WA Low Distortion Projections Development Initiative

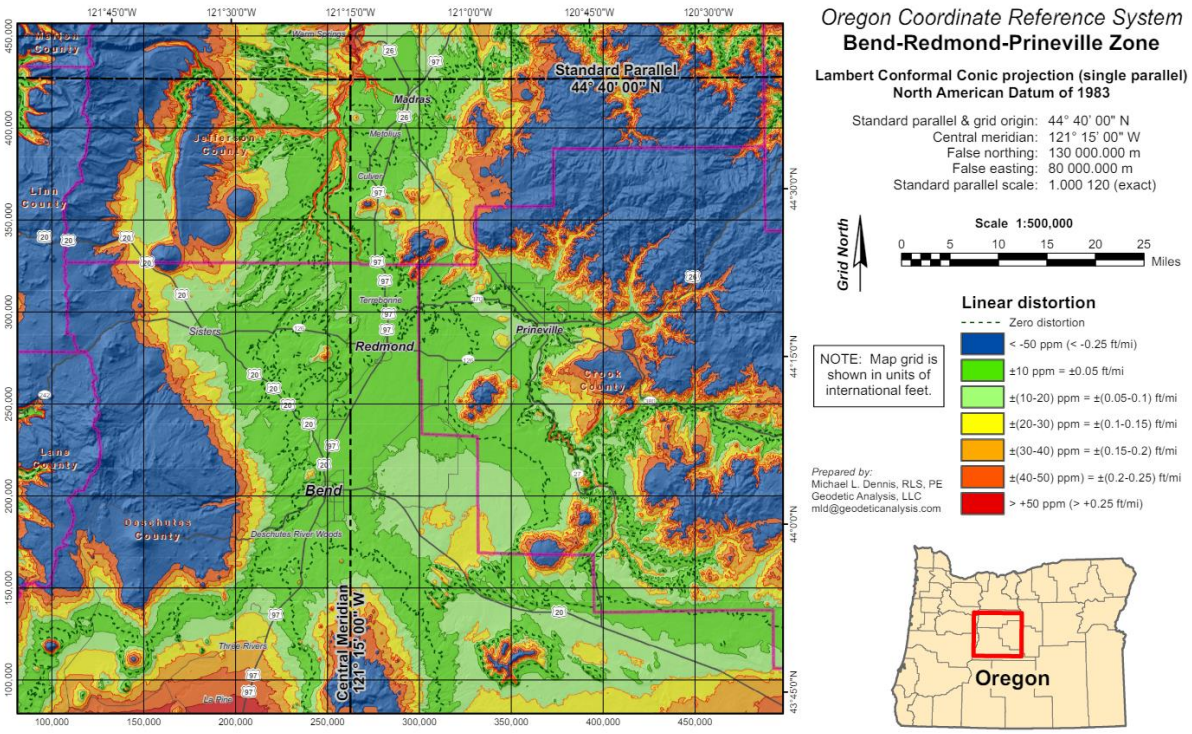
There is a statewide initiative under way to explore the development of Low Distortion Projections for WA. This would supplement the existing two state-plane projection zones, plus a new statewide single zone that will be developed/updated to coincide with the pending National Geodetic Survey update of the National Spatial Reference System (NSRS) slated for the end of 2025 (NATRF2022).

There is an LDP Development Working Group, chaired by WSDOT, comprised of interested parties from the NGS, LSAW, counties, cities, utilities, and private firms.

The working group wants your input on Low Distortion Projections (LDP's) for Washington State. The Working Group hopes to make LDP's available soon after the release of NATRF2022. These projections would not replace the familiar State Plane Coordinate System (though these will be updated for the datum shift). They would simply provide some new options for geospatial professionals in our state.

What is a Low Distortion Projection?
Paper (and digital) maps require projection; the curved surface of the earth is "projected" mathematically onto a planar surface. This always causes distortion, and exactly how much distortion depends on the shape of the terrain, the size of the map area being projected, and the height of the projection surface. Distances and angles would otherwise not match closely between the earth and the map.

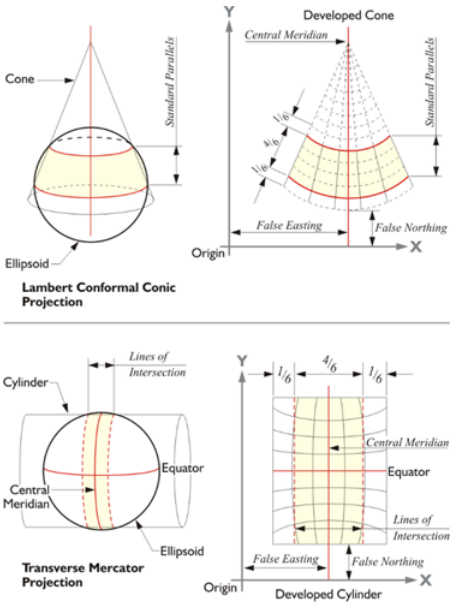
Many of us work daily with State Plane Coordinates, a projection customized for our state and split into North and South zones. LDP's simply extend that idea a little further: instead of two big rectangles covering the state, imagine a few dozen smaller squares and rectangles covering most of the state.



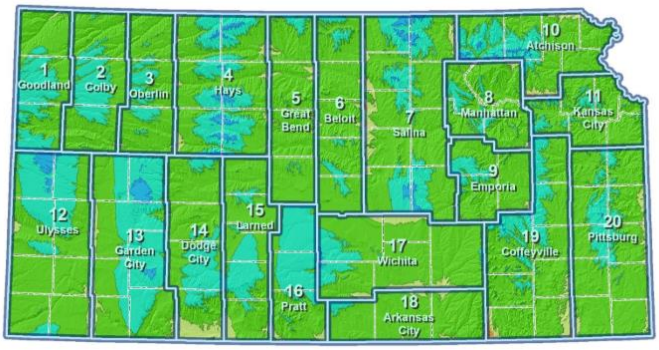
An example of an LDP, as designed and implemented for the State or Oregon

Working in a common projection provides enormous benefits. It not only makes our maps and designs work together, but it ties our work to a national geodetic reference system. The downside of currently available State Plane projections is the distortion present in portions of the state, resulting in significant differences between real world distances and map distances.

One legacy solution is to use a "project datum" or custom local projection developed specifically for your site, but this approach has some drawbacks. The resulting coordinates typically require more than one step of transformation in order to make sense in another datum. The parameters for such a project datum must be entered manually into software and controllers, and those parameters must be preserved in perpetuity in order for the project data to be usable down the line. In some cases, this approach can lead to tedious localization work.



LDPs are designed by using the same types of planar projection as are used for state plane systems. However, they are chosen and refined to fit specific areas of terrain, with different types of vertical relief. For instance, a Transverse Mercator "cylinder" can be fitted to a broad river valley.



In a state like Kansas, where the relief is minimal, LDPs could be designed to encompass one or groups of counties. In WA and OR, while some LDPs might encompass one or more counties in low relief regions, LDPs would need to be designed to fit functional areas of specific relief characteristics.

Benefits of Low Distortion Projections

Simply put, LDP's can mostly eliminate "grid to ground" problems, or the conversion of distances on the map (grid) to distances in the real world (ground).

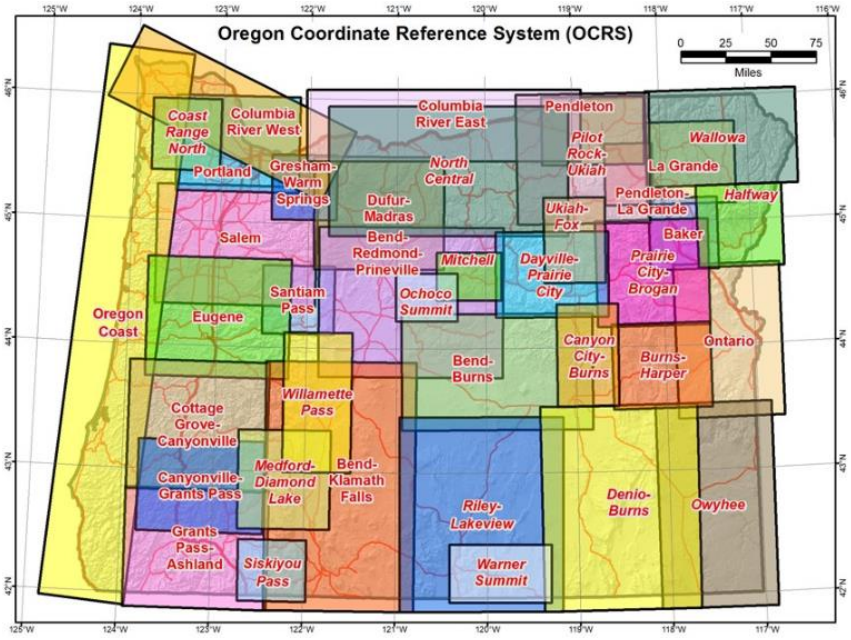
A state-wide system of LDP's created in accordance with NGS guidelines will result in a new "official" set of coordinate systems that will be available in popular field controllers, office survey software, and GIS software.

All SPC and WA LDP coordinates will be directly and easily related to the National Spatial Reference System through the geographic coordinates provided by National and WSRN CORS and other geodetic resources.

LDP's would help close the gap between GIS and surveying data, and allow GIS specialists to make more accurate analyses using modern, high-resolution data such as LIDAR.

Many states have already developed LDPs, and others are in the process of doing so. Once LDPs are developed, the NGS reviews and publishes these. The published definitions are then adopted by manufacturers and added to standard lists of projections in field and office software.

For a look at a well-developed set of state LDP's, check out the Oregon Coordinate Reference System Handbook: https://www.oregon.gov/odot/eta/pages/ocrs.aspx



Oregon, for example, has 39 defined LDPs. These have been reviewed and published by the NGS and included in the standard lists of projections in surveying field and office software, CAD, and GIS software.

Next Steps

Once the working group gathers stakeholder input, the criteria for LDP development would be established. For example: areas of high activity, such as the populated areas of the state and

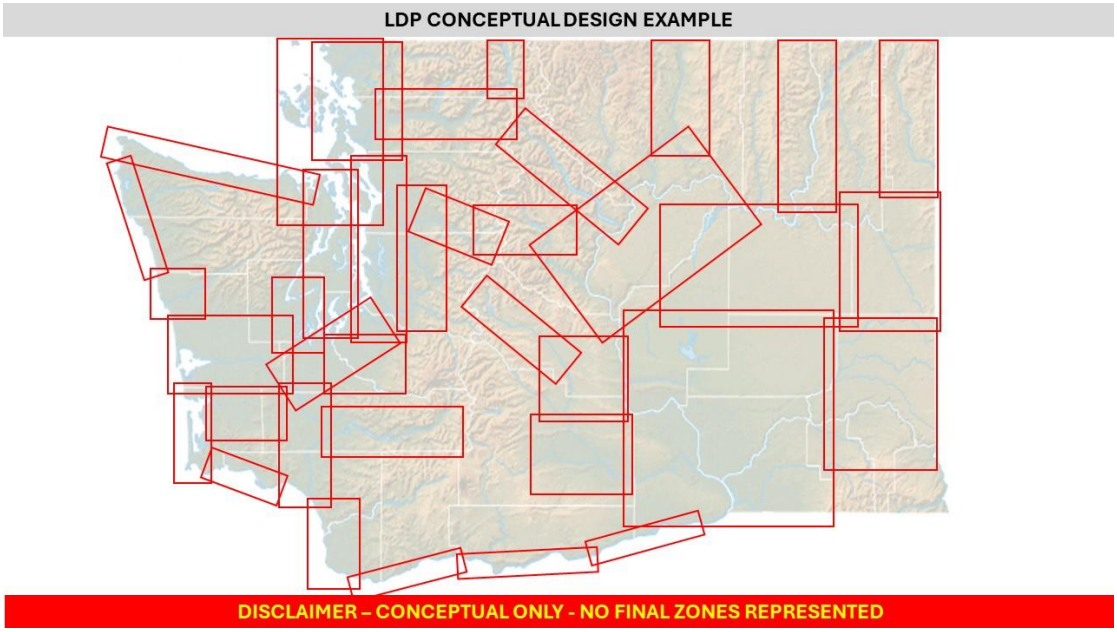
transportation corridors. Plus, targets for acceptable distortion. This is much the same as other states have done.

Then the working group would determine the projected cost of hiring a geodetic consulting firm to develop preliminary LDPs, to be reviewed by the stakeholders. Funding commitments from working group members would be made, and a contract set up.

What do you think?

Tell us what you are hoping for as this project gets under way. What possibilities and challenges do you see? Consider joining the working group and help define design criteria to guide the process. Several entities will be pitching in to fund the development of the LDPs. Even if you are not in a position to contribute funding, we need input from a broad range of potential stakeholders.

Drop us an email with your thoughts: thomas.barger@seattle.gov



As a conceptual exercise only, the graphic above was created from a relief map to look at potential zones. The working group is developing a set of criteria to include in the geodetic consultant contract to inform the design of proposed zones. The consultant will work with said criteria, however, it is the practicalities of terrain that will govern proposed zones. No LDPs will be published without review and acceptance from WA stakeholders and the NGS