# AN EXPERIMENT USING L-SHAPED STEEL RODS TO DOWSE UNDERGROUND PIPES

by

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I would like to cite the assistance of Mr. E. H. Perry and Mr. K. D. Tucker in preparing the field experiment. Appreciation is also expressed to the thirty-two people who participated gratuitously in dowsing tests in behalf of the project.

# I. INTRODUCTION

Dowsing has been called many names: water witching, divining, smelling, witch wriggling, radiesthesia, cryptesthesia, rhabdomancy and a variety of other terms. Dowsing is a method of locating underground objects, such as water, minerals, conduits, etc. by use of dowsing rods that are believed to move in response to the presence of the objects one wishes to locate.

## Historical Background

Since the beginning of civilization, man has used a variety of methods to make predictions. One of those was using the forked twig to dowse underground objects.

Ostrander and Schroeder (1970) stated that the art of dowsing has been practiced for more than seven thousand years. It includes water divining and dowsing for all sorts of things, from ore to buried treasure, with a dowsing rod or pendulum. Bas reliefs from early Egypt portrayed water diviners equipped with dowsing rods and even headgear with antennae. Kings of ancient China, like King Yu (2200 B.C.), were pictured carrying dowsing rods.

Vogt and Hyman (1959) conjectured that the use of the fork twig was apparently begun by German medieval miners in their search for metals. Then the German miners who were imported to England during the sixteenth and seventeenth centuries probably introduced the divining rods to England. By the end of the seventeenth century the technique was found in every European country, and with European exploration and colonization, the use of the dowsing rods was carried by European settlers to Africa, parts of Asia, North and South America, Australia, and New Zealand.

Whether the art of dowsing originally discovered in Germany had any relationship with that in ancient China or Egypt, is still unproven.

Chadwick and Jensen (1971) stated that divining rods were used very early in this country, but no significant recognition of the practice was acknowledged until about 1775 when it became identified with witch hunts. Since that time, numerous newspaper accounts, magazine articles, and books have been written on the subject. The general current popularity of the subject, plus the convincingly often repeated stories of testators, leads one to conclude that dowsing might yet be around for a long time to come.

Recently the L-shaped divining rods have been used to locate underground conduits. The beginning of the use of these angle steel rods for the purpose of finding underground utility conduits was uncertain. Yeosock (1969) stated that during 1967, the U.S. Marines had been using L-shaped divining rods made from coat hangers in Vietnam to locate tunnels, booby traps, and sunken mortar shells.

In 1969, the Urban American Dowser Association was founded to publish books and held yearly meetings. Besides the urban dowsers, according to Hyman and Cohen's report (1957), there were about 25,000 rural practitioners in the whole country. Ostrander and Schroeder (1970) advanced that dowsing in the U.S.S.R. was a legitimate field of scientific study. Major institutes in Moscow and Leningrad had large groups of geologists, geophysicists, and physiologists all researching dowsing.

Various Dowsing Devices and Techniques

In the oldest references, even more than in contemporary practice, the instruments used in dowsing may vary in several ways. They may be made of any kind of wood and metal, and may be manufactured articles such as tongs, snuffers, or even a German sausage. Generally there are two main classes: the dowsing rods and pendulum. The dowsing rods include forked rods, angle rods, and straight rods.

The forked rod, or Y-shaped stick, is the most popular device, usually used to dowse underground water. In early times, it was only made of hazel; now it can be made of nylon, plastic, metal, or whalebone, as well as of any type of wood. Rods range from about six inches to two or three feet in length. To use it, one branch of the fork is held in each hand. The palms are facing upward, and the forearms are extended with the elbows close to the body. The end of the rod is pointed forward in a horizontal or slightly raised position. Although this is the most common dowsing position, it is not without variation. The end of the rod may be held in a vertical position, or the palms of the hand may be turned down rather than up. The end of the forked rod bends down to indicate the presence of the desired objects. Two general forked rod holding methods are shown in FIGURE 1.

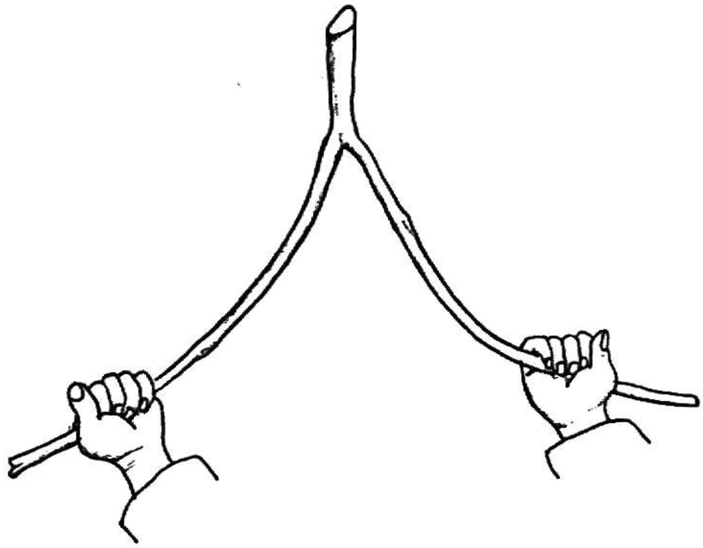
The angle rod, or L-shaped rod, is generally made of a straight, three-foot-long wire with a bend about seven inches from one end. It may vary from simple pieces of bent wire or tubing to instruments with swivel handles. When in dowsing a pair of angle rods are used, one serves for each hand. The short leg of the rod is held in a vertical position, the long leg projecting forward from the top of the hand in a horizontal plane. Normally the projecting legs cross (inward) or swing (outward) to indicate the location of an object. An L-shaped rod usually used is shown in FIGURE 4.

The straight rod may be a straight piece of nylon, plastic, whalebone, wood, or metal. It is from three to five feet in length and often is the terminal end of a fishing rod. To use this instrument, one end is grasped with both hands, held close together. If the rod is tapered, the thin end is held, as shown in FIGURE 2. Projecting in a horizontal plane, the rod bobs up and down to convey information.

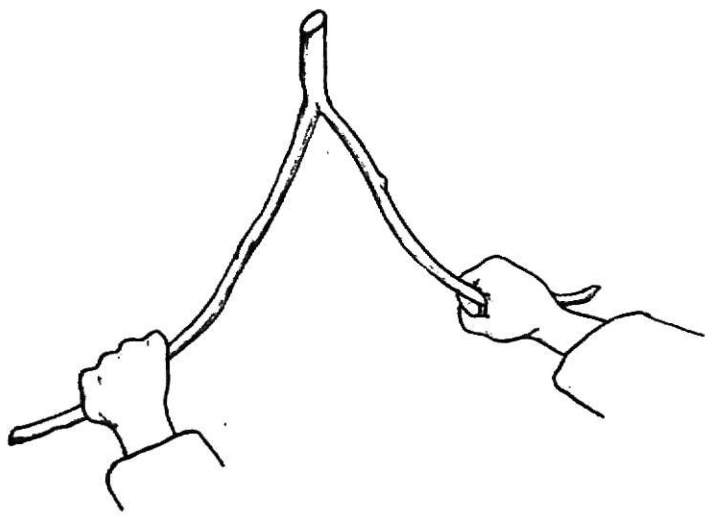
A pendulum is a small weight, often spherical or top-shaped and made of almost any material, and is suspended from a string or chain. Simple versions may employ a button or ring, while elaborate models have hollow chambers or spheres holding a sample of the substance being sought. The string or chain is usually held between the thumb and first finger, as shown in FIGURE 3. Occasionally the pendulum is held in the teeth, hung from an ear, or suspended from a toe. To indicate the presence of an item, the weight will vibrate or swing back and forth in an arc.

With the possible exception of straight rods, involved primarily in determining depth, all dowsing equipment is interchangeable and unspecialized as to function. Many individual dowsers are able to use all types of instruments. It is not uncommon for them to own a variety of equipment.

Some dowsers maintain they do not require special equipment for dowsing. These dowsers received the dowsing reaction through various parts of the body. Hands and arms were most commonly mentioned.



(A) Palms-up grip.



(B) Palms-down grip

FIGURE 1. Two general forked rod holding methods.

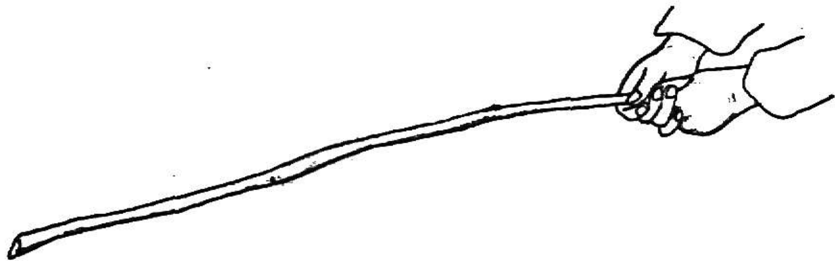


FIGURE 2. The straight rod and holding method.

FOGURE 3. A pendulum and holding method.

Hypotheses for Dowsing

There are many different hypotheses of dowsing. General explanations fall roughly into three categories:

1. Psychical Perception, i.e., Extra-sensory Perception or Cryptesthesia: It relates the movement of the divining rods to parapsychological phenomena.

Barrett and Besterman (1968) reviewed and conducted a number of "successful" incidents and experiments by British and French professional and amateur dowsers. They found various different phenomena occurred in dowsers; some felt malaise, others sensations; some could "see" hidden objects to be found where they were dowsing. Also, the divining rods used or the manner of holding these rods varied with the dowsers. Some dowsers used no rods when they did dowsing, but the "results" were not lessened.

Barrett and Besterman also stated that the dowsing rods were only auxiliary means to intensify the almost unnoticeable change in the physiological condition of the body, and to allow an observer to visualize more strongly the unconscious action of the muscles. They attributed the motion of the rods to unconscious muscular action.

Barrett and Besterman concluded the dowser was a person endowed with a subconscious supernormal cognitive faculty, which, its nature being unknown, they called cryptesthesia. By means of this cryptesthesia, that is to say, psychical perception, knowledge of the object being searched for enters the dowser's subconsciousness. This knowledge is then revealed, along with the sought-for object, by means of an unconsious muscular reaction. Such knowledge also, if more rarely, is revealed by an obscure nervous sensation or emotion which produces physiological disturbances. Rarest of all, such knowledge may be revealed by means of direct supernormal cognition made conscious by a visualization or hallucination.

2. Magnetic Gradient Hypothesis: It considers that the curious phenomenon of the dowser's reflex is caused by a small magnetic variation.

Rocard (1964) suggested that the involuntary movement of the dowsing rods was independent of dowsers' will if they were employed solely in maintaining their grip. He described the dowser, walking with uniform speed at his normal rate and with his rod in position, had his reflex started when he moved through a region where the earth's magnetic field was not entirely uniform and an anomaly was present.

Although Rocard conducted the study about the magnetic anomaly caused by groundwater, he also presented some cases where magnetic field perturbations could cause the dowser's rod to move, such as when: (1) objects were encased in iron, unexploded shells, etc.; (2) certain rocks, basalt among others, became magnetized after being struck by lightning; (3) ordinary humus contained a nonmagnetic iron oxide. If humus has been reduced in certain spots by organic decomposition or fire, it would have a magnetic variation.

Rocard also carried out an experiment to verify that the dowser was sensitive to a magnetic field without autosuggestion and tried to explain this physiological phenomenon (which he called biomagnetism) from the viewpoint of physics.

Chadwick and Jensen (1971) also suggested that water dowsers might get a dowsing reaction as a result of entering a change in magnetic gradient. They conducted seven field experiments. In each test area a small diameter iron rod was embedded. All participants using L-shaped steel wire made from clothes hanger wire walked through the test areas. Chi-square tests showed the dowsing reactions were statistical significant for the null hypothesis being randomness. There was some evidence of correlation between magnetic gradient changes and dowsing responses.

A sequence of experiments made by Tromp (1949) attemped to establish that the dowser's response was due to changes in magnetic fields. Tromp reviewed the ultimate cause of dowsing as physical forces, such as magnetic fields that acted directly upon the muscles of the forearm to produce the dowsing reflex. This muscular reflex, in turn, manifests itself in the rod's movement. Tromp listed a number of phenomena, such as varying contact with the rod, the nature of the rod, periodic variation of the earth-magnetic field, varying sun radiation, local vegetation, movement of the body, presence of other living organisms, varying sensitivity of the central nervous system, etc., that could produce a typical dowsing reaction. Tromp also considered the dowsing phenomenon as a most complex physico-chemical reaction which is unconciously perceptible by nearly everybody, not only a favored few, and after being registered by our nervous systems could be amplified and transformed into phenomenon known in the ordinary perceptible world.

3. 'Chance' Hypothesis: It considers that the reaction spots for dowsers to locate underground objects are a random, or chance, phenomenon.

Gregory (1928) commented that the use of the divining rod in the search for water was due to shallow supplies of water being scattered abundantly, often irregularly and elusively, that their discovery was often a matter of chance. Gregory felt some observers were especially quick in detecting faint clues to the water supply position, and in the areas where diviners were mostly used a large number of successes at finding water was inevitable. This was due to the wide distribution of underground water.

Vogt and Hyman (1959) attempted to prove that the dowsing rod movement was created by human psychological suggestibility and ideomotor action (the notion that ideas manifest themselves in muscular contractions). They proposed that all the movements of the dowsing rods were almost always made imperceptibly and unconsciously. Vogt and Hyman wrote that the dowser's unconscious muscular reaction resulted from a suggestion from his own subconsciousness, and this suggestion was based on the external cues and information stored in the subconscious. Since the dowser grasped the rod in an unstable grip, wrote Vogt and Hyman, a slight imperceptible movement would upset the balance. Thus a microscopic muscular contraction which might, through enhancement, build up to an overt muscular contraction, caused the rod to move. Vogt and Hyman conducted several tests in which the dowsers were disallowed any external cues or hints. The results from these tests showed that the dowsing rods performed only as a random detection device.

## Purpose and Scope

Dowsing has been written about, pro and con --- mostly con. It has been scientifically 'killed' many times, but it still persists. Despite all said to the contrary, some humans still believe in its efficacy. Nowadays, in some public works departments, civil engineering consulting or construction companies, some staffs still use dowsing rods to locate utility lines. Yet there exists little or no evidence to give credence to any particular viewpoint.

The major effort of this report was performed in a designed field experiment to see if there was relationship between dowsing reactions and underground steel pipes. There were 31 persons participating in this experiment. All of them were unexperienced in dowsing. Before doing the tests, they were trained from 10 minutes to 3 hours. One professional dowser, a professional civil engineer, was invited to dowse the same field. All participants used the L-shaped pair of rods as a detection device to locate buried underground steel pipes. The resulting data from the tests were statistically analyzed.

## II. THE FIELD EXPERIMENT

### Equipment

The dowsing rods employed in this experiment were fabricated from ordinary steel bars. The rods were about 36 inches in overall length and 3/16 inch in diameter. Each rod was bent in the shape of an 'L' with the larger side being 29 inches and short side 7 inches, as shown in FIGURE 4. In the experiment, a pair of rods was used by each subject.

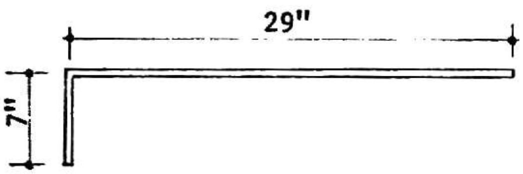



FIGURE 4. An L-shaped dowsing rod used in the experiment.

### Subjects

There were thirty-one people participating in this experiment and they were classed two groups. Eleven persons involved in the first group were instructed ten to twenty minutes to be familiar with holding the rods. The other twenty people included in the second group were trained about two to three hours; in addition to being shown how to employ the rods, they practiced to locate existing drainage pipes, water pipes, or electric conduits and compared the accuracies. All participants of these two groups were faculty members and students (except one from Canada) of

Kansas State University, Manhattan, Kansas. They had no experience with the device and the technique being tested. And they indicated that they had no firm conviction regarding the usefulness of dowsing rods as a detection device.

The subjects were instructed to loosely hold the rods parallel to each other (one rod in each hand), chest high, and to hold the horizontal element at a slight declination as shown in FIGURE 5. This declination served to lower the overall center of gravity of the device and to give the rods a slight positive stability. They were also instructed to keep their arms and muscles relaxed and to think of some other trivial subject while walking. If the subject noticed the rods either swinging in, i.e., crossing each other, or diverging out to become a straight line during dowsing test, he was to stop at once; it was considered that the rods had made a detection. Each reaction spot was measured from the starting line of each test path to the middle of the subject's feet. It is claimed by professional dowsers the direction of the straight line made by the pair of rods was the same direction of the dowsed pipes and that the rods could not work if the dowser walked paralleling to the buried pipes.

One professional dowser, a professional civil engineer, from Kansas City was invited to participate in the experiment.

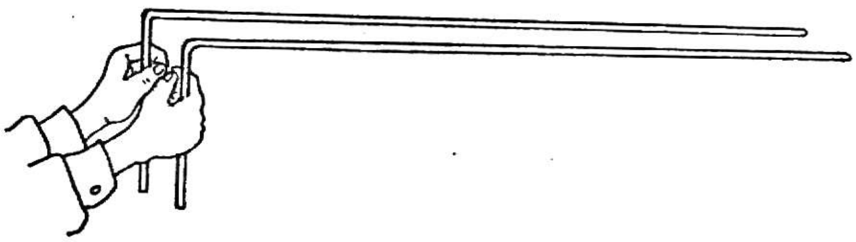


FIGURE 5. General method of L-shaped dowsing rods held in hands.

The Layout of Test Area

The selected test area was a flat and secluded place located near the south side of the football stadium of Kansas State University. The size of the test area was 50 feet in length and 30 feet in width. It was divided into three test paths A, B, and C, i.e., each test path was 50 feet in length and 10 feet in width. In order to measure the dowsing reaction spots easily and accurately, a measuring tape was put on the ground beside the path. The subjects walked along the tapes. Three steel pipes, each 7 foot long and 5/8 inch diameter were laid in the ground about 6 inches below the ground surface. The layout of the test area and the locations of the buried pipes are shown in FIGURE 6.

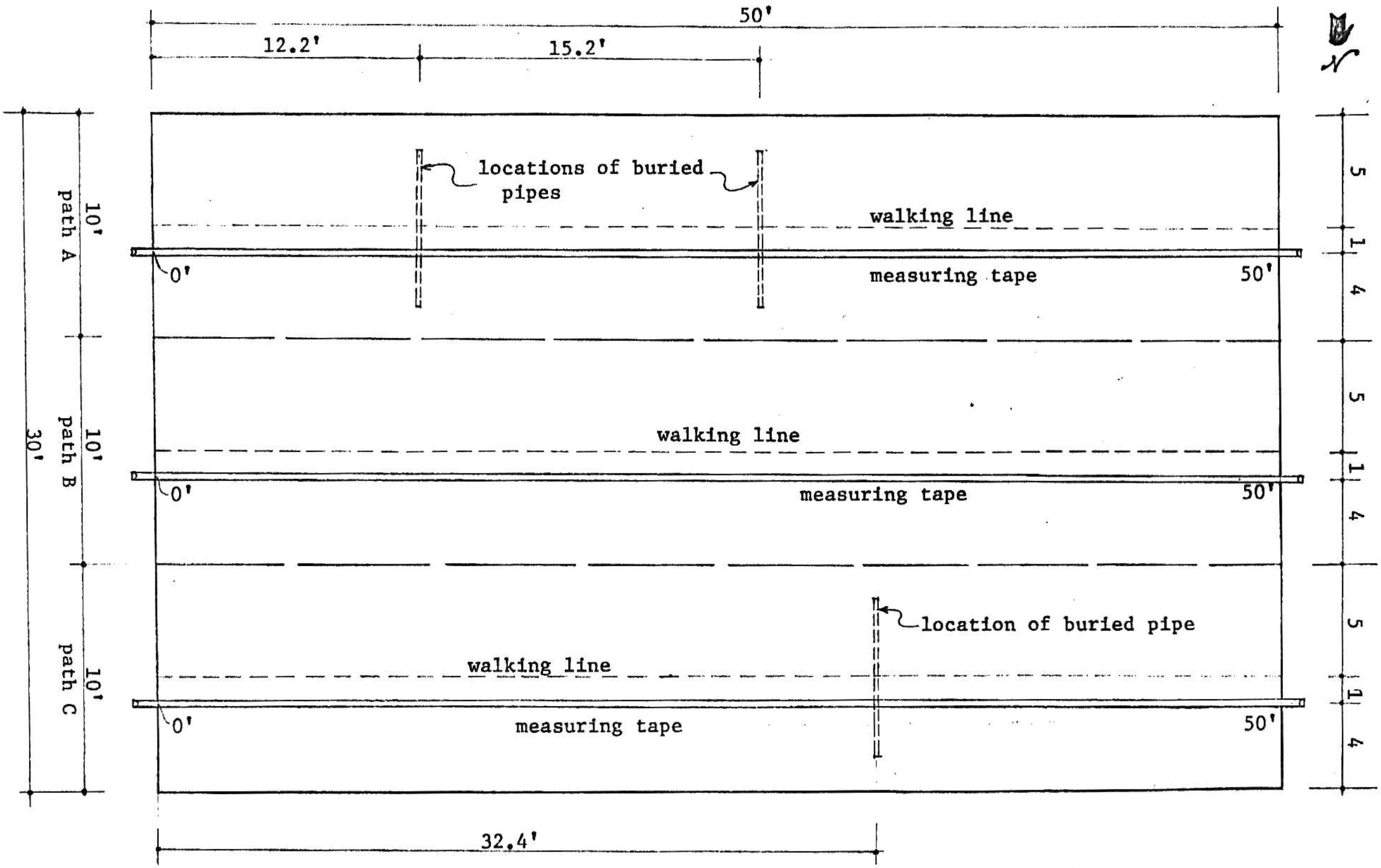



FIGURE 6 Layout of test area and locations of 3 buried steel pipes (each 7 foot long and 5/8 inch diameter).

Preliminary Dowsing Test Considerations

A characteristic of human nature is for one to attempt to work to the best of his ability when required to perform in front of others or in competition with them. As a result, considerable caution had to be exercised when conducting any type of dowsing test. The slightest hint might give the subject all of the knowledge required to make the correct choice. The hint need not be apparent. The subconscious might quickly associate the small hints with the correct response. Vogt and Hyman (1959) illustrated several of these kinds of examples.

In order to prevent the physical characteristics of the test area giving the subjects the slightest hint about where to expect a reaction, the test area was carefully selected, and the locations of buried pipes were carefully disguised. This made it impossible to see any sign of the buried pipes, even upon careful scrutiny.

Before the pipes were buried, the three test paths were dowsed by the L-shaped rods first and checked by metal detector several times to make sure there were no other buried objects. After the pipes were buried, the metal detector made exact responses above the buried pipes.

Procedures and Test Data

In the test conducted, the various participants did not watch each other during the tests. In all cases, only one person was on the course at a time, and there was no discussion about the test between participating individuals until the specific test was completed.

Each subject drew lots before dowsing to decide which test course would be followed. If a lot marked 'A' was drawn, the test path A would be walked first, then path B, at last path C; if a lot 'B', the test course would be B - C - A; if a lot 'C', the course was C - A - B. The three test courses are shown in FIGURE 7.

If the dowsing rod's reaction was really affected by buried pipe, which part of dowsing rods or dowser's body would be exactly above the buried pipe was unknown. In order to cancel the error for measuring each dowsing reaction spot at dowser's feet in the experiment, each response spot at the first reaction was checked back. Each response spot for the first group only one average value (verified in the field by the subjects) was recorded. The response spot for the second group consisted of two values and was also recorded: one was the first response (called the first value) and the other one was the check-back response. The average (called mean value) of the two values was calculated and entered into the data. The measurements were accurate to about one-half foot for the first group, one-tenth foot for the second group.

The test data of the experiment, shown in FIGURES 8, 9, and 10, are plotted twice: the upper parts to illustrate grouping and the lower parts the individual reactions from various subjects. Each dot on the graph indicates one dowsing reaction spot. For the first group there were 28 responses at path A, 2 subjects without response; 31 responses at path B, 1 subject without response; 36 responses at path C, 1 subject without response. The test courses taken by the first group were, 3 in course A - B - C; 7 in B - C - A; 1 in C - A - B. The number of responses recorded per individual varied from 3 to 15 for the full course. For the second group there were 59 responses at path A, 2 subjects without response; at paths B and C, each had 48 responses and

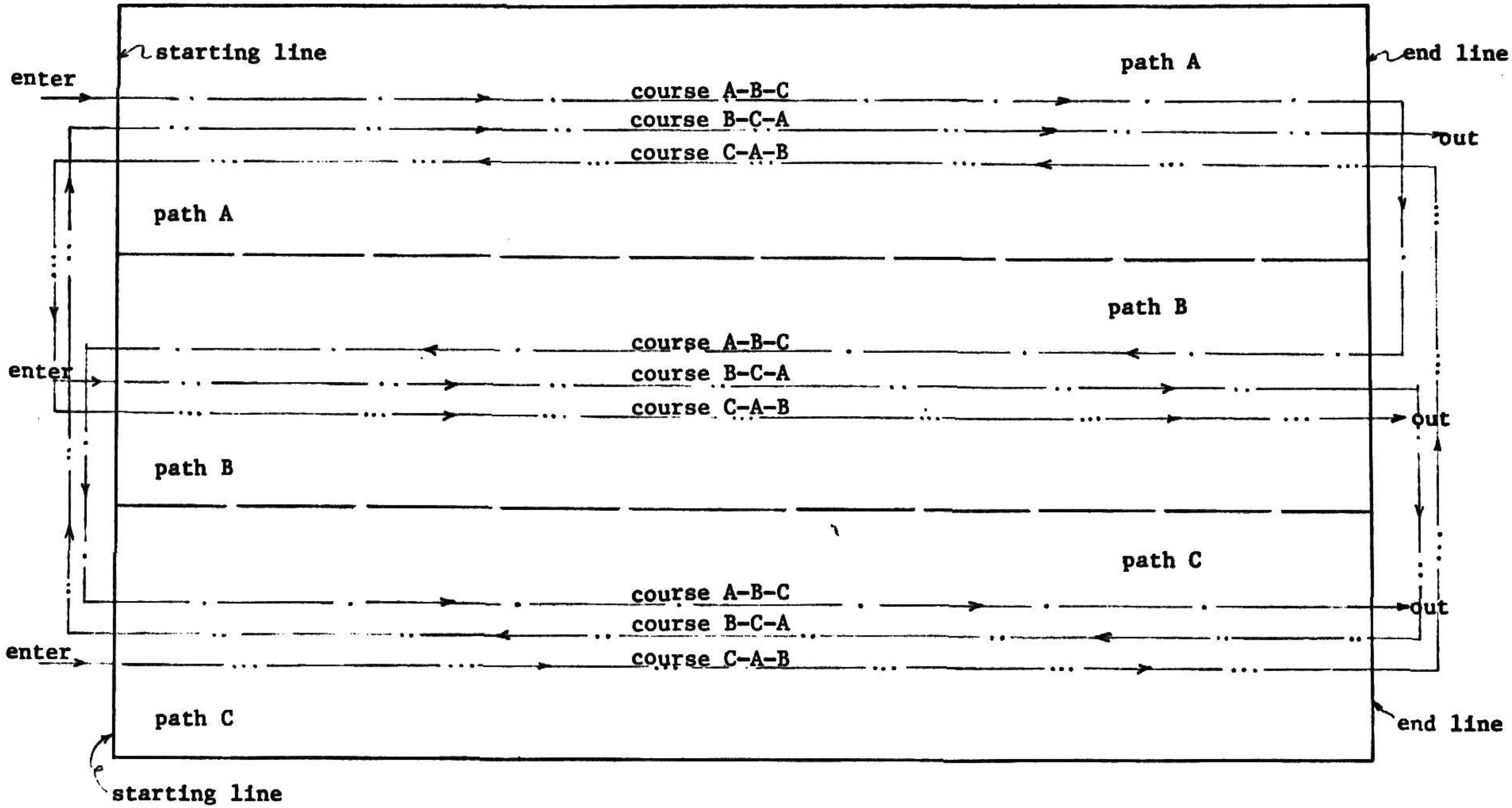
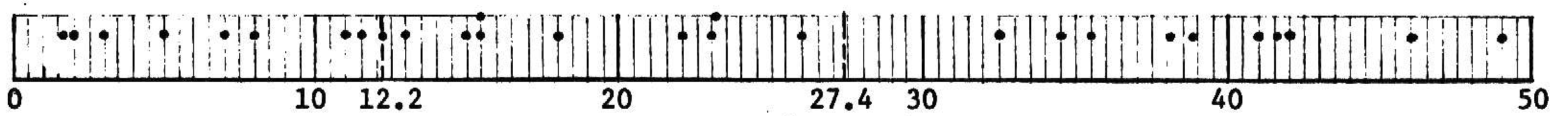



FIGURE 7. Three test courses of the dowsing experiment.

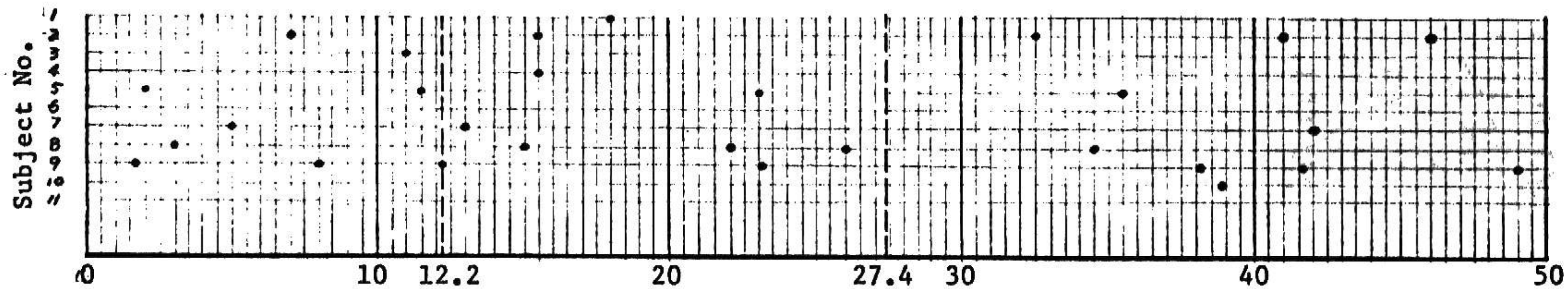
2 subjects without response. The test courses taken by the second group were, 4 in courses A - B - C; 6 in B - C - A; 9 in C - A - B. The number of reactions recorded per individual varied from 2 to 14 for the full course.

It is also possible that every response spot with the average value might have some bias. When every response spot was checked back, the dowser had already known approximately where the first response was, this might influence the check-back response. Therefore, the data of the first response spots for the second group are plotted in FIGURE 10. The number of responses is the same as those in FIGURE 9.

The data conducted by the professional dowser are shown in FIGURE 11. He got 3 responses at path A; 2 at path B; 2 at path C.




(A) For group

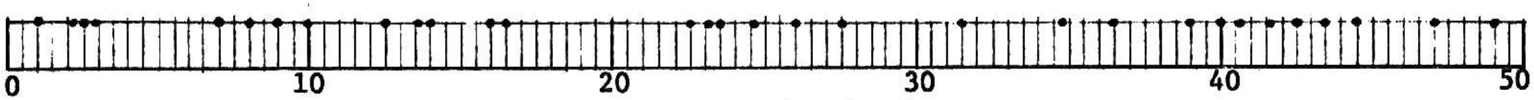



(B) For individuals

Note: Dash lines indicate positions of buried pipes.

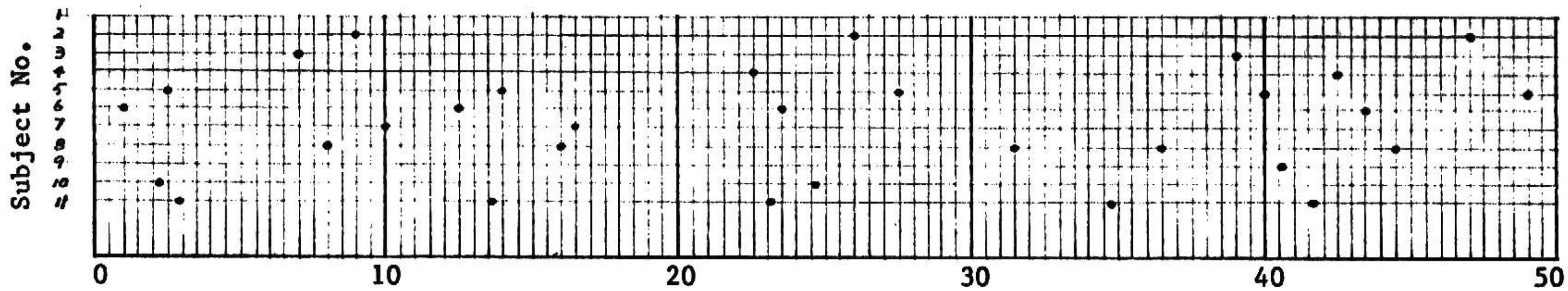
PATH A

FIGURE 8. Dowsing reaction spots for the first group.




Distance (in feet)

(A) For group

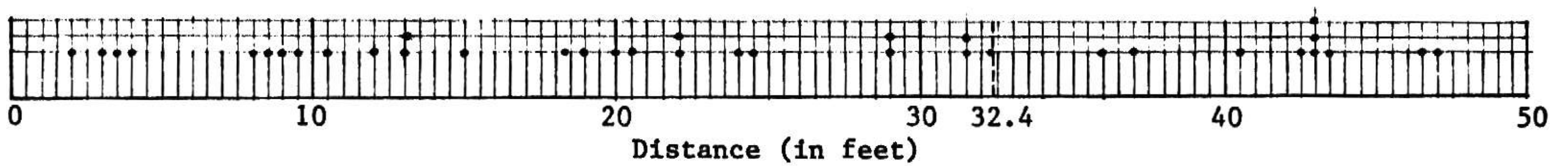



Distance (in feet)

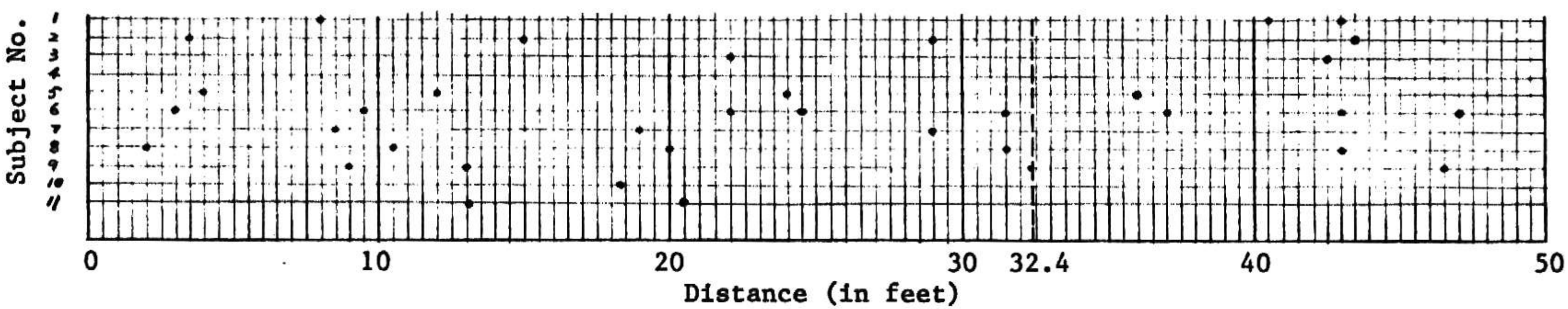
(B) For individuals

PATH B

FIGURE 8 (continued)



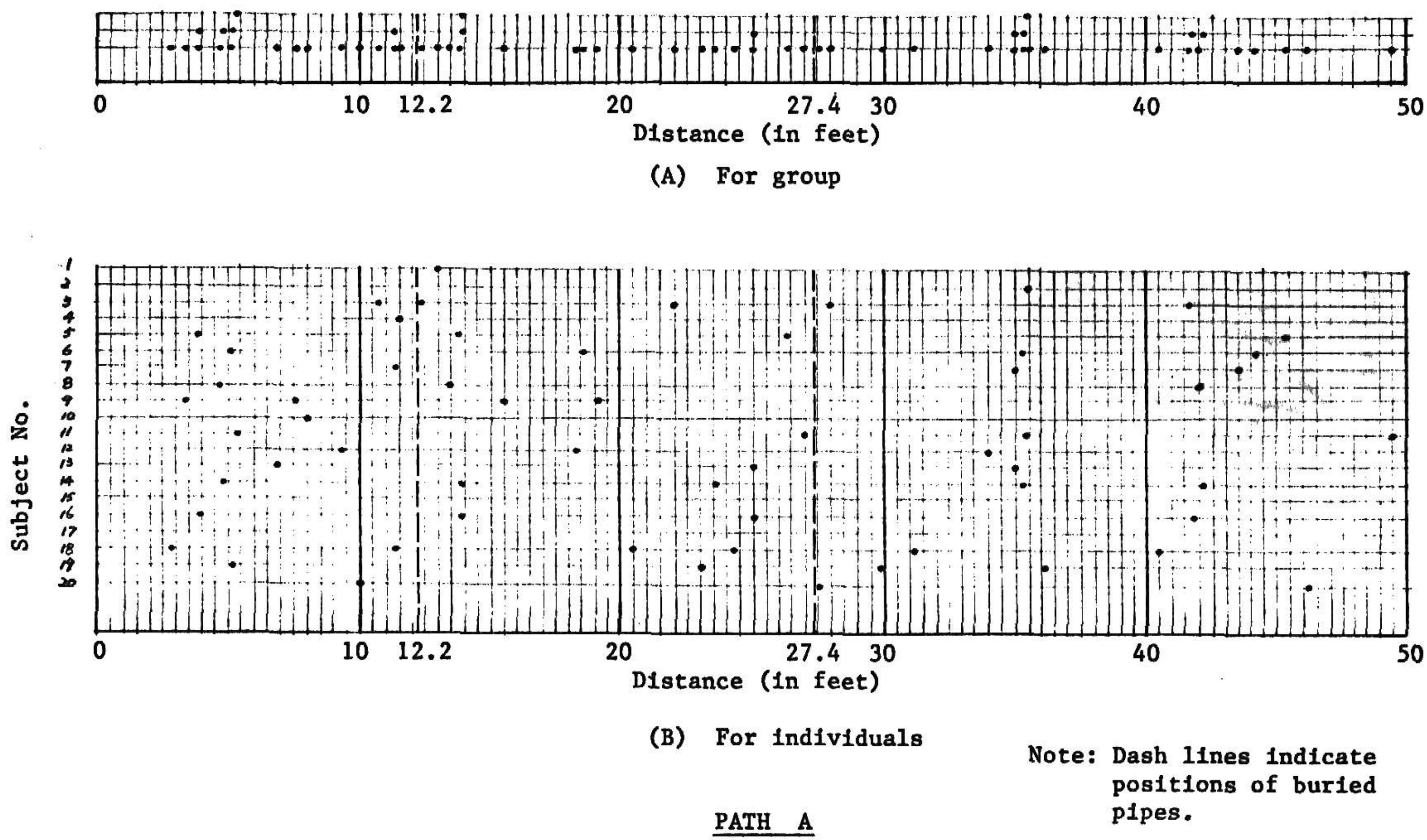

(A) For group




(B) For individuals

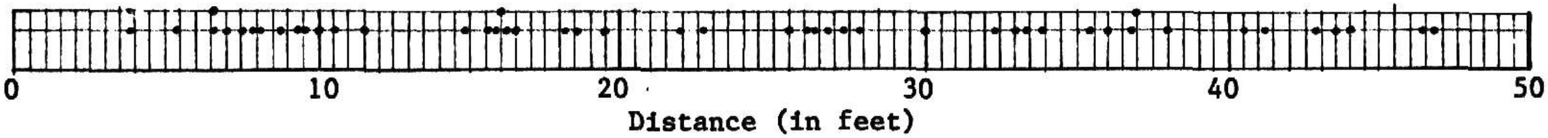
PATH C

FIGURE 8 (continued)

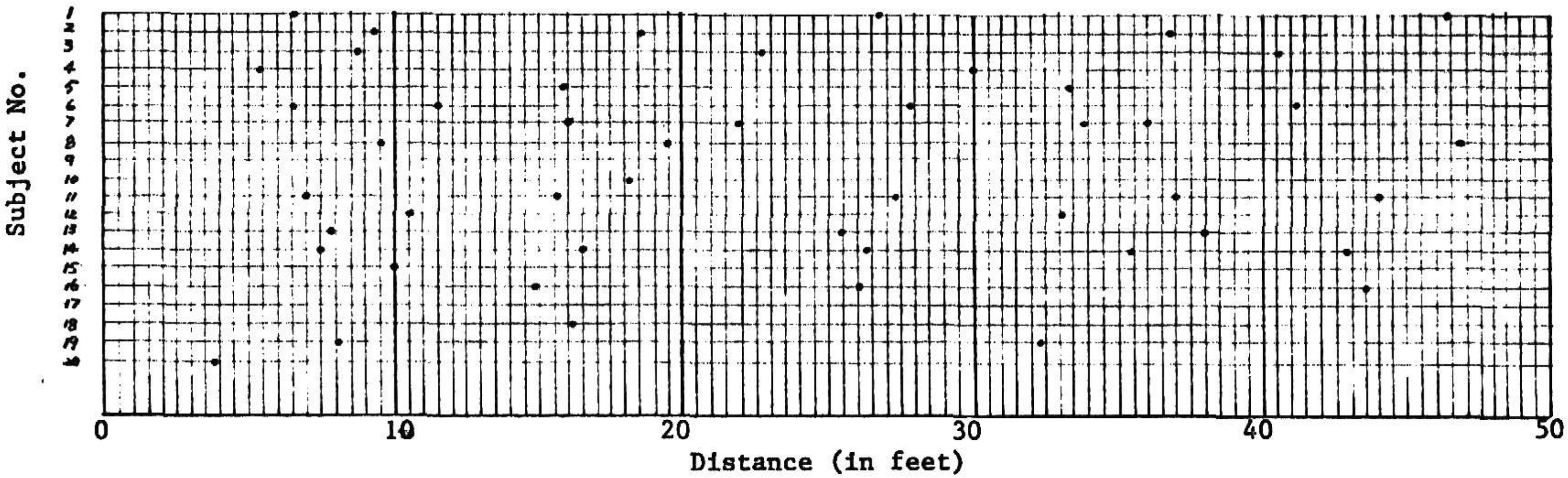



PATH A

FIGURE 9. Mean values of dowsing reaction spots for the second group.



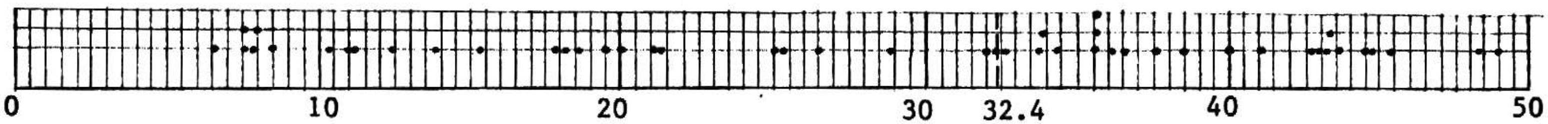

(A) For group



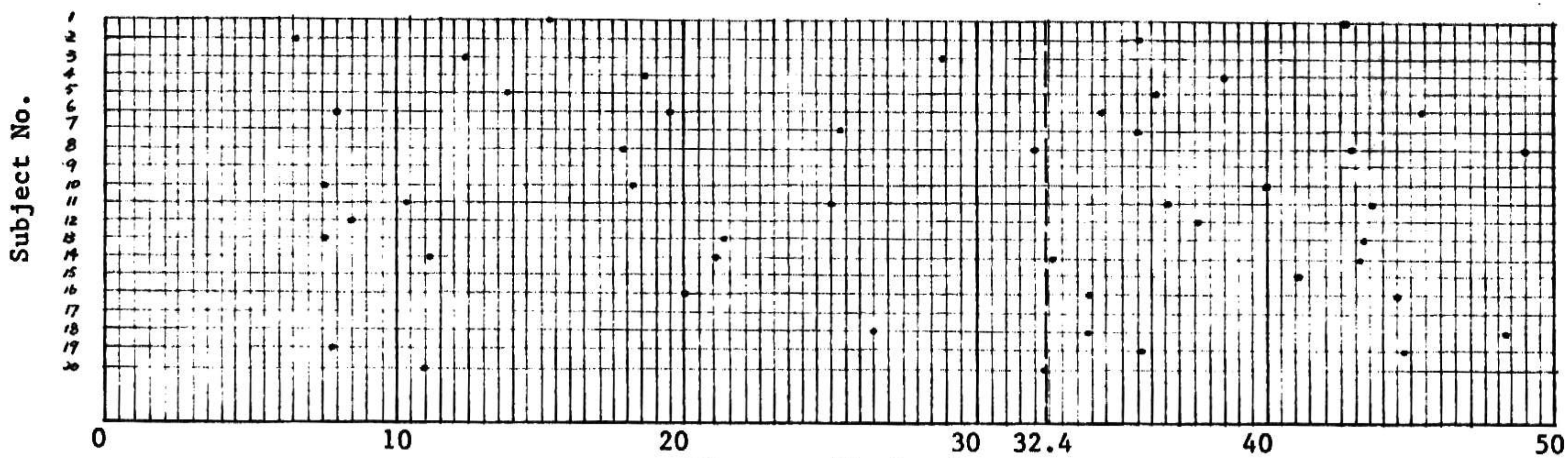

(B) For individuals

PATH B

FIGURE 9 (continued)



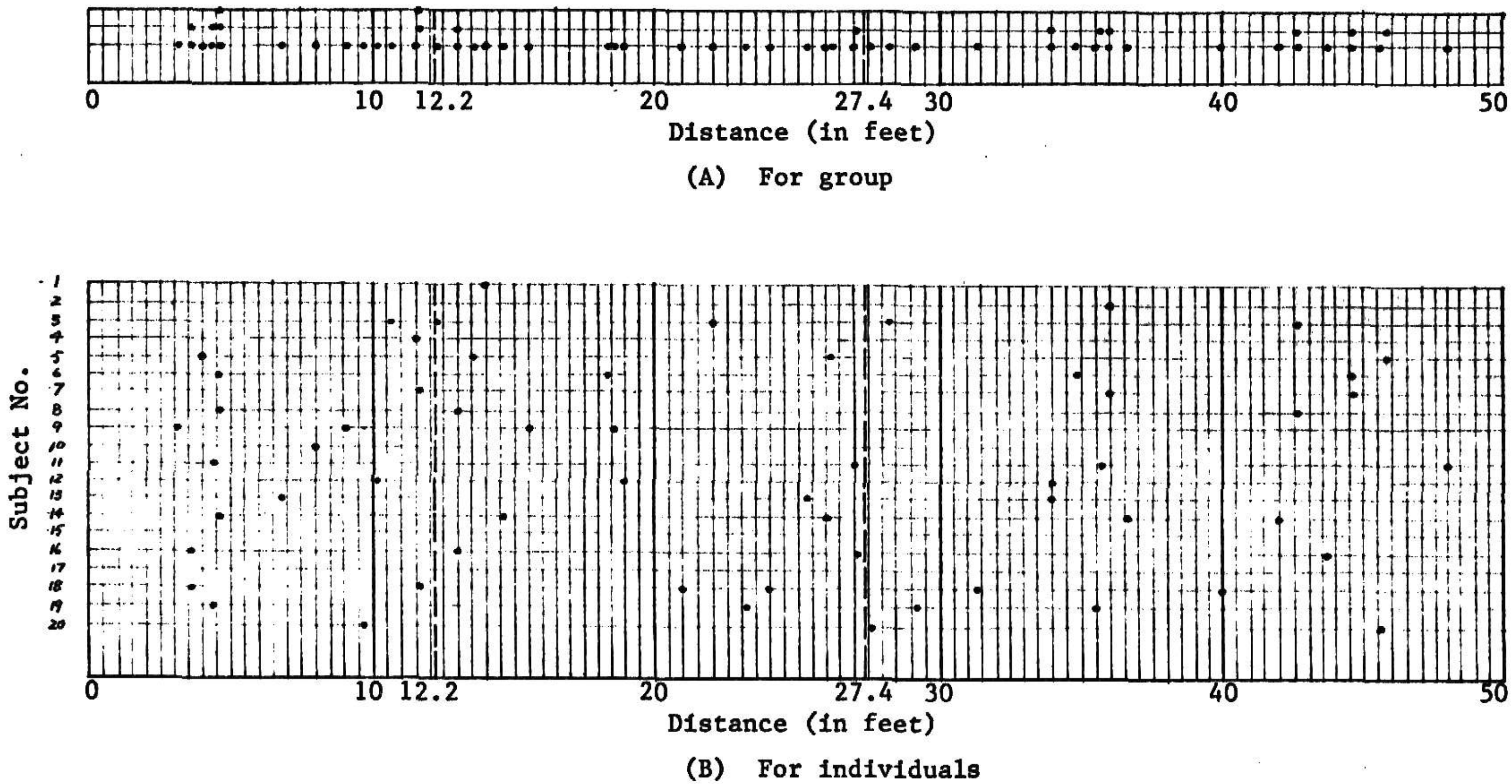

(A) For group




(B) For individuals

PATH C

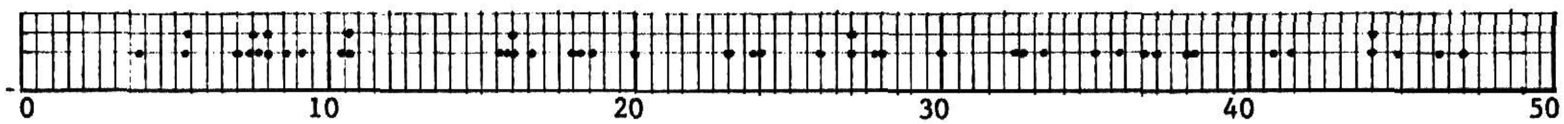
FIGURE 9 (continued)



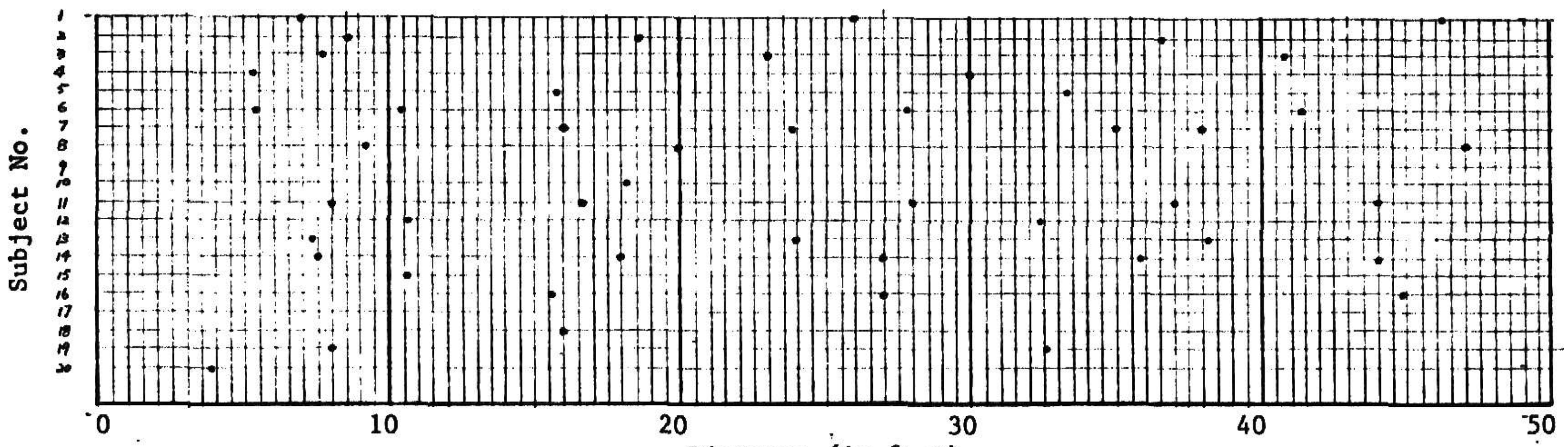

PATH A

Note: Dash lines indicate positions of buried pipes.

FIGURE 10. The first values of dowsing reaction spots for the second group.



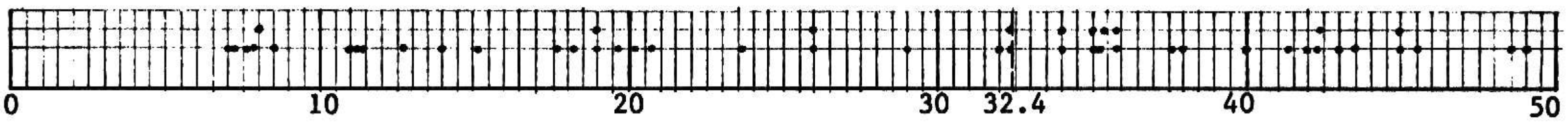

(A) For group



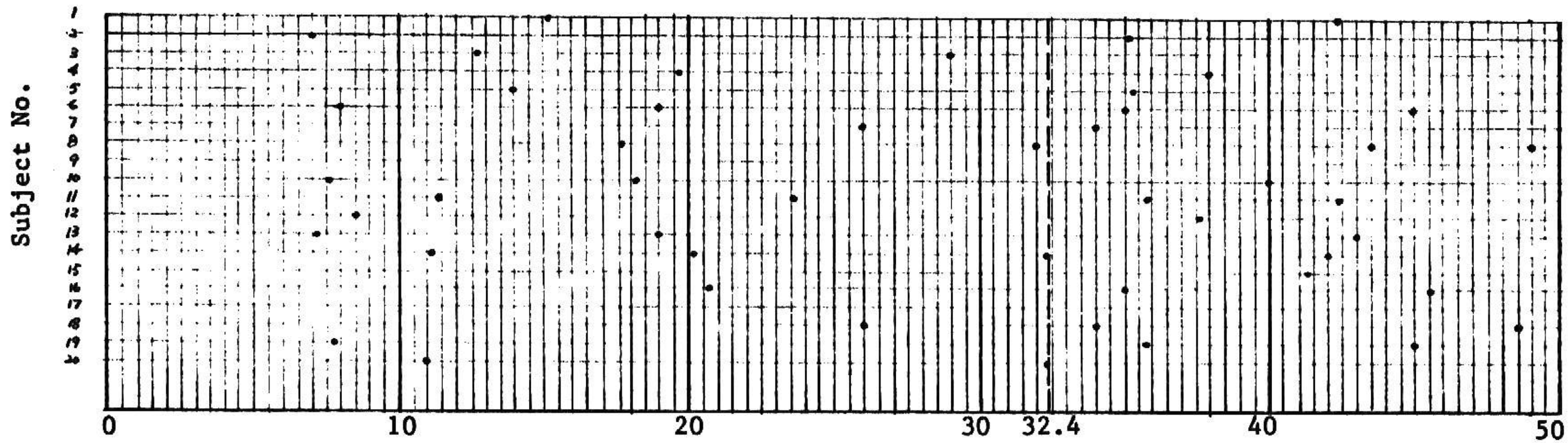

(B) For individuals

PATH B

FIGURE 10 (continued)




(A) For group




(B) For individuals

PATH C

FIGURE 10 (continued)

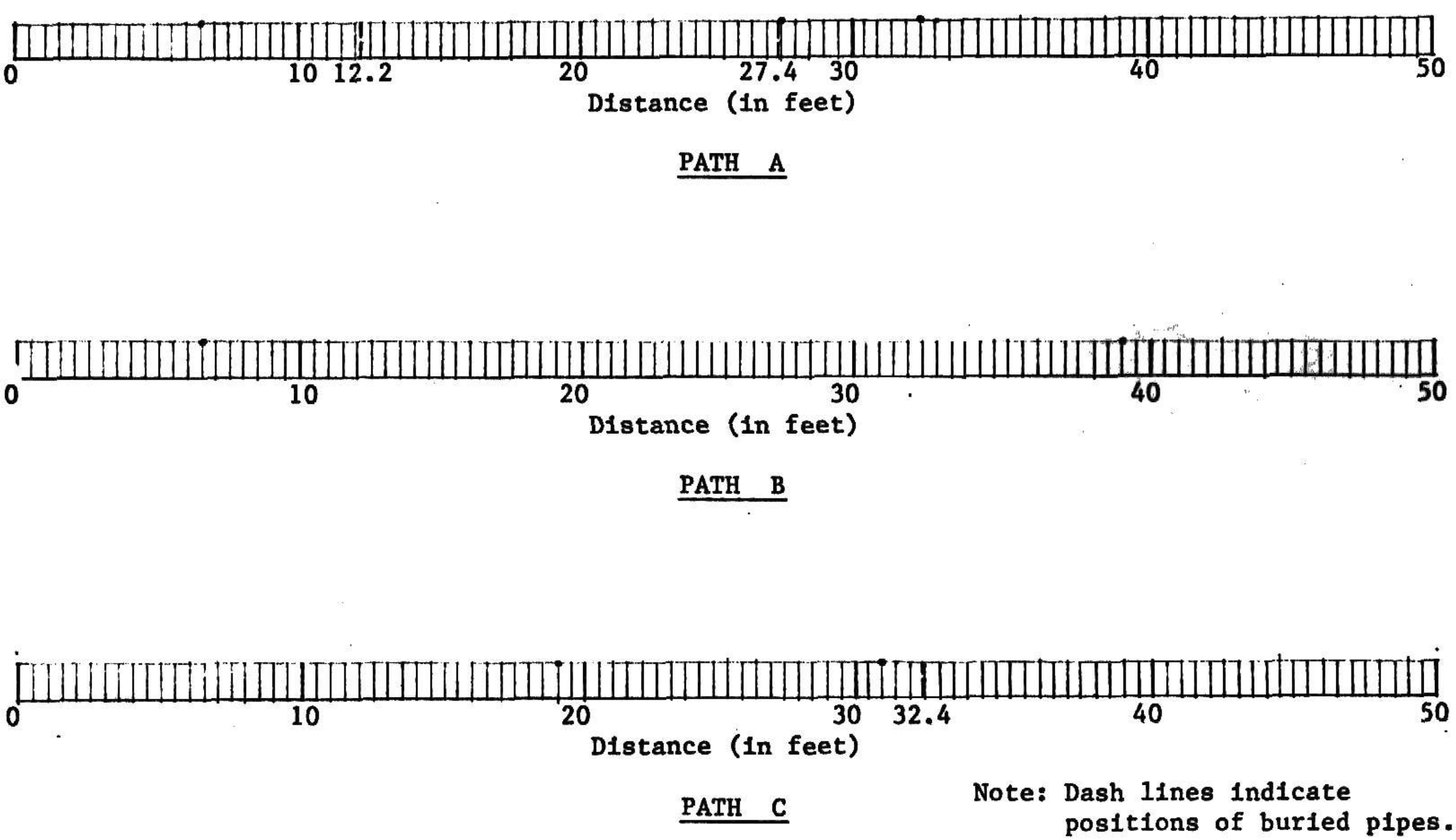



FIGURE 11. Dowsing reaction spots for the professioner dowser.

## Statistical Analyses

Two statistical methods were used to test the dowsing responses:

1. Test for Dowsing Reaction Distribution of Each Subject Group along Every Test Path

The dowsing reaction data were analyzed by the Kolmogorov two-sided test. The null hypothesis proposed that the variate, the number of dowsing reactions, followed a uniform distribution (complete randomness) along the test paths, i.e., the probability of obtaining a dowsing reaction was the same within each specific incremental distance along each test path. The necessary preliminary calculations and analysis of the data with respect to the requirement of the Kolmogorov test are shown in APPENDIX 1. The results confirm the hypothesis that the dowsing reaction distributions were uniform without regard to paths with or without underground pipes, or these L-shaped steel dowsing rods performed randomly as a detection device for underground pipes in this experiment conditions.

The data were analyzed purely to check for the uniformity of the distribution of response points, without considering where the pipes lay. This is because the rejection of uniformity does not necessarily imply good dowsing response. For example, if there had been a clustering of responses at 10 feet (say) and there was no pipe buried at that area, the Kolmogorov statistic could be significantly large and the null hypothesis would be rejected, but it would not support the validity of dowsing. In short, a larger Kolmogorov statistic, to be indicative of good dowsing response, must occur at or near the actual pipe location.

2. Classifying Subjects as 'Successful' Dowsers

Determining when a dowsing reaction occurred was somewhat arbitrary. If the dowsing rods could really locate underground conduits, whether or not the dowsing reaction spots would be exactly above the conduits or have some range in distance was unknown. It might be reasonable that the dowsing reaction spots covered some range, (called the effective boundary), due to influence by the buried pipes. The effective boundary could be presumed different. This is because all the dowsing reaction spots were measured at the middle of the feet while the two feet were close together. Different dowsers had different step lengths, speeds, and habits. The step lengths of subjects in the experiment varied about from 1.5 to 2.5 feet. The variation in speed ranged from 0.4 to 0.9 mph. The inertia of the rods, however, would be nearly a constant. Thus, once a dowsing reaction was initiated more ground can be covered by a fast walker than by one who walks slowly. No effort was made, however, to categorize as a function the speed of walking. The other phenomena might arise due to the variation in the 'sensitivity' of the subjects. Some were noted to get many reactions; some a few. Also some people were noted to walk faster than others, took less notice of what they were doing, etc. These perturbations in reaction might cause a great deal of scatter in the data. Supposedly though, if enough people were tested their characteristics would tend to center around some norm which still leaves things statistically manageable.

In each subject performing this experiment would began at the 'starting line' or, in some cases, the 'end line' and was governed by controlled or constant pacing, it would be possible to walk exactly above buried pipes depending on the distance and location of the pipes from each of mentioned starting points. For example, in path C, the location of buried pipe was 32.4 ft measured from starting line, or 17.6 ft measured from end line of the path. Assuming the rods worked only when the dowser stepped to the spots nearest to buried pipes, and one subject had a 2.3 ft step length, then his nearest step location would be at 32.2 ft or 0.2 ft before the buried pipe; if he walked from the end line, the nearest step would be at 18.4 ft or 0.8 ft in distance from the buried pipe. The various step lengths, nearest distances from steps to buried pipes, and the effective boundaries are evaluated in TABLE 1.

The binomial proportion test was used to examine the hypotheses. The first hypothesis was that the proportion of correct dowsing spots (or steps) taken by each subject while using dowsing rods was equal or smaller than the probability of common persons getting correct spots of underground pipes without using any instrument. If this first hypothesis was accepted, the dowsing reactions for this subject was considered random, which means he failed his dowsing. The statistical calculations are shown in part A of APPENDIX 2. The second hypothesis was that the proportion of number of 'successful' subjects to the total number of subjects for each group was equal to or smaller than the proportion 0.5. If accepted, all the 'successful' subjects tested at the first hypothesis were only by chance. The results are shown in part B of APPENDIX 2.

All the null hypotheses could not be rejected, that is, the L-shaped dowsing rods performed random reactions, even though some subjects had statistic 'successful' dowsing, it was only by chance. It

TABLE 1

The nearest distances between the steps and underground pipe spots for the subjects with various step-lengths walking through each test path from the starting or end line.

(All values in feet)

| Step-length | PIPE LOCATION (measured from 'starting line') AT 12.2 ft. | | 27.4 ft. | | 32.4 ft. | |
|---|---|---|---|---|---|---|
| | WALKING DIRECTION FROM | | | | | |
| | Starting line | End line | Starting line | End line | Starting line | End line |
| 2.5 | + 0.3 | - 0.3 | + 0.1 | - 0.1 | + 0.1 | - 0.1 |
| 2.4 | - 0.2 | + 0.6 | - 1.0 | - 1.0 | ± 1.2 | - 0.8 |
| 2.3 | - 0.7 | - 1.0 | + 0.2 | + 0.4 | - 0.2 | + 0.8 |
| 2.2 | + 1.0 | - 0.4 | - 1.0 | - 0.6 | + 0.6 | 0 |
| 2.1 | + 0.4 | 0 | - 0.1 | + 0.5 | - 0.9 | - 0.8 |
| 2.0 | - 0.2 | + 0.2 | + 0.6 | - 0.6 | - 0.4 | + 0.4 |
| 1.9 | - 0.8 | + 0.2 | - 0.8 | + 0.2 | - 0.1 | - 0.5 |
| 1.8 | + 0.4 | 0 | - 0.4 | + 0.8 | 0 | + 0.4 |
| 1.7 | - 0.3 | - 0.4 | - 0.2 | - 0.5 | - 0.1 | - 0.6 |
| 1.6 | + 0.6 | + 0.6 | - 0.2 | - 0.2 | - 0.4 | 0 |
| 1.5 | - 0.2 | - 0.3 | - 0.4 | - 0.1 | + 0.6 | + 0.4 |
| Max. range | 1.8 | | 2.0 | | 2.4 | |

Note: The sign '+' indicates the nearest step is over buried pipe; the sign '-' indicates before buried pipe. The max. range is the effective boundary.

might be possible only a few persons that had a natural dowsing gift could dowse. Whether these 'successful' subjects in this experiment had special gifts in dowsing was not proved further. Probably the safest interpretation is that the L-shaped dowsing rods could not be used as a detective device for the larger group of common people in this experiment.

## III. SUMMARY

In this experiment L-shaped steel rods were used to locate three 5/8 inch diameter pipes. These pipes were located at depths about 6 inches and were placed in a study field designed especially for this analysis.

Thirty-two subjects participated in this experiment. Of these participants only one had previous experience with dowsing.

The guidelines required that each participating subject execute a simple trial run of this experiment. Each participant observed that upon location of any underground pipes the dowsing rods produced a crossing (inward) or spreading (outward) effect. The spots of observation were then recorded for further analysis. This analysis was performed using the Kolmogorov and binomial tests which measured uniform distribution and correctness of reactions, as well as, the number of 'successful' participants. The results of the data analysis showed that:

(1) the dowsing reaction spots performed in a random distribution manner;

(2) correctness of reactions occurred only by chance or because the 'successful' participants possessed special abilities in detecting underground objects.

To explain this phenomena of special ability or chance, it is suggested that a number of experiments be performed under this same type of controlled environment.

Also, to determine the overall effectiveness of this type of study to engineering and related professions, additional field experiments should be performed using this 'method' to locate existing water pipes, electric conduits, ground water, etc.

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# APPENDIX 1

## Kolmogorov One-Sample with Two-Sided Analysis for the Dowsing Reaction Distribution along Test Paths for Each Group

The Kolmogorov two-sided one-sample test was based on the statistic (Bradley, 1968)

$$k = \text{Maximum}\ |S(X) - F(X)|.$$

Where

$S(X)$ = the observed cumulative probability distribution function of the dowsing reactions.

$F(X)$ = the expected cumulative probability distribution function of the dowsing reactions, or uniform probability distribution function.

The null hypothesis would be rejected if the observed value of the Kolmogorov statistic k was greater than the critical value $k_c$ at the 0.05 level of significance.

For convenience and ease of reading the diagrams, the above formula was transformed to:

$$\begin{aligned} K &= N \cdot k \\ &= N \cdot \text{Maximum}\ |S(X) - F(X)| \\ &= \text{Maximum}\ |N \cdot S(X) - N \cdot F(X)| \\ &= \text{Maximum}\ |S - F|. \end{aligned}$$

Where

K = the maximum difference between the observed and expected number of dowsing reactions.

N = the total number of dowsing reactions per path per group.

S = the observed cumulative distribution of the number of dowsing reactions.

F = the expected cumulative distribution of the number of dowsing reactions.

The null hypothesis would be rejected if K was greater than the critical value $K_c$ at the 0.05 level of significance. The $K_c$ value was equal to $k_c$ multiplied by N.

The dowsing data of each path for each group were analyzed, as shown in FIGURES 12, 13, 14, 15 and TABLE 2. The results are all not significant, or the observed dowsing reaction distributions are uniform. If the subjects make no responses anywhere in the test paths (even though this might be a correct response, as in path B), there is no technique available for coping with this situation of the subjects with and without responses simultaneously in the Kolmogorov test. Because the sample cumulative function with no response is equal to zero in the full interval, this is just same as the analysis of omitting the data for the subjects without responses. On the other hand, the non-responses of the subjects are in a sense the confirmation of the null hypothesis of uniformity, because $S = F = 0$ or $K = \text{Maximum} \left| S - F \right| = 0$, if only non-response subjects are considered. So omitting the subjects with no responses from all these analyses would not effect the results.

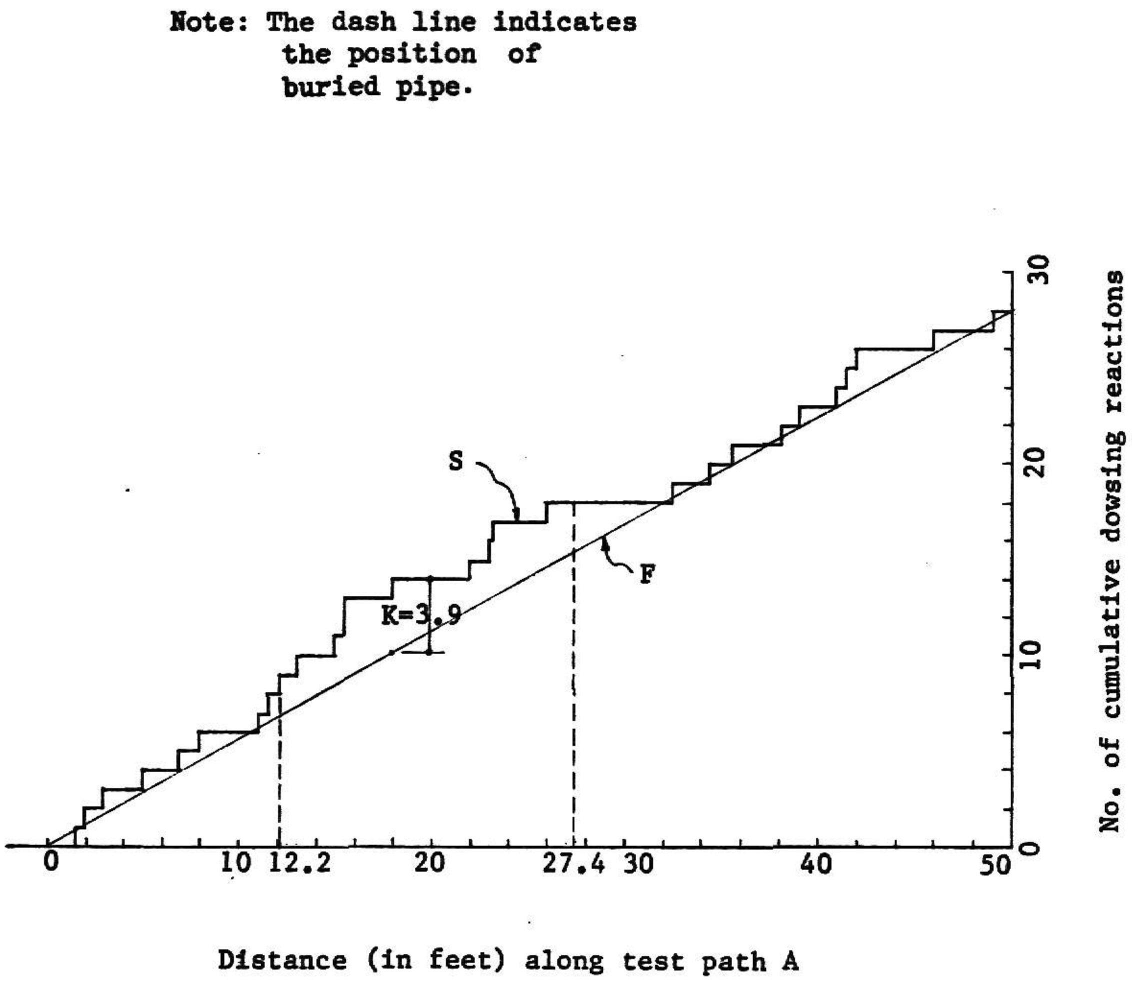



FIGURE 12

Graphical Kolmogorov test for uniform distribution of the dowsing reaction spots for the first group.

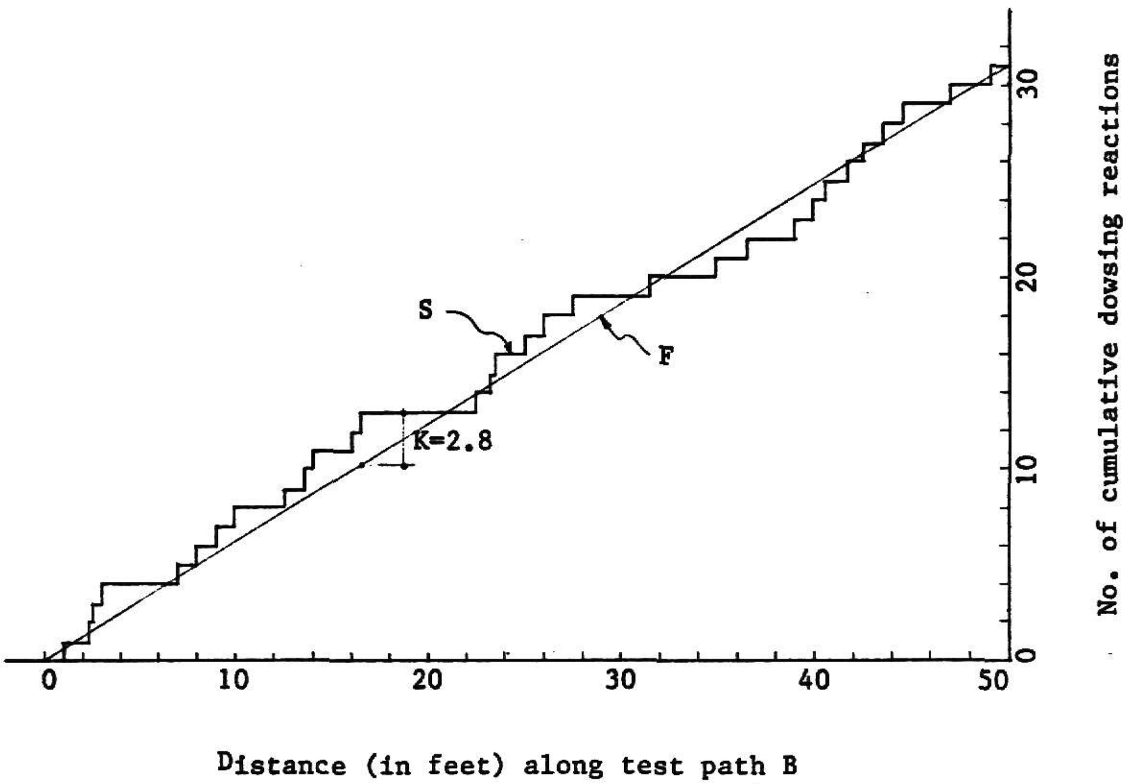



FIGURE 12
(continued)

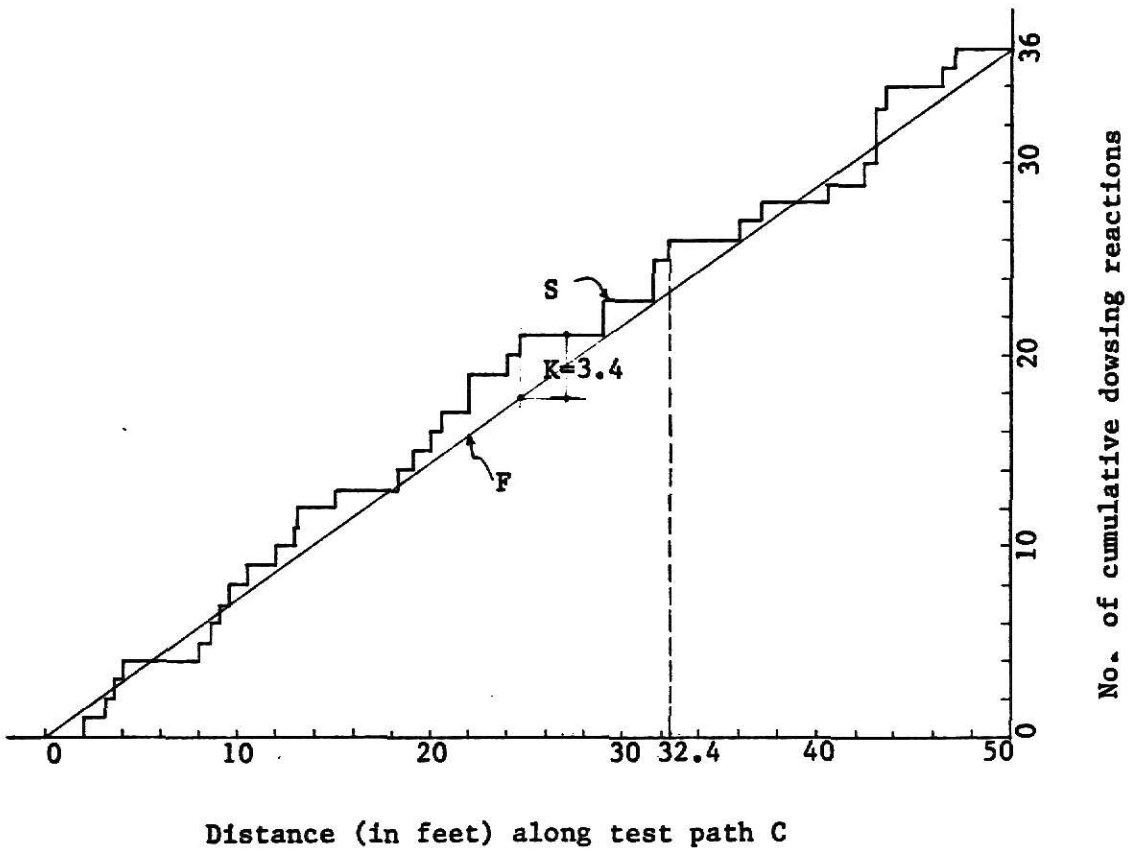



FIGURE 12
(continued)

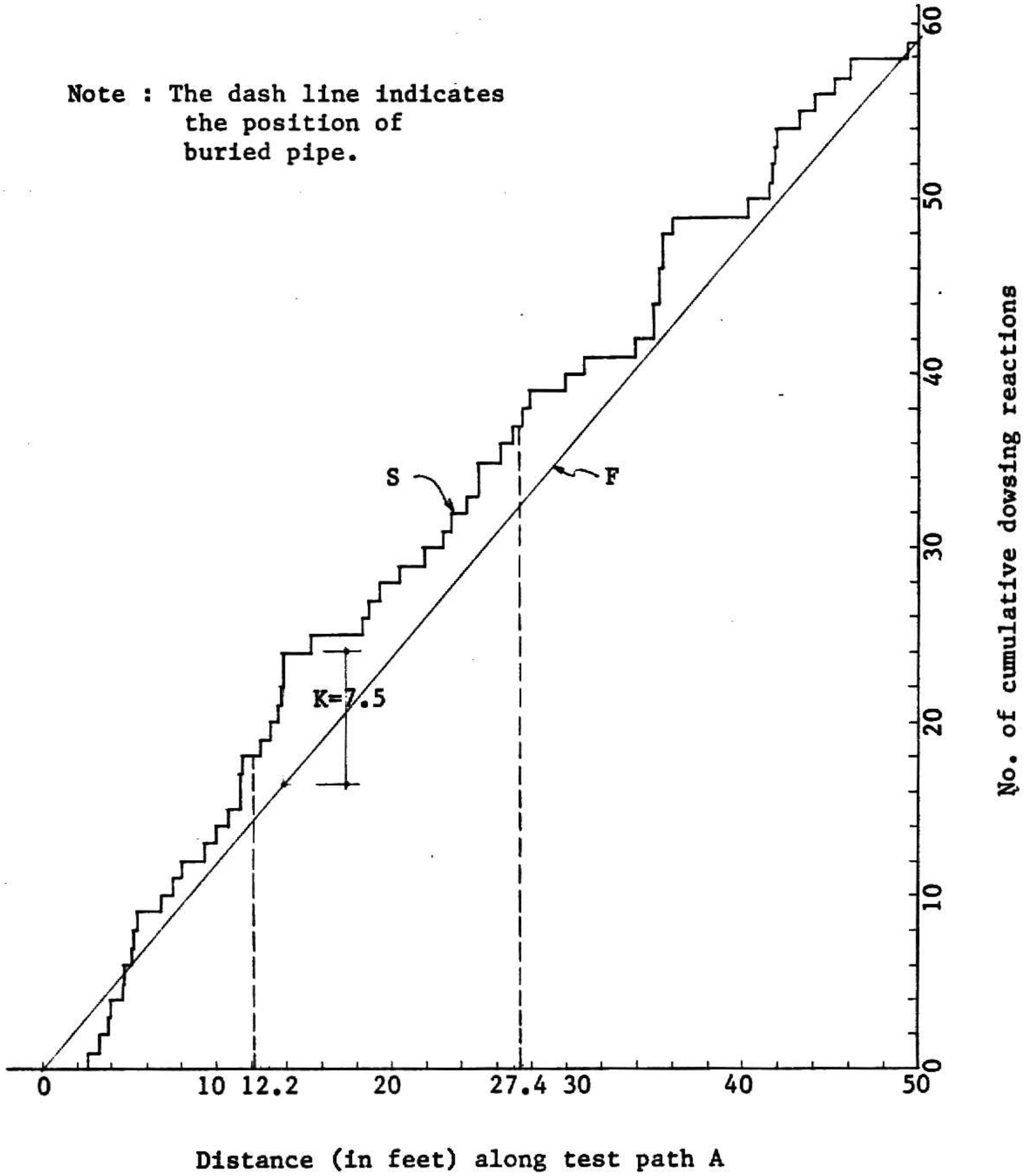



FIGURE 13

Graphical Kolmogorov test for uniform distribution of the mean values of dowsing reaction spots for the second group.

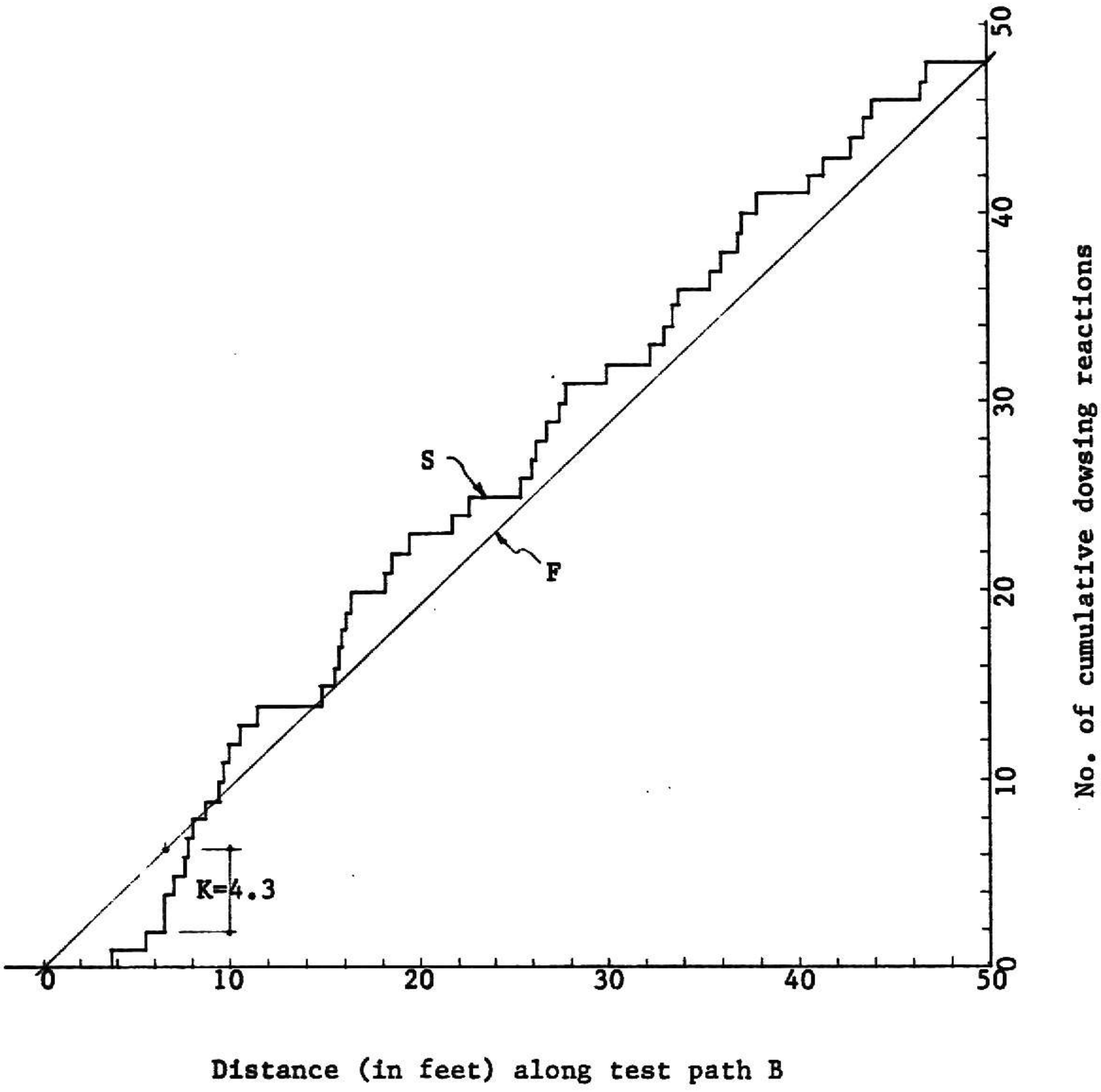



FIGURE 13
(continued)

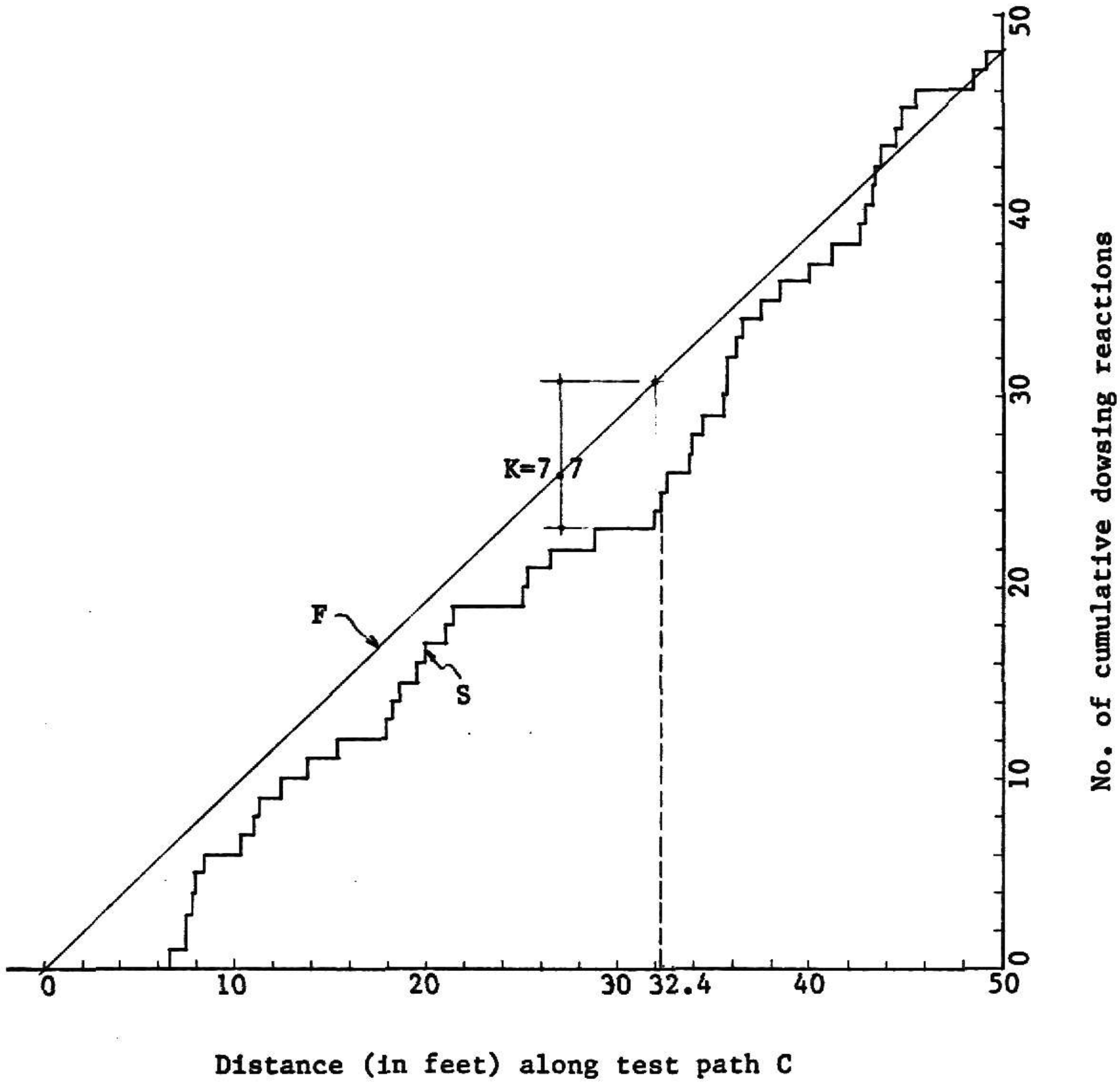



FIGURE 13
(continued)

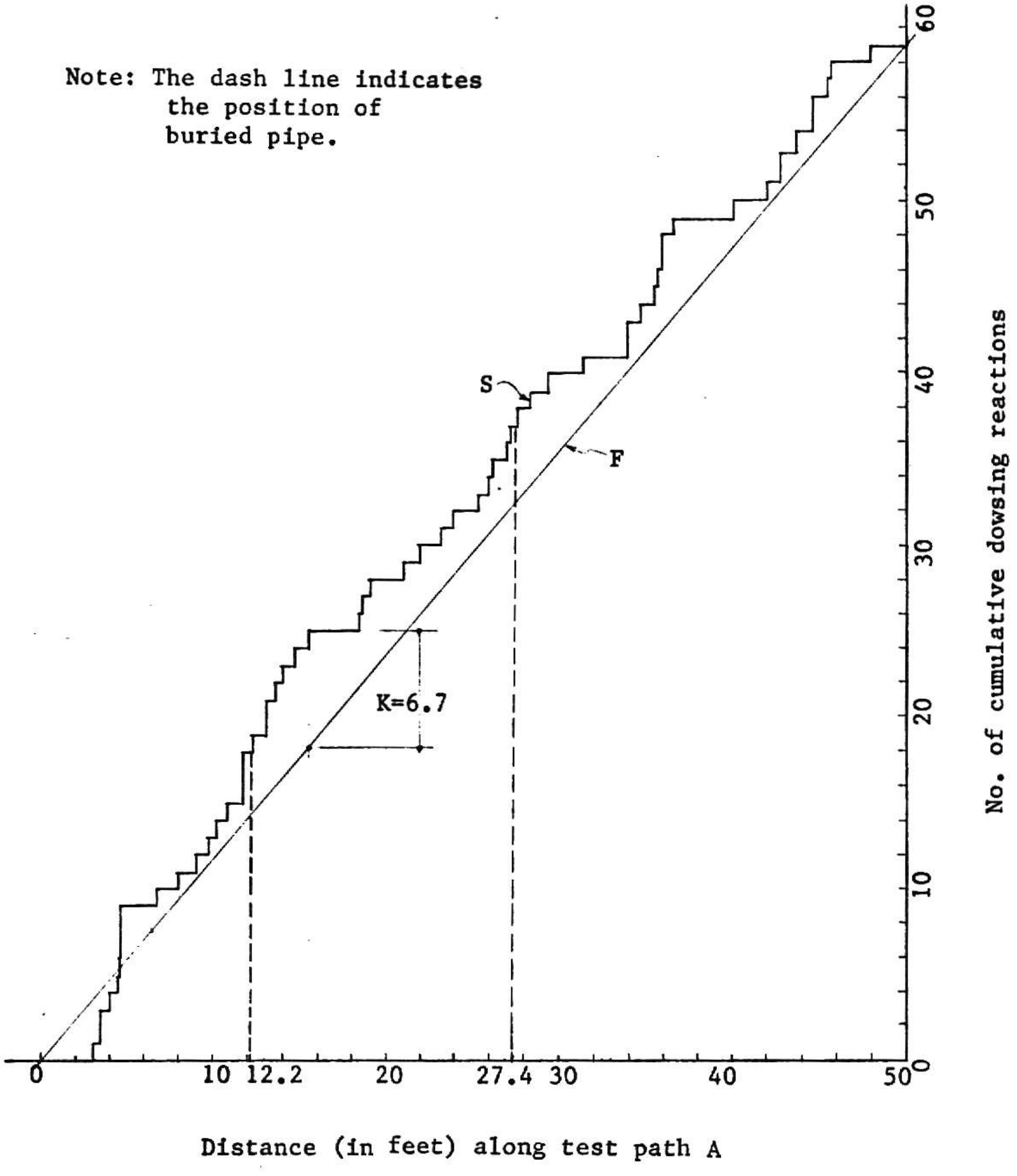



FIGURE 14

Graphical Kolmogorov test for uniform distribution of the first values of dowsing reaction spots for the second group.

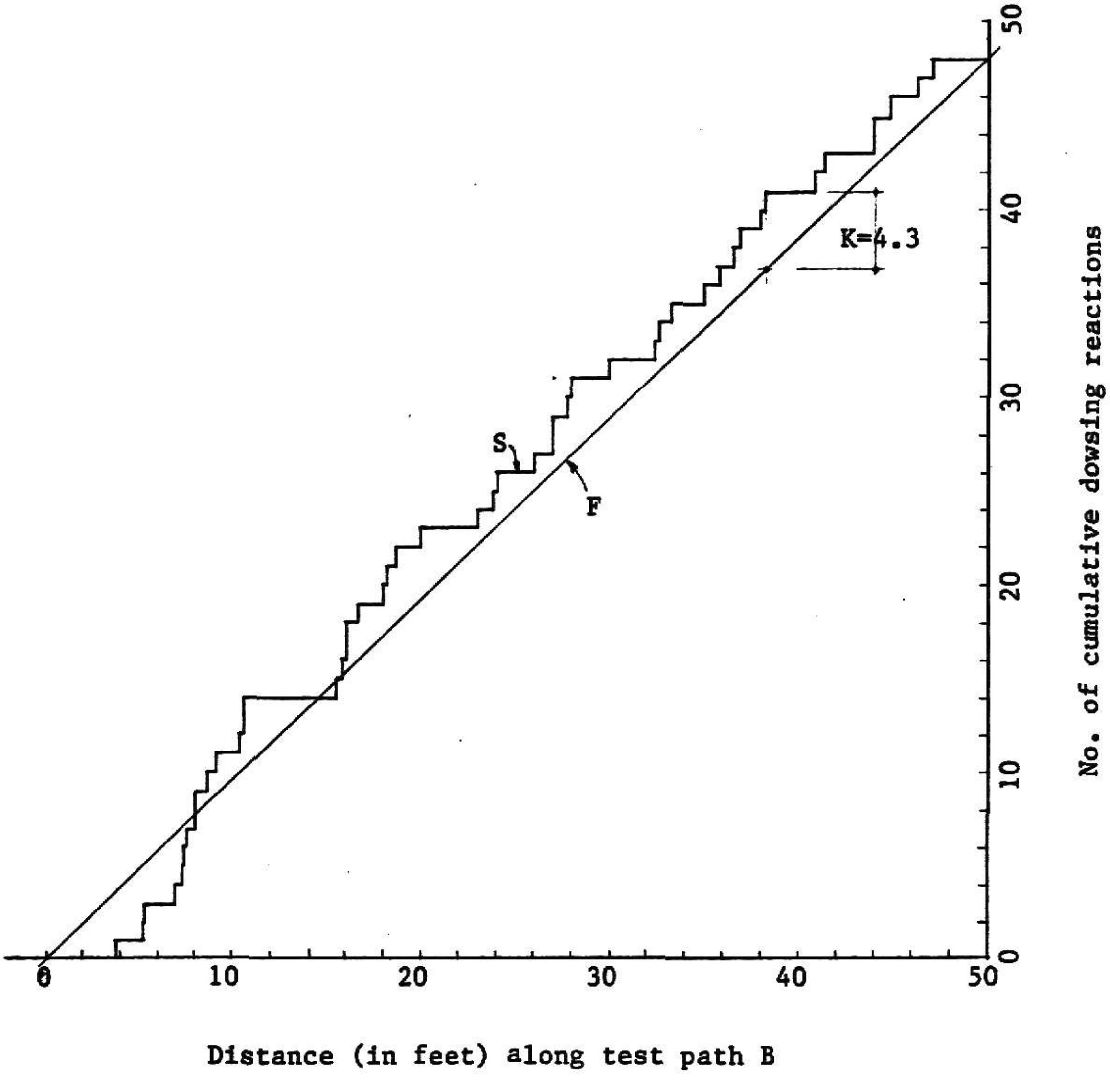



FIGURE 14
(continued)

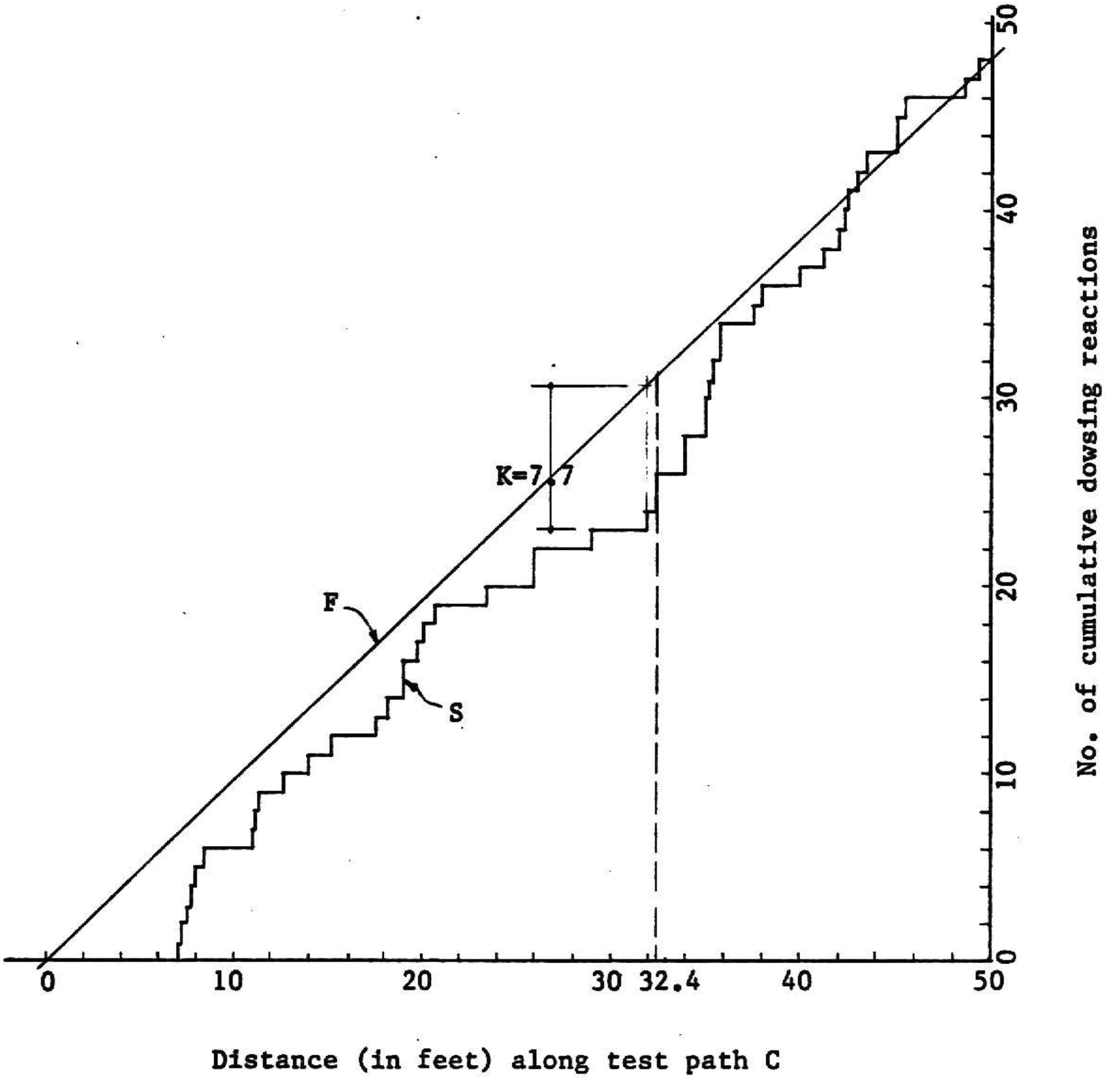
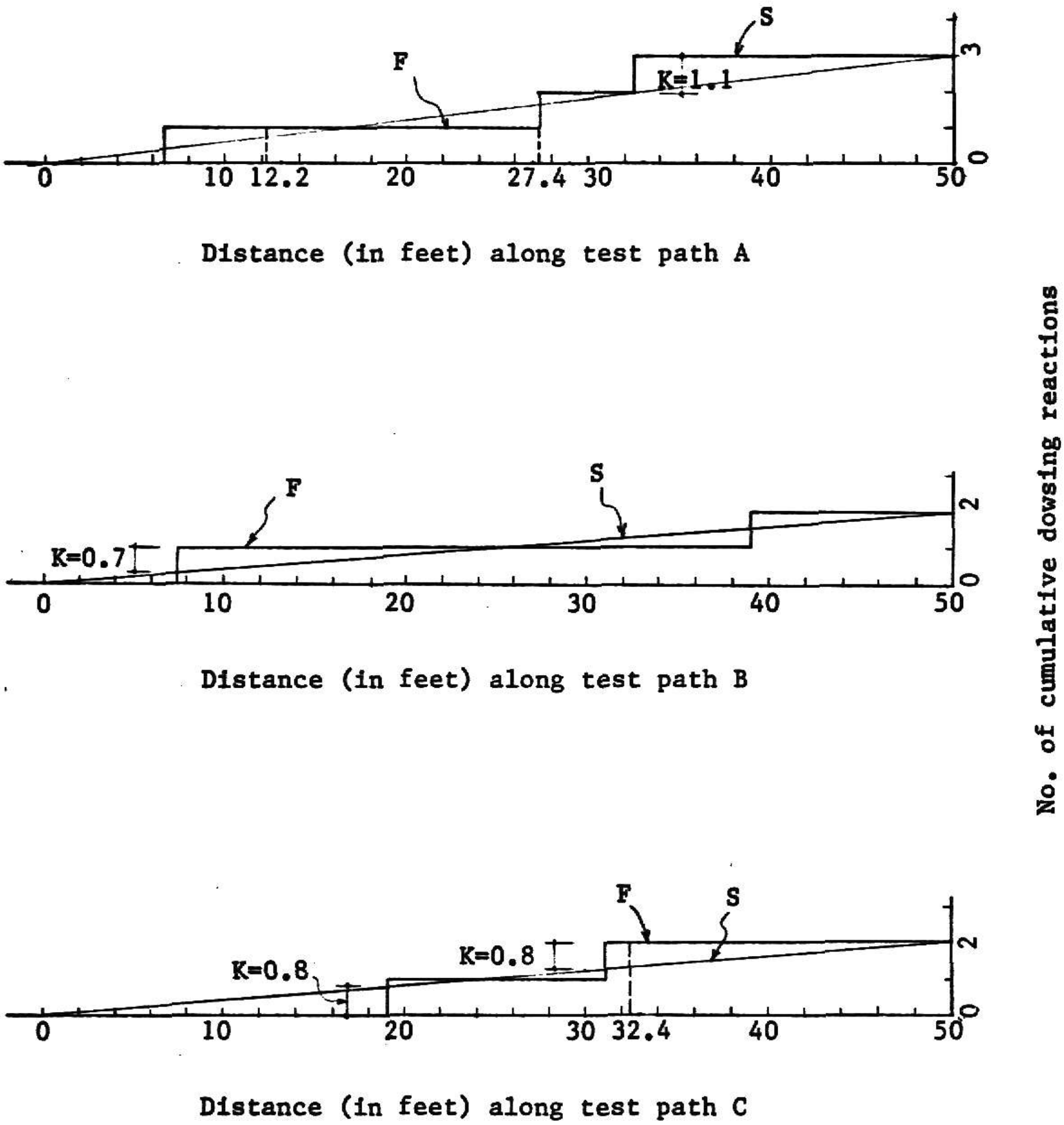



FIGURE 14

(continued)




Note: The dash line indicates the position of buried pipe.

FIGURE 15

Graphical Kolmogorov test for uniform distribution of the dowsing reaction spots for the professional dowser.

TABLE 2

Kolmogorov test for the dowsing reaction distributions.

| | Path | N | $k_c$ | $K_c$ | K | Decision |
|---|---|---|---|---|---|---|
| 1. For the first group: | | | | | | |
| | A | 28 | 0.250 | 7.0 | 3.9 | Not significant |
| | B | 31 | 0.238 | 7.4 | 2.8 | " |
| | C | 36 | 0.221 | 8.0 | 3.4 | " |
| 2. For the mean values of the second group: | | | | | | |
| | A | 59 | 0.174 | 10.3 | 7.5 | Not significant |
| | B | 48 | 0.192 | 9.2 | 4.3 | " |
| | C | 48 | 0.192 | 9.2 | 7.7 | " |
| 3. For the first values of the second group: | | | | | | |
| | A | 59 | 0.174 | 10.3 | 6.7 | Not significant |
| | B | 48 | 0.192 | 9.2 | 4.3 | " |
| | C | 48 | 0.192 | 9.2 | 7.7 | " |
| 4. For the professional dowser: | | | | | | |
| | A | 3 | 0.708 | 2.1 | 1.1 | Not significant |
| | B | 2 | 0.842 | 1.7 | 0.7 | " |
| | C | 2 | 0.842 | 1.7 | 0.8 | " |

## APPENDIX 2

Binomial Proportion Test Calculations for Dowsing Reactions (Freund, 1971)

(A) To test the dowsing reactions for each subject:

It would be reasonable that if the dowsing rods could be used effectively to locate the underground pipes, the probability of getting correct dowsing reactions ($\theta$) should be greater than the probability of getting correct reactions without using any dowsing instruments ($\theta_o$). The null hypothesis ($H_o$) is assumed that $\theta \leq \theta_o$ against the one-sided alternative hypothesis ($H_1$) $\theta > \theta_o$. The critical region of size 0.05 of the likelihood criterion is

$$x \geq k_{0.05}.$$

Where

$\theta_o$ = probability of getting correct dowsing reactions without using dowsing rods, or proportion of the number of buried pipes to total number of steps in test course, i.e. $x_o/n_o$ = 3/75 = 0.04.

$x_o$ = number of buried pipes, or 3.

$n_o$ = mean number of step-length interval, i.e., course length 150 ft divided by mean step-length 2 ft, or 75.

$\theta$ = probability of getting correct dowsing reactions for each subject using dowsing rods, or $\theta = \theta_1 . \theta_2$.

$\theta_1$ = proportion of correct dowsing reactions to total dowsing reactions of the subject, i.e., $x_1/n_1$.

$x_1$ = total number of dowsing reactions in the effective boundaries, 1.8, 2, and 2.4 ft wide for each subject, or the total number of correct dowsing reactions for each subject.

$n_1$ = total number of dowsing reactions of the full course for the subject.

$\theta_2$ = proportion of correct dowsing reactions to number of buried pipes, or $x_1/x_o = x_1/3$.

$x$ = theoretical number of correct dowsing reactions for the subject using the rods, or $n_o \cdot \theta = 75 \cdot \theta$.

$k_{0.05}$ is the smallest integer for which

$$\sum_{y=k_{0.05}}^{n_o} b(y;\, n_o,\, \theta_o) \leq 0.05$$

and $b(y;\, n_o,\, \theta_o)$ is the probability of getting y successes in $n_o$ binomial trials when $\theta = \theta_o$.

From binomial table with $n_o$=75 and $\theta_o$=0.04, $k_{0.05}$=7.

The criterion is that if $x < k_{0.05}$, accept $H_o$; if $x \geq k_{0.05}$, reject $H_o$. The results are shown in TABLES 3, 4, 5, and 6.

(B) To test the 'successful' dowsing subjects for each group:

It was felt that if more than half of the subjects showed some ability to dowse, this could be considered as an adequate basis to reject the null hypothesis that the successful subjects are indeed random, i.e., just by chance, when the L-shaped rods are used by common persons. Hence the test used is the one-sided test $H_o$: $p \leq p_o$=0.5 against $H_1$: $p > p_o$. The critical region of size 0.05 of the likelihood criterion is

$$X \geq K_{0.05}.$$

Where

$p$ = proportion of number of the 'successful' subjects (X) to total number of subjects (N) for that group.

$p_o$ = 0.5.

K is the smallest integer for which

$$\sum_{Y=K_{0.05}}^{N} b(Y;\, N,\, p_o) \leq 0.05$$

and $b(Y;\, N,\, p_o)$ is the probability of getting Y successes in N binomial trials when $p = p_o$.

The results are shown in TABLE 7.

TABLE 3

Binomial test for the dowsing reactions of the first group.

| Subject no. | $x_1$ | $n_1$ | $\theta_1$ | $\theta_2$ | $\theta$ | x | Decision |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 4 | 0 | 0 | 0 | 0 | Not significant |
| 2 | 0 | 12 | 0 | 0 | 0 | 0 | " |
| 3 | 0 | 5 | 0 | 0 | 0 | 0 | " |
| 4 | 0 | 3 | 0 | 0 | 0 | 0 | " |
| 5 | 1 | 13 | 0.077 | 0.333 | 0.026 | 2.0 | " |
| 6 | 1 | 12 | 0.083 | 0.333 | 0.028 | 2.1 | " |
| 7 | 1 | 8 | 0.125 | 0.333 | 0.042 | 3.2 | " |
| 8 | 1 | 15 | 0.067 | 0.333 | 0.022 | 1.7 | " |
| 9 | 2 | 12 | 0.167 | 0.667 | 0.111 | 8.3 | Significant |
| 10 | 0 | 4 | 0 | 0 | 0 | 0 | Not significant |
| 11 | 0 | 7 | 0 | 0 | 0 | 0 | " |

TABLE 4

Binomial test for the mean values of dowsing reactions of the second group.

| Subject no. | $x_1$ | $n_1$ | $\theta_1$ | $\theta_2$ | $\theta$ | x | Decision |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 6 | 0.167 | 0.333 | 0.056 | 4.2 | Not significant |
| 2 | 0 | 6 | 0 | 0 | 0 | 0 | " |
| 3 | 2 | 10 | 0.200 | 0.667 | 0.133 | 10.0 | Significant |
| 4 | 1 | 5 | 0.200 | 0.333 | 0.067 | 5.0 | Not significant |
| 5 | 1 | 8 | 0.125 | 0.333 | 0.042 | 3.2 | " |
| 6 | 0 | 12 | 0 | 0 | 0 | 0 | " |
| 7 | 1 | 9 | 0.111 | 0.333 | 0.037 | 2.8 | " |
| 8 | 1 | 10 | 0.100 | 0.333 | 0.033 | 2.5 | " |
| 9 | 0 | 4 | 0 | 0 | 0 | 0 | " |
| 10 | 0 | 5 | 0 | 0 | 0 | 0 | " |
| 11 | 0 | 13 | 0 | 0 | 0 | 0 | " |
| 12 | 0 | 7 | 0 | 0 | 0 | 0 | " |
| 13 | 0 | 9 | 0 | 0 | 0 | 0 | " |
| 14 | 1 | 14 | 0.071 | 0.333 | 0.024 | 1.8 | " |
| 15 | 0 | 2 | 0 | 0 | 0 | 0 | " |
| 16 | 0 | 10 | 0 | 0 | 0 | 0 | " |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | " |
| 18 | 1 | 10 | 0.100 | 0.333 | 0.033 | 2.5 | " |
| 19 | 0 | 9 | 0 | 0 | 0 | 0 | " |
| 20 | 2 | 6 | 0.333 | 0.667 | 0.222 | 16.7 | Significant |

TABLE 5

Binomial test for the first values of dowsing reactions of the second group.

| Subject no. | $x_1$ | $n_1$ | $\theta_1$ | $\theta_2$ | $\theta$ | x | Decision |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 6 | 0 | 0 | 0 | 0 | Not significant |
| 2 | 0 | 6 | 0 | 0 | 0 | 0 | " |
| 3 | 2 | 10 | 0.200 | 0.667 | 0.133 | 10.0 | Significant |
| 4 | 1 | 5 | 0.200 | 0.333 | 0.067 | 5.0 | Not significant |
| 5 | 0 | 8 | 0 | 0 | 0 | 0 | " |
| 6 | 0 | 12 | 0 | 0 | 0 | 0 | " |
| 7 | 1 | 9 | 0.111 | 0.333 | 0.037 | 2.8 | " |
| 8 | 2 | 10 | 0.200 | 0.667 | 0.133 | 10.0 | Significant |
| 9 | 0 | 4 | 0 | 0 | 0 | 0 | Not significant |
| 10 | 0 | 5 | 0 | 0 | 0 | 0 | " |
| 11 | 1 | 13 | 0.077 | 0.333 | 0.026 | 2.0 | " |
| 12 | 1 | 7 | 0.143 | 0.333 | 0.048 | 3.6 | " |
| 13 | 0 | 9 | 0 | 0 | 0 | 0 | " |
| 14 | 1 | 14 | 0.071 | 0.333 | 0.024 | 1.8 | " |
| 15 | 0 | 2 | 0 | 0 | 0 | 0 | " |
| 16 | 2 | 10 | 0.200 | 0.667 | 0.133 | 10.0 | Significant |
| 17 | 0 | 0 | 0 | 0 | 0 | 0 | Not significant |
| 18 | 1 | 10 | 0.100 | 0.333 | 0.033 | 2.5 | " |
| 19 | 0 | 9 | 0 | 0 | 0 | 0 | " |
| 20 | 2 | 6 | 0.333 | 0.667 | 0.222 | 16.7 | Significant |

TABLE 6

Binomial test for the dowsing reactions of the professional dowser.

| $x_1$ | $n_1$ | $\theta_1$ | $\theta_2$ | $\theta$ | x | Decision |
|---|---|---|---|---|---|---|
| 1 | 7 | 0.143 | 0.333 | 0.048 | 3.6 | Not significant |

TABLE 7

Binomial test for the 'successful' dowsing subjects.

| | N | $K_{0.05}$ | X | Decision |
|---|---|---|---|---|
| 1. For the first group: | | | | |
| | 11 | 9 | 1 | Not significant |
| 2. For the mean values of the second group: | | | | |
| | 20 | 15 | 2 | Not significant |
| 3. For the first values of the second group: | | | | |
| | 20 | 15 | 4 | Not significant |
| 4. For the whole participants: | | | | |
| | 32 | 22 | 7 | Not significant |

AN EXPERIMENT USING L-SHAPED STEEL RODS
TO DOWSE UNDERGROUND PIPES

by

SHIH-NUN CHANG

Diploma, Taipei Institute of Technology, 1963

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AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Civil Engineering

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1976

ABSTRACT

Humans have been using dowsing rods to locate underground water and objects for a long time. Although there are a variety of dowsing rods, it is said that the proficiency for dowsing is no different. Nowadays some employees in public works departments and civil engineering consulting and construction companies in this state still could be found to employ the L-shaped steel rods to dowse the underground drainage pipes and electric conduits. There are various hypotheses, yet there exists little or no scientific explanation for reported successes.

The purpose of this study was to investigate the relationship between the dowsing reaction spots of subjects and the locations of buried pipes. An experiment was conducted in a field where the L-shaped rods were used to detect three 5/8 inch in diameter underground steel pipes. There were thirty-two subjects participating in this experiment.

The Kolmogorov and binomial tests were used to examine the data. The results showed no statistical significance; that is, when used under the conditions of this experiment, L-shaped rods performed as random detection devices.