

16-01 Monumentation and Survey Records

The placement of markers or monuments in the ground is used for a variety of purposes. One of the more common purposes is to mark the corner locations of property ownership. In transferring a particular parcel of real property, written conveyances are used to describe the outer bounds or limits of that parcel. An ancient ritual known as the *livery of seisin* (delivery of possession), had the seller, purchaser and witnesses meet on the property, walk the perimeter or bounds of the parcel and then memorialize the contract by handing over a handful of dirt, twig, driving stakes into the ground or other act while uttering the words “I give,” to bind the conveyance.

Today, the transfer of real property does not have the same fan fare of the *livery of seisin* ritual but the acts of the ritual are still incorporated into our real property transfer laws. Deed documents, written descriptions, physical markers or monuments left by the owner or their land surveyor are evidence of the transfer of ownership (*I give*). Much of today’s real property has been segregated into smaller parcels by written description only. To aid in defining the location of the larger and smaller segregated parcels, land owners and land surveyors have placed markers as a witness corner of the parcel(s) being transferred. Often times these markers or monuments define a different geometry than the written description the monuments are supposed to be defining.

The written conveyances often have errors or described lines within the body of the description that could impact the intent of the geometry or area of a particular parcel. Thus the purpose of the survey monument and Record of Survey/Monumentation Map document is to aid WSDOT and others using this information in defining the location of WSDOT’S right of way and other land holdings.

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Examples of monuments are brass caps, brass plugs, marked stones, iron pipes, lead plugs with tacks, wooden hubs with tacks, railroad spikes with punch marks, finishing nails or brass screws in fence posts, PK nails, concrete posts, reinforcing bars with plastic or aluminum caps and holes drilled in rocks. Monuments set by government agencies are identified by an official designation on the monument.

Monuments can be divided into five groups.

1. Geodetic control - usually set by government agencies.
2. Public Lands Survey System (section and quarter section corners, witness corners, meander corners) – originally set by government surveyors from the General Land Office (GLO).
3. Highway, road, and street alignment – usually set by government agencies.
4. Monuments used to define the location of highway or utility company rights-of-way – set by government or private surveyors.
5. Property corners – usually set by private surveyors.

16-03 Geodetic Control Monuments

Generally, control monuments are classified as either primary or secondary. A control monument can be used for horizontal position, vertical position, or both.

Monuments set by other agencies can be used if they are in a desired location. For example, an existing U. S. Geological Survey benchmark could be used for a horizontal control monument. Specifications for horizontal and vertical control monuments shall meet the standards of the Federal Geodetic Control Subcommittee (FGCS) of the Federal Geographic Data Committee (FGDC).

For safety reasons, control monuments should be placed as far away from traffic danger as possible. They should be set firmly in the ground with considerations as to the possibility of frost heave or ground settling. See Standard Plan H-6 for monument installation. WSDOT maintenance requests that the monument be set flush with the ground surface so it will not interfere with their on-going weed control program. When field conditions permit, monuments can be cemented into drilled holes of solid rock or concrete structures. The terrain of each project will dictate the spacing of the control monuments (see Monument Spacing “ in Chapter 7). Placing a witness post (flexible guide post) near the monument helps find it again at a later date and tends to protect it from accidental destruction. Attach a standard label that states: “Please Do Not Disturb Nearby Survey Marker”.

When writing the station description, include information on how to reach the general location of the monument from some prominent feature such as a junction of two highways. Include the location by section-township-range and by State Route and milepost. Relate the monument to at least three nearby permanent objects by distance and direction and describe the specific details of the monument including any stamping or lettering. This data will be incorporated into the “Report Of Survey Mark” document. When completed, this report is then added to the WSDOT Survey monument Database.

16-04 Horizontal Control Monuments

Horizontal control monuments, whether primary or secondary, must be referenced to the NAD83/91 metric coordinate system of the Washington State Coordinate System.

Primary horizontal control monuments must be tied to the High Precision Network (HPN). Primary horizontal control monuments are normally measured by using the Global Positioning System (GPS). If GPS is not used or is not practicable, then conventional means must be used to establish primary control that is tied to the HPN using procedures and equipment meeting second order class II FGCS specifications.

Secondary control, designed to supplement the primary control, is used for photogrammetry and right of way surveys, to provide the basis for topography, or the layout of alignments and structures. Secondary horizontal control monuments must be tied to the primary horizontal control monuments by a traverse or GPS methods using procedures and equipment meeting third order FGCS specifications.

Wherever possible, when setting horizontal control points, place another horizontal control point to act as an azimuth point. Place it so that development in the area will not block the line of sight and in an area that is unlikely to be disturbed by impending construction.

When setting brass caps for horizontal control, position the cap facing approximately “North” using a compass.

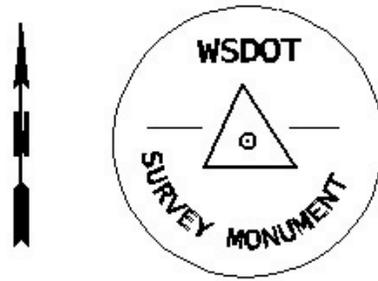


Figure 16-1 Horizontal / Vertical Control Cap

16-05 Vertical Control Monuments

Vertical control monuments must be measured in the metric NAVD88 system. Primary vertical control monuments must be tied to National Geodetic Survey (NGS) bench marks by using equipment and procedures meeting second order FGCS specifications (Chapter 5).

Secondary vertical control, designed to supplement the primary control, is established throughout the project to provide the basis for topography, the layout of grades and structures, or photogrammetry. Secondary vertical control monuments must be tied to the primary vertical control monuments by using equipment and procedures meeting third order FGCS specifications.

16-06 Public Land Survey System Monuments

During the latter portion of the 1800's, the public lands of Washington were surveyed and monumented so that settlers could obtain a "patent" and establish property for private ownership. The monuments which represented a variety of sectional corners (refer to the Bureau of Land Management "Manual of Instructions") were originally set by surveyors from the General Land Office (GLO). Over the last 100 years, either government or private surveyors have perpetuated many of the monuments.

During the course of typical WSDOT projects, sectional corner monuments are often subject to disturbance by construction activities. Several Washington State laws address the procedures and requirements for monument restoration. See *WAC 332-120-040* for more information.

It is the agency's responsibility to make a prudent search, locate and reference all existing General Land Office corners within the highway margins for perpetuation. All General Land Office corners existing at the time of construction will be replaced by state forces, their assign or the contractor on site if disturbed by construction activity.

Also, *RCW 58.09.130* outlines the procedures and requirements regarding monuments disturbed by construction activities. The law states that whenever practical, a suitable monument shall be reset in the surface of new construction. In all other cases, permanent witness monuments shall be set to perpetuate the location of preexisting monuments.

A minimum of two durable witness monuments along with corresponding Washington State Plane Coordinates for each are established when it is deemed unsafe to replace a monument in the traveled portion of any highway.

16-07 Alignment, R/W, and Property Corner Monuments

Monuments in this group control the location of constructed highway alignments, utility easements, and private property ownership. Several State laws address the procedures for monument removal and restoration.

Washington Administrative Code (*WAC 332-120*) pre-scribes the procedure for obtaining a permit from the Department of Natural Resources (DNR) to remove a monument.

The purposes of the regulations are:

- To set standards for the work,
- To establish a chain of evidence on the replacement of an original monument, and:
- To ensure that the work is done by qualified personnel who know the correct procedure.

Before removing a monument, the owning agency should be contacted to coordinate the work. Some agencies may prefer to do the removal and replacement themselves. This particularly applies to horizontal and vertical control monuments belonging to U.S. Government agencies.

The documentation consists of:

- Application for a permit, explaining the necessity for removal.
- Permit approval.
- Report on the removal and what was used for replacement.
- Land Corner Record; used when a section corner, quarter corner, street monument, or other point, which is used for locating property lines, is established or replaced and is not reported on some other recorded map or survey. This establishes a chain of evidence which can be used later to prove the genuineness of the monument at that point.

See the *Design Manual, Chapter 1450* for examples of paperwork for permits to temporarily remove or destroy monuments. When monuments are set for a new project or to replace

old monuments, they should:

1. Be of a permanent nature,
2. Be clearly identified as to who set them,
3. Be referenced to other points so they can be easily reset if disturbed or destroyed,
4. Be filed with the Department of Natural Resources, and with the county auditor or county engineer, depending on legal requirements, so there is a public record of the location and references, and
5. Be located on the Washington coordinate system so they will extend the survey network in this state.

If a monument is offset from the point that it is intended to represent, the record must show the offset and direction between the point and the monument. For example, the base line for a highway may lie along the center of the paving, while the monumentation for the base line may be located in the shoulder.

Public knowledge of the location of the monuments and their relation to the point that they represent will eliminate many problems that have occurred in the past where monuments were destroyed and there was no public record that showed references to remaining points.

16-08 Documentation

The best evidence of a monument's original position is a continuous chain of history by acceptable records, usually written, back to the time of the original monumentation. As part of this, WSDOT surveyors must contribute to the body of public records by documenting monument work appropriately and by striving to preserve and perpetuate existing monuments.

Monuments set by a public officer shall be marked by an official designation. Prior to the "Survey Recording Act" (*RCW 58.09*) in 1973, many surveyors did not mark their monuments, so it is sometimes difficult to determine whether an object is a monument or not.

RCW 58.09.120 requires that any monument set by a land surveyor be permanently marked or tagged with the certificate number of the land surveyor setting it.

Deeds have a chain of title back to their inception, and the validity and correctness of a deed is based upon these records. Similarly, monuments should have a continuous chain of history. The original surveyor sets a stone mound for the section corner. Surveyor number two finds the stone mound and sets a 2-inch iron pipe. Surveyor number three finds the 2-inch pipe and sets reference points 30 feet on each side of a new proposed road. Surveyor number four finds the reference monuments and resets the true section corner in the center line of the new road. Surveyor number five finds the new monument in the center line and wants to prove its identity and the correctness of its position. How can he without a continuous record of what each surveyor did? This is the reason that Washington has a law making it mandatory to file a record of survey under certain circumstances.

RCW 58.09.120 requires that any monument set by a land surveyor be permanently marked or tagged with the certificate number of the land surveyor setting it.

Monuments set by a public officer shall be marked by an official designation. Prior to the "Survey Recording Act" (*RCW 58.09*) in 1973, many surveyors did not leave identifying caps or tags on their monuments, so it was sometimes difficult to determine whether an object is a monument or not.

History or chain of record for monument position is valuable evidence, but all too often there is an interruption in the history, and a continuous chain of records cannot be proven.

Many disputes have been caused because a monument was not properly identified when it was set or because its replacement was not properly identified and marked. Accidental or deliberate destruction of a monument can lead to long and expensive disputes about where it was originally located.

It is therefore essential that, if an existing monument must be disturbed for any reason, its present location must be accurately referenced with modern equipment and methods so that it can be replaced in its old position, or its location accurately determined if it cannot be replaced for some reason.

Presently, WSDOT is documenting the right-of-way alignment of a State Route by the use of a Record of Survey or Monumentation Map. This map shows all of the survey data and ties to the PLSS monuments, county road or city street intersection points, private survey corners, and other pertinent geodetic control markers. The purpose of

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this map is to document how the right-of-way alignment was established using all of the available information. The Monumentation Map shows direct ties or station and offset to all survey markers. Any global positioning points established in the area are directly tied to the right-of-way alignment. Ownership information is not shown on this map. The main purpose is to establish the right-of-way centerline and determine its relationship to the other survey control points. A narrative discussing the procedure used and problem solving methods is a part of this document. This map is filed with the County Engineer's office, at the WSDOT Regional office, WSDOT Headquarters office in Olympia, and at the Department of Natural Resources in Olympia. It is a document used by both WSDOT and the general public. This map is prepared on all new projects that have right-of-way or alignment issues. As new projects are being developed, this monumentation map will be a vital tool in establishing and reestablishing the right-of-way centerline alignment.

16-09 Post Construction Monumentation

The post construction survey serves several purposes:

1. It establishes coordinates and elevations for the monumentation set by the contract.
2. It provides the necessary data for making a Monumentation Map, or updating the map made prior to construction.
3. It establishes a permanent base line from which the right of way line and right of way base line can be reestablished.
4. It establishes a base line for future projects in the area.
5. It enables WSDOT to comply with *RCW 58.09 (Survey Recording)* and *58.20 (Washington Coordinate System)*.
6. It provides a permanent record of how the survey measurements to determine monument location were performed.
7. It documents which monuments were removed, destroyed, replaced, or set within the project limits during construction.

When placing monuments after construction, the following criteria should be considered:

- Monument location should be accessible after construction.
- Monuments should be intervisible and not liable to have the line of sight blocked by brush, trees, or future construction.
- Monuments should be set back from the traveled roadway as far as possible and still meet above requirements.

The procedure is:

1. Designate location of each monument by station and offset on the contract plans. Construction personnel shall not change the location without approval by the location personnel.
2. Include as contract items the installation of monument case and cover (in paved areas), poured-in-place concrete (in unpaved areas) or drilled hole (in rocky areas).
3. If the actual setting of the monument is done by a WSDOT crew, cement the disk inside the pipe, set in the freshly poured concrete or cement into the drilled hole, as applicable. If the monument is to be set by the contractor, furnish WSDOT disks to the contractor. Stamp each disk with the predetermined monument marking before it is set.

4. Mark the location on the ground where the contractor is to install the monument case and pipe, pour the concrete, or drill a hole. The location of the control point shall be within 0.01 feet of the specified location as shown on the contract plans. If the contractor installed the monument, verify that it was set to this specification.
5. After completion of construction, perform a survey meeting secondary control specifications on all new monuments.
6. Prepare a Monumentation Map showing the location of each monument set by its station and offset referred to the right of way base line, together with its state plane coordinates. The Monumentation Map shall be signed and sealed by the person responsible for the survey.
7. If the surveying of the contract is being done as a contract item, the contractor is responsible for engaging a licensed land surveyor to perform this work.

Survey Documentation of survey activity is very important. It allows field crews and offices to share information without having to survey the same areas more than once. The final documentation of survey data allows the design team and other groups within the agency to use the same data for their own particular purposes. These guidelines should be used during the scoping phase of the project to determine preliminary survey cost estimates.

16-10 Guidelines For When A Survey Document is Prepared

16-10.1 What is a survey document?

A survey document could be a number of items but the common documents for which this guideline is prepared for are:

1. Record of Survey
2. Monumentation Map Type 1 or Type 2
3. Application for Permit to Remove or Destroy a Survey Monument
4. Land Corner Record

What determines a need for preliminary land survey work or monumentation inventory?

Preliminary land survey work is required if the proposed construction activity is not clearly within the limits of our existing right of way.

A monumentation inventory is required if the proposed construction activity will physically impact the existing survey monuments. (See “What are WSDOT’s Responsibilities of Maintaining a Monument”)

16-10.2 What is a preliminary land survey?

A preliminary land survey is intended to be part of the Scoping Package. The purpose of the survey is to provide cost estimates for survey labor, documentation (mapping) and monumentation for a specific project. This survey will help determine, at the scoping phase rather than midway through the project, the need for: preparing new or revising existing right of way plans, Record of Survey or type of Monumentation Map, and / or other survey documents.

A preliminary land survey reviews existing survey documents and right of way plans located at WSDOT or the county auditor’s office, etc., locating existing survey monuments in the field, and making field checks to determine if the information is reliable and consistent, and creating a preliminary right of way centerline. (See “What does a Preliminary Land Survey consist of?” on page 8.)

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Who is qualified to do preliminary land surveys?

Preliminary land surveys will be performed under the direct supervision of a licensed professional land surveyor, or licensed professional engineer experienced in the practice of land surveying, in accordance with the survey standards promulgated under Chapter 332-130 WAC.

16-10.3 What does a monumentation inventory consist of?

A monumentation inventory consists of document research and fieldwork to find the monuments, determining ownership of them, and identifying what they represent.

A monumentation inventory should be performed during project scoping.

16-10.4 What determines a need for a Record of Survey or Type 1 Monumentation Map?

A Record of Survey or a Type 1 Monumentation Map is not necessarily required just because WSDOT is acquiring property.

If a new right of way plan is being prepared, one of these survey documents will always be required. The document will show the existing right of way alignment.

If revisions to the existing right of way alignment are being planned, a Record of Survey or a Monumentation Map Type 1 will be prepared of the existing right of way alignment. The Type 1 Monumentation Map is actually an analysis of the centerline alignment. This will define or prove the existing alignment while providing a foundation for the new alignment. In most instances, it is recommended that the existing right of way alignment be retained as the right of way centerline though the construction centerline may change to meet the needs of the project. Those projects that necessitate having a new right of way alignment will include both the existing and the new right of way centerline with station equations at both diversion and conversion points to the existing alignment. This document will be a part of the package presented for Right of Way Plan approval and adoption.

Then a new document will be prepared as a Post Construction Survey Document to show any revisions and ties back to the existing alignment.

If the determination is made (from the preliminary land survey) that the alignment ties are reliable and verified in the field, then a Record of Survey or Type 1 Monumentation Map is not required and the existing right of way plans can be utilized subject to Section 180.01 of the Plans Preparation Manual.

If, during the preliminary survey, it is discovered that the cadastral ties shown on the existing right of way plans are not reliable, then additional research and an economic risk analysis should be done. The design team, with the help of the designated land surveyor and real estate services personnel, will do this analysis. This analysis will determine if the Record of Survey or Type 1 Monumentation Map will identify and/or eliminate present or future ownership rights problems. If the risk is low, with little ownership rights issues or great monetary issues, then a Monumentation Map or Record of Survey is not required. The cadastral tie(s) should be changed on the existing right of way plan.

If, during the preliminary survey, it is discovered that the alignment centerline monuments are not on the right of way centerline, or if unclear what they are intended to represent, then a Record of Survey or Type 1 Monumentation Map is required.

If the cost of preparing the necessary survey document far outweighs the cost of the right of way to be acquired or the cost to remedy present or future problems, a survey document is not required. Before the decision is made to not prepare a survey document, always consult with the region's Cadastral Engineer or designated Land Surveyor.

A Record of Survey will be certified by a Professional Land Surveyor and filed with the county auditor's office in the county where the project resides.

A Type 1 Monumentation Map will be certified by a Professional Land Surveyor or a Professional Engineer, with surveying background, i.e. competent in the technology and knowledgeable of the codes and regulations applicable to land surveying (See *WAC 196-27A-020* and *RCW 58.09.09*), and filed with the county engineer's office, or as instructed by the county engineer, in the county where the project resides.

16-10.5 What determines the need for a Type 2 Monumentation Map?

A Type 2 Monumentation Map is required whenever alignment monuments are being removed, destroyed and not replaced, or new monuments are being established by WSDOT and a Type 1 Monumentation Map or Record of Survey is not being prepared. Examples why new monuments might be established are:

- Monuments are difficult to use due to location within traffic;
- Monuments will be destroyed by the construction activity;
- Monuments are becoming inaccessible due to construction;
- Monument spacing is too great or additional control is required.

A Type 2 Monumentation Map may also be prepared as a method for identifying and preserving monuments during a highway construction project. Washington State Plane Coordinates are used to designate the location of monuments and control in lieu of stations and offsets as with the Type 1 Monumentation Map.

A Type 2 Monumentation Map will be certified by a Professional Land Surveyor or Professional Engineer, with surveying background, i.e. competent in the technology and knowledgeable of the codes and regulations applicable to land surveying (*WAC 196-27A-020*) and filed with the county engineer's office, or as instructed by the county engineer, in the county where the project resides.

16-10.6 What determines a need for a Record of Survey on Sundry Site Plans?

Partial Takes: A Record of Survey will be required. This will help in the parcel split for the county assessor and ensure proper property line location and approval from the Grantor.

Generally, total takes will not require a Record of Survey. However, other issues will need to be taken into account in making this determination (i.e., abandoned railroad and county road rights of way; obvious and potential encroachments; an ambiguity in the deed). If any of these conditions exists, then a Record of Survey should be prepared in an effort to prevent future ownership problems.

16-10.7 Who is qualified to prepare the Application For Permit to Remove or Destroy a Survey Monument?

Both licensed engineers, i.e. competent in the technology and knowledgeable of the codes and regulations applicable to land surveying (*WAC 196-27A-020*) and land surveyors are qualified for preparing this document. A recent letter from the Board of Registration gave us this reminder:

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“Anyone performing construction or maintenance activities should consider the following:

1. No survey monument shall be removed or destroyed (*the physical disturbance or covering of a monument such that the survey point is no longer visible or readily accessible*) before a permit is obtained from the Department of Natural Resources (DNR). *WAC 332-120-030(2)* states, “It shall be the responsibility of the governmental agency or others performing construction work or other activity (including road or street resurfacing projects) to adequately search the records and the physical area of the proposed construction work or other activity for the purpose of locating and referencing any known or existing survey monuments.” (*RCW 58.09.130*).

Any person, corporation, association, department, or subdivision of the state, county or municipality responsible for an activity that may cause a survey monument to be removed or destroyed shall be responsible for ensuring that the original survey point is perpetuated. (*WAC 332-120-030(2)*)

2. Survey monuments are those monuments marking local control points, geodetic control points, and land boundary survey comers. (*WAC 332-120-030(3)*)”

A copy of the survey document prepared may be attached to the Application to Remove or Destroy a Survey Monument. This will aid in the documentation of the point(s) being removed and prevent having separate documents for each monument removed or destroyed. When, or if, the monuments are replaced at the same point, or if new monuments are set in a different location, then a survey document similar to the first is prepared to give that positional relationship between the old removed and the new set monuments.

16-10.8 What are WSDOT’s Responsibilities of Maintaining a Monument?

“Any monument set by a land surveyor to mark or reference a point on a property or land line shall be permanently marked or tagged with the certificate number of the land surveyor setting it. If the monument is set by a public officer it shall be marked by an appropriate official designation.” (*RCW 58.09.120*)

A monument usually has identifiable markings to identify ownership of the monument or one that is shown on a survey document that has been recorded with the county auditor.

Construction activity that will impact any monument will need to be identified and certain documents shall be prepared during the design phase or construction office.

A Record of Survey or a Monumentation Map Type 1 or 2 is a typical document prepared on most WSDOT projects. For those monuments that are being impacted, covered, destroyed, potentially bumped, etc., an Application For Permit to Remove or Destroy a Survey Monument shall be prepared. (See Design Manual Chapter 1450)

This permit will be prepared by the Construction Office or designated Land Surveyor prior to construction commencing. This permit shall be kept in the construction office throughout the duration of the contract. The construction office will follow through with the permit and prepare an “As-Built” survey (Design Manual 1440.03(2), Construction Manual 1-5.1C, Highway Surveying Manual Ch. 16 (Post Construction Surveying)) to acknowledge monuments remaining on site. Unless directed by the Project Engineer, all monuments within the construction site will be maintained per Standard Specifications 1-07.16.

Monuments shall be noted on the permit if they will be destroyed and replaced (field referenced and State Plane Coordinate assigned), destroyed and not replaced, raised in place, or replaced with reference monuments. One permit may be submitted for the entire project limits, (i.e. attach Record of Survey or Monumentation Map).

General Land Office (GLO) corners affected by construction activity shall be referenced as noted above, and replaced in the same position. If this position falls in a hazardous location (middle of traffic lane, top of retaining wall, middle of wetland area), then a minimum of three additional witness monuments shall be set to perpetuate the location of the preexisting monument. A Land Corner Record (See Design Manual Chapter 1450) shall be prepared when the new monuments are in place. This information shall also be included in the As-built Monumentation Map when one is required.

Failure to prepare a permit or total disregard for the monuments on and within the project limits, may subject the project engineer to penalties described in *RCW 58.04.015*. The penalties include being guilty of a gross misdemeanor and liable for the cost of reestablishment. The reestablishment cost could be in excess of \$30,000 per monument.

16-10.9 What does a Preliminary Land Survey consist of?

- I) Research
 - A) WSDOT Records
 - a) R/W plans, contract and as-built plans, field books, monument information files, hard shells, GPS database, etc.
 - B) Underlying county and city records of same type as described above.
 - C) DNR records
 - a) Records of Survey's, plats, Land Corner Records, unrecorded surveys and plats.
 - D) Deeds (relating to placement of the R/W centerline)
 - E) Ownership rights (project vicinity)
 - a) DEEDS (R/W and adjacent), waivers, orders of establishment, etc.
- II) Preliminary analysis
 - A) Evaluate documents collected in Research.
 - B) Is there enough good data to build a preliminary centerline?
 - i) Does information collected agree with itself?
 - ii) Does information agree with R/W Plans?
 - C) If there is enough good information, generate a preliminary centerline based on records evaluated.
 - i) What happens when this centerline is extended? Does it continue to fit?
 - ii) Do records indicate centerline monuments were set?
- III) Preliminary fieldwork
 - A) Verify enough corners to insure preliminary data is good and locate corners for which no information is available.
 - B) Tie centerline monuments and r/w markers if they exist.

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- C) Tie into state plane control if available.
 - D) Tie topography. Does centerline as-built and occupation lines agree with preliminary centerline?
- IV) Preliminary final analysis
- A) Evaluate all data collected.
 - B) Create a preliminary right of way centerline based on this data.

16-11 Survey Monumentation

Survey monuments represent limits of ownership, alignment or a geographic point. It is important to know which of these representations the monument, or marker, found is trying to portray. The intent of the monument helps identify the legal locations of structures, objects, property ownerships, roadway alignments, easement rights, horizontal and vertical control points, etc.

Care needs to be taken when establishing monuments that the accuracy and precision used is clearly noted so that the monument is not used for something beyond its intended purpose. Small errors inherent in establishing a particular point can become a nightmare if this point is used for something it was not intended for.

16-12 Record of Survey/Monumentation Map Policy

Proper documentation and monumentation is important in referencing a highway's alignment that is used to define its right of way and contribute to the body of public records. The department is required by law to perpetuate existing recorded monuments thus it is essential that a documentation and monumentation policy be established. (See Design Manual Ch. 1450.01)

16-13 Record of Survey or a Type 1 Monumentation Map

The purpose of this document is to identify the physical location of the WSDOT Right of Way center line alignment. Measurements taken to: all existing monuments or markers within the project area; existing cadastral corners on each side of the highway corridor; city and county street intersection markers; any other extrinsic feature that was used to determine the right of way centerline alignment. This document will follow the mapping guidelines of a record of survey found *WAC 332-130-050*. A narrative will be added to monumentation map or record of survey to describe the nuances of the survey.

Monuments set or found by WSDOT employees will be mathematically tied to the right of way center line alignment. In those instances when the construction alignment and the right of way alignment differ, all monuments set on the right of way center line or randomly set with station and offsets, with a state plane coordinate, to the right of way center line. The last method is the preferred method when placing new monuments.

If the existing monuments are on a construction alignment, all found alignment monuments shall note a station and offset to the Right of Way center line alignment. A note shall be placed on the Monumentation Map or Record of Survey noting the finding of found monuments on a construction alignment. A DNR "Application for Permit to Remove or Destroy a Survey Monument." Shall be filled out on all monuments removed, destroyed and reset on the project.

16-14 Type 2 Monumentation Map

The purpose of this document is to perpetuate existing monuments that may be covered, raised, destroyed, or replaced within a project area that does not require an alignment determination. New monuments may be set to replace existing monuments in a different location but the mathematical geometry needs to be perpetuated to keep the integrity of the old monument locations.

All monuments found and/or set are shown graphically on a proper type of Monumentation Map. Monuments that were originally set on a construction alignment shall have a note stating construction station and have a right of way alignment station and offset computed and shown on the map.

Monuments set or found by WSDOT employees on projects not requiring the determination of the centerline alignment, but are set or found for perpetuation purposes.

Monuments found or set will have a State Plane Coordinate assigned to them with a brief description or diagram of how the coordinates were determined. Stations assigned to the monuments found will be noted as the station found on the construction as-built plans. No determination of right of way centerline or construction centerline is made during this survey.

16-15 Monument Markers

It is the intent of this policy to change (from the past custom of placing monuments at the construction alignment PC's and PT's) monument placement to a random location. Random points placed in "safe" locations, are assigned a station and offset and a state plane coordinate. Existing monuments that are or will be buried or covered by structures shall be located and removed having new monuments set in a more usable location. New monuments need not be direct offsets from existing points. A random location may replace existing monuments as determined by terrain, visibility, and safety issues.

Existing monumentation documentation can be found with a little research at the county auditor's or surveyors office, county or city engineer's office, DNR, National Oceanic Atmospheric Administration (NOAA), WSDOT construction plans, etc. All Monuments found on the site shall be referenced and outside agencies contacted prior to construction of possible disturbance of said monument. A DNR "Application for Permit to Remove or Destroy a Survey Monument." Shall be filled out on all monuments removed, destroyed and reset on the project. After the project is completed, inspection of the area to ensure all monuments labeled to be removed have been removed, that existing monuments to remain are still in place, existing monuments that were to be replaced have been replaced, and that new monuments set during the project are shown on the record of survey or Type 1 monumentation map and the DNR Application to remove or Destroy a Survey Monument is completed and filed.

Monuments that are reset by the Project Engineer are limited to existing monuments that will be replaced in the original location. A consultant will establish property corners that are to be replaced in their new location. Geodetic monuments are to be reset by Headquarters Geographic Services or the agency to whom they belong. There will be a charge for this work. General Land Office corners that fall within travel way will be replaced in its original location. In addition, for safety reasons, a minimum of three witness corners will be set so that the corner in question may be mathematically computed. A Land Corner Record will be completed by the Project Engineer or Professional Land Surveyor and filed with DNR and the County in which the corner lies.

16-16 Definitions of WSDOT Horizontal Control Hierarchy

Monumentation – the process of establishing a physical survey control network, consisting of survey markers representing specific points or corners and generally assigned with geographical coordinates and/or elevations, which pertain to a defined datum of reference.

As monumentation relates to most State Highway projects, the physical network of survey markers are further defined as being Primary Control, Secondary Control, or Tertiary Control points. All survey markers (monuments) are subject to specifications and procedures, which define the classification.

Primary control – This is the first layer of densification of the National Geodetic Reference System (RGRS). The monuments are WSDOT brass disks and designated as “PRN” (Primary Reference Network). WSDOT Geographic Services Survey Section establish the monuments, using ties to High Accuracy Reference Network (HARN) stations in the network, and provide “Report Of Survey Mark” data sheets available on the World Wide Web (Internet) and the internal WSDOT Intranet. The precision ratio is considered 1:100,000, with a Network Accuracy not to exceed 0.12 feet and a Local Accuracy not to exceed 0.05 feet.

Secondary control – This layer is the densification of the Primary Reference Network. The monuments are WSDOT brass disks and designated with Regional notation (i.e.: “SW” for Southwest Region). The WSDOT Regional Office Survey Section generally establish the monuments, using ties to the PRN stations or previous “GP” monuments supplied for the Regions by WSDOT Geographic Services Survey Section. Regional forces collect the survey data, unless otherwise provided, and “Report Of Survey Mark” data sheets are available on the Regional survey monument database. The precision ratio is considered 1:20,000 with a Network Accuracy not to exceed 0.22 feet, and a Local Accuracy not to exceed 0.08 feet.

Often times rebar and cap monuments are used in this layer when durability due to anticipated highway construction may be in question.

Tertiary control – The monument in this classification is considered temporary and not generally entered into the Regional database. The precision ratio is 1:10,000 or less, with a Local Accuracy not to exceed 0.17 feet. Typical uses of this monument are for stockpile volumes, overcoming a local obstacle in topographic data collection, etc.

Spacing requirements for Primary Control Points see chapter 8 “Global Positioning System (GPS) Survey Specifications”. When establishing the spacing of secondary control Points, the determining factors are terrain, length of project, traffic volumes, and elevation. Line of sight between points is preferred but not necessary. When extenuating circumstances do not allow line of sight, then each secondary control point shall have an Azimuth Reference point established paired with it.

A minimum of two (2) Secondary Control points set, if there are no existing control points in the area, at each end of the project shall be established. Secondary Control points shall have state plane coordinates established and recorded in the region or statewide data base.

Tertiary control points established as durable monuments shall be no further than 1500 feet apart.

What is an acceptable monument? - Any object of durable nature that will not be affected by the normal activity surrounding the monument. All iron rods (#4 or bigger), iron pipes (1/2 in. inside diameter or bigger), or aluminum rods shall have a cap (Brass, plastic, or aluminum) bearing the acronym “WSDOT CONTROL”, “WSDOT PLS #####” or “WSDOT PE #####”. Other durable markers, railroad spikes, PK Nails, axles, etc., shall have a brass washer (bearing the acronym “WSDOT CONTROL”, “WSDOT PLS #####” or WSDOT PE #####”) attached to it by a wire or other permanent method. See Exhibit A. Monuments set to define property corners (right of way break points, pit site property corners) shall use the “WSDOT PLS #####” cap style. All other control monuments set for design, topographic, construction, and other purposes shall have “WSDOT CONTROL”. Monuments set specifically for alignment purposes only shall have the choice of “WSDOT CONTROL”, “WSDOT PLS #####”, or WSDOT PE #####” depending on the office (person supervising the survey activity will be either a Professional Engineer or a Professional Land Surveyor) setting the monument.

For permanent monument placement see Exhibit B for an example.

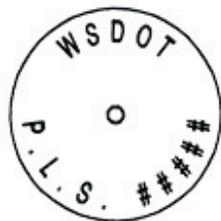
Exhibit A

Plastic or aluminum caps or metal washers to be placed on or attached to iron rods, pipes, PK nails, brass screws, etc.



USES:

Nonboundary delineation point, Network Control Points,
Alignment Control Points

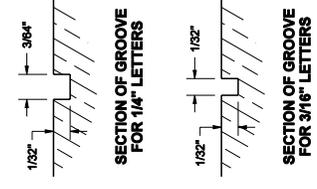
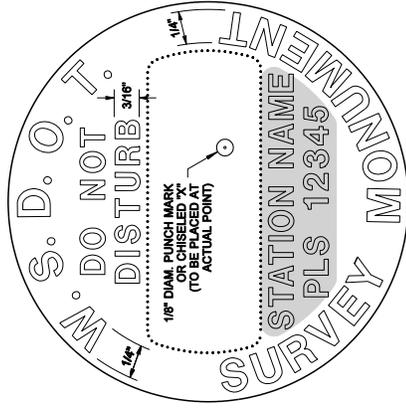
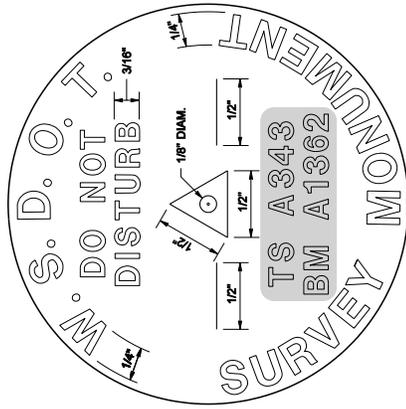


USES:

Boundary Corners, right of way break points,
Alignment Control Points

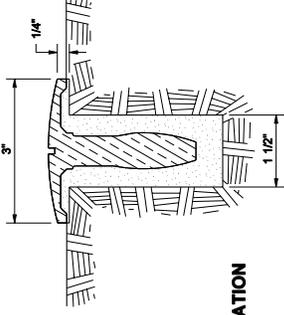
EXHIBIT B

NOTE: THIS PLAN IS NOT A LEGAL ENGINEERING DOCUMENT BUT AN ELECTRONIC OUTPUT OF A CAD PROGRAM. THE ORIGINAL, SIGNED BY THE ENGINEER AND APPROVED FOR PUBLICATION, IS KEPT ON FILE AT THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION. A COPY MAY BE OBTAINED UPON REQUEST.



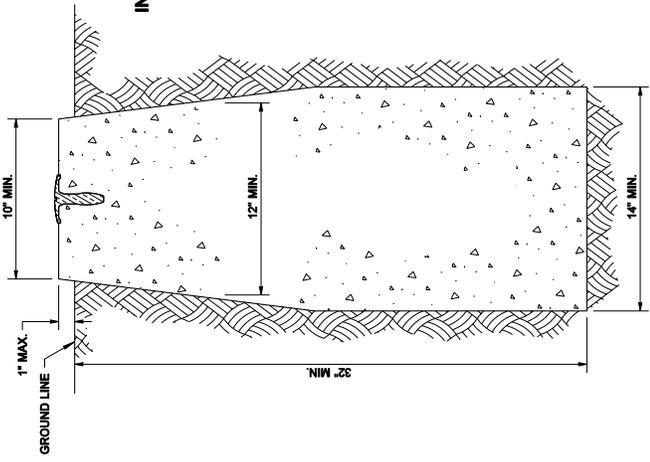
NOTES

1. THE BRASS DISC WILL BE FURNISHED BY THE STATE.
2. THE TEXT IN THE SHADED AREA (SEE TOP VIEW) SHALL BE 3/16" HIGH AND WILL BE STAMPED BY WSDOT PERSONNEL PRIOR TO SETTING THE CAP. ONLY THE ASSIGNED IDENTIFICATION LETTERS AND NUMBERS ARE TO BE PLACED ON THE BRASS DISC.
3. THE HOLE SHALL BE 3/16" MINIMUM IN DEPTH OR 6" BELOW THE DEEPEST RECORDED SURFACE OF THE GROUND. THE BRASS DISC SHALL BE SET IN THE CENTER OF THE HOLE SO THAT THE CONCRETE IS PLACED ON FIRM UNDISTURBED EARTH.
4. THE TOP OF THE CONCRETE SHALL BE TROWELED SMOOTH AND THE BRASS DISC SET IN THE CENTER WITH TOP FLUSH AND LEVEL. WHEN THE CONCRETE IS SET, COVER THE ENTIRE MONUMENT WITH MOIST EARTH AND LEAVE FOR THREE DAYS.
5. THE TOP OF THE MONUMENT MAY BE RECESSED OR PROTRUDING, DEPENDING ON CONDITIONS.
6. TO REPLACE A GENERAL LAND OFFICE (G.L.O.) CORNER, CONSULT A LICENSED PROFESSIONAL LAND SURVEYOR (P.L.S.).



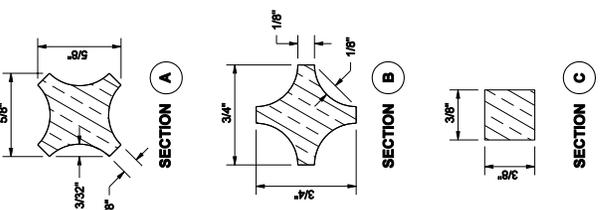
INSTALLATION

SECTION VIEW OF LEDGE ROCK, CONCRETE OR ASPHALT INSTALLATION

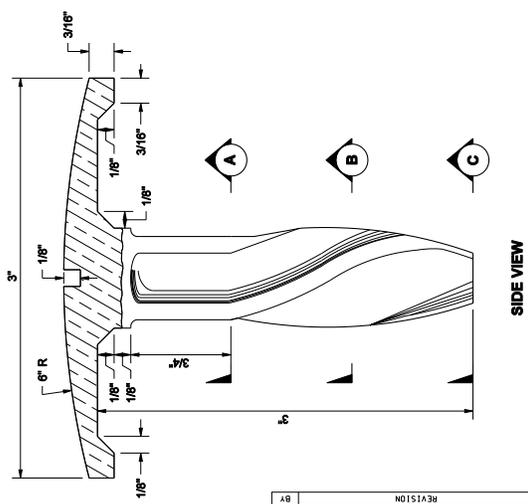


SECTION VIEW OF GENERAL INSTALLATION

TOP VIEW BRASS DISC

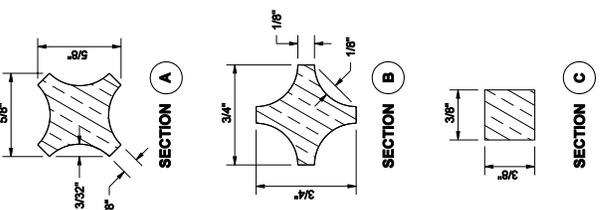


TYPE 1



SIDE VIEW

TYPE 2



EXPIRES MAY 16, 2005

**SURVEY MONUMENTS
TYPE 1 AND TYPE 2
STANDARD PLAN H-6**

SHEET 1 OF 1 SHEET

APPROVED FOR PUBLICATION
Harold J. Peterfeso 10-29-03
 STATE DESIGN ENGINEER DATE
 Washington State Department of Transportation

DATE	REVISION
10/2000	ADDED TYPE 2 MONUMENT
BY	MKS

**EXHIBIT C
RECORD OF SURVEY / MONUMENTATION MAP
CONTENTS CHECKLIST**

WAC 332-130-050.....SURVEY MAP REQUIREMENTS

1. County recording official's information block, which contains:
 - (a) Title block, shown on all sheets, including:
 - (1) Business name
 - (2) Date prepared
 - (3) Sheet identification number, such as "sheet 1 of 2"
 - (b) County Engineer's Certificate, located on the first sheet only
 - (c) Land Surveyor's Certificate, located on the first sheet only
 - (1) Show name, license number, seal, signature, license expiration date, and date the surveyor approved the map
 - (2) Every other sheet shall show only data per (1)
2. Indexing information on the first sheet of multiple sheets:
 - (a) The section-township-range and quarter-quarter of section(s)
 - (b) Additionally, if appropriate, the lot, block, and plat title
3. North arrow
4. Basis of Bearings
5. Bearings: use degrees, minutes, and seconds
6. Distances: use feet and decimals of feet (ground-level distances)
7. Curve data: show the controlling elements
8. Graphic scale bar
9. For the intelligent interpretation of various items shown:
 - (a) Use reference documents that identify different corner positions
 - (b) Identify all corners used to control the survey
 - (c) Describe physical monuments found or re-established
 - (d) Show legal description of surveyed property or recorded reference
 - (e) Identify ambiguities, gaps, and/or overlaps
 - (f) Show any encroachments or evidence of possible conflicts
10. All signatures and writing using permanent black ink
11. Size to be 22" by 34" per WSDOT Plans Preparation Manual.

WAC 332-130-100.....EQUIPMENT AND PROCEDURES USED

1. Equipment used
2. Procedures used

RCW 58.090.050.....RECORD-OF SURVEYS PROCESSING

1. Legible map of permanent quality, using black on mylar
2. Sheet size to be 22"x34"
3. 2" margin on left edge and ½ " margin at all other edges
4. Supply original mylar to the County Engineer.

RCW 58.09.070.....COORDINATES- CONTROL SCHEME REQUIRED

1. Use a control scheme (network diagram) to show how the WSP coordinates were determined from the known points
2. Datum defined : *RCW 58.20.120* states the Washington Coordinate System of 1983 is the designated coordinate system in Washington

RCW 58.09.080.....CERTIFICATES - REQUIRED

See this law for both Surveyor's Certificate and Engineer's Certificate

RCW 58.20.190.....METRIC EQUIVALENT

Conversion to US Foot shall use 1 meter to equal 39.37 inches.

RCW 58.20.140.....DESIGNATION OF SYSTEM - ZONES

Label whether project is in the North zone or the South zone

RCW 58.20.180.....RECORDING COORDINATES

When reference has been made to such coordinates, the scale and sea level factors shall be stated for the survey lines used in computing ground distances and areas.

MISCELLANEOUS ITEMS

State Route (SR) shown on alignment

Legend showing monument symbols and their equivalents

Surveyor's Notes (purpose of the survey), etc.

Document title "RECORD OF SURVEY" or "MONUMENTATION MAP", generally located at top - center of sheet

Surveyor's Statement.....to add a special note for clarification of deeds, etc.

EXHIBIT D
REFERENCE TO STATE STATUTES

16-02 Monumentation and Survey Records

Monuments are defined in Washington Administration Code (WAC).

WAC 332-120-020 Definitions.

Survey monument: The physical structure, along with any references or accessories thereto, used to mark the location of a land boundary survey corner, geodetic control point, or local control point.

16-06 Public Land Survey System Monuments

WAC 332-120-040 Monument removal or destruction.

- (1) All land boundary survey monuments that are removed or destroyed shall be replaced or witness monuments shall be set to perpetuate the survey point.
- (2) A land boundary survey corner shall be referenced to the Washington Coordinate System of 1983, adjusted in 1991, prior to removal or destruction. See WAC 332-130-060, Geodetic control, survey standards.

An applicant may request a variance from this referencing requirement by so noting in the applicant information section on the permit and providing the justification on the back of the form. The department shall note whether the variance is approved or not approved and shall provide the reason for not approving the request.

[Statutory Authority: RCW 58.24.040(8). 94-06-034 (Order 617), § 332-120-040, filed 2/25/94, effective 3/28/94; Order 131, § 332-120-040, filed 3/1/72, effective 4/7/72.]

16-17 State Responsibility of Survey Markers – *RCW 47.36.010*

“Restoration of United States survey markers. The department shall fix permanent monuments at the original positions of all United States government monuments at township corners, section corners, quarter section corners, meander corners and witness markers, as originally established by the United States government survey whenever any such original monuments or markers fall within the right of way of any state highway, and aid in the reestablishment of any such corners, monuments, or markers destroyed or obliterated by the construction of any state highway by permitting inspection of the records in the department’s office.”

The DNR permit uses the terminology “remove or destroy” as required by law and legally defined as follows:

WAC 332-120-020 Definitions.

Removal or destruction: The physical disturbance or covering of a monument such that the survey point is no longer visible or readily accessible.