

Information concerning Survey Coordinate System

By Dan Smith

Colorado has a standard coordinate system established by the National Geodetic Survey (NGS) and mandated by Colorado state law which is used extensively by CDOT. The coordinate system is the Colorado Coordinate System of 1983 and divides the state into three zones, North, Central, and South, all consisting of a Lambert Conformal Conic projection of the North American Datum of 1983 (NAD 83). NGS refers to the system on a national level as the National Spatial Reference System (NSRS).

You will find the specifics for each zone include in the CRS, including counties, standard parallels and origin coordinates. It is also important to note that Colorado has mandated the U.S. Survey Foot as it's unit of measurement.

Please refer to the following link for each of the following CRS:

<http://198.187.128.12/colorado/lpext.dll?f=templates&fn=fs-main.htm&2.0>

38-52-101. Colorado coordinate system zones defined.

38-52-102. Colorado coordinate system names defined.

38-52-103. Colorado coordinate system defined.

38-52-104. Federal and state coordinate description same tract - federal precedence.

38-52-105. Colorado coordinate system origins defined.

38-52-106. Colorado coordinate system - use of term.

38-52-107. Severability.

All CDOT surveyed projects are tied to the NSRS and reference the Colorado Coordinate System of 1983. This is accomplished by first collecting and post processing survey grade accuracies on control monuments for Latitude and Longitude and ellipsoid height and then converting the Lat/Long to the NAD 83 coordinates and orthometric heights, however.... this is where the common reference between each and every CDOT project ends. Due to the fact that NAD 83 zones are intended to provide state plane coordinates on a grid with an acceptable amount of distortion (1 part in 10,000) the state plane coordinates must be converted to ground coordinates in order to mean anything on the surface of the Earth. The process of converting from state plane to ground takes into consideration (among others things) the difference in elevation (elevation factor), the difference in Latitudes (scale factor), is the project situated more north south or more east west, is the project long and narrow or is it windy and more of a square, and other such physical and geometric features of the project. Once the state plane coordinates are converted to ground coordinates a Project Control Diagram is completed showing all the control monuments, the Latitudes, Longitudes, State Plane Coordinates and other Geodetic data, and the finally Ground Coordinates needed for construction.

CDOT's GIS coordinate system references a Universal Transverse Mercator (UTM). There are two UTM zones in Colorado however GIS only uses one of them, zone 13. CDOT projects can be converted from Lat / Long or state plane to UTM, however, civil designers do not work in GIS, they work with AutoCAD or MicroStation drawings that are referenced to ground coordinates which would require a fair amount of work to convert back to state plane, Lat / Long and then to UTM. The work would be in defining each conversion parameter for individual projects as each project would have to be converted separately.

In conclusion.... CDOT projects have a common coordinate system as described above, that is Latitude / Longitude and state plane coordinates, and they can be converted to other coordinate systems, however project plans (e.g. AutoCAD or MicroStation drawings) and all of the other drawings (such as bridge) are on ground coordinates converted from state plane specific to the project.

I would like to emphasize that what you are proposing to do can be done, however one would have to have a solid understanding of the principles of geodesy and understand how to convert between various coordinate system.

If you are in need of further assistance there are places you can go within CDOT for help, the Survey Activities Committee is probably your best source of survey and geodetic information, there is also the GPS/GIS Users Group, of course you could always contact a region survey coordinator, (Region 4 Mark Guerrero to find out specific project info about I-25 North) however with their time being limited working through a group is probably best.

(Another topic not discussed above that you will need to pay attention to is GPS equipment and accuracies)