

# DGPS SURVEY REPORT

Preparation of shape file and geo-reference map  
For Proposed

## DALBHUMGARH AIRPORT

BLOCK- DHALBHUMGARH  
FOREST DIVISION- DHALBHUMGARH  
(JAMSHEDPUR)

(SUBMITTED UNDER FOREST CONSERVATION ACT 1980)



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## **Certificate**

*This is to certify that the D.G.P.S Survey of forest area proposed to be diverted for non – forestry purpose for development of Dhalbhumgarh Airport under Dalbhumgarh (Jamshedpur) forest division, Block Dhalbhumgarh, District East-singhbhum. Surveyed area 97.166 ha done by us as par the guidelines, and the Co-ordinates of alignment are correct in our knowledge.*

*The work done is as follow:*

1. Survey of demarcation done by using DGPS in RTK mode and fixed up its Ground position and preparation of Geo-referenced Cadastral map.
3. The Geo-referenced Cadastral map prepared using DGPS and superimposed on vectorised SOI toposheet map.
4. Prepared DGPS survey report and soft copy of all above maps in Standard Format and digitized maps in shape file and KML for imported in any GIS database

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# 1. INTRODUCTION TO DGPS

## WHAT IS DGPS AND WHY USE IT?

- **Differential Global Positioning System (DGPS)** is an enhancement to Global Positioning System that provides improved location accuracy, from the 15-meter nominal GPS accuracy to about 50 cm in case of the best implementations.

- DGPS refers to using a combination of receivers and satellites to reduce/eliminate common receiver based and satellite based errors reduce orbit errors reduce ionospheric and tropospheric errors reduce effects of SA eliminate satellite and receiver clock errors

- improve accuracy significantly 100's of meters to meters to centimeters to millimeters

1. DGPS uses one or several (network) fixed ground based reference stations (in known locations).

2. The base station compares its own known location, to that computed from a GPS receiver.

3. Any difference is then broadcast as a correction to the user.

Correction signals can be broadcast either from ground stations, or via additional satellites. These services are privately owned and usually require a user subscription.

### **Examples:**

- Satellite Based Augmentation System (SBAS),
- Wide Area Augmentation System (WAAS),
- Local Area Augmentation System (LAAS),
- European Geostationary Navigation Overlay Service (EGNOS),
- Omni STAR
- Coast guard beacon service.

### **Why do we Need Differential GPS?**

By using DGPS we can improve our positional accuracy from around 1.5m with standard GPS to around 40cm with DGPS, without the need for post processing.

In the case of the road survey van (top right), users can measure the amount of road wear and judge whether the road should be resurfaced just by driving over it. Just one day's driving can replace a month's manual work using traditional methods.

There are many other applications like this. The labour saving is immense but at the same time, previously impossible tasks are made possible such as the prediction of earthquakes before they occur.

## 2. DGPS SUMMARY

- Term refers to simple C/A code differential
- Available on GPS receivers from low cost to high cost
- Produces accuracies from sub-meter to meters
- Many real-time DGPS correction providers - Coast guard, EGNOS, OmniSTAR
- Used for many different applications including marine navigation, precision farming and vehicle testing applications.

### **What is RTK?**

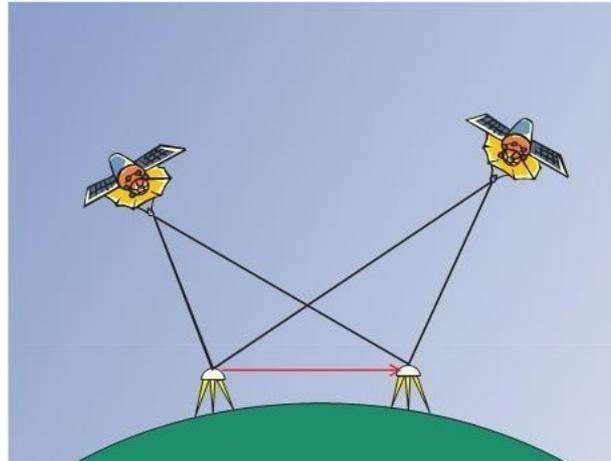
Real Time Kinematic is an advanced form of DGPS which uses the satellites carrier wave to compare 2 observations from different receivers within the system, to fine tune the satellite and receiver clock errors, thus improving positional accuracy.

### **Real Time Kinematic (RTK)**

The GPS signal is made up of 3 distinct components:

- Carrier wave
- GPS Code
- Navigation message

Typical GPS receivers will use the GPS navigation message to calculate its position. RTK uses the carrier wave of the GPS signal, which is 19.02cm long. By counting the number of cycles (and phase of the carrier), the travel time and distance can be measured more accurately.



## **RTK Summary**

- Similar technique as DGPS that uses the carrier phase to provide more accurate positioning
- Cost is higher compared to DGPS receivers
- Produces accuracies from 20 cm to sub-centimeters
- Used for many different applications including machine control (construction, container ports, farming), vehicle testing applications, surveying (land, marine, hydrographic, aerial)

## **RINEX FILE**

The first proposal for the ***Receiver Independent Exchange Format RINEX*** was developed by the Astronomical Institute of the University of Berne for the easy exchange of the Global.

Positioning System (GPS) data to be collected during the first large European GPS campaign

EUREF 89, which involved more than 60 GPS receivers of 4 different manufacturers. The governing aspect during the development was the following fact:

Most geodetic processing software for GPS data uses a well-defined set of observables:

- The carrier-phase measurement at one or both carriers (actually being a measurement on the beat frequency between the received carrier of the satellite signal and a receiver generated reference frequency).
- The pseudo range (code) measurement, equivalent to the difference of the time of reception (expressed in the time frame of the receiver) and the time of transmission (expressed in the time frame of the satellite) of a distinct satellite signal.

- The observation time being the reading of the receiver clock at the instant of validity of the carrier-phase and/or the code measurements. Usually the software assumes that the observation time is valid for both the phase **and** the code measurements, **and** for all satellites observed. Consequently all these programs do not need most of the information that is usually stored by the receivers: They need phase, code, and time in the above mentioned definitions, and some station related information like station name, antenna height, etc. Up till now two major format versions have been developed and published:

- The original RINEX Version 1 presented at and accepted by the 5<sup>th</sup> International Geodetic Symposium on Satellite Positioning in Las Cruces, 1989. [Gurtner et al. 1989],[Evans 1989]

- RINEX Version 2 presented at and accepted by the Second International Symposium of Precise Positioning with the Global Positioning system in Ottawa, 1990, mainly adding the possibility to include tracking data from different satellite systems (GLONASS, SBAS). [Gurtner and Mader 1990a, 1990b], [Gurtner 1994]. Several subversions of RINEX Version 2 have been defined:

- Version 2.10: Among other minor changes allowing for sampling rates other than integer seconds and including raw signal strengths as new observables. [Gurtner 2002]

- Version 2.11: Includes the definition of a two-character observation code for L2C pseudoranges and some modifications in the GEO NAV MESS files [Gurtner and Estey 2005]

- Version 2.20: Unofficial version used for the exchange of tracking data from spaceborne receivers within the IGS LEO pilot project [Gurtner and Estey 2002]. As spin-offs of this idea of a receiver-independent GPS exchange format other RINEX-like exchange file formats have been defined, mainly used by the International GNSS Service IGS:

- Exchange format for **satellite and receiver clock offsets** determined by processing data of a GNSS tracking network [Ray and Gurtner 1999]

- Exchange format for the complete **broadcast data of spacebased augmentation systems** SBAS. [Suard et al. 2004]
- IONEX: Exchange format for **ionosphere models** determined by processing data of a GNSS tracking network [Schaer et al. 1998]
- ANTEX: Exchange format for **phase center variations** of geodetic GNSS antennae [Rothacher and Schmid 2005].

The upcoming European Navigation Satellite System Galileo and the enhanced GPS with new frequencies and observation types, especially the possibility to track frequencies on different channels, ask for a more flexible and more detailed definition of the observation codes. To improve the handling of the data files in case of “mixed” files, i.e. files containing tracking data of more than one satellite system, each one with different observation types, the record structure of the data record has been modified significantly and, following several requests, the limitation to 80 characters length has been removed. As the changes are quite significant, they lead to a new RINEX Version 3. The new version also includes the unofficial Version 2.20 definitions for space-borne receivers. The major change asking for a version 3.01 was the requirement to generate consistent phase observations across different tracking modes or channels, i.e. to apply  $\frac{1}{4}$ -cycle shifts prior to RINEX file generation, if necessary, to facilitate the processing of such data.

The RINEX version 3.00 format consists of three ASCII file types:

1. Observation data File
2. Navigation message File
3. Meteorological data File

Each file type consists of a header section and a data section. The header section contains global information for the entire file and is placed at the beginning of the file. The header section contains header labels in columns 61-80 for each line contained in the header section. These labels are mandatory and must appear exactly as given in these descriptions and examples. The format has been optimized for minimum space requirements independent from the number of different observation types of a specific receiver or satellite system by indicating in the header the types of observations to be stored for this receiver and the satellite systems having

been observed. In computer systems allowing variable record lengths the observation records may be kept as short as possible. Trailing blanks can be removed from the records. There is no maximum record length limitation for the observation records.

Each Observation file and each Meteorological Data file basically contain the data from one site and one session. Starting with Version 2 RINEX also allows including observation data from more than one site subsequently occupied by a roving receiver in rapid static or kinematic applications.

Although Version 2 and higher allow to insert header records into the data section it is not recommended to concatenate data of more than one receiver (or antenna) into the same file, even if the data do not overlap in time. If data from more than one receiver have to be exchanged, it would not be economical to include the identical satellite navigation messages collected by the different receivers several times.

Therefore the navigation message file from one receiver may be exchanged or a composite navigation message file created containing non-redundant information from several receivers in order to make the most complete file.

The format of the data records of the RINEX Version 1 navigation message file was identical to the former NGS exchange format. RINEX version 3 navigation message files may contain navigation messages of more than one satellite system (GPS, GLONASS, Galileo, Quasi Zenith Satellite System (QZSS), BeiDou System (BDS) and SBAS). The actual format descriptions as well as examples are given in the Appendix Tables at the end of the document.

## **BASIC DEFINITIONS**

### Time:

The time of the measurement is the receiver time of the received signals. It is identical for the phase and range measurements and is identical for all satellites observed at that epoch. For single-system data files it is by default expressed in the time system of the respective satellite system. Otherwise the actual time can (for mixed files must) be indicated in the Start Time header record.

### Pseudo-Range:

The pseudo-range (PR) is the distance from the receiver antenna to the satellite antenna including receiver and satellite clock offsets (and other biases, such as atmospheric delays):  $PR = \text{distance} + c * (\text{receiver clock offset} - \text{satellite clock offset} + \text{other biases})$

so that the pseudo-range reflects the actual behaviour of the receiver and satellite clocks. The pseudo-range is stored in units of meters.

### Phase:

The phase is the carrier-phase measured in whole cycles. The half-cycles measured by squaring type receivers must be converted to whole cycles and flagged by the respective observation code.

The phase changes in the same sense as the range (negative doppler). The phase observations between epochs must be connected by including the integer number of cycles. The observables are not corrected for external effects like atmospheric refraction, satellite clock offsets, etc. If necessary phase observations are corrected for phase shifts needed to guarantee consistency between phases of the same frequency and satellite system based on different signal channels.

If the receiver or the converter software adjusts the measurements using the real-time-derived receiver clock offsets  $dT(r)$ , the consistency of the 3 quantities phase / pseudo-range / epoch must be maintained, i.e. the receiver clock correction should be applied to all 3 observables:

$$1 \text{ Time (corr) = Time(r) - } dT(r)$$

$$\text{PR (corr) = PR (r) - } dT(r)*c$$

$$3 \text{ phase (corr) = phase (r) - } dT(r)*\text{freq}$$

### **Doppler:**

The sign of the doppler shift as additional observable is defined as usual: Positive for approaching satellites.

### **Satellite numbers:**

Starting with RINEX Version 2 the former two-digit satellite numbers **nn** are preceded by a one-character system identifier **s**. The same satellite system identifiers are also used in all header records when appropriate.

### THE EXCHANGE OF RINEX FILES:

The original RINEX file naming convention was implemented in the MS- DOS era when file names were restricted to 8.3 characters. Modern operating systems typically support 255 character file names. The goal of the new file naming convention is to be more: descriptive, flexible and extensible than the RINEX 2.11 file naming convention. All elements are fixed length and are separated by an underscore “\_” except for the: file type and compression fields that uses a period “.” separator. Fields must be padded with zeros to fill the field width. The file compression field is optional. In order to further reduce the size of observation files Yuki Hatanaka developed a compression scheme that takes advantage of the structure of the RINEX observation data by forming higher order differences in time between observations of the same type and satellite. This compressed file is also an ASCII file that is subsequently compressed again using the above mentioned standard compression programs.

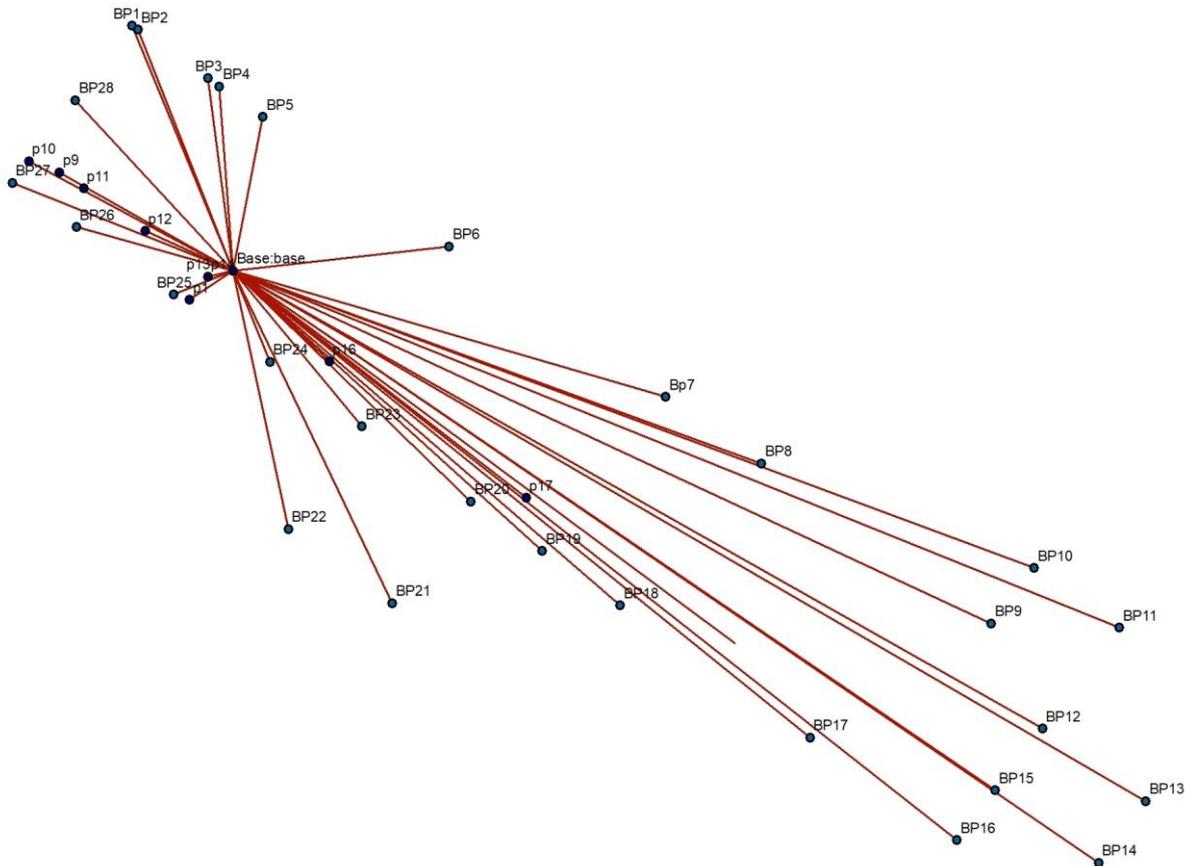
### 3. INTRODUCTION TO SURVEY SITE

The surveyed area is located in Dhalbhumgarh block, East singhbhum district. Brief details of villages are:

S.N.	VILLAGE NAME	THANA NO
1	BURUDIH	387
2	CHARCHAKA	388
3	DEOSOL	191
4	KOKPARA NARSINGHGARH	173
5	RUASHOL	175

### DATA PROCESSING & REPORT

The data was imported in the software, the data taken in RTK mode will display as per below:-



From the above report we will take the coordinate and also check the accuracy of the point. However the normal standard 1st grade accuracy in the survey is 1:50000. We have achieved more than 1:50000 as per the above report.

### **Base Station & survey point**

<b>Point no.</b>	<b>POINT_X</b>	<b>POINT_Y</b>	<b>Longitude</b>	<b>Latitude</b>
Base:base	454985.1773	2490905.918	86.5622743	22.52410635
p1	454901.6221	2490849.065	86.56146345	22.52359055
p9	454651.6505	2491095.893	86.5590257	22.52581368
p10	454592.5778	2491117.739	86.55845066	22.52600945
p11	454698.6018	2491065.322	86.55948313	22.52553876
p12	454816.7032	2490982.679	86.5606339	22.52479532
p13	454937.0835	2490894.331	86.56180698	22.5240004
p14	454937.116	2490894.366	86.56180729	22.52400073
p16	455171.3884	2490730.134	86.56408997	22.52252328
p17	455549.0033	2490465.952	86.56776921	22.52014663
BP1	454791.5305	2491379.898	86.56037777	22.52838302
BP2	454802.1507	2491372.453	86.56048125	22.52831604
BP3	454937.8079	2491278.165	86.56180309	22.52746787
BP4	454959.2823	2491262.299	86.56201236	22.52732511
BP5	455043.1633	2491203.495	86.56282969	22.52679611
BP6	455400.9971	2490952.713	86.56631634	22.52454003
Bp7	455817.6196	2490661.165	86.57037566	22.52191712
BP8	456001.4043	2490532.428	86.5721663	22.52075891
BP9	456443.8553	2490222.326	86.57647706	22.5179689
BP10	456525.5249	2490329.941	86.57726821	22.51894315
BP11	456689.9823	2490214.155	86.57887047	22.51790136
BP12	456541.7845	2490018.876	86.57743485	22.51613348
BP13	456740.4293	2489878.662	86.57937016	22.51487189
BP14	456649.6959	2489759.104	86.57849122	22.51378952
BP15	456451.0511	2489899.317	86.57655591	22.5150511
BP16	456377.8597	2489802.873	86.57584692	22.51417798
BP17	456094.8043	2490001.727	86.57308921	22.51596711
BP18	455729.6065	2490257.642	86.56953114	22.51826952
BP19	455579.7581	2490362.678	86.56807115	22.51921449
BP20	455442.7937	2490458.588	86.56673668	22.52007733
BP21	455291.787	2490261.789	86.56527392	22.51829554
BP22	455091.8565	2490405.538	86.56332584	22.51958887
BP23	455232.8706	2490604.127	86.56469137	22.52138659
BP24	455056.2646	2490729.14	86.56297056	22.52251126
BP25	454871.4428	2490859.552	86.56116969	22.52368448
BP26	454683.9541	2490990.017	86.55934285	22.52485809
BP27	454561.0411	2491076.183	86.55814519	22.52563321
BP28	454682.5168	2491236.225	86.55932182	22.52708222

## 4. SURVEY PHOTOGRAPH



## **DGPS SURVEY REPORT**

Preparation of shape file and geo-reference map  
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