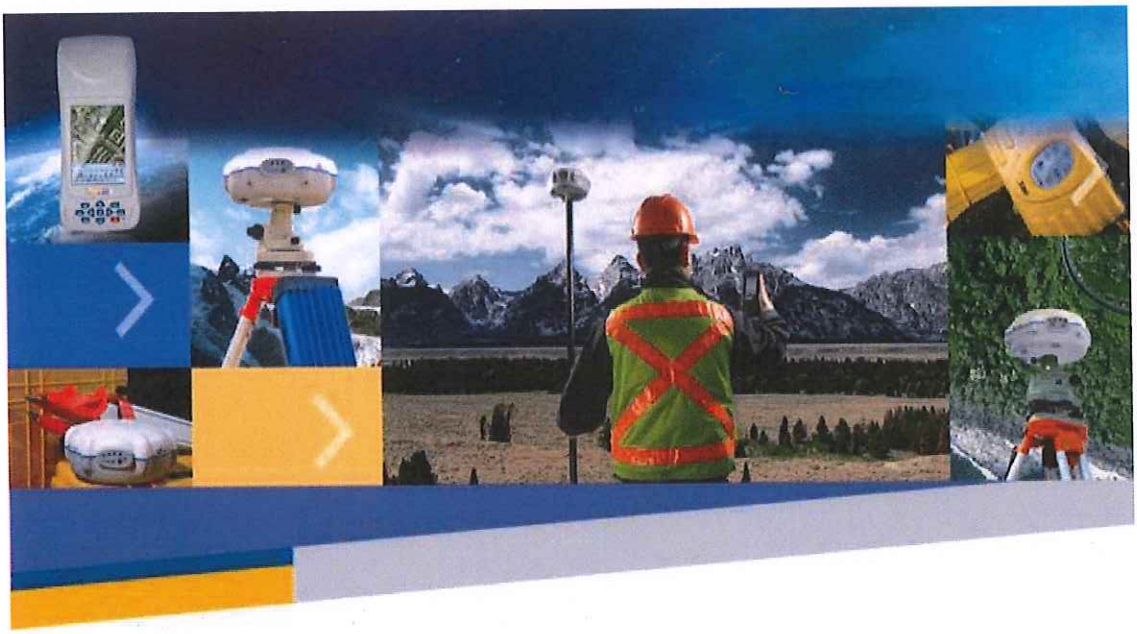
Reliance Jio Infocomm Limited 4G OFC Network

DGPS Survey report for Forest Diversion of proposed OFC Cable Route from Batati to Hati with Route Length 28.45 Km. in District Korba



APPLICATION SUBMITTED BY:

RELIANCE JIO INFOCOMM LIMITED

DGPS SURVEY AND GIS MAPPING DONE BY:

Geotrax International Services
Raipur, Chhattisgarh.

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1. Introduction and Background

PROJECT 4G OPTICAL FIBER CABLE

1.1 Background

Reliance Jio Infocomm Limitedis 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. In most of the places 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 Batati to Hati (Tehsils covered along the route are: Korba, Pasarkhet, kartala and Kudmura; District: Korba) . The Batati to Hati route (Length approx. 28.45 km.) links the town Korba to Dharamjaygarh. The survey site passes through two forest ranges – Korba and Kudmura of Korba forest division. The cable route's proposed starting point is Batati Latitude 22°21'10.73" N and Longitude 82°54'44.77" E and the end location is Hati at Latitude 22°17'58.62" N and Longitude 83°05'12.61" E. The OFC Cable route is covered under Survey of India Toposheet 64 J/15 and 64 N/03 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

छत्तीसगढ़ शासन
खनिज साधन विभाग
मंत्रालय
महानदी भवन, नया रायपुर–492002

19 NOV 2014

//अधिसूचना//

रायपुर, दिनांक नवम्बर, 2014

कमांक एफ 7–14/2013/12:: राज्य शासन एतद् द्वारा चीफ कन्ट्रोलर ऑफ माइन्स, भारतीय खान ब्यूरो नागपुर के परिपत्र कमांक 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 Globle Positioning System(डीजीपीएस) का उपयोग करते हुए सर्वेक्षण करने के लिए तालिका में दर्शित संस्थानों को अधिमान्यता 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, Bhubaneshwar, 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 INTERNATION 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/ अधिमान्यता प्राप्त संस्थानो के लिए शर्तें:–

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 surved using DGPS, at least 2 Hours observation for its ground position.

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 whith base of 1 meter and height of 2 meter and should be placed 1 mater 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 market on all the corner pillars.

2.7 डीजीपीएस सर्वे कार्य हेतु पारिश्रमिक का निर्धारण अधिमान्य प्राप्त संस्थान एवं खनिज रियायतधारी के मध्य आपसी समन्वय से किया जाएगा। किसी भी प्रकार का आपसी विवाद होने पर राज्य शासन उत्तरदायी नही 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 अधिमान्यता प्राप्त संस्थान को करना होगा।

2.10 राज्य शासन द्वारा जारी यह अधिमान्यता 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 अधिमान्यता 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. कमांक एफ 7–14/2013/12 रायपुर, दिनांक नवम्बर, 2014

प्रतिलिपिः–

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 (महाराष्ट)
3. चीफ कन्ट्रोलर ऑफ माईन्स, भारतीय खान ब्यूरो, सेकण्ड फ्लोर, ए–ब्लॉक, इन्दरा भवन, सिविल लाईन, नागपुर (महाराष्ट)
4. क्षेत्रीय खान नियंत्रक, भारतीय खान ब्यूरो, छटवां तल, बी एवं सी –ब्लॉक, इन्दरा भवन, सिविल लाईन, नागपुर (महाराष्ट)
5. संचालक, भौमिकी तथा खनिकर्म, छत्तीसगढ़ ब्लॉक–4, द्वितीय तल, इन्द्रावती भवन, नया रायपुर,
6. समस्त कलेक्टर, जिला ———————— छत्तीसगढ़

.....3

7. समस्त संबंधित ——————————————————
——————————————————

की ओर सूचनार्थ एवं आवश्यक कार्यवाही हेतु

8. संचालक, शासकीय मुद्रणालय, गोन्दवारा, 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 संचानलालय की वेबसाईट में अपलोड करने का कष्ट करें।

10. गार्ड फाईल रजिस्टर

सचिव
छत्तीसगढ़ शासन
खनिज साधन विभाग

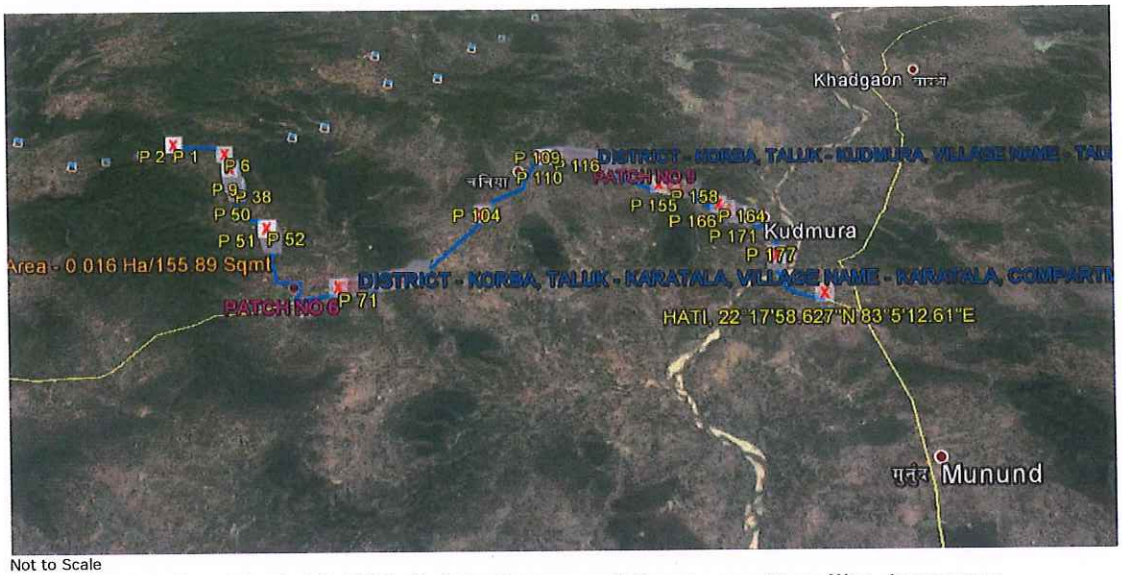

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Fig-1: Batati to Hati 4G OFC Cable Proposed Route on Satellite Imagery

2. Scope of Work

1. Establishment of one base station with 72 Hours observationand secondary control points at every 10km along the proposed route.
2. DGPS Survey for collection of ground coordinates along the OFCCable trench at every 50m interval and/or at every turn/bend along the porposed 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 Georeferencedforest 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 mapsbased 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 (where possible). 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 Planning DGPS Survey & Data Preparation

Based on the input data (maps) the location of DGPS base station - Primary and Secondary Control Points (PCP and SCP) in the project area are planned. One PCP with 72 hours observation was planned at NTPC, Korba Township (on roof top of Ganga Bhavan guest house). Based on the OFC Route details provided by Reliance Jio ROW team, Secondary Control Points (SCP) locations were planned using satellite imagery. For establishment of SCP coordinates a DGPS Static Observation for at least 2 hours duration at each of the Secondary Control Points is planned.

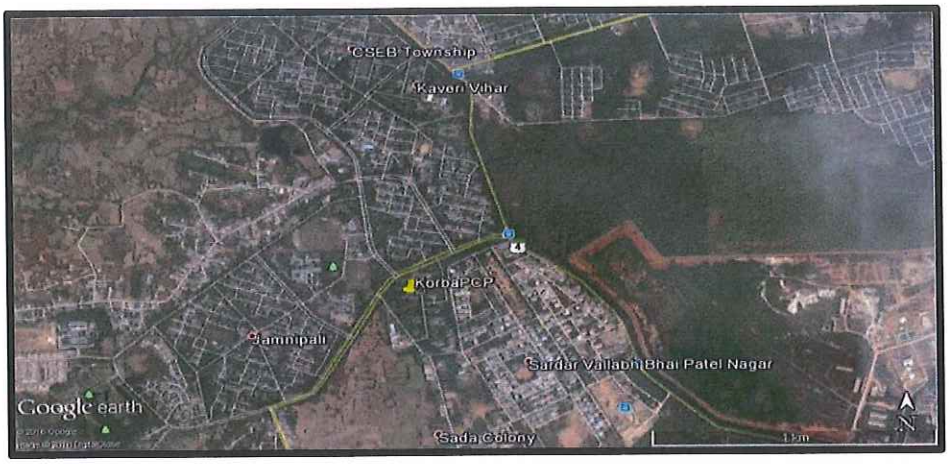

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Fig-3: Satellite Image showing the location of the Primary Control Point in Korba

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 in NTPC Guest House, Korba. The PCP is established inside NTPC Township on roof top of Ganga Bhavan guest house. The DGPS observation was done from 1 September 2015 to 4 September 2015 and the location was marked with a permanent paint. As per Survey of India (SOI) Guideline, the PCP is to be fixed through continuous observation for 72 hours duration. 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). For the route survey of OFC line from Batati to Hatti the NTPC Korba PCP was used as a reference point, and using the reference point more Secondary control points were observed in static and RTK mode along/near the proposed OFC route.

The coordinate of the PCP is as follows:

Point ID	Latitude (d:m:s)	Longitude (d:m:s)	Ellipsoidal Height (m)
Korba PCP	22°24'56.56025"N	82°39'42.25144"E	255.971

Fig-4: Images showing NTPC Township, Ganga Bhawan Guest House Primary Control Point (PCP)

4.4 Establishment of Secondary Control Point (SCP) & Temporary Bench Marks (TBM)

The Secondary Control Point (SCP) with 2-4 hours of static observation was established at various locations along the Korba-Hatti Road. The SCP's were established in static mode and the DGPS data was processed with reference to the Primary Control Point. The static data is Post Processed using Trimble Business Centre software for obtaining the SCP coordinates. All along the road Temporary Bench Mark (TBM) are established at every 5km. The DGPS observation of TBM are established in Real-Time-Kinematic mode.

Point ID	Latitude (d:m:s)	Longitude (d:m:s)	Ellipsoidal Height (m)	Location
Korba PCP	22°24'56.56025"N	82°39'42.25144"E	255.971	Ganga Bhawan Guest House, NTPC Township
SCP 1	22°22'32.40843"N	82°47'34.54303"E	247.307	Korba-Rajgamar Rd

TBM Point ID	Latitude (d:m:s)	Longitude (d:m:s)	Ellipsoidal Height (m)	Remarks
TBM-SCP1	22°22'32. 40843"	82°47'34.543033"	247.307	
TBM-H-2	22°22'20.70255"N	82°47'09.01097"E	253.982	
TBM-H-3	22°22'10.42516"N	82°46'37.67376"E	256.399	
TBM-H-4	22°22'51.95001"N	82°48'26.33150"E	252.322	
TBM-H-5	22°22'54.48452"N	82°49'08.21028"E	261.214	
TBM-H6	22°22'34.27634"N	82°49'19.89877"E	269.726	
TBM H 7	22°22'14.97647"N	82°49'46.95588"E	275.48	

TBM Point ID	Latitude (d:m:s)	Longitude (d:m:s)	Ellipsoidal Height (m)	Remarks
TBM-H-8	22°21'50.70262"N	82°49'58.42005"E	286.674	
TBMH-H-9	22°21'58.85692"N	82°50'50.50235"E	283.058	
TBM-H-11	22°21'55.37619"N	82°51'24.42381"E	287.132	
TBM-H-12	22°21'44.64992"N	82°51'44.68277"E	283.874	
TBM H 14	22°20'44.24805"N	82°53'38.32971"E	310.24	
TBM-H-13	22°21'04.80332"N	82°52'17.25107"E	285.104	
TBM-H-16	22°21'13.65295"N	82°54'45.92949"E	297.734	
TBM-H-18	22°19'38.61747"N	82°56'22.50014"E	260.345	

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 Secondary control Point SCP 1. The base is shifted using the Real Time Kinematic Survey method. The distance between the Base Station 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.

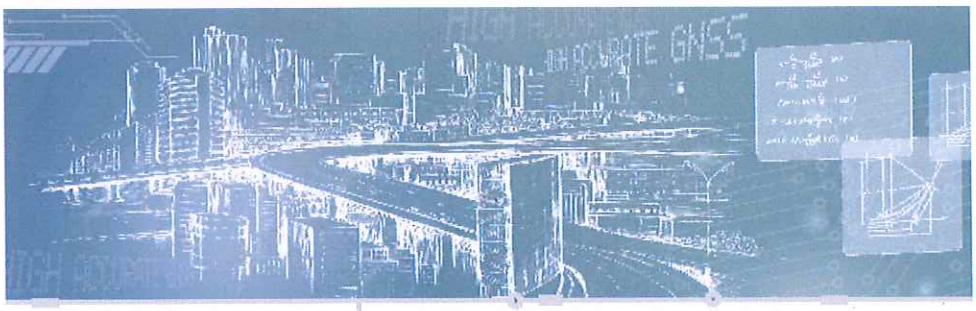
4.6 Creation of Vector Layers

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-RTK[1] (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 MHz [2]
  -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(WxH): 15.8 cm x 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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5. Results

The total route length from Batati to hati is approx. 28.45 km and the proposed forest area for diversion is 0.427 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

BATATI TO HATI - 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)
25.61	8.54	0.0005	0.427

TABLE-A

SCHEDULE OF FOREST LAND - PROTECTED FOREST & ORANGE AREA						
SL. NO.	PATCH NUMBER	DIV.	RANGE	COMPARTMENT TYPE	COMPARTMENT NUMBER	DIVERSION AREA (in HA)
1	3	KORBA	KORBA	PROTECTED FOREST	P 1029	0.058
2	4			ORANGE AREA	OA 1311	0.008
3	5				OA 1311	0.016
4	7		KUDMURA	PROTECTED FOREST	P 1034	0.028
5	8				P 1141	0.009
6	9				P 1138	0.006
7					P 1138	0.072
8	10				P 1139	0.034
9	11			ORANGE AREA	OA 1424	0.031
10	12				OA 1425	0.019
TOTAL FOREST AREA						0.281

TABLE-B

SCHEDULE OF FOREST LAND - REVENUE FOREST (CJJ + BJJ)						
SL. NO.	PATCH NUMBER	DIST.	TALUK	VILLAGE NAME	KHASRA NUMBER	DIVERSION AREA (in HA)
1	1	KORBA	PASARKHET	BATATI	349/1	0.004
2	2				588/6	0.001
3	4		KORBA	GERAON	301/1	0.010
4	6		KARTALA	KARTALA	1179/1	0.019
5					1224/1 & 1224/2	0.013
6	7				1182/1	0.032
7	9		KUDMURA	TAULIPALI	1	0.032
8					205/1	0.002
9	10				467/1	0.012
10	11			KUDMURA	152/1	0.021
TOTAL FOREST AREA						0.146
TOTAL FOREST LAND (TABLE A+TABLE B)						0.427

TBM Point ID	Latitude (d:m:s)	Longitude (d:m:s)	Ellipsoidal Height (m)	Remarks
TBM-H-8	22°21'50.70262"N	82°49'58.42005"E	286.674	
TBMH-H-9	22°21'58.85692"N	82°50'50.50235"E	283.058	
TBM-H-11	22°21'55.37619"N	82°51'24.42381"E	287.132	
TBM-H-12	22°21'44.64992"N	82°51'44.68277"E	283.874	
TBM H 14	22°20'44.24805"N	82°53'38.32971"E	310.24	
TBM-H-13	22°21'04.80332"N	82°52'17.25107"E	285.104	
TBM-H-16	22°21'13.65295"N	82°54'45.92949"E	297.734	
TBM-H-18	22°19'38.61747"N	82°56'22.50014"E	260.345	

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 Secondary control Point SCP 1. The base is shifted using the Real Time Kinematic Survey method. The distance between the Base Station 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.

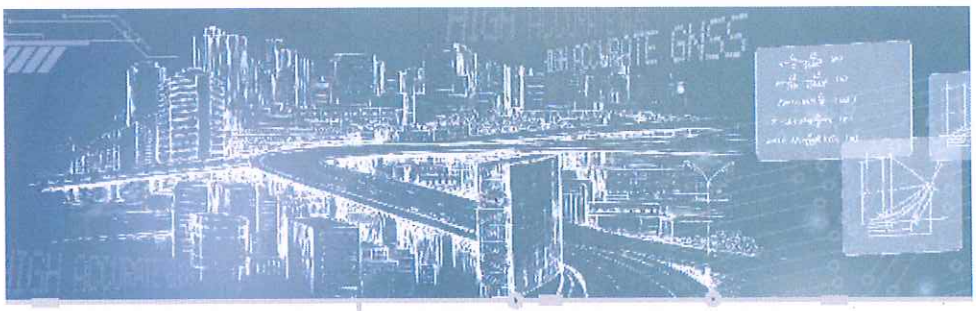
4.6 Creation of Vector Layers

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-RTK[1] (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 MHz [2]
  -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(WxH): 15.8 cm x 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.

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TOTAL FOREST AREA						0.281

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8					205/1	0.002
9	10				467/1	0.012
10	11			KUDMURA	152/1	0.021
TOTAL FOREST AREA						0.146
TOTAL FOREST LAND (TABLE A+TABLE B)						0.427

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

September 5, 2015

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.

Please direct any correspondence to geodesy@ga.gov.au

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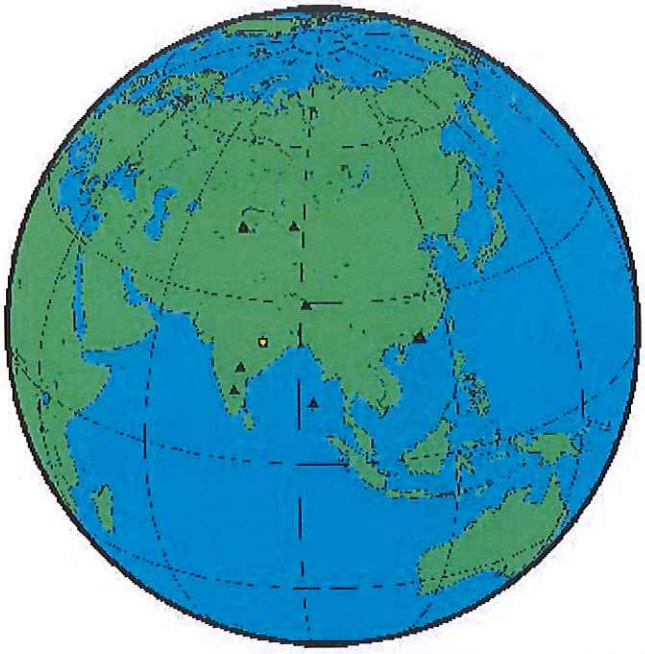
Geoscience Australia
Home Page: http://www.ga.gov.au

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	03102953244a.150	CNTI300 NONE	1.835	2015/09/01 16:58:00	2015/09/04 17:19:00

2 Processing Summary



Date	User Stations	Reference Stations	Orbit Type
2015/09/01 16:58:00	0310	CHUN FCMD HKNP HKOH HKSC HKSL HYDE IISC LHAZ PBRI PGL2 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	753502.779	5851003.824	2417128.610	01/09/2015
CHUM	1228950.508	4508079.981	4327868.535	01/09/2015
FOMO	-2359952.427	5416530.098	2394688.444	01/09/2015
HKNP	-2392360.773	5400226.077	2400094.284	01/09/2015
HKOH	-2423817.411	5386056.906	2399883.192	01/09/2015
HKSC	-2414267.426	5386768.794	2407459.848	01/09/2015
HKSL	-2393382.928	5393860.985	2412592.230	01/09/2015
HYDE	1208444.133	5966805.988	1897077.240	01/09/2015
IISC	1337935.993	6070317.091	1427877.150	01/09/2015
LHAZ	-106941.934	5549269.787	3139215.148	01/09/2015
PBRI	-295635.865	6240848.753	1278178.464	01/09/2015
POL2	1239971.079	4530790.135	4302578.856	01/09/2015
URUM	193030.295	4606851.297	4393311.527	01/09/2015

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	22 24 56.56025	82 39 42.25144	255.971	317.021
CHUM	42 59 54.60506	74 45 03.96764	716.348	759.338
FOMO	22 11 50.69355	113 32 32.97328	56.634	61.319
HKNP	22 14 56.63158	113 53 37.96894	350.652	353.998
HKOH	22 14 51.66789	114 13 42.80678	166.369	168.246
HKSC	22 19 19.81360	114 08 28.29557	20.198	22.654
HKSL	22 22 19.21147	113 55 40.75206	95.260	98.803
HYDE	17 25 02.14157	78 33 03.14377	441.688	518.493
IISC	13 01 16.20960	77 34 13.36808	843.666	929.587
LHAZ	29 39 26.40057	91 06 14.50981	3624.596	3659.287
PBRI	11 38 16.00905	92 42 43.69165	-22.503	38.431
POL2	42 40 47.17388	74 41 39.36690	1714.208	1754.274
URUM	43 48 28.61936	87 36 02.41272	858.878	922.257

4 Ambiguity Resolution - Per Baseline

Baseline	Ambiguities Resolved	Baseline Length (km)
HKOH - HKSL	92.0 %	33.892
HKOH - HKSC	94.2 %	12.211
CHUM - POL2	96.7 %	35.732
0310 - HYDE	49.4 %	700.596
HYDE - PBRI	54.1 %	1649.361
CHUM - URUM	95.9 %	1042.674
HKNP - URUM	85.6 %	3359.554
HKNP - HKSL	91.7 %	14.063
HKNP - PBRI	38.6 %	2522.221
FOMO - HKNP	93.2 %	36.679
HYDE - LHAZ	78.4 %	1856.740
HYDE - IISC	83.9 %	497.626
AVERAGE	79.5%	980.112

Please note for a regional solution, such as used by AUSPOS, an average ambiguity resolution of 50% or better for the network 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

Sl. No.	Patch No	Pillar ID	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
1	PATCH NO 1	P 1	696939.345	2473149.549	22°21'10.77636"	82°54'44.84606"
2		P 2	696953.309	2473161.044	22°21'11.14427"	82°54'45.33910"
3		P 3	696968.126	2473173.347	22°21'11.53806"	82°54'45.86232"
4		P 4	696983.868	2473186.312	22°21'11.95297"	82°54'46.41820"
5		P 5	697000.53	2473200.481	22°21'12.40665"	82°54'47.00673"
6	PATCH NO 2	P 6	698524.705	2472757.142	22°20'57.36432"	82°55'40.06954"
7		P 7	698526.379	2472747.658	22°20'57.05538"	82°55'40.12378"
8		P 8	698527.641	2472740.117	22°20'56.80972"	82°55'40.16450"
9	PATCH NO 3	P 9	698822.941	2472133.089	22°20'36.95563"	82°55'50.21132"
10		P 10	698840.667	2472115.583	22°20'36.37922"	82°55'50.82285"
11		P 11	698850.754	2472100.333	22°20'35.87932"	82°55'51.16848"
12		P 12	698865.006	2472083.519	22°20'35.32686"	82°55'51.65894"
13		P 13	698885.052	2472061.413	22°20'34.59996"	82°55'52.34947"
14		P 14	698896.256	2472043.37	22°20'34.00881"	82°55'52.73287"
15		P 15	698921.913	2472011.752	22°20'32.97039"	82°55'53.61520"
16		P 16	698942.879	2471970.074	22°20'31.60693"	82°55'54.32911"
17		P 17	698959.374	2471947.917	22°20'30.87986"	82°55'54.89554"
18		P 18	698964.02	2471917.564	22°20'29.89131"	82°55'55.04427"
19		P 19	698959.682	2471896.132	22°20'29.19648"	82°55'54.88310"
20		P 20	698959.102	2471883.602	22°20'28.78944"	82°55'54.85722"
21		P 21	698945.129	2471859.891	22°20'28.02455"	82°55'54.35836"
22		P 22	698943.532	2471830.342	22°20'27.06474"	82°55'54.28933"
23		P 23	698941.555	2471810.11	22°20'26.40793"	82°55'54.21119"
24		P 24	698953.081	2471769.864	22°20'25.09495"	82°55'54.59588"
25		P 25	698962.679	2471737.815	22°20'24.04922"	82°55'54.91689"
26		P 26	698980.128	2471699.758	22°20'22.80492"	82°55'55.50952"
27		P 27	698990.978	2471681.188	22°20'22.19679"	82°55'55.88030"
28		P 28	698996.81	2471664.932	22°20'21.66597"	82°55'56.07679"
29		P 29	699017.514	2471627.008	22°20'20.42463"	82°55'56.78321"
30		P 30	699027.469	2471608.633	22°20'19.82321"	82°55'57.12280"
31		P 31	699038.471	2471579.736	22°20'18.87935"	82°55'57.49427"
32		P 32	699046.866	2471558.527	22°20'18.18646"	82°55'57.77809"
33		P 33	699051.45	2471538.949	22°20'17.54817"	82°55'57.92948"
34		P 34	699062.305	2471520.983	22°20'16.95967"	82°55'58.30070"
35		P 35	699081.384	2471498.798	22°20'16.23060"	82°55'58.95738"
36		P 36	699093.031	2471484.768	22°20'15.76971"	82°55'59.35804"
37		P 37	699113.904	2471464.827	22°20'15.11283"	82°56'00.07841"
38		P 38	699149.209	2471430.712	22°20'13.98922"	82°56'01.29667"
39		P 39	699178.604	2471387.561	22°20'12.57436"	82°56'02.30438"
40		P 40	699189.475	2471370.663	22°20'12.02056"	82°56'02.67663"
41		P 41	699199.186	2471350.559	22°20'11.36304"	82°56'03.00692"
42		P 42	699204.662	2471331.245	22°20'10.73296"	82°56'03.18959"

Sl. No.	Patch No	Pillar ID	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
43		P 43	699215.893	2471311.095	22°20'10.07331"	82°56'03.57296"
44		P 44	699224.58	2471292.083	22°20'09.45171"	82°56'03.86795"
45		P 45	699233.124	2471273.62	22°20'08.84802"	82°56'04.15820"
46		P 46	699246.77	2471249.418	22°20'08.05566"	82°56'04.62412"
47		P 47	699253.125	2471215.187	22°20'06.94033"	82°56'04.83083"
48		P 48	699262.65	2471195.74	22°20'06.30425"	82°56'05.15490"
49		P 49	699274.16	2471170.34	22°20'05.47383"	82°56'05.54564"
50		P 50	699279.319	2471115.571	22°20'03.69144"	82°56'05.70134"
51	PATCH NO 4	P 51	700403.532	2469725.174	22°19'18.02712"	82°56'44.35331"
52		P 52	700423.087	2469711.375	22°19'17.57039"	82°56'45.03027"
53		P 53	700436.077	2469700.745	22°19'17.21943"	82°56'45.47927"
54		P 54	700450.343	2469672.656	22°19'16.30042"	82°56'45.96502"
55		P 55	700464.313	2469646.621	22°19'15.44831"	82°56'46.44133"
56		P 56	700479.183	2469618.787	22°19'14.53734"	82°56'46.94826"
57		P 57	700499.82	2469581.084	22°19'13.30317"	82°56'47.65224"
58		P 58	700530.007	2469523.371	22°19'11.41461"	82°56'48.68081"
59		P 59	700543.476	2469479.086	22°19'09.96951"	82°56'49.13139"
60		P 60	700560.17	2469421.242	22°19'08.08231"	82°56'49.68848"
61	PATCH NO 5	P 61	700580.278	2469333.4	22°19'05.21863"	82°56'50.35135"
62		P 62	700590.398	2469312.336	22°19'04.52971"	82°56'50.69539"
63		P 63	700608.739	2469285.441	22°19'03.64781"	82°56'51.32399"
64		P 64	700635.949	2469243.739	22°19'02.28089"	82°56'52.25574"
65		P 65	700653.877	2469215.977	22°19'01.37099"	82°56'52.86953"
66		P 66	700684.586	2469178.138	22°19'00.12816"	82°56'53.92526"
67		P 67	700697.625	2469157.117	22°18'59.43941"	82°56'54.37128"
68		P 68	700703.021	2469126.661	22°18'58.44719"	82°56'54.54604"
69		P 69	700706.227	2469099.507	22°18'57.56323"	82°56'54.64579"
70		P 70	700721.764	2469061.254	22°18'56.31331"	82°56'55.17132"
71	PATCH NO 6	P 71	702698.274	2467588.072	22°18'07.59503"	82°58'03.54758"
72		P 72	702789.053	2467594.35	22°18'07.76060"	82°58'06.72138"
73		P 73	702903.353	2467603.875	22°18'08.02173"	82°58'10.71828"
74		P 74	702951.745	2467610.297	22°18'08.20995"	82°58'12.41159"
75		P 75	703053.637	2467622.925	22°18'08.57715"	82°58'15.97645"
76		P 76	703144.653	2467635.625	22°18'08.95131"	82°58'19.16150"
77		P 77	703247.683	2467638.696	22°18'09.00735"	82°58'22.76176"
78		P 78	703343.462	2467629.171	22°18'08.65704"	82°58'26.10303"
79	PATCH NO 7	P 79	703732.532	2467758.129	22°18'12.68311"	82°58'39.75244"
80		P 80	703834.926	2467799.801	22°18'13.99397"	82°58'43.34821"
81		P 81	703898.823	2467820.835	22°18'14.65043"	82°58'45.58981"
82		P 82	704005.98	2467839.092	22°18'15.19814"	82°58'49.34123"
83		P 83	704098.055	2467869.254	22°18'16.13925"	82°58'52.57132"
84		P 84	704217.656	2467905.304	22°18'17.25995"	82°58'56.76561"
85		P 85	704250.313	2467910.816	22°18'17.42516"	82°58'57.90888"
86		P 86	704300.068	2467909.672	22°18'17.36672"	82°58'59.64634"

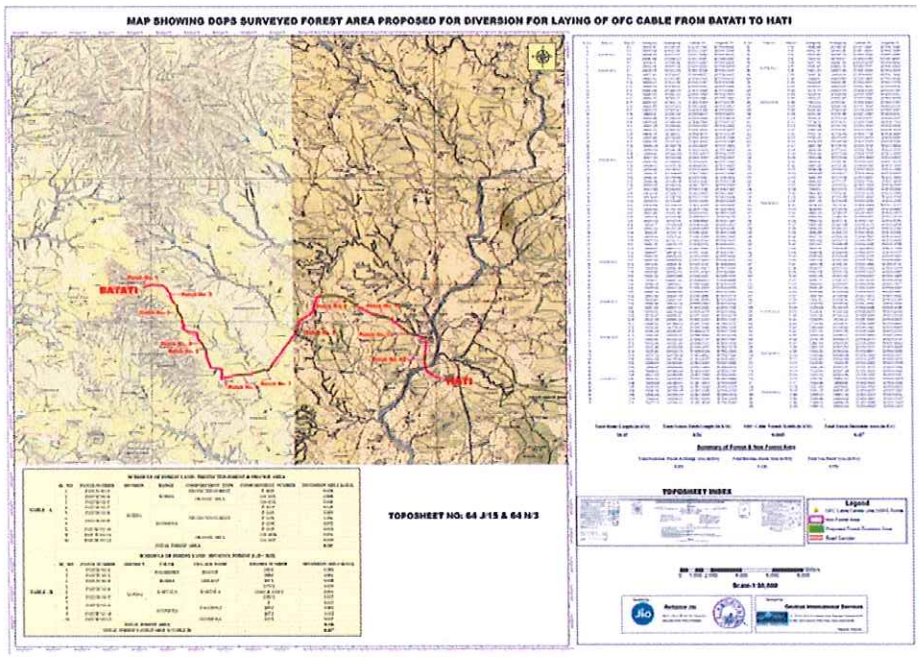
Sl. No.	Patch No	Pillar ID	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
87		P 87	704356.473	2467906.578	22°18'17.24206"	82°59'01.61519"
88		P 88	704381.766	2467903.799	22°18'17.14092"	82°59'02.49742"
89		P 89	704436.034	2467903.119	22°18'17.09563"	82°59'04.39274"
90		P 90	704469.16	2467902.44	22°18'17.05940"	82°59'05.54954"
91		P 91	704477.772	2467903.411	22°18'17.08726"	82°59'05.85081"
92	PATCH NO 7	P 92	704488.668	2467908.764	22°18'17.25661"	82°59'06.23386"
93		P 93	704502.705	2467922.049	22°18'17.68242"	82°59'06.73029"
94		P 94	704521.809	2467948.779	22°18'18.54306"	82°59'07.40989"
95		P 95	704535.39	2467969.077	22°18'19.19703"	82°59'07.89363"
96		P 96	704557.527	2468002.305	22°18'20.26759"	82°59'08.68216"
97		P 97	704583.407	2468036.734	22°18'21.37557"	82°59'09.60202"
98		P 98	704611.453	2468075.099	22°18'22.61056"	82°59'10.59934"
99		P 99	704643.713	2468118.56	22°18'24.00942"	82°59'11.74618"
100		P 100	704668.93	2468158.863	22°18'25.30862"	82°59'12.64560"
101		P 101	704688.045	2468189.482	22°18'26.29564"	82°59'13.32739"
102		P 102	704709.614	2468225.647	22°18'27.46191"	82°59'14.09746"
103		P 103	704725.712	2468253.259	22°18'28.35250"	82°59'14.67249"
104	PATCH NO 8	P 104	706108.321	2470288.502	22°19'33.91059"	83°00'03.91211"
105		P 105	706136.151	2470329.485	22°19'35.23066"	83°00'04.90338"
106		P 106	706152.16	2470353.817	22°19'36.01462"	83°00'05.47395"
107		P 107	706168.846	2470385.156	22°19'37.02604"	83°00'06.07143"
108		P 108	706204.605	2470444.036	22°19'38.92439"	83°00'07.34803"
109	PATCH NO 9	P 109	707642.401	2472700.985	22°20'51.65893"	83°00'58.63371"
110		P 110	707691.43	2472713.214	22°20'52.03507"	83°01'00.35255"
111		P 111	707760.53	2472730.671	22°20'52.57240"	83°01'02.77513"
112		P 112	707818.288	2472745.541	22°20'53.03057"	83°01'04.80020"
113		P 113	707864.408	2472754.865	22°20'53.31354"	83°01'06.41604"
114		P 114	707925.743	2472769.958	22°20'53.77738"	83°01'08.56620"
115		P 115	707955.291	2472773.054	22°20'53.86513"	83°01'09.60009"
116		P 116	707978.454	2472783.648	22°20'54.19937"	83°01'10.41438"
117		P 117	708037.589	2472789.303	22°20'54.35740"	83°01'12.48326"
118		P 118	708102.266	2472772.452	22°20'53.78149"	83°01'14.73525"
119		P 119	708125.285	2472773.245	22°20'53.79725"	83°01'15.53992"
120		P 120	708162.988	2472778.405	22°20'53.94850"	83°01'16.85972"
121		P 121	708185.61	2472783.961	22°20'54.11922"	83°01'17.65276"
122		P 122	708245.219	2472783.296	22°20'54.07160"	83°01'19.73522"
123		P 123	708286.688	2472780.526	22°20'53.96347"	83°01'21.18288"
124		P 124	708335.928	2472780.577	22°20'53.94364"	83°01'22.90339"
125		P 125	708402.504	2472779.166	22°20'53.86871"	83°01'25.22894"
126		P 126	708464.814	2472775.97	22°20'53.73762"	83°01'27.40459"
127		P 127	708494.853	2472776.514	22°20'53.74218"	83°01'28.45443"
128		P 128	708566.9	2472755.673	22°20'53.03330"	83°01'30.96204"
129		P 129	708624.803	2472740.431	22°20'52.51259"	83°01'32.97803"
130		P 130	708663.466	2472736.983	22°20'52.38362"	83°01'34.32733"

Sl. No.	Patch No	Pillar ID	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
131		P 131	708717.542	2472726.606	22°20'52.02269"	83°01'36.21190"
132		P 132	708746.312	2472715.16	22°20'51.63808"	83°01'37.21175"
133		P 133	708788.665	2472709.294	22°20'51.42890"	83°01'38.68883"
134		P 134	708833.245	2472694.95	22°20'50.94317"	83°01'40.23973"
135		P 135	708882.532	2472686.308	22°20'50.64072"	83°01'41.95778"
136		P 136	708936.523	2472672.721	22°20'50.17547"	83°01'43.83786"
137		P 137	708959.246	2472667.989	22°20'50.01172"	83°01'44.62958"
138		P 138	709006.676	2472644.311	22°20'49.22136"	83°01'46.27566"
139		P 139	709086.085	2472603.279	22°20'47.85293"	83°01'49.03091"
140		P 140	709157.755	2472563.545	22°20'46.53007"	83°01'51.51635"
141		P 141	709219.622	2472529.572	22°20'45.39875"	83°01'53.66198"
142		P 142	709272.017	2472498.209	22°20'44.35640"	83°01'55.47788"
143		P 143	709307.95	2472478.099	22°20'43.68702"	83°01'56.72390"
144		P 144	709380.396	2472440.394	22°20'42.42974"	83°01'59.23737"
145		P 145	709393.963	2472434.369	22°20'42.22796"	83°01'59.70856"
146		P 146	709414.728	2472421.461	22°20'41.79931"	83°02'00.42800"
147		P 147	709450.748	2472401.921	22°20'41.14840"	83°02'01.67731"
148		P 148	709498.977	2472370.612	22°20'40.10962"	83°02'03.34764"
149		P 149	709519.302	2472353.796	22°20'39.55414"	83°02'04.04986"
150		P 150	709552.554	2472325.033	22°20'38.60467"	83°02'05.19809"
151		P 151	709589.715	2472287.474	22°20'37.36760"	83°02'06.47876"
152		P 152	709620.925	2472256.873	22°20'36.35930"	83°02'07.55477"
153		P 153	709663.946	2472216.958	22°20'35.04305"	83°02'09.03905"
154		P 154	709714.868	2472170.064	22°20'33.49652"	83°02'10.79607"
155		P 155	710937.923	2471569.061	22°20'13.42372"	83°02'53.24291"
156		P 156	711031.911	2471538.141	22°20'12.37724"	83°02'56.51190"
157		P 157	711160.944	2471499.061	22°20'11.05001"	83°03'01.00140"
158		P 158	711278.938	2471465.435	22°20'09.90489"	83°03'05.10780"
159	PATCH NO 10	P 159	711438.36	2471435.603	22°20'08.86472"	83°03'10.66334"
160		P 160	711531.566	2471420.162	22°20'08.32158"	83°03'13.91232"
161		P 161	711649.875	2471387.51	22°20'07.20791"	83°03'18.03012"
162		P 162	711720.456	2471363.15	22°20'06.38488"	83°03'20.48440"
163		P 163	711818.839	2471328.026	22°20'05.19963"	83°03'23.90483"
164		P 164	712534.317	2470755.594	22°19'46.27660"	83°03'48.62742"
165		P 165	712639.158	2470662.55	22°19'43.20584"	83°03'52.24553"
166		P 166	712745.578	2470566.472	22°19'40.03575"	83°03'55.91733"
167		P 167	712801.844	2470519.837	22°19'38.49496"	83°03'57.86064"
168		P 168	712852.514	2470472.492	22°19'36.93356"	83°03'59.60809"
169	PATCH NO 11	P 169	712926.416	2470410.616	22°19'34.88957"	83°04'02.16020"
170		P 170	712955.044	2470389.498	22°19'34.19043"	83°04'03.15017"
171		P 171	713049.685	2470363.026	22°19'33.28785"	83°04'06.44370"
172		P 172	713159.662	2470343.49	22°19'32.60382"	83°04'10.27629"
173		P 173	713287.109	2470313.207	22°19'31.56272"	83°04'14.71400"
174		P 174	713335.56	2470297.548	22°19'31.03212"	83°04'16.39910"

Sl. No.	Patch No	Pillar ID	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
175		P 175	713414.512	2470245.901	22°19'29.31825"	83°04'19.13241"
176	PATCH NO 12	P 176	713927.84	2468925.212	22°18'46.16404"	83°04'36.42954"
177		P 177	713920.066	2468838.84	22°18'43.36029"	83°04'36.11646"
178		P 178	713917.805	2468768.63	22°18'41.07934"	83°04'36.00371"
179		P 179	713911.767	2468705.904	22°18'39.04335"	83°04'35.76265"
180		P 180	713908.475	2468671.701	22°18'37.93315"	83°04'35.63121"
181		P 181	713898.886	2468620.968	22°18'36.28855"	83°04'35.27187"
182		P 182	713894.52	2468584.059	22°18'35.09088"	83°04'35.10164"
183		P 183	713895.711	2468545.562	22°18'33.83913"	83°04'35.12472"

7.3 Annexure – 3: Geo-Referenced Maps of the Proposed Route

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



Not to Scale

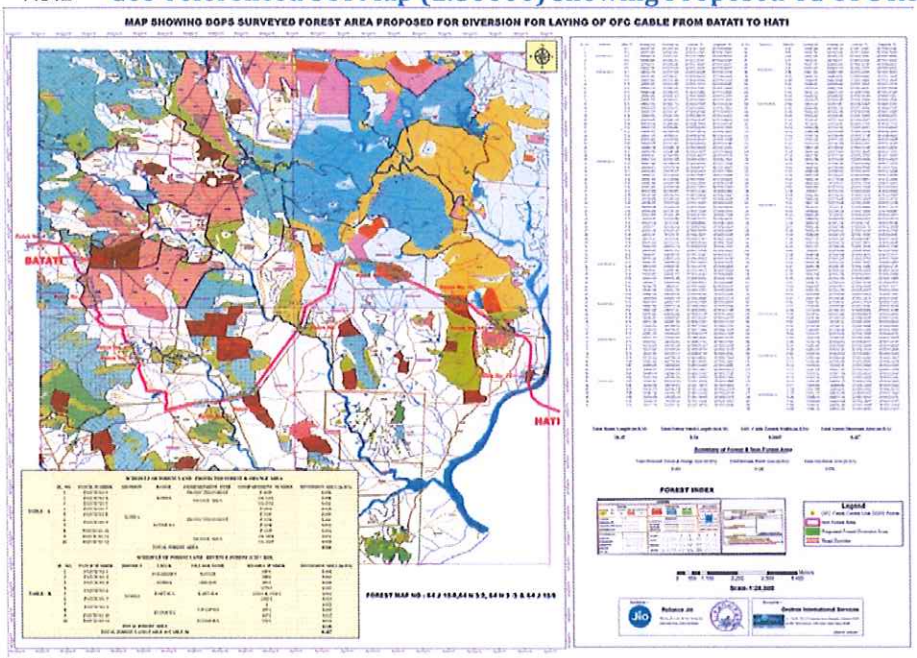
वन परिक्षेत्र अधिकारी
कुदमुरा परिक्षेत्र, कुदमुरा (सा.)

वन परिक्षेत्राधिकारी,
पसरखेत परिक्षेत्र कोरबा (छ ग)

उप वन मंडलाधिकारी
प.क. कोरबा उप वनमंडल

वनमंडलाधिकारी
कोरबा वन मंडल कोरबा

7.3.2 Geo-referenced SOI Map (1:50000) showing Proposed 4G OFC Route



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