of our country.

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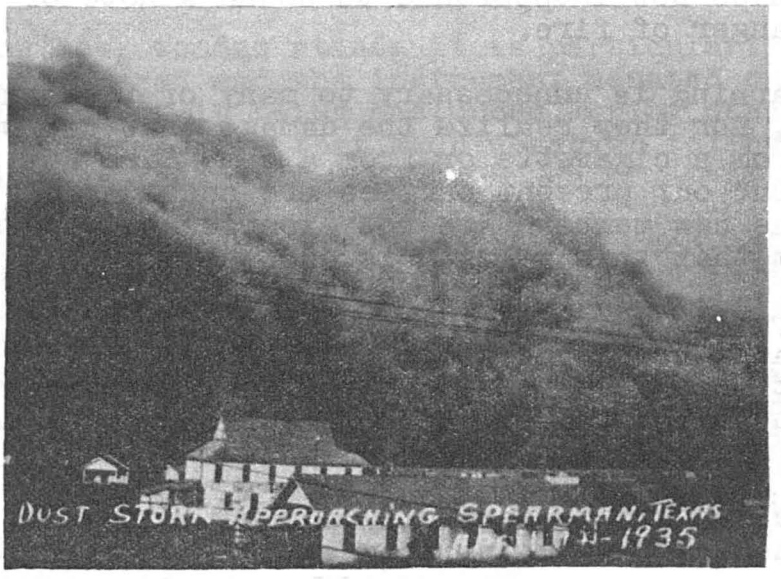
NOTES AND NOTICES

The following notes copied from reports of field parties working in Texas show the conditions with which the parties have had to contend during this winter in the lower middle west.

"On or about April 17 the U. S. Weather Bureau forcasted the end of the dust storms or at least that these storms would be greatly diminished. Since this date there have been but two days free of dust storms. Our trucks, especially those used for building, are suffering. It has been found impossible to keep the sand out of the motors. Although to date no member of the party has suffered ill health from the dust, it is feared that if exposure to these storms is continued much longer sickness must result. There is a great deal of dust pneumonia in this area."



"Texas is a good state, but I was glad to leave it this time. Our work was considerably delayed by severe dust storms. These came on the average, twice a week, and one day we had two, morning and afternoon. Their duration is variable, but usually visibility was very low for two or three days following one, and then another came. They come up almost without warning. At one time, I parked the truck in clear atmosphere and walked about half a mile through the woods to find visibility had been reduced to a quarter of a mile. Another time a dust cloud that stopped all work for two days, arrived unnoticed while I was driving through the business district of Fort Worth. However, American humor won't be

denied, and they are referred to as "West Texas Rains" and "Vitamin K", the latter founded on the assumption that the dust comes from Kansas. Up in Kansas though, they say it comes from Texas."

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Messrs. Elmer C. Houdlette and R. H. Baldock, State Representatives of Massachusetts and Oregon, respectively, have both compiled interesting and useful publications for their states that are to be used for computing plane coordinates on the U. S. Coast and Geodetic Survey Grid System. The one for Oregon consists of 53 pages of mimeographed material, including the necessary Plane Coordinate Projection Tables, while the one for Massachusetts consists of 72 pages of matter lithographed from an exceptionally neat job of free hand lettering throughout. It contains sample field notes, computation of geodetic positions and computation of grid coordinates with tables. These State Representatives are to be commended for compiling and producing these useful publications.

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Employees of field parties should inform their correspondents that in addressing mail to them they should address it in care of the chief of party. This will prevent confusion when several field parties are working in the same locality.

Attention is again called to the bad practice of some chiefs of party in requesting the postmaster to forward <u>all</u> mail addressed "c/o U. S. Coast and Geodetic Survey" rather than furnishing him with a list of the members of the party for whom mail should be forwarded. This matter was also the subject of an editorial in the January 1935 number of the Geodetic Letter.

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The following new U. S. Coast and Geodetic Survey publications are now available for issuance:-

Special Publication No. 193 - Manual of Plane Coordinate Computations - By Oscar S. Adams and Charles N. Claire. Price: 35¢.
Computation of Plane Coordinates - By J. H. Brittain. Price: Free upon request.

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A "Biographical Memoir of John Fillmore Hayford" by Professor William H. Burger, Department of Engineering of Northwestern University has just been issued by the National Academy of Sciences.

Dr. Hayford for ten years was the Chief of the Division of Geodesy of the Coast and Geodetic Survey and accomplished work of great scientific value. After leaving the Coast Survey in 1909

he became the Director of the College of Engineering at Northwestern University, Evanston, Illinois. Professor Burger, who had been with the Coast Survey since 1899, accompanied Dr. Hayford to Northwestern University to accept a professorship at that institution.

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CUBAN GRAVITY EXPEDITION

Harold E. McConnell

The gravity party of the U. S. Coast and Geodetic Survey has just returned from a season's work in the island of Cuba. With the cooperation of various interests, including that of the Cuban government, a total of 84 new gravity stations were established in various parts of the island. Three stations were occupied which had been previously established in 1933, and five reoccupations were made during the course of the season to test the integrity of the pendulum.

The work was divided into four groups of stations in widely different areas, in the provinces of Matanzas, Santa Clara, and Oriente. The Emilia group, near the town of Jaguey Grande, in Matanzas, represents an attempt to work out a previous geophysical picture which had been made with the torsion balance, and is the most detailed gravity study of a single geophysical feature yet undertaken by this Bureau. Thirty-six stations were placed in an area of approximately 200 square miles. Almost exact agreement was found with the previous pictures, with several clarifying concepts added, and it is a particularly good example of the peculiar significance and relation of gravity studies to an isolated geophysical feature. Anomaly differences were found in this area ranging from about plus 18 to minus 5 milligals.

The almost complete lack of roads made it necessary to put the gravity truck and companion car to unusual hardships, over country so rough and rocky that tires were soon worn and cut to pieces, bodies were bent and crank cases were continually being cracked. The gravity truck was spared as much as possible by leaving it under the care of some farmer while the party returned to the base. At one time it was found necessary for the observers to ride in on horseback daily as the roads were completely impassable to the lighter car.

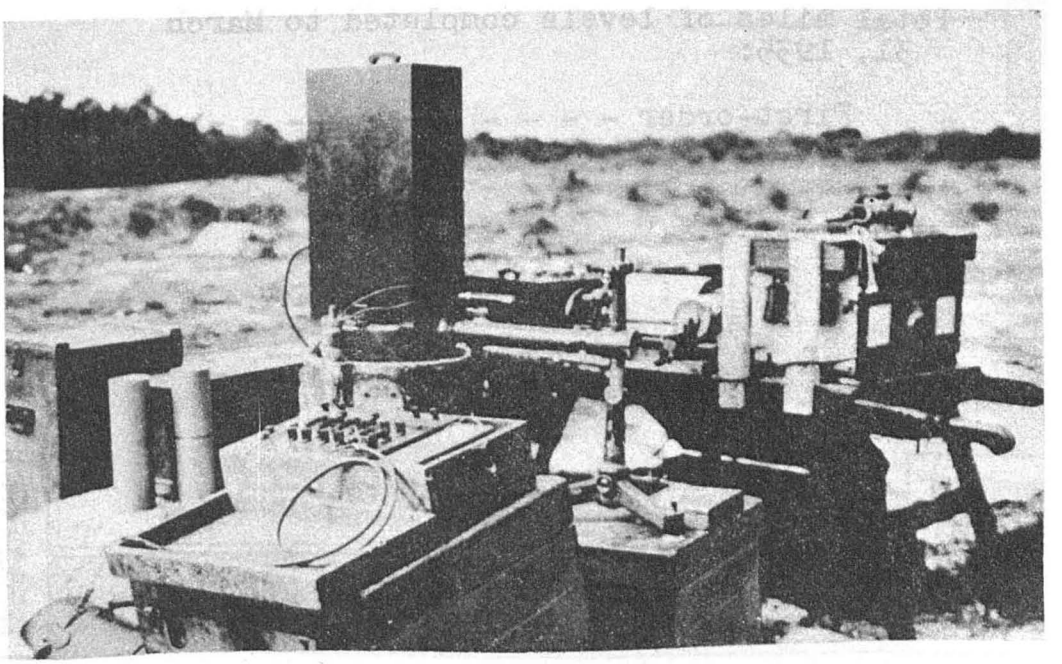
The Cauto work, in Oriente, consisting of 7 stations, was an attempt to get additional information on a high gravity area of considerable magnitude and importance, isostatically, just to the north of the Sierra Maestra mountains and the Bartlett Deep. An anomaly of plus 116 (Bowie method), which is probably the highest land anomaly yet discovered on our continent, was disclosed, in addition to more accurately defining the limits and trend of this area. Here again the party was greatly hampered by lack of roads.

For a part of the stations a freight car and motorized engine was secured, through the cooperation of an American sugar company. The gravity truck was loaded on the freight car and hauled to sidings on the company cane line railroad, where it remained during the time of observation.

The Rodas group of 19 stations, in Santa Clara to the east of the Emilia group, though surveyd in less detail over a territory of 400 square miles, represented in general an attempt to arrive at a correlation between two known high gravity areas and a known low gravity area on the north. The anomalies ranged from plus 36 to minus 54 milligals. The roads were in much better condition here and the work progressed rather smoothly in the regular way. It was while we were working in this area that an attempted political uprising or revolution of some proportions took place in Habana. It did not, however, have popular support or sympathy in the outlying areas and was quickly put down by the government. The party was unmolested.

The Keys group consisted of 22 stations placed along the coast line and islands off the coast of Santa Clara province about 225 miles east of Habana. A 40 foot yacht was obtained, and through the use of some previously constructed equipment the gravity recording instruments were transferred to the yacht with a minimum of external connections or delay. This equipment was transferred to the shore at each station by the use of a small boat, where a few connections were quickly made and observations started. The boat was well manned and we were able to maintain a progress of a station per day, which is the maximum progress on inland stations with the present truck and equipment.

(Shown below is a picture of the gravity apparatus set up at station Pueblo Viejo.)



REPORT OF PROGRESS

Triangulation:

Lineal miles of triangulation through axis of schemes completed during March, 1935:

First-order - - - - - - - - - - - - - -	1,474
Second-order - - - - - - - - - - - - - -	428

Total miles of triangulation completed to March 31, 1935:

First-order - - - - - - - - - - - - - -	57,846
Second-order - - - - - - - - - - - - - -	3,964

Levels:

Lineal miles of levels completed during March, 1935:

First-order - - - - - - - - - - - - - -	1,243
Second-order - - - - - - - - - - - - - -	8,763

Total miles of levels completed to March 31, 1935:

First-order - - - - - - - - - - - - - -	103,371
Second-order - - - - - - - - - - - - - -	121,417

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