Reliance Jio Infocomm Limited 4G OFC Network

DGPS Survey report of OFC Cable Route from Charama to Dunderpal – Route Length 41.90 km in Tehsil Kanker, District Kanker

APPLICATION SUBMITTED BY:

RELIANCE JIO INFOCOMM LIMITED

DGPS SURVEY AND GIS MAPPING DONE BY:

Geotrax International Services
Raipur, Chhattisgarh.

Table of Contents

1. Introduction and Background

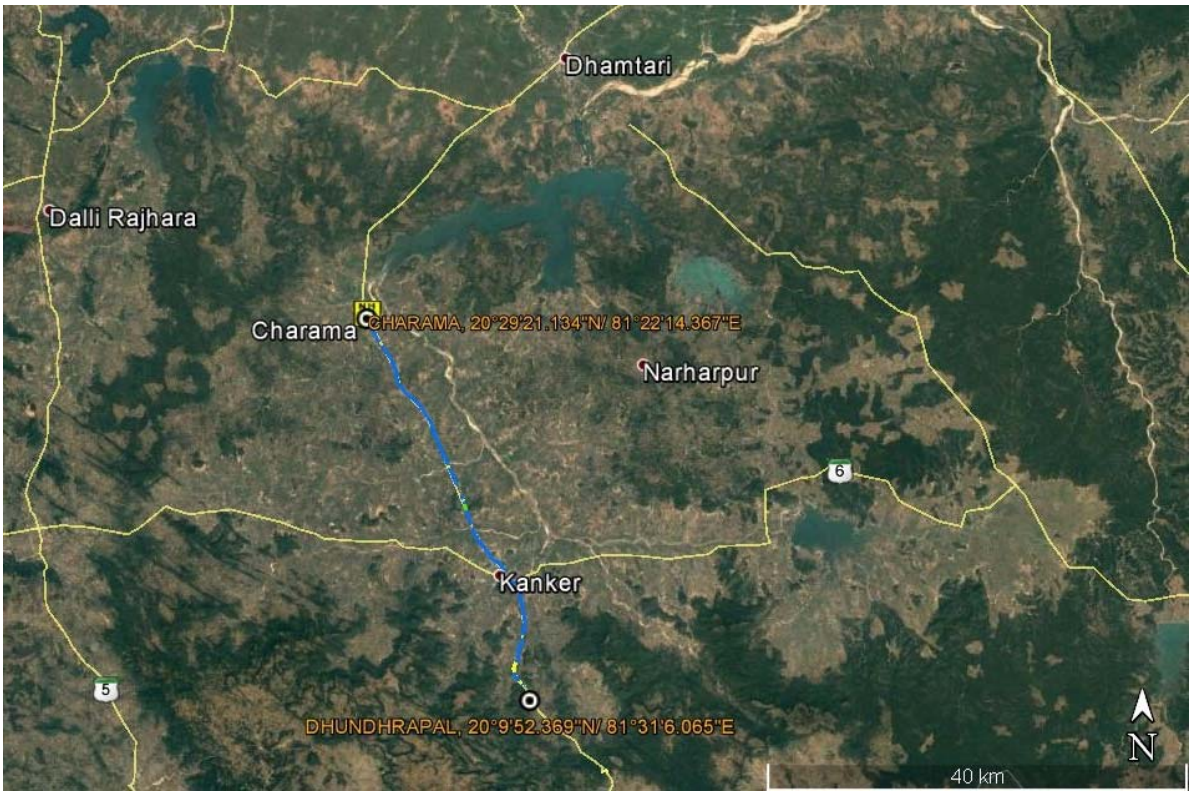
PROJECT 4G OPTICAL FIBER CABLE

1.1 Background

Reliance Jio Infocomm Limited is setting up 4G Optical Fiber Cable network across the country. In the state of Chhattisgarh, the company plans to set up the telecom network (including laying of OFC cable) along the NHAI/PWD Road corridor. Reliance Jio Infocomm is granted license by Ministry of Communications & IT, Dept. of Telecommunications, 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 Charama to Kanker is on the National Highway corridor NH-43. The route length is approx. 41.90 km. The OFC cable route falls in the tehsil Kanker in district Kanker. The cable route passes through two forest ranges – Kanker and Charama of Kanker forest division. The cable route's proposed starting point is Charama at Latitude 20°29'21.134"N and Longitude 81°22'14.367"E, and the end location is Dunderpal at Latitude 20°9'52.369"N and Longitude 81°31'6.065"E. The OFC Cable route is covered under Survey of India Toposheet 64H/7, 64H/11 & 64H/12 on RF 1:50000.



Not to Scale

Fig-1: Charama to Dunderpal 4G OFC Cable Proposed Route on Satellite Imagery

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

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

19 0 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

10 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

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 OFC Cable 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 4-6 hours of static observation was established at Gurur Forest Guest House (Station ID: **Charama_Sec1**).

	Grid		WGS84	
Charama_Sec1	**North(m)**	2276279.308	**Latitude**	20°35'06.27555"N
	East(m)	541731.3651	**Longitude**	081°24'01.58151"E
	Height(m)	368.572105	**Ellipsoid Height(m)**	368.572106

TBM Station	Latitude (d:m:s)	Longitude (d:m:s)	Ellipsoidal Height (m)
TBM-70	20°19'30.98071N	81°27'32.83869E	336.322
TBM-71	20°20'38.59726N	81°27'07.51705E	327.51

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 (*Charama_Sec1, TBM-70*). The base is shifted using the Real Time Kinematic Survey method. The distance between the Base Station TBM and rover was always less than 5km.

The other DGPS instrument was working as Rover. The survey was conducted in Real Time Kinematic (RTK) mode. The Survey team carried out DGPS Survey of boundary points by walking along the proposed cable trench boundary. DGPS readings were collected at every 50m distance along trench and at every turn or bend. For Geo-referencing village maps around 5 GCPs were collected for the each village having Govt. Forest Land.

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

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

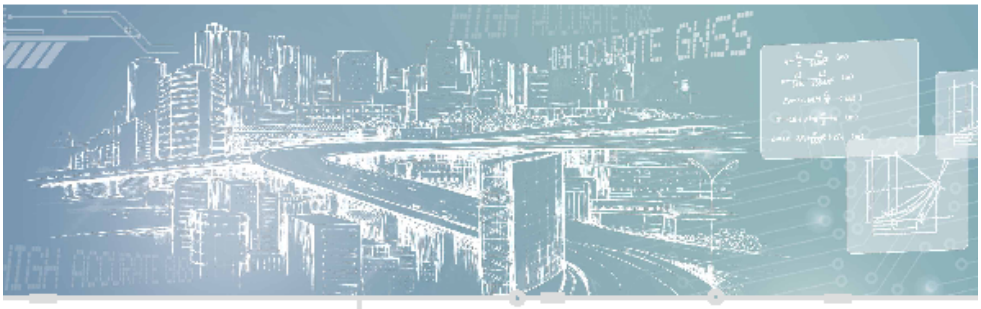
4.6 Creation of Vector Layers

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

4.7 Specification of DGPS Equipment

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

ComNav T300 GNSS Receiver



Features

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

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

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

Design driven to improve user experience

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

Hot swap battery design

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

Consumer grade batteries... always available

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

Technical Specifications T300

Signal Tracking

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

Performance Specifications

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

Positioning Specifications

- Post Processing Static
  -Horizontal: 2.5 mm + 0.5 ppm RMS
  -Vertical: 5 mm + 0.5 ppm RMS
- Real Time Kinematic
  -Horizontal: 8 mm + 1 ppm RMS
  -Vertical: 15 mm + 1 ppm RMS
- E-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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201103 Shanghai - China

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www.comnavtech.com

5. Results

The total route length from Charama to Dunderpal is approx. 41.90km and the proposed forest area for diversion is 0.313 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

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)
41.90	**6.27**	**0.0005**	**0.313**

TABLE-A	SCHEDULE OF FOREST LAND - ORANGE AREA & RESERVE FOREST						
	SL. NO.	PATCH NUMBER	DIVISION	RANGE	COMPARTMENT TYPE	COMPARTMENT NUMBER	DIVERSION AREA (in HA)
	1	PATCH NO 5	KANKER	KANKER	ORANGE AREA	392 OA	0.052
	2					392 OA	0.002
	3	PATCH NO 9				391 OA	0.020
	4	PATCH NO 7				387 OA	0.003
	5	PATCH NO 10				354 OA	0.021
	6	PATCH NO 13				346 OA	0.053
	7	PATCH NO 15		CHARAMA		1474 OA	0.023
	8	PATCH NO 11		KANKER	RESERVE FOREST	66 RF	0.030
	TOTAL AREA						**0.205**

TABLE-B	SCHEDULE OF FOREST LAND - REVENUE FOREST (CJJ + BJJ)						
	SL. NO.	PATCH NUMBER	DISTRICT	TALUK	VILLAGE NAME	KHASRA NUMBER	DIVERSION AREA (in HA)
	1	PATCH NO 5	KANKER	KANKER	DUDERAPAL	3/1	0.012
	2				KOMALPUR	12	0.001
	3					12	0.006
	4	PATCH NO 6				5	0.003
	5	PATCH NO 7			KULGAON	352	0.002
	6					352	0.018
	7	PATCH NO 8				166	0.038
	8					127	0.013
	9	PATCH NO 12			NATHIYA NAWAGAON	907	0.007
	10	PATCH NO 14			GAURGAON	366	0.009
	TOTAL AREA						**0.108**
	TOTAL FOREST LAND (TABLE A+TABLE B)						**0.313**

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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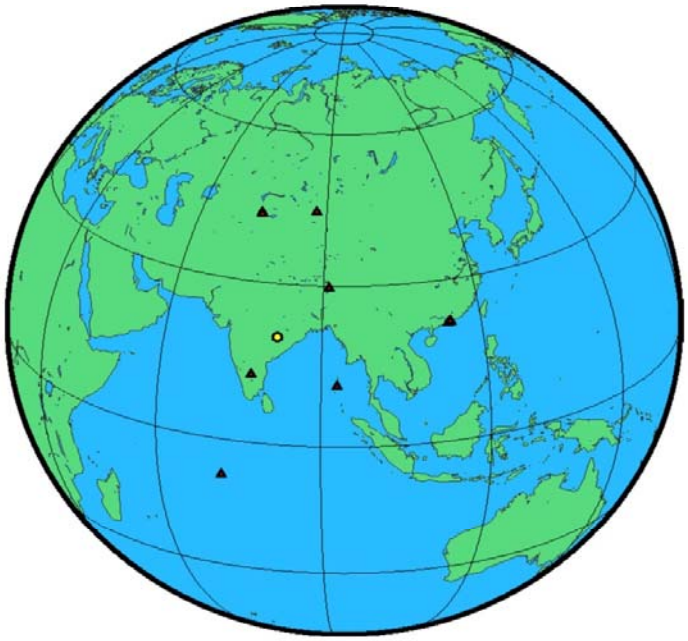
1 User Data

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		554157.359	2229845.570	20°09'54.67510"	81°31'05.76573"
2	P 2		554120.427	2229916.770	20°09'56.99499"	81°31'04.50107"
3	P 3		554105.797	2229944.699	20°09'57.90500"	81°31'04.00007"
4	P 4		554092.978	2229976.486	20°09'58.94033"	81°31'03.56187"
5	P 5		554082.941	2229993.598	20°09'59.49800"	81°31'03.21793"
6	P 6		554068.297	2230015.172	20°10'00.20129"	81°31'02.71575"
7	P 7		554026.900	2230073.246	20°10'02.09463"	81°31'01.29585"
8	P 8		554013.536	2230099.601	20°10'02.95334"	81°31'00.83826"
9	P 9		553985.029	2230155.819	20°10'04.78498"	81°30'59.86222"
10	P 10		553958.196	2230208.669	20°10'06.50690"	81°30'58.94348"
11	P 11		553928.971	2230265.553	20°10'08.36031"	81°30'57.94274"
12	P 12		553897.346	2230328.537	20°10'10.41238"	81°30'56.85998"
13	P 13		553871.248	2230380.098	20°10'12.09229"	81°30'55.96639"
14	P 14		553844.798	2230432.353	20°10'13.79482"	81°30'55.06077"
15	P 15	PATCH NO 1	553819.376	2230500.998	20°10'16.03043"	81°30'54.19229"
16	P 16		553814.765	2230513.449	20°10'16.43592"	81°30'54.03476"
17	P 17		553799.221	2230574.028	20°10'18.40813"	81°30'53.50572"
18	P 18		553774.089	2230673.709	20°10'21.65332"	81°30'52.65051"
19	P 19		553754.694	2230753.028	20°10'24.23550"	81°30'51.99078"
20	P 20		553739.693	2230814.097	20°10'26.22361"	81°30'51.48048"
21	P 21		553724.397	2230866.327	20°10'27.92420"	81°30'50.95909"
22	P 22		553711.638	2230909.837	20°10'29.34086"	81°30'50.52415"
23	P 23		553695.639	2230944.359	20°10'30.46549"	81°30'49.97665"
24	P 24		553675.278	2230981.117	20°10'31.66329"	81°30'49.27908"
25	P 25		553651.802	2231013.097	20°10'32.70593"	81°30'48.47370"
26	P 26		553637.602	2231030.613	20°10'33.27718"	81°30'47.98634"
27	P 27		553610.862	2231060.895	20°10'34.26492"	81°30'47.06830"
28	P 28		553592.294	2231081.921	20°10'34.95076"	81°30'46.43085"
29	P 29		553574.210	2231102.161	20°10'35.61100"	81°30'45.80996"
30	P 30		553513.484	2231141.374	20°10'36.89270"	81°30'43.72198"
31	P 31	PATCH NO 2	553456.142	2231164.959	20°10'37.66568"	81°30'41.74889"
32	P 32		553483.635	2231154.190	20°10'37.31261"	81°30'42.69496"
33	P 33		553362.003	2231200.929	20°10'38.84520"	81°30'38.50940"
34	P 34		553322.621	2231215.407	20°10'39.32011"	81°30'37.15412"
35	P 35		553294.507	2231230.305	20°10'39.80755"	81°30'36.18708"
36	P 36		553268.741	2231252.131	20°10'40.52013"	81°30'35.30169"
37	P 37	PATCH NO 3	553207.874	2231311.550	20°10'42.45911"	81°30'33.21096"
38	P 38		553151.705	2231368.181	20°10'44.30693"	81°30'31.28176"
39	P 39		553099.253	2231421.227	20°10'46.03773"	81°30'29.48020"
40	P 40		553051.394	2231469.275	20°10'47.60551"	81°30'27.83641"
41	P 41		553017.386	2231503.419	20°10'48.71959"	81°30'26.66830"

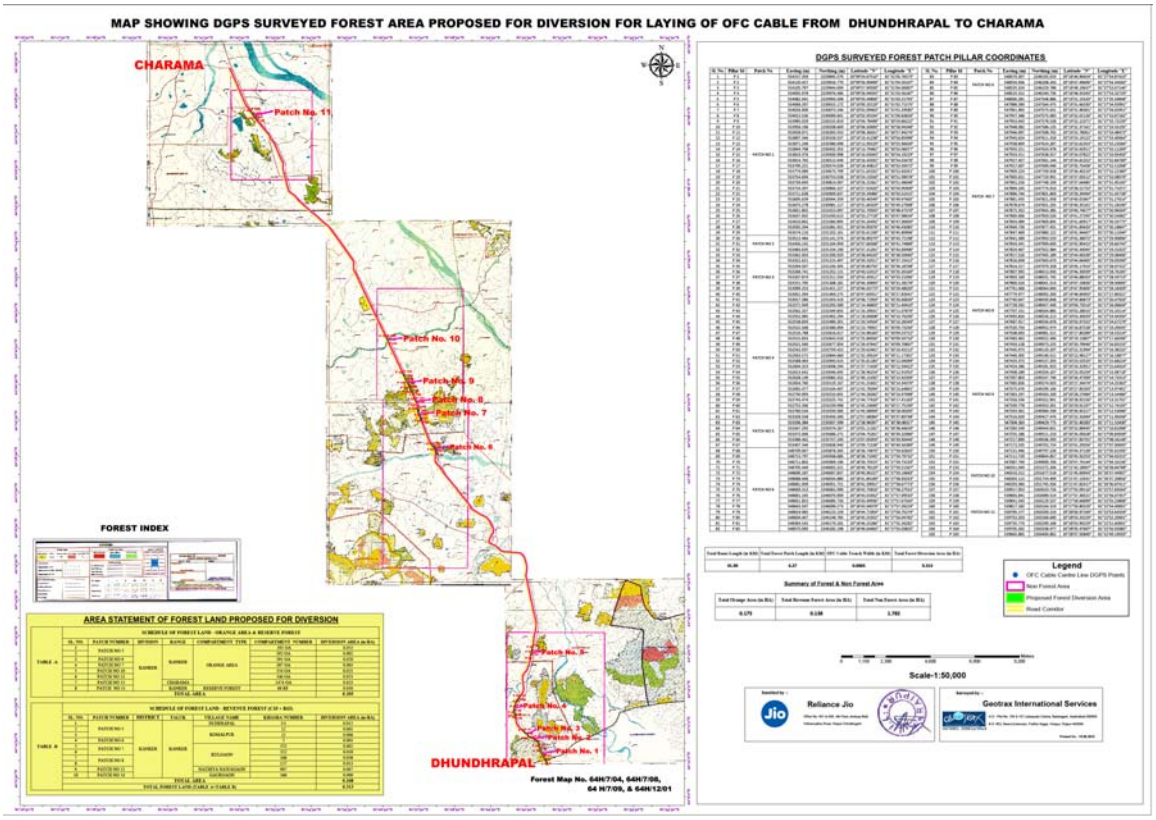
Sl. No.	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
42	P 42	PATCH NO 4	552571.949	2232293.589	20°11'14.46803"	81°30'11.40410"
43	P 43		552562.337	2232349.855	20°11'16.29931"	81°30'11.07879"
44	P 44		552552.985	2232402.294	20°11'18.00608"	81°30'10.76206"
45	P 45		552538.859	2232480.301	20°11'20.54504"	81°30'10.28349"
46	P 46		552522.568	2232580.004	20°11'23.79001"	81°30'09.73256"
47	P 47		552516.788	2232616.617	20°11'24.98160"	81°30'09.53722"
48	P 48		552515.833	2232643.019	20°11'25.84056"	81°30'09.50710"
49	P 49		552521.560	2232677.954	20°11'26.97642"	81°30'09.70807"
50	P 50		552542.037	2232759.423	20°11'29.62461"	81°30'10.42213"
51	P 51		552563.572	2232844.660	20°11'32.39524"	81°30'11.17301"
52	P 52		552588.463	2232943.615	20°11'35.61183"	81°30'12.04099"
53	P 53		552604.323	2233008.294	20°11'37.71426"	81°30'12.59422"
54	P 54		552613.642	2233046.695	20°11'38.96254"	81°30'12.91933"
55	P 55		552628.149	2233083.332	20°11'40.15292"	81°30'13.42304"
56	P 56		552654.760	2233119.167	20°11'41.31601"	81°30'14.34370"
57	P 57		552692.477	2233164.407	20°11'42.78394"	81°30'15.64801"
58	P 58		552730.993	2233210.601	20°11'44.28282"	81°30'16.97998"
59	P 59		552743.474	2233225.741	20°11'44.77410"	81°30'17.41163"
60	P 60		552753.306	2233239.998	20°11'45.23690"	81°30'17.75190"
61	P 61		552760.534	2233250.585	20°11'45.58059"	81°30'18.00205"
62	P 62	PATCH NO 5	553328.558	2235450.300	20°12'57.08084"	81°30'37.80748"
63	P 63		553336.384	2235507.599	20°12'58.94397"	81°30'38.08327"
64	P 64		553347.293	2235574.267	20°13'01.11161"	81°30'38.46629"
65	P 65		553372.006	2235686.271	20°13'04.75261"	81°30'39.32980"
66	P 66		553388.462	2235757.240	20°13'07.05959"	81°30'39.90446"
67	P 67		553407.346	2235838.940	20°13'09.71538"	81°30'40.56389"
68	P 68	PATCH NO 6	548709.067	2245878.365	20°18'36.74870"	81°27'59.62835"
69	P 69		548713.797	2245938.685	20°18'38.71045"	81°27'59.79732"
70	P 70		548711.802	2245969.196	20°18'39.70315"	81°27'59.73150"
71	P 71		548705.449	2246002.321	20°18'40.78129"	81°27'59.51567"
72	P 72		548696.187	2246007.837	20°18'40.96157"	81°27'59.19683"
73	P 73		548688.446	2246034.880	20°18'41.84199"	81°27'58.93253"
74	P 74		548681.009	2246051.721	20°18'42.39051"	81°27'58.67773"
75	P 75		548669.313	2246062.990	20°18'42.75816"	81°27'58.27552"
76	P 76		548661.165	2246070.909	20°18'43.01652"	81°27'57.99533"
77	P 77		548651.852	2246085.726	20°18'43.49936"	81°27'57.67563"
78	P 78		548643.597	2246099.273	20°18'43.94079"	81°27'57.39229"
79	P 79		548624.982	2246123.159	20°18'44.71954"	81°27'56.75274"
80	P 80		548604.467	2246148.785	20°18'45.55502"	81°27'56.04782"
81	P 81		548584.542	2246170.181	20°18'46.25286"	81°27'55.36282"
82	P 82		548575.095	2246182.198	20°18'46.64463"	81°27'55.03825"

Sl. No.	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
83	P 83	PATCH NO 6	548570.307	2246192.019	20°18'46.96454"	81°27'54.87410"
84	P 84		548554.936	2246208.343	20°18'47.49696"	81°27'54.34565"
85	P 85		548535.324	2246229.788	20°18'48.19637"	81°27'53.67146"
86	P 86		548525.312	2246240.736	20°18'48.55343"	81°27'53.32729"
87	P 87	PATCH NO 7	548000.281	2247548.886	20°19'31.15520"	81°27'35.34848"
88	P 88		547988.390	2247564.473	20°19'31.66330"	81°27'34.93991"
89	P 89		547961.965	2247573.631	20°19'31.96361"	81°27'34.02951"
90	P 90		547957.388	2247575.083	20°19'32.01126"	81°27'33.87182"
91	P 91		547953.043	2247578.528	20°19'32.12371"	81°27'33.72230"
92	P 92		547948.082	2247586.135	20°19'32.37161"	81°27'33.55195"
93	P 93		547946.097	2247598.702	20°19'32.78061"	81°27'33.48472"
94	P 94		547943.624	2247611.318	20°19'33.19122"	81°27'33.40064"
95	P 95		547938.809	2247624.287	20°19'33.61353"	81°27'33.23584"
96	P 96		547935.211	2247633.978	20°19'33.92911"	81°27'33.11269"
97	P 97		547933.511	2247638.557	20°19'34.07822"	81°27'33.05450"
98	P 98		547927.457	2247661.144	20°19'34.81352"	81°27'32.84789"
99	P 99		547917.607	2247690.046	20°19'35.75458"	81°27'32.51098"
100	P 100		547909.224	2247709.928	20°19'36.40210"	81°27'32.22380"
101	P 101		547905.021	2247729.991	20°19'37.05512"	81°27'32.08079"
102	P 102		547901.226	2247748.109	20°19'37.64485"	81°27'31.95165"
103	P 103		547894.165	2247774.910	20°19'38.51732"	81°27'31.71071"
104	P 104		547886.744	2247801.869	20°19'39.39494"	81°27'31.45738"
105	P 105		547881.435	2247821.058	20°19'40.01967"	81°27'31.27614"
106	P 106		547878.674	2247831.255	20°19'40.35161"	81°27'31.18190"
107	P 107		547872.352	2247843.385	20°19'40.74677"	81°27'30.96504"
108	P 108		547860.006	2247859.526	20°19'41.27295"	81°27'30.54082"
109	P 109		547854.089	2247869.845	20°19'41.60917"	81°27'30.33775"
110	P 110		547849.739	2247877.431	20°19'41.85633"	81°27'30.18847"
111	P 111		547847.469	2247880.122	20°19'41.94407"	81°27'30.11044"
112	P 112		547841.589	2247893.529	20°19'42.38072"	81°27'29.90896"
113	P 113		547834.541	2247909.600	20°19'42.90415"	81°27'29.66743"
114	P 114		547824.407	2247922.984	20°19'43.34045"	81°27'29.31923"
115	P 115		547817.526	2247945.189	20°19'44.06339"	81°27'29.08406"
116	P 116		547816.658	2247963.670	20°19'44.66465"	81°27'29.05590"
117	P 117		547814.217	2247979.328	20°19'45.17423"	81°27'28.97322"
118	P 118		547807.992	2248013.930	20°19'46.30039"	81°27'28.76185"
119	P 119		547803.169	2248031.745	20°19'46.88033"	81°27'28.59723"
120	P 120		547800.524	2248041.514	20°19'47.19836"	81°27'28.50695"
121	P 121		547791.068	2248064.840	20°19'47.95800"	81°27'28.18309"
122	P 122		547779.977	2248092.200	20°19'48.84903"	81°27'27.80321"
123	P 123	PATCH NO 8	547740.647	2248430.848	20°19'59.86873"	81°27'26.47926"
124	P 124		547728.592	2248457.449	20°20'00.73514"	81°27'26.06604"
125	P 125		547707.151	2248504.885	20°20'02.28015"	81°27'25.33114"
126	P 126		547695.826	2248536.213	20°20'03.30029"	81°27'24.94356"

Sl. No.	Pillar Id	Patch No	Easting (m)	Northing (m)	Latitude "N"	Longitude "E"
127	P 127		547687.917	2248556.878	20°20'03.97322"	81°27'24.67279"
128	P 128	PATCH NO 9	547530.754	2248952.974	20°20'16.87228"	81°27'19.29035"
129	P 129		547508.693	2248981.521	20°20'17.80289"	81°27'18.53224"
130	P 130		547483.462	2249022.496	20°20'19.13807"	81°27'17.66596"
131	P 131		547459.128	2249073.225	20°20'20.79046"	81°27'16.83155"
132	P 132		547445.973	2249120.207	20°20'22.31994"	81°27'16.38232"
133	P 133		547440.305	2249140.521	20°20'22.98127"	81°27'16.18877"
134	P 134		547425.572	2249157.203	20°20'23.52525"	81°27'15.68224"
135	P 135		547424.286	2249181.923	20°20'24.32951"	81°27'15.64024"
136	P 136		547408.189	2249204.107	20°20'25.05259"	81°27'15.08718"
137	P 137		547397.803	2249247.746	20°20'26.47309"	81°27'14.73313"
138	P 138		547383.826	2249274.503	20°20'27.34474"	81°27'14.25363"
139	P 139		547375.676	2249290.106	20°20'27.85303"	81°27'13.97401"
140	P 140		547363.197	2249303.100	20°20'28.27684"	81°27'13.54486"
141	P 141		547356.536	2249322.901	20°20'28.92156"	81°27'13.31701"
142	P 142		547339.778	2249353.301	20°20'29.91197"	81°27'12.74193"
143	P 143		547333.561	2249384.339	20°20'30.92217"	81°27'12.53046"
144	P 144		547316.629	2249427.476	20°20'32.32694"	81°27'11.95058"
145	P 145		547304.263	2249429.775	20°20'32.40283"	81°27'11.52430"
146	P 146		547283.539	2249444.831	20°20'32.89445"	81°27'10.81098"
147	P 147		547255.186	2249511.210	20°20'35.05628"	81°27'09.83939"
148	P 148		547217.899	2249596.590	20°20'37.83701"	81°27'08.56148"
149	P 149		547172.535	2249702.724	20°20'41.29356"	81°27'07.00693"
150	P 150		547131.946	2249797.228	20°20'44.37139"	81°27'05.61595"
151	P 151		547111.729	2249844.857	20°20'45.92253"	81°27'04.92315"
152	P 152		547087.749	2249900.706	20°20'47.74144"	81°27'04.10136"
153	P 153	PATCH NO 10	546351.049	2251572.206	20°21'42.18007"	81°26'38.84788"
154	P 154		546310.212	2251677.518	20°21'45.60943"	81°26'37.44907"
155	P 155		546303.113	2251724.409	20°21'47.13541"	81°26'37.20856"
156	P 156		546293.360	2251745.556	20°21'47.82417"	81°26'36.87411"
157	P 157	PATCH NO 11	539917.053	2263019.726	20°27'55.09116"	81°22'57.83564"
158	P 158		539865.841	2263089.514	20°27'57.36521"	81°22'56.07357"
159	P 159		539841.543	2263129.537	20°27'58.66899"	81°22'55.23808"
160	P 160		539817.182	2263164.319	20°27'59.80229"	81°22'54.40001"
161	P 161		539795.177	2263200.216	20°28'00.97169"	81°22'53.64334"
162	P 162		539753.203	2263268.690	20°28'03.20229"	81°22'52.20001"
163	P 163		539735.770	2263290.168	20°28'03.90229"	81°22'51.60001"
164	P 164		539705.262	2263338.477	20°28'05.47607"	81°22'50.55082"
165	P 165		539665.865	2263400.862	20°28'07.50840"	81°22'49.19593"

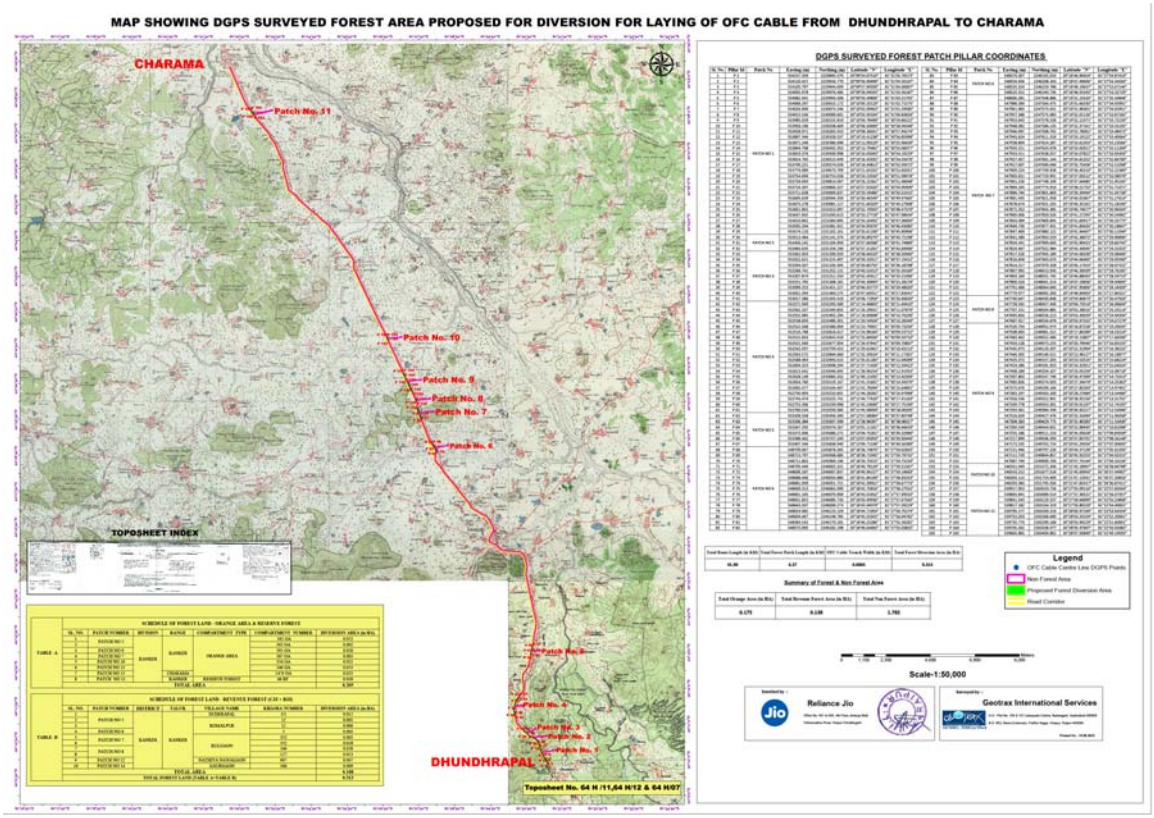
7.3 Annexure – 3: Geo-Referenced Maps of the Proposed Route

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