

DIVISION OF NATIONAL MAPPING

Specification for Permanent Marking for Levelling Operations

Statement of Work

- 1(a) The Bench Marking Authority or Contractor shall furnish all personnel, material, superintendence, equipment and transportation necessary for the performance of the marking operations set out in the accompanying Schedule and shall deliver to the Director of National Mapping or the Surveyor General of the State in which the marks have been placed such sets of reports and plans as are required by this Specification and the accompanying Schedule. All work shall be executed in an expeditious and workmanlike manner to the satisfaction of the Director of National Mapping or the Surveyor General and shall be in complete accordance with this Specification and the accompanying Schedule.
- 1(b) The Director of National Mapping or the Surveyor General shall furnish to the Bench Marking Authority or Contractor at the beginning of the marking operations two copies of illustrative maps attached to and forming part of the accompanying Schedule.
- 1(c) The Director of National Mapping or the Surveyor General shall in advance of the operations have marked with a marker post and/or indicated on the illustrative maps (see Schedule A) the location of each bench mark to be constructed or shall have laid down specified distances between bench marks to be constructed along an indicated route. All such bench marks are to be constructed in terms of this Specification and the accompanying Schedule.

Requirements for Permanent Marking

2. Permanent bench marks shall be established along leveling traverses at the approximate intervals set out in the accompanying Schedule and at the locations marked by marker posts and/or indicated on the provided illustrative maps or at specified distances. The bench marks shall be marked by such metal plaques as are approved by the Director of National Mapping or the Surveyor-General. These plaques shall be made of noncorrodable metal and be firmly set in either of the following types of marks:
 - 2(a) a precast concrete block the upper surface of which shall have an area of not less than twenty five square inches and the lower one not less than one hundred and forty four square inches. The block shall be two feet in depth and shall rest on a concrete foundation five inches thick poured at the site.
 - 2(b) concrete poured into a roughly cut hole and tamped, the dimensions of this mark to be the same as under clause 2a unless situated on a solid rock base.

2(c) a precast concrete collar of at least ten inches in length and having a cross sectional area of at least twenty five square inches with a one inch diameter hole through its centre and the centre of the plaque. This collar to be the top part of a deep bench mark to be constructed as follows:

a hole of four to six inches in diameter and up to twelve feet in depth to be dug with a post hole digger. Two feet of concrete is to be placed in the bottom of the hole and a brass rod or galvanised iron pipe is to be set in the concrete so that the top of the rod or pipe is level with the surface of the surrounding ground. The hole is then to be filled with gravel, sand or soil to within one foot of the ground surface and the precast collar is to be placed over the rod or pipe so that the rod or pipe stands about 1 inch above the plaque, the collar resting on the gravel, sand or soil and free to move without disturbing the rod or pipe.

2(d) Composition of Concrete to be used in precast concrete blocks and precast concrete collars as well as of any concrete prepared at the site of the permanent bench mark shall consist of the following materials at the specified volume parts:

Portland Cement		1	part in volume
Coarse aggregate		3	"
Fine aggregate		2	"
Water	about	1	"

Coarse aggregate is understood to consist of either gravel; pebbles or fragment of broken stone of $\frac{1}{4}$ inch to $1\frac{1}{2}$ inch in size.

Fine aggregate is understood to consist of sharp sand.

Indicator Marks

3. At a distance of 2 feet from the concrete block containing the permanent bench mark a hole 1 foot deep by 36 square inches in area is to be excavated. A 5'6" steel fence dropper or iron pipe of the same length shall be hammered into the centre of this hole so that finally 2'6" of the steel dropper or iron pipe will be protruding above the ground surface. The hole is to be filled with concrete to make any future extraction of this marker post difficult.

Marking for Air Photo Identification

4. A cross of stones with six feet arms and two feet wide or a circle of stones twelve feet in diameter and two feet wide and with the top painted with a white cement base paint is to be centered around each bench mark. When stones are not readily available a two feet wide circular trench one foot deep of twelve feet inside diameter is to be dug around the centre of the bench mark. The excavated spoil is to be mounded symmetrically around the outside of the trench, with the inside edge of the mound one foot from the outside edge of the

trench, to avoid spoil falling back into the trench. On or near aircraft landing strips marking by a stone cross is not to be performed as this type of marking may be taken for an aerodrome ground signal.

Location of Permanent Bench Marks

5. Permanent Bench Marks are usually located alongside roads or tracks. Few marks are located in trackless country.

The site of marks along public roads is normally to be located on the area reserved for this public road between the actual formed road surface and the fence line.

These marks and marks along tracks shall be located in such positions that the marks are unlikely to be disturbed by subsequent construction operations and in such positions that bench marks indicator marks and the marking for photo identification purposes will in no way constitute hazard or danger to anyone.

Permanent Bench Marks are to be located at sites which facilitate an easy photo identification of marks, but not under trees or under any other obstacle which may cover the mark. Permanent Bench Marks are to be placed where they are least likely to be damaged or destroyed by nature or man.

Numbering of Bench Marks

6. Each bench mark is to be numbered with a specially provided number by punching this number into the metal plaque. A list of numbers to be used for identifying new marks shall be provided by the Director of National Mapping or the Surveyor General.

DIVISION OF NATIONAL MAPPING

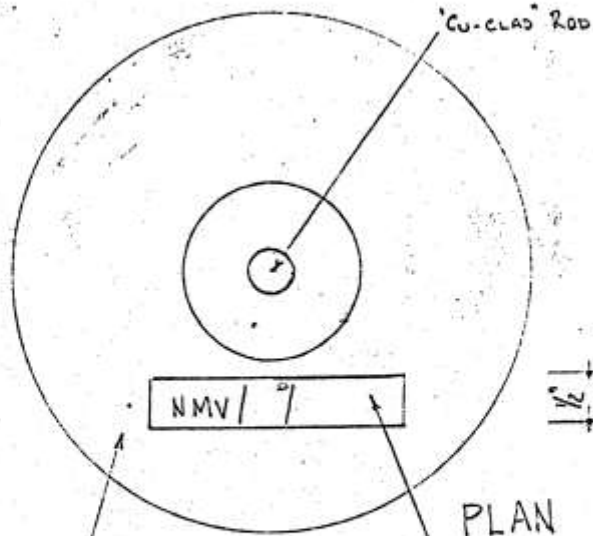
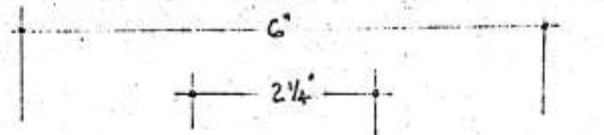
Specification for

Establishing Reference Bench Marks for Levelling Operations

1. Marks previously referred to as "Fundamental Bench Marks" are to be referred to as "Reference Bench Marks" in future.
2. A cluster of Reference Bench Marks shall consist of three Permanent Bench Marks placed on solid rock or on permanent and substantial man-made structures with each of the three marks on different rock outcrops or structures, or placed in soil in a roughly equilateral triangular pattern about 300 feet apart.
3. Reference Bench Marks shall be constructed in accordance with sections 2, 3 and 4 of the "Specification for Permanent Marking for Levelling Operations". When marks have been placed on manmade structures the "Marking for Air Photo Identification" as outlined in section 4 is not required.
4. Clusters of Reference Bench Marks shall be placed at the intersections and junctions of all level traverses and along level traverses at intervals of about 50 miles, depending on circumstances and localities.
5. Where level traverses cross black soil or other unstable country clusters of Reference Bench Marks shall be placed outside but at each edge of the black soil or unstable country provided that the interval between clusters of marks as set out in section 4 of this Specification can be reasonably maintained.
6. Each of the three marks comprising a cluster of Reference Bench Marks shall be allocated a different identifying number, each number to be prefixed by the letters: RBM. These numbers are to be legibly stamped on each mark.
7. It is not intended that Reference Bench Marks be of elaborate construction but every reasonable care should be taken to ensure maximum stability.

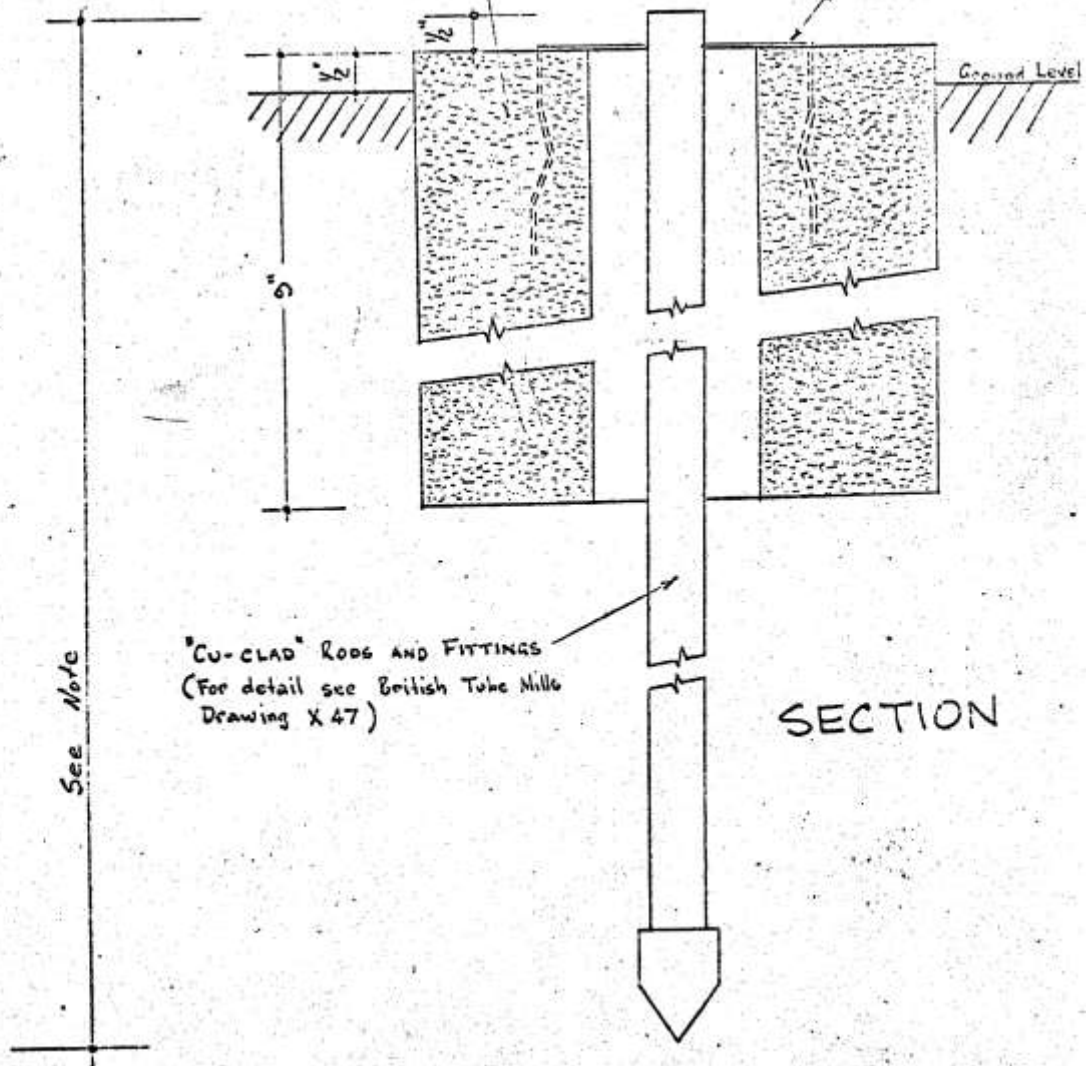
NOTE:

The rods must be driven at least to 10 feet or to refusal.
If refusal is encountered at a depth of less than 4 feet, a new site must be selected or a different type of bench mark used.
If the time required to drive a rod 5 feet, with a power hammer, is less than 2 minutes, additional sections must be added and driven until the rate of penetration for a 5-foot section is slower than 2 minutes.



PRE-CAST CONCRETE COLLAR

BRASS PLATE



CU-CLAD RODS AND FITTINGS
(For detail see British Tube Mills
Drawing X 47)

See Note

GALVANISED STEEL
STAR PICKET

PRE-CAST CONCRETE COLLAR

BRASS PLATE

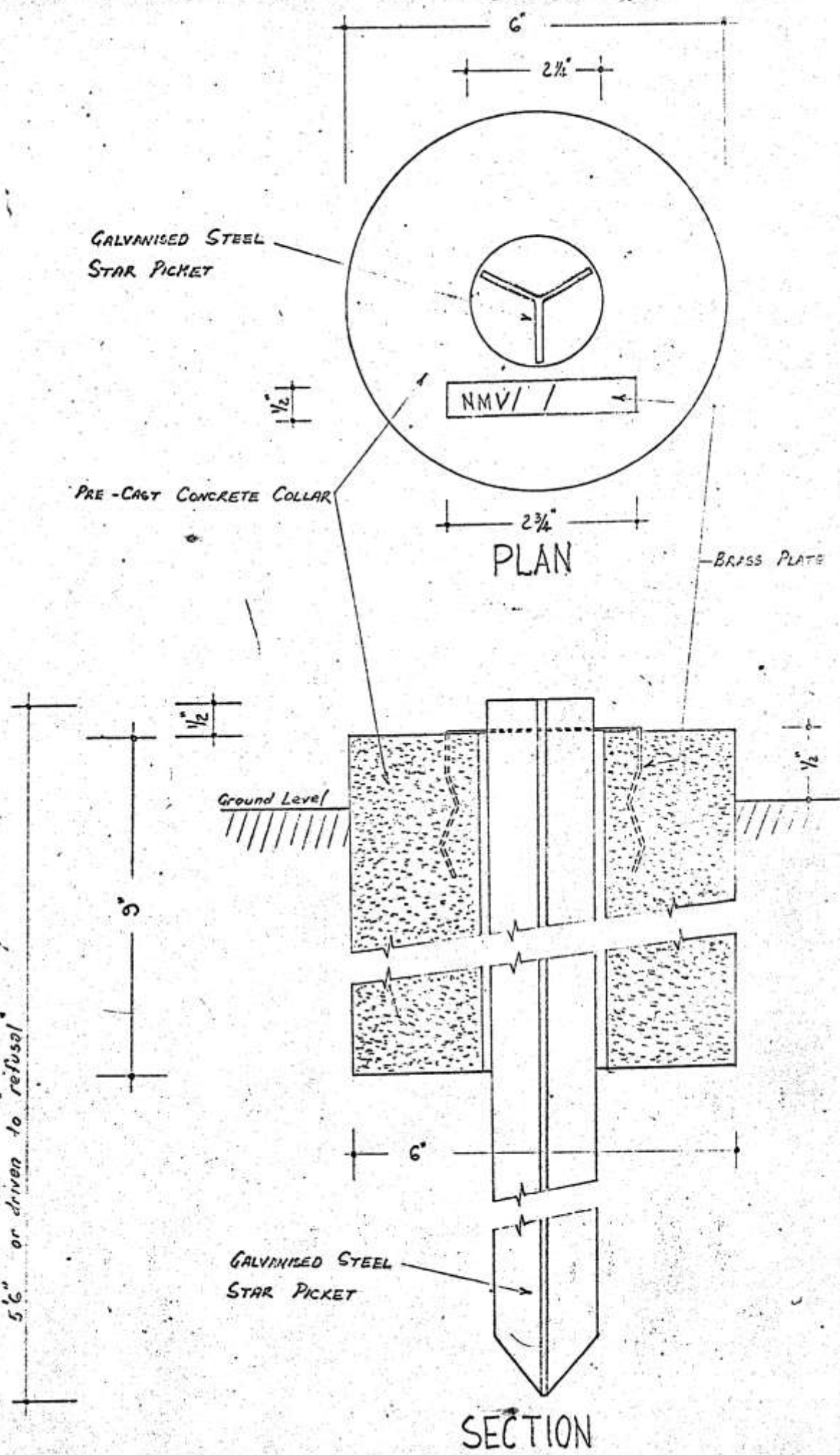
PLAN

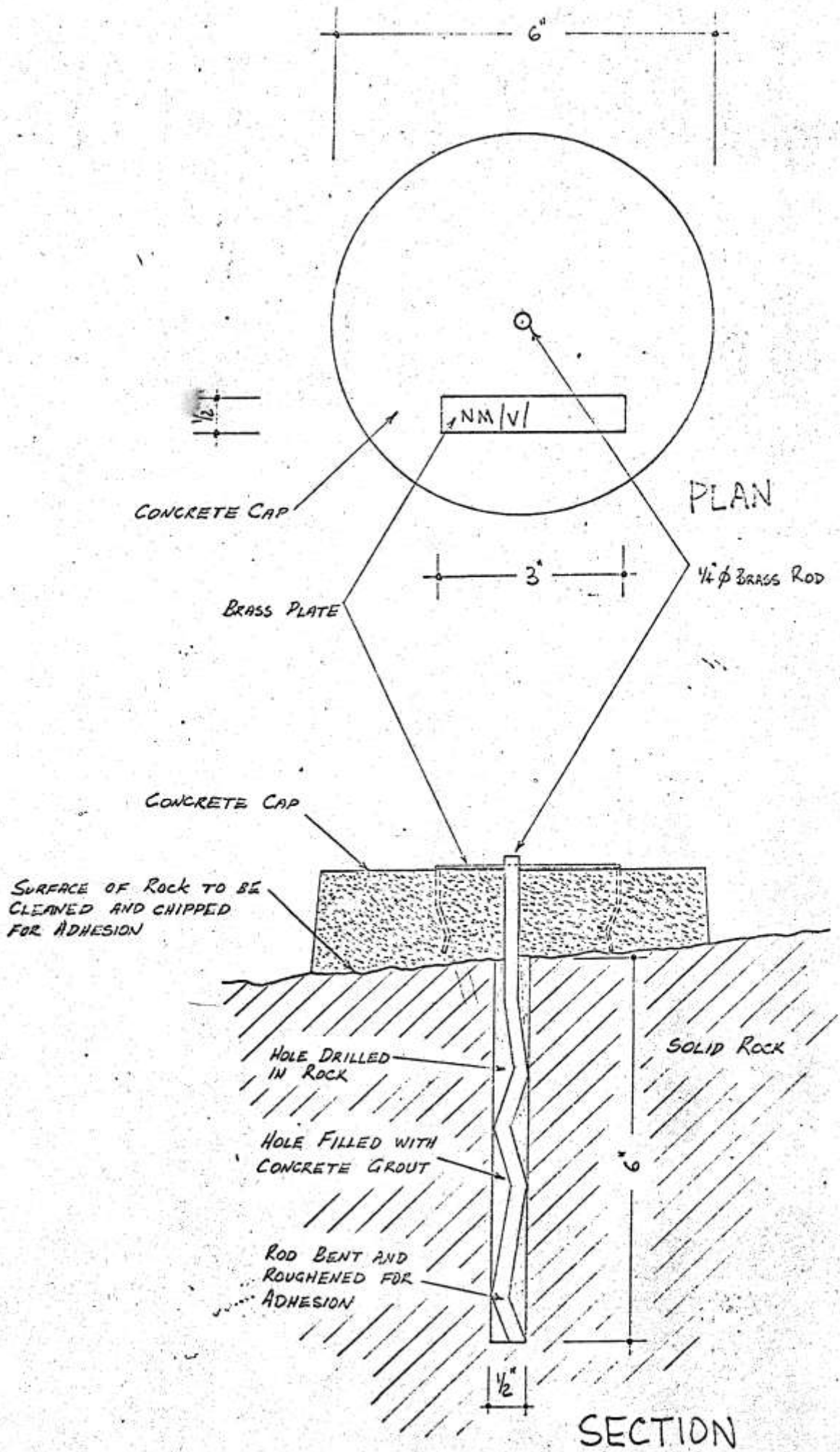
Ground Level

GALVANISED STEEL
STAR PICKET

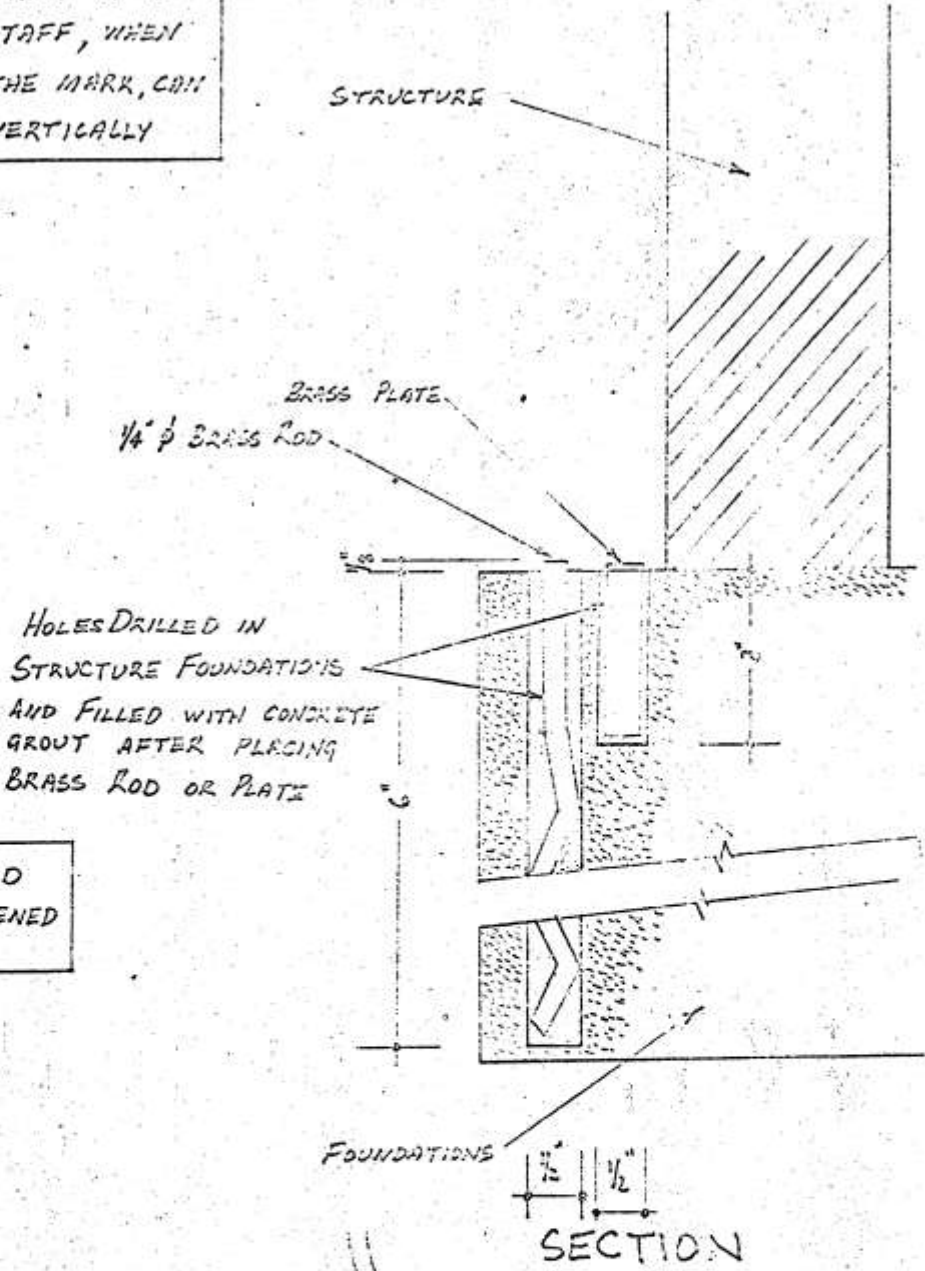
SECTION

5'6" or driven to refusal

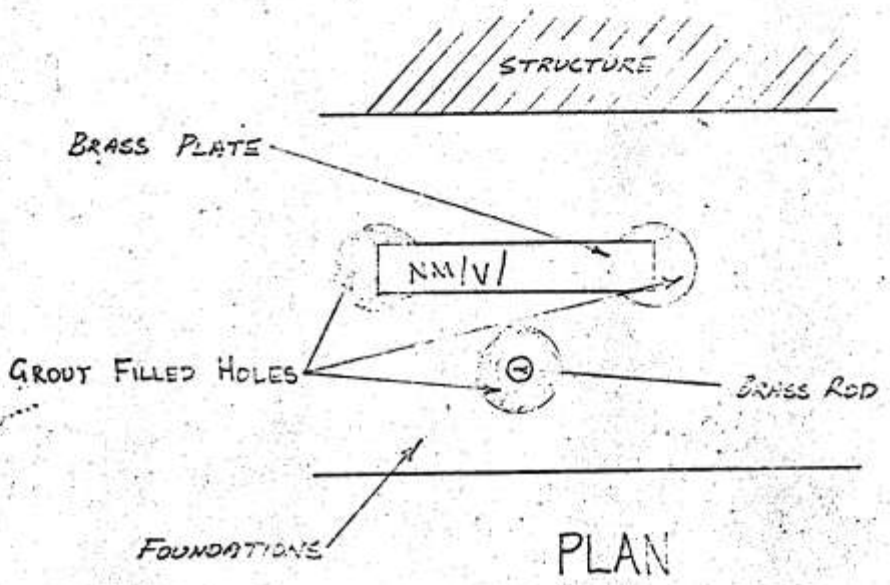




NOTE: CARE SHOULD BE TAKEN TO ENSURE THAT A 12' LEVELLING STAFF, WHEN PLACED ON THE MARK, CAN BE HELD VERTICALLY



ROD AND PLATE SHOULD BE BENT AND ROUGHENED FOR ADHESION.



BENCH MARK SKETCHES

