

13th COTA International Conference of Transportation Professionals (CICTP 2013)

Economical Applications of GPS in Road Projects in India

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Abstract

The Global Positioning System (GPS) is a satellite based navigation system made up of a network of 24 satellites placed into orbit by U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, they made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. Therefore it has become a widely deployed and useful for commerce, scientific uses, tracking and surveillance. GPS's accurate time facilitates everyday activities such as banking, mobile phone operations and even the control power grids by allowing well synchronized hand-off switching. In general GPS applications are realized in following:

- In Air – navigation by general aviation and commercial aircraft
- At Sea – navigation by recreational boaters, commercial fishermen, and professional mariners
- For Surveyors – cost saving by drastically reducing setup time at the survey and providing incredible accuracy

All above applications employ the service of 4- satellites in the orbit at any point of time. In this paper a new method is suggested for which, software is being developed to get the GPS outputs making use of data from a single satellite. The software is known as 'Geomatic Engineering Application software'. Its use will bring saving of hiring time of 3- satellites, therefore it would cut down the financial implication to a large extent in any project. GPS application in Road projects is discussed herein with this new concept.

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Selection and peer-review under responsibility of Chinese Overseas Transportation Association (COTA).

Traversing; Globematic Science; Geomatic Engineering; Road Surveys; Geometrical figures; Global Positioning System (G.P.S.)

1. GPS Application in Current Practice

There are 24 satellites that make up GPS space segment Fig.1. All the satellites are orbiting the earth about 20,000 km above us. They are constantly moving, making 2 complete orbits in less than 24 hours. These satellites

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are travelling at speed of 11,500 km per hour. They are powered by solar energy. They have backup batteries on board to keep them running in the event of a solar eclipse. Small rocket boosters on each satellite keep them flying in the correct path. GPS receivers take information and use triangulation to calculate the user's exact location. Essentially a GPS receiver compares the time of transmitting a signal to the satellite with the time it receives signal from it. The time difference tells the GPS receiver position. The mathematical principle called trilateration requires distance measurements from few more satellites to determine the user's position and display it on the unit's electronic map. A GPS receiver's job is to find out the distance to each of the satellites and use this information to deduce its own location. Finally the location of GPS receiver is calculated in terms of latitude, longitude and elevation.

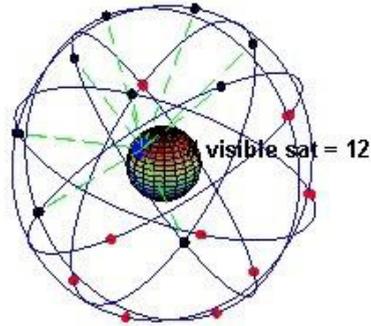


Fig.1. GPS – the space segment of US satellites

In order to make simple calculations the GPS receiver has to know following data:

- The location of at least three satellites in the space
- The distance between transmitting point and each of the 3 satellites
- The GPS receiver provides two information by analyzing high frequency, low power radio signals from GPS satellites (see Fig.2.)

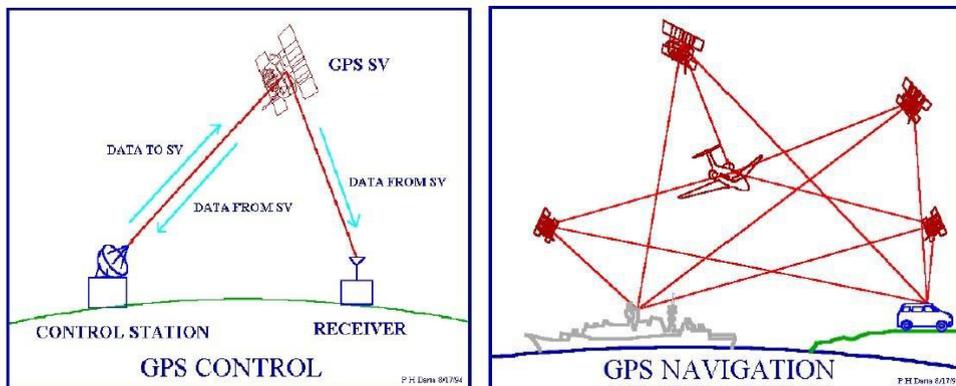


Fig.2. GPS – Principle of working

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