

Reliance Jio Infocomm Limited 4G OFC
Network

DGPS Survey report for Forest Diversion of
proposed OFC Cable Route from Jagdalpur to
Banpuri with Route Length 39.48 Km. in
District Bastar



APPLICATION SUBMITTED BY:
RELIANCE JIO INFOCOMM LIMITED

DGPS SURVEY AND GIS MAPPING DONE BY:
Geotrax International Services
Raipur, Chhattisgarh.

Table of Contents

1. Introduction and Background	3
1.1 Background.....	3
1.2 Location and Communication	3
1.3 Objective	4
1.4 Geotrax Empanelment Certificate in Chhattisgarh	5
2. Scope of Work	8
3. Deliverables.....	9
4. Brief description of the Technical approach.....	9
4.1 Input Data	9
4.2 GIS Data Preparation	9
4.3 Establishment of Primary Control Point (PCP)	10
4.4 Establishment of Temporary Benchmarks (TBM)	11
4.5 DGPS Survey Procedure	11
4.6 Creation of Vector Layers	12
4.7 Specification of DGPS Equipment	12
5. Results	15
6. Background of Organization	17
6.1 Company Profile: Geotrax	17
7. Annexure	19
7.1 Annexure – 1: PCP Observation Processing Report.....	19
7.2 Annexure – 2: DGPS Surveyed coordinates of Forest Patches	26
7.3 Annexure – 3: Geo-Referenced Maps of the Proposed Route	35
7.3.1 Geo-referenced Forest Map showing Proposed 4G OFC Route	35
7.3.2 Geo-referenced SOI Map showing Proposed 4G OFC Route.....	36

1. Introduction and Background

PROJECT 4G OPTICAL FIBER CABLE

1.1 Background

Reliance Jio Infocomm Limited is setting up 4G Optical Fiber Cable network across the country. In the state of Chhattisgarh, the company plans to set up the telecom network (including laying of OFC cable) along the NHAI/PWD Road corridor. Reliance Jio Infocomm is granted license by Ministry of Communications & IT, Dept. of Telecommunications, and Govt. Of India, to establish Optical Fiber Cable network under the license number 370/2011 dated. 23.06.2011 issued to M/S Infotel Broadband Services Limited (company name changed to Reliance Jio Infocomm Limited on 22.01.2013). The OFC Cable is laid under the ground at approx. depth of 1.65m and the trench width is 0.5m. The cable trench line on National Highways is approx. at a distance of 14.5m from the road centerline and for State/District highways it is approx. 7m from the road centerline.

1.2 Location and Communication

The proposed OFC Cable route from Jagdalpur to Bhanpuri is on the National Highway corridor NH-43. The route length is approx. 39.48 km. The OFC cable route falls in three tehsils – Jagdalpur, Bakawand & Bastar in district Bastar. The survey site is located in four ranges of Bastar division, namely - Bhanpuri, Bastar, Bakawand & Jagdalpur Ranges. The cable route's proposed starting point is Jagdalpur at Latitude 19°05'28.546"N and Longitude 82°02'35.383"E, and the end location is Banpuri at Latitude 19°21'13.598"N and Longitude 81°48'41.850"E. The OFC Cable route is covered under Survey of India Toposheet 65I/04, 65E/15, 65E/16 on RF 1:50000.

1.3 Objective

As per directives of Ministry of Environment & Forests (MoEF) dated 8th July 2011; all applications for Forest Diversion, under Forest Conservation Act, 1980 must be accompanied with Geo-referenced shape file, showing the boundary of the proposed area (both soft copy and hard copy maps), prepared using Differential GPS (DGPS) and the same should be uploaded to MoEF website along with the online application.

To meet this requirement of MoEF, Reliance Jio Infocomm Limited, entrusted the DGPS survey work to M/s Geotrax International Services, Raipur, which is an empanelled agency of Directorate of Geology and Mines, Chhattisgarh (**Ref. Circular No. F-7-14/2013/12, dated. 10.11.2014**).

1.4 Geotrax Empanelment Certificate in Chhattisgarh

By Speed post 366

छत्तीसगढ़ शासन
खनिज साधन विभाग
मंत्रालय
महानदी भवन, नया रायपुर-492002
// अधिसूचना //

19 NOV 2014
रायपुर, दिनांक नवम्बर, 2014

क्रमांक एफ 7-14/2013/12:: राज्य शासन एतद् द्वारा चीफ कन्ट्रोलर ऑफ माइन्स, भारतीय खान ब्यूरो नागपुर के परिपत्र क्रमांक 2/2010, दिनांक 06.4.2010 के पैरा-2 के बिन्दु-2 के तारतम्य में समस्त खनिजों के खनिज रियायतों के सीमा स्तम्भ का Differential Global Positioning System (डीजीपीएस) का उपयोग करते हुए सर्वेक्षण करने के लिए तालिका में दर्शित संस्थानों को अधिमाम्यता प्रदान करता है:-

क्र.	एजेंसी का नाम एवं पता
1	2
1	M/S SHREERAM GEMICON (PVT.) LIMITED GEOLOGICAL AND MINING CONSULTANTS L-09, Songanga Colony Seepat Road, Bilaspur (Chhattisgarh)
2	M/S SINHA MINING CONSULTANCY, GOA Office No. 9, D.Costa Commercial Apartment, Near Old Railway Station Gate, Malbhat, Margo - 403601, Goa-India
3	M/S SPATIAL PLANNING AND ANALYSIS RESEARCH CENTRE PVT. LTD. E/11, Infocity, Chandaka Industrial Estate, Bhubaneswar, Orissa, India, Pin - 751024
4	M/S SIDDHARTH GEO CONSULTANTS, 21/3, First Floor Ramkund, Samta Colony, Behind Lifeworth Hospital, Raipur (Chhattisgarh) 492001
5	M/S SOHAM FERRO MANGANESE PVT. LTD. Block No. 16,17 Ground Floor N.K.Y. Tower, Anjani Sq. Wardha Road, Nagpur (Maharashtra)
6	M/S SAN SURVEY ENGINEERING, HOOGHLY(WB) Regd. Off. - 465, Jiban Pal Bagan, Karbala (West), P.O. & Dist. - Hooghly, West Bengal, Pin - 712103 Contact Office - Anjali Complex, Bankim Kanan, Chinsurah Station Road, Chinsurah, Hoogly, West Bengal -712102
7	M/S GEOTRAX INTERNATIONAL SERVICES, HYDERABAD (TELANGANA) Plate No 156 & 157, Lokayuta Colony, Badangpet Nadergul, Hyderabad 500058, Telangana
8	M/S RAFT CONTRACTORS AND DESIGNERS, Plot No. D-36, Ground Floor, Koelnagar, Raurkela, Dist. Sundargarh, Orissa, Pin No. - 769014
9	M/S MICRONET SOLUTION, Bisesar House, Opp. HSSC Board Office, (P.B. 85 G.P.O.) Civil Line, Nagpur, Maharashtra - 440001
10	M/S BHARAT ALUMINIUM COMPANY LIMITED (BALCO) P.O. Balco Nagar Korba(C.G.), India, Pin 495684

2/ अधिमाम्यता प्राप्त संस्थानों के लिए शर्त:-

2.1. The Survey Agency Shall Be responsible for the accuracy of the data collected and Survey.

2.2. Coordinates of boundry pillars shall be established in the World Geodetic System 1984 (WGS-84) Datum.

2.3. Each boundry pillar shall be served using DGPS, at least 2 Hours observation for its ground position.



1/21

- 2.4 The maximum distance between any two successive pillars should not be more than 100 meter.
- 2.5 All corner pillar should be of pyramid shaped with base of 1 meter and height of 2 meter and should be placed 1 meter above the ground and 1 meter below the ground.
- 2.6 Distance and bearing to the forward and backward pillars and latitudes and longitudes should be marked on all the corner pillars.
- 2.7 डीजीपीएस सर्वे कार्य हेतु पारिश्रमिक का निर्धारण अधिमन्य प्राप्त संस्थान एवं खनिज रियायतधारी के मध्य आपसी समन्वय से किया जाएगा। किसी भी प्रकार का आपसी विवाद होने पर राज्य शासन उत्तरदायी नहीं होगा।
- 2.8 डीजीपीएस सर्वे कार्य के गुणवत्ता में कमी पाये जाने पर या किसी भी प्रकार की कार्य संबंधी शिकायत पाये जाने पर जांच उपरांत राज्य शासन को यह अधिकार होगा कि उक्त अधिकृत एंजेसी की मान्यता किसी भी समय समाप्त की जा सकती है।
- 2.9 डीजीपीएस सर्वे के संबंध में भारतीय खान ब्यूरो/राज्य शासन द्वारा समय-समय पर जारी निर्देशों का पालन अधिमन्यता प्राप्त संस्थान को करना होगा।
- 2.10 राज्य शासन द्वारा जारी यह अधिमन्यता 03 वर्ष के लिए होगी। समयावधि समाप्ति से 03 माह पूर्व अधिकृत एंजेसी नवीनीकरण हेतु आवेदन कर सकेगा।
- 2.11 भारत सरकार एवं राज्य शासन द्वारा डीजीपीएस सर्वे के संबंध में समय-समय पर जारी निर्देशों का पालन किया जाना होगा।
- 3/ यह अधिमन्यता अधिसूचना के जारी होने की तिथि से 03 वर्ष के लिए होगी।

छत्तीसगढ़ के राज्यपाल के नाम से
तथा आदेशानुसार,

(सुबोध कुमार सिंह)
सचिव
छत्तीसगढ़ शासन
खनिज साधन विभाग

पृ. क्रमांक एफ 7-14/2013/12
प्रतिलिपि:-

रायपुर, दिनांक 10 नवम्बर, 2014

1. सचिव, भारत सरकार, खान मंत्रालय, शास्त्री भवन, नई दिल्ली,
2. कंट्रोलर जनरल, भारतीय खान ब्यूरो, सेकण्ड फ्लोर, ए-ब्लॉक, इन्दरा भवन, सिविल लाईन, नागपुर (महाराष्ट्र)
3. चीफ कंट्रोलर ऑफ माईन्स, भारतीय खान ब्यूरो, सेकण्ड फ्लोर, ए-ब्लॉक, इन्दरा भवन, सिविल लाईन, नागपुर (महाराष्ट्र)
4. क्षेत्रीय खान नियंत्रक, भारतीय खान ब्यूरो, छटवां तल, बी एवं सी -ब्लॉक, इन्दरा भवन, सिविल लाईन, नागपुर (महाराष्ट्र)
5. संचालक, भौमिकी तथा खनिकर्म, छत्तीसगढ़ ब्लॉक-4, द्वितीय तल, इन्द्रावती भवन, नया रायपुर,
6. समस्त कलेक्टर, जिला _____ छत्तीसगढ़

.....3

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(504)

7.1

समस्त संबंधित

- की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु
8. संचालक, शासकीय मुद्रणालय, गोंदवारा, भनपुरी, रायपुर(छत्तीसगढ़) की ओर राजपत्र में प्रकाशनार्थ।
 9. श्री श्रीकांत राव, सहायक भौमिकी विद्, संचालनालय भौमिकी तथा खनिकर्म, द्वितीय फ्लौर, इन्द्रावती भवन, नया रायपुर। कृपया उक्त आदेश/अधिसूचना को संचालनालय की वेबसाईट में अपलोड करने का कष्ट करें।
 10. गार्ड फाईल रजिस्टर

सचिव

छत्तीसगढ़ शासन
खनिज साधन विभाग

abf

Fig-1: Jagdalpur to Banpuri 4G OFC Cable Proposed Route on Satellite Imagery

1. Establishment of one base station with 72 Hours observation and secondary control points at every 10km along the proposed route.
2. DGPS Survey for collection of ground coordinates along the OFC Cable trench at every 50m interval and/or at every turn/bend along the proposed trench. The DGPS data is collected at forest patches only.
3. Data processing and Interpretation
 - a. Geo-referencing of SOI Toposheet (1:50000), Forest Stock map (1:15000, if available) and satellite imagery
 - b. Creation of OFC Cable trench boundary vector map using the DGPS Surveyed data
 - c. Superimposition of cable route layer on Georeferenced forest maps, SOI Toposheet and Satellite imagery.
 - d. Computation of Forest area proposed for diversion. It includes Reserved/Protected Forest & Revenue Forest.
 - e. Preparation of Geo-referenced forest map at 1:15000 scale, and SOI Toposheet at 1:50000 scale.
 - f. Preparation of DGPS survey report along with soft copy of – maps in shapefile format and kml file

4. Printing of report and Geo-referenced maps and Technical compliance.

3. Deliverables

The deliverables envisaged for the assignment are described below

1. Post processed DGPS observations data as well as raw data in RINEX format.
2. DGPS Reports - Base line & network adjustment report for the primary and Secondary Control Points.
3. Geo-referenced SOI maps & forest block maps based on DGPS observations – Hard and Soft Copy (SHP and KML formats).
4. Proposed Forest Diversion area statement as per DGPS Survey
5. DGPS Survey and mapping report

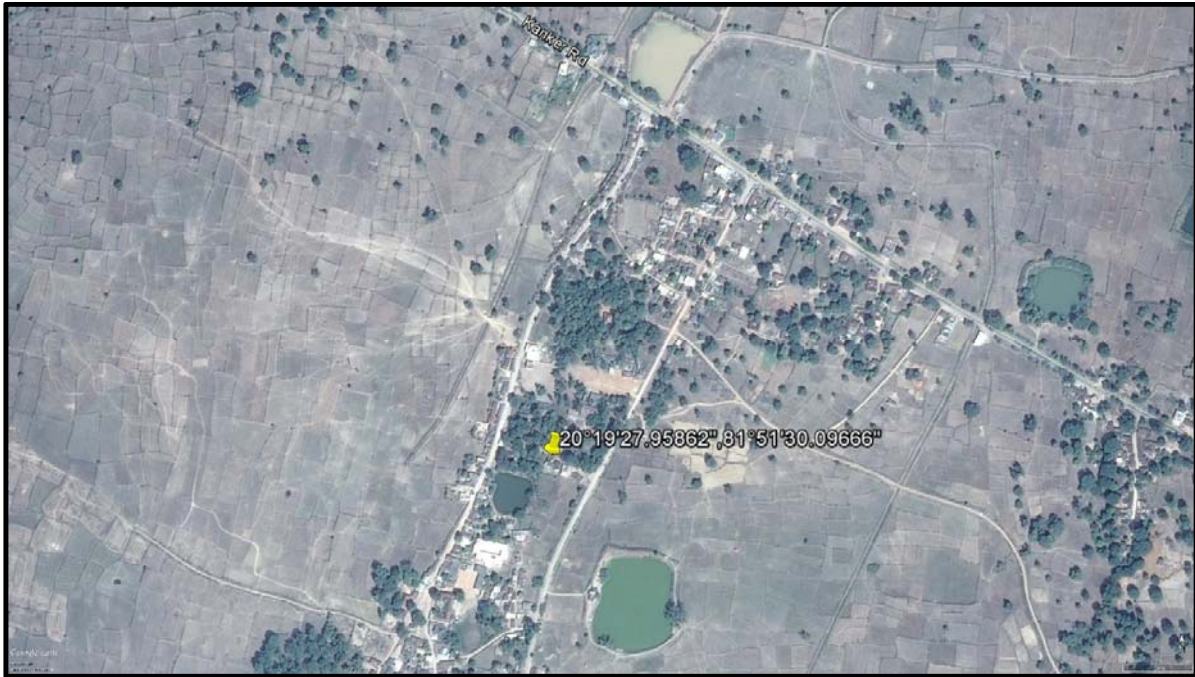
4. Brief description of the Technical approach

4.1 Input Data

The proposed 4G Cable Route plan is shown on the ground by the engineer/ Vendor of Reliance Jio Infocomm Ltd (RJIL). The Forest & SOI maps required for geo-referencing were provided by Reliance Jio Infocomm Limited. It is proposed that the cable is laid within the ROW of the NHAI/PWD road corridor. The cable trench is laid at a depth of 1.65m below ground and the trench width is 0.5m. The revenue village maps were collected from NIC online website (<http://cg.nic.in/bhunaksha/>). The revenue forest information & details are collected from the District Revenue department and were provided by RJIL.

4.2 GIS Data Preparation

Based on the input data and information provided, the DGPS base station - Primary and Temporary Benchmarks Control Points (PCP and TBM) in the project area are planned. One PCP with 72 hours observation is planned and established on the roof top of the Forest Department office, Birgudi Range, Dhamtari.



Not to Scale

Fig-2: Satellite Image showing the location of the Primary Control Point

4.3 Establishment of Primary Control Point (PCP)

The Primary Control Point (PCP) with 72 hours of DGPS Observation was established as the DGPS base station. The PCP was established in the Forest Department office of Birgudi Range in Dhamtari division. As per Survey of India (SOI) Guideline, the PCP is to be fixed through continuous observation for 72 hours duration. The 72 hours of observation was carried out using DGPS from 8th March 2016 to 11th March 2016. The observed data was processed with reference to the data of International GNSS Service (IGS) stations as per SOI guideline (IGS processed report is enclosed as Annexure-1).

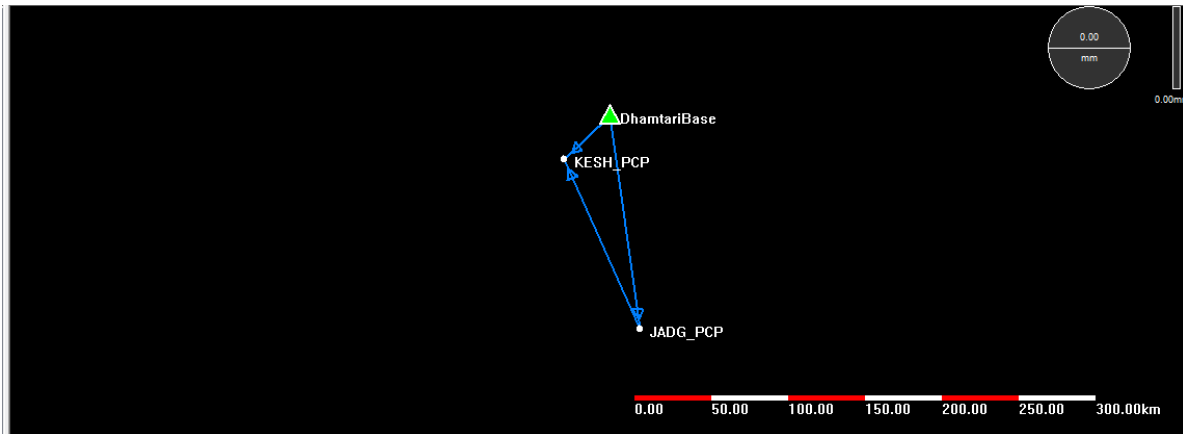
Station (s)	Submitted File	Antenna Type	Antenna	Start Time	End Time
			Height (m)		
DhamtariPCP	03102966068t.160	CNT300	1.835	3/8/2016 11:05	3/11/2016 11:08

The coordinate of the PCP is as follows:

Station	Latitude (d:m:s)	Longitude (d:m:s)	Ellipsoidal Height (m)
PCP Base @ Forest Office, Birgudi	20°19'27.95862"	81°51'30.09666"	526.826219

4.4 Establishment of Temporary Benchmarks (TBM)

The Temporary Control Point with 24 hours of static observation was established in Jagdalpur (Station ID: **JADG_PCP**) and Keshkal (Station ID: **KESH_PCP**). The TBM are post-processed using the Dhamtari Base.



JADG_PCP	Grid		WGS84	
	North(m)	2109591.622	Latitude	19°04'34.70024"N
	East(m)	608826.178	Longitude	82°02'03.86504"E
KESH_PCP	Height(m)	491.344	Ellipsoid Height(m)	491.344
	North(m)	2218861.487	Latitude	20°03'56.56788"N
	East(m)	561503.883	Longitude	81°35'17.51417"E
	Height(m)	615.101	Ellipsoid Height(m)	615.101

4.5 DGPS Survey Procedure

DGPS survey was carried out using a pair of DGPS instrument. One DGPS Instrument was used as Base Station. The first base station for the survey was established at the nearest TBM (JADG_PCP). The base is shifted using the Real Time Kinematic Survey method. The distance between the Base Station TBM and rover was always less than 5km.

The other DGPS instrument was working as Rover. The survey was conducted in Real Time Kinematic (RTK) mode. The Survey team carried out DGPS Survey



of boundary points by walking along the proposed cable trench boundary. DGPS readings were collected at every 50m distance along trench and at every turn or bend. For Geo-referencing village maps around 5 GCPs were collected for the each village having Govt. Forest Land.

During the survey the start and end of forest patch was identified in the field with the help of staff from the forest department. The forest department staff also provided information regarding the forest range, compartment number etc.

The static data is Post Processed using Trimble Business Centre software for obtaining the TBM coordinates.

4.6 Creation of Vector Layers

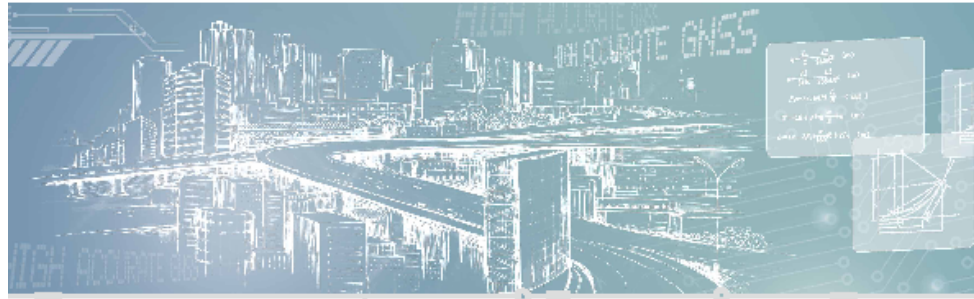
The surveyed points captured through DGPS were plotted in the GIS Software and the Polygon and Polyline layers are created using the DGPS Surveyed points. Different layers such as the Forest Patch polygon, Forest Trench centerline, Non-Forest Trench line, polygon showing Revenue forest patches (Chote Jad ka Jungle + Bade Jad Ka Jungle) etc., are prepared. The vector layers prepared are then super-imposed on the Geo-referenced Forest map and Cadastral maps.

4.7 Specification of DGPS Equipment

Geotrax deployed the most advance and hi-precision devices to carry out the DGPS survey. The DGPS performance specifications are given below. The corresponding fact sheets are placed below for ready reference.

COMNAV

T300 GNSS Receiver



Features

- **Ultra small**
- **Super light**
- **Many user-friendly conveniences built in**
- **GPS L1/L2/L5, BeiDou B1/B2/B3, GLONASS L1/L2**
- **Low power consumption**
- **Support long baseline E-RTK**

RTK robust enough for challenging environments, in a device that is light and easy to carry

With decades of experience in the surveying GNSS receiver, the T300 is a product which combines lots of market proved advantages together. It can track all the working GNSS constellations. By using ComNav's unique QUAN™ algorithm technology, it can function in RTK mode with all the GNSS constellations or by using any single GNSS constellation such as GLONASS or BeiDou. The strong anti-interference ability of the receiver makes it possible to work in any environment.

Design driven to improve user experience

Our R&D people are always thinking about how to improve the physical experience of users and workflow in the field. With this in mind, the T300 integrates a cutting edge GNSS board, Bluetooth®, UHF (Rx&Tx) into a compact board. Smart design makes the T300 the lightest and smallest (volume) receiver in the world.

Hot swap battery design

Extending the field working time is also a passion for our R&D people. They do lots of tests and analysis to reduce the power consumption, and make the whole system work more efficiently. In parallel, they've designed in the capability to hot swap the battery source. When the warning sounds and LED flashes, put your second battery in place. Then recharge the first while you keep working.

Consumer grade batteries... always available

Losing power in the field is significantly inconvenient for users, as the batteries for GNSS receivers are often unusual types and not readily available. Once again our R&D people developed a solution so that the T300 runs on normal consumer batteries.

Technical Specifications

T300

Signal Tracking

- 256 channels with simultaneously tracked satellite signals
- GPS: L1 C/A, L1 C, L2 P, L5
- BeiDou: B1, B2, B3
- GLONASS: L1, L2
- SBAS: WAAS, EGNOS, MSAS, GAGAN

Performance Specifications

- Cold start: <50 s
- Warm start: <30 s
- Hot start: <15 s
- Initialization time: <10 s
- Singal re-acquisition: <2 s
- Initialization reliability: >99.9%

Positioning Specifications

- Post Processing Static
- Horizontal: 2.5 mm + 0.5 ppm RMS
- Vertical: 5 mm + 0.5 ppm RMS
- Real Time Kinematic
- Horizontal: 8 mm + 1 ppm RMS
- Vertical: 15 mm + 1 ppm RMS
- E-RTK¹ (baseline<100 km)
- Horizontal: 0.2 m + 1 ppm RMS
- Vertical: 0.4 m + 1 ppm RMS
- Code differential GNSS positioning
- Horizontal: 0.25 m + 1 ppm RMS
- Vertical: 0.5 m + 1 ppm RMS
- SBAS: Typically <1 m 3D RMS
- Standalone: <1.5 m 3D RMS

Communications and Memory

- 1 Serial port (7 pin Lemo).
- Baud rates up to 921,600 bps.
- Radio modem: Tx/Rx with full frequency range from 410-470 MHz²
- Transmit power: 0.5-2W adjustable
- Range: 1-4 km
- Position data output rates: 1 Hz, 2 Hz, 5 Hz, 10 Hz
- 5 LEDs (indicating Power, Satellite Tracking, Bluetooth[®] and Differential Data)
- Bluetooth[®]: V 2.X protocol, work compatible with Windows 7, Windows mobile and Android

Data Format

- Correction data I/O:
- RTCM 2.x, 3.x, CMR (GPS only), CMR+ (GPS only).
- Position data output:
- ASCII: NMEA-0183 GSV, RMC, HDT, VHD, GGA, GSA, ZDA, VTG, GST, PJK, PTNL
- ComNav Binary update to 20 Hz

Physical

- Size(W×H): 15.8 cm × 7.5 cm
- Weight: 0.95 kg (include 2 batteries)

Environmental

- Operating temperature: -40 °C to +65 °C (40 °F to 149 °F)
- Storage temperature: -40 °C to +85 °C (40 °F to 185 °F)
- Humidity: 100% condensation
- Waterproof and dust proof: IP67 protected from temporary immersion to depth of 1 meter, floats
- Shock: survives a 2 meter drop on to concrete

Electrical

- Input Voltage: 5-27 VDC
- Power consumption: 2.85 W (3 constellations)³
- Li-ion battery capacity: 2 × 1800 mAh, up to 8 hours typically
- Memory: 256 MB internal with up to 16 GB pluggable memory card

Software

- ComNav field data collection software CGSurvey
- Carlson's SurvCE field data collection software (optional)
- MicroSurvey's FieldGenius field data collection software (optional)

¹ E-RTK, BeiDou B3 signal used in RTK calculate engine; concern the current situation, this mode can be used in APAC.

² 410-470 MHz, 3 frequency range, 410-430, 430-460, 460-470, need to clarify when place the order.

³ Power consumption will increase if using internal radio modem transmitter.

Specifications subject to change without notice.

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Fax: +86 21 54308582

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www.comnavtech.com

5. Results

The total route length from Jagdalpur to Bhanpuri is approx. 39.48 km and the proposed forest area for diversion is 0.699 Ha. DGPS Survey processing report and co-ordinates of the PCP are in Annexure-1, and DGPS coordinates of TBM and forest patch boundary coordinates is in Annexure-2. The geo-referenced maps are in Annexure -3.

AREA STATEMENT

Jagdalpur to Bhanpuri Proposed Forest Diversion Area Statement			
Total Route Length (in KM)	Total Forest Patch Length (in KM)	OFC Cable Trench Width (in KM)	Total Forest Diversion Area (in HA)
39.48	13.99	0.0005	0.699

Jagdalpur To Bhanpuri - Details of Reserved/Protected Forest Land					
SL. NO	PATCH NUMBER	COMPARTMENT TYPE	COMPARTMENT NUMBER	TYPE OF LAND	DIVERSION AREA (in HA)
1	1	Reserved Forest	1718	RF	0.029
2	2	Reserved Forest	1333	RF	0.026
3	3	Reserved Forest	1334	RF	0.070
4	5	Reserved Forest	1335	RF	0.028
5	14	Protected Forest	1428	PF	0.145
6	18	Protected Forest	1086	PF	0.061
7	26	Protected Forest	1071	PF	0.090
Total Protected/Reserved Forest Area (A)					0.449

Jagdalpur To Bhanpuri - Details of Revenue Forest Land					
SL. NO	PATCH NUMBER	VILLAGE NAME	KHASRA NUMBER	TYPE OF LAND	DIVERSION AREA (in HA)
1	4	METAWARA	283	Revenue Forest	0.003
2	6	METAWARA	23	Revenue Forest	0.004
3	7	METAWARA	21	Revenue Forest	0.014
4	7	METAWARA	7	Revenue Forest	0.016
5	8	METAWARA	79	Revenue Forest	0.005
6	11	MAHUPAL BARAI	34	Revenue Forest	0.006
7	12	MAHUPAL BARAI	1	Revenue Forest	0.005
8	13	BASTAR	454/1	Revenue Forest	0.096
9	15	BALENGA	696	Revenue Forest	0.005
10	16	BALENGA	698	Revenue Forest	0.013
11	17	CHAPKA	235/1	Revenue Forest	0.021

Jagdalpur To Bhanpuri - Details of Revenue Forest Land					
SL. NO	PATCH NUMBER	VILLAGE NAME	KHASRA NUMBER	TYPE OF LAND	DIVERSION AREA (in HA)
12	2	ASANA	132	Revenue Forest	0.008
13	9	PARCHANPAL	1	Revenue Forest	0.010
14	10	MAHUPAL BARAI	85	Revenue Forest	0.002
15	19	MANJALA	513	Revenue Forest	0.001
16	19	MANJALA	514	Revenue Forest	0.003
17	20	MANJALA	503	Revenue Forest	0.002
18	21	TARAGAON	432	Revenue Forest	0.006
19	22	TARAGAON	429	Revenue Forest	0.002
20	23	TARAGAON	413	Revenue Forest	0.007
21	24	TARAGAON	228	Revenue Forest	0.005
22	25	TARAGAON	417	Revenue Forest	0.007
23	27	BHANPURI	443	Revenue Forest	0.004
24	28	BHANPURI	445	Revenue Forest	0.005
Total Revenue Forest Area					0.250

6. Background of Organization

6.1 Company Profile: Geotrax

Geotrax International Services (www.geotrax.in) is a Professional Land Mapping and Services provider across India established in the year 1999. During the last 14+ years, we had an opportunity to execute a variety of surveying jobs all over India and in the Middle East to various customer specifications for RIS, LIS, and Municipal GIS oriented jobs. Cadastral Surveys using ETS/DGPS and Provision of Ground control conforming to stringent accuracy standards using high end instruments as RTK/GPRS DGPS is our specialty. We also have a UAV (Drone) and Ground Penetrating Radar (on Roaster).

Geotrax is headed by Mr. V.V.S Bandhakavi (Ex-Survey of India employee) who has more than 40+ years' experience in the field of surveying in India and abroad.

Some of our major clients include:

- Odisha Space Application Centre (ORSAC)
- Steel Authority of India (SAIL)
- National Thermal Power Corporation (NTPC)
- Survey Settlement and Land Records Department (Govt. Of Gujarat)
- Survey Settlement and Land Records Department (Govt. Of Madhya Pradesh)
- Irrigation Dept. (Govt. of Jammu and Kashmir)
- National Remote Sensing Agency (Hyderabad)
- Meinhardt India Private Limited (Delhi),
- Nagarjuna Construction Company (NCC, Hyderabad)
- Consulting Engineering Services (CES, New Delhi)
- Lee Associates of South Asia (LASA, Delhi)
- Power development Corporation (Govt. of Jammu and Kashmir)

Geotrax expertise covers:

- ❖ DGPS Surveys for Mining lease boundary, and Forest Diversion
- ❖ Consultancy services for Mining Plan & EIA
- ❖ Boundary and cadastral surveys using DGPS and Total station;
- ❖ Topographic surveys.
- ❖ Ground control surveys for photogrammetric projects, including Airborne GPS.



- ❖ Only one of the two companies in India who are empanelled by NRSA for DGPS survey for ground control point collection
- ❖ Route and alignment surveys combining conventional and photogrammetric methods.
- ❖ Construction and cross-section surveys (from road design to precision layout and quality control).

Being a client focused organization, GeoTrax's combination of survey equipment, personnel, and computer resources allow for the tailoring of the project approach to match the orders of accuracy and precision requirements for each project. GeoTrax's equipment resources include 250 DGPS, 33 hand-held GPS units, theodolites, electronic digital and automatic levels, 19 Electronic Total Stations, and data collectors.

On the mapping side, our CAD and GIS professionals assist the survey projects by creating accurate maps. We have dedicated CAD experts who have extensive experience with different CAD software.

7. Annexure

7.1 Annexure – 1: PCP Observation Processing Report



AUSPOS GPS Processing Report

March 13, 2016

This document is a report of the GPS data processing undertaken by the AUSPOS Online GPS Processing Service (version: AUSPOS 2.2) . The AUSPOS Online GPS Processing Service uses International GNSS Service (IGS) products (final, rapid, ultra-rapid depending on availability) to compute precise coordinates in ITRF anywhere on Earth and GDA94 within Australia. The Service is designed to process only dual frequency GPS phase data.

An overview of the GPS processing strategy is included in this report.

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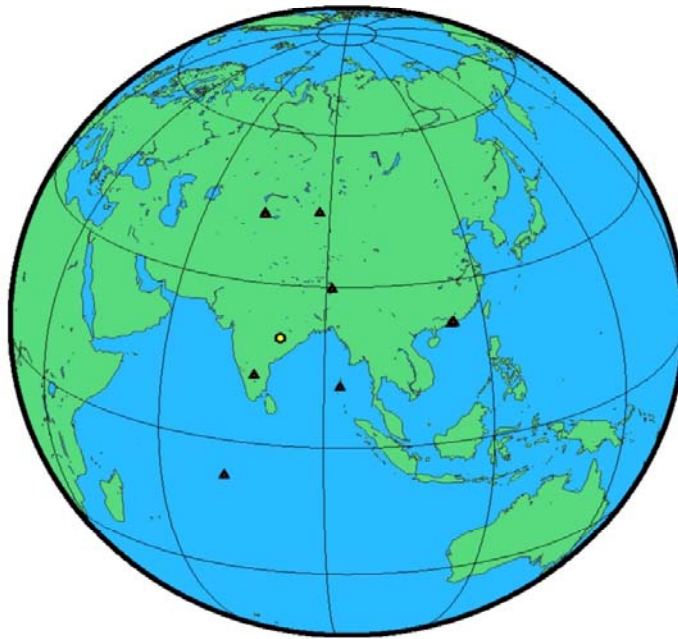


1 User Data

All antenna heights refer to the vertical distance from the Ground Mark to the Antenna Reference Point (ARP).

Station (s)	Submitted File	Antenna Type	Antenna Height (m)	Start Time	End Time
0310	03102966068t.160	NONE NONE	1.835	2016/03/08 11:05:00	2016/03/11 11:08:00

2 Processing Summary



Date	User Stations	Reference Stations	Orbit Type
2016/03/08 11:05:00	0310	CHUM COAL DGAR FOMO HKNP HKSC HKSL IISC LHAZ PBRI POL2 URUM	IGS rapid

Remark: An IGS Rapid Orbit product has been used in this computation, IGS Rapid orbits are usually of very high quality. However, to ensure you achieve the highest quality coordinates please resubmit approximately 2 weeks after the observation session end to ensure the use of the IGS Final Orbit product.



3 Computed Coordinates, ITRF2008

All computed coordinates are based on the IGS realisation of the ITRF2008 reference frame. All the given ITRF2008 coordinates refer to a mean epoch of the site observation data. All coordinates refer to the Ground Mark.

3.1 Cartesian, ITRF2008

Station	X (m)	Y (m)	Z (m)	ITRF2008 @
0310	847431.032	5923497.015	2201542.645	08/03/2016
CHUM	1228950.494	4508079.980	4327868.536	08/03/2016
COAL	-2363061.244	5418784.895	2386861.974	08/03/2016
DGAR	1916268.941	6029977.645	-801719.532	08/03/2016
FOMO	-2359952.443	5416530.098	2394688.441	08/03/2016
HKNP	-2392360.793	5400226.084	2400094.284	08/03/2016
HKSC	-2414267.443	5386768.794	2407459.846	08/03/2016
HKSL	-2393382.945	5393860.986	2412592.226	08/03/2016
IISC	1337935.984	6070317.122	1427877.174	08/03/2016
LHAZ	-106941.954	5549269.791	3139215.168	08/03/2016
PBRI	-295635.867	6240848.757	1278178.473	08/03/2016
POL2	1239971.069	4530790.141	4302578.862	08/03/2016
URUM	193030.282	4606851.294	4393311.529	08/03/2016

3.2 Geodetic, GRS80 Ellipsoid, ITRF2008

Geoid-ellipsoidal separations, in this section, are computed using a spherical harmonic synthesis of the global EGM2008 geoid. More information on the EGM2008 geoid can be found at <http://earth-info.nga.mil/GandG/wgs84/gravitymod/egm2008/>

Station	Latitude (DMS)	Longitude (DMS)	Ellipsoidal Height(m)	Derived Above Geoid Height(m)
0310	20 19 27.95862	81 51 30.09666	374.523	439.432
CHUM	42 59 54.60521	74 45 03.96822	716.346	759.336
COAL	22 07 14.46822	113 33 40.99130	169.428	173.849
DGAR	-7 16 10.85492	72 22 12.87672	-64.945	8.936
FOMO	22 11 50.69337	113 32 32.97380	56.639	61.324
HKNP	22 14 56.63138	113 53 37.96948	350.665	354.011
HKSC	22 19 19.81344	114 08 28.29612	20.203	22.659
HKSL	22 22 19.21124	113 55 40.75260	95.266	98.809
IISC	13 01 16.21017	77 34 13.36859	843.700	929.621
LHAZ	29 39 26.40107	91 06 14.51053	3624.609	3659.300
PBRI	11 38 16.00933	92 42 43.69169	-22.497	38.437
POL2	42 40 47.17396	74 41 39.36737	1714.214	1754.280
URUM	43 48 28.61949	87 36 02.41330	858.876	922.255



3.3 Positional Uncertainty (95% C.L.) - Geodetic, ITRF2008

Station	Longitude(East) (m)	Latitude(North) (m)	Ellipsoidal Height(Up) (m)
0310	0.006	0.005	0.011
CHUM	0.006	0.005	0.009
COAL	0.008	0.005	0.010
DGAR	0.007	0.007	0.015
FOMO	0.008	0.005	0.010
HKNP	0.008	0.005	0.009
HKSC	0.008	0.005	0.010
HKSL	0.008	0.005	0.009
IISC	0.006	0.005	0.010
LHAZ	0.006	0.005	0.010
PBRI	0.006	0.005	0.010
POL2	0.006	0.005	0.009
URUM	0.006	0.005	0.008



4 Ambiguity Resolution - Per Baseline

Baseline	Ambiguities Resolved	Baseline Length (km)
CHUM - POL2	94.5 %	35.732
DGAR - IISC	88.9 %	2303.736
CHUM - URUM	90.6 %	1042.674
HKSC - HKSL	84.8 %	22.645
COAL - HKNP	92.0 %	37.121
HKNP - URUM	67.2 %	3359.554
HKNP - HKSL	85.1 %	14.063
HKNP - PBRI	66.7 %	2522.221
0310 - IISC	94.5 %	927.744
LHAZ - PBRI	70.9 %	1994.328
0310 - PBRI	75.0 %	1503.302
COAL - FOMO	91.4 %	8.718
AVERAGE	83.5 %	1147.653

Please note for a regional solution, such as used by AUSPOS, ambiguity resolution success rate of 50% or better for a baseline formed by a user site indicates a reliable solution.



5 Computation Standards

5.1 Computation System

Software	Bernese GNSS Software Version 5.2.
GNSS system(s)	GPS only.

5.2 Data Preprocessing and Measurement Modelling

Data preprocessing	Phase preprocessing is undertaken in a baseline by baseline mode using triple-differences. In most cases, cycle slips are fixed by the simultaneous analysis of different linear combinations of L1 and L2. If a cycle slip cannot be fixed reliably, bad data points are removed or new ambiguities are set up. A data screening step on the basis of weighted postfit residuals is also performed, and outliers are removed.
Basic observable	Carrier phase with an elevation angle cutoff of 7° and a sampling rate of 3 minutes. However, data cleaning is performed a sampling rate of 30 seconds. Elevation dependent weighting is applied according to $1/\sin(e)^2$ where e is the satellite elevation.
Modelled observable	Double differences of the ionosphere-free linear combination.
Ground antenna phase centre calibrations	IGS08 absolute phase-centre variation model is applied.
Tropospheric Model	A priori model is the GMF mapped with the DRY-GMF.
Tropospheric Estimation	Zenith delay corrections are estimated relying on the WET-GMF mapping function in intervals of 2 hour. N-S and E-W horizontal delay parameters are solved for every 24 hours.
Tropospheric Mapping Function	GMF
Ionosphere	First-order effect eliminated by forming the ionosphere-free linear combination of L1 and L2. Second and third effect applied.
Tidal displacements	Solid earth tidal displacements are derived from the complete model from the IERS Conventions 2010, but ocean tide loading is not applied.
Atmospheric loading	Applied
Satellite centre of mass correction	IGS08 phase-centre variation model applied
Satellite phase centre calibration	IGS08 phase-centre variation model applied
Satellite trajectories	Best available IGS products.
Earth Orientation	Best available IGS products.



5.3 Estimation Process

Adjustment	Weighted least-squares algorithm.
Station coordinates	Coordinate constraints are applied at the Reference sites with standard deviation of 1mm and 2mm for horizontal and vertical components respectively.
Troposphere	Zenith delay parameters and pairs of horizontal delay gradient parameters are estimated for each station in intervals of 2 hours and 24 hours.
Ionospheric correction	An ionospheric map derived from the contributing reference stations is used to aid ambiguity resolution.
Ambiguity	Ambiguities are resolved in a baseline-by-baseline mode using the Code-Based strategy for 180-6000km baselines, the Phase-Based L5/L3 strategy for 18-200km baselines, the Quasi-Ionosphere-Free (QIF) strategy for 18-2000km baselines and the Direct L1/L2 strategy for 0-20km baselines.

5.4 Reference Frame and Coordinate Uncertainty

Terrestrial reference frame	IGS08 station coordinates and velocities mapped to the mean epoch of observation.
Australian datum	GDA94 coordinates determined via Helmert transformation from ITRF using the Dawson and Woods (2010) parameters.
Derived AHD	For stations within Australia, AUSGeoid09 is used to compute AHD. AUSGeoid09 is the Australia-wide gravimetric quasigeoid model that has been a posteriori fitted to the Australian Height Datum.
Above-geoid heights	Earth Gravitational Model EGM2008 released by the National Geospatial-Intelligence Agency (NGA) EGM Development Team is used to compute above-geoid heights. This gravitational model is complete to spherical harmonic degree and order 2159, and contains additional coefficients extending to degree 2190 and order 2159.
Coordinate uncertainty	Coordinate uncertainty is expressed in terms of the 95% confidence level for both GDA94 and ITRF2008. Uncertainties are scaled using an empirically derived model which is a function of data span, quality and geographical location.

7.2 Annexure – 2: DGPS Surveyed coordinates of Forest Patches

Sr. No	Patch No	Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
1	PATCH NO-1	P1	609738.973	2111292.351	19°05'29.84889"	82°02'35.44205"
2		P2	609717.540	2111358.772	19°05'32.01371"	82°02'34.72220"
3		P3	609688.472	2111471.838	19°05'35.69736"	82°02'33.75060"
4		P4	609666.337	2111567.041	19°05'38.79861"	82°02'33.01258"
5		P5	609653.361	2111641.532	19°05'41.22429"	82°02'32.58376"
6		P6	609634.985	2111724.877	19°05'43.93906"	82°02'31.97194"
7		P7	609631.567	2111740.046	19°05'44.43316"	82°02'31.85807"
8		P8	609610.920	2111779.963	19°05'45.73565"	82°02'31.15969"
9		P9	609601.208	2111809.160	19°05'46.68731"	82°02'30.83331"
10		P10	609583.984	2111838.350	19°05'47.64019"	82°02'30.24987"
11	PATCH NO-2	P11	607760.418	2113778.052	19°06'51.08881"	82°01'28.23863"
12		P12	607753.014	2113825.817	19°06'52.64401"	82°01'27.99484"
13		P13	607745.383	2113871.786	19°06'54.14085"	82°01'27.74290"
14		P14	607739.623	2113908.949	19°06'55.35085"	82°01'27.55322"
15		P15	607734.744	2113936.361	19°06'56.24349"	82°01'27.39175"
16		P16	607732.593	2113945.533	19°06'56.54226"	82°01'27.31997"
17		P17	607729.066	2113960.573	19°06'57.03221"	82°01'27.20226"
18		P18	607725.941	2113973.898	19°06'57.46625"	82°01'27.09799"
19		P19	607721.750	2114007.452	19°06'58.55855"	82°01'26.96130"
20		P20	607716.677	2114048.076	19°06'59.88103"	82°01'26.79581"
21		P21	607712.208	2114083.856	19°07'01.04582"	82°01'26.65005"
22		P22	607702.858	2114154.505	19°07'03.34579"	82°01'26.34424"
23		P23	607692.526	2114229.389	19°07'05.78375"	82°01'26.00563"
24		P24	607684.996	2114283.959	19°07'07.56035"	82°01'25.75888"
25		P25	607680.488	2114339.882	19°07'09.38038"	82°01'25.61580"
26		P26	607674.136	2114400.207	19°07'11.34396"	82°01'25.41050"
27		P27	607669.101	2114448.027	19°07'12.90051"	82°01'25.24775"
28	PATCH NO-3	P28	607636.212	2114744.450	19°07'22.54942"	82°01'24.18154"
29		P29	607599.494	2115127.945	19°07'35.03149"	82°01'23.00170"
30		P30	607604.204	2115049.668	19°07'32.48425"	82°01'23.14722"
31		P31	607609.754	2114985.034	19°07'30.38066"	82°01'23.32420"
32		P32	607616.644	2114920.783	19°07'28.28925"	82°01'23.54716"
33		P33	607623.658	2114864.387	19°07'26.45335"	82°01'23.77589"
34		P34	607629.064	2114812.446	19°07'24.76268"	82°01'23.95050"
35		P35	607578.714	2115233.805	19°07'38.47910"	82°01'22.31169"
36		P36	607562.425	2115347.991	19°07'42.19664"	82°01'21.77707"
37		P37	607544.249	2115513.009	19°07'47.56815"	82°01'21.18800"
38		P38	607529.474	2115648.911	19°07'51.99184"	82°01'20.70954"
39		P39	607520.051	2115742.041	19°07'55.02318"	82°01'20.40568"
40		P40	607497.245	2115795.571	19°07'56.76884"	82°01'19.63582"
41		P41	607494.810	2115848.150	19°07'58.47968"	82°01'19.56301"
42		P42	607490.118	2115887.305	19°07'59.75428"	82°01'19.41025"

Sr. No	Patch No	Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
43	PATCH NO-4	P43	607485.180	2115991.352	19°08'03.13988"	82°01'19.26208"
44		P44	607446.512	2116125.539	19°08'07.51233"	82°01'17.96544"
45		P45	607405.366	2116387.191	19°08'16.03171"	82°01'16.60951"
46		P46	607397.486	2116402.897	19°08'16.54410"	82°01'16.34294"
47		P47	607388.200	2116421.404	19°08'17.14789"	82°01'16.02882"
48		P48	607379.545	2116438.655	19°08'17.71073"	82°01'15.73600"
49	PATCH NO-5	P49	607358.862	2116517.158	19°08'20.26838"	82°01'15.04379"
50		P50	607317.805	2116564.302	19°08'21.80975"	82°01'13.64795"
51		P51	607264.962	2116624.979	19°08'23.79361"	82°01'11.85140"
52		P52	607206.699	2116691.879	19°08'25.98095"	82°01'09.87055"
53		P53	607167.203	2116737.231	19°08'27.46372"	82°01'08.52775"
54		P54	607135.261	2116773.909	19°08'28.66292"	82°01'07.44174"
55		P55	607060.614	2116828.882	19°08'30.46534"	82°01'04.89771"
56		P56	607043.573	2116846.919	19°08'31.05531"	82°01'04.31801"
57		P57	607019.060	2116873.804	19°08'31.93454"	82°01'03.48435"
58		P58	606998.203	2116896.440	19°08'32.67483"	82°01'02.77497"
59		P59	606984.422	2116913.686	19°08'33.23846"	82°01'02.30671"
60		P60	606968.855	2116928.779	19°08'33.73239"	82°01'01.77690"
61	PATCH NO-6	P61	606960.138	2116934.663	19°08'33.92543"	82°01'01.47968"
62		P62	606948.380	2116946.653	19°08'34.31771"	82°01'01.07961"
63		P63	606935.969	2116960.796	19°08'34.78013"	82°01'00.65763"
64		P64	606920.806	2116978.074	19°08'35.34506"	82°01'00.14209"
65		P65	606912.990	2116991.827	19°08'35.79392"	82°00'59.87728"
66		P66	606907.259	2117001.910	19°08'36.12299"	82°00'59.68315"
67	PATCH NO-7	P67	606894.769	2117016.121	19°08'36.58766"	82°00'59.25846"
68		P68	606859.822	2117046.298	19°08'37.57591"	82°00'58.06829"
69		P69	606828.368	2117073.458	19°08'38.46540"	82°00'56.99705"
70		P70	606794.255	2117095.772	19°08'39.19771"	82°00'55.83389"
71		P71	606754.271	2117118.641	19°08'39.94921"	82°00'54.46982"
72		P72	606707.546	2117142.116	19°08'40.72168"	82°00'52.87515"
73		P73	606692.133	2117151.141	19°08'41.01816"	82°00'52.34940"
74		P74	606675.517	2117160.870	19°08'41.33778"	82°00'51.78260"
75		P75	606661.809	2117168.896	19°08'41.60146"	82°00'51.31497"
76		P76	606616.780	2117191.294	19°08'42.33859"	82°00'49.77816"
77		P77	606570.421	2117213.465	19°08'43.06856"	82°00'48.19574"
78		P78	606532.294	2117231.912	19°08'43.67585"	82°00'46.89437"
79		P79	606491.387	2117250.213	19°08'44.27888"	82°00'45.49779"
80		P80	606459.342	2117264.477	19°08'44.74892"	82°00'44.40377"
81		P81	606424.700	2117280.825	19°08'45.28726"	82°00'43.22124"
82		P82	606394.799	2117295.026	19°08'45.75485"	82°00'42.20059"
83		P83	606372.887	2117305.500	19°08'46.09969"	82°00'41.45264"
84	PATCH NO-8	P84	606320.226	2117327.317	19°08'46.81933"	82°00'39.65443"
85		P85	606295.155	2117340.476	19°08'47.25212"	82°00'38.79887"
86		P86	606268.143	2117354.654	19°08'47.71842"	82°00'37.87710"

Sr. No	Patch No	Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
87		P87	606351.835	2117311.350	19°08'46.29397"	82°00'40.73321"
88	PATCH NO-9	P88	601236.879	2120559.182	19°10'32.88771"	81°57'46.26542"
89		P89	601203.006	2120579.557	19°10'33.55659"	81°57'45.10963"
90		P90	601166.095	2120601.759	19°10'34.28546"	81°57'43.85014"
91		P91	601132.811	2120627.583	19°10'35.13150"	81°57'42.71550"
92		P92	601112.931	2120644.793	19°10'35.69491"	81°57'42.03816"
93		P93	601092.422	2120662.951	19°10'36.28927"	81°57'41.33942"
94		P94	601072.825	2120680.300	19°10'36.85717"	81°57'40.67179"
95	PATCH NO-10	P95	600821.517	2120945.359	19°10'45.52467"	81°57'32.11797"
96		P96	600812.491	2120955.156	19°10'45.84499"	81°57'31.81079"
97		P97	600803.964	2120964.412	19°10'46.14760"	81°57'31.52059"
98		P98	600793.766	2120975.481	19°10'46.50950"	81°57'31.17354"
99	PATCH NO-11	P99	600518.319	2121265.206	19°10'55.98358"	81°57'21.79759"
100		P100	600498.109	2121293.098	19°10'56.89452"	81°57'21.11089"
101		P101	600481.740	2121315.687	19°10'57.63230"	81°57'20.55472"
102		P102	600463.857	2121334.960	19°10'58.26242"	81°57'19.94609"
103		P103	600447.460	2121352.631	19°10'58.84019"	81°57'19.38802"
104	PATCH NO-12	P104	600272.845	2121539.007	19°11'04.93419"	81°57'13.44460"
105		P105	600250.992	2121558.507	19°11'05.57244"	81°57'12.70006"
106		P106	600225.671	2121583.784	19°11'06.39921"	81°57'11.83784"
107		P107	600204.073	2121605.343	19°11'07.10439"	81°57'11.10243"
108	PATCH NO-13	P108	600201.696	2121607.017	19°11'07.15925"	81°57'11.02136"
109		P109	600186.586	2121622.372	19°11'07.66145"	81°57'10.50689"
110		P110	600166.857	2121641.867	19°11'08.29914"	81°57'09.83508"
111		P111	600159.874	2121648.767	19°11'08.52486"	81°57'09.59729"
112		P112	600136.525	2121679.818	19°11'09.53910"	81°57'08.80367"
113		P113	600122.616	2121698.314	19°11'10.14327"	81°57'08.33092"
114		P114	600047.375	2121777.556	19°11'12.73440"	81°57'05.76963"
115		P115	599988.306	2121829.930	19°11'14.44863"	81°57'03.75703"
116		P116	599915.635	2121904.439	19°11'16.88534"	81°57'01.28283"
117		P117	599795.661	2122033.645	19°11'21.10976"	81°56'57.19920"
118		P118	599702.954	2122131.462	19°11'24.30822"	81°56'54.04330"
119		P119	599645.522	2122192.595	19°11'26.30707"	81°56'52.08827"
120		P120	599578.131	2122261.665	19°11'28.56587"	81°56'49.79374"
121		P121	599556.631	2122276.840	19°11'29.06332"	81°56'49.06043"
122		P122	599444.688	2122400.231	19°11'33.09707"	81°56'45.25054"
123		P123	599390.125	2122455.727	19°11'34.91200"	81°56'43.39264"
124		P124	599326.090	2122533.630	19°11'37.45752"	81°56'41.21461"
125		P125	599253.765	2122641.816	19°11'40.98964"	81°56'38.75831"
126		P126	599201.415	2122722.241	19°11'43.61511"	81°56'36.98076"
127		P127	599180.565	2122747.331	19°11'44.43498"	81°56'36.27151"
128		P128	599121.784	2122847.183	19°11'47.69357"	81°56'34.27736"
129		P129	599110.672	2122887.638	19°11'49.01156"	81°56'33.90437"
130		P130	599090.250	2122921.723	19°11'50.12395"	81°56'33.21146"

Sr. No	Patch No	Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
131		P131	599073.828	2122927.381	19°11'50.31092"	81°56'32.65019"
132		P132	599022.870	2123001.135	19°11'52.71912"	81°56'30.91905"
133		P133	598986.451	2123060.520	19°11'54.65735"	81°56'29.68302"
134	PATCH NO-14	P134	596537.881	2125443.394	19°13'12.59914"	81°55'06.27286"
135		P135	596489.547	2125500.491	19°13'14.46484"	81°55'04.62797"
136		P136	596456.591	2125544.569	19°13'15.90439"	81°55'03.50735"
137		P137	596426.169	2125593.032	19°13'17.48614"	81°55'02.47427"
138		P138	596386.196	2125669.722	19°13'19.98778"	81°55'01.11924"
139		P139	596349.205	2125737.846	19°13'22.21024"	81°54'59.86475"
140		P140	596302.167	2125822.392	19°13'24.96864"	81°54'58.26914"
141		P141	596236.179	2125940.429	19°13'28.81978"	81°54'56.03057"
142		P142	596187.069	2126029.572	19°13'31.72806"	81°54'54.36481"
143		P143	596124.378	2126142.737	19°13'35.42010"	81°54'52.23826"
144		P144	596088.122	2126209.365	19°13'37.59377"	81°54'51.00860"
145		P145	596032.286	2126329.159	19°13'41.50031"	81°54'49.11794"
146		P146	596014.065	2126350.891	19°13'42.21038"	81°54'48.49782"
147		P147	595997.905	2126447.342	19°13'45.35074"	81°54'47.96174"
148		P148	595987.735	2126460.511	19°13'45.78088"	81°54'47.61583"
149		P149	595987.535	2126611.628	19°13'50.69687"	81°54'47.63614"
150		P150	595970.085	2126767.982	19°13'55.78614"	81°54'47.06664"
151		P151	595911.644	2126870.256	19°13'59.12316"	81°54'45.08353"
152		P152	595838.653	2126984.878	19°14'02.86435"	81°54'42.60432"
153		P153	595806.417	2127038.317	19°14'04.60827"	81°54'41.50990"
154		P154	595742.441	2127133.037	19°14'07.70048"	81°54'39.33583"
155		P155	595670.949	2127243.523	19°14'11.30684"	81°54'36.90716"
156		P156	595587.327	2127363.203	19°14'15.21434"	81°54'34.06465"
157		P157	595515.521	2127457.285	19°14'18.28711"	81°54'31.62221"
158		P158	595460.041	2127540.254	19°14'20.99559"	81°54'29.73691"
159		P159	595423.078	2127613.337	19°14'23.37932"	81°54'28.48402"
160		P160	595387.682	2127677.356	19°14'25.46790"	81°54'27.28319"
161		P161	595308.483	2127809.991	19°14'29.79605"	81°54'24.59435"
162		P162	595247.235	2127907.193	19°14'32.96850"	81°54'22.51398"
163		P163	594934.497	2128410.703	19°14'49.40100"	81°54'11.89236"
164		P164	594920.558	2128432.411	19°14'50.10953"	81°54'11.41878"
165		P165	594905.263	2128456.228	19°14'50.88692"	81°54'10.89918"
166		P166	594883.216	2128490.564	19°14'52.00760"	81°54'10.15012"
167		P167	594849.188	2128542.384	19°14'53.69912"	81°54'08.99386"
168		P168	594824.492	2128578.092	19°14'54.86489"	81°54'08.15433"
169		P169	594803.149	2128616.065	19°14'56.10379"	81°54'07.43007"
170		P170	594801.249	2128622.555	19°14'56.31520"	81°54'07.36614"
171		P171	594780.337	2128663.936	19°14'57.66490"	81°54'06.65722"
172		P172	594744.488	2128724.653	19°14'59.64612"	81°54'05.44014"
173		P173	594708.948	2128770.986	19°15'01.15936"	81°54'04.23109"
174		P174	593120.181	2131099.557	19°16'17.17551"	81°53'10.22011"

Sr. No	Patch No	Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
175		P175	593084.962	2131126.280	19°16'18.05069"	81°53'09.01830"
176		P176	593046.779	2131150.165	19°16'18.83402"	81°53'07.71448"
177		P177	593025.173	2131164.211	19°16'19.29453"	81°53'06.97678"
178		P178	593015.377	2131168.875	19°16'19.44789"	81°53'06.64202"
179		P179	593006.502	2131168.269	19°16'19.42964"	81°53'06.33789"
180		P180	592974.094	2131188.933	19°16'20.10722"	81°53'05.23132"
181		P181	592892.234	2131250.438	19°16'22.12162"	81°53'02.43783"
182		P182	592843.307	2131284.138	19°16'23.22601"	81°53'00.76765"
183		P183	592800.899	2131312.591	19°16'24.15862"	81°52'59.31985"
184		P184	592780.589	2131326.154	19°16'24.60319"	81°52'58.62646"
185		P185	591496.894	2132473.431	19°17'02.13614"	81°52'14.84862"
186		P186	591455.312	2132525.604	19°17'03.84014"	81°52'13.43303"
187		P187	591398.531	2132597.346	19°17'06.18325"	81°52'11.50009"
188		P188	591338.906	2132674.091	19°17'08.68954"	81°52'09.47058"
189		P189	591282.998	2132746.193	19°17'11.04420"	81°52'07.56759"
190		P190	591212.710	2132837.523	19°17'14.02669"	81°52'05.17523"
191		P191	591147.989	2132922.610	19°17'16.80518"	81°52'02.97246"
192		P192	591083.721	2133007.364	19°17'19.57276"	81°52'00.78518"
193		P193	591044.580	2133058.690	19°17'21.24880"	81°51'59.45301"
194		P194	591000.375	2133123.530	19°17'23.36530"	81°51'57.94962"
195		P195	590857.693	2133297.731	19°17'29.05537"	81°51'53.09110"
196		P196	590791.021	2133381.670	19°17'31.79679"	81°51'50.82119"
197		P197	590746.721	2133438.767	19°17'33.66138"	81°51'49.31319"
198		P198	590249.999	2134099.329	19°17'55.23036"	81°51'32.40725"
199		P199	590241.709	2134108.658	19°17'55.53518"	81°51'32.12480"
200		P200	590234.106	2134117.214	19°17'55.81476"	81°51'31.86575"
201		P201	590223.631	2134129.351	19°17'56.21127"	81°51'31.50891"
202		P202	590213.800	2134140.764	19°17'56.58412"	81°51'31.17404"
203		P203	590204.373	2134152.274	19°17'56.96007"	81°51'30.85299"
204		P204	590196.823	2134161.492	19°17'57.26116"	81°51'30.59586"
205		P205	590142.521	2134235.672	19°17'59.68306"	81°51'28.74794"
206		P206	590136.165	2134243.477	19°17'59.93799"	81°51'28.53152"
207		P207	590129.889	2134251.186	19°18'00.18978"	81°51'28.31777"
208		P208	590122.491	2134260.272	19°18'00.48654"	81°51'28.06584"
209		P209	590117.074	2134266.924	19°18'00.70381"	81°51'27.88139"
210		P210	590112.681	2134272.319	19°18'00.88003"	81°51'27.73179"
211		P211	590107.091	2134281.710	19°18'01.18641"	81°51'27.54185"
212		P212	590098.040	2134294.075	19°18'01.59010"	81°51'27.23383"
213		P213	590088.461	2134307.160	19°18'02.01731"	81°51'26.90786"
214		P214	590077.414	2134322.252	19°18'02.51005"	81°51'26.53190"
215		P215	590066.313	2134337.417	19°18'03.00518"	81°51'26.15412"
216		P216	590055.012	2134352.855	19°18'03.50922"	81°51'25.76953"
217		P217	590031.833	2134384.519	19°18'04.54300"	81°51'24.98075"
218		P218	590042.432	2134370.040	19°18'04.07028"	81°51'25.34144"

Sr. No	Patch No	Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
219		P219	589830.148	2134645.089	19°18'13.05198"	81°51'18.11454"
220		P220	589825.671	2134650.276	19°18'13.22146"	81°51'17.96200"
221		P221	589821.028	2134655.655	19°18'13.39717"	81°51'17.80384"
222		P222	589815.534	2134662.020	19°18'13.60512"	81°51'17.61667"
223		P223	589809.391	2134669.137	19°18'13.83761"	81°51'17.40741"
224		P224	589478.252	2135108.929	19°18'28.19751"	81°51'06.13558"
225		P225	589459.554	2135132.032	19°18'28.95207"	81°51'05.49879"
226		P226	589439.482	2135156.832	19°18'29.76204"	81°51'04.81524"
227		P227	589422.140	2135178.259	19°18'30.46188"	81°51'04.22463"
228		P228	589405.203	2135199.186	19°18'31.14536"	81°51'03.64784"
229		P229	589386.779	2135225.561	19°18'32.00630"	81°51'03.02097"
230		P230	589383.873	2135231.960	19°18'32.21492"	81°51'02.92247"
231		P231	589360.123	2135259.188	19°18'33.10447"	81°51'02.11328"
232		P232	589346.228	2135278.100	19°18'33.72191"	81°51'01.64038"
233		P233	589334.233	2135294.806	19°18'34.26729"	81°51'01.23217"
234		P234	589319.041	2135317.388	19°18'35.00432"	81°51'00.71544"
235		P235	589077.256	2135636.769	19°18'45.43264"	81°50'52.48436"
236		P236	589062.551	2135656.320	19°18'46.07102"	81°50'51.98376"
237		P237	589048.696	2135674.741	19°18'46.67248"	81°50'51.51212"
238		P238	589032.986	2135693.040	19°18'47.27027"	81°50'50.97688"
239		P239	589020.157	2135707.984	19°18'47.75843"	81°50'50.53980"
240		P240	589004.036	2135730.005	19°18'48.47738"	81°50'49.99109"
241		P241	588988.793	2135747.198	19°18'49.03911"	81°50'49.47167"
242		P242	588981.739	2135749.860	19°18'49.12683"	81°50'49.23041"
243		P243	588924.721	2135826.606	19°18'51.63250"	81°50'47.28951"
244		P244	588910.054	2135847.173	19°18'52.30391"	81°50'46.79041"
245		P245	588895.366	2135867.772	19°18'52.97635"	81°50'46.29054"
246		P246	588886.944	2135889.887	19°18'53.69709"	81°50'46.00568"
247		P247	588853.663	2135926.299	19°18'54.88693"	81°50'44.87136"
248		P248	588837.225	2135937.916	19°18'55.26742"	81°50'44.31007"
249		P249	588828.219	2135942.522	19°18'55.41870"	81°50'44.00222"
250		P250	588766.180	2136018.746	19°18'57.90818"	81°50'41.88917"
251		P251	588763.966	2136025.476	19°18'58.12748"	81°50'41.81444"
252		P252	588639.381	2136187.750	19°19'03.42618"	81°50'37.57250"
253		P253	588520.574	2136335.785	19°19'08.26073"	81°50'33.52614"
254		P254	588492.083	2136394.471	19°19'10.17433"	81°50'32.55962"
255		P255	588465.554	2136416.441	19°19'10.89325"	81°50'31.65424"
256		P256	588284.666	2136643.557	19°19'18.31014"	81°50'25.49361"
257		P257	588108.515	2136876.440	19°19'25.91386"	81°50'19.49608"
258		P258	588187.195	2136769.834	19°19'22.43346"	81°50'22.17452"
259		P259	588074.529	2136907.842	19°19'26.94076"	81°50'18.33667"
260		P260	587995.435	2137032.099	19°19'30.99540"	81°50'15.64692"
261		P261	587896.179	2137145.194	19°19'34.69013"	81°50'12.26439"
262		P262	587894.446	2137153.856	19°19'34.97217"	81°50'12.20644"

Sr. No	Patch No	Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
263		P263	587820.266	2137248.882	19°19'38.07513"	81°50'09.68017"
264		P264	586033.631	2139478.362	19°20'50.88047"	81°49'08.81696"
265		P265	586022.437	2139488.641	19°20'51.21661"	81°49'08.43498"
266		P266	586007.278	2139502.196	19°20'51.65989"	81°49'07.91762"
267		P267	585993.510	2139514.143	19°20'52.05066"	81°49'07.44770"
268		P268	585978.406	2139527.249	19°20'52.47934"	81°49'06.93218"
269		P269	585965.284	2139537.863	19°20'52.82665"	81°49'06.48419"
270		P270	585944.525	2139552.888	19°20'53.31863"	81°49'05.77514"
271		P271	585916.840	2139572.925	19°20'53.97472"	81°49'04.82954"
272		P272	585883.832	2139596.815	19°20'54.75696"	81°49'03.70215"

Sr. No		Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
137	PATCH NO-14	P137	596426.169	2125593.032	19°13'17.48614"	81°55'02.47427"
138		P138	596386.196	2125669.722	19°13'19.98778"	81°55'01.11924"
139		P139	596349.205	2125737.846	19°13'22.21024"	81°54'59.86475"
140		P140	596302.167	2125822.392	19°13'24.96864"	81°54'58.26914"
141		P141	596236.179	2125940.429	19°13'28.81978"	81°54'56.03057"
142		P142	596187.069	2126029.572	19°13'31.72806"	81°54'54.36481"
143		P143	596124.378	2126142.737	19°13'35.42010"	81°54'52.23826"
144		P144	596088.122	2126209.365	19°13'37.59377"	81°54'51.00860"
145		P145	596032.286	2126329.159	19°13'41.50031"	81°54'49.11794"
146		P146	596014.065	2126350.891	19°13'42.21038"	81°54'48.49782"
147		P147	595997.905	2126447.342	19°13'45.35074"	81°54'47.96174"
148		P148	595987.735	2126460.511	19°13'45.78088"	81°54'47.61583"
149		P149	595987.535	2126611.628	19°13'50.69687"	81°54'47.63614"
150		P150	595970.085	2126767.982	19°13'55.78614"	81°54'47.06664"
151		P151	595911.644	2126870.256	19°13'59.12316"	81°54'45.08353"
152		P152	595838.653	2126984.878	19°14'02.86435"	81°54'42.60432"
153		P153	595806.417	2127038.317	19°14'04.60827"	81°54'41.50990"
154		P154	595742.441	2127133.037	19°14'07.70048"	81°54'39.33583"
155		P155	595670.949	2127243.523	19°14'11.30684"	81°54'36.90716"
156		P156	595587.327	2127363.203	19°14'15.21434"	81°54'34.06465"
157		P157	595515.521	2127457.285	19°14'18.28711"	81°54'31.62221"
158		P158	595460.041	2127540.254	19°14'20.99559"	81°54'29.73691"
159	PATCH NO-15	P159	595423.078	2127613.337	19°14'23.37932"	81°54'28.48402"
160		P160	595387.682	2127677.356	19°14'25.46790"	81°54'27.28319"
161		P161	595308.483	2127809.991	19°14'29.79605"	81°54'24.59435"
162		P162	595247.235	2127907.193	19°14'32.96850"	81°54'22.51398"
163	PATCH NO-15	P163	594934.497	2128410.703	19°14'49.40100"	81°54'11.89236"
164		P164	594920.558	2128432.411	19°14'50.10953"	81°54'11.41878"
165		P165	594905.263	2128456.228	19°14'50.88692"	81°54'10.89918"
166		P166	594883.216	2128490.564	19°14'52.00760"	81°54'10.15012"
167		P167	594849.188	2128542.384	19°14'53.69912"	81°54'08.99386"

Sr. No		Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
168	PATCH NO-16	P168	594824.492	2128578.092	19°14'54.86489"	81°54'08.15433"
169		P169	594803.149	2128616.065	19°14'56.10379"	81°54'07.43007"
170		P170	594801.249	2128622.555	19°14'56.31520"	81°54'07.36614"
171		P171	594780.337	2128663.936	19°14'57.66490"	81°54'06.65722"
172		P172	594744.488	2128724.653	19°14'59.64612"	81°54'05.44014"
173		P173	594708.948	2128770.986	19°15'01.15936"	81°54'04.23109"
174	PATCH NO-17	P174	593120.181	2131099.557	19°16'17.17551"	81°53'10.22011"
175		P175	593084.962	2131126.280	19°16'18.05069"	81°53'09.01830"
176		P176	593046.779	2131150.165	19°16'18.83402"	81°53'07.71448"
177		P177	593025.173	2131164.211	19°16'19.29453"	81°53'06.97678"
178		P178	593015.377	2131168.875	19°16'19.44789"	81°53'06.64202"
179		P179	593006.502	2131168.269	19°16'19.42964"	81°53'06.33789"
180		P180	592974.094	2131188.933	19°16'20.10722"	81°53'05.23132"
181		P181	592892.234	2131250.438	19°16'22.12162"	81°53'02.43783"
182		P182	592843.307	2131284.138	19°16'23.22601"	81°53'00.76765"
183		P183	592800.899	2131312.591	19°16'24.15862"	81°52'59.31985"
184		P184	592780.589	2131326.154	19°16'24.60319"	81°52'58.62646"
185	PATCH NO-18	P185	591496.894	2132473.431	19°17'02.13614"	81°52'14.84862"
186		P186	591455.312	2132525.604	19°17'03.84014"	81°52'13.43303"
187		P187	591398.531	2132597.346	19°17'06.18325"	81°52'11.50009"
188		P188	591338.906	2132674.091	19°17'08.68954"	81°52'09.47058"
189		P189	591282.998	2132746.193	19°17'11.04420"	81°52'07.56759"
190		P190	591212.710	2132837.523	19°17'14.02669"	81°52'05.17523"
191		P191	591147.989	2132922.610	19°17'16.80518"	81°52'02.97246"
192		P192	591083.721	2133007.364	19°17'19.57276"	81°52'00.78518"
193		P193	591044.580	2133058.690	19°17'21.24880"	81°51'59.45301"
194		P194	591000.375	2133123.530	19°17'23.36530"	81°51'57.94962"
195	PATCH NO-19	P195	590857.693	2133297.731	19°17'29.05537"	81°51'53.09110"
196		P196	590791.021	2133381.670	19°17'31.79679"	81°51'50.82119"
197		P197	590746.721	2133438.767	19°17'33.66138"	81°51'49.31319"
198		P198	590249.999	2134099.329	19°17'55.23036"	81°51'32.40725"
199		P199	590241.709	2134108.658	19°17'55.53518"	81°51'32.12480"
200		P200	590234.106	2134117.214	19°17'55.81476"	81°51'31.86575"
201		P201	590223.631	2134129.351	19°17'56.21127"	81°51'31.50891"
202		P202	590213.800	2134140.764	19°17'56.58412"	81°51'31.17404"
203		P203	590204.373	2134152.274	19°17'56.96007"	81°51'30.85299"
204		P204	590196.823	2134161.492	19°17'57.26116"	81°51'30.59586"
205	PATCH NO-20	P205	590142.521	2134235.672	19°17'59.68306"	81°51'28.74794"
206		P206	590136.165	2134243.477	19°17'59.93799"	81°51'28.53152"
207		P207	590129.889	2134251.186	19°18'00.18978"	81°51'28.31777"
208		P208	590122.491	2134260.272	19°18'00.48654"	81°51'28.06584"
209		P209	590117.074	2134266.924	19°18'00.70381"	81°51'27.88139"
210		P210	590112.681	2134272.319	19°18'00.88003"	81°51'27.73179"
211		P211	590107.091	2134281.710	19°18'01.18641"	81°51'27.54185"

Sr. No		Pillar Id	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
212	PATCH NO-21	P212	590098.040	2134294.075	19°18'01.59010"	81°51'27.23383"
213		P213	590088.461	2134307.160	19°18'02.01731"	81°51'26.90786"
214		P214	590077.414	2134322.252	19°18'02.51005"	81°51'26.53190"
215		P215	590066.313	2134337.417	19°18'03.00518"	81°51'26.15412"
216		P216	590055.012	2134352.855	19°18'03.50922"	81°51'25.76953"
217		P217	590031.833	2134384.519	19°18'04.54300"	81°51'24.98075"
218		P218	590042.432	2134370.040	19°18'04.07028"	81°51'25.34144"
219	PATCH NO-22	P219	589830.148	2134645.089	19°18'13.05198"	81°51'18.11454"
220		P220	589825.671	2134650.276	19°18'13.22146"	81°51'17.96200"
221		P221	589821.028	2134655.655	19°18'13.39717"	81°51'17.80384"
222		P222	589815.534	2134662.020	19°18'13.60512"	81°51'17.61667"
223		P223	589809.391	2134669.137	19°18'13.83761"	81°51'17.40741"
224	PATCH NO-23	P224	589478.252	2135108.929	19°18'28.19751"	81°51'06.13558"
225		P225	589459.554	2135132.032	19°18'28.95207"	81°51'05.49879"
226		P226	589439.482	2135156.832	19°18'29.76204"	81°51'04.81524"
227		P227	589422.140	2135178.259	19°18'30.46188"	81°51'04.22463"
228		P228	589405.203	2135199.186	19°18'31.14536"	81°51'03.64784"
229		P229	589386.779	2135225.561	19°18'32.00630"	81°51'03.02097"
230	PATCH NO-24	P230	589383.873	2135231.960	19°18'32.21492"	81°51'02.92247"
231		P231	589360.123	2135259.188	19°18'33.10447"	81°51'02.11328"
232		P232	589346.228	2135278.100	19°18'33.72191"	81°51'01.64038"
233		P233	589334.233	2135294.806	19°18'34.26729"	81°51'01.23217"
234		P234	589319.041	2135317.388	19°18'35.00432"	81°51'00.71544"
235	PATCH NO-25	P235	589077.256	2135636.769	19°18'45.43264"	81°50'52.48436"
236		P236	589062.551	2135656.320	19°18'46.07102"	81°50'51.98376"
237		P237	589048.696	2135674.741	19°18'46.67248"	81°50'51.51212"
238		P238	589032.986	2135693.040	19°18'47.27027"	81°50'50.97688"
239		P239	589020.157	2135707.984	19°18'47.75843"	81°50'50.53980"
240		P240	589004.036	2135730.005	19°18'48.47738"	81°50'49.99109"
241		P241	588988.793	2135747.198	19°18'49.03911"	81°50'49.47167"
242		P242	588981.739	2135749.860	19°18'49.12683"	81°50'49.23041"
243	PATCH NO-26	P243	588924.721	2135826.606	19°18'51.63250"	81°50'47.28951"
244		P244	588910.054	2135847.173	19°18'52.30391"	81°50'46.79041"
245		P245	588895.366	2135867.772	19°18'52.97635"	81°50'46.29054"
246		P246	588886.944	2135889.887	19°18'53.69709"	81°50'46.00568"
247		P247	588853.663	2135926.299	19°18'54.88693"	81°50'44.87136"
248		P248	588837.225	2135937.916	19°18'55.26742"	81°50'44.31007"
249		P249	588828.219	2135942.522	19°18'55.41870"	81°50'44.00222"
250		P250	588766.180	2136018.746	19°18'57.90818"	81°50'41.88917"
251		P251	588763.966	2136025.476	19°18'58.12748"	81°50'41.81444"
252		P252	588639.381	2136187.750	19°19'03.42618"	81°50'37.57250"
253		P253	588520.574	2136335.785	19°19'08.26073"	81°50'33.52614"
254		P254	588492.083	2136394.471	19°19'10.17433"	81°50'32.55962"
255		P255	588465.554	2136416.441	19°19'10.89325"	81°50'31.65424"

7.3.1 Geo-referenced Forest Map showing Proposed 4G OFC Route

STICK MAP FOR ROAD BHAMPUR-JAGDALPUR

Legend

- Red line: Road Alignment
- Yellow line: Road Alignment
- Green area: Forest Area
- Blue area: Water Body
- Black line: Boundary

Scale: 1:40000

North Arrow

Scale Bar

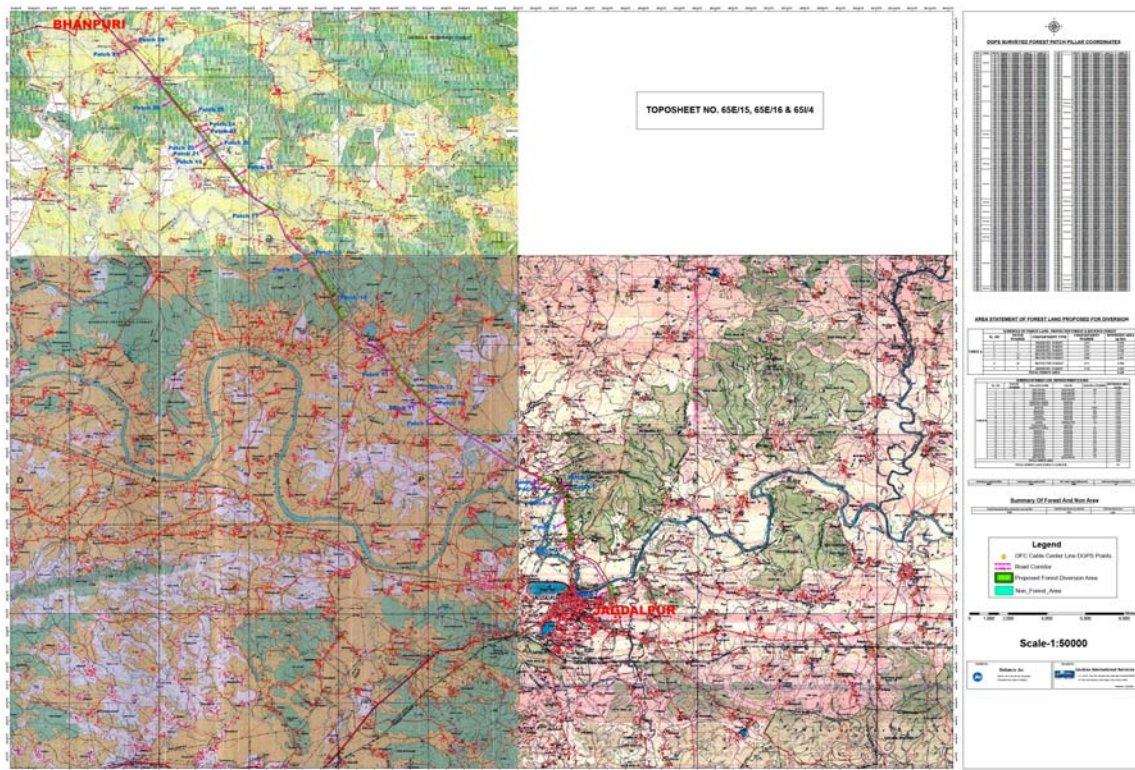
Summary of Forest and Non-Forest Area

Category	Area (Hectares)
Forest Area	1200
Non-Forest Area	800
Total Area	2000

Page 35 of 36

7.3.2 Geo-referenced SOI Map showing Proposed 4G OFC Route

MAP SHOWING DGPS SURVEYED FOREST AREA PROPOSED FOR DIVERSION FOR LAYING OF OFC CABLE WITHIN PWD ROAD CORRIDOR FROM JAGDALPUR TO BHANPURI



Not to Scale