

12-01 General

Contact Headquarters Geographic Services for your mapping needs. They have a staff of mapping specialists, engineers and on-call consultants to make sure you get the right mapping products and geographic information for your project.

Photogrammetric surveys are used for reconnaissance, location design, PS&E, and construction projects. They are used for mapping, digital terrain modeling, cross sectioning, and alignment determination. If a project will take more than 4-5 field crew days or there is a safety concern, using photogrammetry will be to your advantage.

If you are contemplating a project, contact the Photogrammetry Branch early to get them on your project delivery team.

The telephone number is (360) 709-5541

Please take time to visit the Photogrammetry website at <http://wwwi.wsdot.wa.gov/PPSC/Photogrammetry/Default.htm>

12-02 Glossary

The mapping sciences are based on technology that is advancing and changing rapidly. Please see the Photogrammetry website for current terminology, information, education, and assistance on remote sensing and mapping.

<http://wwwi.wsdot.wa.gov/PPSC/Photogrammetry/Default.htm>

12-03 Mapping

When you need mapping, photogrammetric surveys are quick, safe, and economical. Photogrammetric mapping should be requested from the WSDOT Photogrammetry Branch whenever savings in time and/or manpower can be realized, when safety of field surveyors cannot be assured, or when lane closures for mapping would significantly impair traffic flows.

The Photogrammetry Section treats each project as a custom job so that you will get what you need to deliver your project. The nature of the topography, the amount and types of land cover / land use, and your specific needs for coverage and accuracy are some of the factors that the Photogrammetrist considers when designing your mapping job. When you contact the Photogrammetrist, you make a valuable addition to your Project Delivery Team. The Photogrammetrist will meet with you to determine the best way to approach your mapping requirements.

Since design is all computerized now, mapping is done that way too.

Features are recorded in three dimensions (x, y, and z coordinates) and topography is described by using breaklines (to describe a change of slope) and mass points. This data, together with selected 3D planimetric features, are used to make digital terrain models (DTMs), digital elevation models (DEMs), or other engineering products.

12-03.1 Reconnaissance

Reconnaissance mapping should be used where, in the opinion of the engineer, adequate information is unavailable and lack of current data may affect the proper development of a reconnaissance survey.

Photos of 1:24000 scale are commonly used in areas of sparse land use, where the character of the topography is mountainous, where heavily timbered areas restrict more accurate photogrammetric determination of topography, or where it is known in advance that developed areas will not be appreciably altered by proposed routes.

Photos of 1:12000 scale are commonly used in areas of moderate to intense land use, especially in urban areas. Consider this scale where the topography is slightly rolling or nearly level, and more accurate delineation of detail would be necessary.

The existing geodetic control is used, and additional ground control is usually necessary as well.

12-03.2 Location Design

Location design mapping is performed to furnish the engineer sufficient data to produce the best location for the highway and to aid in the preparation of detailed right of way plans. The aerial photography obtained at this stage will provide a record of conditions prior to construction.

Design mapping is a detailed and accurate survey of the important factors that affect the position, physical characteristics, and geometric design of the highway route.

A flight scale of 1:3000 is usually best for this need. When topographic design mapping is specified and the map sheets are also to be used as right of way or construction plans, the CADD system allows the user to eliminate details not needed on a particular plan sheet or exhibit.

For bridge site maps, refer to the *Design Manual* Chapter 11.10 for the appropriate map scale.

Horizontal and vertical mapping accuracy is directly proportional to the scale of the photograph. The number and placement of photo control points also affect photogrammetric mapping accuracy. Weather conditions at the time of flight and the season of the year have significant effects as well, since sun illumination angle and atmospheric factors affect the quality of the photo image. In areas where the ground is obscured by timber or other dense vegetation, photogrammetric design mapping cannot ordinarily be accomplished to the degree of accuracy required. Approximate ground form lines can be determined. Use field surveys to get the precise data needed to supplement the approximate contours. It is advised to contact the WSDOT Aerial Photogrammetry Department during the planning phase of your project to coincide Photogrammetry accuracy to project needs.

If you need preliminary cross section data and there is a safety problem, a centerline may be developed photogrammetrically from the existing painted stripes.

12-03.3 PS&E

Photo scale of 1:3000 or larger is needed in order to get data accurate enough to be used for construction quantities.

Photogrammetrically generated data are especially beneficial in areas of rough terrain or where heavy traffic could be a problem for field crews. However, some fieldwork may be necessary for data points not visible in the photos. In areas of heavy vegetation, photography should also be obtained after clearing and grubbing.

Controlled aerial photos can be used to update plans for existing conditions (as-builts). The photography taken at this stage will be particularly valuable if questions or disputes should arise after construction because it will show the conditions prior to any construction work.

The digital terrain model is used primarily for road design, but contours may also be generated by using CADD or GIS software.

12-04 Photography

Aerial photography with proper ground control is the basis of a photogrammetric survey. Skilled photogrammetrists use very specialized analytical Digital Photogrammetric Workstations (DPWs) to interpret and make precise measurements of the aerial imagery. The data are recorded in 3D files using WSDOT level playing field (LPF) CAD software.

Aerial photos for mapping or orthophotos should be taken between mid-March and mid-September for best results. The Photogrammetrist on your managing project delivery (MPD) team can explain the many factors to consider in getting photos done at the right time.

Aerial photography and those products derived from it also have extensive use as a visual communication tool for planning, property acquisition, engineering, construction, litigation, and public relations.

12-04.1 Aerial Photograph Section

The Aerial Photography Section uses a special aerial mapping camera to take very precise, high-resolution images on 9 x 9 inch film. The photo lab unit can provide uncontrolled digital image files or hard copy products from the film negatives. Uncontrolled imagery should not be used for measurements.

12-04.2 Aerial Photography

The aerial camera has a variety of lenses and filters for capturing images for different purposes. Vertical aerial photography for mapping can be taken at scales from 1:1200 to 1:64000, and oblique photography from 1,000 feet to 30,000 feet above sea level. Photos can be grayscale, color, or color infrared.

Photo scale is like map scale. On a large-scale photo, objects appear large. On a small-scale photo, objects appear small, but more area is shown. Photo scale is a function of flying height and camera lens focal length.

12-04.3 Print Mosaicking, Mounting, and Framing

Enlargements and special display mounting, framing, and laminating are available as well.

Photogrammetry

12-04.4 Placing An Order

Use the Aerial Photography and Lab Service Request form (DOT 350-148) or the Photogrammetry request form (DOT 274-015A). The forms are available electronically or in hard copy. Mail routine requests to the following address:

WSDOT Geographic Services
PO Box 47384
1655 South Second Avenue
Tumwater, WA 98504-7384

Send urgent requests by email, or Fax 360 709 5599.

12-05 Field Surveys

Survey telephone (360) 709-5530.

Ground control for photogrammetric surveys is different for every project. The Photogrammetry and Geodetic Survey sections will design the specifications and set the parameters for ground control on your project.

Assistance in placing control points, methods of placement, training of personnel, location of known points, accuracies required, and any other help needed to assure a quality product are available from the Geographic Services Office.

Coordinates and elevations for WSDOT mapping must fit in the departmental GIS database along with hundreds of other data layers. Therefore, mapping work is done in State Plane Coordinates, North or South zone, depending on location. The horizontal datum must be NAD83/91, the vertical datum NAVD88, and units of measure US Survey feet. A new datum adjustment is expected in 2003 or 2004 and will become the new standard when adopted by the agency Survey Committee. Most of the state is now covered by a high accuracy reference network (HARN) of monuments. The Geographic Services website has links to the monument database.

12-05.1 Premarking

Contact the Photogrammetry Section for a ground control layout designed for your specific project. The proper placement of photo targets prior to aerial photography improves map accuracy. The overall distribution of points and the specific location of each point must be determined by a Photogrammetrist in order to get the optimum accuracy/cost balance for your mapping project.

The size, shape, spacing, and material used for premarks are determined by the photography scale, film type, weather conditions, season, and type of terrain on which the targets will be placed.

12-05.2 Establishing Control Photogrammetrically

In many instances, it is impossible for field crews engaged in establishing control surveys to reach certain areas due to topography or accessibility. To overcome these situations, equipment is now available to assist the field engineer in obtaining additional control data.

By using a digital photogrammetric workstation (DPW), horizontal and vertical positions of desired points (preferably premarked) can be measured from controlled aerial photos. This method is particularly useful in determining the positions of section corners, property lines, property corners, or any other existing features, which are identifiable on the photograph.

Another useful feature of this method is the establishing of horizontal and vertical positions of premarked control points or other identifiable features, which may surround an area of heavy vegetation. These can then be used by the engineer to accomplish field completion in areas not covered by the photogrammetric mapping.

12-06 Programming

This can be summarized in two words. “order early.” The best time to contact the Photogrammetry Branch is during scoping. Include mapping, photographic products, and control in the initial programming of a project to insure that you get a schedule and budget that works. Ask a Photogrammetrist to participate on your project delivery team to provide estimates and technical advice on mapping.

12-06.1 Mapping

Some of the first things you need to know when you establish a mapping schedule are: map accuracy requirements, length of project, mapping widths, type and scale of mapping, priority areas, and the latest date delivery can be accepted.

12-06.2 Photographic Products

Aerial photos are useful for many purposes, but the photo flight mission for “just plain pictures” is very different from the mission to obtain photos for mapping or orthophotos (true scale photos). Your photogrammetrist team member will keep you advised on these important matters.

12-06.3 Field Surveys

Do your programming for geodetic or control surveys during your project scoping.

When you request a control survey, send a sketch (diagram) of the proposed work to the Photogrammetry Branch. This plan should indicate the known existing control stations, proposed primary and supplemental control stations to be established, and tentative mapping limits. Information about existing monuments and necessary new ones should also be included.

12-07 Procedures for Ordering

Send all requests for photography, mapping, and related items to the Geographic Services Office. Be aware that the department has an approved group of private on-call firms that are selected by the legally required qualification based system (QBS). These firms are supervised and overseen by the Geographic Services Branch. Your project team need not take on the extra work and responsibility of managing private mapping consultants on your own.

See section 12-04.4 above for forms information.

