

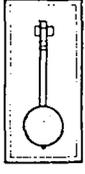
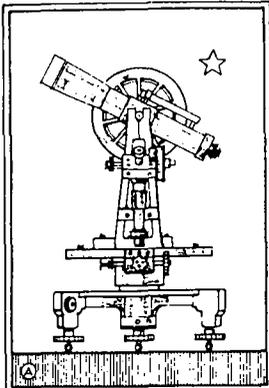
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GEODETIC LETTER



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Volume 2

Number 8

Plea for up to date maps	2
Control survey monuments are lasting longer.	3
Visit to triangulation party	5
Magnetic work by field parties and state representa- tives of the Coast and Geodetic Survey.	7
Constructive criticism.	10
Gleanings of experience	12
Vertical control for rivers.	14
Party organization	15
Leveling party units	20
Ball bearings as turning points.	23
The red rod.	24
Comments on national planning.	25
Mapping the country.	27
Geodetic control and private boundary surveys.	28
Suggestions from the field	30
An appreciation of Coast and Geodetic Survey work.	31
Shadows.	35
- - And sudden death	35
Failure of steel towers.	40
Scene changes along a leveling line.	41
Excerpts from field reports.	42
Notes and notices.	43
Report of progress	45

PLEA FOR UP TO DATE MAPS

There is a widespread interest in topographic maps for carrying on the various activities of our country and especially by officers of the Army who must prepare for warfare by studying and using maps. If they have maps, military operations can be carried on with greater effectiveness.

There is quoted below an article which appeared in the San Francisco "Call", which should interest readers of the Geodetic Letter.

New Maps for California

A few weeks ago a group of officers attached to a regiment stationed in California were given a problem to work out.

It was a simple problem, consisting merely of establishing a line of outposts in familiar, inhabited territory. And for use in determining the location of the posts, they carried one of those familiar contour maps that the United States government produces, and that are popularly believed to be the best in the world.

But within half an hour, using that map, they found themselves completely bewildered. It showed plainly enough the larger topographical elements of the country, but for any detailed work it was worse than useless. Roads did not lie where they were shown on the map. Some highways marked on the map did not exist at all on the terrain. Others, not shown on the map, were wide and plain on the landscape. A road that ran to the RIGHT of a railroad on the map, really ran to the LEFT. Finally one of the officers said, "Let's see the date of that map!" and it was discovered that it had been made by the government in 1885 and had never been adequately brought up to date.

It had been a perfect, a useful map fifty years ago, but in the last half century men have made enormous changes in California. We have dug tunnels and canals, we have laid down railroads and hundreds of thousands of roads and highways. And in the thickly populated sections of the state, a government topographical map that is out of date is nearly useless.

For ordinary purposes such a map is at the worst a serious inconvenience. But for military purposes it is positively DANGEROUS.

We do not contemplate war in California, on the Pacific Coast. We hope and pray that war will never be waged along this

coast, but we should realize that in time of war accurate maps are as valuable as armament and troops, and are essential to the maneuvering of forces.

At the beginning of the world war, the French army was tragically handicapped by the lack of accurate maps of its own eastern terrain. The French general staff had never dreamed that the war, when it came, would be fought in France. So, although they had excellent maps of Germany, they had none of their own territory. The British, also, had maps of Germany and Belgium, but none of France. As a result the allies lost valuable time and thousands of lives. French engineers immediately began the making of accurate maps and by the close of the war they were well equipped, but a fatal mistake had been made for which France paid heavily.

Here on the Pacific Coast we are in the same state of unpreparedness. Some areas are adequately mapped. Others are tragically out of date. The government engineers have been working for more than half a century on the mapping of the state, but we have been changing the face of the land almost as fast as they have mapped it.

Here, therefore, is an opportunity for the government to employ thousands of civil engineers in useful, necessary work. Instead of using a small corps of engineers on one quadrangle at a time, the government could use hundreds of groups and bring every section of the state up to date in a comparatively short period of time.

A tremendous number of engineers have no employment at present.

Tremendous areas of the Pacific Coast are dangerously and inadequately mapped.

Let the federal government put those private engineers to work on this urgently needed project.

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CONTROL SURVEY MONUMENTS ARE LASTING LONGER

Of all developments in surveying and mapping in this country, it is believed that the improvement in the monuments used on federal, state, county, city and private surveying is outstanding. There have been in the past, many control surveys made by different kinds of organizations with little or no thought given to the perpetuation of the survey stations. In most cases the control surveys were designed to serve some immediate objective. The thought that these field stations could be of value to

others for future operations never seemed to have been given due consideration.

Along the coast we have been carrying on triangulation for more than a hundred years, and it is only in recent years that the coast triangulation stations have been monumented in an adequate way. There are cases on the coast where the station mark was a brick with a drilled hole set a foot or more below the ground with a wooden peg above the brick. One can imagine the difficulty in finding the brick.

As a matter of fact along parts of our coasts there are no natural features to which the station can be referred. About the only way to find the brick is to have another station established somewhere in its general vicinity. Then with the position of the hole and the new station known, the brick can probably be found. But what is the use of finding the brick if you have to establish a new station in order to do so? In general, it is better not to waste time hunting the old station where it is very inadequately marked.

The bench marks set on the level lines run in the interior of the country were very poor affairs prior to about thirty years ago. In the early days the bench marks were squares cut in culverts, along railroads, or on the steps of banks, schools and similar buildings, abutments of bridges and other highway structures. In nearly all cases those structures were replaced or destroyed and the bench marks were lost. Prior to about 1900 there were very few special concrete bench marks set.

Now all bench marks are inscribed metal tablets usually set into specially poured blocks of concrete or outcropping rock. They are still placed in the outer walls or steps of buildings and other more or less temporary structures, but such bench marks are supplemental to the regular distribution of marks along a line of levels.

In the days of the ox and wagon, the ideal place to put a bench mark for a triangulation station or a leveling mark was in the corner of a field at the intersection of two roads. Now with the automobile and the development of our highways, such a position is the very worst for a control survey station. The corners are cut off by the highway engineer in order to ease the curves in going from one road to another. Another ideal place for a survey monument was alongside the highway. It didn't make much difference whether the station was placed just outside of the traveled road or on the edge of the right-of-way of the road. But with highway development the roads are widened and straightened. In consequence, many of the control survey stations have been destroyed during the improvement of highways.

At the beginning of the highway extension in this country, the engineers and others engaged on highway work paid very little attention to the control survey stations. They were dug up and thrown away. But there has been a gradual increase in the appreciation by highway workers of the value of control survey stations. Frequently letters come to the Washington office of this Bureau from highway engineers in various states, saying that a certain monument is in the way of the development and asking what shall be done about it. In most cases the station is preserved by putting in another one nearby and tying it to the one that must be removed. Sometimes this is done by highway engineers; in other cases, if a party of this Bureau is near the region, a unit of the party is sent to do the work.

The thoughtfulness of the engineers in preserving these monuments is deeply appreciated. They are performing a real service whenever they can save the marks. One is reminded of the old story that we read in the school books on "Woodman, Spare that tree". The tree of course is nice to look at and it may be valuable for shade, but its greatest value is when it has been cut down and used for lumber. We should have another story and that might be entitled, "Engineer, Save this Survey Mark". The mark is of no value except as it remains absolutely undisturbed and it can be used over and over again for a hundred or a thousand years. Each time it is used it becomes more valuable for it is the starting or reference point for local surveys.

Any one coming to the Washington office of the Bureau, should see the number of station marks of various kinds mounted on the board in the office of Mr. H. S. Rappleye, Chief of the Section of Leveling of the Division of Geodesy. This array of station marks shows clearly that engineers making control surveys believe it pays to perpetuate the survey stations. The inscribed metal tablet conveys definite information to visitors at the station. Their curiosity is allayed and therefore the mark is not thoughtlessly dug up in a search for buried treasure nor is it considered worthless by the engineer or others who may be carrying on some kind of a development in its vicinity.

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VISIT TO TRIANGULATION PARTY

The following interesting letter to the Chief, Division of Geodesy of this Bureau, was received from Mr. George D. Whitmore of the Engineering Service Division, Tennessee Valley Authority:

Dear Major Bowie:

I believe you will be interested in knowing of a visit

made by some of the Tennessee Valley Authority engineers to your triangulation observing party under Ensign Maurice A. Hecht, now stationed at Livingston, Tennessee. On June 6, Mr. Ned H. Sayford, Director, Engineering Service Division, also Tennessee Valley Authority representative on the Board of Surveys and Maps, and the writer drove to Livingston and contacted Mr. Hecht for the purpose of becoming better acquainted with the sort of equipment and methods of your observing parties. We were very cordially received by Mr. Hecht, who showed us in considerable detail the camp equipment. In fact, all of the members of the party were exceedingly courteous and seemed to thoroughly enjoy demonstrating to us their equipment and methods.

We then drove to Cookeville, Tennessee, and watched a tower building party erect a 55-ft. steel tower. The remarkable speed and efficiency with which this tower was erected was nothing short of astonishing. The anchor holes were started at about 3:00 P.M., and shortly after 6:00 P.M. the tower was complete and could have been occupied. Any organization which develops tower erecting parties as efficient as the unit we observed, deserves a good deal of credit.

It was not convenient at this date to visit an observing party, because all such parties were situated on mountain tops several miles distant, requiring a two or three hour hike to reach them. On June 17, therefore, Mr. Harry Wiersema, Assistant Director, Engineering Service Division, and the writer went to Livingston again, arriving there about 6:00 P.M., for the purpose of spending the evening with an observing party and observing the present day technique. Mr. and Mrs. Hecht gave us what they called a camp meal, which I shall have to confess equaled or excelled most hotel dinners in quality.

As soon as it became dark, we ascended the 77-ft. steel tower at Livingston, which happens to be a subsidiary station, and watched the observer complete eight positions on two stations, as well as the signaling of results to the principal observing party. The speed and efficiency of the observing parties is remarkable. It so happened that the party which we visited was the extra observing party and did not have a Parkhurst theodolite. We were told that the results would have been secured even faster had a Parkhurst instrument been available. We were especially impressed with the feature of signaling the results to the principal observing party so that the triangles could be tested for closure before leaving the tower.

Mr. Sayford, Mr. Wiersema, and I were extremely well impressed with the efficiency of the methods used, the high grade equipment and the high character of the personnel engaged upon the work. We feel that you and your organization should be complimented upon your field representatives, and upon the development of the field procedure to its high state of efficiency. Mr. Hecht especially was unusually courteous, and if all of the party chiefs

are of this grade, you certainly have a first-class field organization of which you may well be proud.

With kind personal regards, I am

Very cordially yours,

(Signed) Geo. D. Whitmore

Geo. D. Whitmore
Engineering Service Division.

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MAGNETIC WORK BY FIELD PARTIES

and

STATE REPRESENTATIVES OF THE COAST AND GEODETIC SURVEY

E. W. Eickelberg

Excellent response has been obtained from both those in charge of the state control surveys and from our own reconnaissance and triangulation parties in reporting on the condition of magnetic stations.

Complete or nearly complete information has been received from the following states: California, Colorado, Florida, Georgia, Indiana, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, Oklahoma, South Carolina, and Washington.

In addition to making these complete reports, some of the state representatives have made declination observations at many of the old magnetic stations and have established new stations to replace those that were lost or of no further use due to some local attraction having been introduced since the station was established. The instrument used for this work (Compass Declinometer) was loaned to the state representative for such time as was necessary to complete the work.

Professor Philip Kissam has made observations at all of the New Jersey magnetic stations and in addition has established compass testing stations at a number of New Jersey airports.*

* The Military Engineer, No. 153, May-June, 1935, pp 174-177, Compass Corrections in Military Aviation; Philip Kissam.



(Magnetic field party making observations with compass declinometer.)

The importance of this latter work can hardly be overemphasized. In aircraft, the complete gyro compass will not function due to centrifugal accelerations, and in its place the directional gyro is used, which on account of friction in its bearings has to be reset by the magnetic compass every twenty minutes. Radio compass homing devices, radio ranges, radio phones all fail or their range becomes greatly impaired when they are most needed, that is, in thunder storms, snow, fog, etc., when visibility is reduced and under bad conditions of static. Under favorable conditions, radio ranges in the United States are good for a distance of one hundred miles, but under bad conditions of static, etc., as low as thirty miles. In case of a thunder storm, they are of no use since the pilot is then forced to ground his antenna to prevent the plane from being struck by lightning. He is then entirely dependent for his course on the magnetic compass.

It is for these reasons that an airport should be equipped with a compass testing table for a convenient and rapid method of compensating and calibrating the compasses of airplanes. The magnetic compass should be tested at frequent intervals because the magnetic condition of the plane's steel members changes from time to time and as the result of being struck by lightning.

Other state representatives who have established magnetic stations at airports are C. J. Tilden, of Connecticut, Frank H. Prouty of Colorado, E. C. Houdlette of Massachusetts, Edmond W. Bowler of New Hampshire, and T. C. Hamby of South Carolina in cooperation with Coast and Geodetic Survey magnetic field party.

This office is ready to cooperate in furnishing instruments

and instructions for establishing compass testing tables at airports in other states or for making observations for declination at various county seat magnetic stations.

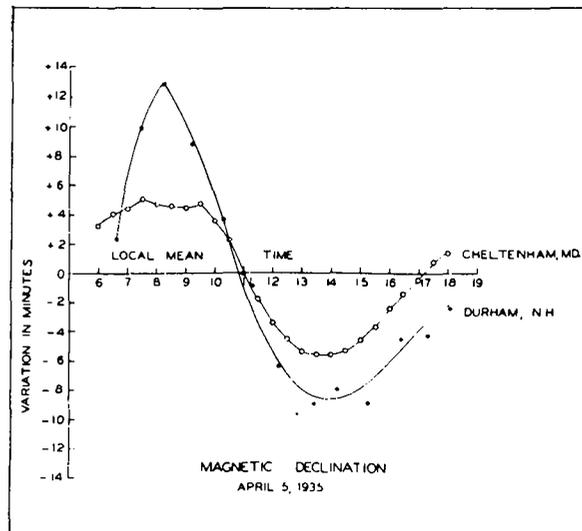
Professor Bowler of New Hampshire has an interesting program under way for observing declination at all of the New Hampshire magnetic stations and in addition expects to make continuous observations throughout several days for the purpose of obtaining the diurnal variation in declination for that locality.

The Coast and Geodetic Survey records these variations continuously at its observatories in Alaska, Arizona and Maryland, so that observations at other places can be corrected for these diurnal variations by interpolation. However, observations such as those made by Professor Bowler enable this office to make better interpolations by having a direct comparison.

Many states are finding the Coast and Geodetic Survey magnetic stations of value in referring local magnetic prospecting surveys to them as a standard. Notable examples are Missouri, Arkansas, Illinois and Michigan.

Such surveys are of value not only in locating mineral resources, but also of assistance in some cases in the location of ground water and coal, and particularly in delineation of geologic structure.

Our own field parties in triangulation and reconnaissance are cooperating in furnishing accurate positions and azimuths at many of the existing magnetic stations at county seats. Thus the local county surveyor is furnished a station with accurate latitude, longitude, azimuth and declination all at the same station, and usually very close to his headquarters.



Curves showing diurnal variation of magnetic declination at Durham, N.H., and Cheltenham, Md., on April 5, 1935; the range at Durham should be greater than at Cheltenham on account of the higher magnetic latitude.

CONSTRUCTIVE CRITICISM

Andrew L. Breckenridge

During the past winter in the course of my duty, I contacted many civil engineers engaged in private practice and on public work. As a group, they held the work of the Coast and Geodetic Survey in high regard, but in individual instances, they took advantage of the chance to tell me as a representative of the Survey of some error which they had discovered or about some detail which they felt should be changed for their benefit. The criticisms may be summarized as follows:

1. Some of the information published by the Survey, especially the descriptions contained in Publication No. 181, (Leveling in Mass., R.I., and Conn.) is obsolete before the date of issue. It is my understanding that supplements are to be issued in the near future, which will bring the descriptions up to date. I would also suggest that if Congress will appropriate the necessary funds that all marks should be inspected periodically. Two methods suggest themselves. One is to have an observer attached to the Survey assigned to recover and report on each mark at some stated regular interval, two consecutive inspections not being made by the same observer. The other method, while maybe not as efficient, would tend to increase the knowledge of the work of the Survey by engineers in general. It would be to appoint a local surveyor or engineer as custodian of the Survey's marks, it being his duty to make periodic inspections of the marks in his community and report.

2. Many inaccuracies in the descriptions were brought to my attention. I would suggest that every description of a station or bench mark should be checked in the field before publication.

3. Reports forwarded to the Survey by private engineers are acknowledged but ignored in publications issued subsequently. You are right in not wishing to note a mark as "destroyed" until positive proof is furnished. The value of the rule is proved by my recovery of two marks which engineers had informed me that they had reported as destroyed. To keep the engineers friendly to the Survey, I would suggest that in cases where an engineer had reported that he is unable to recover a mark and the mark is later found, the Survey should notify him that the mark had been restored and was available for his use.

4. My attention was called to a map recently published by the Survey. The engineer who purchased it pointed out features in the topography which have not been as shown for over forty years. He inquired "How do I know what information on this map is correct?" I would suggest that where maps are republished and not entirely resurveyed, that the new work on the map should

be printed in heavy lines and the old or copied work in faint lines.

5. Complaint was received that the published elevations of many of the old bench marks marked with the U.S.C. & G.S. and U.S.G.S. disks have never been republished in agreement with the 1929 General Adjustment.

6. The marks are not set as securely as they could be. This criticism is justified, I believe, only in certain types of setting. Marks set in shaly rock have disappeared, not through fault in the regulation of the Survey, but because of poor judgment upon the part of the man who selected the spot. Marks set at the top of tile pipes show a high rate of disturbance both from natural causes and from the deviltry of trespassers. Posts set near the shore should be both deeper and higher. Where it is necessary to locate a station in a sand dune, in an earth bluff or on a beach, I would suggest that the bottom of the concrete post should be cast in the form of a tripod and placed with two legs away from the water. Such a post should be buried well in the ground with a surface mark which should extend at least two feet above the ground. A post should be large enough in cross section to make it difficult for souvenir collectors to remove the disk.

7. An engineer engaged in private practice states that he would like to tie his surveys into Government points, but that he cannot afford the time as he has to set his price for surveys in competition with other surveyors, and suggests that the Government stations and bench marks should be more conspicuously marked. The public utility companies, in some regions, mark their underground work with white concrete posts set so as to be visible above high grass, leaves, and ordinary snows. The Survey might well adopt this type of post for reference marks, the actual point being the intersection of two lines cast in the top of the post. A disk similar to ones now used could be cast into the face of post.

* * * * *

10. A drill hole or a copper pin in a rock is not ample description, I found. The rocks are full of drill holes other than those made by the Survey. Where a distinguishing mark such as a triangle or square has not been chiseled around the hole or pin, the size (diameter and depth) should be cited. Possibly the surest way to preserve a point is to mark the station and the reference point in dissimilar fashion. Hunters of souvenirs may destroy the station where both station and reference marks are marked with disks, but they will not disturb drill holes. On the other hand, the inscription of the Survey on a disk commands respect from those having at heart the common weal. Such a person might unwittingly destroy a rock containing a copper pin or drill hole, but would not dynamite or move one containing a disk.

I might add a suggestion in regard to describing stations. At first, I spent considerable time in checking on proper names of places and of natural features. When I learned that the U.S.

Geographic Board had published an Official Gazetteer, I purchased a copy and followed its recommendations as to choice of names and spelling. I would suggest that every party chief working in Rhode Island should be supplied with a copy of this publication.

The descriptions would be more uniform if the Survey adopted a glossary of such terms as may be variously defined by different individuals. Then those whose duties involve the composition or revision of descriptions would all use the same word for the same thing. Especially have I in mind such terms as bridge and culvert, boulder and rock ledge, barn and shed, dome and cupola, tower and spire and steeple and pinnacle, belfry and bell cote.

In a state like Rhode Island, where the people think in terms of town boundaries and where the counties are merely judicial districts, it would be more convenient for local engineers to have the descriptions include the names of the towns as well as of the counties. In addition to the General Index, an index by towns would assist the local engineer.

In the list of geographic positions, stations which have been positively determined to have been destroyed might be indicated by italics. It would also help to have added to this list an extra column in which would appear the page number on which the station is described.

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GLEANINGS OF EXPERIENCE

(Excerpts from letters of a party chief)

"They say the longer one lives, the more he learns and I have just learned something about a truck that should be self evident to a beginner. I was disgusted at the way my old car labored on the hills and how the gas mileage went down. Then I thought about back pressure and put on a new exhaust pipe and cleaned the muffler. The change was revolutionary and the car now runs like a straight eight. I wouldn't be surprised if many of the old trucks in service are not in the same condition. It seems to take very little scale in the pipes and muffler to make a great difference. I plan to put on a complete new muffler as soon as I can afford it."

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"A partially idle man, especially at the same pay as the other men, is bad medicine on any party."

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"One of our aversions has been the recovery of stations of recent date and making arrangements for new work. We are so often met by a shotgun or a hard luck story about unsettled damages and unfulfilled promises, that I feel like leaving the motor running. However, a letter received from one of the members of our party presents a refreshing contrast and I shall quote from it.

' _____ must have a real good bunch of fellows on his building party. I have recovered all the old stations and every one remarked on the lack of damage, how well the men did the job and minded their own business. They were all glad to hear that another party would come through to do some more work. One fellow at station _____ said that he gained a lot of knowledge as the members of the party answered all his questions even though he did ask a lot of them.

'The only comment I could make, and this is only my own opinion, is on the type of marks. The marks are good, but in setting the disk, it has been countersunk about an inch, which causes it to hold a lot of water which will permeate the concrete and, I would think, cause freezing and tend to crack the top of the mark in cold weather. I did not find any trace of freezing on the marks visited and of course, the countersinking would prevent anyone from breaking off a little of the concrete and removing the disk. I would think that if the mark were set flush with the concrete, it would leave a good place for a topo rod to be set, (if ever that happens), and which would not be full of water and dirt when a fellow wanted to set up over it, and would finish the top off better. I think they showed good judgment in setting the reference marks as to position for intersections and for lasting qualities. All in all it was a good job. It is not bad to recover stations when they are left as these were.'

"There are many ways a reconnaissance party can aid the triangulation party and this is certainly one way that they can help. I think it unnecessary to report the many sources of irritation such as driving across the alfalfa when wet, etc., but, since the reconnaissance party is always placed in the position of asking a favor of the property owner, I sincerely wish that everyone connected with the survey would act as befits one receiving a privilege. I often have to make quasi-promises of care being taken by the men that follow, and I regret very much when such promises are broken by those out of my control. I know the building parties are a hard working crew but perhaps a half hour more spent at the station cleaning up and putting better workmanship on the marks would be well invested.

"Regarding the marks, I am inclined to agree with the

extract given from the letter above. Also, I am in favor of a wooden collar form instead of the circular steel ones in use on some parties. These latter soon become deformed from being forced down into the concrete requiring that they be pried off and bent out of shape. The result is that the marks are oval, irregular, and not of uniform batter. Perhaps this does not appear pertinent, but I feel that a mark is judged by other engineers much as is a person, - by its appearance. I will say that the quality of concrete is generally better than it was a few years ago but still, the marks are not heavy enough, nor deep enough in the ground. The round collars have shrunk in many cases to 1 foot diameter, which is much less in volume than the specified 14 inches square and I have yet to find a mark 42 inches deep, even in northern states with severe frost action. In fact, at one place in Minnesota, a road cut of slightly over 3 feet had completely erased all trace of the sub-mark. I was advised by authorities in Texas, that marks placed in the black lands must be deep and well belled at the bottom, so that I would advise building parties to get something longer than a D-handled shovel for digging holes.

"Another thing I have stressed before is symmetry of marks. It quite frequently happens that vandals break off the top of a mark and remove the disk. If the concrete is symmetrical with the disk the center can be recovered from the stub for all practical purposes. However, if the disk is set in one side, or the collar slapped on crooked, it becomes necessary to excavate to the sub-mark. When I see a sloppy job at the surface, I always wonder about the accuracy of centering the sub-mark, too. Since our bureau does work of precision, why can't we expend a little more care in workmanship on marks which, after all, are our ultimate contact with the public?

"As chief of party I have found it difficult to maintain a high standard of marks and have come to the conclusion that this vital feature of our work is intrusted to a laborer too far down the scale of responsibility, and that an officer, signalman or trusted foreman with a conscientious desire to do things right, should be in charge of marking stations."

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VERTICAL CONTROL FOR RIVERS

W. M. Gibson

It seems that a great amount of attention is now being directed toward the rivers and waterways of this country with an eye to future developments. The Ohio River seems to be a good example and has afforded considerable opportunity for study lately.

As near as can be ascertained, the control of the river is dependent upon a precise traverse and level line running along the south and east bank. Since 1900 many improvements have been made along the river in the way of locks and bridges, and there is a twenty-year plan under contemplation which calls for raising the water level back of the dams in many places. It seems entirely possible that most of the remainder of these precise traverse and level bench marks may disappear within a few years.

The precise control is more or less unsuited for Ohio and Indiana on account of the width of the river, and the following general plan regarding vertical control for an important river is offered for comment:

1. Lines of first-order accuracy crossing the river at right angles every fifty miles.
2. Lines of leveling consisting of a single running crossing the river at right angles half-way between the first-order lines.
3. Lines of leveling consisting of single running along each bank of the river and paralleling it throughout.
4. Short connecting lines of leveling of single running across bridges (or river crossings) at twenty-five mile intervals to divide the twenty-five mile spacing into 12-1/2-mile spacing.

By altering the specifications regarding length of sights and balancing the sights (as well as proximity of sights to bottom or top of rod) considerably more than second-order accuracy might be obtained on lines of single running.

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PARTY ORGANIZATION

John Bowie, Jr.

The personnel of the first-order triangulation party in my charge numbers 112 men. The party is divided into 3 separate double observing parties, one consisting of 34 men and two with 36 men each. The two extra men on the 2 parties are due to our having steel towers over 90 feet in height which require 2 trucks for the transportation of each tower instead of 1. The remaining 6 men: signalman, mechanic, supply foreman, accountant, mathematician and computer, are stationed with the office trailer or divide their time between the 3 parties depending on where they are needed most.

The parties are modeled after the old time double observing parties of Lieut. H.W.Hemple and William Mussetter. All the

men live in tents. The building parties locate near a town where they can readily obtain sand, cement, lumber, water, and other materials. The observing parties, lightkeepers, and take-down parties camp on their stations except in certain sections of the country where it is impracticable to do so.

Each double observing party has 2 modern first order theodolites and a third theodolite of older make and design. The 2 best instruments are used for the main scheme stations while the third instrument is used for reobserving, for central points and for supplemental stations. Each observing unit consists of 3 men and 1 truck. There are 5 lightkeepers, 2 on the forward stations, 2 on the rear stations, and the fifth one to post lights and go where most needed. One of the forward lightkeepers drives a truck and moves the other forward lightkeeper each day to his new station. The same system is used by the rear lightkeepers. The take-down party, consisting of 4 men and 1 truck, camp with the rear lightkeepers and receive their take-down signals from the rear lightkeeper. The double observing party and the triple observing party signal their angles to the observing party, which closes the triangles while still on the tower and then signals instructions for the next night's work. No attempt is made to work a side equation test on the quad before giving a take-down as the loss of time thereby incurred is not justified. Instances of the sides failing to check, within the prescribed limits, when the closures are good, have been very rare in the parties with which I have been connected. With good observers, good instruments, good runs, careful centering of the instruments, lights, and measuring all eccentricities, however small, there should be no reason why the sides shouldn't check.

With each double observing party are 2 building parties, each consisting of 1 foreman, 5 men, 1 screen body truck and 1 express body truck. An assistant signalman is in charge of the 2 parties. His duties are to plan the work of the building parties, put out bids for supplies, interview property owners at each station in advance of the erection of the tower, check the reconnaissance description and to locate Laplace azimuth stations.

The take-down party consists of 1 foreman, 3 men, and 1 truck. This unit takes down 2 towers a day. The steel haulers number 2 or 4 depending on whether the towers are over 90 ft., in which case a follow truck is needed with each semi-trailer.

During the past several years, vandalism has increased to such a point that it has now become necessary to have a watchman with the building party camp to keep government equipment and supplies from being stolen during the daytime while the men are out at work. Besides watching the camp, the watchman also helps prepare the meals for the building parties.

There are now 52 trucks on the party. Several are over 5 years old and will have to be replaced soon but most of them are new and in fine condition. During the year 1934, truck No. 276 (sedan delivery) averaged 17-1/2 miles per gallon of gasoline and towed the office trailer on every move. The truck is now 1-1/2 years old and the only repairs it has ever needed have been two tires and one radiator cap. The speedometer now reads 27,000 miles.

The present system of having an office trailer is a big improvement over the old 9 by 9 foot tent. All records, accounts, etc., can now be kept inside and it is a pleasure to work without the danger of losing records or valuable papers. Everything can be filed systematically so that finding what you want no longer requires a big search through papers kept in a box, suitcase or some similar contraption.

I am strongly in favor of the large parties of the present being organized into small double observing parties. I consider that the small party of the double observing type has many advantages over the large party for the reasons given below:

1. Accuracy.

In a large party, the lightkeepers and observers stack 4, 5 or 6 lights on top of each other. If the bottom light is not perfectly level, the top lights are going to be eccentric, thus making large closing errors. If all of the lights in a quad are this way, very poor closures and length checks will result. Also, the wind will have a tendency to blow the lights out of plumb when a large number has been stacked up. With a double observing party, only 2 and sometimes 3 lamps are stacked up so it is readily seen that the top light will be more closely centered and therefore better results will be obtained.

2. Progress.

I believe also that more progress can be obtained by using double observing parties.

If the reconnaissance is faulty, only a small party is held up instead of a large one. The same applies to the weather and especially on those nights when it clears up unexpectedly. By camping on the stations, each man will be on the job when the weather clears instead of being miles away in a town. The reverse also applies to prevent observers from being discouraged too easily by adverse weather, for a camp in town has a lot of magnetism and this will be eliminated by camping on the station. Last month, the three double observing parties in my charge occupied and completed 142 stations and one party made a 600 mile move during the month.

3. Cost.

By making the maximum progress, naturally the cost per station is low and operating expenses are less. With reference to trucks, it is an undisputed fact that they will run less miles per month by camping on the station than they would if operated from a central camp. In running less miles per month, less gas and oil will be used and the truck will last a longer period before being expended. This is especially true of the steel trucks. A double observing party uses 12 towers while a 4-way party uses 18. This makes 6 quads against 9. Thus each steel truck, in moving towers from the rear to the front, travels 3 quads more one way, or 6 quads more a round trip per day on a 4-way party than on a double observing party. Thus if the quads average 15 miles, the steel truck on the double observing party will each save 90 miles per day. Supplies are also purchased in large quantities with substantial saving as a result. By having reobserving at a minimum, partially due to not stacking up many signal lights, the unit cost of the party is kept low.

4. Efficiency.

I believe a double observing party operates more efficiently. Certainly less moves by the building parties are required. A building party cannot move and build a tower on the same day regularly and as the progress of the observing party is reflected directly by the number of towers the building units build, it is obvious that the less moves the building parties have to make per month the more towers they will build. If the building parties do build on the move, the steel trucks will have to be used to move the camp equipment and this amounts to no steel being moved forward that day unless steel haulers work overtime. It has been my experience during the past year, that it is quite a job to find a camping space for a large party, especially in the more thickly settled parts of the country such as Virginia, Maryland, and Pennsylvania.

I believe also, that the double observing party system helps develop engineers faster which will be of great benefit to themselves and the Coast Survey. Should any expansion occur in the future, I have 2 men who are capable of being placed in charge of a triangulation party. These men are now sub-chiefs on the double observing parties.

Another point which cannot be taken too seriously is "night driving". From personal experience I would say that two-thirds of our truck accidents happen at night. If night driving could be eliminated, two-thirds of the accidents would be prevented. Serious injury or loss of life to members of the party is always a possibility whenever an accident occurs. All this could be avoided and night driving placed at a minimum by camping on the station instead of operating from a central camp.

Reports such as truck reports, monthly personal reports, etc., are rather slow coming in but this has no direct bearing on the progress of the party.

The office trailer is located as near to the center of the field of work as possible in order that the parties can be reached easily. In this way the office trailer can be located in one place for two or more months. I inspect the observing units at least once a month and sometimes more often. Mart Braden, signalman, does the same with the building parties. The assistant signalman and sub-chiefs also come to headquarters quite often to talk over various things, get expense money, turn in sub-receipts, records, computations, etc. Although correspondence is rather heavy, I really have more time to myself than when I was in charge of a large party operating as one unit.

Six-month contracts for gasoline and oil at service stations are made. Also six-month contracts for bolts, nuts, and batteries. This makes the accounts smaller and at the same time the obtaining of supplies on short notice is made possible. All the truck drivers have courtesy cards for service station purchases on charge account which eliminate sub-receipts for gas and oil and enable me to keep my cash balance under \$500.00 by not having to supply truck drivers with expense money.

Speed Notes:

J. W. Stirni, Junior Engineer, observed a five line first-order station in 38 minutes.

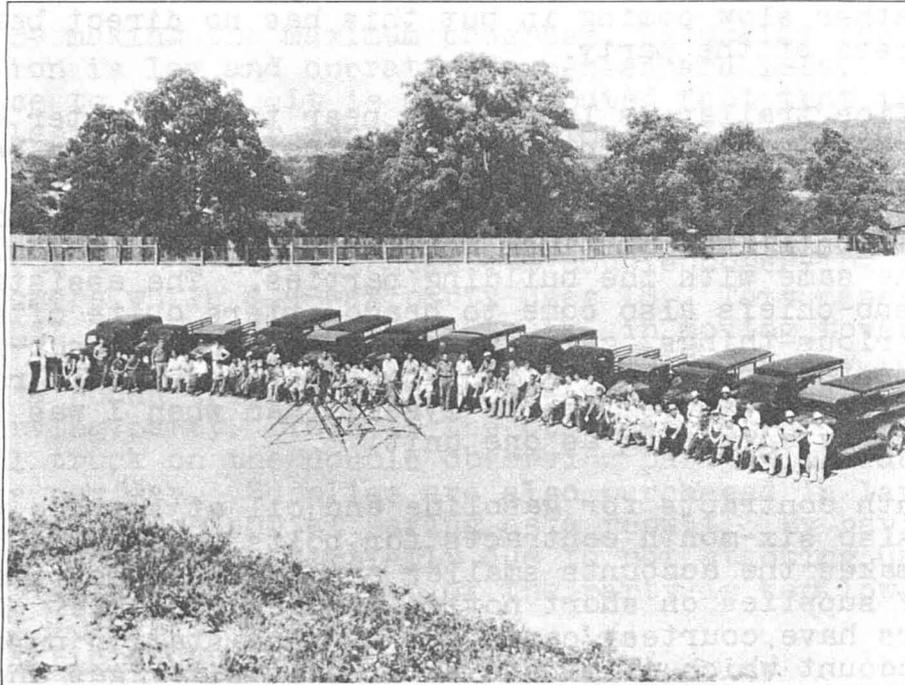
William Bragg, building foreman, built a 103 ft. steel tower in 2-1/2 hours. This included digging holes and setting all marks. Dean B.R. Van Leer, Florida State Representative, did the timing.

Albert Cook, building foreman, built a 90 ft. tower in 1-3/4 hours. This did not include the holes which were dug the previous day. Colonel Mo Tsao of China, witnessed this building.

Foremen J.M. Harris and Elmer Holford have each taken down a 103 ft. tower complete in one hour flat. Colonel Tsao witnessed one of these.

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I enjoy reading the "Geodetic Letter" as do all the men working with me. I believe it is to the advantage of the Survey for each man to know the other fellows' ideas and problems, and I even recommend the "Geodetic Letter" to the personnel of the Accounting Division.



LEVELING PARTY UNITS

W. M. Gibson

As far as I am aware, the organization and equipment of a leveling party unit has never been the subject of very much discussion. In 1931 this party consisted of an observing unit with one truck, and a bench mark unit with another truck. Later, an extra observing unit with a third truck was added. Bench marks for this double observing unit were set by a bench mark unit of two men with the third truck. At that time, most of the leveling was of first-order accuracy.

The plan of one bench mark unit for two leveling units seems to be pretty well fixed. Some improved methods were necessary to allow one bench mark unit to set bench marks for two leveling units engaged on second-order leveling. The addition of a third man was made to the bench mark unit, and precast posts were used instead of posts cast in place.

It is thought that this ratio is about the best that can be expected. At maximum strength, on this party, there were eight 6-man leveling units and four 3-man bench mark units in operation. If one of the leveling units had any extensive first-order leveling to do, an effort was made to reduce the size of the leveling party by one man, and divert some of the bench mark setters to recovery operations.

However, the point most open to discussion in my opinion, is the organization and equipment of the leveling units. The

old double parties were much less efficient than two single parties. When the double parties were in operation, the chief of party was observer on one unit. At times it seemed that the double party made a combined progress as great as two single parties, but it is believed that a chief of party cannot find time to exercise enough supervision under this arrangement to insure the best results. Of course, the chief of party was also burdened with accounts.

With this in mind, some hesitation was felt in assigning a double unit to an observer. It was thought that the ordinary observer does not stand out enough to efficiently manage two units and do the observing on one of them. However, the addition of the sixth man to each second-order unit may have changed this.

The following plan is advanced for comment:

Double Leveling Unit - 12 men - 1 truck.

Surveyor, in charge

1. Plans work for two units each day.
2. Pays or verifies all bills.
3. Closely supervises all data.
4. Supervises field work of each unit.
5. Observes in case of emergency.
6. Supervises care and upkeep of equipment.

This differs considerably from the old double observing unit, which was as follows:

Double Observing Unit - 12 men - 3 trucks.

Chief of party, in charge

- 1 to 4, and 6 above.
7. Observed on one party.
8. Submitted accounts.
9. Supervised bench mark unit.

In the above suggestion for the double unit, considerable saving would be effected in the elimination of one truck. However, there would be days when the work of both units would be broken up by ending of a line or some other mix-up. The present trucks are equipped with small bodies that would hardly accommodate 11 or 12 men with their instrumental equipment. It is thought that in the future purchases of trucks for level parties a much larger truck could be specified. The jitney seats in the bodies take up too much room and are of little value. Regardless of whether or not trucks are ever purchased for use of a double observing unit, it is thought a body should always be specified which will at least be as long as the leveling rod boxes. Another disadvantage to the use of one truck for two leveling units

is that no one truck could carry all the men and their camp equipment.

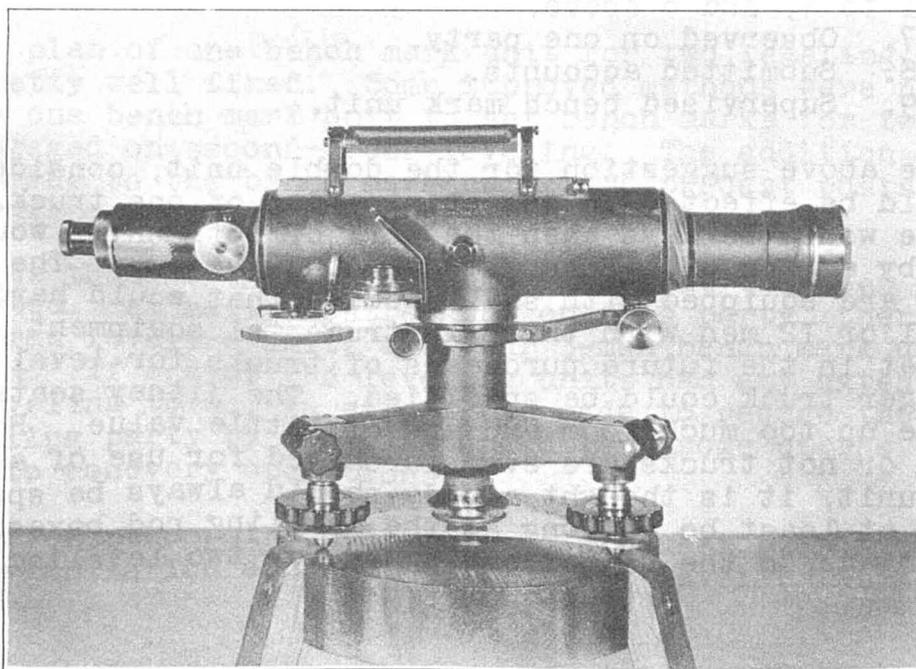
While working on a project, two trips could be made on moving day, but in long trips from one project to another, the bench mark setter's truck would have to carry a large load of camp equipment. It usually works out that the bench mark setters must move several days ahead of the leveling units. The only alternative in this case seems to be to ship the camp equipment by freight or express or discontinue camping.

With the present arrangement, most of the time of the chief of party is taken up with coordination of the work of the twelve independent units, verifying the lines, repairing the equipment, etc., and by grouping the eight observing units into four double units, this coordination could be cut in half, as the Surveyor in charge would necessarily have to coordinate the work of his two units. The number of interparty accounts would be reduced from twelve to eight (perhaps lower if a grouping of the bench mark units were also effected).

This would allow the chief of party more time for field inspection and institution of desirable changes in order to improve the quality of the work. It is thought, however, that more frequent field inspections would be necessary for double units than for single ones.

On the double unit, one recorder would have to observe and one rodman work as recorder.

In view of the fact that such an arrangement would eliminate four trucks from the present equipment of a party of this size, it seems that a lower unit cost might result and this saving more than offset the slight decrease in progress.



BALL BEARINGS AS TURNING POINTS

E. J Helin

On May 6, I wrote you suggesting the idea of using ball bearings as turning points in leveling along concrete highways. At that time there was no opportunity of trying it out. Early in June, however, this method was used successfully by level parties under Mr. W. W. Studdert on a concrete highway between Oil City, Penna. and Tionesta, Penna.

The rodmen were equipped with some 3/8 inch steel ball bearings and the standard hammer used in driving staples. A single stroke was sufficient to produce an indentation in the concrete for the ball bearing to set in a secure position. The ball bearing was used as a turning point for the rods, in place of the bulky and awkward foot pins.

The points were conspicuously marked with keel around the indentation to call attention to the location of the point. Any rejection of a turning point because of grade or interval was shown by drawing a cross through the indentation.

Because of constantly changing grades, the rodmen held their points in order that the observer might select the proper interval. However, when constant grades are encountered, the rodmen move ahead in the same manner as along the railroad. In this case the front rodman would need a supply of ball bearings sufficient for the length of the section. The rear rodman would pick up the ball bearing at the end of each set up, and at the completion of each section he will have in his possession all the ball bearings. He can then go forward and repeat the procedure as the front rodman.

It has been found advisable not to strike twice at the same point due to danger of making a hole in which the ball bearing will not have a firm position. Rodmen should blow out what little dust there is in the indentation.

It has been found that the ball bearing makes an excellent turning point, much easier to turn a rod on than a foot pin. As all steel ball bearings of good quality are manufactured to a high standard of precision, they can be replaced or substituted at any point with no loss of accuracy.

The use of ball bearings as turning points on concrete highways has the following advantages:

1. Elimination of carrying and driving foot pins.
2. Elimination of "leapfrogging" on highways, saving time by having the front rodman on his point and ready by the time the instrument is set up. The rodmen also are relieved of the necessity of having to run while "leapfrogging".

3. Transpositions can easily be checked in the field without re-running a section.

4. In seven miles of first-order work the closures were much smaller than those ordinarily found in using foot pins. Thus proving that ball bearings have a much larger foundation area in the concrete pavement than is ever found in the 1-1/4 inch cross section area of the foot pin.

I find that in the units of our leveling party both the rodmen and the observers prefer this method as it speeds up the work and better closures are acquired.

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THE RED ROD

(Report by W. W. Studdert)

In an effort to eliminate transpositions in precise levels, the following method was devised. For obvious reasons, this method has been designated as the "Red Rod".

On the back of one rod, in line with the 1/3 meter divisions, a 1/2-inch bright scarlet stripe has been painted the full length of the rod. When the observer reads the back of this rod, he calls out "RED", in addition to the back of rod reading. The recorder enters this "RED" reading as "R", just above the 1/3 meter reading in the back of rod column. The other rod is read and entered in the usual manner, as no color is to be found.

When the rodmen drift, as along railroads, the "R" entries will all be in one column, showing that the "Red Rod" was either in front throughout this section or in the rear, as the case may be. When the rodmen leapfrog or hold their points as along highways, the "R" entries will be alternating in each of the back of rod columns. Thus, when the recorder is taking the readings, he can tell at once by noting the consistency of the "Red Rod" entries, if a transposition has been made and catch the mistake before the instrument is moved to the next setup.

Should a transposition be made and go undetected by a new recorder, it can be found by the observer at the end of the section by merely glancing at the consistency of the "R" entries. Observers on this party have learned the wisdom of being "R" conscious, being sure to note any inconsistencies in the "R" entries while checking all of the arithmetical work of the recorders at the end of the day's work.

The advantages of the "Red Rod" are numerous. It not only gives identity to that rod but to the other rod also, as the plain rod could easily be called the "White Rod". Besides identifying the rods, it also identifies the point where each rod

is held. As the rodmen use the same rods daily, it also calls attention to which rodman held each point.

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Editor's Note: Upon receipt of the above report on the "Red Rod" the following circular (abstracted) was issued to all leveling parties:

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"The method outlined in Mr. Studdert's report appears to be capable of application to the leveling work of this Bureau without any increase of cost and bids fair to very materially reduce the amount of rerunning necessary to detect blunders resulting from transposed sights.

"Upon receipt of this letter and the mimeographed copies of the report, you will at once instruct your observing units to follow the method outlined in the report when doing single-line leveling. Whether this method is to be used on double run lines or not will be left to the judgment of the chief of party.

"After this method has been used for a month or six weeks, I would appreciate it if you would forward to this Office your comments concerning the method and any suggestions concerning changes or modifications which you deem it advisable to make."

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COMMENTS ON NATIONAL PLANNING

C. J. Tilden

(Reprinted from Civil Engineering for July 1935.)

To the Editor: The article by Mr. McDonald in the March issue, is an effective summary of the needs for a national mapping program. He points out the vital importance of the basic triangulation and precise level work of the U. S. Coast and Geodetic Survey. The extension of this work in the various states was one of the first steps taken by Congress, in November 1933, to relieve the unemployment situation among professional engineers.

The Federal Emergency Relief Administration asked the U. S. Coast and Geodetic Survey to undertake this work as part of the drive for economic recovery. It was stated that the two principal objectives were to give immediate employment to the largest possible number of engineers and others, and to have the employment result in high-grade work of permanent value. A quota was established for each state, and field parties, labor gangs, and

clerical and computing staffs were rapidly organized. Many competent engineers, who had been out of work for some time, eagerly accepted such positions of responsibility as supervisors or chiefs of party, at rates of pay far below those to which they had been accustomed in better times. The Survey directed the work through a representative in each state.

In the middle of February 1934, all the work was shifted to the Civil Works Administration, a short-lived agency, which was followed by the various state emergency relief administrations. These receive federal funds directly from Washington and disburse them within the state according to relief needs. In some states certain groups were found to be in greater need of relief than were the surveyors, so the triangulation work was stoped.

Connecticut has had the sympathetic cooperation of the State Emergency Relief Administration. In this state the fundamental character of the state-wide local control surveys, based on the work of the U. S. Coast and Geodetic Survey as first set up, has been recognized as of prime public value. Unemployed engineers in many widely separated localities were set to work. Advice and assistance have been given to local town surveys, which have been started with relief funds. This assistance included instruction in approved methods, the calibration of tapes and instruments, and similar services.

Mr. McDonald makes the interesting suggestion that, with the increase in mapping activity which he favors, a related change be made in curricula of engineering schools. He advocates more instruction in triangulation, precise leveling, astronomy, and geodesy. This at once raises the question, what can be left out of the already crowded four-year course to give time for such instruction? Our engineering students are given sound training in the fundamental theory of surveying operations, supplemented by summer field work which, while elementary, is basic and highly instructive. This familiarizes students with the ordinary instruments of surveying, their uses, and the way in which the results obtained in the field are used in the preparation of maps. It is doubtful if it would be wise to carry formal technical instruction much beyond this point, at least for undergraduate students. To build a bridge or complete a primary survey an organization of specially trained men is needed, and this training can be obtained only through apprenticeship on actual work. Instruction given in school, including the few weeks of summer field work, puts the student in a position to absorb quickly and efficiently the details of field practice. It is only through months of such field work, supplemented by further reading and study and office experience, that one may reach the rank and dignity of a geodetic engineer.

MAPPING THE COUNTRY

(The following article written by Mr. Waldemar Kaempffert, Science Editor of the New York Times, appeared in that paper under date of July 7, 1935.)

Without accurate topographic maps it is impossible to extend highways, prevent floods, lay oil, water and gas pipes in lines that are straight for hundreds of miles, run a telegraph, telephone or electric power line with equal accuracy, dig irrigation and drainage ditches that cover a whole country in accordance with a carefully developed geometric pattern. And accurate topographic maps are possible only with accurate triangulation and leveling. The surveyors of the United States Coast and Geodetic Survey are therefore doing work that is indispensable to every engineer who builds a bridge, digs a canal or plans a railway.

Five years ago the Survey spent only \$150,000 a year on such work. Then came the depression. It seemed as if triangulation and leveling must stop, and this although a complete, detailed map of the United States was not in existence. With the chance of employing thousands of technically trained men in surveying there came first an appropriation of \$400,000 in 1930, then one of \$500,000 in 1932 (under the Wagner bill) and this year one of \$2,500,000, later increased to \$3,500,000.

Probably no money ever spent by the government has done more good. Engineers and college men were given not only a chance to earn a living but intensive training in a branch of science of which they had but a smattering. Nearly all of the seventy-six leveling and fifty-one triangulation parties now in the field are composed of men who, while they had a good basic training, scarcely knew of the Coast and Geodetic Survey.

The government has been accused of wasting the public funds in its effort to create employment. But there has been no waste here. According to the Engineering-News Record the unit costs for the years 1933 and 1934 are 12 per cent less than in 1931 and 1932. Moreover there has been no lowering in the standards of accuracy - standards which are as high as any in the world.

The funds that the Survey has received from the PWA were exhausted on June 30. Luckily the work can go on because last week Secretary Ickes pledged \$350,000 to the Coast and Geodetic Survey. But only July is provided for. It has been no easy task to recruit 1,500 men to work on geodetic surveying. An organization that is doing necessary work is threatened with disruption if adequate funds are not provided for the future.

GEODETTIC CONTROL AND PRIVATE BOUNDARY SURVEYS

Hugh C. Mitchell

Considerable interest has been evinced in the May number of the Geodetic Letter which contained a symposium on the use of geodetic control for private boundary surveys. An edition of about three times the size of the normal edition of this journal is already practically exhausted.

A specific item commented upon by several of our correspondents to which we would like to call attention at the present time is the proposed act permitting surveyors to enter upon private property for survey purposes. Surprising as it may seem at first, these comments, written from a background of experience, suggest that some attention be given to the surveyor's need to occupy public space - streets, roads, etc., - in making such surveys. One correspondent, writing from Boston, says:

"Why not include the right to work in public streets? At present, I understand that a surveyor has no legal right to occupy space in a public way while making a survey although usually in city work, and frequently in country work, it is the only way that a proper survey can be made. Automobiles have made this matter very important. I believe that there is no Supreme Court decision." - (Letter from William S. Crocker, Civil Engineer.)

The following comes from Chicago:

"As to the suggested act to give the right to any qualified or licensed surveyor in the practice of his profession to enter private property for the purpose of finding monuments subject to the paying of any damages he may cause, I think this would be a wonderful law but I see no reason why it should be confined to the finding of the monuments placed by the U. S. Coast and Geodetic Survey." - (Letter from W. D. Jones, Land Surveyor and Civil Engineer.)

In a letter in the May, 1924, number of the Bulletin of the Illinois Society of Engineers, Mr. Jones tells of one incident when such a law might have been very helpful, for without it a day's work was lost, his survey party was put under arrest, and a jury trial resulted from the cutting into a road to occupy a section corner mark which lay beneath it - a necessary operation in the survey he was making.

Our attention has been called to a law enacted in the State of New Jersey in 1887. One section of this law permits entry onto land adjacent to that which is under survey for such purely public purposes as street and road work, and for quasi-public purposes such as the drainage of swamps and meadows. A second section of the same law permits entry onto private property for the running of doubtful or disputed lines and the searching for monuments, but this authority is granted only after a

court action has been commenced, and then only on an order from the court. Is it not possible that free access to survey monuments and the right to enter upon adjacent lands in the beginning might make unnecessary a court action with all its unhappy incidents, and costs often wholly out of proportion to the interests involved?

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Considerable reaction and comment was to be expected from surveyors in the Public Land States where the laying out of lands into sections and townships has made possible the simplest type of property description. The description of a parcel of land under the public land survey system makes unnecessary a description of the actual boundaries thereof. No one questions the extreme simplicity and clarity of such a description, nor has it ever entered our thoughts that this method of description should be abandoned. But is it any more than a method of relative description, an excellent index system? Had the original surveys of the public lands been made with a satisfactory degree of accuracy, then the descriptions would have had as a base a very fine coordinate system. That this is not the case is easily seen from conditions in the northern parts of Illinois and Indiana, where township lines on opposite sides of the State line are of the order of two miles apart. And when one considers that these township lines were set from the same base line, some 200 miles distant, one realizes the surveyor must be called upon to reestablish a lost corner and is dependent upon either recovering old survey marks nearby or in being able to retrace the footsteps of the original surveyor, using the evidences of witnesses, occupation, and the like; and that if he has to go back far in the surveys and rely upon the system as one of coordinates, he is going to have a difficult time getting anywhere near the original corner. If he has to go back to the base line he will have to reproduce a survey the original accuracy of which may not have been better than 1 part in 100. If his corner is tied into the first-order control net of the country and he has to go back the same distance before he picks up a base, he at least has the comfort of knowing that the survey he has to reproduce had an accuracy of better than 1 part in 25,000.

But there is no more chance of it being necessary for the public land surveyor having to go back to the base line for a starting point, than for a surveyor in Texas to have to make the historical research involved in determining the size of cigarro and speed of horse involved in old deeds which I am told are on file in San Antonio, giving a man as much land as he could ride around while smoking so many cigarros. The early surveyors left too many footprints for this, but in identifying these, the present-day surveyor has had to develop a technique that might be described as little short of marvelous. He must be a man of high technical skill, a student of natural history, be possessed of a great amount of patience, considerable legal skill, and a sixth sense of survey location which would make Holmes exclaim in

wonder, "Let's go back to Baker Street, Watson, this is too much for me".

After the cadastral engineer has shown conclusively just where the old corner stood, and there of course, is where the true corner belongs, what then? Will a monument forever after hold the point free from disturbance, or should the simple form of insurance provided by a connection with the national control survey be used so that ever after the replacement of this corner will be a simple undertaking in which the fine art of the cadastral surveyor is replaced by the exact science of the geodetic engineer, and time is conserved and money and effort saved?

But if this is done should not the work of the geodetic engineer be given legal recognition by some form of legislative enactment so that his coordinates will be accepted in a court as complete and sufficient evidence as to the location of a corner? Engineers may be fully satisfied that the corner once determined by cadastral methods and while still existent, tied into the triangulation net of the country, can always be replaced by geodetic methods, but acceptance of this evidence should be general and approval should begin with those bodies of highly trained men to whom we must look for the enactment of our laws.

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SUGGESTIONS FROM THE FIELD

Mr. W. G. Hodder, recorder on the party of W. W. Studdert, engaged on first and second-order leveling, writes to Mr. Studdert as follows:

"I would like to suggest a different color arrangement for our umbrellas. During the hunting season many of the leveling units will be working in the wooded sections where careless and nervous hunters are apt to mistake part of our olive drab umbrella for some wild animal. It seems there are enough accidents in hunting country even when some precautions are taken with bright colors. I believe an umbrella made up of black and grey, the Coast and Geodetic colors, or some other combination fanning or radiating out alternately from the center would be a great help in the safety of our field men."

Undoubtedly there is some danger in working through wooded roads and trails with sunshades of olive drab, tan or brown. It would seem advisable during the hunting season, to use some other color that could not readily be mistaken for a wild animal by an excitable hunter.

It would seem that a solid color would be satisfactory such as green or blue. If such a color should be satisfactory, perhaps the umbrellas that are now at the Washington office for

issue to the field could be dyed. Future orders from umbrella factories could specify the new color desired.

It is hardly probably that any of the umbrellas now in use in the field would last until the hunting season which in most states does not open until sometime in September.

The readers of Geodetic Letter are requested to write the editor and give him the benefit of their suggestions on this matter.

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AN APPRECIATION OF COAST AND GEODETIC SURVEY WORK

The following letters received from Mr. W. D. Tyler, Vice President of the Clinchfield Coal Corporation, Dante, Va., show an appreciation of the work of the Coast and Geodetic Survey and the uses to which it can be put in the location of property boundaries, outcrop lines, etc.:

"I have just received from the office of the Coast and Geodetic Survey the Geodetic Letter #5 of Volume 2 for the month of May, 1935 and because it contains a letter from Mr. Fred E. Ruediger, Engineer of the Virginia Commission of Fisheries, I have been particularly interested in it.

"It so happens that for some ten years or more I have served with Mr. Ruediger as a member of the Virginia State Board for the Examination and Certification of Professional Engineers, Architects and Land Surveyors. His article on the acceptance of geodetic control in the surveys of oyster planting grounds in Virginia is interesting in the extreme and is just what could be expected from an engineer of Mr. Ruediger's ability and exactness. I have frequently discussed some of the problems that he refers to in this article with him,

"There is in the extreme southwestern corner of Virginia, a condition that, while it is not similar to the oyster bed situation of the State, is in some senses, unique.

"The writer took charge of the real estate of what is now the Clinchfield Coal Corporation on the first day of February, 1906, and one of the first undertakings to be seriously considered was the making of a triangulation survey of their property comprising some 300,000 acres of fee simple and mineral ownership located in the Counties of Buchanan, Dickenson, Russell and Wise. Early in the program it was decided that it would be wise to secure as consulting engineer in connection with this work, the late Colonel R. A. Marr, formerly connected with your survey and later Professor of Civil Engineering at Virginia Military Institute, and still later at Virginia Polytechnic Institute where he was serving in 1906.

"Colonel Marr arranged with your Coast and Geodetic Survey for a loan of theodolites with which to do the instrumental work. This, upon condition that the results of the survey should be given to your office.

"In making search for a proper base off of which to start the survey it was finally decided to take a line between the Clinch Station and the Big Knob Station, Clinch Station being located just northeast of Little Moccasin Gap on Clinch Mountain and on the boundary line between Russell and Washington Counties, while Big Knob Station is located about twenty-six miles further to the southwest and in Scott County near Big Moccasin Gap and a short distance from Gate City. This base line was the extreme existing line of the oblique eastern arc of the Coast and Geodetic Survey. Beginning in 1906 and continuing through the next two or three years this survey was prosecuted, the primary points in addition to those on the base line were on Big A Mountain, on the Cumberland Mountain on the Virginia-Kentucky line, on High Knob near Norton and the east butte of State Line Spur near the headwaters of Powell's and Guests River and including a central point on a spur off of Sandy Ridge at Dante. The area included was about nine hundred square miles.

"This survey with its secondary and tertiary points was concluded after some interruption in a period of about three years and during two years of this time Colonel Marr was on the ground during vacation periods as consulting engineer.

"Upon the completion of the field work the usual computations were made and these were submitted to Mr. O. H. Tittman, then in charge of the United States Coast and Geodetic Survey and by him referred to Mr. John F. Hayford, in charge of the Computing Department, who had the computations checked and reported them to be satisfactory. Copies of these results were then furnished to both the United States Coast and Geodetic Survey and the United States Geological Survey.

"Some years later the Geological Survey, using Clinchfield Coal Corporation work as a base, further extended the investigations and mapping of the coal counties of southwestern Virginia and for the counties named above and geological and contour maps of a large part of the area covered by Clinchfield Coal Corporation surveys were then prepared.

"During the time that our triangulation survey was in progress a complete resurvey of Clinchfield Coal Corporation's properties was undertaken including the real estate boundaries, stream lines, the outcroppings of the several coal seams, location of roads, and on lands owned by the Corporation in fee simple, the boundaries of the clearings and the location of the buildings thereon.

"The property of the Corporation is roughly rectangular in shape, about twenty-five miles long and twenty-three miles wide. The area to be mapped was, therefore, so great that it was felt that it would be necessary to use the polyconic method of projection and maps were laid out covering the entire area using this system. All field work of whatever nature was tied into primary triangulation points where possible and finally to secondary and tertiary points; even the outcrop lines being tied into triangulation base with ties nowhere more than two and one-half miles in length. This tying up of the outcrop lines proved to be of great advantage for the reason that in order to determine the coal value of the property on the subsequent mapping, we were compelled to plot the outcrop lines even ahead of the real estate boundaries and because of our system of ties to triangulation, this proved to be easily done. Subsequently, practically all of our lands in Russell County as well as in Wise County and a large percentage of the lands in Dickenson County have been completely resurveyed and mapped.

"In preparing for the mapping of real estate boundaries we worked out what we called "triangulation-land line traverses" embracing areas from one to two thousand acres in extent and worked out spherical coordinates for all the points on these traverses. These circuits were then laid down on our permanent maps. When an area had been so plotted, we then prepared separate plots of the several land tracts lying within the circuit computed and put these down, using the lines of the triangulation-land line traverses to control their location. As a result we have a very accurate set of maps of the territory.

"One outcome of this work has been that in the purchase and sale of properties acquired or disposed of by our Corporation since the surveys were begun, we have referred our descriptions to the astronomical meridian and the deeds of conveyances whether to or from the Corporation, carry a statement of this fact in connection with the descriptive matter. The timber corners of the thousands of tracts owned have, of course, been gradually disappearing and to care for this situation and preserve accurately the location of the boundaries, many of their corners have been marked by a concrete monument and for this purpose we have taken a four inch tile sewer pipe set bell down in the ground bedded in concrete and filled with concrete. The top of the monument is flush or just below the ground. This makes a monument that is permanent even though the terra cotta pipe should deteriorate. We first centered these monuments with copper centers, but later we discovered that there was so often occasion to mend a still with copper that there was a disposition on the part of the citizens of the country to break up the top of the monument and take the copper center out. As a consequence, we abandoned the use of copper for centers and used instead a six penny wire nail set with the head down so that only the point was exposed. Within a period of a few years this nail rusts out and leaves simply a hole in the concrete which is, of course, an accurate mark.

"The monuments so set are tied in either directly or indirectly to triangulation base so that at any time in the future it will be relatively easy to replace them even though they might be completely destroyed.

"Another feature of our work has been that in the neighborhood of our operating mines we have broken down a tertiary triangulation and have set permanent monuments near the mine mouths for the use of our mining engineers to enable them to have at all time an accurate azimuth and location checks for their underground work. A recent check of real estate boundaries from such a base as this, extending for a distance of three miles or more from the mine mouth station resulted in a naught naught azimuth check in a land line at that distance.

"One of the results of this whole system of work is that there are now being recorded in the counties where our properties lie, deeds whose descriptions are based on astronomical azimuth and a foundation is thus being laid for much better control for the future.

"The difficulties mentioned by Mr. Ruediger in his paper are multiplied many times in the mountainous country of the southwest by the inaccuracies of incompetent surveyors who have been responsible for the descriptions contained in most of the deeds of record going back even to the latter portion of the eighteenth century.

"I have written what precedes because I thought that possibly you might be interested to know that in more than one corner of Virginia methods have been adopted which will in the future lessen controversies as to the correct locations of lands of quite as much value as Virginia's oyster beds."

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After the above letter from Mr. Tyler was acknowledged, he wrote as follows:

"Possibly I should have added in my original letter to you that Clinchfield Coal Corporation has furnished to the Virginia Coal and Iron Company of Big Stone Gap, Virginia, the Virginia Iron, Coal and Coke Company of Roanoke, Virginia and Toms Creek, Virginia, the Consolidation Coal Company of Jenkins, Kentucky, and I believe also to the New River Pocahontas Coal and Coke Company (Berwind White interests) sufficient of our basic triangulation data to enable each of these large land-owning corporations to establish astronomical control of their real estate surveys. This additional information I am sure will be of interest to you."



SHADOWS

(Observer on the party of Ensign A. L. Wardwell, leveling across one of the dry alkali lakes in the desert of Nevada.)

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--- AND SUDDEN DEATH

J. C. Furnas

(Reprinted from the Reader's Digest by special permission of the Publishers.)

Publicizing the total of motoring injuries - almost a million last year, with 36,000 deaths - never gets to first base in jarring the motorist into a realization of the appalling risks of motoring. He does not translate dry statistics into a reality of blood and agony.

Figures exclude the pain and horror of savage mutilation - which means they leave out the point. They need to be brought closer home. A passing look at a bad smash or the news that a fellow you had lunch with last week is in a hospital with a broken back will make any driver but a born fool slow down at least temporarily. But what is needed is a vivid and sustained realization that every time you step on the throttle, death gets in beside you, hopefully waiting for his chance. That single horrible accident you may have witnessed is no isolated horror. That sort of thing happens every hour of the day, everywhere in the United States. If you really felt that, perhaps the stickful of type in Monday's paper recording that a total of 29 local citizens were killed in week-end crashes would rate something more than a perfunctory tut-tut as you

turn back to the sports page.

An enterprising judge now and again sentences reckless drivers to tour the accident end of a city morgue. But even a mangled body on a slab, waxily portraying the consequences of bad motoring judgment, isn't a patch on the scene of the accident itself. No artist working on a safety poster would dare depict that in full detail.

That picture would have to include motion-picture and sound effects, too - the flopping, pointless efforts of the injured to stand up; the queer, grunting noises; the steady, panting groaning of a human being with pain creeping up on him as the shock wears off. It should portray the slack expression on the face of a man, drugged with shock, staring at the Z-twist in his broken leg, the insane crumpled effect of a child's body after its bones are crushed inward, a realistic portrait of an hysterical woman with her screaming mouth opening a hole in the bloody drip that fills her eyes and runs off her chin. Minor details would include the raw ends of bones protruding through flesh in compound fractures, and the dark red, oozing surfaces where clothes and skin were flayed off at once.

Those are all standard, everyday sequels to the modern passion for going places in a hurry and taking a chance or two by the way. If ghosts could be put to a useful purpose, every bad stretch of road in the United States would greet the oncoming motorist with groans and screams and the educational spectacle of ten or a dozen corpses, all sizes, sexes and ages, lying horribly still on the bloody grass.

Last year a state trooper of my acquaintance stopped a big red Hispano for speeding. Papa was obviously a responsible person, obviously set for a pleasant week-end with his family - so the officer cut into papa's well-bred expostulations: "I'll let you off this time, but if you keep on this way, you won't last long. Get going - but take it easier." Later a passing motorist hailed the trooper and asked if the red Hispano had got a ticket. "No," said the trooper, "I hated to spoil their party." "Too bad you didn't," said the motorist, "I saw you stop them - and then I passed that car again 50 miles up the line. It still makes me feel sick at my stomach. The car was all folded up like an accordion - the color was about all there was left. They were all dead but one of the kids - and he wasn't going to live to the hospital."

Maybe it will make you sick at your stomach, too. But unless you're a heavy-footed incurable, a good look at the picture the artist wouldn't dare paint, a first-hand acquaintance with the results of mixing gasoline with speed and bad judgment, ought to be well worth your while. I can't help it if the facts are revolting. If you have the nerve to drive fast and take the chances, you ought to have the nerve to take the appropriate cure. You can't ride an ambulance or watch the doctor working on the victim in the hospital, but you can read.

The automobile is treacherous, just as a cat is. It is tragically difficult to realize that it can become the deadliest missile. As enthusiasts tell you, it makes 65 feel like nothing at all. But 65 an hour is 100 feet a second, a speed which puts a viciously unjustified responsibility on brakes and human reflexes, and can instantly turn this docile luxury into a mad bull elephant.

Collison, turnover or sideswipe, each type of accident produces either a shattering dead stop or a crashing change of direction - and, since the occupant - meaning you - continues in the old direction at the original speed, every surface and angle of the car's interior immediately becomes a battering, tearing projectile, aimed squarely at you - inescapable. There is no bracing yourself against these imperative laws of momentum.

It's like going over Niagara Falls in a steel barrel full of railroad spikes. The best thing that can happen to you - and one of the rarer things - is to be thrown out as the doors spring open, so you have only the ground to reckon with. True, you strike with as much force as if you had been thrown from the Twentieth Century at top speed. But at least you are spared the lethal array of gleaming metal knobs and edges and glass inside the car.

Anything can happen in that split second of crash, even those lucky escapes you hear about. People have dived through windshields and come out with only superficial scratches. They have run cars together head on, reducing both to twisted junk, and been found unhurt and arguing bitterly two minutes afterward. But death was there just the same - he was only exercising his privilege of being erratic. This spring a wrecking crew pried the door off a car which had been overturned down an embankment and out stepped the driver with only a scratch on his cheek. But his mother was still inside, a splinter of wood from the top driven four inches into her brain as a result of son's taking a greasy curve a little too fast. No blood - no horribly twisted bone - just a gray-haired corpse still clutching her pocketbook in her lap as she had clutched it when she felt the car leave the road.

On the same curve a month later, a light touring car crashed a tree. In the middle of the front seat they found a nine-months-old baby surrounded by broken glass and yet absolutely unhurt. A fine practical joke on death - but spoiled by the baby's parents, still sitting on each side of him, instantly killed by shattering their skulls on the dashboard.

If you customarily pass without clear vision a long way ahead, make sure that every member of the party carries identification papers - it's difficult to identify a body with its whole face bashed in or torn off. The driver is death's favorite target. If the steering wheel holds together it ruptures his liver or spleen so he bleeds to death internally. Or, if the steering wheel breaks off, the matter is settled instantly by the steering column's plunging through his abdomen.

By no means do all head-on collisions occur on curves. The modern death-trap is likely to be a straight stretch with three lanes of traffic - like the notorious Astor Flats on the Albany Post Road where there have been as many as 27 fatalities in one summer month. This sudden vision of broad, straight road tempts many an ordinarily sensible driver into passing the man ahead. Simultaneously a driver coming the other way swings out at high speed. At the last moment each tries to get into line again, but the gaps are closed. As the cars in line are forced into the ditch to capsize or crash fences, the passers meet, almost head on, in a swirling, grinding smash that sends them caroming obliquely into the others.

A trooper described such an accident - five cars in one mess, seven killed on the spot, two dead on the way to the hospital, two more dead in the long run. He remembered it far more vividly than he wanted to - the quick way the doctor turned away from a dead man to check up on a woman with a broken back; the three bodies out of one car so soaked with oil from the crankcase that they looked like wet brown cigars and not human at all; a man, walking around and babbling to himself, oblivious of the dead and dying, even oblivious of the dagger-like sliver of steel that stuck out of his streaming wrist; a pretty girl with her forehead laid open, trying hopelessly to crawl out of a ditch in spite of her smashed hip. A first-class massacre of that sort is only a question of scale and numbers - seven corpses are no deader than one. Each shattered man, woman or child who went to make up the 36,000 corpses chalked up last year had to die a personal death.

A car careening and rolling down a bank, battering and smashing its occupants every inch of the way, can wrap itself so thoroughly around a tree that front and rear bumpers interlock, requiring an acetylene torch to cut them apart. In a recent case of that sort they found the old lady, who had been sitting in back, lying across the lap of her daughter, who was in front, each soaked in her own and the other's blood indistinguishably, each so shattered and broken that there was no point whatever in an autopsy to determine whether it was broken neck or ruptured heart that caused death.

Overturning cars specialize in certain injuries. Cracked pelvis, for instance, guaranteeing agonizing months in bed, motionless, perhaps crippled for life - broken spine resulting from sheer side-wise twist - the minor details of smashed knees and splintered shoulder blades caused by crashing into the side of the car as she goes over with the swirl of an insane roller coaster - and the lethal consequences of broken ribs, which puncture hearts and lungs with their raw ends. The consequent internal hemorrhage is no less dangerous because it is the pleural instead of the abdominal cavity that is filling with blood.

Flying glass - safety glass is by no means universal yet - contributes much more than its share to the spectacular side of accidents. It doesn't merely cut - the fragments are driven in as if a cannon loaded with broken bottles had been fired in your face, and a sliver

In the eye, traveling with such force, means certain blindness. A leg or arm stuck through the windshield will cut clean to the bone through vein, artery and muscle like a piece of beef under the butcher's knife, and it takes little time to lose a fatal amount of blood under such circumstances. Even safety glass may not be wholly safe when the car crashes something at high speed. You hear picturesque tales of how a flying human body will make a neat hole in the stuff with its head - the shoulders stick - the glass holds - and the raw, keen edges of the hole decapitates the body as neatly as a guillotine.

Or, to continue with the decapitation motif, going off the road into a post-and-rail fence can put you beyond worrying about other injuries immediately when a rail comes through the windshield and tears off your head with its splintery end - not as neat a job but thoroughly efficient. Bodies are often found with their shoes off and their feet all broken out of shape. The shoes are back on the floor of the car, empty and with their laces still neatly tied. That is the kind of impact produced by modern speeds.

But all that is routine in every American community. To be remembered individually by doctors and policemen, you have to do something as grotesque as the lady who burst the windshield with her head, splashing splinters all over the other occupants of the car, and then, as the car rolled over, rolled with it down the edge of the windshield frame and cut her throat from ear to ear. Or park on the pavement too near a curve at night and stand in front of the tail light as you take off the spare tire - which will immortalize you in somebody's memory as the fellow who was mashed three feet broad and two inches thick by the impact of a heavy duty truck against the rear of his own car. Or be as original as the pair of youths who were thrown out of an open roadster this spring - thrown clear - but each broke a windshield post with his head in passing and the whole top of each skull, down to the eyebrows, was missing. Or snap off a nine-inch tree and get yourself impaled by a ragged branch.

None of all that is scare-fiction; it is just the horrible raw material of the year's statistics as seen in the ordinary course of duty by policemen and doctors, picked at random. The surprising thing is that there is so little dissimilarity in the stories they tell.

It's hard to find a surviving accident victim who can bear to talk. After you come to, the gnawing, searing pain throughout your body is accounted for by learning that you have both collarbones smashed, both shoulder blades splintered, your right arm broken in three places and three ribs cracked, with every chance of bad internal ruptures. But the pain can't distract you, as the shock begins to wear off, from realizing that you are probably on your way out. You can't forget that, not even when they shift you from the ground to the stretcher and your broken ribs bite into your lungs and the sharp ends of your collarbones slide over to stab deep into each side of your screaming throat. When you've stopped screaming, it all comes back - you're dying and you hate yourself for it. That isn't fiction either. It's what it actually feels like to be one of that 36,000.

And every time you pass on a blind curve, every time you hit it up on a slippery road, every time you step on it harder than your reflexes will safely take, every time you drive with your reactions slowed down by a drink or two, every time you follow the man ahead too closely, you're gambling a few seconds against this kind of blood and agony and sudden death.

Take a look at yourself as the man in the white jacket shakes his head over you, tells the boys with the stretcher not to bother and turns away to somebody else who isn't quite dead yet. And then take it easy.

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FAILURE OF STEEL TOWERS

In South Dakota recently, four towers were blown over and demolished during a sudden wind twister. Four men were injured and two theodolites smashed.

The following circular was issued by this Office and sent to all triangulation parties, in the hope that similar accidents might be prevented:-

"During the last two years quite a number of our steel towers have blown over as a direct result of anchors pulling out of the ground. Aside from the property loss involved, amounting in each case to approximately \$400 for each tower and \$2,000 for each of three first-order direction theodolites which were destroyed when the towers went down there has been injury to personnel and it is fortunate that no deaths have so far resulted. It is only under the most fortunate of circumstances, as otherwise some of the injuries certainly would have been fatal.

"Apparently the weakness in anchoring the towers is due to two reasons: (1) Less work is involved to the building party where anchors are not set at a sufficient depth or where the earth over them is not carefully tamped. (2) Less work is involved also to the tearing down party where the anchors are not deep or well tamped. It would appear, in this connection, that the foremen of the building parties have lost sight of the danger to lives involved in this very careless method of work, which cannot be further tolerated. This is a condition which must not continue and immediate measures will be taken by all building foremen to see that towers are anchored securely so that, regardless of the sources of failure, the tower itself will collapse before any anchor gives way.

"It is believed that if the parties adhere rigidly to the practice of placing a number of boards across the anchor boards, after the latter are set in place, the anchors will not pull out. The anchor hole should be made larger at the bottom than at the top and the cross boards long enough so that the ends will become embedded in the side walls when the anchors have a tendency to lift.

"After the receipt of this notice, any building foreman in charge of steel tower work where the anchor of a tower gives way before the tower collapses, will be immediately removed from his position as foreman by this Office, unless the report by the investigating officer indicates that the failure of the anchors to hold was due to a cause or causes, other than faulty construction or negligence by the foreman in charge of the building unit."

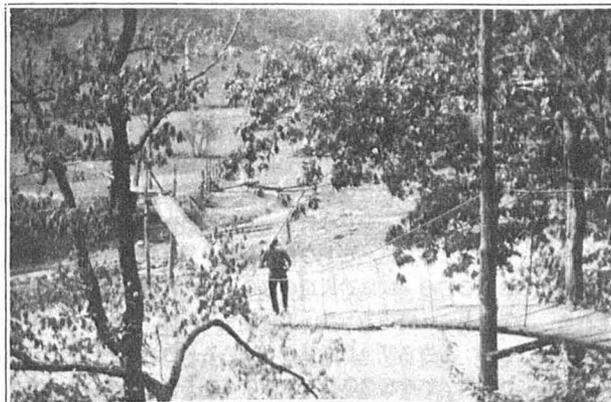
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SCENE CHANGES ALONG

A LEVELING LINE

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(From
report of
W. M. Gibson)

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EXCERPTS FROM FIELD REPORTS

(Base line furnished for resurvey of boundary lines of the Cuyamaca State Park.)

"At the time we were working here (Jacumba, California) Mr. John M. Lyle, of the National Park Service was carrying on a resurvey of boundary lines of the Cuyamaca State Park and requested that we furnish him with a base line from which he could control his surveys. Stations Rattlesnake and Mesa were located with second-order accuracy giving him a base line, and azimuth from which his desired ties could be made. He assisted in furnishing men, clearing trail, and furnishing assistant lightkeepers for this work and was greatly pleased that we could offer this cooperation. In his own words our extra night's work saved him at least one month's work and gave him data which he could not hope to get with the equipment he had on hand."

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(Special arrangement for holding lights.)

"The reconnaissance work called for numerous ties to the U. S.-Mexican boundary monuments by intersection and as practically all of these monuments were located on rough terrain, requiring packs up to one hour, and as towers were required over these monuments at the least the height of the monuments, it was apparent that targets would not be satisfactory for observing points. This conclusion was reached from the results of our past experience with targets on first-order triangulation where locating supplementary points. There is a relatively short period from slightly before sun down until darkness when the observing party can observe eight positions on targets and in the event there are several of these objects to locate, it is a serious problem for the observing party to accomplish this work before darkness. Also when these targets are not on the sky line it is not always an easy task to pick them up and in several instances they have not been found from the stations before dark. For this reason and also due to the fact that the lines were long, it was decided to construct a special rig for holding lights mounted directly over monuments, the controlling factor being the design of a light wooden frame that could readily be packed to the monuments.

"The monuments were in general, four sided shafts about eight feet high above the stone bases, terminating in a spired point at the apex of the monument. A frame was built so that it would fit snugly over the sloping sides of the monument, and about a foot above the top, with a small base for holding the lights and a cantilever shelf for holding the batteries. A ladder was built and left at each of these monuments for use of the lightkeeper in setting his lights. At each of the monuments so located by intersection, a regular lightkeeper was assigned and the program worked out very well with no possibility of observers sighting on wrong monuments

or not seeing the monuments in case of confusion of identifying monuments."

..... From Season's Report of Lieut. Charles Pierce.

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NOTES AND NOTICES

A new Special Publication No. 194, "Manual of Traverse Computation on the Lambert Grid", by Dr. Oscar S. Adams and Mr. Charles Claire, has just been issued by the U. S. Coast and Geodetic Survey. Copies may be obtained from the Superintendent of Documents, Washington, D.C. Price, \$.20.

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Mr. Carroll F. Merriam and his associates of the Pennsylvania Water and Power Company, Baltimore, Md., who are doing such excellent cooperative work with the engineers of the Coast and Geodetic Survey, makes the following suggestion in a letter dated April 9, 1935:-

"I think it would be a fine thing if, in approaching a property owner, the Chief of Party could have a bulletin somewhat similar to Serial 529 attractively printed on glazed paper with a few illustrations such as Figures 1, 3, and 5. Such a publication might be useful, first, in establishing the confidence of the landowner that he is really dealing with a duly authorized agent of the government; second, it would give him some idea of what to expect when the building party starts erecting the tower, and third, it would show him the type of marker that is to be placed on his property. A section should be devoted to his rights with respect to removal of a monument which proves an actual detriment, as well as the advantages which may accrue to him in providing a definite reference for his property. It might be explained to him that once his land was referenced to this mark, all landmarks in that vicinity could then be destroyed, and yet his boundaries could be re-established thus giving permanence to his claim. A section might be devoted to the care which your parties are required to exercise in respecting the property of the owner, and it could be made clear that any complaint should be addressed to the Director.

"A section might be devoted to cautioning the owner against wild rumors as to the purposes of this survey, explaining that it is for mapping only, and not in connection with any railroad, roadway, public works, or anything which would enhance the value of his property from this point of view. I find on visiting some of these stations that there is a misunderstanding on the part of the owners in regard to the purpose, and also how to get in touch with the Survey in case these markers prove a detriment to the property. I have in mind a specific case at CHANNEL where the people living at this site said that the question had arisen with the Road Commissioner whether they would have the right to bury the marker under a proposed road.

"Such a booklet as I would suggest, should be comparatively short, but attractive, and written particularly for the rural landowner. I believe its use would pave the way to even more cordial relations between the landowners and the Survey.

"Another thought is that local surveys would not have to uncover the station monument when buried underground provided the two reference points can be seen one from another. It might be well to publish the true bearing for these reference marks as well as their coordinates. In many cases I believe this would be a help to the local surveyor, for although data are given for determining these facts, it would be one step towards assisting him in his work. In any case, the use of the two reference marks would avoid need for uncovering the monument itself."

Following Mr. Merriam's suggestion, there is now being prepared a pamphlet for the use of triangulation and leveling parties which it is hoped will be of use in approaching property owners for permission to establish monuments on their land.

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Attention of all field officers is invited to Bureau Circular No. 12, dated August 2, 1932 which required that all truck drivers employed by this Bureau should have permits from some state or from the District of Columbia, except that parties employed in states which do not issue permits or licenses would not be required to obtain permits until they move into some state that did require them. A single license from the District of Columbia or any state issuing permits or licenses is acceptable. Chiefs of party are again instructed, in accordance with that Circular, to require that all operators of motor vehicles of this Bureau obtain permits. Copies of the Circular may be obtained on application to this Office.

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The Office is in receipt of information that there is now available on the market a traction device which can be readily installed on any dual-wheel truck.

It is believed that trucks subjected to duty under extremely trying road conditions will be materially aided by the use of this device.

Any chief of party desiring further information regarding this equipment may obtain it through this Office.

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REPORT OF PROGRESS

Triangulation:

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

First-order - - - - -	1,260
Second-order - - - - -	170

Completed during July, 1935:

First-order - - - - -	1,611 (Est.)
Second-order - - - - -	120

* Total miles of triangulation completed to July 31, 1935:

First-order - - - - -	60,620
Second-order - - - - -	5,527

* These figures have been corrected to June 30, 1935, to agree with an accuract scaling of the triangulation completed during the year.

Levels:

Lineal miles of levels completed in June, 1935:

First-order - - - - -	731
Second-order - - - - -	6,938

Lineal miles of levels completed in July, 1935:

First-order - - - - -	434
Second-order - - - - -	6,994

Total miles of levels completed to July 31, 1935:

First-order - - - - -	106,280
Second-order - - - - -	154,458