



## FDM 9-25-1 Perpetuation of Landmarks

October 28, 1994

It is the policy and practice of the department to take all reasonable measures to perpetuate survey landmarks. The purpose of this procedure is to specify in more detail the responsibilities of the department in achieving a continuing program of perpetuation of landmarks. For the department's policy on perpetuation of landmarks refer to [FDM 9-5-1](#).

The records for the State Commissioners of Public Lands contain copies of the original notes of the U. S. Public Land Surveys. Photostat copies of the original plat of a township and notes for specific section corners, quarter corners, etc., can be obtained by writing to the Department of Justice, Board of Commissioners of Public Lands, P. O. Box 8943, Madison, WI 53708-8943. Technical Services has a complete set of the photostat copies of these records.

It is not within the authority or responsibility of the department to establish the boundary between property owners abutting the highway; however, it is the practice of the department to avoid the destruction of any property corner monument. Therefore, the position of every monument that is found and that is likely to be disturbed by construction activities shall be perpetuated in accordance with the perpetuation of landmarks policy (see [FDM 9-5-1](#)).

### 1.1 Corners To Be Recovered And Perpetuated

1. When the proposed project involves only resurfacing of the existing pavement, all landmarks of a survey of public record that have previously been perpetuated by a monument in the existing pavement surface shall be perpetuated in the new surface.
2. When the proposed project involves reconstruction within the existing right-of-way, all corners for which a survey of public record shows a landmark was placed and which lie within the construction limits of the project shall be recovered, and if found, shall be perpetuated.
3. On any project requiring the acquisition of right-of-way, in addition to the corners specified in the paragraphs above, the corners of the U. S. Public Land Survey at both ends of every section and one-quarter section line that runs along, upon, or across the right-of-way should be recovered and perpetuated. In some areas of the state where many of the U. S. Public Land Survey corners are "lost corners," as defined in the Manual of Surveying Instruction, 1973, professional judgment may dictate that recovery of every section line would be too costly. In such cases, sufficient corners shall be recovered and perpetuated so that every parcel of right-of-way to be acquired is tied to at least one monumented line of the section within which it lies.
4. Any lost corners that are established at WisDOT's expense shall be perpetuated.

### 1.2 Landmark Perpetuation

#### 1.2.1 Before Surveys

A thorough search of the records should be made to determine if landmarks of public record exist on the proposed project. County surveyors and city/village engineers should be asked to research their records and provide WisDOT with any information they have concerning landmarks within the project limits. The region should make a thorough search of the records in the region office.

#### 1.2.2 During Surveys

During the original survey, locate and record in the survey notes every corner required to be perpetuated. Record the exact location of every monument found that appears to be a landmark identifying a lot corner, even though it may not be perpetuated.

After the field search, if there is a reasonable doubt as to the evidence identifying any of the corners required to be perpetuated, a Registered Land Surveyor should supervise the recovery of the corner. The region may negotiate a special services contract (see [Chapter 8](#)) with a Registered Land Surveyor in full-time private practice (preferably the county surveyor) for recovering and perpetuating the required corners. In those counties where there is no county surveyor, and it appears desirable to have one appointed, the procedure outlined in Section 59.635(3), Wisconsin Statutes, may be followed.

To facilitate the excavation work necessary to recover evidence of landmarks and to minimize the cost of such

excavation, the region may request the County Highway Commissioner to rent equipment and operators to the region. See [FDM 8-5-1](#) for Short Form contract boilerplate language.

### **1.2.3 Prior to Construction**

See [FDM 9-5-1](#)

### **1.2.4 During Construction**

Refer to [CMM 7-85](#) for monumentation practices and procedures during construction.

### **1.2.5 After Construction**

All USPLS landmarks and/or block corners that WisDOT deemed of interest will be restored to original location after construction and/or perpetuated with four or more witness monuments or offset markers. Monumented lot corners that are disturbed by WisDOT construction will be restored at the request of the property owners.

WisDOT will make a field survey of the landmark and witness monuments and provide a copy to the county. This will be done for informational purposes only. The note will state explicitly that this monument is not being certified as an actual corner, only that a certain type of landmark was found and is perpetuated by a monument or reference monuments.

Upon completion of construction, WisDOT will, if requested, reset an appropriate type of monument in the original location. WisDOT will file with the county/municipality the type of monument set. This will be done for informational purposes only. The notes will state that this monument is not being certified as an actual landmark, only that certain evidence of a landmark was found and that due to construction, it was necessary to remove and reset a landmark at the location.

## **FDM 9-25-5 Control Monumentation**

*August 15, 2019*

Permanent monumentation of selected survey points is necessary to efficiently survey existing and future transportation improvement projects. [FDM 9-25-10](#) describes the different types of survey monuments. This procedure describes engineering control monumentation and [FDM 9-25-6](#) describes required right-of-way monumentation.

### **5.1 Horizontal Control**

Use a Type 1 or Type 2 monument to monument each primary horizontal control survey station for a transportation improvement project. A pair of stations monumented with Type 1 or Type 2 monuments shall be established at each end of the project (see [FDM 9-35-1](#) for types of projects requiring horizontal control) and at intervals no greater than 2 to 3 miles throughout the project. Only one pair of stations is required to be monumented with Type 1 or Type 2 monuments for a project of less than 0.5 mile in length. The pairs of stations for primary project horizontal control are usually best established using Global Positioning System (GPS) methods.

Use a Type-2 or Type-3 monument to monument secondary horizontal control survey stations for a transportation improvement project.

Reference each horizontal control station (including any existing stations) to a minimum of three nearby geographical features with a distance measured to each feature to at least the nearest 0.5 foot. These distances are intended to help find the station, not to reestablish the station. Usually the road centerline will be one of the features. The station shall be described in a textual description detailing the general location, specific location with a distance and a direction relative to each of the features, and the type of monument. A location sketch for each station may be drawn in addition to the textual description.

### **5.2 Vertical Control**

Use a Type 1 monument or Type 2 chiseled-square monument to monument each primary vertical control survey station (i.e., a benchmark) for a transportation improvement project. Projects requiring vertical control shall have a pair of benchmarks monumented with Type 1 monuments or Type 2 chiseled-square monuments at each end of the project and at intervals no greater than 2 to 3 miles throughout the project. Only one pair of benchmarks is required to be monumented with Type 1 monuments or Type 2 chiseled-square monuments for a project of less than 0.5 mile in length.

Reference each benchmark (including existing benchmarks) to a minimum of three nearby geographical features with a distance measured to each feature to at least the nearest 0.5 foot. These distances are intended to help find the station. Usually the road centerline will be one of the features. When a benchmark is on a

feature, the feature name should be included (e.g., a chiseled square on the north end of the east abutment of bridge B-12-123). The “station and out” method of locating a project benchmark may be used in lieu of measuring distances to features. The benchmark shall be described in a textual description detailing the general location, specific location with a distance and a direction relative to each of the features, and the type of monument. A location sketch for each benchmark may be drawn in addition to the textual description.

Existing benchmarks which appear to be in danger of being destroyed during construction shall be considered for preservation or relocation. If the benchmark is listed in the National Spatial Reference System<sup>1</sup> maintained by the National Geodetic Survey (NGS), the NGS State Geodetic Advisor<sup>2</sup> shall be contacted early in the design phase. If the monument will be destroyed by highway construction, an item under Landmark Reference Monuments may be included in the plan for setting a new monument and a general note should be included to describe such items as type of disk and special dimensions. Transferring of elevations should be done by a survey crew in accordance with instructions provided by the NGS Geodetic Advisor.

The region survey coordinator will be the primary point of contact to provide a survey disk to the contractor to be placed in a structure during construction. The disk shall be set horizontally (not vertically) in the top of the parapet in close proximity to the structure name plate per section 6.3.3.7 of Bridge Manual. A station name is generally not assigned to a disk set in a structure per this section. An elevation shall be transferred to the disk prior to the completion of the construction project. Contact the region survey coordinator for the appropriate region form(s) used to document the new elevation, location and other information. Each region office will determine the proper mechanism to maintain and disseminate this information. See Bridge Manual 6.3.3.7 for more information on structure benchmarks.

### **5.3 Three-Dimensional Control**

Three-dimensional control survey stations should be monumented to at least the minimum requirements listed above for Horizontal Control AND for Vertical Control. Three-dimensional control survey stations will usually be established using Global Positioning System (GPS) survey methods. When traditional methods have been used to extend horizontal control to a survey station AND spirit leveling has been used to determine an elevation of a benchmark, the monumentation should meet the requirements for a three-dimensional station.

### **5.4 Alignment Surveys**

A sufficient number of alignment points or horizontal control survey points shall be monumented to facilitate reestablishing the alignment. The points shall be monumented with a Type 1 monument either during or upon completion of construction. The monumented points may include PIs, POTs, PCs, PTs, or project horizontal control points. All monumented points shall be referenced to a minimum of three nearby geographical features with a distance measured to each feature to at least the nearest 0.5 foot. These distances are intended to help find the station, not to reestablish the station. Usually the road centerline will be one of the features. Enough points shall be monumented to define the bearing of each tangent with two points.

### **5.5 General Survey Disk Characteristics and Stamping**

Survey disks that are to be set as part of a Wisconsin DOT transportation improvement project shall:

- Have a diameter of between 3 and 3-1/2”.
- Have a stem that is at least 2-3/4” long
- The top be domed rather than flat
- Disk shall be made from aluminum or bronze

Survey disks should be pre-stamped from the manufacturer with information and format shown below. All initial stamping from the manufacture shall be in capital letters. See Figure 5.1.

- A center dimple.
- On the upper, outer row of lettering: WIS. DEPT. OF TRANSPORTATION
- On the upper, next to outer row of lettering: SURVEY STATION
- On the lower, next to outer row of lettering: UNLAWFUL
- On the lower, outer row of lettering: TO DISTURB

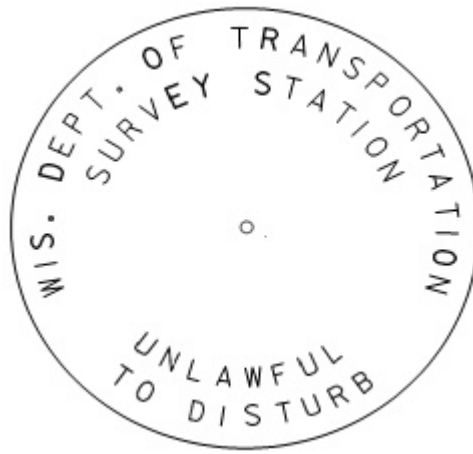


Figure 5.1. Sample Survey Disk

It is not necessary that every station disk have a station name, but in many cases, a station name makes it easier to facilitate communication regarding the station. The survey coordinator will determine station names and if it will be stamped on a disk at a later date.

Other monument types may not allow for the standard stamping as detailed above. The region survey coordinator will determine how best to place information on other types of monuments.

## **FDM 9-25-6 Right of Way Monumentation**

*November 30, 2018*

Right-of-way monuments shall be set in accordance with Department policy for all new right-of-way acquisitions in fee or by highway easement, and for all Permanent Limited Easements (PLE). See [FDM 9-5-5](#) for more information on Right-of-Way Monumentation Policies and [FDM 9-25-10](#) for more information regarding survey monuments. Requests for additional information about right-of-way monumentation should be directed to the Right-of-Way Plat Coordinator/Land Surveyor at 608-243-3397 or the Chief Surveying & Mapping Engineer at 608-246-7941.

### **6.1 Monument Location and Type**

A right-of-way monument shall be set:

- At every change in direction of a right-of-way line.
- At the beginning and end of every curve.
- At a maximum spacing between right-of-way monuments of approximately 0.25 mile (0.40 km) on tangents and 500 feet (150 m) on curves.

A right-of-way monument usually will be a Type 2 monument; however, a more substantial Type 1 monument may be used in lieu of a Type 2 monument. See [FDM 9-25-10](#) for characteristics of different monument types.

### **6.2 Right-of-Way Marker Post**

A right-of-way marker post shall be set near every right-of-way monument; except, the requirement to place a right-of-way marker post is waived when the post would generate aesthetic or safety concerns if set in a front lawn, decorative landscaped area, sidewalk, pathway, parking lot, or driveway.

A right-of-way marker post shall be set in the right-of-way with the back of the post along the right-of-way line. When the marker post is at a corner monument, the marker post shall be set along the longer of the two right-of-way lines.

The right-of-way marker post shall conform to the standard shown in the standard detail drawing (SDD) for Marker Post for Right-of-Way (see Chapter 16, [SDD 15A1](#)).

A right-of-way marker post shall be set:

- 0.5 to 2 feet (0.15 to 0.6 m) from the monument.
- With a R/W plaque on the front of the marker post facing the roadway.
- With an informative plaque on the back of the marker post facing away from the roadway.

#### **6.2.1 Installation**

Monuments shall be set in a timely manner within the limits of the region workload prior to or at the time of land transfer. Type 1 monuments and right-of-way marker posts shall be set by contract bid item unless stated on the

plan to be set by others, or unless they are in place prior to the letting of the contract.

### 6.3 Coordinates

The location of each right-of-way monument and each U.S. Public Land Survey System (PLSS) corner shall be identified on the right-of-way plat. When Type 1 monuments are used, the location of each Type 1 monument shall be provided to the county surveyor in addition to being identified on the right-of-way plat. Each PLSS corner shown shall have a Wisconsin County Coordinate System (WCCS) or Wisconsin Coordinate Reference Systems (WISCRS) coordinate value (see [FDM 9-20-27](#)). When the Wisconsin State Plane Coordinate System (SPCS) (see [FDM 9-20-26](#)) is used to control the transportation project, SPCS coordinates may be used in lieu of WCCS or WISCRS coordinates to record the right-of-way acquisition.

### 6.4 Positioning Requirements

Each right-of-way monument (whether new or existing) shall:

- Be referenced to a minimum of two monumented PLSS corners.
- Have its position determined to a minimum horizontal positional accuracy of one part in three thousand (1:3,000) for a Type 2 monument or one part in ten thousand (1:10,000) for a Type 1 monument.

In addition to the above positioning requirements, one or more of the following methods may be used to identify the location and/or boundary of the right-of-way acquisition. Whichever method is used, it shall be followed completely. When more than one method is used, each method shall be followed completely.

- When Type 1 monuments are set on the right-of-way line, they shall be set in pairs, one each at two intervisible right-of-way points. The distance between the monuments in a pair shall be a minimum of 1000 feet (305 m). Reasonable care should be used in selecting the location of the right-of-way monument pairs so they will continue to be intervisible for some years after the transportation improvement project has been completed. A pair of monuments shall be set approximately every mile (1.6 km).
- When Type 1 monuments are set on a survey reference line to provide monumentation of the highway (usually on the centerline), then the right-of-way monuments may be referenced to the survey reference line. Points monumented on the reference line may include PIs or selected POTs. PCs or PTs maybe used when PIs are outside of the right-of-way, on shoulders, or in other unusable locations. Enough points shall be monumented on the reference line to define the bearing of each tangent with two points.
- When an existing geodetic control station monument (e.g., Wisconsin High Accuracy Reference Network [HARN] station, User Densification Network [UDN] station, or Wisconsin Height Modernization Program [HMP] station) is used to determine the position of a right-of-way monument, the geodetic control station designation, the reference datum/adjustment, and the station WCCS, WISCRS, or SPCS coordinates should be identified in the right-of-way documentation.

### 6.5 Documentation

Each region shall develop and maintain documentation showing the placement of right-of-way monuments and supporting monuments. Information shown on the plat shall be referenced and not duplicated in the region documentation. The documentation shall include for each right-of-way monument and each supporting monument:

- A description of the size, shape, and material of the monument.
- The name (designation) and other information stamped on the monument marker.
- The depth of the top of the monument below ground or the height the monument projects above ground.
- The condition of the monument.
- The geographic or rectangular coordinates of the monument.
- The coordinates of the beginning point(s) of the survey.
- The reference geodetic datum/adjustment of the beginning point(s) of the survey.
- The source of information for the beginning point(s) coordinates.

The documentation should include the dates and methods of fieldwork, computations, and other information, which could be useful for future work.

### 6.6 Minor Acquisition

Right-of-way monuments for a minor right-of-way acquisition of less than \$1000 shall meet all of the above requirements except that the right-of-way monuments need to be referenced to only one monumented PLSS

corner and have a basis of bearing. The “basis of bearing” requirement may be met by each right-of-way monument having a WCCS or WISCRS coordinate (see [FDM 9-20-27](#)), or by referencing two monumented PLSS corners. When the Wisconsin SPCS (see [FDM 9-20-26](#)) is used to control the transportation project, SPCS coordinates may be used in lieu of WCCS or WISCRS coordinates.

## **FDM 9-25-10 Engineering Survey Monuments**

August 15, 2019

The purpose of a survey monument is to provide a recoverable, stable, and usually permanent reference point for future surveys. Engineering survey monuments used for control of a transportation improvement project or to identify a property boundary may be constructed to less stringent specifications than geodetic survey monuments which are part of a statewide geodetic control network.

Engineering survey monuments have traditionally been referred to within the department as Type 1, Type 2, or Type 3 monuments. Higher-order monuments may be used in lieu of a lower-order monument. For example, a geodetic survey monument may be used when a Type 1 monument is required; a geodetic survey monument or a Type 1 monument may be used when a Type 2 monument is required.

Type 1 and Type 2 monuments are considered as permanent monuments and therefore should have a permanent description of their location filed with the appropriate document. For example as a minimum, the location of a monument used for project control should be identified on or with a project plan; the location of a property monument should be identified on a plat.

Monuments are the foundation for survey control. It is critical that a monument be placed in a location that insures the permanency and stability required. The environment of the monument always needs to be evaluated prior to setting a monument; e.g., will the kind of monument selected be sufficiently stable in the soil conditions encountered?

### **10.1 Type 1 Monument**

A Type 1 monument shall be constructed to be permanent, stable, and identifiable. It should be constructed of materials that can be expected to last for at least 50 years and be placed in a location that is not expected to be in the way of construction or maintenance equipment. If equipment travel is anticipated in the area of the monument, the top of the monument should be recessed 1 to 3 inches below ground level. A Type 1 monument should be sufficiently stable to serve its intended purpose with only minimum motion in a horizontal or vertical direction.

A metal marker<sup>3</sup> shall be firmly attached to the top of the monument base. The stem of the survey disk is usually pushed into fresh concrete when cast-in-place or precast concrete monuments are used; however, cured concrete may be drilled and the stem of the survey disk anchored in the drill hole with epoxy resin. The survey disk or cap should include an inscription (a cast or machine-imprinted legend or logo) of the establishing agency and space for the survey station (bench mark or corner) designation (name) to be stamped on the survey disk or cap.

Within the category of Type 1 monuments, some monuments will exhibit better stability, endurance, availability, and economics than others. Generally, the order in which they are listed below is the order of monument preference for engineering control and right-of-way monumentation. A rock, permanent structure, or cast-in-place concrete monument should be the selected Type 1 monument unless another Type 1 monument is specified in the contract or approved by the project manager.

The following listed monuments are a Type 1 monument (see [Attachment 10.1](#)).

#### **10.1.1 Rock Monument**

A rock monument is a survey disk firmly set with epoxy resin into a drill hole in a rock outcrop. Only sound bedrock should be selected as a location for setting the survey disk. This monument is suitable for use on a survey requiring a monument with horizontal, vertical, or three-dimensional control.

#### **10.1.2 Permanent Structure Monument**

A permanent structure monument is a survey disk firmly attached to a horizontal surface of a structure, wingwall or building foundation that is stable and permanent in nature. A survey disk should NOT be attached to anything that is subject to movement. This type of monument is suitable for use with horizontal, vertical, or three-dimensional control. An existing survey disk that was set vertically and has an existing elevation may be used for vertical control. However, when a new survey disk is to be set on a structure it shall be set horizontally (not vertically).

#### **10.1.3 Cast-In-Place Concrete Monument**

A cast-in-place concrete monument is a cast-in-place concrete post with a survey disk set into the top of the post. The post should have embedded steel rods for easier magnetic detection and strength. See [SDD 16A1](#), "Landmark Reference Monuments" (Type A) for shape and minimum dimensions of monument and survey disk. This monument is suitable for use on a survey requiring a monument with horizontal, vertical, or three-dimensional control.

#### **10.1.4 Precast Concrete Monument**

A precast concrete monument is a precast concrete post with a survey disk set into the top of the post. The post should be in the shape of a truncated prism with the lower end larger than the upper end for resisting frost action. The post should have embedded steel rods for easier magnetic detection and strength. See [SDD 16A1](#), "Landmark Reference Monuments" (Type A) for minimum dimensions of monument and survey disk. This monument is suitable for use on a survey requiring a monument with horizontal, vertical, or three-dimensional control.

#### **10.1.5 Boulder Monument**

A boulder monument is a survey disk set into a drill hole in a large boulder and firmly attached with epoxy resin. The stability of the boulder must be evaluated as even a very large surface boulder is subject to movement by erosion and by frost heave if it does not extend below the frost depth. This monument is suitable for use on a survey requiring a monument with horizontal control. It may be used with caution for vertical or three-dimensional control.

---

<sup>3</sup> Called a "survey disk" when the stem of the disk is anchored in concrete or rock, or a "survey cap" when attached to the end of a pipe or rod.

#### **10.1.6 Iron Pipe Monument**

An iron pipe monument is a 2- or 3-inch inside diameter iron or steel pipe<sup>4</sup> weighing not less than 3.65 pounds per lineal foot and at least 30 inches in length with a survey cap firmly affixed to the top of the pipe. This monument is suitable for use on a survey requiring a monument with horizontal control.

#### **10.1.7 Metal Monument**

A metal monument is a metal post or pipe with a survey cap affixed to the top and has magnetized material top and bottom for easier detection. See [SDD 16A1](#), "Landmark Reference Monuments" (Types C and D) for details. This is a special purpose monument, normally used where other Type 1 monuments would not be as stable (e.g., in a sandy soil or marshy area) or not be economical (e.g., in an area not accessible by vehicle to transport concrete to the site). The drive-in monument (Type C) is not intended for use in cohesive (clayey) soil. When the drive-in monument is used in a marshy area, the pipe should be as long as necessary to be stable but be no less than 60 inches in length. This monument is suitable for use on a survey requiring a monument with horizontal control.

### **10.2 Type 2 Monument**

A Type 2 monument shall be stable and constructed to be permanent. It should be constructed of materials that can be expected to last for at least 25 years. This type monument is often used to monument property boundaries. Recessing the monument below ground level will likely prolong its life by keeping it out of the way of maintenance equipment. A nonmetallic (plastic) or metal cap with a machine imprinted legend (logo) is usually used to identify the establishing agency.

The following listed monuments are a Type 2 monument (see [Attachment 10.2](#)).

#### **10.2.1 Iron Pipe Monument**

An iron pipe monument is a 1-inch or larger, inside diameter iron or steel pipe weighing not less than 1.13 pounds per lineal foot and at least 24 inches long with a cap. This monument is suitable for use on a survey requiring a monument with horizontal control.

#### **10.2.2 Metal Rod Monument**

A metal rod monument is a ¾-inch or larger-diameter steel rod (a number 6, or larger, reinforcing bar) at least 24 inches long with a nonmetallic (plastic) cap. This monument is suitable for use on a survey requiring a monument with horizontal control.

#### **10.2.3 Extendable Metal Rod Monument**

An extendable metal rod (drivable anchored rod) monument is a ¾-inch or larger-diameter metal rod at least 24 inches long with a fluted cast point and magnetized metal tap-on cap. This monument is useful in unstable or

very sandy soil. This monument is suitable for use on a survey requiring a monument with horizontal control.

#### **10.2.4 Metal Pipe Monument**

A metal pipe monument is a 1-inch or larger-diameter nonmagnetic, light-weight, metal pipe at least 24 inches long with a fluted cast point and magnetized metal tap-on cap. This is a special purpose monument, normally used where other monuments would not be as stable (e.g., in a sandy soil or marshy area). This monument is not intended for use in cohesive (clayey) soil. When this monument is used in a marshy area, the pipe length should be as long as necessary to be stable but be no less than 60 inches in length. This monument is suitable for use on a survey requiring a monument with horizontal control.

#### **10.2.5 Chiseled-Cross Monument**

A chiseled-cross monument is a 2-inch by 2-inch or larger, chiseled, or sawed, cross (“+”) at least ¼ inch deep in a concrete structure or foundation. This monument is suitable for use on a survey requiring a monument with horizontal control. This monument shall not be used for vertical or three-dimensional control.

#### **10.2.6 Chiseled-Square Monument**

A chiseled-square monument is a 2-inch by 2-inch or larger, chiseled or sawed square (“ ”) outline at least ¼ inch deep on a horizontal surface of a concrete abutment or foundation for a large structure or building. The elevation point is the undisturbed horizontal surface of the concrete inscribed by the square outline. Avoid using a structure exhibiting previous vertical movement with deformation cracks or by not being level. This monument is suitable for use on a survey requiring a monument with vertical control. This monument shall not be used for horizontal or three-dimensional control because the shape of the monument does not have a finitely defined

---

<sup>4</sup> The department normally uses a 2-inch pipe.

horizontal point.

### **10.3 Type 3 Monument**

A Type 3 monument is a temporary survey monument. A temporary survey monument is intended to be used only for a single project and often only for a single season. Even a temporary monument should be unique so as not be confused with other similar nearby monuments and be stable enough to not move significantly during its expected life. The stability of the monument will be no better than the stability of the feature; therefore, the stability of the feature needs to be evaluated prior to using the feature for a monument.

Some Type 3 monuments may be needed for multiple seasons; therefore, the feature supporting the monument needs to be evaluated to assure selection of the most stable feature in the area. Examples: Asphalt pavement may be a stable feature at one location but an unstable feature at another location or different time of year. A culvert may be a stable feature at one location but at another location a culvert may be an unstable feature, or a culvert may be unstable depending upon the time of year. A culvert with water flowing year around and placed many feet below the roadway will usually be more stable than a nearby culvert flowing water only after a storm and placed only a foot below the roadway.

A monument intended to be used for multiple projects or for multiple years normally should be a permanent Type 1 or Type 2 monument. A Type 3 monument may be used to monument engineering control (not property boundaries) expected to be used in multiple years if the Type 3 monument meets all of the following:

- The monument is expected to be sufficiently durable to last for the entire project.
- The monument is stable enough to not move significantly for the entire project.
- The monument is identifiable from any other similar monuments in the area.
- The monument is described with at least three references (ties) for verification.
- The monument description is filed with the project control data.
- The monument is supplementary to other nearby permanent monuments.
- The monument is approved by the region survey unit coordinator to be used in lieu of a higher-order monument.

The following listed monuments are a Type 3 monument (see [Attachment 10.3](#)).

#### **10.3.1 Metal Rod Monument**

A metal rod monument is a 5/8-inch or larger-diameter steel rod (a number 5, or larger, reinforcing bar) at least 24 inches long with, or without, a nonmetallic (plastic) cap. In loose soil (e.g., clean fine sand, soft wet organic soil, or poorly compacted fill material), the length of the rod should be increased to improve horizontal stability.



This monument is suitable for use on a survey requiring a monument with horizontal control.

### **10.3.2 Masonry Nail Monument**

A masonry nail monument (often called a PK™ nail or MagNail™ monument) is a nail usually driven vertically into a dense massive feature such as asphalt pavement, concrete pavement, or a concrete structure. For concrete, the nail will be driven at a joint, crack, or drill hole. This monument may be suitable for use on a survey requiring a monument with horizontal, vertical, or three-dimensional control. When placed in a feature that is not horizontal, this monument may not be suitable for a survey requiring a monument with three-dimensional control.

### **10.3.3 Railroad Spike Monument**

A railroad spike monument is a railroad spike driven vertically into a dense massive feature such as asphalt pavement or horizontally into a pole to less than full length. This monument is suitable for use on a survey requiring a monument with horizontal control when the spike is driven vertically and a punch mark is placed on the head of the spike. It is suitable for vertical control when driven vertically into pavement or other massive stable feature, or driven horizontally into the side of a large tree or pole. It is suitable for three-dimensional control when driven vertically and the punch mark is at the high point of the spike.

### **10.3.4 Chiseled-Cross Monument**

A chiseled-cross monument is a chiseled, or sawed, cross (“+”) in concrete pavement, a concrete structure, or concrete foundation. This monument is suitable for use on a survey requiring a monument with horizontal control. This monument shall not be used for vertical or three-dimensional control.

### **10.3.5 Sawed-Cross Monument**

A sawed-cross monument is a sawed cross (“+”) in a metal surface; e.g., in a corrugated metal pipe culvert or rim bolt on a water hydrant. The cross may be stamped on a bolt head with a cold chisel. This monument is suitable for use on a survey requiring a monument with horizontal control. It is suitable for use on a survey requiring a monument with vertical or three-dimensional control if the cross (“+”) is at the high point of the metal surface.

### **10.3.6 Chiseled-Square Monument**

A chiseled-square monument is a chiseled or sawed square (“ ”) outline normally on a horizontal surface of concrete pavement, concrete structure, or concrete foundation. The elevation point is the high point of the undisturbed surface of the concrete inscribed by the square outline. If placed on a curved surface such as a concrete culvert pipe, the high point of the curve must be at the center of the square. A chiseled-square monument shall not be placed on a sloping surface. This monument is suitable for use on a survey requiring a monument with vertical control. This monument shall not be used for horizontal or three-dimensional control because the shape of the monument does not have a finitely defined horizontal point.

A Type 3 monument shall not be used when a permanent monument is required.

## **10.4 Type 4 Monument**

A Type 4 monument is a temporary survey monument and should be used only when requiring use of a Type 3 (or higher order) monument would cause unreasonable delay to the surveying operation. Any object may serve as a Type 4 monument providing the object meets all of the following:

- Be unique so as not be confused with other similar nearby objects.
- Be sufficiently strong to support a survey rod or staff.
- Be stable enough to not move significantly during its expected life.
- Have a definite high point when used as a vertical control monument.
- Have a defined “center” point when used as a horizontal control monument.

A Type 4 monument normally serves only a low-order, short-term purpose for a single project, a single season, and usually only a single survey crew. The following listed monuments are examples of a Type 4 monument.

- Nail in a tree, pole, structure, or railroad tie.
- Hardwood hub.
- Existing railroad spike in a railroad tie.
- Existing bolt or steel bar protruding from a structure.
- Corner of a building.
- Edge or corner of pavement.

- Fire hydrant.

The following listed features are examples of features that do not meet the minimum requirements for a Type 4 monument.

- Top nut of a fire hydrant.
- A large aggregate in asphalt pavement.
- Wooden or steel post in a fence line.
- Boulder or chunk of concrete on the surface of the ground.
- An object which moves when bumped, stepped on, leaned against, or touched by a human or animal.
- An object which floats on water, or may float when water raises.
- An object which "floats" by design such as the expansion/contraction span of a structure.

A Type 4 monument shall not be used when a permanent monument is required.

### **LIST OF ATTACHMENTS**

<a href="#">Attachment 10.1</a>	Type 1 Monuments
<a href="#">Attachment 10.2</a>	Type 2 Monuments
<a href="#">Attachment 10.3</a>	Type 3 Monuments