DGPS SURVEY REPORT

OF

COMPENSATORY AFFORESTATION AREA

(REHABILITATION & UPGRADATION TO 2 LANE OF DEWRI – SALDIH- GADPHULJHAR- TOSHGAON- TORESINGHA ROAD , DISTRICT : MAHASAMUND)

Reg. No. FP/CG/ROAD/32638/2018

FOREST DIVISION : MAHASAMUND

FOREST RANGE : BAGBAHARA

NARANGI VANKHAND : CHIKHLI `B`(OA 469)

AREA : 5.534 Ha.

SUBMITTED TO
DIVISIONAL FOREST OFFICER
MAHASAMUND FOREST DIVISION
MAHASAMUND (C.G.)

SUBMITTED BY
PROJECT MANAGER (ADB PROJECT)
C.G. STATE ROAD DEVELOPMENT PROJECT
PWD , BALODABAZAR (C.G.)

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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 10 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 metres to metres to centimetres to millimetres

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.

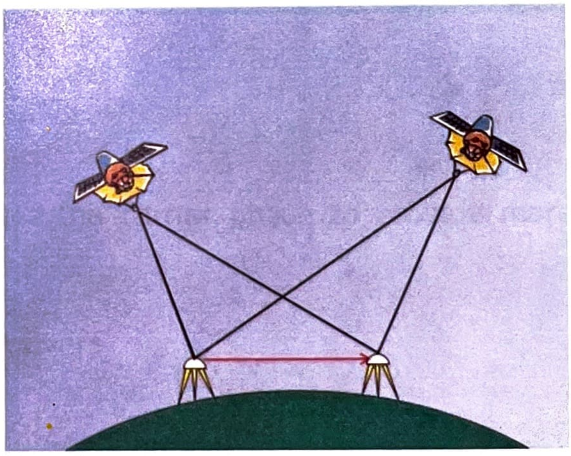
In the case of the road survey van (top right), users can measure the amount of road wear and judge whether the road should be resurfaced just by driving over it. Just one day's driving can replace a month's manual work using traditional

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.

DGPS Summary

- Term refers to simple C/A code differential
- Available on GPS receivers from low cost to high cost
- Produces accuracies from sub-metre to metres
- 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-centimetres
- RTK corrections provided via a local base station or by a private correction provider - OmniSTAR, Leica, Trimble

- 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 use 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 receivergenerated reference frequency).

- The pseudorange (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 stationrelated 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 5th 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 ¼-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 = distance + c * (receiver clock offset –satellite clock offset + 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 halfcycles 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 Time (corr) = Time(r) - dT(r)

2 PR (corr) = PR (r) - dT(r)*c 3 phase (corr) = phase (r) - dT(r)*freq

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

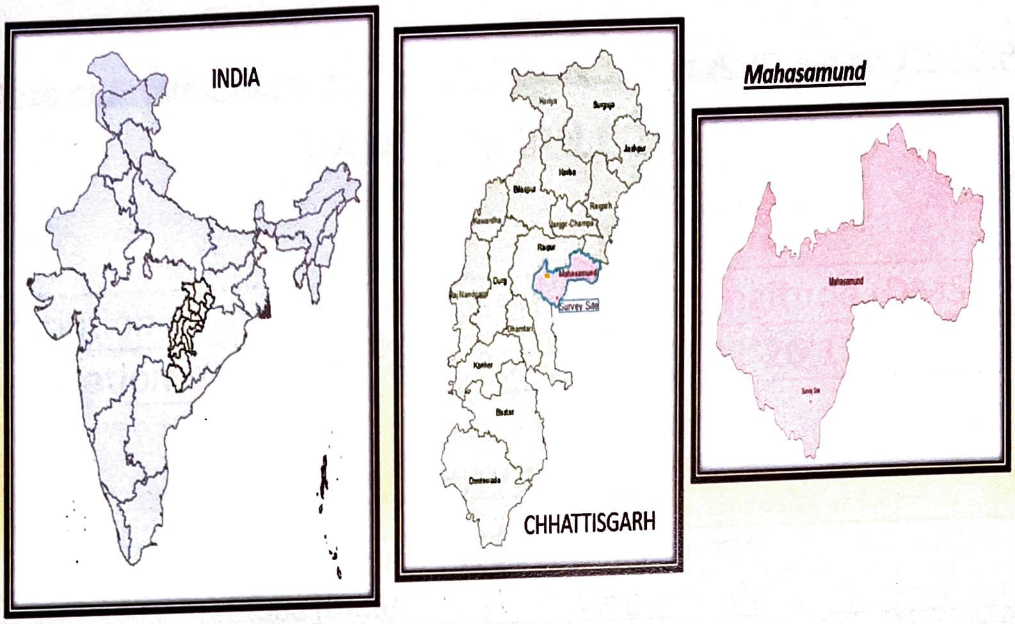
Satellite numbers:

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 MSDOS 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 program.

Location Plan



AREA DETAIL

S. no.	District /Division	Range	Village	Type of Forest	Compartment no.	Area (ha.)
1	Mahasamund	Bagbahara	Chikhali `B`	Orange Area	469	5.534
					Total	5.534

SAN SURVEY ENGINEERING HOOGHLY

Divisional Forest Officer
Mahasamund General Di.

Project Manager
A.D.B. Project
C.G.Road Development Project
P.W.D. Baloda Bazar

COORDINATE LIST

Mahasamund Forest Division
Baghbahara Range

Date of Survey June. 15th to 16th 2021 Time 8:20 AM to 17:12 PM

BASE STATION POINT

Description	Latitude (DMS)	Longitude (DMS)
Base Station	N20°56'51.86"	E82°26'17.61"

DGPS SURVEY POINTS

DGPS SURVEY POINT CO-ORDINATES			
Sl. No.	Latitude (DMS)	Longitude (DMS)	Pillar Id
1	N20°56'52.29"	E82°26'22.11"	P1
2	N20°56'49.92"	E82°26'19.08"	P2
3	N20°56'47.15"	E82°26'15.62"	P3
4	N20°56'45.22"	E82°26'13.31"	P4
5	N20°56'47.64"	E82°26'11.39"	P5
6	N20°56'52.39"	E82°26'11.68"	P6
7	N20°56'53.46"	E82°26'15.99"	P7
8	N20°56'55.60"	E82°26'16.84"	P8
9	N20°56'55.06"	E82°26'20.40"	P9
10	N20°56'54.91"	E82°26'22.82"	P10

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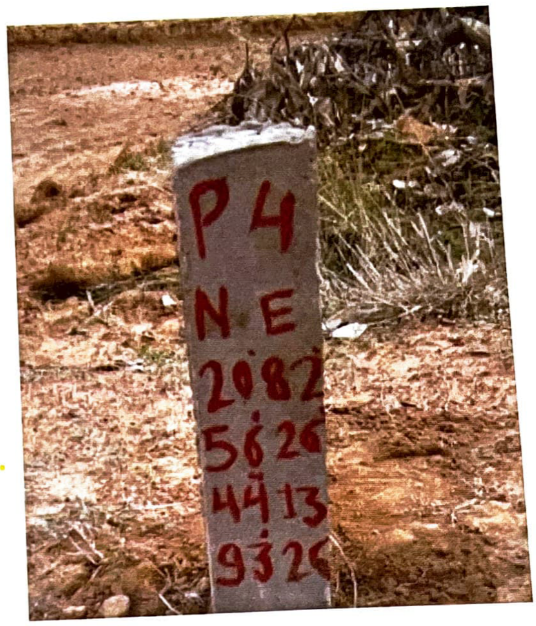
Site Photographs


P33
N E
2082
5626
4715
1562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P7
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56 26
55 16
6 84

P9
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20 82
56 26

P10
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