

# PERMANENT SURVEY MONUMENTS

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One of the things the world lost by the fall of the Roman Empire is of especial interest to surveyors. In the realm of surveying the New World would be better off today if it still worshipped the Roman god Terminus. The antique civilization of Egypt, the ancient culture of the Greeks, the laws of Rome, all recognized the great value and the sanctity of the boundary mark, - but we seem to have forgotten it.

To indicate how the boundary mark was regarded in the era of the Roman Empire, we quote, with some abbreviation, from the Encyclopaedia Britannica as follows:

"terminus (Lat. a boundary stone), a stone or post which was set up in the ground with the following religious ceremonies. A hole was dug and a fire lighted; a victim was sacrificed and its blood poured into the hole, together with incense and fruits, honey and wine, and the ashes of the sacrifice. Then the boundary stone, which had been previously anointed and crowned with garlands, was placed upon the hot ashes and fixed in the ground. Any one who removed a boundary stone was accursed and might be slain with impunity; a fine was afterwards substituted for the death penalty. From this sacred object evolved the god Terminus. On Feb. 23 (the end of the old Roman year) the festival called Terminalia, (of the boundary stones) was held. The owners of adjacent lands assembled at the common boundary stone and garlanded each his own side of the stone. An altar was set up and offerings of cakes, corn, honey and wine were made ....The proceeding closed with songs to the god and a general merrymaking, in which all the members of the family and the servants took part .... When the Capitoline temple was to be build the auguries forbade the removal of one of these termini (a boundary mark of some old precinct?) and it was enclosed within the walls of

the new sanctuary, an indication of the immovability of such stones and of the permanence of the Roman territory."

Perhaps some members of the Ontario Land Surveyors' Association have not heard of an old English custom, which may be a descendant of the Roman ceremony, because it is apparently based on a similar recognition of the value of perpetuating boundary marks. We quote again from the Britannica:

"BONDS, BEATING THE, an ancient custom still observed in many English parishes. In times when maps were rare it was usual to make a perambulation of the parish boundaries on Ascension day or during Rogation week. In the north of England the latter is still called 'gang week' or 'ganging days' from this 'ganging' or procession. The priest of the parish with the church wardens and the parochial officials headed a crowd of boys who, armed with green boughs, beat with them the parish border-stones. Sometimes the boys were themselves whipped or even violently bumped on the boundary-stones to make them remember. The object of taking boys was to ensure that witnesses to the boundaries should survive as long as possible. The custom is an old as Anglo-Saxon days, as it is mentioned in laws of Alfred and Aethelston. It may have been derived from the Roman festival Terminus, the god of landmarks.... In England a parish-ale or feast was always held after the perambulation, which assured its popularity. Beating the bounds had a religious side in the practice which originated the term, Rogation.... This was prohibited by the Injunctions of Queen Elizabeth; but the perambulation continued as a quasi-secular function, so that evidence of the boundaries of parishes, etc. might be preserved."

The Roman god Terminus was being

worshipped in that period of time which is denoted by the Prefix B.C. It is a long step from ancient Rome to Upper Canada, both in the measure of distance and of time, but the late C.F. Aylesworth in his paper read before this Association in 1928 shows that our wise forebears transported out to the New World a proper understanding of the real value of the community of permanent land marks and boundaries. In this paper reference is made to an Act passed in this very city in which we are meeting today, then called York, the date being 1798, entitled "An Act to ascertain and establish on a permanent footing the lines of the different townships of this Province". The preamble stated it to be expedient and necessary to ascertain and establish upon some permanent principle, the boundary lines of the different townships, and distinctly to preserve them when so ascertained and established. It provided for the placing of stone monuments or monuments of other durable material. A later section of the Act reads that if any person shall knowingly and wilfully pull down, deface, alter, or remove, any such monuments, he, she, or they shall be judged guilty of felony and shall suffer death without the benefit of the clergy.

Notwithstanding however, generally speaking, when the first land surveys were made in Canada, and for many years after it was deemed sufficient to perpetuate boundaries by driving a wooden peg or post into the ground. It is only within the last decade or two that any of our ordinary survey posts were so designed that they would not quickly rot or could not easily be pulled out. Even today the preponderance of boundary marks set up are either wooden posts or iron pins driven into the ground.

Let us turn now to something of more modern vintage and examine a little in the realm of the text book. Here



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are a few quotations from "The Law of Operations Preliminary to Construction in Engineering and Architecture" by John Cassan Wait (John Wiley & Sons, New York, 1900) who has taken up very fully from a legal standpoint the problems of the surveyor.

"...The calls as generally adopted to locate a survey are in the following order, viz.: (1) monuments or marks on the ground; (2) calls for adjoiners; (3) courses and distances; (4) quantity or area. If the marks found upon the ground conflict with the calls for adjoiners, with the courses and distances, and with the area, the marks upon the ground, i.e., monuments, must still govern."

"The highest and best evidence of the location of a tract of land is that furnished by the monuments found on the ground and which have been made for that particular tract."

"The marks on the ground of an old survey, indicating the lines originally run, are the best evidence of the location of the survey."

Continuing with special reference to the legal aspect, we quote a few more extracts from "A Treatise on the Law of Surveying and Boundaries" by Frank Emerson Clark of the Minnesota Bar (The Bobbs-Merrill Company, Indianapolis 1922):

"Fixed monuments. - We can not express on the surveyor too strongly the necessity of planting at each corner established by him, permanent monuments for future reference and from which future surveys may be made. If possible these should be of stone or iron, set firmly in the soil."

"Courses and distances yield to fix monuments. - The principle, that courses and distances yield to fixed monuments, applies to all surveys, ancient and modern."

Under the caption "Marking Lines and Corners" he says:

"Fixed monuments are of paramount importance in all surveys. They control courses and distances as we have seen. They furnish undisputed evidence of the location of lines and corners and must not be disregarded. They are the sources of the surveyor's confidence in the accuracy of his work.

Whether the survey be an original one, the relocation of lines and corners long obliterated, or the planting of subdivisional corners of a section the surveyor should establish permanent monuments at all corners with great care. These permanent monuments should consist of steel, copper, or stone firmly set in the soil. Take the time and do not neglect this important matter."

I know you must be weary of listening to so many extracts and quotations, but please bear with me for one more, which is of very recent date. The city of Miami in Florida, in order to establish accurate control lines, has been making precise surveys and setting very permanent monuments throughout the city. An editorial in Engineering News-Record of January 4th last has this to say about it:

"Monuments for the New Year:

"One of the often neglected elements of municipal engineering is the establishment of a system of survey monuments and the preparation of accurate block maps. This is a serious omission because basic information of this kind is the starting point for practically every public works improvement and private development. If only as a service to himself, the municipal engineer can do nothing more useful in eliminating some troublesome headaches than to correct deficiencies in survey monuments and maps of his community...."

To look at it from another point of view we might speak for a minute of one large survey organization with which we are familiar, and remind you that its long experience proved the inadequacy of the non-permanent survey monument and its continual endeavor was to have adopted better and more permanent monuments. Speaking generally, and in great brevity, the Dominion Lands Systems of Survey started in 18971 with wooden posts which later gave way to iron bars which were driven in. In 1915 there was adopted for general use the first really permanent monument in the form of an iron pipe filled with concrete and a foot plate on the bottom; this post was dug in flush with the ground and could not easily be pulled out. Some years prior to 1930 a certain number of township

corners were marked with a still more permanent precast concrete post 5 inches square at the top, 8 inches square at the bottom and 42 inches long; a bronze cap was set in the top of the post. More extended remarks on this subject will be found in the very interesting paper by Mr. T.S. Nash and printed in the annual report for 1926 of the Association of Dominion Land Surveyors.

It is not the intention to infer that recognition of the inadequacy of non-permanent survey marks was confined to the Dominion Lands survey, for on the contrary we believe that a study of the progress of the Provincial Land surveys across Canada will reveal a similar situation. One notable example of long standing is the restoration of monuments by the Department of Public Works of the province of Manitoba.

We have already made a good many references to permanent boundary marks and perhaps it would be well to have some understanding of what is meant by this term. We have used it in the sense of meaning a permanent survey monument and we have specific reference to the latter in attempting a definition. The term permanent survey monument is not easy to define. Permanent means lasting, or intended to last indefinitely, but such an attribute is far beyond any ordinary survey monument. There are only a few fundamental survey marks in the world which are properly called permanent and, so far as the writer knows, there is not one in Canada. Experience shows that a monument of, say good granite stone, may be regarded as permanent if set up in an unpopulated district, but as soon as people come in and development takes place it is a very different story. Quite apart from vandalism, the farmer's plough, earth excavating machinery and dynamite all wage relentless war against survey monuments and they cannot be expected to withstand such enemies.

We can say definitely that the 1 1/2 inch square wooden peg driven into the ground with three inches left sticking up is not permanent because it can be kicked out by an idle person. The iron bar driven into the ground comes in the



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same category because three or four kicks in different directions and a good pull and out it comes. In our opinion the following describes what might be considered a general purpose permanent survey monument. A post made of one inch iron pipe twenty-four inches long filled with concrete with a three and one-half inch foot plate and a three-inch bronze cap planted flush with the ground. The arguments supporting this opinion are that such a post is invisible to the ordinary passer by, and if it is seen it cannot be pulled out; also its appearance is likely to command respect. If made up in quantities such a post would probably cost about \$ 1.25.

So there may be no misunderstanding of our remarks above concerning fundamental survey marks we make this short reference to the fundamental bench marks which the Geodetic Service of Canada have been establishing since 1925. These are substantial monuments of re-inforced concrete in the form of a pier 18 inches square on top, 7 feet long placed on a circular base 6 feet in diameter 1 foot thick, the bottom being 7 feet underground. Each bench mark has a surface mark on top of the pier and another buried mark set in the underground base. To date there have been established 144 of these bench marks in Canada, of which 60 are in the province of Ontario.

Under the caption "Proposals for the perpetuation of Survey Monuments" Mr. J.W. Pierce in his paper read at your annual meeting in 1934 gave a very thoughtful presentation of the problem with a suggestion that the ideal arrangement would be some action under the direction of the Surveyor-General of Ontario. It is not the intention of this paper to suggest action by any government, but rather to place the matter before the surveyors in private practice for their consideration. We have made a good many side peregrinations but they have all been to the purpose of indicating that the surveyor using his chain and his transit or recording the measures in his note book has overlooked the paramount requisite of survey work which is to perpetuate it on the ground with adequate marks or references. We

think it has been forgotten that the primary function of the surveyor is to measure and mark lines or boundaries on the ground and that the recording, filing or registration of the survey record is truly only the secondary and precautionary action to the end that the original survey or boundary marks can be found again and re-established if lost.

Let us illustrate by recounting the story often quoted as explaining how the need for legal surveys first arose. Under very ancient Egyptian civilization the flat alluvial lands along the river Nile produced abundant crops; they were closely populated, intensely cultivated and valuable. On this alluvian there were no natural landmarks and the face of the land was annually changed by the silt deposits following the river floods. To avoid disputes due to the intentional or unintentional encroachment of one man upon another, and to establish the boundaries of leasehold or freehold, it became the custom to mark corners with stones set up in the ground. These stones gradually became buried under the annual siltage and other things caused their disappearance as time went on. In order to record the location of these stones so they could be replaced when lost or destroyed the art of surveying was developed. The survey plan came later as a ready means of computing areas for purposes of taxation and for other purposes of administration. Please note that the practical necessity was for the monument marking the boundary on the ground and it came first; the art of surveying the locations came later.

The most of this short paper is comprised of extracts and quotations. These were gathered from a rather short search in our own office reference library and we have no doubt that had time permitted, a more extended search from other and similar sources would have made possible a much fuller and more convincing recital of the great value of permanent survey marks. It really seems to us it is unnecessary in addressing a survey audience to adduce any further argument in favor of our contention be-

cause, based on a fairly wide acquaintance and correspondence with surveyors all over Canada, we believe that in the bottom of his heart every experienced surveyor knows the great value of permanent survey marks.

If our feeling be correct, then why is it that so many private surveys continue to be made without being permanently marked on the ground? There must be good reason. It is not a matter entailing great expense. We are inclined to think the present day custom of failing to properly monument surveys on the ground is one which, like Topsy, has just growed up out of bad precedent.

I would like to think that this paper may carry some weight in changing past practice on private survey work and bringing it about that in the future every survey made will be marked by at least one permanent survey post dug into the ground.

Chairman - Mr. Peters, we listened with a great deal of pleasure to your paper on Permanent Boundary Marks.

Mr. E.W. Neelands, Falconbridge - Mr. Chairman, Fellow Surveyors: I have listened with a great deal of pleasure to Mr. Peters' paper, as there is much in it that applies to work that has been thrust upon me in recent years in the Sudbury Basin. It has been my duty for some time now to re-establish lines run over fifty years ago around the rim of the Sudbury Basin, as the Company, the Falconbridge Nickel Mines whom I am with, and International Nickel Mines, have claims surrounding the rim of this basin, and they are all mixed up, necessitating common boundary lines. International Nickel some years ago, afternoting the difficulty in finding corners, went to great expense in building up, or trying to lay some surveys around the rim of this basin and tie on to the geodetic system. It was only within the last few weeks that this triangulation system has been finally completed, or at least a plan of same made, and I must say that I received a copy one week before the engineer, (Mr. Durrell), died suddenly, and he had left many monuments to his credit.

These monuments established in

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this triangulation system consist of iron pins set in holes drilled in the rock, and they are in prominent points all around the district, it is the desire of both companies that we use a common base, the starting of which is in Murray Line, we work out the co-ordinates of all these triangulation lines and tie on all the corners as far as we make any of these surveys.

Now about the only think I could add to Mr. Peters' paper is that during my time spent in Northern Ontario, and firstly around Cobalt, I discovered that monuments move. In the case of the survey of the Buffalo Mine in Cobalt, the Manager Mr. Jones, asked that these boundaries be definitely established by drilling holes at different points along the boundary line and an iron or other metal post be put in. This was done. A few years later I had oc-

casion to make a survey of a subdivision of town lots, and I found that one of the corners had shifted in a north-westerly direction two feet. Later on I was called upon to make a re-survey of the Bailey-Cobalt mine, which was a 20-acre claim lying south of Nipissing mine, I found out that one of the monuments planted in our survey eight years before had moved 8 inches. We were able to settle it, however, without bringing in another surveyor, as the true position of the line did not affect the original survey.

On road work I have noticed the sliding of road, and it is very noticeable in guard rails in connection with base lines laid down prior to my arrival at Falconbridge for construction purposes. I found that both base lines which had been permanently set with concrete monuments had also shifted.

On actual survey work in Sudbury Basin I have found that where other surveyors or myself had discovered the remains of an old post, it would be sometimes as much as five or six lengths off-line.

So that there is just the point - I don't know whether any other surveyors have had similar experiences, but I more or less looked for such a thing because of big landslides and cracking of foundations, which is more or less prevalent in Northern Ontario due to the type of soil.

I don't know that there is anything more I can say at this time.

While I am on my feet and before there is any further discussion, I would like to move a vote of thanks to Mr. Peters for the very valuable and interesting paper he has given.

Applause.