

REPORT ON

**DGPS SURVEY FOR COMPENSATORY AFFORESTATION
AREA AGAINST CONSTRUCTION OF
SURAJPUR DISTRICT COURT BUILDING**

Submitted to

**EXECUTIVE ENGINEER
PUBLIC WORK DEPARTMENT, SURAJPUR,
DISTRICT: SURAJPUR, CHHATTISGARH**



Submitted by

छत्तीसगढ़ अंतरिक्ष उपयोग केन्द्र

**CHHATTISGARH SPACE APPLICATIONS CENTRE
CHHATTISGARH COUNCIL OF SCIENCE AND TECHNOLOGY
VIGYAN BHAVAN, VIDHAN SABHA ROAD, DALDAL SEONI,
PIN-492014, RAIPUR C.G.**

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Official Notification (for DGPS Survey)
No. F7-14/2013/12
Government of Chhattisgarh

DGPS SURVEY CARRIED OUT

FOR

COMPENSATORY AFFORESTATION AREA AGAINST
CONSTRUCTION OF SURAJPUR DISTRICT COURT BUILDING

PUBLIC WORK DEPARTMENT, SURAJPUR,
DISTRICT: SURAJPUR
CHHATTISGARH


Executive Engineer
P.W.D.(B/R) Division Surajpur
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कार्यालय,
विज्ञान भवन,
छत्तीसगढ़ विज्ञान एवं प्रौद्योगिकी परिषद,
विधान सभा रोड, दलदल सिवनी,
रायपुर (छ.ग.) पिन - 492014

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1. INTRODUCTION

Ministry of Environment and Forests, Govt. of India vide their circular No.F.No.-11-9/98-FC, dated 08-07-2011 have stipulated that to ensure accurate delineation of forest area proposed to be diverted for non-forestry purposes under Section-2 of Forest Conservation Act, 1980 the diversion proposal under Forest Conservation Act shall be accompanied by DGPS/ETS surveyed reports of the revenue forest land proposed for diversion as per guidelines laid down in the circular issued by ministry of forest and environment, Government of India from time to time. While submitting proposal for diversion of forest land for non forest purpose, the user agency has to submit the georeferenced boundary, using DGPS in shape file containing maps along with hard copy authenticated by Divisional Forest Officer (DFO) concerned. The conventional methods of survey to delineate and demarcate the forest land with reference to the earlier Cadastral/Forest Compartment/compartment base map are time consuming. Further, the conventional surveys are "Unprojected" Surveys, hence linking them to geospatial domain is a challenging task. The modern survey technique using Differential Global positioning system (DGPS) with geo referenced high resolution satellite image bring efficacy in survey in shorter time span compared to old method of survey and record preparation.

Earth observation satellites can today monitor almost every corner of our planet; the collection of information over each location, even in difficult terrain, has been intensively carried out in recent years using satellite data. In the recent years, since high resolution satellites have become operational, the information that can be collected from space borne images has dramatically increased, since the improved geometrical resolution has enabled the detection of natural and man-made features that were simply impossible to distinguish in the past with medium resolution satellite data. Therefore it is now possible to produce accurate representations of a specific location of the earth just sitting in front of a computer.

High-resolution space-borne remote sensing image data show a high level of detail and provide many opportunities to be used as base for Forest Compartment map generation. The combination of GIS and GPS activities play a crucial role in developing the survey of the forest boundary points and making Forest Compartment maps. Area, length other measures in the GIS numerical database are considerably easy to compute and correlate with already available data with line department.

In view of the above, Office of Executive Engineer Public Work Department Surajpur, District – Surajpur awarded the task to Chhattisgarh Council of Science & Technology (CCOST) for carrying out DGPS survey for revenue forest land (1.82 Ha.) and 3.64 Ha. Compensatory Afforestation land in Surajpur District vide letter No. 1805/व.ले.लि./2019-20/दिनांक 5.09.19. DGPS survey is to be carried out in Revenue Forest area for demarcating boundary. Land identified by Revenue Department, Govt. of Chhattisgarh.

2. OBJECTIVES

- DGPS survey for demarcation of 3.64 Ha. Revenue Forest land in in Bakirma village, falling in Khasra no. 780.
- Deriving coordinates of each observations point using DGPS in the world geodetic system 1984 (WGS-84) Datum.
- Preparation of Geo-referenced Revenue Forest boundary map showing DGPS observation point.
- Vectorization of boundary map.
- Integration of Geo-referenced Vectorized cadastral map.
- Merging of Cartosat 1 with LISS-IV (1:4000) and also to superimpose Geo-referenced boundary map on high resolution satellite image (merged product).
- GIS data base creation and analysis.

DGPS Survey was carried out in Tilsiwan and Bakirma Village, District – Surajpur for demarcation of Revenue Forest boundary from 16/10/2019 to 17/10/2019.

3. LOCATION OF THE AREA

DGPS survey carried out in Bakirma village located in Premnagar Block of Surajpur District. The total CA land area for afforestation is 3.64 Hectare. The area is falling in Survey of India Toposheet No.64J/09. Approximate coordinates of the polygon bounding the two corners is given below:-

- Lower left corner - $22^{\circ} 59' 14.632''$ N, $82^{\circ} 39' 15.599''$ E
- Upper right corner - $22^{\circ} 59' 20.137''$ N, $82^{\circ} 39' 32.714''$ E

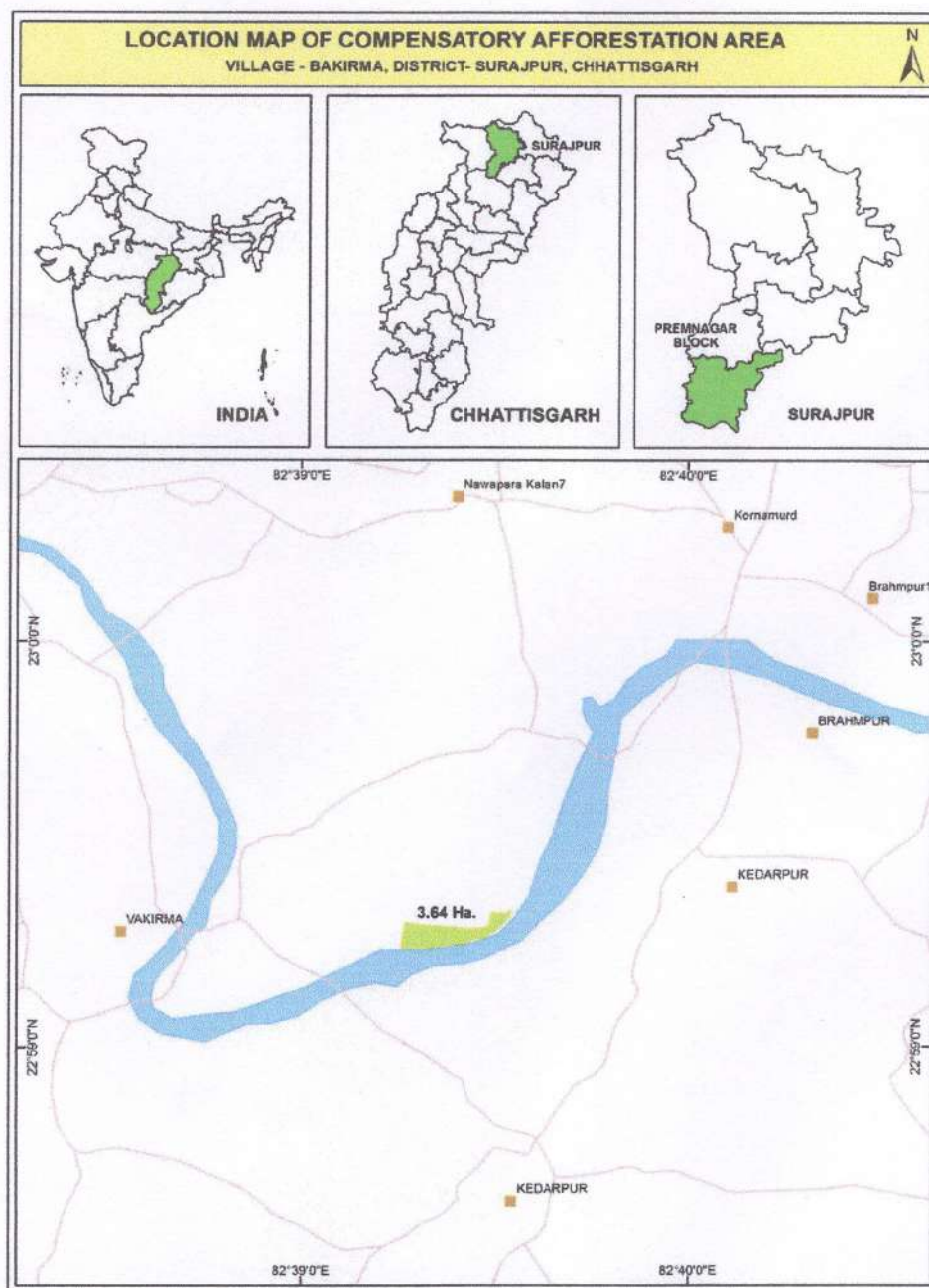


Fig: 1 Location map of the area

4. DATA SETS USED

a) The Satellite Imagery:

High resolution Cartosat-1 data with panchromatic images of 2.5 m resolution and multispectral images of Resourcesat-2 (LISS-IV) with 5.8 m resolution used for study areas.

b) DGPS Data:

Leica DGPS with CS/GS12 Raw Data Logging License for Viva CS field controller, which enables logging of GNSS raw data with a GS12 receiver and GS12 GNSS Smart Antenna, Geodetic 120 channel GNSS receiver was used for GCPs collection.

5. DGPS SYSTEM

DGPS system consist a reference receiver located on a known position and one or more receivers, the antenna, differential correction processing system and data link equipment. Both the reference receiver and user receiver collect and store data for later processing. DGPS system is based on the principle that receiver in the same vicinity will simultaneously experience common error on a particular satellites ranging signal. In the user receiver, measurements are taken from the reference receiver to remove common errors. Based on this principle, the user receiver must use the same set of satellites as the reference station then the DGPS equation is formulated to remove the common error get cancel. The common errors are signal path delay through atmosphere and satellite clock.

6. PROCEDURE FOR SURVEY

DGPS Survey has been carried out along the revenue forest boundary for CA land which were shown by the concerned PWD staff as per confirmation to locations and extent of land, DGPS observations at each observation points along the periphery of land allocated for afforestation are taken by Rover with minimum observation period of about 01 minutes at 50 meter interval in RTK mode.

6.1. Establishment of Base Station:

Base station was fixed near the site for observation in RTK mode of survey as there was no SOI reference points was available in that area.

6.2. Digitization and geo-referencing of Compartment maps

Revenue Forest Boundary vector in the form of shape file has been prepared by generating the coordinates of the observation points in geographic latitude & longitude as well as UTM projection with WGS 84 datum. Demarcated boundary geo-referenced with the help of coordinates and superimposed on Cartosat-1 image. (Merged product)

6.3. GIS Analysis

The surveyed boundary shape file from DGPS survey, geo-referenced CA Land, geo-referenced revenue map is superimposed on the satellite image using ArcGIS software (10.0). Area calculated and statistics of area was generated.

7. INPUT DATA

- Digital data Cartosat 1 PAN and LISS IV.
- Leica GS12 Base and Rover Dual Frequency RTK / Post Processing Differential Global Positioning System with configuration as under
- Revenue map of the area provided by Public Work Department Surajpur.

8. EQUIPMENT SPECIFICATIONS

S. No.	DGPS EQUIPMENT SPECIFICATIONS
1.	DESCRIPTION BASE AND ROVER
	GS12 GNSS Smart Antenna, Geodetic 120 channel GNSS receiver, includes GPS L1 + L2, 1 Hz position rate, (e.g. Glonass, Gallileo, GPS L5, Network RTK, Raw data logging ...)
	GS12 GLONASS License for the Viva CS10 field controller, which enables use of GLONASS with a GS12 receiver.
	GS12 Raw Data Logging License for Viva CS10 field controller, which enables logging of GNSS raw data with a GS12 receiver.
	GS12 5Hz License for Viva CS10 field controller, which enables to compute 5 Hz positions with a GS12 receiver.
	GS12 RTK Reference Station License key for Viva CS10 field controller, which enables the GS12 to be used as an RTK base station.
	CS10 Field Controller. Ruggedized WinCE field controller with full VGA touch display, 1GB NAND Flash Memory, 512MB SDRAM, CF/SD card slot and 2MP camera. Includes Bluetooth, virtual numeric keypad, and stylus.
2.	RTK Base and Rover Radio HPR2, Sateline-EASY Pro 35W high power radio, 403-473 Mhz RX/TX radio. 5 Meter Mast for Base, Gainflex antenna, CGR10, 403-470 Mhz RXO radio for controllers. ProCom Unity Gain Antenna, GLS13 telescopic aluminum pole
3.	Field Software Smart Worx Viva Software (with CS LT license)
4.	Data Processing Software Leica Geo Office GNSS-PP Bundle (Node locked). Includes Land XML Import/Export, COGO calculations, L1/L2 GNSS processing, GLONASS, RINEX Import and Datum & Map., LGO Design & Adjustment 3D
5.	Measurement Performance & Accuracy
	Accuracy (rms) Code differential with DGPS / RTCM2
	DGPS / RTCM
	Accuracy (rms) with Real-Time (RTK)²
	Standard of compliance

S. No.	DGPS EQUIPMENT SPECIFICATIONS	
	Rapid static (phase)	
	Static mode agree initialization	
	Kinematic (phase)	
	Moving mode after initialization	
	Accuracy (rms) with Post Processing²	
	Static (phase) with long observations	
	Static and rapid static (phase)	Typically 25 cm (rms)
	Kinematic (phase)	
	On the Fly (OTF) Initialization	Compliance with ISO17123-8
	RTK technology	Horizontal: 5 mm + 0.5 ppm (rms) Vertical: 10 mm + 0.5 ppm (rms)
	Reliability of OTF initialization	Horizontal: 10 mm + 1 ppm (rms) Vertical: 20 mm + 1 ppm (rms)
	Time of initialization	
	ORF range	Horizontal: 3 mm + 0.1 ppm (rms) Vertical: 3.5 mm + 0.4 ppm (rms)
	Network RTK	Horizontal: 5 mm + 0.5 ppm (rms) / Vertical: 10 mm + 0.5 ppm (rms)
	Network technology	Horizontal: 10 mm + 1 ppm (rms) / Vertical: 20 mm + 1 ppm (rms)
	Supported RTK network solutions	Leica Smart Check+ technology
	Supported RTK network standards	Better than 99.99% ²

**9. DGPS COORDINATES OF REVENUE FOREST AREA FOR CA LAND,
VILLAGE - BAKIRMA, BLOCK - PREMNAGAR, DISTRICT - SURAJPUR**

Table 1: Survey Coordinates

POINT ID	GEOGRAPHICAL CO-ORDINATES		UTM CO-ORDINATES	
	LATITUDE	LONGITUDE	NORTHING	EASTING
1	22° 59' 18.47378" N	82° 39' 16.18663" E	2543199.27717	669586.20183
2	22° 59' 18.31680" N	82° 39' 17.18494" E	2543194.76935	669614.68610
3	22° 59' 18.12241" N	82° 39' 18.42109" E	2543189.18757	669649.95655
4	22° 59' 18.03251" N	82° 39' 19.51035" E	2543186.77243	669681.00738
5	22° 59' 17.94841" N	82° 39' 20.66615" E	2543184.55714	669713.95135
6	22° 59' 17.83992" N	82° 39' 22.13621" E	2543181.69283	669755.85334
7	22° 59' 17.72530" N	82° 39' 23.61342" E	2543178.64210	669797.96072
8	22° 59' 17.50365" N	82° 39' 25.33492" E	2543172.37830	669847.06246
9	22° 59' 17.47444" N	82° 39' 27.06177" E	2543172.03543	669896.24979
10	22° 59' 17.84749" N	82° 39' 29.11726" E	2543184.17175	669954.65615
11	22° 59' 18.99938" N	82° 39' 29.56636" E	2543219.74729	669967.04481
12	22° 59' 19.85736" N	82° 39' 29.67626" E	2543246.17311	669969.87614
13	22° 59' 19.67460" N	82° 39' 31.37111" E	2543241.09737	670018.20542
14	22° 59' 19.83493" N	82° 39' 32.10305" E	2543246.26464	670038.99364
15	22° 59' 20.13741" N	82° 39' 32.63949" E	2543255.74131	670054.16500
16	22° 59' 19.96800" N	82° 39' 32.71417" E	2543250.55474	670056.35064
17	22° 59' 19.09416" N	82° 39' 32.27886" E	2543223.53617	670044.25794
18	22° 59' 18.14716" N	82° 39' 31.24942" E	2543194.07592	670015.27118
19	22° 59' 17.06635" N	82° 39' 30.06078" E	2543160.44855	669981.79710
20	22° 59' 16.15161" N	82° 39' 28.63102" E	2543131.85182	669941.39855
21	22° 59' 15.79451" N	82° 39' 26.50473" E	2543120.18345	669880.97033
22	22° 59' 15.35239" N	82° 39' 25.18155" E	2543106.15873	669843.44235
23	22° 59' 15.20529" N	82° 39' 23.50129" E	2543101.09343	669795.64296
24	22° 59' 15.00839" N	82° 39' 21.81925" E	2543094.49604	669747.81018
25	22° 59' 14.70942" N	82° 39' 20.04212" E	2543084.72887	669697.30492
26	22° 59' 14.66727" N	82° 39' 18.33609" E	2543082.88398	669648.73525
27	22° 59' 14.63195" N	82° 39' 16.90666" E	2543081.33820	669608.03997
28	22° 59' 14.66077" N	82° 39' 15.59889" E	2543081.80457	669570.78728
29	22° 59' 15.84369" N	82° 39' 15.78122" E	2543118.24853	669575.56939
30	22° 59' 17.18059" N	82° 39' 15.98729" E	2543159.43601	669580.97394
BASE STATION	22° 59' 18.31791" N	82° 39' 20.41095" E	2543195.84049	669706.55561

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लोक निर्माण विभाग, संभाग सूरजपुर
जि.सूरजपुर (छ.ग.)
वनमण्डलाधिकारी
सूरजपुर वनमण्डल - सूरजपुर
जिला-सूरजपुर (छ.ग.)

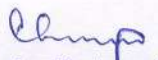
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10. GIS ANALYSIS AND CONCLUSION


Area for Compensatory Afforestation in revenue forest, located in Bakirma village was provided by Public Work Department Surajpur. The area computed from the DGPS geo-referenced map was compared with the revenue forest land schedule proposed to be diverted for afforestation. The area as per revenue record allocated to Public Work Department Surajpur for compensatory afforestation is 3.64 Hectare, which were confirmed by DGPS survey. Details of Khsara/Rakba are given in Table 2:

Table 2: Summary of Land Statistics for Compensatory Afforestation

SUMMARY OF LAND STATISTICS FOR AFFORESTATION			
S. No.	TYPE OF LAND	KHASRA No.	APPLIED AREA AS PER DGPS SURVEY (In Ha.)
1	Revenue Forest	780	3.64
TOTAL AREA (In Ha.)			3.64


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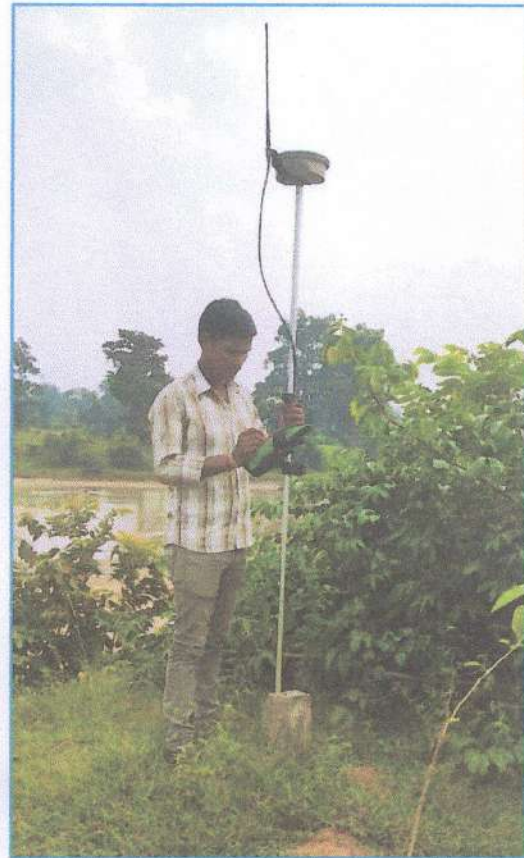
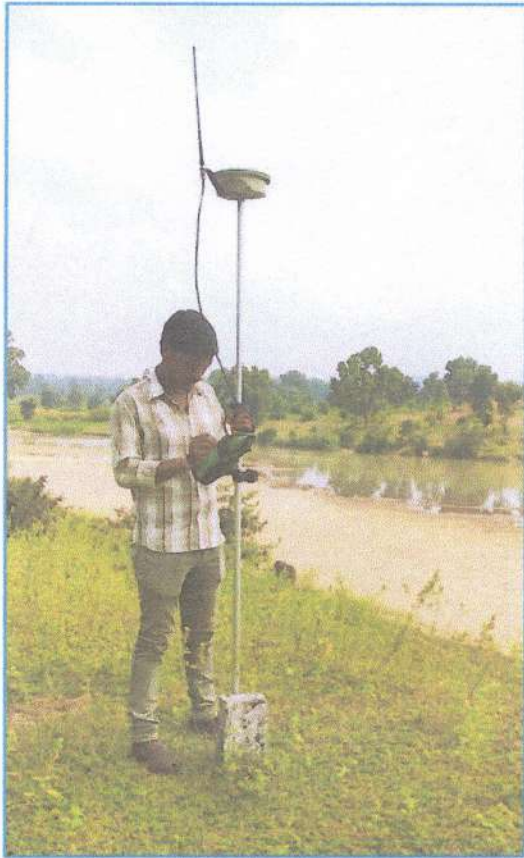

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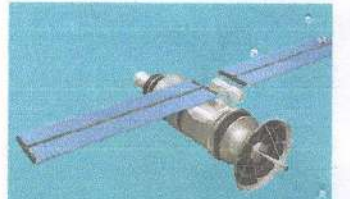

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जिला-सूरजपुर (छ.ग.)

11. DELIVERABLES

- Index map of Revenue Forest area for Compensatory Afforestation (CA Land) against construction of District Court Building Surajpur **ANNEXURE-I**
- DGPS Survey Boundary of Revenue Forest area for (CA Land) superimposed on Toposheet on (1:50000) scale **ANNEXURE-II**
- Revenue Forest area for Compensatory Afforestation (CA Land) Superimposed on High resolution satellite image on (1:5000) scale **ANNEXURE-III**
- DGPS Survey Boundary & Coordinates of Revenue Forest area for Compensatory Afforestation (CA Land) on (1:4000) scale **ANNEXURE-IV**



**** Glimpses of Field ****



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