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**COURSE TITLE: ENGINEERING SURVEYING II**

**COURSE CODE: CVE 301**

**DISCUSS THE BENEFITS OF GPS OVER OTHER FORMS OF EQUIPMENT FOR MEASURING.**

**(1) Highly Accurate and Fast Process**

The GPS technology supports the surveying process by providing data with highest accuracy due to the multi-channel design. This equipment is also faster when compared with conventional surveying equipment.

Because the data collection process is faster, the time for getting final results and making decisions is understandably shorter and all of this is done with the minimum chance for mistakes which are not uncommon with conventional methods, as is the example with the use of the limited line-of-sight, for instance.

Despite all the painstaking traditional work, a single mistake would be enough to impact the whole project without ever being discovered. With the application of GPS in land surveying this is no longer the case and as a result, it improves the quality of work. It's no surprise the surveying and mapping community registered an immediate increase in productivity upon adopting GPS surveying methods.

## **(2) Time, Cost and Labor-Saving Technique**

The traditional and conventional surveying can be a very costly and time-consuming process, to say the least. In the past, surveyors had to make several visits to one site in order to use each and every piece of equipment, going step by step to gather accurate data.

This advanced GPS surveying reduces both equipment and labor that was once required for completion of a surveying task thus it's a preferred option if you want to reduce costs altogether. Nowadays, a single surveyor can complete all the tasks in one day, something that took a whole team to do in a longer period in the past.

Moreover, given that there's wiser use of the resources it's safe to say it contributes to sustainability too. Along with this, despite the complexity of this new technology it's still created to be user-friendly, meaning the additional advantages of GPS are lesser needs of highly trained crews since even less trained operators can do the job.

## **(3) Not Affected by Weather Conditions**

Another huge benefit is that the GPS surveying is not affected by weather conditions like snow, rain, high or low temperatures. Unlike the traditional surveying techniques, the GPS surveying is not affected by constraints such as the line of site visibility between the survey locations.

## **(4) Portability**

It's necessary to point out the reduction of weight in this kind of survey equipment which certainly comes in handy when one has to pack up and get going to the site where surveying ought to take place. Before, when all sorts of equipment were required, all the weight was certainly slowing the process down.

Then of course, there was the risk of damaging it, something you won't have to worry about with the latest GPS devices, designed to be of quality and provide longer use. Best of all is their design keeps decreasing, though not at the expense of efficiency or price!

## **(5) Location and Area Size**

As can be seen with the surveying of the waterways and the coasts, even with few land-based points you can still collect data and carry out the process properly. Since it's the kind of technology that allows for accurate work over long distances, there's no need to keep relocating the base unit to be able to perform a survey at remote areas, something unimaginable years ago. In other words, the amount of operational limitations is significantly reduced. On the plus side too, regardless of the size of the area, it can be even a large one, the level of accuracy remains the same with GPS technology.

## **(6) Economic Gains**

As mentioned, the adoption of these techniques brings about numerous benefits of GPS, among which the reduction of costs but it's important to note the economic gains go way beyond this, considering the improvements in productivity thanks to GPS applications and GNSS in general in surveying, asset mapping, machine guidance, mining, agriculture and automation of operations brought to an increase in the Australian GDP, adding between \$2.3 billion and \$3.7 billion in 2012. It's projected that this amount is going to increase significantly as of next year, thanks to the increased use of this technology, its contribution expected to reach between \$7.8 billion and \$13.7 billion.

All in all, the ongoing modernization and development of the GPS technology as well as its connection with other techniques will make the GPS surveys even more useful and widely adopted worldwide in the near future.

The position information is three dimensions that is, vertical as well as horizontal information are provided.

Its an all-weather system available twenty-four hours a day.

Some errors include

(i) **Clock stability**

GPS depends on accurate time measurement. GPS satellite carry rubidium and cesium time standards that are usually accurate to one part in  $10^{12}$  and one part in  $10^{13}$  respectively, while most receiver clocks are accurate by quartz standard accurate of one part in  $10^8$ .

(ii) **Selective Availability (SA)**

this is the process applied by the US department of defense to the GPS signal. This is intended to deny civilian and hostile foreign powers from getting full accuracy of GPS by subjecting the satellite clocks to a process known as Dithering, which alters their time slightly.

(iii) **Anti-Spoofing(A/S)**

this is similar to SA and its intended to deny civilians access to the P-code part of the GPS signal thereby forcing then user to use the C/A code which has selective availability applied to it. A/S encrypts the P-code into a signal called the Y-code, only user with military GPS receivers can decrypt the Y-code.

(iv) **Signal Multipath**

Multipath describes an error affecting positioning that occurs when the signal arrives at the receiver from more than one part. This occurs when the GPS receiver is positioned closed to a large reflecting surface such as a lake, a big rock, or a building, in this case the satellite signal does not travel directly to the antenna but hits the nearby object first and is reflected into the receiver's antenna creating a false measurement. This increases the travel time of the signal, thereby causing errors. This is called Multipath error and it is similar to the ghost effect of a TV receiver.

#### (v) Satellite and Receiver Clock Errors

Even though the clock in the satellite are very accurate to about 3 nano seconds, they do sometimes drift slightly and cause small errors, affecting the accuracy of the position. The satellite clocks are independent of each other, the clocks are made of Rubidium and Cesium oscillators. These oscillators are stable unless frequent tacking does not disturb them and adjustments required is minimum. While GPS time drift is to be kept within one micro-second, the satellite clocks can be allowed to drift up to a milli-second from the GPS time.