Reliance Jio Infocomm Limited

4G OFC Network

DGPS Survey report for Forest Diversion of Proposed OFC Cable Route from Patla to Keshkal with Route Length 24.99 Km, in District Kondagaon (C.G.)

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. 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 Patla to Keshkal is on the National Highway corridor NH-43. The route length is approx. 24.99 km. The OFC cable route falls in Keshkal tehsil in district Kondagaon. The survey site is located in Keshkal ranges of Keshkal division. The cable route's proposed starting point is Patla Latitude 19°53'13.44" N and Longitude 81°38'4.23" E, and the end location is Keshkal at Latitude 20°6'3.48" N and Longitude 81°35'19.67" E. The OFC Cable route is covered under Survey of India Toposheet 64 N/8 and 64 O/5, 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

3666

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

10 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.

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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

17 0 NOV 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

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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

Not to Scale

Fig-1: Patla to Keshkal 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. 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 8thMarch 2016 to 11thMarch 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).

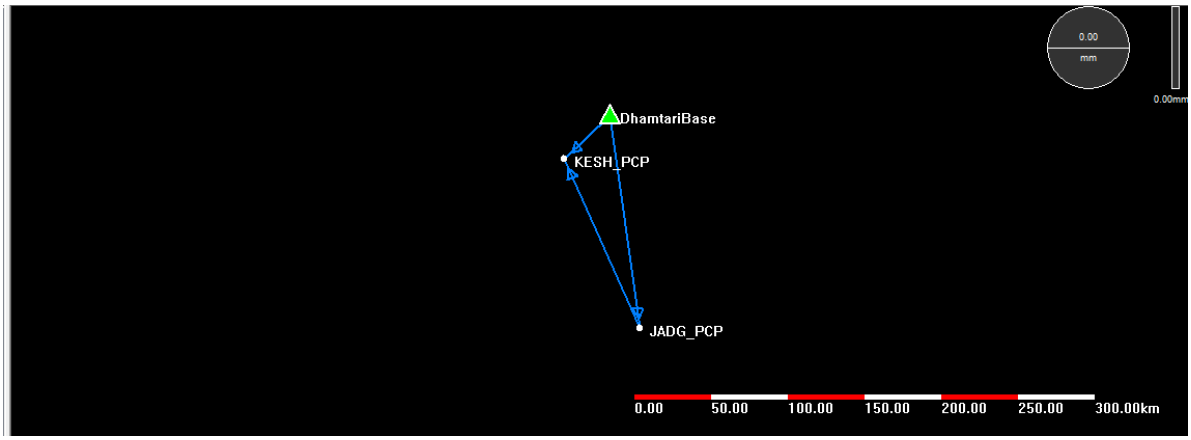
Station (s)	Submitted File	Antenna Type	Antenna Height (m)	Start Time	End Time
DhamtariPCP	03102966068t.16O	CNT300	1.835	3/8/2016 11:05	3/11/2016 11:08

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 24hours 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.



	Grid		WGS84	
JADG_PCP	**North(m)**	2109591.622	**Latitude**	19°04'34.70024"N
	East(m)	608826.178	**Longitude**	82°02'03.86504"E
	Height(m)	491.344	**Ellipsoid Height(m)**	491.344
KESH_PCP	**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 eachvillage 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.

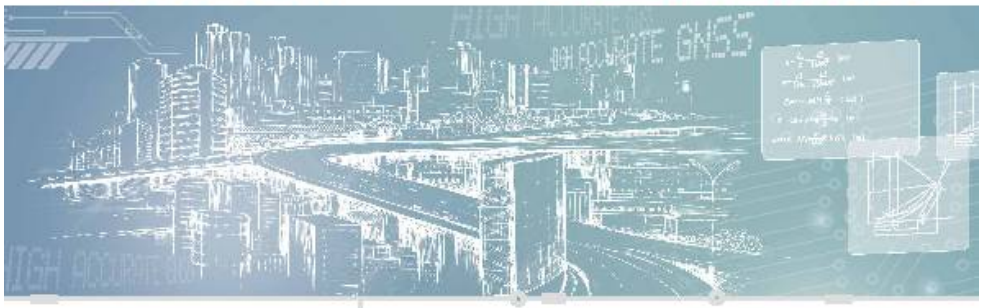
4.6 Creation of Vector Layers

The surveyed points captured through DGPS were plotted in the GIS Software and thePolygon and Polylinelayers 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 (ChoteJadka Jungle + Bade JadKa 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(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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Email: sales@comnavtech.com
www.comnavtech.com

5. Results

The total route length from Patla to Keshkal is approx. 24.99 km and the proposed forest area for diversion is 0.830 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

Patla to Keshkal - 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)
24.99	**16.60**	**0.0005**	**0.830**

TABLE-A

Patla to Keshkal - Schedule of Forest Land - Protected Forest						
SL. NO.	PATCH NUMBER	DIVISION	RANGE	COMPARTMENT TYPE	COMPARTMENT NUMBER	DIVERSION AREA (in HA)
1	2	KESHKAL	KESHKAL	PROTECTED FOREST	16	0.031
2	11				14	0.043
3	15				13	0.032
4	1				16	0.026
5	5				17	0.041
6	7				18	0.061
7	14				13	0.011
8	19				2854	0.085
9	21				2737	0.030
10	22				2737	0.064
TOTAL AREA						**0.423**

TABLE-B	Patla to Keshkal - Schedule Of Forest Land - Revenue Forest (CJJ + BJJ)						
	SL. NO.	PATCH NUMBER	DISTRICT	TALUK	VILLAGE NAME	KHASRA NUMBER	DIVERSION AREA (in HA)
	1	13	KONDA GAON	KESHKAL	PIPRA	44/1	0.024
	2	18			BERMA	39/6	0.025
	3	20			SINGHANPUR	260/141	0.087
	4	23			BATRALI	66/1	0.084
	5	3			MANJHI ATGAON	3/2	0.002
	6	4				3/2	0.008
	7	6			PIPRA	339/1	0.028
	8	8			MASU KOKODA	74/10	0.029
	9	9				74/1	0.028
	10	10			PIPRA	152/1	0.009
	11	12				51/3	0.027
	12	16			BERMA	37/1	0.007
	13	17				39/7	0.005
	14	24			BATRALI	44/4	0.024
	15	25			BORGAON	77/3 KA	0.021
	TOTAL AREA						**0.407**
	TOTAL FOREST LAND (TABLE A+TABLE B)						**0.830**

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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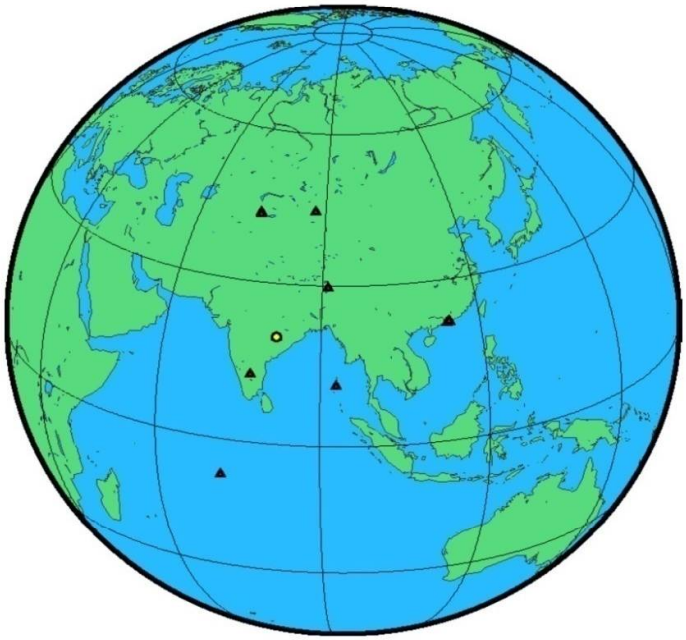
1 User Data

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.16O	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

Sl.No	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
1	P 1	PATCH NO.1	566334.376	2199784.290	19°53'35.40854"	81°38'01.33348"
2	P 2		566319.692	2199836.216	19°53'37.09952"	81°38'00.83522"
3	P 3		566301.286	2199902.282	19°53'39.25093"	81°38'00.21078"
4	P 4		566247.556	2200028.640	19°53'43.36798"	81°37'58.37934"
5	P 5		566232.443	2200057.963	19°53'44.32372"	81°37'57.86339"
6	P 6		566189.499	2200159.334	19°53'47.62662"	81°37'56.39962"
7	P 7		566174.981	2200219.519	19°53'49.58624"	81°37'55.90811"
8	P 8		566144.320	2200269.857	19°53'51.22750"	81°37'54.86017"
9	P 9	PATCH NO.2	566075.231	2200381.889	19°53'54.88039"	81°37'52.49858"
10	P 10		566055.312	2200433.450	19°53'56.56012"	81°37'51.82019"
11	P 11		565991.151	2200573.448	19°54'01.12214"	81°37'49.63165"
12	P 12		565862.990	2200847.127	19°54'10.04065"	81°37'45.25920"
13	P 13		565847.981	2200879.051	19°54'11.08097"	81°37'44.74711"
14	P 215		566111.684	2200322.473	19°53'52.94310"	81°37'53.74457"
15	P 14	PATCH NO.3	565828.079	2200944.251	19°54'13.20438"	81°37'44.07104"
16	P 15		565820.782	2200978.094	19°54'14.30620"	81°37'43.82442"
17	P 16	PATCH NO.4	565679.585	2201295.342	19°54'24.64356"	81°37'39.00902"
18	P 17		565668.701	2201348.039	19°54'26.35914"	81°37'38.64145"
19	P 216		565641.016	2201453.458	19°54'29.79183"	81°37'37.70281"
20	P 18	PATCH NO.5	565637.956	2201465.112	19°54'30.17131"	81°37'37.59905"
21	P 19		565608.917	2201630.488	19°54'35.55459"	81°37'36.62149"
22	P 20		565591.633	2201700.872	19°54'37.84630"	81°37'36.03605"
23	P 21		565587.217	2201722.748	19°54'38.55847"	81°37'35.88697"
24	P 22		565550.108	2201871.725	19°54'43.40926"	81°37'34.62973"
25	P 23		565501.284	2202018.159	19°54'48.17873"	81°37'32.96922"
26	P 24		565467.382	2202141.600	19°54'52.19843"	81°37'31.81897"
27	P 25		565445.535	2202215.572	19°54'54.60741"	81°37'31.07701"
28	P 26		565439.618	2202242.425	19°54'55.48167"	81°37'30.87693"
29	P 217		565639.681	2201458.544	19°54'29.95745"	81°37'37.65753"
30	P 218		565436.747	2202252.606	19°54'55.81319"	81°37'30.77949"
31	P 27	PATCH NO.6	565294.281	2202755.211	19°55'12.18038"	81°37'25.94354"
32	P 28		565284.030	2202791.457	19°55'13.36071"	81°37'25.59557"
33	P 29		565265.497	2202855.123	19°55'15.43403"	81°37'24.96623"
34	P 30		565249.590	2202912.863	19°55'17.31426"	81°37'24.42646"
35	P 31		565227.453	2202990.242	19°55'19.83410"	81°37'23.67490"
36	P 32		565212.676	2203050.101	19°55'21.78312"	81°37'23.17426"
37	P 33		565183.892	2203155.996	19°55'25.23140"	81°37'22.19769"
38	P 219		565151.623	2203281.545	19°55'29.31946"	81°37'21.10372"
39	P 34	PATCH NO.7	565129.022	2203369.476	19°55'32.18260"	81°37'20.33753"
40	P 35		565104.596	2203458.059	19°55'35.06718"	81°37'19.50863"
41	P 36		565103.656	2203466.243	19°55'35.33353"	81°37'19.47734"

Sl.No	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
42	P 37		565086.632	2203573.350	19°55'38.81981"	81°37'18.90539"
43	P 38		565047.122	2203626.685	19°55'40.55957"	81°37'17.55313"
44	P 39		565046.105	2203671.580	19°55'42.02015"	81°37'17.52386"
45	P 40		565046.079	2203671.606	19°55'42.02100"	81°37'17.52297"
46	P 41		565035.906	2203772.926	19°55'45.31820"	81°37'17.18593"
47	P 42		564999.731	2203850.674	19°55'47.85173"	81°37'15.95147"
48	P 43		564976.272	2203897.359	19°55'49.37323"	81°37'15.15047"
49	P 44		564938.460	2204014.750	19°55'53.19655"	81°37'13.86472"
50	P 45		564886.940	2204186.435	19°55'58.78772"	81°37'12.11431"
51	P 46		564838.918	2204384.791	19°56'05.24608"	81°37'10.48758"
52	P 220		564818.625	2204436.428	19°56'06.92829"	81°37'09.79608"
53	P 47	PATCH NO.8	564804.338	2204472.784	19°56'08.11268"	81°37'09.30922"
54	P 48		564753.951	2204660.270	19°56'14.21771"	81°37'07.59970"
55	P 49		564732.085	2204741.789	19°56'16.87218"	81°37'06.85784"
56	P 50		564717.889	2204818.327	19°56'19.36369"	81°37'06.37920"
57	P 51		564713.815	2204844.184	19°56'20.20531"	81°37'06.24233"
58	P 52		564707.783	2204849.496	19°56'20.37884"	81°37'06.03550"
59	P 53		564683.648	2204931.971	19°56'23.06467"	81°37'05.21570"
60	P 54		564668.034	2204989.397	19°56'24.93464"	81°37'04.68584"
61	P 55	PATCH NO.9	564634.864	2205111.112	19°56'28.89804"	81°37'03.56019"
62	P 56		564608.410	2205214.571	19°56'32.26676"	81°37'02.66324"
63	P 57		564593.244	2205264.527	19°56'33.89366"	81°37'02.14783"
64	P 58		564586.308	2205269.257	19°56'34.04836"	81°37'01.90983"
65	P 59		564571.102	2205330.538	19°56'36.04367"	81°37'01.39448"
66	P 60		564558.529	2205377.871	19°56'37.58494"	81°37'00.96794"
67	P 61		564548.945	2205412.239	19°56'38.70408"	81°37'00.64258"
68	P 62		564535.544	2205463.747	19°56'40.38126"	81°37'00.18808"
69	P 63		564528.308	2205503.873	19°56'41.68744"	81°36'59.94422"
70	P 64		564520.227	2205507.193	19°56'41.79640"	81°36'59.66664"
71	P 221		564648.463	2205061.212	19°56'27.27316"	81°37'04.02168"
72	P 232		564514.090	2205524.820	19°56'42.37055"	81°36'59.45775"
73	P 65	PATCH NO.10	564500.459	2205563.970	19°56'43.64574"	81°36'58.99377"
74	P 66		564484.357	2205641.527	19°56'46.17062"	81°36'58.44963"
75	P 67		564477.449	2205670.922	19°56'47.12768"	81°36'58.21569"
76	P 222		564467.623	2205698.457	19°56'48.02458"	81°36'57.88114"
77	P 69	PATCH NO.11	564443.378	2205787.755	19°56'50.93237"	81°36'57.05834"
78	P 70		564405.584	2205927.346	19°56'55.47782"	81°36'55.77576"
79	P 71		564384.290	2206003.967	19°56'57.97287"	81°36'55.05286"
80	P 72	PATCH NO.11	564372.802	2206046.682	19°56'59.36378"	81°36'54.66304"
81	P 73		564367.594	2206079.561	19°57'00.43396"	81°36'54.48801"
82	P 74		564367.800	2206083.287	19°57'00.55515"	81°36'54.49557"
83	P 75		564366.267	2206104.824	19°57'01.25594"	81°36'54.44554"
84	P 76		564357.843	2206122.062	19°57'01.81770"	81°36'54.15791"
85	P 77		564347.861	2206132.821	19°57'02.16888"	81°36'53.81586"

Sl.No	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
86	P 78		564347.802	2206159.955	19°57'03.05157"	81°36'53.81725"
87	P 79		564349.540	2206176.470	19°57'03.58860"	81°36'53.87912"
88	P 80		564320.488	2206295.980	19°57'07.47977"	81°36'52.89472"
89	P 81		564291.805	2206378.145	19°57'10.15604"	81°36'51.91829"
90	P 223		564262.539	2206459.199	19°57'12.79623"	81°36'50.92166"
91	P 224		564241.695	2206516.927	19°57'14.67663"	81°36'50.21183"
92	P 82	PATCH NO.12	564075.307	2207083.254	19°57'33.11921"	81°36'44.55864"
93	P 83		564034.249	2207222.184	19°57'37.64354"	81°36'43.16348"
94	P 84		564023.849	2207287.418	19°57'39.76686"	81°36'42.81385"
95	P 85		564000.823	2207380.590	19°57'42.80051"	81°36'42.03334"
96	P 86		563985.245	2207434.056	19°57'44.54162"	81°36'41.50408"
97	P 225		563944.237	2207603.243	19°57'50.05018"	81°36'40.11440"
98	P 68	PATCH NO.13	564466.094	2205702.742	19°56'48.16415"	81°36'57.82908"
99	P 87		563918.441	2207709.669	19°57'53.51533"	81°36'39.24021"
100	P 88		563903.764	2207775.013	19°57'55.64273"	81°36'38.74342"
101	P 89		563892.693	2207814.822	19°57'56.93904"	81°36'38.36750"
102	P 90		563828.170	2208072.210	19°58'05.31958"	81°36'36.17973"
103	P 91	PATCH NO.14	563792.539	2208142.447	19°58'07.60864"	81°36'34.96260"
104	P 92		563772.975	2208214.043	19°58'09.94000"	81°36'34.29842"
105	P 93		563749.518	2208283.311	19°58'12.19608"	81°36'33.50000"
106	P 233		563826.677	2208078.164	19°58'05.51346"	81°36'36.12912"
107	P 94	PATCH NO.15	563703.658	2208459.925	19°58'17.94681"	81°36'31.94417"
108	P 95		563690.599	2208520.844	19°58'19.93007"	81°36'31.50246"
109	P 96		563667.880	2208590.504	19°58'22.19881"	81°36'30.72946"
110	P 97		563631.855	2208721.582	19°58'26.46707"	81°36'29.50629"
111	P 98		563599.832	2208831.311	19°58'30.04037"	81°36'28.41814"
112	P 99		563581.643	2208911.456	19°58'32.64966"	81°36'27.80229"
113	P 226		563746.799	2208286.266	19°58'12.29253"	81°36'33.40680"
114	P 100	PATCH NO.16	563524.181	2209063.854	19°58'37.61399"	81°36'25.84413"
115	P 101		563529.744	2209165.394	19°58'40.91646"	81°36'26.04819"
116	P 234		563512.279	2209204.955	19°58'42.20545"	81°36'25.45218"
117	P 102	PATCH NO.17	563354.798	2209682.404	19°58'57.75553"	81°36'20.09284"
118	P 103		563353.261	2209687.992	19°58'57.93750"	81°36'20.04064"
119	P 104		563338.217	2209751.662	19°59'00.01047"	81°36'19.53089"
120	P 235		563332.146	2209771.928	19°59'00.67044"	81°36'19.32451"
121	P 105	PATCH NO.18	563321.876	2209806.210	19°59'01.78686"	81°36'18.97538"
122	P 106		563294.858	2209914.119	19°59'05.30034"	81°36'18.05911"
123	P 107		563274.987	2210008.394	19°59'08.36947"	81°36'17.38705"
124	P 108		563247.340	2210119.668	19°59'11.99249"	81°36'16.44953"
125	P 109		563229.875	2210190.871	19°59'14.31080"	81°36'15.85738"
126	P 110		563232.922	2210198.718	19°59'14.56571"	81°36'15.96321"
127	P 111		563217.638	2210257.752	19°59'16.48789"	81°36'15.44460"
128	P 112	PATCH NO.19	562450.911	2212106.717	20°00'16.72469"	81°35'49.28779"
129	P 113		562408.120	2212224.988	20°00'20.57704"	81°35'47.82967"

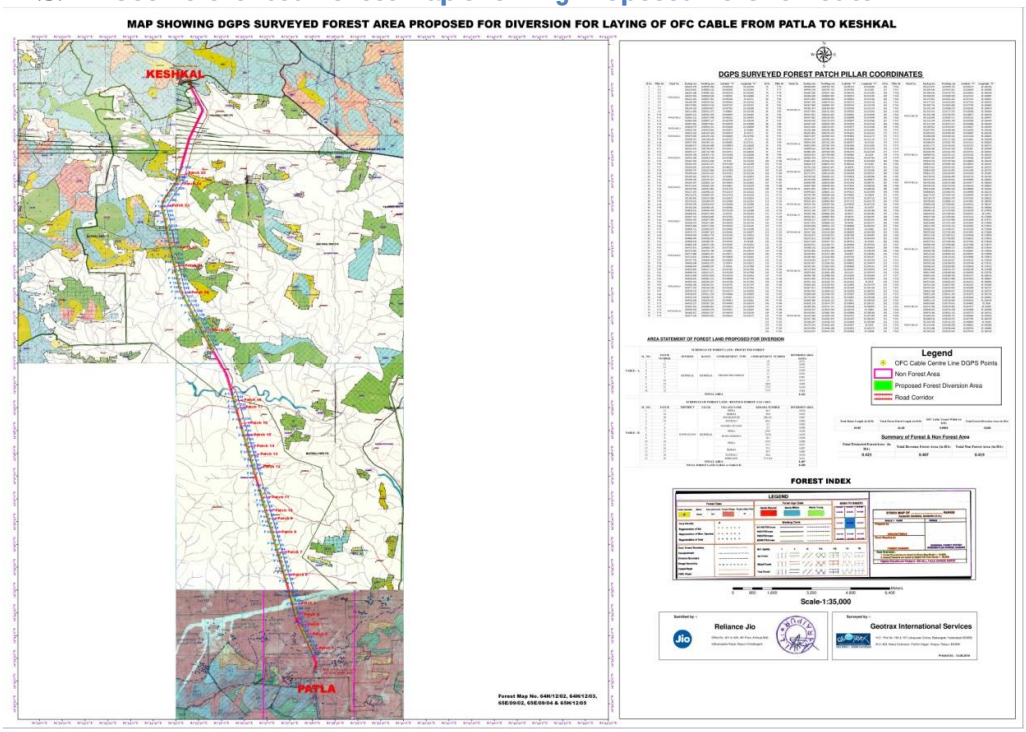
Sl.No	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
130	P 114		562363.866	2212301.353	20°00'23.06634"	81°35'46.31605"
131	P 115		562349.902	2212317.086	20°00'23.57975"	81°35'45.83741"
132	P 116		562285.840	2212426.904	20°00'27.15958"	81°35'43.64618"
133	P 117		562258.094	2212477.534	20°00'28.80980"	81°35'42.69750"
134	P 118		562203.427	2212568.362	20°00'31.77078"	81°35'40.82724"
135	P 119		562165.381	2212654.939	20°00'34.59154"	81°35'39.52845"
136	P 120		562119.304	2212738.663	20°00'37.32043"	81°35'37.95292"
137	P 121		562076.942	2212835.180	20°00'40.46504"	81°35'36.50678"
138	P 122		561994.780	2212988.556	20°00'45.46387"	81°35'33.69781"
139	P 123		561922.090	2213126.248	20°00'49.95140"	81°35'31.21286"
140	P 124		561911.134	2213156.770	20°00'50.94555"	81°35'30.83951"
141	P 125		561856.404	2213239.932	20°00'53.65712"	81°35'28.96602"
142	P 126		561827.911	2213298.995	20°00'55.58173"	81°35'27.99257"
143	P 127		561806.668	2213349.510	20°00'57.22744"	81°35'27.26759"
144	P 128		561743.594	2213456.722	20°01'00.72232"	81°35'25.10980"
145	P 236		561664.092	2213609.022	20°01'05.68581"	81°35'22.39205"
146	P 129		561660.386	2213616.122	20°01'05.91718"	81°35'22.26536"
147	P 130		561630.135	2213674.737	20°01'07.82741"	81°35'21.23131"
148	P 131		561589.260	2213751.711	20°01'10.33608"	81°35'19.83382"
149	P 132		561556.357	2213815.934	20°01'12.42903"	81°35'18.70915"
150	P 133		561520.061	2213891.538	20°01'14.89260"	81°35'17.46908"
151	P 134		561435.486	2214059.220	20°01'20.35701"	81°35'14.57845"
152	P 135	PATCH NO.20	561327.184	2214265.307	20°01'27.07343"	81°35'10.87575"
153	P 136		561288.407	2214338.378	20°01'29.45487"	81°35'09.54991"
154	P 137		561279.353	2214362.466	20°01'30.23949"	81°35'09.24118"
155	P 138		561244.844	2214449.388	20°01'33.07102"	81°35'08.06390"
156	P 139		561235.037	2214472.574	20°01'33.82638"	81°35'07.72914"
157	P 140		561221.917	2214495.752	20°01'34.58186"	81°35'07.28036"
158	P 141		561193.426	2214557.811	20°01'36.60390"	81°35'06.30720"
159	P 142		561189.620	2214570.755	20°01'37.02541"	81°35'06.17776"
160	P 143		561183.002	2214600.558	20°01'37.99566"	81°35'05.95356"
161	P 144		561175.961	2214622.632	20°01'38.71453"	81°35'05.71387"
162	P 145		561177.181	2214633.830	20°01'39.07867"	81°35'05.75721"
163	P 146		561169.754	2214662.668	20°01'40.01762"	81°35'05.50504"
164	P 147		561150.146	2214698.270	20°01'41.17799"	81°35'04.83443"
165	P 148		561142.541	2214727.355	20°01'42.12500"	81°35'04.57617"
166	P 149	PATCH NO.20	561135.188	2214782.974	20°01'43.93514"	81°35'04.32977"
167	P 150		561126.840	2214814.171	20°01'44.95093"	81°35'04.04619"
168	P 151		561125.344	2214841.104	20°01'45.82724"	81°35'03.99794"
169	P 152		561121.104	2214873.111	20°01'46.86892"	81°35'03.85585"
170	P 153		561109.452	2214910.837	20°01'48.09748"	81°35'03.45932"
171	P 154		561097.991	2214958.586	20°01'49.65207"	81°35'03.07058"
172	P 155		561092.624	2214996.592	20°01'50.88903"	81°35'02.89041"
173	P 156		561084.638	2215036.541	20°01'52.18949"	81°35'02.62034"

Sl.No	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
174	P 157		561080.654	2215052.785	20°01'52.71836"	81°35'02.48516"
175	P 158		561051.771	2215145.653	20°01'55.74266"	81°35'01.50216"
176	P 227		561040.786	2215217.566	20°01'58.08327"	81°35'01.13269"
177	P 159		561036.580	2215245.100	20°01'58.97942"	81°35'00.99122"
178	P 160		561018.781	2215322.730	20°02'01.50677"	81°35'00.38790"
179	P 161	PATCH NO.21	560998.761	2215472.112	20°02'06.36847"	81°34'59.71673"
180	P 162		560967.263	2215591.837	20°02'10.26673"	81°34'58.64690"
181	P 163		560916.150	2215795.566	20°02'16.89988"	81°34'56.91196"
182	P 164		560902.333	2215893.336	20°02'20.08193"	81°34'56.44808"
183	P 165		560873.421	2216035.922	20°02'24.72356"	81°34'55.46996"
184	P 166		560843.458	2216142.835	20°02'28.20486"	81°34'54.45138"
185	P 167		560832.291	2216194.401	20°02'29.88358"	81°34'54.07316"
186	P 168		560778.554	2216426.484	20°02'37.43937"	81°34'52.25118"
187	P 169		560754.475	2216554.813	20°02'41.61667"	81°34'51.43766"
188	P 170	PATCH NO.22	560740.409	2216674.698	20°02'45.51814"	81°34'50.96781"
189	P 171		560740.329	2216722.976	20°02'47.08865"	81°34'50.97083"
190	P 172		560718.579	2216821.074	20°02'50.28226"	81°34'50.23385"
191	P 173		560706.092	2216883.315	20°02'52.30838"	81°34'49.81144"
192	P 229		560898.863	2215892.913	20°02'20.06857"	81°34'56.32857"
193	P 230		560671.547	2217052.512	20°02'57.81630"	81°34'48.64249"
194	P 228		560914.828	2215803.165	20°02'17.14723"	81°34'56.86737"
195	P 174		560668.209	2217068.861	20°02'58.34851"	81°34'48.52954"
196	P 175		560653.319	2217121.012	20°03'00.04668"	81°34'48.02320"
197	P 176		560648.136	2217145.992	20°03'00.85987"	81°34'47.84776"
198	P 177		560643.032	2217180.055	20°03'01.96852"	81°34'47.67613"
199	P 178		560637.346	2217264.861	20°03'04.72792"	81°34'47.49052"
200	P 179		560625.892	2217323.990	20°03'06.65269"	81°34'47.10328"
201	P 180		560618.806	2217413.249	20°03'09.55711"	81°34'46.87001"
202	P 181		560613.190	2217433.123	20°03'10.20424"	81°34'46.67905"
203	P 182		560589.362	2217469.671	20°03'11.39585"	81°34'45.86314"
204	P 183		560555.829	2217556.699	20°03'14.23067"	81°34'44.71916"
205	P 184		560531.329	2217665.613	20°03'17.77642"	81°34'43.88873"
206	P 185	PATCH NO.23	560505.565	2217785.801	20°03'21.68907"	81°34'43.01613"
207	P 186		560507.351	2217938.362	20°03'26.65171"	81°34'43.09580"
208	P 187		560490.240	2217959.883	20°03'27.35372"	81°34'42.50931"
209	P 188		560497.312	2218009.173	20°03'28.95633"	81°34'42.75864"
210	P 189		560506.789	2218049.452	20°03'30.26555"	81°34'43.08970"
211	P 190		560513.345	2218060.316	20°03'30.61822"	81°34'43.31669"
212	P 191		560531.364	2218124.652	20°03'32.70905"	81°34'43.94469"
213	P 192		560535.940	2218140.817	20°03'33.23439"	81°34'44.10416"
214	P 193		560558.190	2218198.023	20°03'35.09280"	81°34'44.87697"
215	P 194		560568.542	2218206.682	20°03'35.37331"	81°34'45.23438"
216	P 195		560596.295	2218242.373	20°03'36.53121"	81°34'46.19408"
217	P 196		560617.804	2218280.929	20°03'37.78302"	81°34'46.93917"

Sl.No	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
218	P 197		560691.546	2218389.194	20°03'41.29657"	81°34'49.49080"
219	P 198		560717.894	2218427.808	20°03'42.54971"	81°34'50.40249"
220	P 199		560751.602	2218482.437	20°03'44.32299"	81°34'51.56949"
221	P 200		560761.240	2218507.987	20°03'45.15304"	81°34'51.90436"
222	P 201		560787.504	2218553.053	20°03'46.61607"	81°34'52.81395"
223	P 202		560812.184	2218584.057	20°03'47.62184"	81°34'53.66733"
224	P 203		560831.100	2218611.166	20°03'48.50156"	81°34'54.32179"
225	P 204		560862.848	2218661.668	20°03'50.14080"	81°34'55.42085"
226	P 205		560901.122	2218706.664	20°03'51.60019"	81°34'56.74392"
227	P 206		560939.665	2218778.615	20°03'53.93639"	81°34'58.07950"
228	P 207	PATCH NO.24	560948.393	2218791.438	20°03'54.35253"	81°34'58.38152"
229	P 208		560974.286	2218811.133	20°03'54.99027"	81°34'59.27532"
230	P 209		561058.456	2218958.741	20°03'59.78241"	81°35'02.19086"
231	P 231		561073.786	2219010.856	20°04'01.47597"	81°35'02.72492"
232	P 210		561080.910	2219035.073	20°04'02.26295"	81°35'02.97309"
233	P 211		561104.708	2219120.225	20°04'05.03024"	81°35'03.80267"
234	P 212	PATCH NO.25	561114.596	2219186.308	20°04'07.17881"	81°35'04.15106"
235	P 213		561155.688	2219308.448	20°04'11.14735"	81°35'05.58052"
236	P 214		561181.523	2219414.874	20°04'14.60646"	81°35'06.48282"

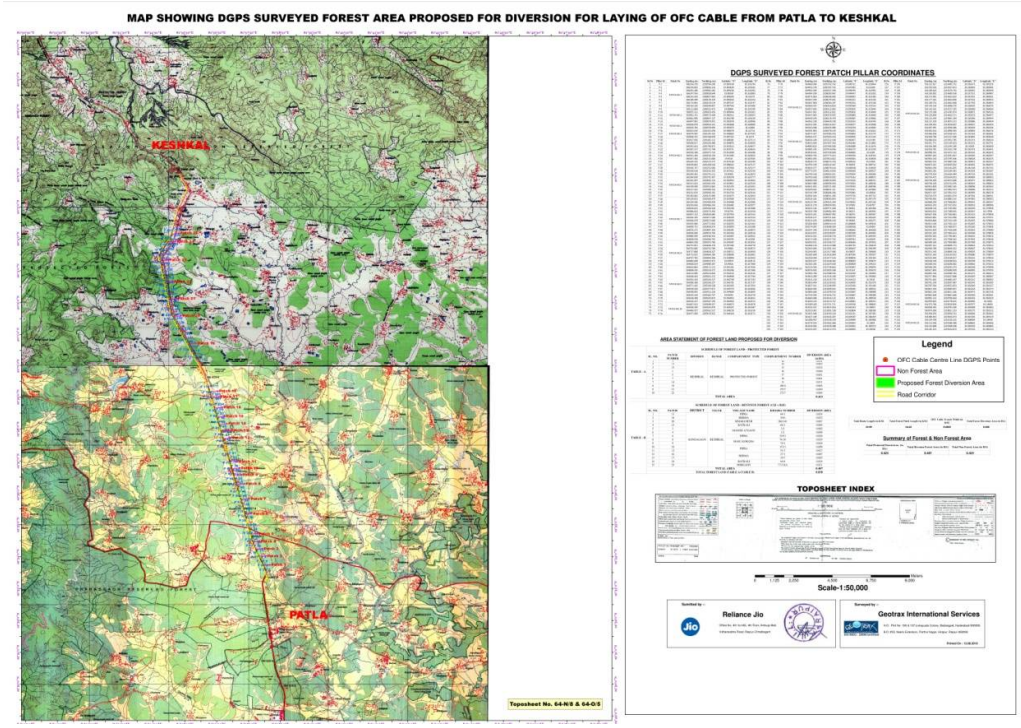
7.3 Annexure – 3: Geo-Referenced Maps of the Proposed Route

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



Not to Scale

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



Not to Scale

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