For example, if we need to define a point in Louisa, Virginia, the latitude can be defined as the angular difference between that point and the equator as shown in **Figure 10-I**. Similarly, the longitude can be defined as the angular difference from Greenwich, England, as shown in **Figure 10-J**. This point would be defined as 38^{O} North latitude and 78^{O} West longitude. This would relate our point in Louisa, Virginia to any other point on the surface of the earth. This is a very precise and universally accepted method of defining positions on the surface of the earth. However, while the system of geodetic coordinates is precise, the computations associated with them are unnecessarily complex when one is dealing with a relatively small area on the face of the earth, and it becomes expedient to establish a simpler model of the earth while still maintaining acceptable accuracy. This can be accomplished by utilizing the VDOT State Plane Coordinate System, which is based on NAD83 coordinate values.

This plane coordinate system allows the use of relatively simple theories and formulae of plane geometry and trigonometry used by surveyors since the beginning of history for the measurement of land and structures on the earth's surface.

The interstate highway system that we enjoy today is one of the prime contributing factors to the establishment of the Virginia State Plane Coordinate System and similar systems employed by all the other states in the United States. State and Federal engineers agreed that plane coordinate systems would be established to allow accurate surveys to be performed, which with the proper corrections applied, would be accurate, nationwide. In addition, the various zones in these systems would be small enough so that if no corrections were applied, positional accuracy within the respective zones would exceed 1 part in 10,000.

Sec. 10.09 **Depiction of Two Coordinate Zones**

Figure 10-K is a graphic representation of the State of Virginia showing the two coordinate systems. Refer to the Virginia South Zone and note that the line intersects the surface of the earth at two points similar to the way the long chord of a curve intersects the P. C. and P. T. of that curve. Likewise, the distance along the line from 36^{O} 46' to Point A would be shorter than the distance along the arc from 36^{O} 46' to Point A. The relationship between these two distances would give us a scale factor to apply to distances measured along the arc to reduce them to distances along the line. At 36^{O} 46' and 37^{O} 58' these corrections would be expressed as 1.0000000 multiplied by the distance measured. As you move to the center of the zone; this factor decreased to 0.9999454. As you proceed South from 36^{O} 46' to the North Carolina line, the correction increased to about 1.0000464. You will note that this variation from high to low gives a possible difference in 1000 feet of 0.10 feet, which was the required accuracy for the coordinate system. This basic idea holds true for the Virginia North Zone.

Sec. 10.10 **Relation of Grid North and True North**

All lines or meridians of longitude run through the North and South Pole. Therefore, they cannot be parallel. The central meridian for the State of Virginia is 78° 30' West longitude for both the North and South Zones. This means that throughout both zones grid north is exactly parallel to the 78° 30' West longitude, central meridian. The angular difference between the true north and grid north is called the θ (theta) angle. **Figure 10-L)** shows this graphically.