DGPS / Total Station Survey Report

For

Proposal for Diversion of Forest land For Detailed Project Report for up gradation of Champa-Korba-Chhuri-Katghora Section of NH-149B in the state of Chhattisgarh to two/four lane with paved shoulder configuration (package no. NH/IAHE/09 in the State of Chhattisgarh. Pakage-I (0+00 to 37+000)

Champa Forest Divison (1.673 Ha)

& Korba Forest Division (2.82 Ha)

Total Area- 4.493 Ha

Submitted To

DFO Korba & DFO Champa,

Chattishgarh

Submitted By

भारतीय राष्ट्रीय राजमार्ग प्राधिकरण

National Highways Authority Of India

(Ministry Of Road Transport & Highways Government Of India)

PIU Bilaspur,NHAI

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.

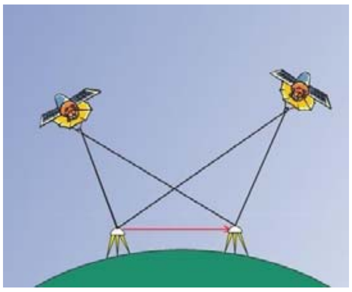
Why do we Need Differential GPS?

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 justby 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

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• 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

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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.

• 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–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

1 Time (corr) = Time(r) - dT(r)

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

Doppler:

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

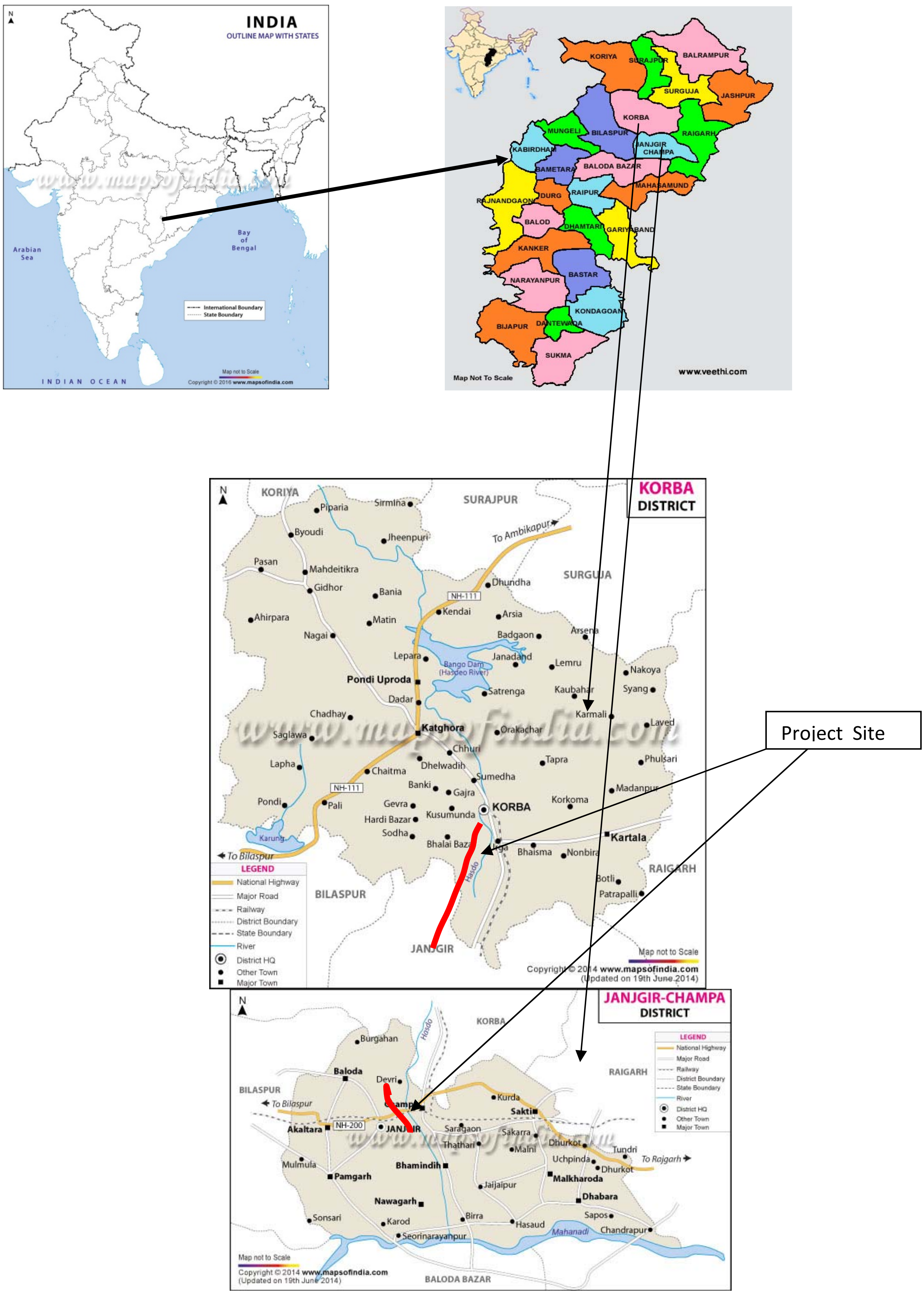
Satellite numbers:

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 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 programs.

Location Plan



Area Statement for Land Requirement for the Project

Details of land Requirement				
District	**Sub District**	**Non-Forest Land. (In Ha)**	**Forest Land (in Ha)**	**Total Area (in Ha)**
Janjgir Champa	Champa	67.552	1.673	**69.225**
Korba	Kartala	67.134	0.300	**67.434**
	Korba	32.413	2.52	**34.933**
	Total Area	**167.099**	**4.493**	**171.592**

Details of Revenue Forest land					
District/ Forest Division	**Sub District**	**Village**	**Khasra no.**	**Revenue Forest Land (in Ha)**	**Total Area (in Ha)**
Janjgir Champa	Champa	Kosmanada	892/1	1.588	**4.493**
		Seoni	1321/1	0.085	
Korba	Kartala	Banjari	5	0.300	
	Korba	Urga	67	2.520	
			Total Area		**4.493**

Forest Land Proposed for diversion in Champa Forest Division is 1.673 Ha

Forest Land Proposed for diversion in Korba Forest Division is 2.82 Ha

Total Revenue Forest Area Proposed to be diverted is **4.493 Ha**.

DGPS Survey Details

Forest Division Champa

Village- Kosmanada, Tehsil Champa,

Khasra no-892/1

Revenue Forest Patch 1- Area =1.588 Ha

Piller ID	Left Side		Piller ID	Right Side	
	Longitude	Latitude		Longitude	Latitude
S1LP1	22.035309	82.711775	S1RP1	22.03578	82.712061
S1LP2	22.035643	82.711342	S1RP2	22.036073	82.711696
S1LP3	22.035936	82.710978	S1RP3	22.036366	82.711322
S1LP4	22.036229	82.710603	S1RP4	22.036659	82.710957
S1LP5	22.036522	82.710239	S1RP5	22.036961	82.710593
S1LP6	22.036913	82.709767	S1RP6	22.037254	82.710228

Village- Seoni, Tehsil Champa,

Khasra no-1321/1

Revenue Forest Patch 2- Area =0.085 Ha

Piller ID	Left Side		Piller ID	Right Side	
	Longitude	Latitude		Longitude	Latitude
S2LP1	22.071032	82.687168	S2RP1	22.071197	82.687363
S2LP2	22.071202	82.686907	S2RP2	22.071369	82.686976

Forest Division Korba

Village- Banjari, Tehsil Kartala,

Khasra no-5

Revenue Forest Patch 3- Area =0.30 Ha

Piller ID	Left Side		Piller ID	Right Side	
	Longitude	Latitude		Longitude	Latitude
S3LP1	22.160074	82.708875	S3RP1	22.160084	82.708562
S3LP2	22.16092	82.708934	S3RP2	22.160947	82.70862

Village- Urga, Tehsil Korba,

Khasra no-67

Revenue Forest Patch 4- Area =2.52 Ha

Piller ID	Left Side		Piller ID	Right Side	
	Longitude	Latitude		Longitude	Latitude
S4LP1	22.281672	82.733654	S4RP1	22.281631	82.734319
S4LP2	22.282232	82.734035	S4RP2	22.282083	82.734598
S4LP3	22.282742	82.734353	S4RP3	22.282468	82.734845
S4LP4	22.283129	82.734602	S4RP4	22.282854	82.735103
S4LP5	22.283745	82.734997	S4RP5	22.283445	82.735495
S4LP6	22.284201	82.735295	S4RP6	22.284286	82.736007
S4LP7	22.284925	82.735735	S4RP7	22.28466	82.736263

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कोरबा वनमण्डल कोरबा (छ.ग.)

DGPS Survey Details

Forest Division Champa

Village- Kosmanada, Tehsil Champa,

Khasra no-892/1

Revenue Forest Patch 1- Area =1.588 Ha

Piller ID	*Left Side*		Piller ID	*Right Side*	
	Longitude	Latitude		Longitude	Latitude
LP1	22.035309°	82.711775°	RP1	22.035780°	82.712061°
LP2	22.035643°	82.711342°	RP2	22.036073°	82.711696°
LP3	22.035936°	82.710978°	RP3	22.036366°	82.711322°
LP4	22.036229°	82.710603°	RP4	22.036659°	82.710957°
LP5	22.036522°	82.710239°	RP5	22.036961°	82.710593°
LP6	22.036913°	82.709767°	RP6	22.037254°	82.710228°

Village- Seoni, Tehsil Champa,

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Piller ID	Left Side		Piller ID	Right Side	
	Longitude	Latitude		Longitude	Latitude
LP1	22.071032°	82.687168°	RP1	22.071197°	82.687363°
LP2	22.071202°	82.686907°	RP2	22.071369°	82.686976°

Dhruv Consultancy Services Pvt. Ltd. Navi Mumbai

वनमण्डलाधिकारी
कोरबा वनमण्डल कोरबा (छ.ग.)

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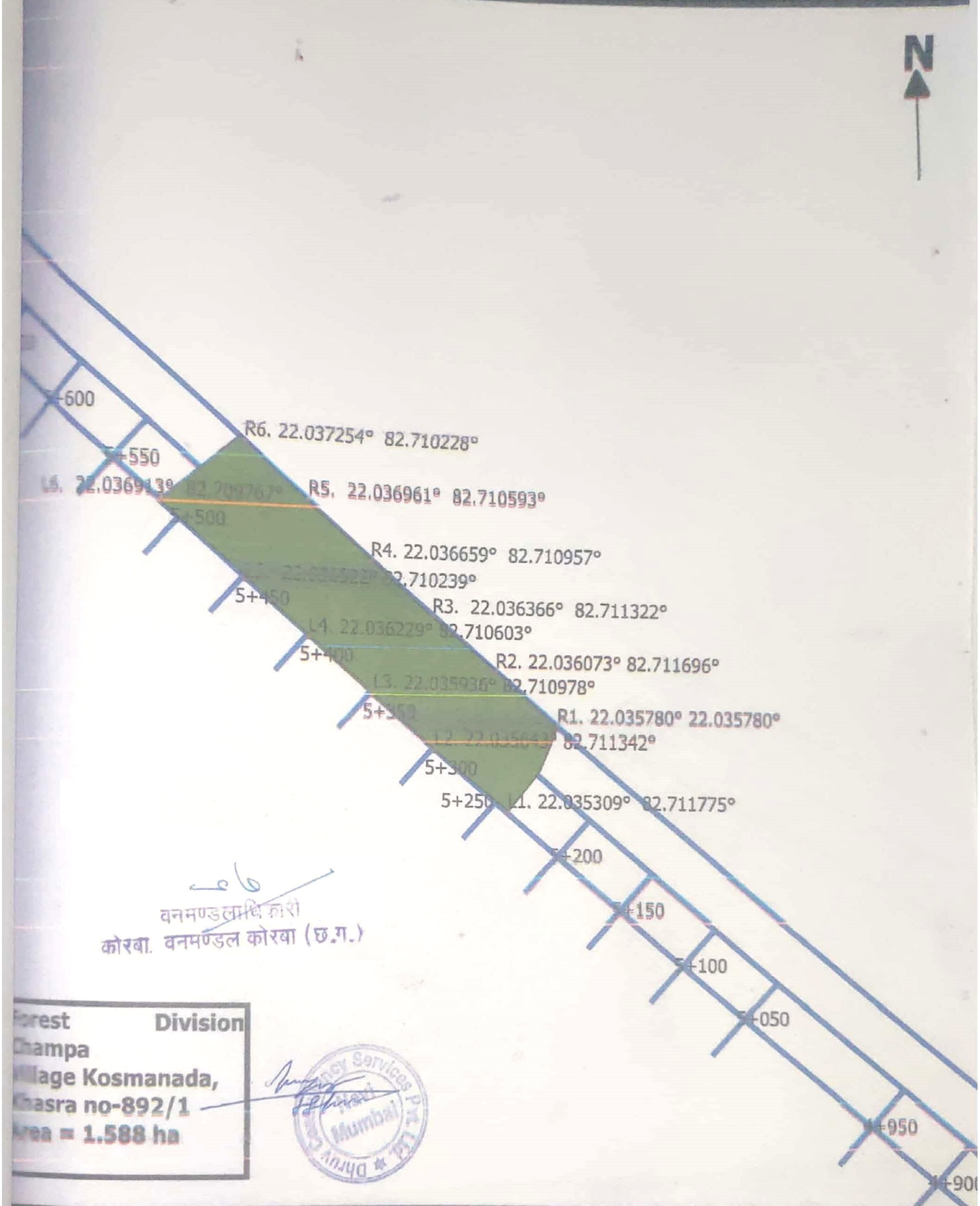

Forest Division
Champa
Village Kosmanada,
Khasra no-892/1
Area = 1.588 ha

Applicant:
National Highway Athuority of India
Govt. Of Indai
(PIU Bilaspur)

Legend

- Forest Patches Pillar Coordinates
- Forest Patch
- PROW
- PROW Chainage

50 0 50 100 150 200 m

Map for Diversion of Forest land For Detailed Project Report for up gradation of Champa-Korba-Chhuri-
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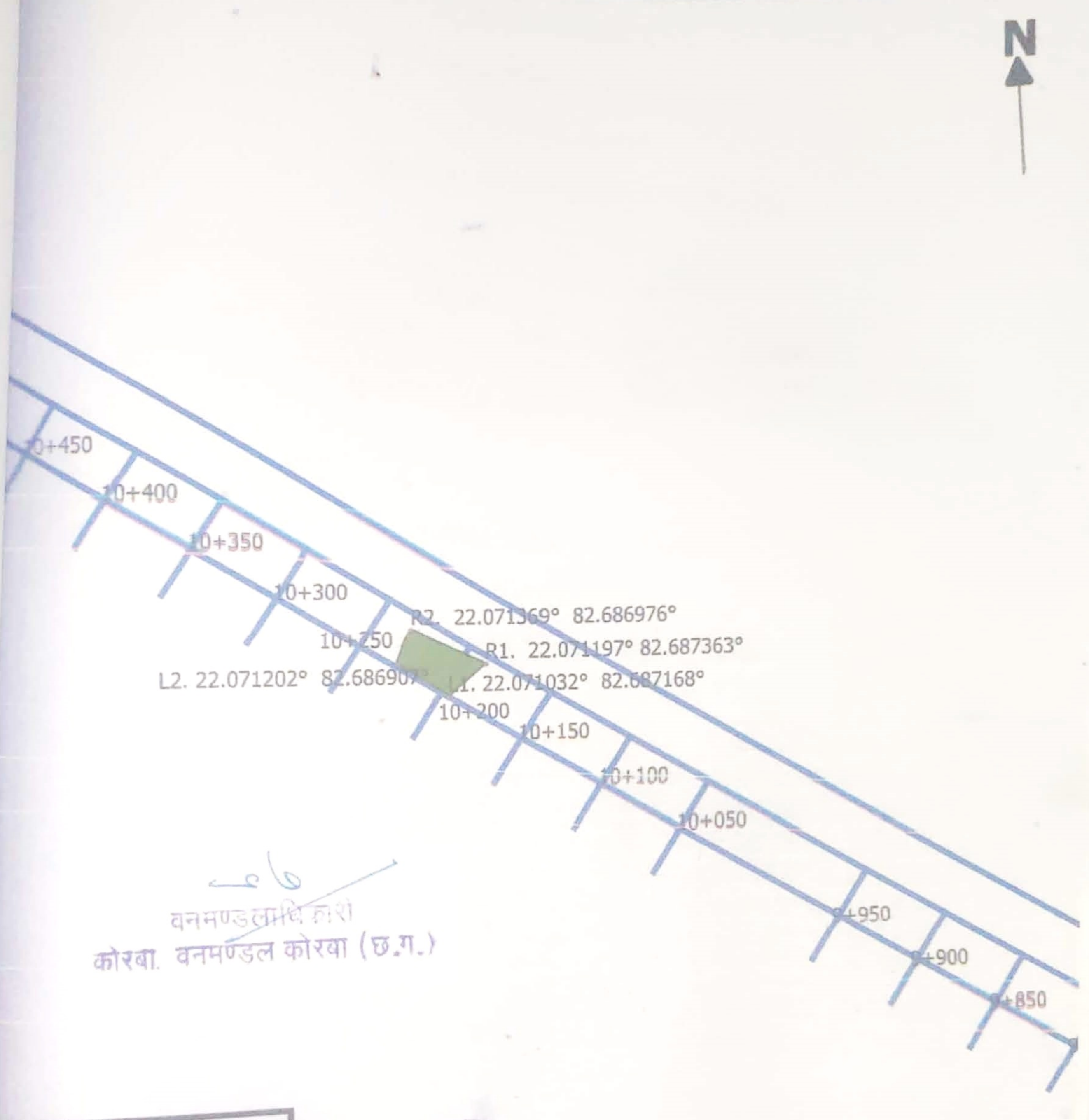

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Forest Division Korba

Village- Banjari, Tehsil Kartala,

Khasra no-5

Revenue Forest Patch 3- Area =0.30 Ha

Piller ID	Left Side		Piller ID	Right Side	
	Longitude	Latitude		Longitude	Latitude
LP1	22.160074°	82.708875°	RP1	22.160084°	82.708562°
LP2	22.160920°	82.708934°	RP2	22.160947°	82.708620°

Village- Urga, Tehsil Korba,

Khasra no-67

Revenue Forest Patch 4- Area =2.52 Ha

Piller ID	Left Side		Piller ID	Right Side	
	Longitude	Latitude		Longitude	Latitude
LP1	22.281672°	82.733654°	RP1	22.281631°	82.734319°
LP2	22.282232°	82.734035°	RP2	22.282083°	82.734598°
LP3	22.282742°	82.734353°	RP3	22.282468°	82.734845°
LP4	22.283129°	82.734602°	RP4	22.282854°	82.735103°
LP5	22.283745°	82.734997°	RP5	22.283445°	82.735495°
LP6	22.284201°	82.735295°	RP6	22.284286°	82.736007°
LP7	22.284925°	82.735735°	RP7	22.284660°	82.736263°

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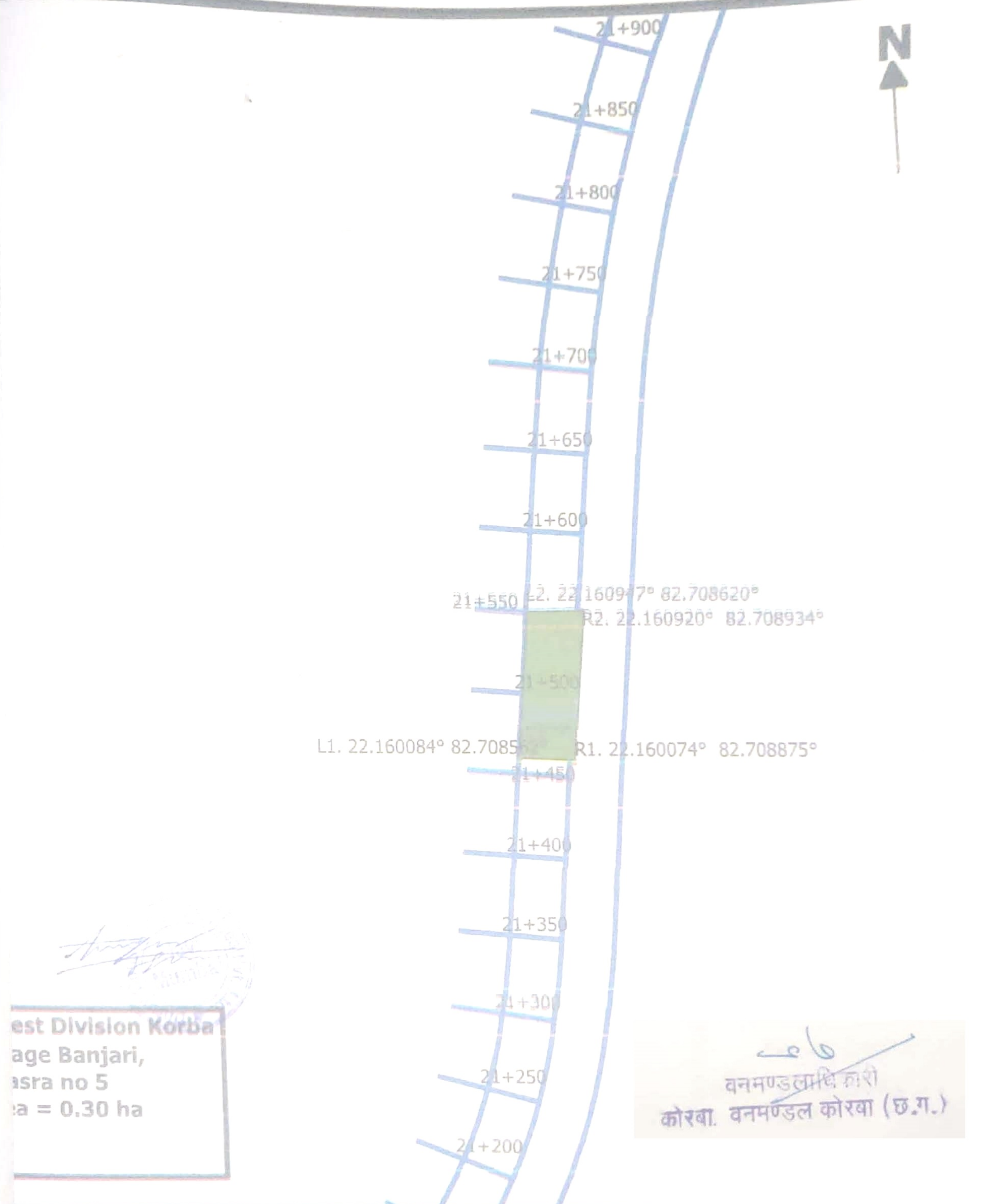

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Legend

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