

SUBJECT: Survey and Topographic Mapping Status Summary
DATE: February 4, 2014
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Primary Control. Primary control for the Columbia River Crossing (CRC) Project was established in 2005 by WSDOT Geographic Services from GPS and digital level data. The control network report is titled "SR 005 Vancouver Photo Control". WSDOT made considerable efforts to resolve discrepancies including running levels as far as the Steel Bridge in Portland.

Aerial photo control was established by WSDOT Geographic Services in Washington and by ODOT in Oregon from the primary control. Aerial control monuments were typically P-K nails in pavement.

Aerial Mapping. Aerial mapping and digital orthophotography were provided by WSDOT in 2005, using both WSDOT and contract photogrammetrists. (At least one match line discrepancy between photogrammetrists was reported and corrected.) A strip about 1,000 feet in width was mapped along the Project corridor. Well-defined visible points in the digital file (such as points within unobscured pavement areas) were specified to be accurate within 0.1 meter of true ground position at the 95 percent confidence level. Additional mapping for a corridor about 0.5 miles wide on each side of I-5 was provided by higher altitude WSDOT photogrammetry. This mapping was intended primarily for orthorectification of digital photography.

Coordinates. The Project is controlled, mapped, and designed using Local Datum Plane (LDP) coordinates, scaled from Washington State Coordinate System, South Zone (4602) state plane coordinates to closely match ground distances within the project area. The LDP is based on the North American Datum of 1983 (NAD 83/91). The vertical datum is the North American Vertical Datum of 1988 (NAVD88). Horizontal and vertical coordinates are in U.S. Survey feet (defined as 1 meter = 39.37 inches exactly). To convert to or from Project LDP coordinates:

- $LDP\ Coordinate = State\ Plane\ Coordinate / 1.0000576$
- $State\ Plane\ Coordinate = LDP\ Coordinate \times 1.0000576$

Careful identification of project coordinates and use of check shots is recommended. The LDP factors are near 1.0, so LDP coordinates resemble Washington State Plane coordinates (the difference is a little over 30 feet). Surveyors working in Washington may be used to seeing ground coordinates truncated per WSDOT standards. Oregon surveyors may not be accustomed to using U.S. Survey foot units. The system was established using a combination of standard practices from each state.

Primary Project Control. Starting in August 2008, DEA established permanent project control based on the WSDOT primary control, using GPS, total station, and digital differential leveling equipment. Newly set monuments were 2-inch aluminum caps (marked "CRC CONTROL" and stamped with the point number) on 5/8" x 30" iron rods set in concrete (typically 8" diameter by one foot deep). New monuments set in existing concrete were 1-1/8" brass caps with the same marking and stamping. The network was adjusted using StarNet software. Control information is recorded in Book 60, Page 36 in Clark County Washington and in Survey Number 63031 in Multnomah County Oregon.

DEA has performed several additions to and readjustments of portions of the control network. For example, several new monuments were established on Hayden Island after mall reconstruction. Control has not been checked for at least a year.

Field Topographic Survey. DEA added to or replaced aerial mapping with topographic data collected using traditional surveying and stationary and mobile scanning methods. Field work was performed at various times between July 2008 and January 2013. Some topographic survey was performed by WSDOT field crews using DEA control in the downtown Vancouver transit area.

CADD Standards. The aerial mapping was originally assembled using ODOT standards, because WSDOT standards were not available for the Project version of MicroStation. They were then converted to the new WSDOT standards when available. It has been proposed that the mapping be converted to ODOT drafting standards, but that work has not yet been authorized. It is my understanding that ODOT has standards only for the versions of MicroStation before and after the current Project version.

DTMs. DTMs were developed for the ground surface in each State, for the underside and top surfaces of various overpasses, and from hydrographic surveys provided by DEA's Marine Services group. We experienced computer crashes thought to be linked to "smart" features in our large DTMs. Work on adding "smart" features to our DTMs was resumed, but not completed, so the available DTMs are generic. The Washington DTM was up to date with our surveys; the Oregon DTM was complete except for newly surveyed features near the reconstructed mall.

Confidence Reports. ODOT format Confidence Reports were prepared for many areas and are available for review. Confidence Reports were used as a tool to identify problem areas in interim mapping but were not in general finalized. Check shot points exist separate from the DTM so additional Confidence Reports can be run. In some cases check shots were higher than the DTM surface because of pavement overlays between the original surveys and the check shots. We were directed not to resurvey the repaved areas. Some other relatively minor DTM discrepancies had not been resolved when work was suspended.

Gaps in Topographic Mapping. There are still areas within the Project obscured by vegetation or other obstacles, and/or on private property where access was not obtained and where current mapping will not meet design needs. There may also have been changes due to construction projects since the mapping was acquired. The attached exhibit entitled "Gaps in Topographic Mapping" was intended to highlight some areas within the "Columbia River Bridges and Approaches" design build area that might need to be mapped. I am told that mapping of Area 1 in that exhibit is not needed.

Utilities. DEA initially surveyed utilities as part of our mapping, but starting about November 2011 responsibility for that work was assumed by Utility Mapping Services, Inc. (UMS) as part of their Subsurface Utility Engineering (SUE) services.

Professional of Record. Two DEA professional land surveyors have been consistently involved in the project. Kenneth J. Murto (OR PLS 2461 (1990) and WA PLS 49914 (2012)) has served as project surveyor since July 2006 and he stamped the most recent surveys. I have served as survey task leader since June 2005 (Kristen Rinell Westersund, OR PLS 2164 (1985) and WA PLS 33152 (1996)). If a "Professional of Record" is needed, that would be me for most purposes.

Attachment: Exhibit Map: "Gaps in Topographic Mapping"

File Name: P:\ODOT0000818\0600\INFO\SV\Memos\Topographic Survey Summary.docx