Policy: 4420-1- Georgia State Plane Coordinate System
Section: Plane Coordinate System
Office/Department: Office of Design Policy & Support
Reports To: Division of Engineering
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The necessity of relating the horizontal positions of points in one survey to those in another by means of a common system of coordinates has become unquestionably more important in recent years. Modern civil engineering projects have increased greatly in complexity and extent of area covered. The need for higher accuracy and greater precision of surveys has demanded more rigid geometric control. It has been very rare for any one survey to remain independent and isolated from another. This trend has underlined the need of converting existing geodetic positions to plane rectangular coordinates and of computing and expressing the results of horizontal surveys in terms of some standard plane coordinate system.

In the early 1930's, the U.S. Coast and Geodetic Survey (the predecessor of the National Ocean Survey) established a coordinate system for each state in the United States. In designing the state plane coordinate systems, they elected to use the transverse Mercator mapping projection for states whose major dimensions extended north to south and the Lambert conformal projection for states extending primarily east to west. They chose to hold the distortion between the sea level curved surface of the earth and the projected plane to less than 1 part in 10000. Due to the curvature of the earth, this meant that the maximum width of area which could be projected on a single plane surface would be about 158 miles. Thus, the state plane coordinate system of Georgia consists of two zones, and uses the transverse Mercator projection. The datum for the system is the North American Datum of 1927 which is based on the Clarke spheroid of 1866.

The two zones of the Georgia State Plane Coordinate System are the West Zone and the East Zone. In order to minimize scale and angular distortions in the projections to the plane surface, central meridians were chosen as 84º 10' West Longitude and 82º 10' West Longitude for the West and East Zones respectively. The boundary between the two zones was made to follow county lines in order that only one zone would be needed in any one county (see Figure 1).

The planes for the system were defined as being one ten-thousandth of the radius of the earth below the sea level curved surface of the earth at each of the two central meridians. The easting or x coordinate values increase from west to east and the central meridian of each zone was arbitrarily assigned a value of 500,000 feet. The northing or y coordinate values increase from south to north and the intersection of the central meridian for each zone with the 30 North Latitude parallel was given a value of 0 feet. All coordinates for both zones are, therefore, positive.

Both true or geodetic azimuths and plane azimuths were defined as the clockwise angle from the south. Plane azimuths are referred to the central meridian of each plane as the north and south line. Unlike geodetic lines, lines in a single plane coordinate zone having the same plane azimuths are parallel. As the distance of a line from the central meridian increases, the difference between the plane azimuth and the true or geodetic azimuth increases due to the convergence of the true or geodetic azimuth toward the central meridian. In computation involving only plane coordinates, no account need be made of this convergence.

In order to use the Georgia State Plane Coordinate System measured distances must be reduced to grid distances before they are used in traverse computations. After slope distances have been reduced to horizontal distances, a sea level factor must be applied for reduction to sea level and a scale factor must be applied for reduction to grid. The sea level factor depends on the elevation of the area and the scale factor depends on the distance of the area east or west of the central meridian of the zone. (For an

explanation on how to determine and apply these factors, see Figure 2. Tables of Sea Level Factors and Scale Factors are provided in Figure 3.)

The reference library of any surveyor or engineer who performs control surveys or employs the State Coordinate Systems should contain the following NGS and ACSM publications and papers.

1. Coast and Geodetic Survey: **Plane Coordinate Projection Tables, Special Publication Series.** For states where projects will be undertaken.
2. Mitchell, H.C., and Simmons, L.G., 1945, revised 1974, reprinted 1975: **The State Coordinate Systems (A Manual for Surveyors), Special Publication No. 235.**
3. Dracup, J.F., and Kelley, C.F., 1973, reprinted 1975: **Horizontal Control as Applied to Local Surveying Needs.**
4. Simmons, L.G., 1968, reprinted 1975: **Geodetic and Grid Angles - State Coordinate Systems, ESSA Technical Report C&GS 36.**
5. Federal Geodetic Control Committee, 1974, reprinted 1975/1976: **Classification, Standards of Accuracy, and General Specifications of Geodetic Control Surveys.**
6. Federal Geodetic Control Committee, 1975/1976: **Specifications to Support Classification, Standards of Accuracy, and General Specifications of Geodetic Control Surveys.**
7. Dracup, J.F., 1969, revised 1973: **Suggested Specifications for Local Horizontal Control Surveys, Technical Monograph No. CS-1.**
8. Dracup, J.F., 1970: **Standards and Specifications for Supplemental Horizontal Control Surveys.**
9. Mitchell, H.C., 1948, reprinted 1974/1976: **Definitions of Terms used in Geodetic and Other Surveys, Special Publication No. 242.**
10. Tomlinson, R.W., and Burger, T.C., 1971, revised 1975: **Electronic Distance Measuring Instruments, Technical Monograph No. CS-2.**

Some surveyors and engineers contend the State systems are not adaptable to their projects because ground distances are required in laying out structures, etc. This problem, of course, can be generally overcome by projecting the State plane coordinates to the average elevation and correcting for the average scale factor of the site.

Why employ the state plane coordinate systems?

1. No point can ever be considered legally lost since it can be repositioned to original accuracy.
2. All surveys correlated to a single reference framework.
3. Bordering and overlapping mapping project s are consistent.
4. Few blunders will go undetected if two or more coordinated points are used to control a survey.
5. The accuracy of a survey has nothing to do with whether or not the state plane coordinate system should be used.
6. Computational time-negligible! Additional costs are due to field operations necessary to connect survey to points of known coordinates.
7. Provides supplemental identification for property descriptions.

References:

Figure 1 – Georgia East & West Zone map

Figure 2 – Cross-section diagram and explanations of Factors

Figure – Tables of Sea level Factors and Scale Factors

History:

first 2 paragraphs after reference list removed (does not change policy): 08/20/13; added to Manual of Guidance: 1976