

## **HR-316 Maximized Utility of the Global Positioning System**

**Key Words:** GPS, Ashtech, Photogrammetry

### **ABSTRACT**

The Ashtech XII GPS receivers in this project were studied in static, pseudo-static, kinematic, and pseudo-kinematic modes. In order to maximize the utility of GPS, four projects were undertaken: Campus, Des Moines, Iowa, and Mustang. The Campus project shows that, for points within a radius of one mile, the GPS and the method of collocation can determine the elevation of points with an accuracy of  $\pm 2$  mm. The Des Moines project shows that in an area approximately five miles long, GPS and the method of collocation yields elevation of points with an accuracy of about 3 mm, provided that control points are established along the direction of the project. Accuracy of elevation within  $\pm 0.6$  m can be obtained for points within a 100-mile radius by using the gravimetric method of determining local undulation. This is demonstrated by the Iowa project.

According to the findings of the Mustang project, for improved accuracy in planimetry and azimuth, a separate adjustment by constraining the known azimuth yields an azimuth accuracy of about 211 and two dimensional position accuracy of 5 cm. The Mustang project also shows that for points within 30 miles, vertical accuracy of less than 10 cm can be achieved by using GPS data, the Geolab adjustment program, and the method of collocation.

This research also shows that the gravimetric method of computing local undulation is both time consuming and tedious. The method of collocation for determining local undulation is less time consuming and is also suitable for highway applications. Both Geolab and the collocation method are project oriented. The Iowa DOT personnel were trained to use the GPS and worked along with the ISU research team in all four projects. The use of GPS in photogrammetry is promising and requires further investigation.