# Using State Plane and Project Datum Coordinates

*Prepared by:*
*Perry Semones, P.E.*
*Survey Coordinator*
*Kentucky Transportation Cabinet*
*Division of Design*
*502.564.3280*

KENTUCKY TRANSPORTATION CABINET

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# and
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***A basic approach for relating state plane coordinates and project datum coordinates for projects in Kentucky.***

Prepared by:

Perry Semones, P.E.
Survey Coordinator
Kentucky Transportation Cabinet
Division of Design
502-564-3280

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## GPS Surveying methods becoming more common

Since the Kentucky Transportation Cabinet is now using GPS on a regular basis to control all kinds of projects, the state plane coordinate system is now becoming more in use. In the past it was cumbersome to bring state plane coordinates to a project site because of the distances and the terrain the survey crew had to endure. But now, with GPS surveying methods, obtaining state plane coordinates on project sites is becoming commonplace. Basically, we obtain latitudes and longitudes from GPS. These are then converted to state plane coordinates during the post processing process. It is these state plane coordinates that form our basis for our surveys and mapping. This manual will provide a very simple approach in reviewing and using the state plane coordinate system in Kentucky.

## Why use a state plane coordinate system?

The system provides a common datum for all surveys. In theory, if all surveys were done on state plane coordinates (and done correctly) all property boundaries and highway right of way lines would match without the problems of overlaps and gaps. The system can also provide a real location of where the project is on the earth and therefore can be valuable for GIS (**G**eographic **I**nformation **S**ystems) databases that are becoming more common. The system also provides a more dependable reference for azimuths than the magnetic north and at the same time overcome the problem of converging true north azimuths. Again, use of the system allows for more continuity in the use of surveys for planning by governmental agencies and public utility companies. This leads to greater efficiency in all phases of land use and planning.

Some terms that you need to be familiar with when dealing with GPS and state plane coordinates are listed below:

1) Map Projections
2) Central Meridian
3) Geoid
4) Datums
5) Scale Factor, Elevation Factor, Combination (Grid) Factor, Project Datum Factor
6) Ellipsoid
7) Heights and Elevations

## Map Projections

The earth because of its "roundness" in geodetic terms is referred to a spheroid and uses an ellipse rotated about its minor axis as a mathematical model. This is called the ***ellipsoid***. The means to transform positions on a spheroid to coordinates on a plane are done in the mathematics of map projections. A *projection* is simply a means of transferring points on one surface to corresponding points on another surface. A *map projection* is a projection where one of the surfaces is a spheroid and the other is a surface that can be developed into a plane. Since the earth is round and maps are flat, projections must be used if a map is to accurately depict a significant part of the earth's surface.

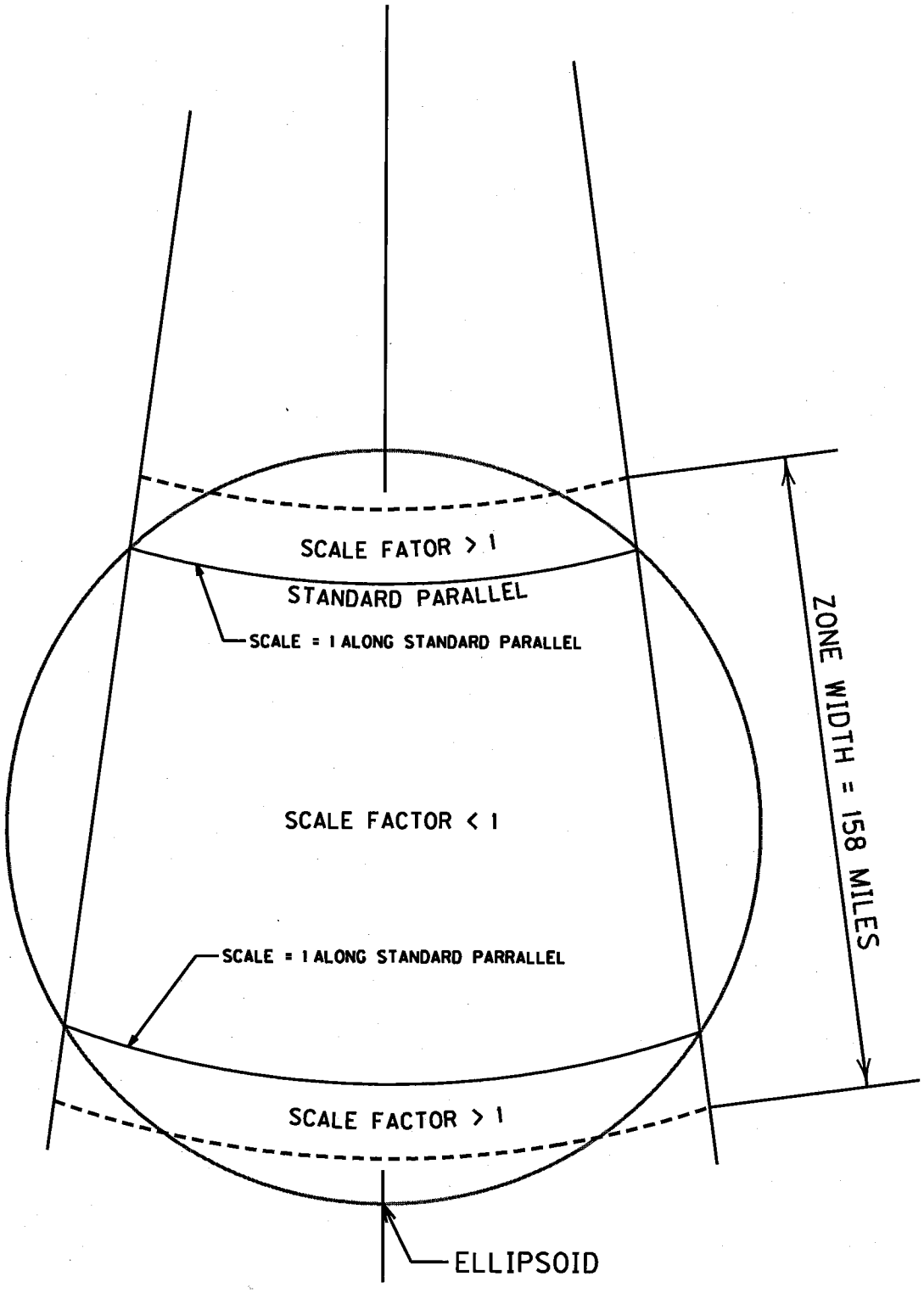
There are many types of projections but the one that we will deal with is called the Lambert conformal conical projection (See **Figure 1**) because this is the projection system that is used for the state of Kentucky. This system is used primarily (but not always) for states that are longer in the east-west direction compared to the north-south direction.

From **Figure 2** you will notice that the Lambert projection for Kentucky contains two *zones,* **North Zone & South Zone**. The boundary between the zones follow county lines for convenience but either zone can be used when you are working close to this area.

Kentucky has also adopted a new zone called the **Single Zone** (See Appendix A). Currently all three zones can be used but may be going to the Kentucky Single Zone entirely in the near future. Some state agencies are already using the Single Zone exclusively.

## Central Meridian

Also from **Figure 2** you will notice that each zone contains a *Central Meridian.* This meridian or longitude line is placed near the middle of each zone. At the intersection of this meridian and a chosen standard parallel (latitude line) is referred to as the origin for each zone. For the North Zone the origin coordinates are Northing 0.0 and Easting 500,000.00. For the South Zone the origin coordinates are Northing 500,000.00 and Easting 500,000.00. These are just arbitrary coordinates assigned by NGS when the NAD83 system was developed. Be aware that these are metric coordinates.




# CONFORMAL CONICAL PROJECTION

## (LAMBERT PROJECTION)

FIGURE 1