WASHINGTON STATE DEPARTMENT OF
Natural Resources

SRCW
SPATIAL REFERENCE
CENTER OF WASHINGTON

What is Height Modernization?

Height Modernization is the National Oceanic and Atmospheric Administration – National Geodetic Survey (NOAA/NGS) program with the goal of facilitating precise elevation measurements using the Global Positioning System; refining these measurements from 20 cm to 2 cm and improving regional consistency.

Why is this Important?

Quick access to a precise and a consistent elevation framework is important in construction, navigation, remote sensing (Light Detection and Ranging 'LiDAR' and aerial photo surveys), farming, flood mapping, surveying, and engineering. The savings in precise elevation acquisition can be millions of dollars in each state, which can then be better used to further develop our nation's infrastructure.

What is Washington State doing to implement Height Modernization?

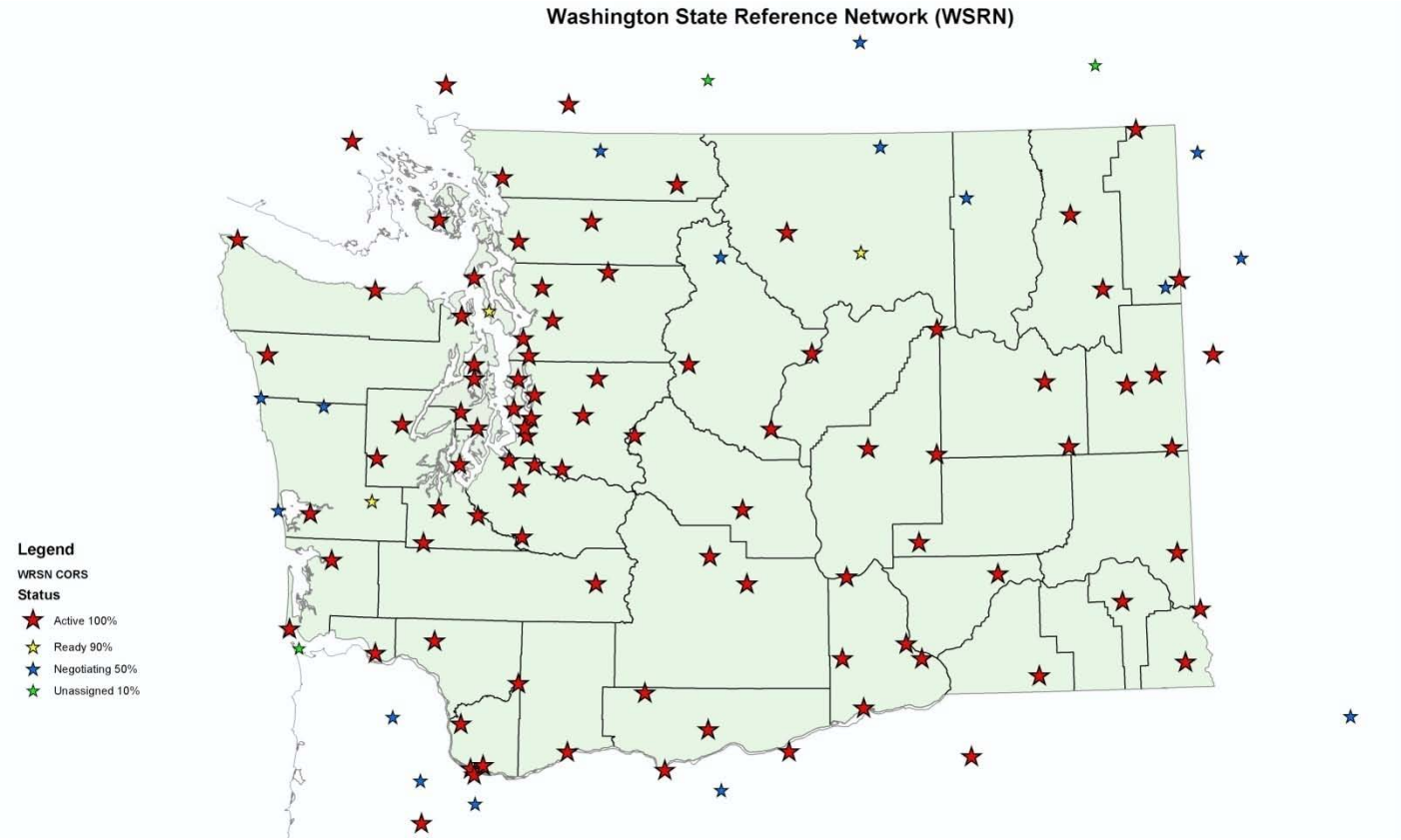
Created a Spatial Reference Center

- The Spatial Reference Center of Washington (SRCW) was organized in 2004 to oversee the funding, development and implementation of geodetic network modernization. The Washington Department of Natural Resources', Geodetic Survey Program was chosen to manage the program, and collaborates with the

SRCW while managing height modernization. NGS grants have been received in FY 2004, 2005, 2007, and 2008.

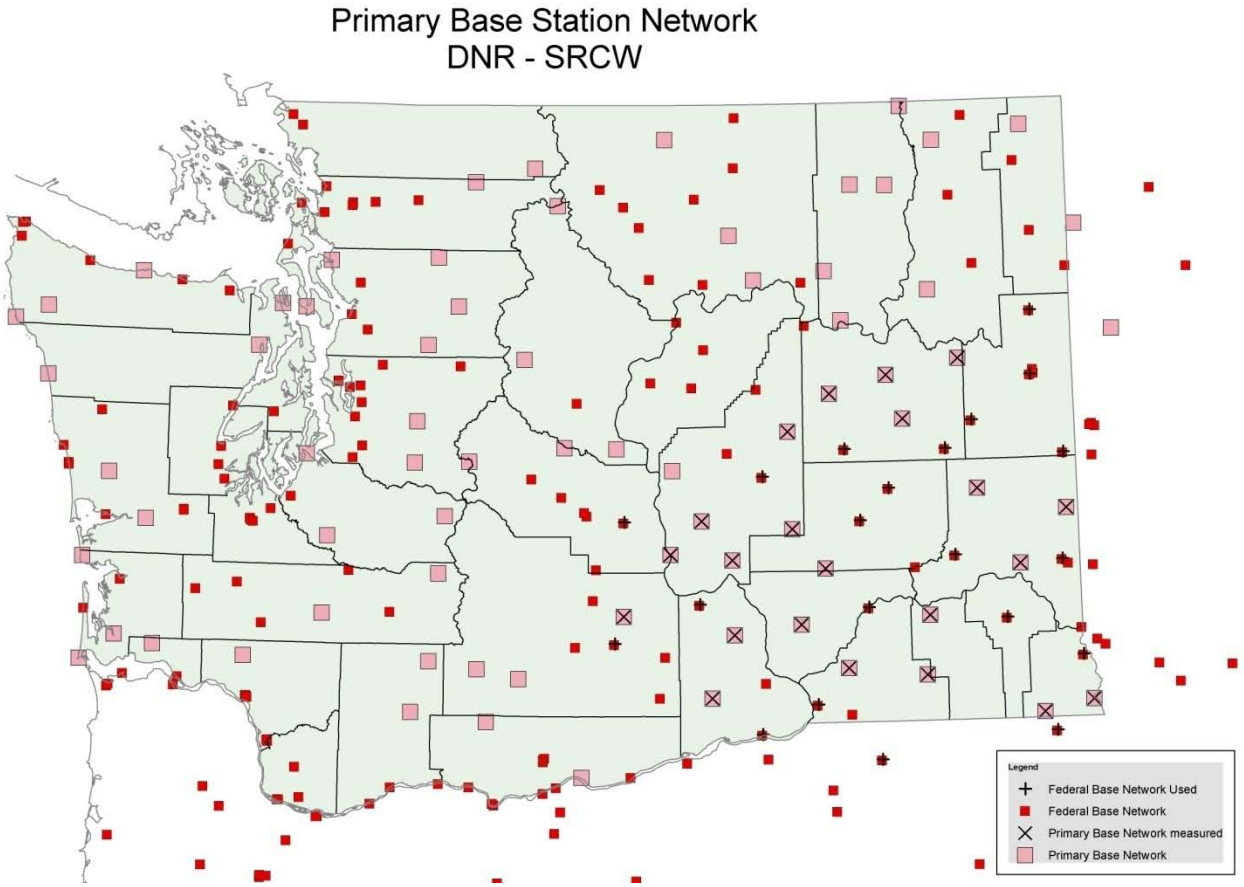
Construct an Active Control Network

- A statewide network of GPS stations or active control network named the Washington State Reference Network (WSRN) has been developed through cooperation with the SRCW. Many state, county, and local agencies and private companies worked together to fund, install, and manage this network of approximately 85 stations. The City of Seattle masterminded this network, along with many partners, and manages the real-time data flow and network integrity monitoring.



Develop a Primary Base Station Network

The existing High Accuracy Reference Network (HARN) in Washington did not routinely include precise ground elevations in the network development. This degrades the quality of Global Positioning System (GPS) ground elevation measurements, especially in areas of significant crustal motion. A supplemental network of monuments called the Primary Base Station Network will be positioned to fill gaps in the current HARN with optimal spacing of 30 km across the entire state. Ellipsoid heights will be precisely measured on 60 existing 1st and 2nd order benchmarks and tied into 45 existing HARN stations, in addition to Federal Continuously Operating Reference Stations (CORS) and WSRN stations. Great care is being taken to improve the WSRN and all of the ground monuments in the network and all will be included in the National Spatial Reference System. The resultant data will allow GPS measurements to be made with relative accuracies less than 20 mm vertically and 5 mm horizontally.

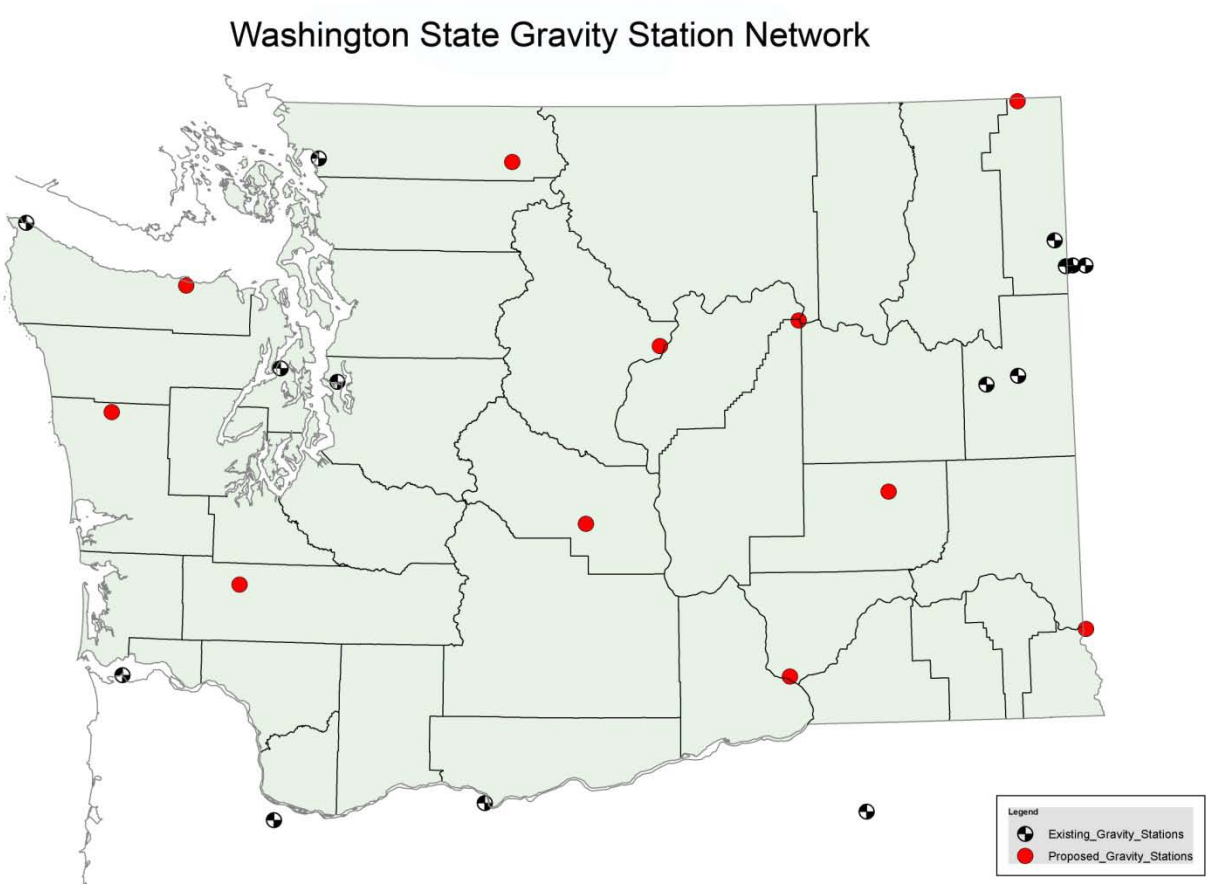


Traditional Leveling

- Precise leveling is necessary in some areas where benchmarks have been destroyed or to establish ground elevations on GPS base station antennas. Over the past few years, we established ground elevations on 15 WSRN stations and found the cost to be significantly higher than implementing the Primary Base Station Network. Both measurements are used to improve the accuracy of GPS measuring ground elevations, but the cost to measure all GPS stations is too high and we have put that project on hold. Regional leveling projects are planned to resolve elevation changes due to crustal motion and to replace some of the destroyed benchmarks in urbanized areas. These projects are extremely expensive and should only be implemented when there are no GPS measurement solutions available. Our measurement experiences on the Primary Base Station Network have shown that precise GPS surveys will be more accurate than traditional leveling and will help detect the elevation differences between multiple leveling lines. Height Modernization is intended to replace most traditional and expensive leveling projects.

Gravity

- NGS has pointed a way to the future elevation datum; a gravity based elevation datum. The program implemented to achieve that goal is called Gravity for the Re-definition of the American Vertical Datum (GRAV-D) and will produce the necessary data to further improve the accuracy of GPS elevation measurements. The new gravity datum will not be available for another decade, so in the meantime, we must improve what we can to achieve similar goals. The GRAV-D program can be aided by local cooperation and Washington intends to measure a network of absolute gravity stations that are spaced approximately 100 km. These will be located near airports to support the aerial GRAV-D survey and are evenly spaced to allow future monitoring of the moving crustal plates across the state.



Contacts

Washington State Dept. of Natural Resources
Geodetic Survey
David Steele, Director
PO Box 47030
Olympia, WA 98504-7030
360-902-1171
David.Steele@dnr.wa.gov

The Spatial Reference Center of Washington
http://www.washington3d.org/

Washington State Reference Network
http://www.wsrn.org/