

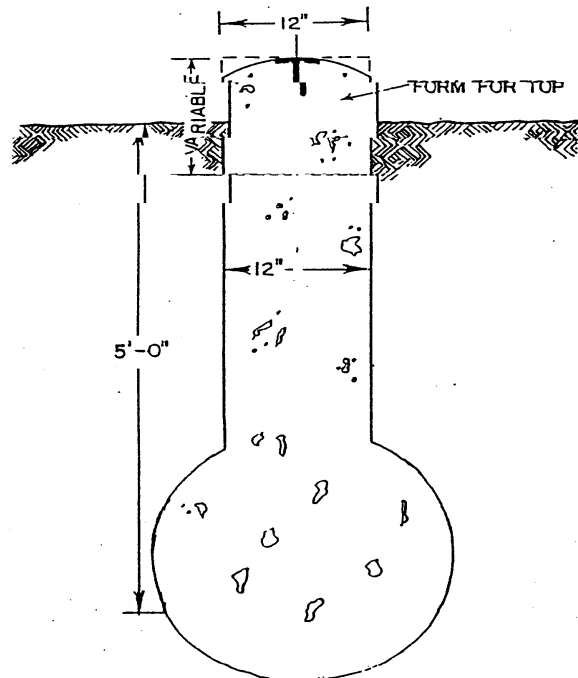
## APPENDIX E

### MONUMENTATION

This appendix is intended to provide guidance to those providing surveying services to the Michigan Department of Transportation for the proper monumentation of various classes of surveys. Properly monumenting a survey helps insure repeatability of survey observations.

#### E.1 Primary Control Monuments

##### HORIZONTAL AND VERTICAL GEODETIC MONUMENT INSTALLATION



The concrete monument is normally poured in place in a hole dug in the ground, using a top form only. The hole is dug to a depth of 5 feet (sufficient to extend below the frost line) with either a square or circular cross section (depending on shape of top form used, and about 12 to 14 inches or more in diameter). The bottom of the hole is enlarged about 2 inches in radius tapering upward for about 1/2 foot in order to make the bottom of the monument bell-shaped. The concrete is poured and tamped in the hole until a level is reached where the top form when set on the concrete will either be flush or will protrude from 2 to 6 inches from the ground. The form should be fitted into the hole before the last 1 foot of concrete is poured in order to avoid any shoulders or mushrooming effect near the top of the monument which might afford purchase for frost action. The pouring, tamping, and back-filling are completed, and the top of the monument smoothed off and beveled with a trowel. The disk is then pushed into the center of the concrete monument and recessed slightly to elude prying out the disk.

A paper cement bag may be used as a top form for the concrete monument. Cut both bottom and top out of bag.

Monuments for primary horizontal and vertical control shall conform to the following standards. Alternatives should be coordinated with the survey project manager.

## **E.2 Secondary Control Monuments**

Secondary control monuments such as traverse points and property corners shall be monumented with #4 or larger steel reinforcing rod. Traverse point monuments shall be at least 3 feet long and **may** be capped with the identification of the surveyor. Property corner monuments shall conform to Public Act 74 of 1970 as amended, “The Corner Recordation Act”; Public Act 132 of 1970, “The Certified Surveys Act”; Public Act 288 of 1967, “The Land Division Act”; Public Act 345 of 1990, “The State Survey and Remonumentation Act”; and **shall** be capped with the identification (license number) of the surveyor.

## **E.3 Public Land Survey Corners**

Monuments representing corners of the Public Land Survey System shall conform to Public Act 74 of 1970 as amended.

## **E.4 Alignment Points**

Points of Beginning (POB’s), Points of Ending (POE’s), Points of Curvature (PC’s), Points of Intersection (PI’s), Points of Tangency (PT’s), Points on Tangent (POT’s) and the like in hard surface areas shall be monumented with #4 or larger steel reinforcing rod placed inside of a monument box. Alignment points not in hard surfaced areas shall be monumented with #4 or larger steel reinforcing rod with a length of 3 feet being preferred. Monument boxes are not required in areas not hard surfaced.

## **E.5 MDOT Rights of Way**

MDOT rights of way shall be monumented with #5 or larger steel reinforcing rod. An MDOT cap shall be placed over the top of the rod and stamped with the proper MDOT monument number. Caps may be obtained from MDOT and numbering schemes coordinated with the MDOT survey project manager.

## **E.6 Mapping Points**

Mapping points shall be monumented with #4 or larger 18 inch long steel reinforcing rod. Mapping points are not capped. While elevations may be established on mapping points for use at the time of the survey, mapping points are not benchmarks and shall not be used or documented as such.

## **E.7 Benchmarks**

Substantial, identifiable and permanent objects only such as chiseled squares in concrete abutments, headwalls, or footings; chiseled “X’s” in flange bolts of hydrants; primary control monuments and the like shall be used as benchmarks. While existing nails in tree roots and existing spikes in utility poles may be used if found they shall not be set.

## **E.8 PK Nails**

PK nails as monuments are allowed only when called for by a specific scope of work or when specified in other areas of this manual such as for certain bridge surveys or photo targeting.

## **E.9 Exceptions**

Exceptions to any of the above specifications shall be coordinated with and approved by the MDOT survey project manager.