IS/ISO 9001:2000

FINAL REPORT ON FEASIBILITY OF LAYING COMMON DUCT IN THE CITY OF DEOGHAR, JHARKHAND

FOR

TELECOM REGULATORY AUTHORITY OF INDIA

Date: 1st May 2017

By

TELECOMMUNICATIONS CONSULTANTS INDIA LTD.

TCIL Bhawan, Greater Kailash-I, New Delhi – 110048

Telephone: 011-26202020 Fax: 011-2624226

Contents

1 Executive Summary

1.1. Background

TRAI officials during their visit to Jharkhand state capital Ranchi had discussions with the state government officials regarding the broadband penetration in the major cities of the state. It came out during the discussions that the broadband penetration is low and not to the desired level. It was felt by TRAI that a study should be conducted with inputs from all stakeholders as to the reasons for low penetration and how it can be increased. It emerged that if a common duct policy can be evolved which shall enable the TSP's/ISP's to lay fiber easily for providing the broadband services in areas they desire as the duct would already be available. Availability of a common infra structure would save time, cost and efforts. Only the OFC would need to be laid to complete the OSP (Outside Plant Engineering).

Deoghar city was selected as a pilot case to study the feasibility for laying of common duct.

TCIL was awarded the work for carrying out "Feasibility Study for improving the broadband penetration by laying of common duct in Deoghar, Jharkhand" on 13.06.2016. **[Work Order placed at Annexure 1.]**

1.2. Methodology to prepare the report

The below steps were carried out for preparing the report:

Discussion with various stakeholders and gathering of data for the current telecom scenario from the TSP's and ISP's was carried out.

Performa was sent to the TSP's /ISP's operating in Deoghar to gather data w.r.t the current telecom presence in terms of length of OFC laid, no. of BTS towers, wireline/wireless/broadband subscribers etc.

Bandwidth estimation was done for the current scenario as well as projection was carried out for subsequent years.

A route survey was carried out to understand the layout of roads, important buildings and landmarks. **The route of the existing OFC of the various TSP's was also seen.**

Based on the existing data, and estimating the future requirements of optical fiber cable from discussions with the various stakeholders and taking the population increase, smart infra structure requirements in view the number of ducts/micro ducts were determined and the BoQ and specifications finalized.

Budgetary quotes were taken from vendors and existing data from Purchase Orders used to determine the CAPEX for the common duct infrastructure required. The OPEX is considered for a period of 20 years.

The Business Plan preparation involved the following flow:

- Understanding the different funding models prevalent in industry.
- Comparing the cost of the micro duct per km that has been estimated with the cost that it costs a TSP to lay a duct for its own use.
- Determining the sale price that can be kept so that it is lucrative for the buyer as well as for the seller to earn a profit.
- Determining the breakeven point where in the CAPEX cost is recovered.
- Projecting the % sale of the micro duct.

1.3. Broad Findings

About Deoghar City: Deoghar city is the biggest city of Deoghar district. It has an area of 337 sq. km. It is divided into 36 wards and each ward having an average area of 9.36 km.

Population growth: From 2001 to 2011 census the population recorded a growth of ~ 28%. The population as per 2011 census is 2.03 lakhs.

GDP growth: The GDP of Deoghar recorded a growth of 8.15% from 2005 to 2009 which was above the average growth rate of Jharkhand for the same period.

Bandwidth Estimation: The bandwidth requirement has been estimated for the current scenario and projection for subsequent years. The data for the number of institutions/ organizations has been gathered from the internet and taken from municipal authorities. The major assumptions used for the projection are:

Five members per household have been assumed and a contention ration of 30:1 has been taken for calculation of bandwidth for households.

All institutions like schools, colleges, hospitals, dispensaries, government offices, police stations, banks, market places, private offices have been considered for the usage of bandwidth.

The existing telecom scenario has been studied and the requirement for future backhaul bandwidth of mobile operators has been considered for wireless broadband usage.

The requirement during the tourist surge period like Shravana mela has been taken.

The Digital India requirements have been considered.

The Smart infra-structure requirements have been taken into account.

Based on all of the above the bandwidth requirement comes out to be as below:

- 2016 (As on date) – 10 Gbps
- 2026 (After 10 yrs.) – 30 Gbps
- 2036 (After 20 yrs.) – 75 Gbps

It can be seen that for achieving growth, knowledge and economic progress connectivity to internet through broadband is mandatory. For bandwidth of the order of Gbps, radio technology is inadequate to meet these needs, due to spectrum scarcity. **The option that is most suitable is optical fiber connectivity.**

Optical Fiber Cable can be laid in two ways – Underground (U/G) and Aerial.

Laying of U/G Cable is a costly task. Operators that lay U/G cables for their network encounter the following difficulties:

- Acquiring the RoW (Right of Way) permission from the State Governments
- Doing the restoration works after laying of cables
- Damage to the cable of one operator while the other one is laying his cable
- Maintenance of this infra-structure

Envisaging the laying of a common duct infra structure can solve the above problems to a large extent. Based on this Deoghar city has been taken up as a pilot study and TCIL has carried out the survey for duct route, duct dimensioning, specifications, cost estimation and business plan preparation.

Route km: After discussions with the authorities it emerged that the duct planning should be done for all the roads. The city is divided into 36 wards and from the detailed planning, the average route length per ward comes to 8.3 km. Thus the total route length is 300 km.

The roads were categorized into primary, secondary and tertiary roads. The route length for each type is estimated as below:

- Primary road = 86 km
- Secondary road = 71 km
- Tertiary road = 143 km

Total = 300 KM [In draft report – 252 km.]

Note: The route lengths have been updated based on the final drawing updation.

Duct Dimesioning:

Duct Type 1 [For Primary Routes]

Description	Specs
Outer sheath	1 mm
Micro Duct Size	20/16 mm
No. of Micro-ducts	7
Duct Drum Size	1 KM

The primary route shall have six such ducts which implies **6X7 = 42 micro ducts.**

Duct Type 2 [For Secondary Routes]

Description	Specs
Outer sheath	1 mm
Micro Duct Size	14/10 mm
No. of Micro-ducts	7
Duct Drum Size	1 KM

The secondary route shall have four such ducts which implies **4X7 = 28 micro ducts.**

Duct Type 3 [For Tertiary Routes]

Description	Specs
Outer sheath	1 mm
Micro Duct Size	10/8 mm
No. of Micro-ducts	7
Duct Drum Size	1 KM

The tertiary route shall have two such ducts which implies **2X7 = 14 micro ducts**

Duct km:

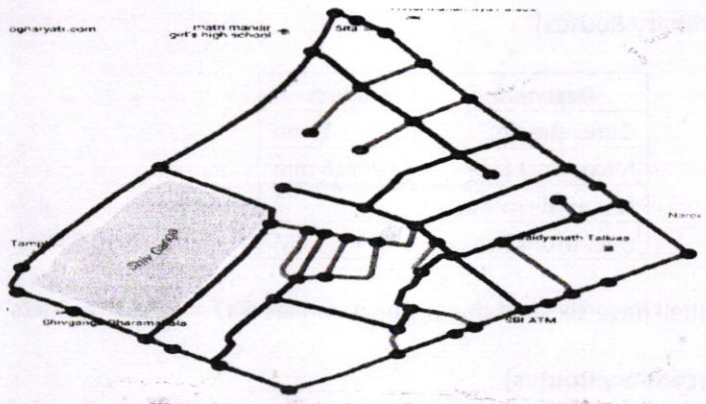
Primary route = 86 x 6 = 516 km
Secondary route = 71 x 4 = 284 km
Tertiary route = 143x2 = 286 km

Total = 1,086 KM

The total micro duct route km comes to 1,086 X 7 = 7,602 km.

Besides the 7 way micro ducts 2 No of simple ducts would be laid along the primary and secondary routes, which makes an additional of 314 duct km.

Sample Ward Plan – 21



Primary Route

Secondary Route

Tertiary Route

Summary for Ward-21	
Total Route (Mtr)	5,567
Primary Route (Mtr)	2,488
Secondary Route (Mtr)	1,782
Tertiary Route (Mtr)	1,297
Chambers	50

CAPEX:

- The cost for laying of the common duct is estimated at **INR 44.36 Cr** for **7602 micro duct route km.**
- **RoW cost of INR 1.50 Cr.**
- **Total CAPEX is estimated to be INR 45.86 Cr.**

Summary of Business Plan

- The implementation **cost per micro duct km** comes to **be INR 60,330**
- The **loaded cost per micro duct km** comes to be **INR 86,186** [Assuming maximum 70% sale of duct]
- The implementation cost for any operator for laying of duct comes to appx. INR 7-8 lakhs per km.
- The business scenario has been analysed keeping in mind **three unit sale prices** of **INR 2.5, 2.75 and 3.0 lakhs**. The table is provided in Sec 9.4.1 of this document.
- For sale price of INR 2.50 Lac, break even is achieved in 10 Yrs.
- For sale price of INR 2.75 Lac, break even is achieved in 4 years
- For sale price of INR 3.0 Lac, break even is achieved in 1 year
- Sale price can vary between the above two rates and may be more also depending upon the market forces.

1.4. Structure of report

Chapter 2 – Covers the introduction, profile of Deoghar city and the present Telecom Scenario, stakeholder details and the project objectives.

Chapter 3 – Covers the Telecom Demand Assessment which includes a study of the existing infra-structure, the future requirements of connectivity, services, internet access, mobile coverage and OFC requirements.

Chapter 4 – Covers the methodology used for planning of the duct route, categorization of the roads and the route plan.

Chapter 5 – Covers the duct dimensioning, design, specifications of the duct and BoQ.

Chapter 6 – Covers the types of ducts, laying methodologies, pros and cons of the different laying techniques.

Chapter 7 – Covers the CAPEX and OPEX costs.

Chapter 8 – Covers the Financing and Business Models.

Chapter 9 – Covers the implementation strategy i.e the project execution plan and timelines.

Chapter 10 – Covers the challenges and risks.

List of Annexures

Annexure 1 – TRAI WORK ORDER

Annexure 2 – DEOGHAR ROADS

Annexure 3 – DEOGHAR POPULATION

Annexure 4 – EXISTING TELECOM INFRA-STRUCTURE

Annexure 5 – DEOGHAR INSTITUTIONS

Annexure 6 – DUCT ROUTES

Annexure 7 – BANDWIDTH ESTIMATION

Annexure 8 – BUSINESS VIABILITY

Annexure 9 – TRAI FEEDBACK ON DRAFT REPORT

Introduction

2.1. Background

TRAI officials during their visit to Jharkhand state capital Ranchi had discussions with the state government officials regarding the broadband penetration in the major cities of the state. It came out during the discussions that the broadband penetration is low and not to the desired level. It was felt by TRAI that a study should be conducted with inputs from all stakeholders as to the reasons for low penetration and how it can be increased. It emerged that if a common duct policy can be evolved which shall enable the TSP's/ISP's to lay fiber easily for providing the broadband services in areas they desire as the duct would already be available. Availability of a common infr structure would save time, cost and efforts. Only the OFC would need to be laid to complete the OSP (Outside Plant Engineering).

Deoghar city was selected as a pilot case to study the feasibility for laying of common duct.

TCIL was awarded the work for carrying out "Feasibility Study for improving the broadband penetration by laying of common duct in Deoghar, Jharkhand" on 13.06.2016. **[Work Order placed at Annexure 1.]**

2.2. Project Objective:

The objective of this project was to carry out a feasibility study and cost benefit analysis for laying of a common duct in Deoghar city.

2.3. Scope of Work:

The scope of work was as given below:

- Study and gather the data w.r.t the existing broadband penetration in Deoghar i.e number of existing customers, number of service providers, overall telecom scenario. Demand assessment for citizen/Business/Government, smart cities/surveillance etc.
- Interact with the various TSP's to understand why the broadband penetration is low.
- Interaction with various stakeholders (like Municipal Corporation and others) to assess the present infrastructure of OFC/ducts available.
- Assess the requirement and identify the potential Area of Interest (AoI).
- Planning of duct route for the city considering the existing infrastructure as well as future demand.
- Preparation of technical specs and infrastructure dimensioning.
- Estimate the CAPEX and OPEX.
- Identifying the Business Model for implementing the above project. Exploring the PPP model, Gap funding model, any other model to assess the best possible feasibility of project. Devising Implementation Strategy.
- Cost Benefit Analysis in various scenarios.

2.4. About Deoghar City

Deoghar is the main city of Deoghar district of the Santhal Parganas of Jharkhand state. Deoghar has a population of 2,03,116 as per Census 2011.

Deoghar district has two towns, **Deoghar being class I** and Madhupur being Class II as per Census 2011 classification. Deoghar is the main city of Deoghar district. Deoghar city has an area of about 337 sq. km. It is divided into 36 wards, each ward having an average area of 9.36 sq. km. There is a semi circular main road that runs through half of the city. The secondary roads branch from this main road. The road map is placed at **Annexure 2.**

Its main importance arises from the fact that it has the Baidyanath Jyotirlinga temple also know as Baba Baidyanath dham and is one of the twelve Jyotirlingas, one of the most sacred abodes of Shiva.

Millions of pilgrims visit this shrine every year. It is famous for the mela of Shraavana (a month of the Hindu calendar), between July and August. About 7 to 8 million devotees visit the place from various parts of India and offer holy water of Ganges to the deity collected from Sultanganj, which is almost 108 km from Deoghar and Baidyanath. The water is also brought by the Kānvarias, who carry the water in Kavadi, and walk all the distance, on bare foot. Large crowds can be seen walking all the way carrying water. An unbroken line of people in saffron-dyed clothes stretches over the full 108 km for the month. Pilgrims to the temple later visit the Basukinath temple.

2.4.1. Wards & Their Population

Deoghar is divided into 36 municipal wards. Below table gives the major areas of each ward along with the population: **[Annexure 3.]**

Ward #	Major Areas in Ward	Population
1	Jasidih Market, North & South Sathal	5,482
2	Jasidih Market, Basuwadih, Baghmara	5,397
3	Rohini, Mishra Toll	5,690
4	Gosaindih, Rupsagar, Gordhowa, Sarmul	5,591
5	Ramchandrapur, Kunjisar, Chandpur	5,844
6	Kalipur, Gopalpur, Ratanpur, Dubeydih, Sinariya	5,852
7	Barmasia, Circular Road, Nandan Pahad, Maheshmara	5,382
8	Belabagan, Chandajori, Court, Sri Kant Road	5,593
9	Hirna, Basmata, Gulipathar, Suratilona	5,758
10	Basmata, Koriyasa, Guglidih, Devnathdih	5,711
11	Kalyanpur, Purandaha	5,686
12	BDRS, Bajla Chowk	5,517
13	Bidubhusan Sarkar Road, Parmeshwar Dayal Road, Madhusudan Chhorat	5,548
14	Madari Chak, Circular Road, Kumudani Ghosh Road	5,538
15	Ambedkar Nagar	5,589
16	Williams Town, Hanuman Tikri	5,564

17	Salonatar, Baghmara, Jathhi, Khijoriya, Banga More	5,466
18	Bam Bam Baba Path, B N Jha Road, College Road, R.K. Mission	5,548
19	Jalasar Tank, Jalasar Mode, Tower Chowk	5,498
20	Peda Gali, Bada Bazaar, Brij Bihari Lane, Baiju Mandir Gali	5,596
21	Shiv Ganga Lane, Hari Narayan Mukherjee Road	5,904
22	Bilasi Town, Professor Colony, Neelkanthpur	5,762
23	Dumka Road, Jhosagarhi, Dhanuk Tola	5,920
24	Baidhnathpur, Chhatisi	5,917
25	Rampur, Maheshmara, Refugee Colony	5,886
26	Punsia	5,706
27	Bandha, Chhit Karhanibag	5,596
28	Karhanibag, Mali Tola	5,375
29	Kusta Ashram, Ram Mandir Road	5,840
30	June Pokhar, Harijan Colony	5,563
31	Karnibagh, Bawan Bigha	5,489
32	Castor Town, Railway Colony	5,567
33	Bariyarbandhi, Torradih, Bampass Town	5,716
34	Devsangh, Chittolorhiya, Bhandar Kola	5,795
35	Thari Dulampur	5,572
36	Charki Pahadi, Bandhdih, Kunda	5,665
	Total	**2,03,123**

2.4.2. Important Places

Besides the Baba Baidyanath temple the other important places in Deoghar are as below:

- IGNOU Regional Center
- Ten other educational institutions
- Rikhia Ashram
- Naulakah Mandir
- Ramakrishna Vidyapeeth
- Satsang Ashram
- Other spiritual institutions
- Government offices

2.4.3. The Road Network

The total road length of Deoghar city is approx. 300 km which includes primary, secondary and tertiary roads. **[Annexure 6]**

2.5. Current Telecom Scenario

Jharkhand is currently underserved in terms of telecom infrastructure. As of December 2014, Jharkhand had 3.5 million wireless connections and 0.14 million wireline connections.

Deoghar is in Jharkhand state and Jharkhand comes under the Bihar Telecom Service Area. There are around 8 TSP's providing mobile telecom services in Deoghar.

- BSNL
- Idea
- Airtel
- Vodafone
- RCom
- Tata Tele services
- Aircel
- Telenor

BSNL is the only operator providing fixed line services in the area. All other TSP's are providing 2G only or 2G plus 3G services.

2.6. Concerned Organizations

The concerned organizations are the stakeholders and the customers who would be keen to buy/lease the micro duct for their needs. The suggestive list is given below:

2.6.1. Stakeholders:

Below is the list of stakeholders for this project:

- TRAI
- Government of Jharkhand
- Ministry of IT
- Ministry of Urban Development
- Department of Town Planning
- Municipality of Deoghar
- PWD
- Electricity Department
- Police Department
- Water Department

2.6.2. Customers

The potential customers for the common duct would be the various TSP's/ISP's

- Telecom Operators
  - Airtel
  - Aircel
  - BSNL
  - Idea
  - Vodafoe
  - Reliance
  - Tata Communications
  - Tata tele Services
  - SIFY
- Cable Operators
  - Baba Darshan Network
  - Darshan Network
  - Maa Tara Cable
  - Movie vision
- DTH Operators
  - Tata Sky
  - Videocon DTH
  - Airtel Digital TV
  - Dish TV

The DTH operators may use OFC infrastructure for backhauling purposes. In DTH communication, content is generated by TV studios and transmitted to DTH operator's office/data center. It is then transmitted to VSAT hub from where it is transmitted via satellite to customers.

The fiber link, if available, can be used:

(a) Between Content providers (TV studios) and DTH operator's data centers

(b) Between DTH operators data centers & VSAT hub station

Currently, Deoghar being a small city, TV studios and VSAT Hub station are not there, but in future, such requirements could come when this city is developed as a smart city.

2 Bandwidth Demand Assessment

3.1. The Socio economic profile of Deoghar:

The GDP of Deoghar district has grown at a growth rate (CAGR) of 8.15% during 2005-2009 compared to the state average of 6.70% during the same period. [**Source:** Draft Master Plan Report Madhupur (For Consultation) March 2016, prepared for Urban Development Department, Govt. of Jharkhand]

The current ARPU for telecom as indicated by the TSP's is on the lower side. But with the growth of GDP as indicated above the same can be expected to grow.

3.2. Projections for Deoghar

The population of Deoghar as on per census 2011 is 2.03 lakhs. The population growth rate of Deoghar district for ten years (from 2001 to 2011) is ~ 28%. Therefore, taking this % increase for five years (14%) the population as in 2016 comes to 2.32 lakhs, for 2026 (i.e after 10 years) it comes to 2.96 lakhs and for 2036 it comes to 3.8 lakhs. The summarized table is given below:

Description	Unit	2016	2026	2036
Area	Sq. KM	337	337	337
Population	No	231,420	296,218	379,159
Wards	No	36	36	36
Average Population per ward	No	6,428	8,228	10,532
Average Area per ward	Sq. KM	9.36	9.36	9.36
Primary Roads	KM	80	80	80
Secondary Roads	KM	60	60	60
Tertiary Roads	KM	112	144	185
Educational Institutions (Schools/Colleges)	No	14	18	24
Govt. Offices (Police, MCD, Electricity, Water, Post, Courts etc.)	No	13	17	22
Health Centers (Hospitals)	No	6	8	11
Banks	No	27	35	45
Main Markets/Malls	No	2	3	4
Tourist Places	No	13	13	13

3.3. Institutions of Deoghar

In today's digital world for individuals as well as institutions to interact with each other connectivity to the internet is required. Also many activities and tasks can be done over the internet which eases travel and other difficulties. Knowledge can be shared over the network, making our world ubiquitous. The list and number of the institutions/offices and the applications have been discussed in subsequent sections. **[List of institutions/offices placed at Annexure 5]**

3.4. Existing Telecom Infrastructure

3.4.1. Telecom Operators

The following telecom operators are providing their services in Deoghar:

S.No	Mobile Service Provider	Subscribers
1.	Aircel	42,576
2.	Airtel	71,558
3.	BSNL	~100,000
4.	Idea	22,058
5.	Reliance Comm	~15,000
6.	Tata Teleservices	28,121
7.	Telenor	~10,000
8.	Vodafone	18,545

The total mobile subscribers in Deoghar are ~ 3.08 Lakhs.
The summary of their infra structure is tabulated below:

S.No	Operator Name	No. of Subscribers	Wireline BB	Optical Fibre (KM)	No. of BTS (2G &3G)	No. of Microwave
1	AIRCEL	42,576		Nil	13	14
2	AIRTEL	71,558		38	25	23
3	BSNL	1,00,000	728	33	30	4
4	IDEA	22,058		Nil	20	23
5	RCOM	15,000		17.5	10	6
6	TATA TELESERVICES	28,121		32	17 (2G) 7 CDMA	26
7	TELENOR	10,000		Leased Media (MPLS)	22	NIL
8	VODAFONE	18,545		12.5	27	30

3.4.1.1. Cable Operators

The following telecom operators are providing their services in Deoghar:

S.No	Service Provider	Services	Subscribers
1.	Baba Darshan Cable	Cable	37,000
2.	Darshan Cable Network	Cable	20,000
3.	Movie Vision	Cable	1,50,000
4.	Maa Tara Cable	Cable	

3.4.1.2. DTH Service Providers

The following telecom operators are providing their services in Deoghar:

S.No	Service Provider	Services	Subscribers
1.	Tata Sky	DTH	
2.	Videocon D2H	DTH	
3.	Airtel Digital TV	DTH	
4.	Dish TV	DTH	

3.4.2. Optical Fiber Infrastructure

The details of OFC laid by various telecom operators in Deoghar are as follows:

S.No	Operator	Existing OFC	Existing Towers	Expansion Plans	Reference
1.	Airtel	38 KM	BTS - 25 MW - 230	2G Expansion-06 nos 3G Expansion-07 nos 4G Expansion-20 nos Fiber approx-20 km FTTB for Corporate Business Unit & Airtel Business Unit Customer	Annexure-4.1
2.	BSNL	33 KM	BTS - 30 MW – 4		
3.	Reliance Comm	17.5 KM	BTS - 10 MW – 6	FTTH in Ward No-2	Annexure-4.2
4.	Tata Tele Services	28 KM	BTS - 24 MW - 26		Annexure-4.3
5.	Vodafone	12.5 KM	BTS – 27 MW - 30		Annexure-4.4
6.	Idea	0	BTS – 20 MW - 23	4.5 KM	Annexure-4.5

- The OFC routes covered by various operators are provided in **Annexure 4.**
- Some operators are sharing other operator's fiber/infra-structure.
- The duct laid by TSP's currently is the simple duct (40/33 mm) and is mainly along the circular road.

3.5. Future Demand Assessment

3.5.1. Population Growth

As per census 2011, the population of Deoghar has increased by **28% from 2001 to 2011**. Assuming the same rate of growth, the population would be about **2.9 Lakhs by 2026** and **3.8 Lakhs by 2036.**

This would increase the number of households to 59,200 and 76,000 in 2026 and 2036 respectively.

Requirement of Wireline Broadband: As on date from the available data the wireline broadband connections are only ~ 750. Even if we assume that all households may not demand a broadband connection and even if 50% households take up a connection, then also there is a potential of 20,000 wireline broadband subscribers as on date.

Having an adequate infra structure in place acts as a catalyst for the latent or dormant demand to be activated.

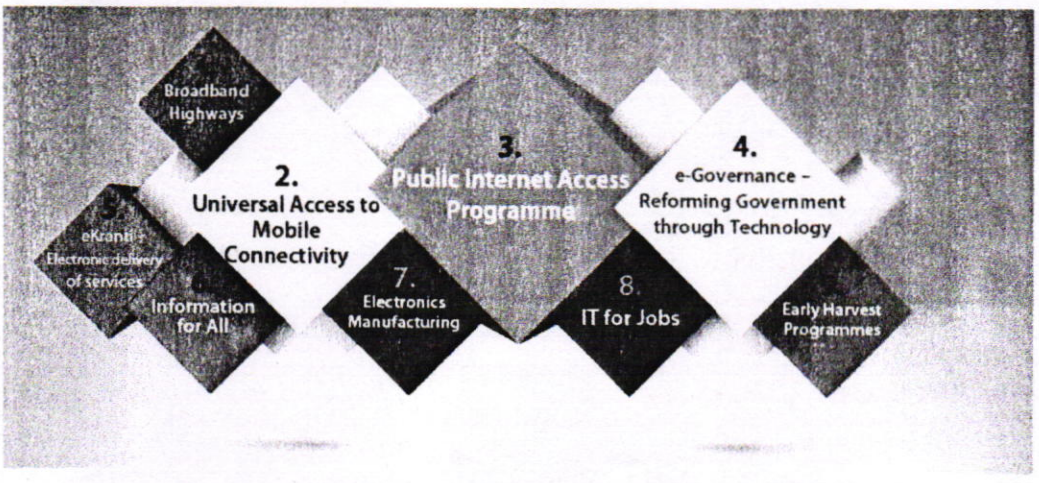
Requirement of Wireless Broadband: Besides the wireline, the wireless subscribers would also increase. 3G services are already present in Deoghar by various operators. People have started to use broadband on the move. Wireless broadband would need substantial backhaul bandwidth to sustain these connections. The required backhaul bandwidth can be provided to the BTS's only through an OFC backhaul.

[As on date, in India only about 17-20% BTS's are on OFC backhaul.]

3.5.2. Digital India Initiative:

The Digital India initiative of the GoI aims to enable each and every citizen to make use of the services provided by the Government and to further their, social and economic horizons.

Only a knowledge based society can be truly powerful.



Digital India has nine pillars out of which the first three pillars form the basis for the remaining six pillars:

- Broadband Highways
- Universal Access to Mobile Connectivity
- Public Internet Access Program

Some of the services that are expected to drive future demand of network bandwidth are:

1. Video on Demand
2. Mobile applications like m- banking
3. E-commerce & m-Commerce
4. E-Governance & m-Governance
5. FTTH
6. Tele-medicine
7. Tele-education
8. Cloud Computing
9. Online Navigation
10. E-voting
11. Online News & TV Serials/shows
12. Online Gaming and movies
13. Online Meetings / Video Conferencing

3.5.3. Smart City Initiative:

The GoI has announced a list of 100 cities to be made into smart cities. The below diagram indicates the smart solutions that would make the lives of citizens more comfortable and safe. Few applications are explained in detail below:

1. **Security and surveillance:** As CCTV cameras would be installed in all parts of the city, these would be connected to a central server e.g in the police control room where all the instances can be monitored. Transmission of the CCTV data to the control room would require bandwidth.

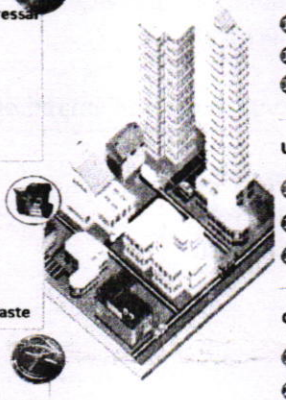
2. **Smart Meters and Management for both water and electricity:** All the major street lights would be monitored and their intensity controlled based on the natural light availability. W.r.t water the leakages would be identified and preventive maintenance carried out.

3. **Skill Development and Incubation Centers**: The skill development centers would have all the infra structure to enable tele-education classes of government funded programs wherein courses from larger universities can be transmitted to Deoghar. It could be possible for private entities also to hire this infra structure for their training purposes and give rent to the government.

The incubation centers shall provide resources to entrepreneurs for their IT needs.

ILLUSTRATIVE LIST

Smart Solutions



E-Governance and Citizen Services

1. Public Information, Grievance Redressal
2. Electronic Service Delivery
3. Citizen Engagement
4. Citizens - City's Eyes and Ears
5. Video Crime Monitoring

Waste Management

6. Waste to Energy & fuel
7. Waste to Compost
8. Waste Water to be Treated
9. Recycling and Reduction of C&D Waste

Water Management

10. Smart Meters & Management
11. Leakage Identification, Preventive Maint.
12. Water Quality Monitoring

Energy Management

13. Smart Meters & Management
14. Renewable Sources of Energy
15. Energy Efficient & Green Buildings

Urban Mobility

16. Smart Parking
17. Intelligent Traffic Management
18. Integrated Multi-Modal Transport

Others

19. Tele-Medicine & Tele Education
20. Incubation/Trade Facilitation Centers
21. Skill Development Centers

3.5.4. Service Requirements

In today's digital world for individuals as well as institutions to interact with each other connectivity to the internet is required. Also many activities and tasks can be done over the internet which eases travel and other difficulties. Knowledge can be shared over the network, making our world ubiquitous. The list and number of the institutions/offices in Deoghar and the applications that they use/would use is given in the following table.

SN	Description	Applications	Qty in 2016
1	Households	Voice, Internet Access	46,330
2	Main markets/malls/movie theaters	Voice, Internet Access, E-commerce applications	5
3	Police stations	Voice, Internet Access, CCTNS & others	3
4	Water authority offices	Voice, Internet Access, ERP, NMS etc	1
5	Electricity authority offices	Voice, Internet Access, ERP, CRM, EMS etc	1
6	Offices (Telecom/Cable/ISP)	Voice, Internet Access, NMS, CRM, etc	26
7	Colleges	Voice, Internet Access, Tele-education	6
8	Schools	Voice, Internet Access, Tele-education	10
9	Hospitals	Voice, Internet Access, Tele-medicine	6
10	Primary health centers	Voice, Internet Access, Tele-medicine	4
11	Banks	Voice, Internet Access, Banking & e-commerce	27
12	PWD offices	Voice, Internet Access, ERP, NMS etc	3
13	MCD offices	Voice, Internet Access, e-Governance	1
14	Courts	Voice, Internet Access, e-Courts	1
15	Post offices	Voice, Internet Access, e-money, insurance etc	4
16	Tourist Places	Voice, Internet Access	13
17	Tourist Office	Voice, internet	1
18	Pvt. Offices and Corporates	Voice, Internet Access	20
19	Backhaul for mobile	Voice and data for Wireless subscribers	8
20	Floating BW for tourist season		

3.5.5. Connectivity Requirements

The following services are expected to drive future demand of network bandwidth:

1. Wi-Fi connectivity to all public places
2. Networking of all hospitals
3. Networking of all educational institutions
4. CCTV camera network for police
5. Networking of all police stations
6. Connectivity to all shopping complexes & markets
7. FTTH
8. Mobile connectivity to all pilgrims
9. Backhaul connectivity for the 3G BTS's to provide wireless broadband

3.5.6. Telecom Growth

In order to provide above services and connectivity requirements, the no. of operators will increase. The no. of operators will depend on the Govt. policy. However, looking at the total population and growth potential of Deoghar city, the maximum no. of telecom operators is expected to be as follows:

S.No	Agencies/ Organizations	Current	After 10 Years	After 20 Years
1	Mobile Service Providers	8	12	15
2	Internet Service Providers	8	12	15
3	Cable Operators	4	6	10
4	FTTH Operators	2	4	10
5	DTH Operators	4	6	10

As already mentioned in Section 3.5.1 the telecom operators would need to substantially enhance their backhaul bandwidth to provide wireless broadband on 3G and also to provide wireline broadband on demand.

3.5.7. Bandwidth Estimation:

Based on all the above requirements the current and future bandwidth demand has been estimated for 2016 (as on today), 2026 (after 10 years) and 2036 (after 20 years). The detailed calculations are provided at **Annexure-7.** The summary of bandwidth required decade wise is as below:

SN	Year	Bandwidth Req.
1.	2016	10 Gbps
2.	2026	30 Gbps
3.	2036	75 Gbps

Assumptions for bandwidth estimation:

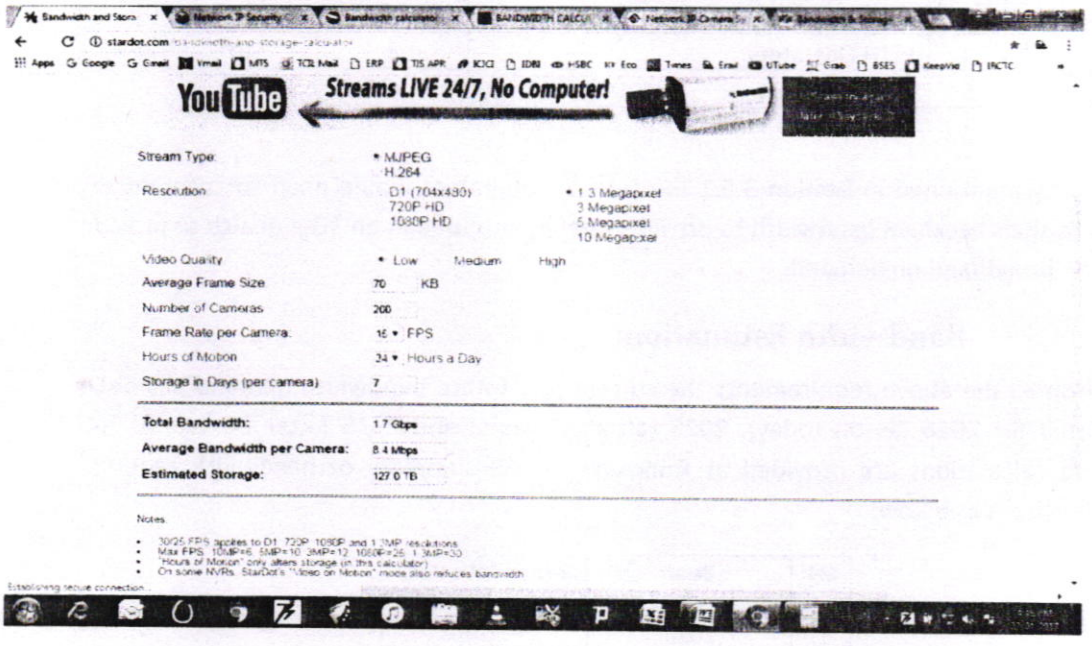
- The number of households has been determined by assuming five members per household.
- Bandwidth requirement per household has been taken as 2 Mbps (2016), 4 Mbps (2026) and 10 Mbps (2036) with a contention ratio of 1:30.
- The current number of various institutions has been determined from data from stakeholders and internet and subsequently projected.

Bandwidth Estimation for CCTV Surveillance Network:

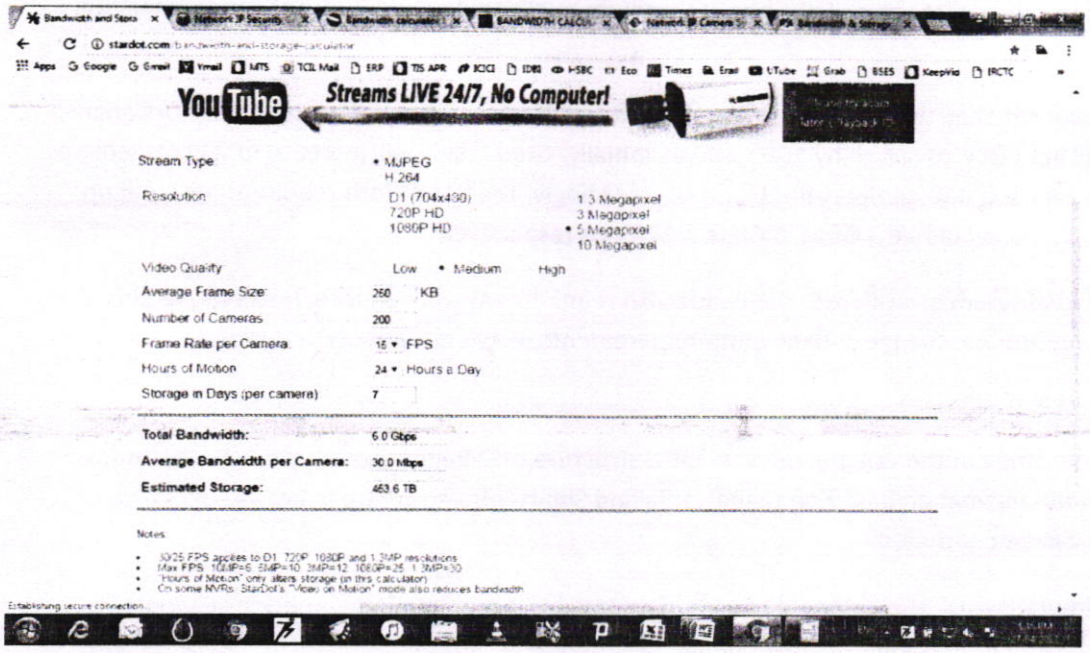
CCTV surveillance network is the major smart city application that consumes bandwidth as live videos are to be recorded and stored. Hence bandwidth for the same has been estimated.

The bandwidth required for a CCTV network varies significantly depending on Stream Type, Video Quality, No. of Cameras and Frame rate per camera. To illustrate the variation, few scenarios are taken below and bandwidth requirements mentioned using a Bandwidth Calculator.

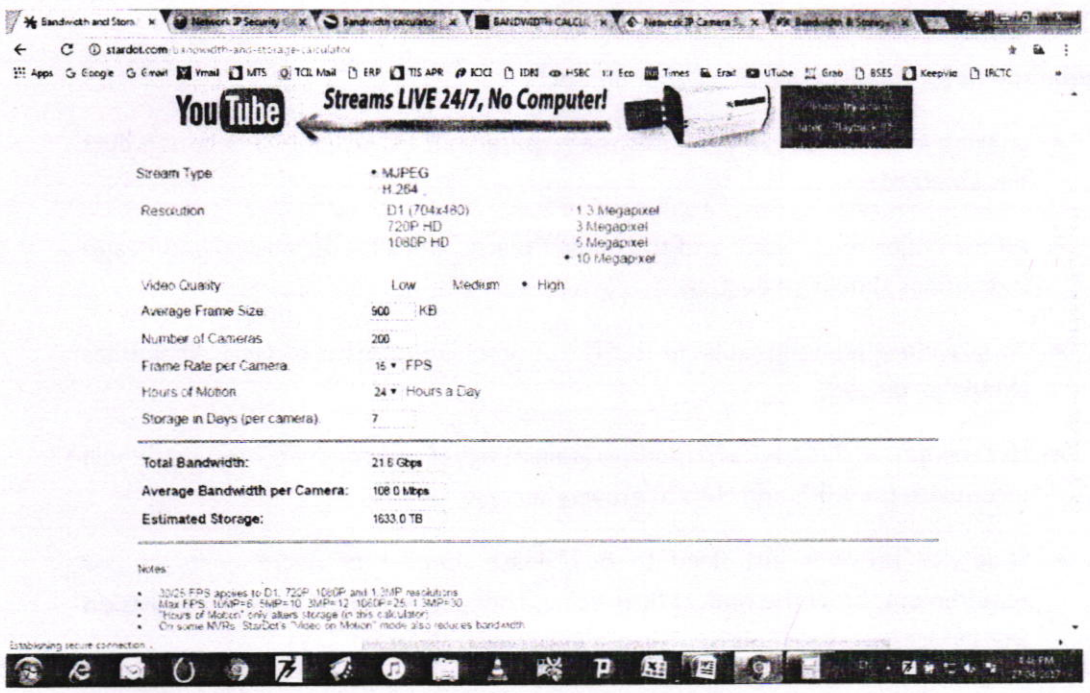
Scenario 1 (Low Quality Video):



Scenario 2 (Medium Quality Video):



Scenario 3 (High Quality Video):



As illustrated above, bandwidth required for a 200 number of cameras network is about 1.7 Gbps for low quality video, 6.0 Gbps for medium quality video and 22 Gbps for high quality video.

It is assumed that the sensitive areas [e.g market places and major crossings] of Deoghar city will get CCTV coverage by 100 cameras initially. Gradually it will increase to 200 cameras in 10 years and 400 cameras in 20 years. Accordingly, the bandwidth required, for medium quality video, would be 3 Gbps, 6 Gbps & 12 Gbps respectively.

If high quality video is relayed, the bandwidth requirement will be more. However, as this is a ducting project, change in bandwidth requirements would not affect the design.

3.5.8. Conclusion:

From the study of the existing telecom infra-structure of Deoghar, population details, future bandwidth estimation based on Digital India and Smart infra-structure initiatives of GoI, the below can be concluded:

- **Stimulation of the latent/dormant demand for broadband/IT services:** It would be pertinent to note that the low number of broadband subscribers does not indicate that a demand does not exist. Presence of adequate infra structure would activate the latent demand which we can see from the bandwidth projection estimates that it exists. **As we have seen in the above sections numerous applications and scenarios exist for requirement of broadband.**

- **Requirement for Provisioning of a Common Duct :**

  - Looking at all the above use cases the requirement for laying of a common duct has emerged.
  - All the major roads leading to the market places, offices, educational and health institutions should be ducted.
  - To provide wireline broadband to the households the roads of residential areas should be ducted.
  - If a common duct infra structure [consisting of micro ducts] is laid it will incentivize the TSP's and ISP's to provide services.
  - A service provider just need to buy/ lease number of micro ducts as per requirement, blow the optical fiber cable, connect the electronics and provision the services.
  - The hassles of trenching, ducting, and RoW permissions would be avoided.
  - The owner of the duct infra structure [which could be government or outsourced by government] would maintain the ducts.

The required bandwidth can be provided to the households, government offices and institutions by incentivizing the TSP's/ISP's to come forward and give broadband services. One way could be that a common duct be laid and the service providers can come forward and buy/lease duct/ducts as per their needs.

Advantages of laying a common duct:

- Laying of a common infra-structure at one go would enable different organizations to lease/buy a duct for their needs, in which only the optical fiber would have to be blown.
- The investment in cables would be deferred to only when needed.
- The digging, restoration and re- digging of the roads would be avoided as chambers/manholes would be provided at suitable intervals to lay the fiber.
- Hassles of arranging RoW permissions would be avoided.
- Since the common cost would be incurred only once, this would result in cost savings for the investor and reasonable sale rates to the buyers.

Feasibility of laying the Common Duct: Based on the above feasibility of laying a common duct in Deoghar city was carried out. The survey findings, duct dimensioning, specifications, costs and business plan have been discussed in subsequent chapters.

3 Planning of the Duct Route

4.1. Planning Methodolgy

The maps of Deoghar city were obtained and studied and a preliminary survey was carried out to study the layout of the city. This included:

- Understanding layout of the city w.r.t residential, commercial & institutional areas.
- Broad survey of roads for their lengths & widths.
- Major landmarks/chowks in the city.

Further discussions were held with TSPs/NSPs in Ranchi and Delhi to understand and obtain the following data for their networks:

- Customer Base
- Types of services being provided
- Extent and route of OFC laid
- Number and locations of there towers

Discussions were held with Deoghar Municipal Corporation officials to understand layouts/routes of various utilities in the city and their requirements.

4.2. Categorization of Roads/Routes

The roads have been categorized into 3 categories:

4.2.1. Primary roads/routes:

The routes along which the OFCs of almost all service providers are likely to run have been identified as primary routes. Maximum no. of ducts/micro-ducts will be required along these roads/routes.

4.2.2. Secondary roads/routes:

The routes along which the OFCs of 50-60% service providers are likely to run have been identified as secondary routes.

4.2.3. Tertiary roads/routes:

These are internal roads of a ward. Only few operators (approximately 25% of total operators) will be active within a particular ward. These operators will most likey be FTTH operators, Cable operators and Internet Service providers.

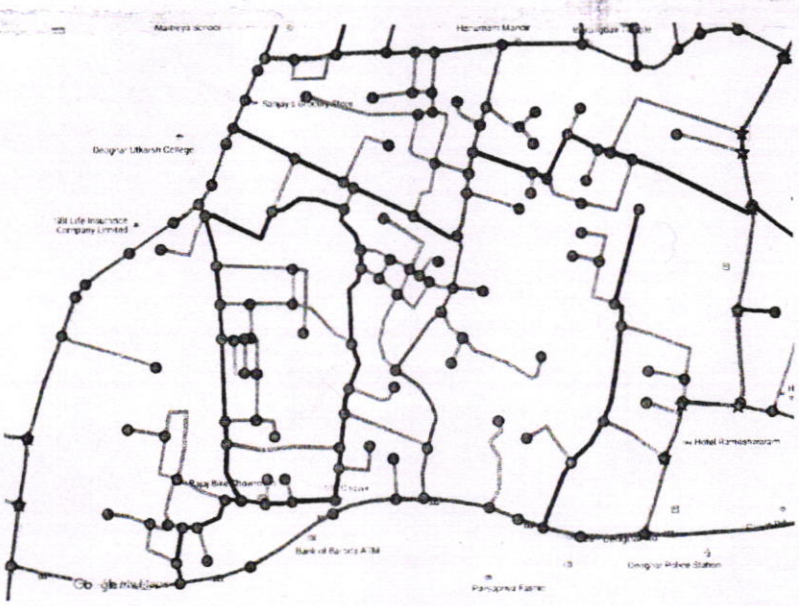
4.3. Route Plan

It has been assumed that ducting will be done to cover all households, commercial complexes, institutions and public places.

The routes have been selected & categorized as above and colour marked as follows:

- **Red** : Primary roads/routes
- **Black** : Secondary Roads/Routes
- **Blue** : Tertiary Roads/Routes

The route maps and route tables for individual wards are provided in **Annexure 6**. As a sample, the map and route table for ward no. is provided below:



Summary	
Total Route (mt.)	14,377
Primary Route (mt.)	4,523
Secondary Route (mt.)	3,383
Tertiary Route (mt.)	6,471
Chambers	155

4.4. Overall Route

The route maps and route table for all the 36 wards are enclosed. The total route length has come to about 300 KM as follows:

Primary Route (mt.)	86 KM
Secondary Route (mt.)	71 KM
Tertiary Route (mt.)	143 KM
Total Route (mt.)	**300 KM**

It may be noted that the route length measurements have been done using Google maps. It may vary by +-10% when actual measurements are done.

4 Ducting Design & BoQ

5.1. Infrastructure Dimensioning

Traditionally the ducts were laid as single big sized ducts in which the cable could be pulled. These were of 40mm/100mm diameter. With the advent of FTTx technology more numbers of optical fibers in a single duct were required that could be easily branched or installed when the need arose. This gave rise to the concept of micro ducts where in a single big duct contains sub ducts and a bundle of fibers can be blown into each micro duct as per requirements.

Thus especially for city areas where the cable is required to permeate to each and every building micro ducting becomes important:

- A branch can be made simply at any place, any time.
- Low initial costs.
- The network can grow on demand.
- It is easy to install micro duct routes in occupied ducts.

5.1.1. Dimensioning Parameters

- **No. of telecom service providers having OFC infrastructure**

  As on date five TSP's have their own OFC laid in Deoghar but which is not of substantial length. Appx. 30% of the route/roads have OFC. Based on the discussions it appears that if a common duct is made available TSP's /ISP's would come forward to take a micro duct.

- **No. of commercial/residential buildings to be connected**

  With the Digital India initiative of the GoI, it is desired that the government services be made available on line to each and every citizen of the country. Also for applications like tele education and tele medicine optical fiber connectivity is required to get the desired bandwidth.

- No. of service providers in a particular area/ward, having their OFC infrastructure
- Other agencies requiring OFC infrastructure
- Bandwidth required

5.1.2. Assumptions

- All commercial/residential buildings need to be connected. 30% expansion in next 10 years and 60% in next 20 years may be assumed
- Maximum no. of telecom service providers, having OFC infrastructure, would be 20
- Maximum no. of service providers, having OFC infrastructure, in a particular area/ward would be 3
- The other agencies which may require OFC infrastructurer are as follows:
    a. Police Department
    b. Electricity Department
    c. Water department
    d. Public Works Department
    e. Gas Authority

5.1.3. No. of Micro-Ducts Required

The estimated no. of ducts / micro-ducts required is as follows:

SN	Agencies/ Organizations	Nos	Micro-Ducts Required		
			Primary Routes	Secondary Routes	Tertiary Routes
1	Mobile Service Providers	20	20	12	-
2	ISPs/Cable/FTTH Operators	10	10	6	4
3	Police Department	1	1	1	1
4	Electricity Department	1	1	1	1
5	Water department	1	1	1	1
6	Public Works Department	1	1	1	1
7	Gas Authority	1	1	1	1
8	Others / Spare	5	5	5	5
	Total	**40**	**40**	**28**	**14**

Summary of the above table is as follows:

- In primary routes, 40 micro-ducts are required. Hence, 6 main ducts having 7 micro-ducts will have to be laid. In addition, 2 simple ducts (40/33mm) are proposed for exceptional conditions.
- In secondary routes, 28 micro-ducts are required. Hence, 4 main ducts having 7 micro-ducts will have to be laid. In addition, 2 simple ducts (40/33mm) are proposed for exceptional conditions.
- In tertiary routes, 14 micro-ducts are required. Hence, 2 main ducts having 7 micro-ducts will have to be laid.

5.1.4. Route Length

After discussions with the authorities it emerged that the duct planning should be done for all the roads. The city is divided into 36 wards and from the detailed planning, the average route length per ward comes to 8.3 km.

The roads were categorized into primary, secondary and tertiary roads. The route length for each type is estimated as below:

Primary road – 86 km
Secondary road – 71 km
Tertiary road – 143 km

Note: The route lengths have been updated based on the final drawing updation. In draft report the total route length was estimated as 252 km and now it is 300 km. Accordingly all the other parameters have been arrived at.

5.1.5. Size of Ducts/ Micro-ducts

In Deoghar city, since the intent is that the broadband networks penetrate as much as possible and also the smart infra structure demand optical fiber connectivity micro ducts are the ducts of choice. 7-way micro duct has been chosen with the below dimensioning:

Duct Type 1 [For Primary Routes]

Description	Specs
Outer sheath	1 mm
Micro Duct Size	20/16 mm
No. of Micro-ducts	7
Duct Drum Size	1 KM

The primary route shall have six such ducts which implies **6X7 = 42 micro ducts**.

Duct Type 2 [For Secondary Routes]

Description	Specs
Outer sheath	1mm
Micro Duct Size	14/10 mm
No. of Micro-ducts	7
Duct Drum Size	1 KM

The secondary route shall have four such ducts which implies **4X7 = 28 micro ducts**.

Duct Type 3 [For Tertiary Routes]

Description	Specs
Outer sheath	1 mm
Micro Duct Size	10/8 mm
No. of Micro-ducts	7
Duct Drum Size	1 KM

The tertiary route shall have two such ducts which implies **2X7 = 14 micro ducts**.

Duct km:

Primary route	=	86 x 6 = 516 km
Secondary route	=	71 x 4 = 284 km
Tertiary route	=	143 x 2 = 286 km
Total	**=**	**1,086 KM**

The total micro duct route km comes to 1,086 X 7 = 7,602 km.

Besides the 7 way micro ducts 2 No of plain duct [40/33 mm] would be laid along the primary and secondary routes, which makes an additional of 314 duct km.

5.1.6. Duct Lengths

The duct lengths will be as follows:

Description	Route	Route Length (KM)	Duct Length (KM)
6 Ducts of Type-1	Primary	86	516
4 Ducts of Type-2	Secondary	71	284
2 Ducts of Type-3	Tertiary	143	286
Total		**300**	**1,086**

5.1.7. Bill of Quantity

5.1.7.1. Material

The materials BOQ for primary, secondary and tertiary routes will be as follows:

Route	Description	Unit	Total Qty
Primary	Duct Type-1	Km	516
	Coupler Type-1	No	2,580
	End Plugs Type-1	No	36,120
	Duct Type-4	Km	172
	Coupler Type-4	No	860
	End Plugs Type-4	No	1,720
	Spacers	No	25,800
	Warning Tape	Km	86
	Route Markers	No	430
	Tools & Testing Kit	No	1

Route	Description	Unit	Total Qty
Secondary	Duct Type-2	Km	284
	Coupler Type-2	No	1,420
	End Plugs Type-2	No	19,880
	Duct Type-4	Km	142
	Coupler Type-4	No	710
	End Plugs Type-4	No	1,420
	Spacers	No	14,200
	Warning Tape	Km	71
	Route Markers	No	473
	Tools & Testing Kit	No	1

Route	Description	Unit	Total Qty
Tertiary	Duct Type-3	Km	286
	Coupler Type-3	No	2,860
	End Plugs Type-3	No	20,020
	Spacers	No	14,300
	Warning Tape	Km	143
	Route Markers	No	1,430
	Tools & Testing Kit	No	1

5.1.7.2. Services

The BoQ for the services required to lay the ducts is as follows:

Description	Unit	Qty
Trenching in Normal Soil	KM	165
Trenching in Soft Rock	KM	60
GI in Hard Rock/PCC	KM	20
Road Crossings	No.	17
Culvert Crossings	No.	6
Bridge Crossings	No.	6
PCC in Drains	KM	26
Construction of OFC Chambers Type-1 (1m x 1m)	No.	430
Construction of OFC Chambers Type-2 (1.5 m x 1.5 m)	No.	470
Construction of OFC Chambers Type-3 (2 m x 2 m)	No.	1430

5 Construction Methodology

6.1. Types of Ducts

A duct is essentially a tube like structure which is used for housing the Optical Fiber Cable (OFC). This provides protection to the OFC from damage.

For underground networks, suitably sized ducts are required to match the cable design and additional ducts considered for network growth and maintenance. If smaller ducts or sub-ducts are used then the feeder capacity is provided by using a number of smaller size cables e.g. 24 – 96 Fiber cables.

6.1.1. Simple Duct [Merits, demerits, broad specs, cost]

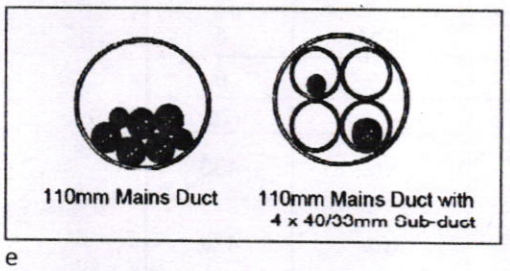
The use of a single duct maximizes the number of cables that can be installed, but at any time in future full ducts make it difficult to extract older cables (typically at the bottom of the duct) to create room for new cables.

Using sub-duct reduces the total number of cables that can be installed, but at least older cables can be removed and new ones installed. It also allows the use of cable blowing as well as cable pulling, since it is easier to obtain an airtight connection to the sub-duct.

Table - Typical duct sizes

Main duct	O.D. 110mm, 100mm or 90mm
Sub-duct	50/43mm (50mm outer diameter, 43mm inner)
	40/33mm
	33/26mm
	25/20mm
	Smaller' micro ducts may also be deployed

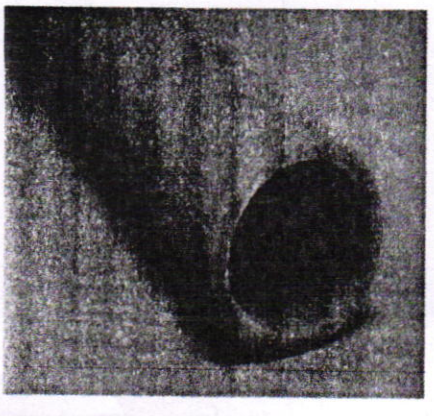
The duct material is usually HDPE.



Cable installation in duct: ***Cables are installed into the ducts by pulling, blowing or floating.*** If they are to be pulled, then the duct either

e

ds to contain a pre-installed draw-rope or to have one installed by rodding and roping. If they are to be blown in or floated, then the duct and any connections between sections of duct need to be airtight.



The inner wall of the sub-duct is manufactured to ensure low friction with the cable sheath. This is typically achieved with a low friction coating. Alternatively, the sub-duct could contain low friction extruded profile and/or special duct lubricants can be used.

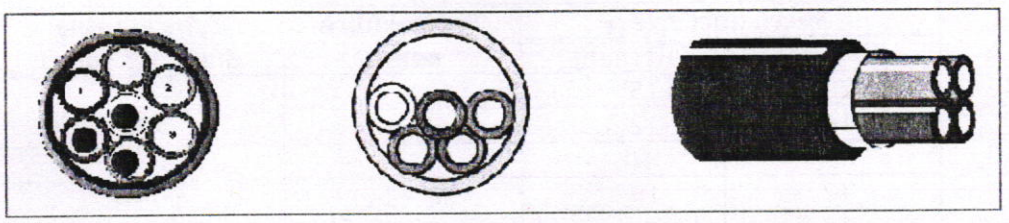
Main factors that govern the continuous length that can be pulled or blown:

- Coefficient of friction
- Bends in the duct route (vertical as well as horizontal)
- Strength or weight of the cables
- Installation equipment used

6.1.2. Micro duct

Micro duct cabling uses small, flexible, lightweight tubes, of following types (*Source: FTTH Council Europe*)

- Small conventional duct typically less than 16 mm in diameter (e.g. 10 mm OD, 8 mm ID), pre-installed or blown into a larger sub-duct e.g. further segment a sub-duct is further segmented using five 10 mm micro ducts).
- Small tubes (e.g. 5mm outer diameter, 3.5 mm inner diameter) that are actually manufactured as a single or multi-tube cable assembly, known as 'protected micro duct'. The protected micro duct assemblies may contain from one to twenty-four micro ducts.

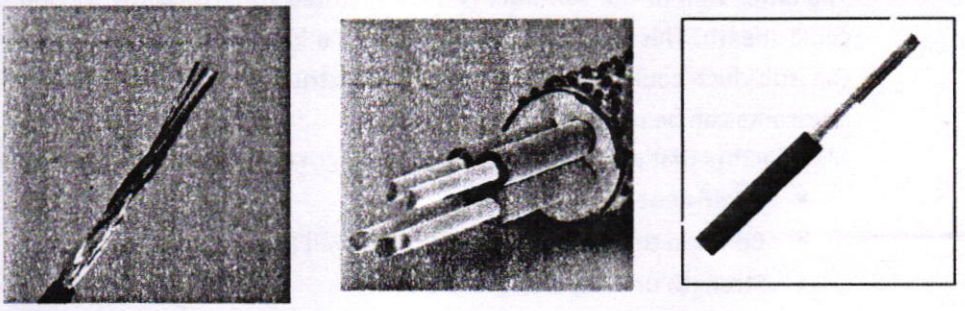


Sub-divided sub | Post installed micro duct | Protected micro duct

Micro ducts are sized to suit the accommodating main duct and the cables to be installed. **Unlike normal ducting, micro ducting needs to be matched to the optical cables to be used to ensure compatibility during installation**. Micro ducts can be provided as separate loose tubing, pre-bundled or for direct burial. Other versions are available for wall mounting (tunnels) or pole structures for aerial drops.

6.1.2.1. Types of Micro duct cable and Fiber Units

The micro duct cables are small blown fiber unit cables e.g. 72 fiber 6mm diameter for use in a 10/8 micro duct or containing up to 12 fibers within 1 to 3mm (e.g. 4 fiber x 1mm diameter for use in 5/3.5mm tubes). **The cables used in these tubes are small lightweight designs that typically require the tube for protection. In other words, the tube and cable act together as a system**. The cables are installed by blowing. Both cable types may have special outer coatings to assist with air blowing.



Examples of micro duct fiber optic cables

Source: FTTH handbook European council

6.1.2.2. Micro duct sizes

The micro duct size is chosen to suit the cable and required fiber count. Typical combinations of cable size and duct size are given below. Other sizes and combinations can be used.

Table - Representative micro duct sizes

Micro duct size		Typical fibre count	Typical cable diameter (mm)
OD (mm)	ID (mm)		
20	15		
16	12	24 - 144	9.2
14	10		
12	10	24 - 144	7 - 8
10	8	72 - 96	6 - 6.5
7	5.5	48 - 72	2.5
5	3.5	6 - 24	1 - 1.6
4	3	2 - 12	1.8 - 2

6.1.2.3. Micro duct Tube connectors and closures

The micro duct sections are to be connected together during installation, and figures below illustrate the range of connectors in water and gas-sealed easy-fit versions.

Push/ Easy Fit Tube Connectors

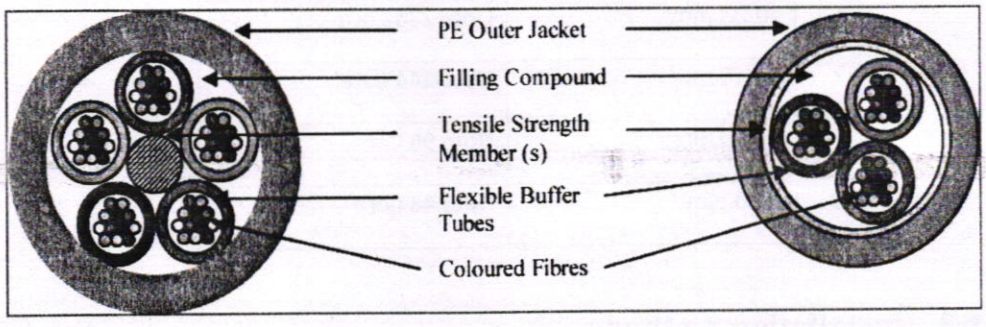
Gasblock Tube Connector | Straight Tube Connector | End Tube Connector

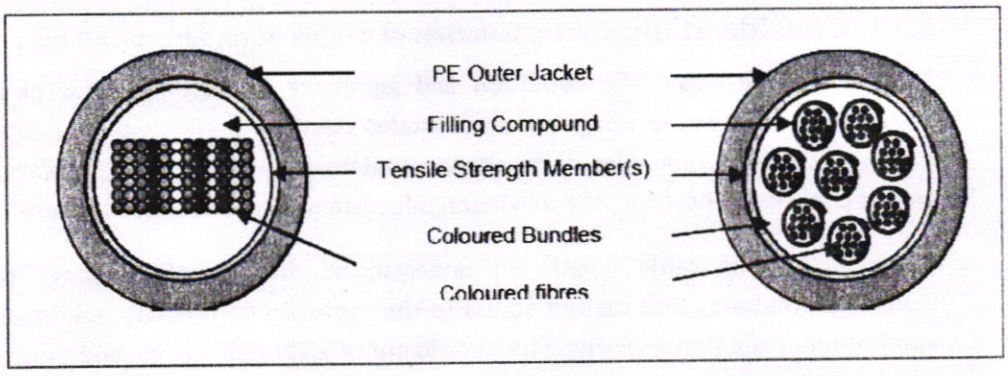
6.1.2.4. Micro duct optical fiber cables

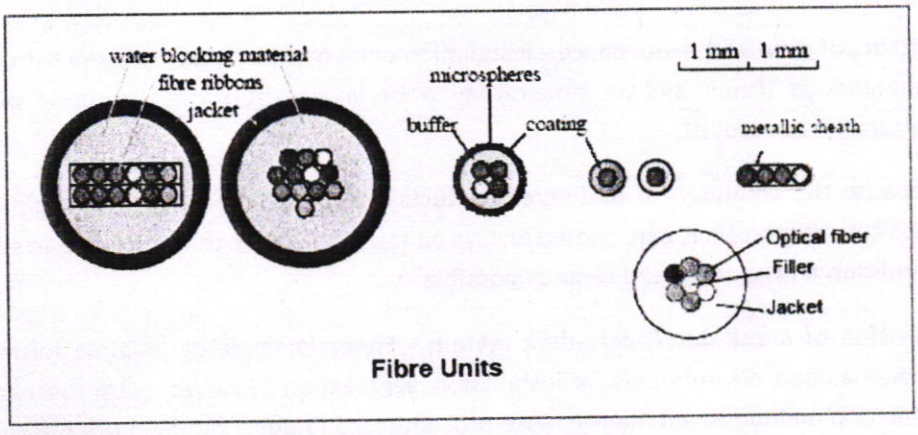
Following figures illustrate the various types of micro duct optical fiber cables, and enable making informed choices in the project.

Various type of micro duct OFC (Not to Scale)

(Source: FTTH handbook, European Council)







6.2. Duct to Fiber Mapping

After discussions with government officials, TSP's and others it emerged that the duct planning should be done for all the roads of the city. This would enable the fiber

reach to the smallest inner roads and help in the smart infra-structure implementation as well. Hence the duct planned would need to be of the FTTx type i.e Fiber to the 'x' (Kerb/Building/Home).

The micro ducts and the optical fiber cable envisaged for the city is given below:

SN	Duct Size	OFC Type
1.	40/33 mm	Upto 288 Core
2.	20/16 mm	Upto 144 Core
3.	14/10 mm	Upto 96 Core
4.	10/8 mm	Upto 48 Core

6.3. Installation methods

6.3.1. Considerations for Installation of cables in underground duct

Route considerations - The condition and geometry of duct routes is of great importance. Where the infrastructure includes ducts in poor condition, contains excessive curvature, includes ducts already containing cables or access points with abrupt changes of direction, the maximum pull distance will be reduced accordingly.

Provision of long cable lengths in underground duct situations may involve installation methods that require access to the cable at intermediate points for the application of additional winching force or figure-of-eight techniques, and these sites should be chosen with care.

Factors of time and disturbance - Installation equipment may be required to run for long periods of time and the time of day, noise levels, and traffic disruption should be taken into account.

Because the condition of underground ducts intended for optical fiber cable is of particular importance, care should always be taken to ensure that **ducts are in sound condition and as clean and clear as possible**.

Provision of a sub-duct/micro-duct system - Either in single or multiple forms, to provide a good environment for installation, segregation of cables, extra mechanical protection and improved maintenance procedures. Sub ducts can be more difficult to rope and cabled than normal size duct, particularly over long lengths, and the diameter ratio between the cable and sub duct should be considered.

Methods have been developed that install cables into small size ducts by blowing, which leaves the cable essentially stress free. **This method may be as extensively used in the FTTH project in city areas.**

6.3.2. Installation of duct with trenching methods

Underground Duct laying

The **underground duct laying (open trenching/ HDD/ micro-trenching) is the more reliable installation vis-à-vis aerial, therefore this is recommended as the preferred method for feeder and distribution routes.**

Open trench excavation method

Open trench U/G cable laying methodology is indicated as follows:

- Micro-trenching is not suitable
- Within residential campuses where operation of trenching machine may be too noisy to tolerate
- On streets in residential societies where open-cut trenching may be considered suitable and more economic in comparison to micro-trenching,
- Connecting sections between HDD pit to Micro-trench pit.

Micro-trenching method

The micro-trenching method of U/G cable laying may be used on main roads where

- If road construction surface/composition so permits.
- If road is wide enough to deploy the trenching machine.
- If road is not in bad condition - due for repairs (since repair work may damage the micro-duct duct/OFC).
- If concretization / re-surfacing of road is not planned which is likely to overlay the OFC jointing/ branching manholes if any to be constructed on metallic part of road in line with micro-trench line.
- Any site-specific condition that precludes cable/duct depth limitation of 300 mm – 450 mm.

6.3.3. Installation of Duct with the trenchless technique

The trenchless techniques (or no-dig techniques) allow installation of underground optical cables minimizing or eliminating the need for excavation. These techniques create a horizontal bore below the ground in which the underground infrastructure (ducts, pipes or direct buried cables) can be placed. Trenchless techniques can reduce environmental damage and social costs and, at the same time, provide an economic alternative to open-trench methods of installation. A **broad classification of the available trenchless techniques** is given below.

Table - Trenchless techniques

Sl. No.	Technique	emarks	
1	Guided boring/directional Drilling	Fluid-assisted boring Dry boring	
2	mpact moiling		
3	Pipe ramming		
4	Pipe jacking		
5	Micro-tunnelling	• High strength pipe method	* Penetrating method * Auger excavation

Sl. No.	Technique	emarks	
			method * Slurry method * Slurry pressure balanced method * Boring method
		• Low strength pipe method	* Penetrating method * Auger excavation method * Slurry method * Slurry pressure balanced method * Boring method

Requirement of trenchless techniques

From a general point of view, the **trenchless techniques are very useful in the following situations, where**:

- Road surface excavation is restricted or prohibited by administrative agencies, etc. (newly constructed roads, emergency vehicle entrances/exits, etc.)
- The open-cut method cannot assure safety or would cause risks to traffic and pedestrians
- Noise, vibration, dust and other pollution are caused by open-cut method, and is not acceptable in the immediate environment (like VIP areas, places of worship, hospitals etc.)
- Open-cut method may impede road traffic and thus hinder the business of nearby stores/ shops;
- In congested sections where open-cut method may damage the buried facilities of other companies or sections where the presence of buried objects causes significant lack of work efficiency;
- Conduits should be buried at deep locations and open-cut construction would greatly increase the amount of excavated soil
- Road surfaces use high-grade material which would increase the cost of reinstatement after excavation;
- Road sections with high traffic volumes limit the work to the night-time hours (lower work efficiency, higher labour costs)
- Open-cut construction would involve extra costs to move historic remains or other items.

If the installation is in ducts, following points may be observed:

- Manholes / boxes are installed for use as network splice /flexibility branching points, Excess length of cable stored in boxes (when applicable): 15 - 20 metres
- Any PE or PVC sub-ducts should be installed within the duct typically by pulling

- OF cables should be installed in the duct by any of the methods described below under the heading **"Installation of cables in underground ducts"**.
- When required the cable should be installed from an intermediate point, laying part of the cable as a figure eight, this will help in laying long length of cable by pulling within cable tension limits
- It is arranged for the storage of excess cable in boxes or manholes.

Depth of duct laid

The size of single HDPE/PLB duct that is laid is 40 mm to 50 mm OD and it is for consideration that what size / depth of trench need to be excavated. More than one duct may be laid side by side or positioned vertically with small spacing. *The trench depth is determined by factors other than the size*:

- **Presence of other underground service infrastructure:**

Since cable/duct is to be laid on land used by others for public purposes and road surfaces are also periodically repaired/re-surfaced using manual methods/mechanical machinery, both metaled part and un-metaled parts (except raised sidewalks) are subject to static and dynamic mechanical loading from all sizes of vehicles, telecom cable buried at shallow depths is prone to man-made faults. These features indicate higher depths of cable/duct laying.

- **Repair and maintenance of other services:**

The cables/ pipes of other services are to be repaired and maintained by other agencies and it is likely that telecom cable laid at same depth may get damaged. The minimum depth clearance from ground surface should be around 4 ft.

- **Rodent problem:**

The telecom cable, unless sheathed by armor and chemically inert material, is liable to be chewed up by rodents especially the burrowing kind. The incidence of rodents decreases with depth and is considered minimal after 5.5 ft. depth.

- **Delicate glass fiber:**

The medium of communication is thin glass fiber of few microns diameter and is evidently fragile. Mechanical stability is provided by the manufacturer in the fiber bundling and cabling process. Direct burying of cable is also possible but not recommended except in intra-campus areas. Full length excavation of section is required to repair the cable. The duct also provides a benign environment for cable in comparison to earth material.

- **Industry practice:**

For best reliability (continued operation of fiber without interruption) in India conditions, various organizations have evolved and standardized their practices. Railway department specifies depth ≥ 1.2 metres in open trenching methodology and use of single sheath armored cable, gas and pipeline companies go in for depths ≥ 1.5 metre and double-sheath armored cable. These organizations usually have their own land area in which the cable route is positioned.

Telecom organizations like BSNL install OFC on public land used by other agencies and populace at large, and **following T&D/DoT prescribed standard practice**, lay HDPE/PLB pipes at nominal depth of 1.5 metres and avoid armoring (except in necessary situations) since long lengths o metallic armor sheath can build up lethal amounts of electric charge which is not advisable for operating and maintenance personnel, therefore the armor is to earthed every 1 Km. or so. Periodic checking, maintenance and earth resistance checking of the numerous earth pits on telecom OFC route becomes cumbersome and costly.

6.3.4. Micro-trenching

The micro-trenching cable laying technique is typically used for customer drop connection to the distribution network (connections to existing networks).

Micro-trenching technique allows installing underground cables at a shallow depth, in small grooves. *The advantages of this technique over conventional cable laying technologies lie essentially in its speed of execution, lower cost, significantly lower environmental impact and limited disruption to road.*

The micro-trenching technology can be applied on routes that involve asphalted surfaces, such as roads or sidewalks with a base of compact material (asphalt or concrete).

Micro-trenching is normally carried out by cutting a shallow groove in the asphalt, but without penetrating past the asphalt layer. *Protection against breakage from road reparation is not possible due to the shallow depths used in micro-trenching techniques.* **It is therefore essential to carefully plan the routes on which these techniques are to be used, in order to provide long-term stability of the routes.** Care must be taken to avoid cutting entirely through the asphalt, as this could cause the pavement along the sides of the groove to crack or split. This precaution must be borne in mind in all cases where there is no lateral protection on one or both sides of the groove, which can prevent the asphalt layer from shifting and particularly in cases where micro-trenching is performed along the edge of a road with no curb or sidewalk. **In such cases, the groove shall normally be located at a suitable distance (e.g. at least one metre) from the edge of the road.**

Groove width may vary (e.g. 10-15 mm) in accordance with the diameter of the cable laid. **The cable should meet exacting demands as to crush resistance and, in particular, temperature resistance, which is needed when sealing the cable in the groove with hot bitumen. The bitumen temperature during the sealing operation can reasonably vary between 100° C and 170° C.**

The optical fibers are preferably enclosed in a metallic (e.g. copper) tube filled with a suitable filling compound and surrounded by a polyethylene jacket. There are currently in use different cable types, containing varying numbers of fibers and with different outside diameters.

The cable can be manufactured and supplied in long lengths; in city networks it is, however, often convenient to use short or matching lengths, particularly for crossing under road or rail. Some further details are given in Appendix 10/1.

6.3.5. Impact moiling

Impact moiling is defined as the creation of a bore by the use of a tool which comprises a percussive hammer within a suitable cylindrical casing, generally torpedo shaped. The hammer may be hydraulic or pneumatic.

6.3.6. Pipe ramming

Pipe ramming is a non-steerable system of forming a bore by driving a steel casing, usually open-ended, using a percussive hammer from a drive pit. The soil may be removed from an open-ended casing by augering, jetting (with water) or compressed air. In appropriate ground conditions a closed casing may be used.

6.3.7. Aerial OFC

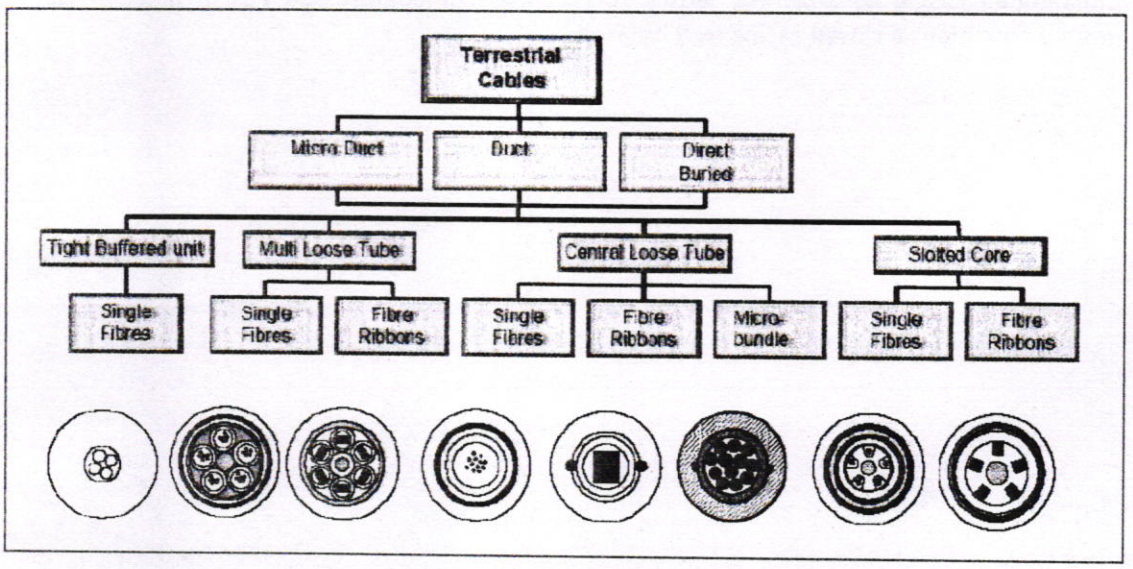
Aerial OFC methodology is indicated as follows:

- Congested areas where U/G laying is not feasible
- Speed of deployment is most important
- Drop-wire connections are required as suitable.

6.4. Duct inspection

At the end of the installation the internal diameter should be checked over the whole length of the ducts, in order to be sure that no restriction or obstruction inside the ducts occurred during the pulling phase. It is possible to simply perform this operation by blowing inside the pipe a light circular probe having a diameter slightly less than the internal diameter of the pipe itself, which will reach the other end of the pipe if no restrictions or obstructions are present.

6.5. Types of terrestrial OFCs



As seen above, there are a variety of cable designs, but these are based on a **small number of elements (listed below) that determine the suitability of deploying a particular type of cable in specific environments.**

- The most common 'building-block' is a loose tube, comprising a plastic tube containing the required number of fibers (typically 12) together with a tube filling compound that both buffers the fibers and helps them to move within the tube as the cable expands and contracts at environmental and mechanical extremes.
- Multiple fibers may be placed in a ribbon form or in a thin easy-strip tube coating.

- Fibers may also be laid in narrow slots grooved out of a central cable element.
- The tubes contain individual fibers or multiple ribbons
- The tubes are laid around a central cable element that comprises a strength member with plastic jacketing
- Water blocking materials such as water swellable tapes and threads (or grease) can be included to prevent moisture permeating radially or longitudinally through the cable
- The fiber assembly is over-sheathed with polyethylene (or alternative materials) to protect it from the external environment
- Fibers, ribbons or bundles (protected by a coloured micro-sheath or identified by a coloured binder) may also be housed within a large central tube. This is then over sheathed with strength elements being included.
- Direct buried cables may have **additional crush protection** like corrugated steel tape or the application of a thick sheath of suitably hard polyethylene

(i) **Lightening protection:** Non-metallic designs are favoured in areas of high lightning activity

(ii) **Rodent protection:** Corrugated steel tape is the best protections against rodent damage or other burrowing animals.

(iii) **Termite protection:** Nylon sheaths, though costly, give excellent protection against termites. It is hard, which resists 'bite' damage, and is chemically resistant to substances excreted by the termites.

7 Costing

7.1. Material Cost

The cost estimates for materials required are as follows:

Route	Description	Unit	Total Qty	Unit Cost (Rs.)	Total Cost (Rs.)
Primary	Duct Type-1	Km	516	2,16,810	11,18,73,960
	Coupler Type-1	No	2,580	132	3,40,560
	End Plugs Type-1	No	36,120	93	33,59,160
	Duct Type-4	Km	172	60,000	1,03,20,000
	Coupler Type-4	No	860	70	60,200
	End Plugs Type-4	No	1,720	35	60,200
	Spacers	No	17,200	200	34,40,000
	Warning Tape	Km	86	10,000	8,60,000
	Route Markers	No	430	2,000	8,60,000
	Tools & Testing Kit	No	1	2,00,000	2,00,000
	Total				**13,13,74,080**

Route	Description	Unit	Total Qty	Unit Cost (Rs.)	Total Cost (Rs.)
Secondary	Duct Type-2	Km	284	1,28,195	3,64,07,380
	Coupler Type-2	No	1,420	78	1,10,760
	End Plugs Type-2	No	19,880	50	9,94,000
	Duct Type-4	Km	142	60,000	85,20,000
	Coupler Type-4	No	710	70	49,700
	End Plugs Type-4	No	1,420	35	49,700
	Spacers	No	14,200	200	28,40,000
	Warning Tape	Km	71	10,000	7,10,000
	Route Markers	No	473	2,000	9,46,667
	Tools & Testing Kit	No	1	2,00,000	2,00,000
	Total				**5,08,28,207**

Tertiary	Duct Type-3	Km	286	61,595	1,76,16,170
	Coupler Type-3	No	2,860	59	1,68,740
	End Plugs Type-3	No	20,020	42	8,40,840
	Spacers	No	14,300	200	28,60,000
	Warning Tape	Km	143	10,000	14,30,000
	Route Markers	No	1,430	2,000	28,60,000
	Tools & Testing Kit	No	1	2,00,000	2,00,000
	Total				**2,59,75,750**

Total Material Cost = Rs. 20,81,78,037

7.2. Services Cost

The cost estimates for services required are as follows:

Description	Unit	Qty	Unit Cost (Rs.)	Total Cost (Rs.)
Trenching in Normal Soil	KM	165	4,00,000	6,60,00,000
Trenching in Soft Rock	KM	60	5,00,000	3,00,00,000
GI in Hard Rock/PCC	KM	20	15,00,000	3,00,00,000
Road Crossings	No.	17	15,00,000	2,55,00,000
Culvert Crossings	No.	6	15,00,000	90,00,000
Bridge Crossings	No.	6	15,00,000	90,00,000
PCC in Drains	KM	26	10,00,000	2,60,00,000
Construction of OFC Chambers Type-1 (1m x 1m)	No.	430	10,000	43,00,000
Construction of OFC Chambers Type-2 (1.5 m x 1.5 m)	No.	470	15,000	70,50,000
Construction of OFC Chambers Type-3 (2 m x 2 m)	No.	1,430	20,000	2,86,00,000
Total				**23,54,50,000**

7.3. Total Capital Cost

The total CAPEX inclusive of material plus services comes to Rs. 44,36,28,037 **[Rs. 44.36 Cr.]** as detailed above.

7.4. RoW Cost

The RoW cost would be charged at a rate of Rs. 50,000 per km by the government from the executing agency. **Total RoW cost comes to INR 1.50 Cr.**

7.5. Operational Cost

It has been estimated that the operational cost would be charged @3% p.a. of the sale value to the respective customer.

8 Implementation Strategies

8.1. Technical Requirements

The summary of project requirements is as follows:

- Ducts are to be laid in all 36 wards of the city
- Total route length will be about 300 KM
- Total duct length will be about 1,086 KM

8.2. Implementation Time

The implementation time is yet to be finalized. However, a typical project plan may be as follows:

- Implementation to be completed 1 year
- O&M for 20 Years

8.3. Funding Requirements

The funding required will be as follows:

- **CAPEX : Rs. 44.36 Cr.**
- **RoW: Rs. 1.50 Cr.**

8.4. Implementation Methodologies/Strategies

8.4.1. Phase-wise Implementation

For successful implementation and financial viability of the project, it is suggested that the project be implemented in a phased manner. The suggested phases are as follows:

Phase-1:

This phase would cover following wards which would cover about 50% of the population consist of maximum concentration of current telecom subscribers & infrastructure:

- Wards 1, 5, 8, 12 to 27

Total route length covered would be about 150 km.

Phase-2:

This phase would cover the remaining wards.

8.4.2. Public Private Partnership

In order to reduce the implementation time and ensure smooth sale/leasing, operation and maintenance of the infrastructure, it is recommended to utilize technical and financial expertise of private sector.

The implementation, operation & maintenance of the duct infrastructure should be done by a contractor selected through competitive bidding. This will reduce Govt's involvement and reduce requirement of its limited human resources.

When O&M for next 20 years is given to the implementing agency, they will ensure good quality of work so that their O&M expenses are minimized.

Implementation by third party will also ensure minimal requirement of funds from Govt.

8.4.3. Royalty for Govt.

As Govt. is allowing its land / ROW to be used by other operators/agencies, a royalty may be charged by the Govt. It is recommended that the royalty be charged on monthly or annual basis so that it doesn't become a burden for the implementing agency. Paying a large sum of one-time royalty may not be possible for the implementing agency.

8.4.4. Minimum Internevtion by Govt

The Govt. should avoid day-to-day intervention in sale/auction/lease of the telecom infrastructure. It should also leave the pricing of sale/auction/lease of ducts to the implementing agency. This will allow the implementing agency to vary their prices based on demand at a particular point in time.

8.4.5. Govt's Stake in the Project

The Govt. should have a certain percentage of stake in the project so that the implementing agency does not monopolize the telecom infrastructure.

The Govt. should set guidelines for sale/lease of the telecom infrastructure to ensure free and fair availability of the infrastructure to all the operators and other agencies.

9 Financing and Business Models

9.1. Business Models

The mobile technology has touched the life of every one since the time of its origin. Now the next step in this technology is to access internet on mobile phones i.e. broadband on wireless.

The current trend shows that the contribution of broadband customers accessing internet on wireless are more. As the telecom companies are expanding their network to reach more and more customers and provide broadband, they need to expand their network. The optical fiber network is required by the Telco's to provide high speed on demand in both backbone and backhaul.

In the process of laying OFC network, the repeated road digging and trenching cause substantial damage to day to day working and leads to wastage of resources. Hence it is beneficial to implement a common duct policy i.e. instead of giving Right of Way to multiple operators at different times, an investment is made in laying duct consisting of multiple micro – ducts and these micro ducts are leased to operators.

This chapter details the various business models by which the common duct policy can be implemented with their respective features. The objective is to select a suitable model such that end customers are benefitted by this policy.

As the Right of Way for laying duct from state government and the duct laid shall be used by telecom service providers to lay fibers and provide better services to the end customers. The business model under which the project execution involves both public and private party to provide services to end customer is known as Public Private Partnership (PPP) Model.

9.2. TYPE OF MODEL

I. Public Owned

In this model, government / or any government body provide entire funding for the project undertaken. The contractors are selected through tender process as any Engineering, procurement & Construction contract. The government owns the network, operate and maintain it.

II. Private Owned

In this model, the private party owns the network build by it which is entirely funded by the private party itself. In Deogarh duct network, the existing scenario is working on this model wherein Telecom service providers (TSPs/ISPs) are paying RoW to government and laying their own individual network.

III. Public-Private Partnership (PPP)

Public-private partnership (PPP) is a funding model for a public infrastructure project such as a new telecommunications system, airport or power plant. The public partner is represented by the government at a local, state and/or national level.

Public Private Partnership means an arrangement between a government / statutory entity / government owned entity on one side and a private sector entity on the other, for the provision of public assets and/or public services, through investments being made and/or management being undertaken by the private sector entity, for a specified period of time, where there is well defined allocation of risk between the private sector and the public entity and the private entity receives performance linked payments that conform (or are benchmarked) to specified and pre-determined performance standards, measurable by the public entity or its representative.

Mere outsourcing contracts are not PPPs. In a PPP model, it is essential to have a arrangement with private sector entity. The asset owned by government shall be provided under the contractual arrangement for a defined period of time to the Private Sector entity to provide services to the citizens. The terms of a PPP are typically set out in a contract or agreement to outline the responsibilities of each party and clearly allocate risk.

Public-private partnerships (PPPs) take a wide range of forms varying in the extent of involvement of and risk taken by the private party. The type of PPP used to implement the project, shall depend on which party takes up the funding, execution, operations & maintenance. Typically the investment and/or management is undertaken by the private sector entity. The idea is to harness the private sector efficiency in the delivery of quality services to the users and share the risk. The broad classification of PPP is as under:

1) Management Contract:

- A management contract expands the services to be contracted out to include some or all of the management and operation of the public service (i.e., utility, hospital, port authority, etc.).
- Although ultimate obligation for service provision remains in the public sector, daily management control and authority is assigned to the private partner or contractor. In most cases, the private partner provides working capital but no financing for investment.
- The private contractor is paid a predetermined rate for labour and other anticipated operating costs.
- Management contract variants include supply and service contract, maintenance management and operational management.

2) Lease contract:

- Under a lease contract, the private partner is responsible for the service in its entirety and undertakes obligations relating to quality and service standards.
- Except for new and replacement investments, which remain the responsibility of the public authority, the operator provides the service at his expense and risk.
- The duration of the leasing contract is typically for 10 years and may be renewed for up to 20 years.
- Responsibility for service provision is transferred from the public sector to the private sector and the financial risk for operation and maintenance is borne entirely by the private sector operator.
- In particular, the operator is responsible for losses and for unpaid consumers' debts.
- Leases do not involve any sale of assets to the private sector.

3) Concessions:

- A concession makes the private sector operator (concessionaire) responsible for the full delivery of services in a specified area, including operation, maintenance, collection, management, and construction and rehabilitation of the system.
- Importantly, the operator is now responsible for all capital investment. Although the private sector operator is responsible for providing the assets, such assets are publicly owned even during the concession period.
- The public sector is responsible for establishing performance standards and ensuring that the concessionaire meets them. In essence, the public sector's role shifts from being the service provider to regulating the price and quality of service.
- The concessionaire collects the tariff directly from the system users.
- The tariff is typically established by the concession contract, which also includes provisions on how it may be changed over time.
- In some cases, the government may choose to provide financing support to help the concessionaire fund its capital expenditures.
- The concessionaire is responsible for any capital investments required to build, upgrade, or expand the system, and for financing those investments out of its resources and from the tariffs paid by the system users.
- A concession contract is typically valid for 25–30 years so that the operator has sufficient time to recover the capital invested and earn an appropriate return over the life of the concession.
- Government may contribute to the capital investment cost by way of subsidy (Viability Gap Funding - VGF) to enhance commercial viability of the concession.
- The concessions are effective contracts to provide investment for creation of new facilities or rehabilitation facilities.

The common duct policy shall essentially be a long term investment in which the investor shall be leasing the duct and the user (service provider) shall be using it after blowing fiber through it. The useful life of optical fiber cable is many years, however for financial accounting it is taken as 18 to 20 years. Therefore the PPP business model Concession contract shall be applicable in this project.

Some of the commonly adopted forms of PPPs include build-operate-transfer (BOT) and its variants, build-lease-transfer (BLT), design-build-operate-transfer (DBFOT), Operate-maintain-transfer (OMT), etc.

- **Build Operate Transfer (BOT) :**
  - BOT and similar arrangements are a kind of specialized concession in which a private firm or consortium finances and develops a new infrastructure project or a major component according to performance standards set by the government.
  - Under BOTs, the private partner provides the capital required to Build the new facility, Operate & Maintain (O&M) for the contract period and then return the facility to Government as per agreed terms.
  - Importantly, the private operator now owns the assets for a period set by contract—sufficient to allow the developer time to recover investment costs through user charges.

BOTs generally require complicated financing packages to achieve the large financing amounts and long repayment periods required. At the end of the contract, the public sector assumes ownership but can opt to assume operating responsibility, contract the operation responsibility to the developer, or award a new contract to a new partner. The main characteristic of BOT and similar arrangements are given below:-

- **Design Build (DB)**: Where Private sector designs and constructs at a fixed price and transfers the facility.

- **Build Transfer Operate (BTO):** Where Private sector designs and builds the facility. The transfer to the public owner takes place at the conclusion of construction. Concessionaire is given the right to operate and get the return on investment.

- **Build-Own-Operate (BOO):** A contractual arrangement whereby a Developer is authorized to finance, construct, own, operate and maintain an Infrastructure or Development facility from which the Developer is allowed to recover his total investment by collecting user levies from facility users. Under this Project, the Developer owns the assets of the facility and may choose to assign its operation and maintenance to a facility operator. The Transfer of the facility to the Government, Government Agency or the Local Authority is not envisaged in this structure; however, the Government may terminate its obligations after specified time period.

- **Design-Build Operate (DBO):** Where the ownership is involved in private hands and a single contract is let out for design construction and operation of the infrastructure project.

- **Design Build Finance Operate (DBFO) :** With the design–build–finance–operate (DBFO) approach, the responsibilities for designing, building, financing, and operating & maintaining, are bundled together and transferred to private sector partners. DBFO arrangements vary greatly in terms of the degree of financial responsibility that is transferred to the private partner

- **Build- Operate- Transfer (BOT):** Annuity/Shadow User Charge: In this BOT Arrangement, private partner does not collect any charges from the users. His return on total investment is paid to him by public authority through annual payments (annuity) for which he bids. Other option is that the private developer gets paid based on the usage of the created facility.

4) Joint Venture:

- Joint ventures are alternatives to full privatization in which the infrastructure is co-owned and operated by the public sector and private operators.
- Under a joint venture, the public and private sector partners can either form a new company (SPV) or assume joint ownership of an existing company through a sale of shares to one or several private investors.
- A key requirement of this structure is good corporate governance, in particular the ability of the company to maintain independence from the government, because the government is both part owner and regulator.
- From its position as shareholder, however, the government has an interest in the profitability and sustainability of the company and can work to smoothen political hurdles.

9.3. POSSIBLE MODELS FOR IMPLEMENTATION

The model selected should be able to gel the positive aspects of both the sectors. The positive aspects in private sector owing to flexibility in its working are faster execution, project management; maintenance and marketing whereas public sector is bound by procedure & policy and thus its working is sometimes time consuming. At the same time, public sector ensures transparency in its working.

The successful implementation of common duct policy shall require that this policy is implemented through a suitable business model for win-win situation for both public and private sector.

The type of PPP business model that can be used to implement common duct policy is broadly classified on the basis of which party is investing in the project.

A. Investment by Private Party

In this model the investment shall be made by the private agency which shall build, own & operate (BOO) or build , own , operate and transfer(BOOT) the project for a pre-defined period. The asset provided by government as concession in this project shall be the ubiquitous right of way for laying duct in Deogarh city and the revenue earned shall be shared among the state government and private agency in an ratio of investments made.

The private agency may be a single party or consortiums which are interested in making investment, execute own and operate the project. There can be number of possibilities depending on the type of investor like investment made by:

i) A Telecom Service Provider (TSP) or consortium of TSPs

In this model either a single TSP or consortium of TSPs may invest in laying the duct. This kind of model has already been there for sharing the mobile towers but the consortium so formed is a separate entity.

The issue with this model is the conflict of interest. As the TSP shall be serving the end customers, they may hike the charges of leasing duct to their competitors and try to establish monopoly in the market.

ii) A Infrastructure Provider-1 (IP-1) license Holder or a consortium with lead as IP-1.

To overcome the issue of monopolization in above model, the private party selected shall be such that it does not provide services to end customers like IP-1 License holders. Companies registered as IP-I can provide assets such as Dark Fibre, Right of Way, Duct space and Tower. As the owner of the duct will be a neutral party, this shall ensure the unbiased distribution of ducts among TSPs.

However, it is seen that now a days there are few takers for projects under the traditional Build-Operate-Transfer (BOT-Toll) and BOT-Annuity modes. The reason is the infrastructure projects require huge investments, which implies more cost of capital for private party. Also traditional BOT models put all risks which is uncertainty of revenue or return on private partner.

B. Investment by Public Party

In a city like Deoghar with very small population, with low paying capacity it is likely that the private party may not find business case lucrative enough to make investments. In that case, the public sector may need to invest. There can be different model of financing:-

i) **Total Investment (EPC)**

In this model, the entire cost of duct network shall be borne by government. The USP is that being the only investor government will own the network and to increase broadband penetration in city, it may lease the ducts at nominal rates to encourage more TSPs to expand their network.

However, without involvement of any private partner in implementation, this model will be like any EPC (Engineering, Procurement and Construction) contract. Whereas the fundamental driver of PPP is to harness the expertise and efficiencies that the private sector can bring to the delivery of certain facilities and services traditionally procured and delivered by the public sector.

ii) **Hybrid Annuity Model (HAM)**

Now a day seeing less interest of private party in BOT model, the government has decided to take up infrastructure projects on the hybrid-annuity mode, a new model for implementing contracts under the Public Private Partnership (PPP) projects. The motive is to accelerate the pace of projects and it is keen to experiment with new modes of financing which help fast track works and reduce the burden on developers and financial institutions.

Under this new model, government provides 40% of the project cost during the construction period and the release of funds is linked to the progress of construction.

The private player needs to raise the rest 60% in the form of equity and loan. Since the overall requirement is less, the private bidder needs to put less equity .Similarly, as the loan requirement is less in comparison to the other modes of PPP, banks will also be comfortable to lend. Government pays back the rest in installments during the entire contract period and it is linked to the performance of the private player and the asset.

Under this model, the asset created shall belong to government and revenue collection would be the responsibility of government.

Advantage of this model is that it gives enough liquidity to the developer and the financial risk is shared by the government. While the private partner continues to bear the construction and maintenance risks as in the case of BOT model, he is required only to partly bear the financing risk.

iii) Investment by providing Viability Gap Funding

The third option is the investment by both; private sector may invest a set amount as per its suitability and the gap funding is done by public.

In case private operator does not show interest in laying duct network because of no business case. The government may provide viability gap funding to make the business case feasible for private partner to make incremental investment and operate the project.

In this model the private partner shall own the network. As government shall be providing the gap funding, it can mandate the private partner to reduce the lease rate of duct. This will attract more telecom operators and therefore increase broadband penetration.

9.4. Cost Benefit Analysis

There are various models of implementing this project as discussed above. The cost benefit analysis of "Investment by private partner" in different scenarios and return on investments, net present value and breakeven point are estimated.

9.4.1. Business Plan Assumptions

A financial plan of 10 years is made for depending on model i.e. investment made by private partner or public partner. The Key common assumptions used are listed below:

i. Capital cost

Project Cost

There are two approaches to make investment in the common duct network 1) incremental cost using the existing network and 2) cost towards the entire new network.

It is possible to lay the incremental duct i.e. only on roads where there is no duct laid by any TSP and use the existing ducts. The TSP can lease the new duct by swapping its existing duct with the state government which it can further sub-lease to other TSPs.

The USP of this model shall be the cost saving as no replication of the duct.

However, as per the analysis of existing data, it is seen that presently very less duct km. has been laid by the TSPs. The issues of limitation of existing number of ducts available with operators to sub-lease and willingness of the TSP to lease the duct with its competitors may arise. To overcome the issues in above scheme, it is prudent to lay new duct network so as to meet the future requirements.

In the cost benefit analysis, the cost of laying all new networks is taken. As the actual cost of the project shall be known once it is awarded through tendering. A estimated capital cost of the project assuming new duct laying based on the GIS planning, the latest rates of

components involved gathered from various sources, apart from this there may be several other onetime expenses like forming of SPV, obtaining license for the SPV, office establishment etc. as detailed in above chapter has been taken.

The government shall be investing in form of Right of Way. Considering RoW of Rs. 50,000 per km, for a 255 km. of road network, the RoW cost comes to Rs. 127 lakhs.

Item	Value (Cr. Rs.)
Duct Network Cost	44.36
RoW	1.50
Total	45.86

Cost Price per Unit

- Total micro duct km = 7602
- Unit cost per micro duct km = INR 60,330
- Loaded Unit cost per micro duct km = **INR 86,186** [Assuming 70% sale]

ii. Maintenance cost

The duct network created shall have to be maintained. It is proposed that a maintenance cost @ 3% of the lease charges shall be charged from the purchaser.

iii. Revenue

There are many factors which contribute to demand of duct like socio-economic profile of population of Deoghar, presence of industries and/or EEZ or any other tourist attraction. The TSP data indicates that the ARPU for Deoghar is on the lower side. It has a famous temple which is major tourist attraction in Deoghar and draws around 1 lakh tourist per day from around the country for two months (shravana period) in a year. The existing network of telecom operators is only covering some of the major population wards and temple. The rest of the Deoghar is covered either by BSNL landline copper network or mobile network working on microwave. In fact in the period of tourist month to address the administrative requirements and manage sudden huge tourist population, all the bandwidth is taken over by the administrative departments.

Therefore, at present private operators has the network sufficient for their presence but does not ensure quality in providing broadband services. If this project is taken up and the duct is provided on nominal rates to TSPs, they may extend their network.

As the honorable PM of India has started initiatives like Digital India, Smart City, etc the administrative units of government may also need duct for providing e-governance services.

The revenue will depend on two factors

i) The number of ducts leased/sold per year.
ii) The sale rate of each unit.

The duct shall be leased for a longer period (say 20 years) as the operator will be blowing its fiber through it.

Unlike bandwidth selling business where quantity of bandwidth can vary from 1 Mbps to 100 Mbps as per demand, in the duct network minimum saleable km. of duct has to be specified for effective utilization of entire duct.

The analysis of the duct network in Deoghar it is found that a ward in the city is covered in approximately 5 to 6 km. considering that we sell minimum unit of 6km, there shall be 1101 such units. The assumptions for the business plan are summarized below:

- Revenue will depend on the number of ducts leased/sold per year and the per unit selling price. [micro duct km]
- Approx. 70% of the ducts will be sold.
- The sale pattern is assumed to be 25% in first year and increasing by 5% every year till tenth year.
- The duct shall be leased for a period of 20 years.
- The operator will be blowing its fiber through it.
- Yearly maintenance charges for duct shall be payable @ 3% of the lease charges.
- 50 % debt is considered at an interest of 12 % p.a.

Three scenarios have been considered by varying the selling price per micro-duct km.

Item	SP per micro duct km
	(Rs.lakhs)
Scenario 1	2.50
Scenario 2	2.75
Scenario 3	3.00

The other parameters considered are:

Parameter	Value
Debt: Equity Ratio	50:50
Debt Interest Rate	12 %
Debt Payback Period	10 years
Duct Depreciation	10% p.a
Corporate Tax	33%
Opportunity Loss	10% p.a
Business Cycle	10 years
Project Period	20 years

Note: Any change in the above assumptions shall vary the output of the business plan.

iv. Depreciation

The value of the assets deployed in the network shall be depreciated with time. The main assets created in this project shall be optical fiber and equipment. The CAPEX estimated for this project has major cost towards duct supply and laying. The duct network is robust and may last for years. However, for financial planning a Straight line depreciation is taken @ 10 % i.e. a 10 year period.

v. Taxes

A corporate tax of 33% payable to government is also include in the cash flow model, payable only when there is net profit.

vi. Cost of Capital

It is assumed that the capital invested shall be taken on loan and equity by the private agency investing in the project in the ratio mentioned above.

9.4.2. Key Results - Financial Plan

The financial plan analysis can have two approaches:

i) **Fixing the desirable internal rate of return** and derive the rate at which the ducts are lease so as to achieve the IRR.

Based on the discussion with TSP's it appears that there would be demand if the common duct is laid and provided to them at reasonable cost. The duct leasing rate will decide the leasing pattern and further the broadband penetration.

In this method to achieve the target return the sale price of duct need to be increased, which may not be attractive for TSPs. Therefore this approach will not suit the Deoghar Common Duct Network Model.

ii) **Fixing the revenue earned and then to derive the IRR.**

In this method the sale price of duct is set at a reasonable value say cost price plus 20% or 30% profit. And then the return is estimated based on cash flow. This method is used for financial plan analysis in each model.

The outflow of the CAPEX presumes that the duct of estimated approximately 1,086 km [7602 micro duct km] shall be laid within a period of 1 year including survey, award of work, execution and acceptance testing. In the financial plan the CAPEX and OPEX value remain same in all scenarios. The tariff considered is given below.

The key results of the three scenarios analyzed by varying the selling price are given below.

Per KM Per micro Duct Sale Price (Lakh)	After 10 Years			Break Even Yr	IRR
	Expenditure (Cr.)	Income (Cr.)	Profit (Cr.)		
2,50,000	1,33,03,50,000	1,32,31,05,573	72,44,427	10 Yrs	0.70%
2,75,000	1,46,33,85,000	1,32,31,05,573	14,02,79,427	4 Yrs	12.50%
3,00,000	1,59,64,20,000	1,32,31,05,573	27,33,14,427	1 Yr	18.31%

[**Breakeven point** is where the CAPEX is recovered.]

Conclusion: From the above table it is determined that:

1. For a Sale Price of INR 2.50 Lac per micro duct km, breakeven is achieved in 10 years.
2. For an INR 2.75 Lac per micro duct km sale price, breakeven is achieved in 4 years.
3. For an INR 3.0 Lac per micro duct km sale price, breakeven is achieved in 1 year.

Thus it can be seen that the Sale Price can be kept anywhere between Rs. 2.75 Lakhs to Rs. 3.0 Lakhs.

The detailed sheets are placed at **Annexure 8.**

Recommended Model for Common Duct Implementation:

From the Business Plan analysis it seems that a BOOT model may be viable for implementation:

- Government may float EOI to get the interested parties on board.
- The private party shall invest in the project.
- Government shall provide the RoW and facilitate.
- As can be seen if the pricing is kept anywhere between Rs. 2.75 to Rs. 3.0 lakhs the break even would be achieved in ~ 1 to 4 years.
- Once break even is achieved the Private party starts to give revenue at the agreed rate to the government.
- The advantage shall be that the private partner shall do aggressive marketing and bring its expertise to the table.

9.5. Implementation Strategy

To implement the project successfully it is imperative to plan a strategy of implementing it. The key points in strategic plan are:

- No permission for further digging and trenching shall be given on the routes where common duct has been laid.

- **Pre-booking of the duct** shall be done as a part of marketing to ensure constant source of revenue prior to laying it.

- The TSP may lease duct from agency investing in the duct network on IRU basis for a set period of time.

- Maintenance shall remain with the agency investing in the duct network .The Service Level Agreement (SLA) between this agency and TSP shall include the O&M expenses payable by TSP annually and penalty may be deducted for any loss made to service provisioning due to cut in duct.

10 Challenges & Risks

The idea of laying a common duct for telecom and smart city applications is indeed useful and its successful implementation can lead to many long term benefits.

However, as with any project this also could have its risks and challenges, some of which are identified below:

10.1 Challenges

1. As is understood from the discussions with govt. officials of Deoghar, no master plan exists for other utilities such as electricity, water, gas, telecom etc. Allocation of RoW for telecom duct could be a challenge as the duct route may clash with the utilities. There could also be existing ducts of some TSP's.

2. Laying of telecom ducts in tertiary routes which are mostly in densely populated areas. Clearing the sides of the roads from encroachments would be a challenge for RoW.

3. Govt. may be required to make a policy that one operator will not share OFC with another operator. Otherwise, sale of ducts will come down heavily making it financially unviable project for the implementer. The guideline should be that each TSP/ISP or any other user should lease/take a complete micro duct/ duct for its use.

4. As OFC laying vendor may be different from duct laying vendor, there could be coordination issues during operation & maintenance period.

5. An SPV needs to be created to monitor the project & its financials. The accounts of this project should be kept separately for auditing purposes.

10.2 Risks

1. Ducts may get damaged during road expansions, construction of elevated roads/flyovers etc. or any other heavy activity on the road.

2. Litigations, if any, during clearing of ROWs may stall/delay some sections of the project.

IS/ISO 9001:2000

ANNEXURES

TO

Report on Feasibility for Laying of Common Duct to improve the broadband penetration in Deoghar, Jharkhand

FOR

Telecom Regulatory Authority of India

Date: 01.05.2017

By

TELECOMMUNICATIONS CONSULTANTS

INDIA LTD. TCIL Bhawan, Greater Kailash-I,

New Delhi – 110048

Telephone: 011-26202020 Fax: 011-2624226

ANNEXURE – 1

TRAI WORK ORDER

Telecom Regulatory Authority of India

Mahanagar Doorsanchar Bhawan, Jawahar Lal Nehru Marg,
(Old Minto Road), New Delhi 110002.

F.No. 5-4/2016-BB&PA

Dated: 13th June, 2016

To,

Ms. Shivalini Sinha,
Group General Manager (T),
Telecommunication Consultants India Limited,
TCIL Bhawan, Greater Kailash-I,
New Delhi – 110 048

Subject: Award of Work for preparation of Feasibility Report for improving the Broadband penetration by laying of common duct in the city of Deoghar, Jharkhand

Please refer to your Techo-Commercial Proposal dated 28th April, 2016, letter no. TCIL/51/1134/2016/TC/TRAI Deoghar dated 11th May 2016, e-mail dated 3rd June 2016 and discussions held in the chamber of Secretary TRAI on 4th May 2016 for **Feasibility Report for improving the Broadband penetration by laying of common duct in the city of Deoghar, Jharkhand**.

2. The undersigned is directed to convey the approval of the competent authority to award the work for preparation of "**Feasibility Report for improving the Broadband penetration by laying of common duct in the city of Deoghar, Jharkhand**" to M/s TCIL; subject to the terms and conditions enclosed as Annexure-I.

3. It is requested to forward your acceptance at the earliest.

(Arvind Kumar)
Advisor (BB&PA)

Encl: Annexure-I

Annexure-I

TERMS AND CONDITIONS

1. **Project:**

M/s Telecommunication Consultants India Limited (TCIL) shall prepare feasibility study for improving the Broadband penetration by laying of common duct in Deoghar, Jharkhand.

2. **Scope of Work:**

i. Study and gather the data w.r.t. the existing broadband penetration in Deoghar i.e. number of existing customers, number of service providers, overall telecom scenario. Demand assessment for citizen/Business/ Government, smart cities/surveillance etc.

ii. Interact with the various TSPs to understand why the broadband penetration is low.

iii. Interaction with various stakeholders (like Municipal Corporation and others) to assess the present infrastructure of OFC/ducts available.

iv. Assess the requirement and identify the potential Area of Interest (AoI).

v. Planning of duct route for the city considering the existing infrastructure as well as future demand.

vi. Preparation of technical specs and infrastructure dimensioning.

vii. Estimate the Capex and Opex.

viii. Identifying the business model for implementing the above project. Exploring the PPP model, Gap funding model, any other model to assess the best possible feasibility of the project. Devising implementation strategy.

ix. Cost Benefit Analysis in various scenarios.

3. **Payment Terms:**

TRAI agrees to pay TCIL a sum of ₹ 22,00,000 (Rupees twenty two lakh) plus Service Tax as per the following details:

i. 80% payment against submission of Draft Feasibility report.
ii. 20% payment against submission of Final report.

4. **Payment Timelines/Milestones:**

(i) The draft report covering complete scope of work as mention in Sl No. 2 should be submitted within six weeks.

(ii) The final report should be submitted within 15 days of receiving feedback from TRAI on the draft report.

(iii) TCIL will mobilize for the project within seven days of getting Work Order and the Start of Assignment will be reckoned from the Mobilization date.

(iv) The payment will be made after the work has been successfully completed to the satisfaction of the TRAI.

5. Liquidated Damages:

In case the activities specified at Sl. No. 1 above are not completed according to the schedule stipulated therein solely on account of delays attributable to TCIL, a penalty of 2% per week will be levied for delay in submission of final report subject to a limit of 10%. The decision on the quantum of penalty assessed and levied by the TRAI shall be final.

6. Other Conditions:

a) The amount indicated at Sl. No. 3 above for the scope of work identified at Sl. No. 1 and covers the amount which TCIL may decide to pay to specialists from private sectors/ other organizations/ agencies and all other expenses, including those on travel, boarding and lodging and use of its internal infrastructure.

b) All reports and data shall be submitted by TCIL in soft copies as well as hard copies. 3 copies of Feasibility Study shall be submitted.

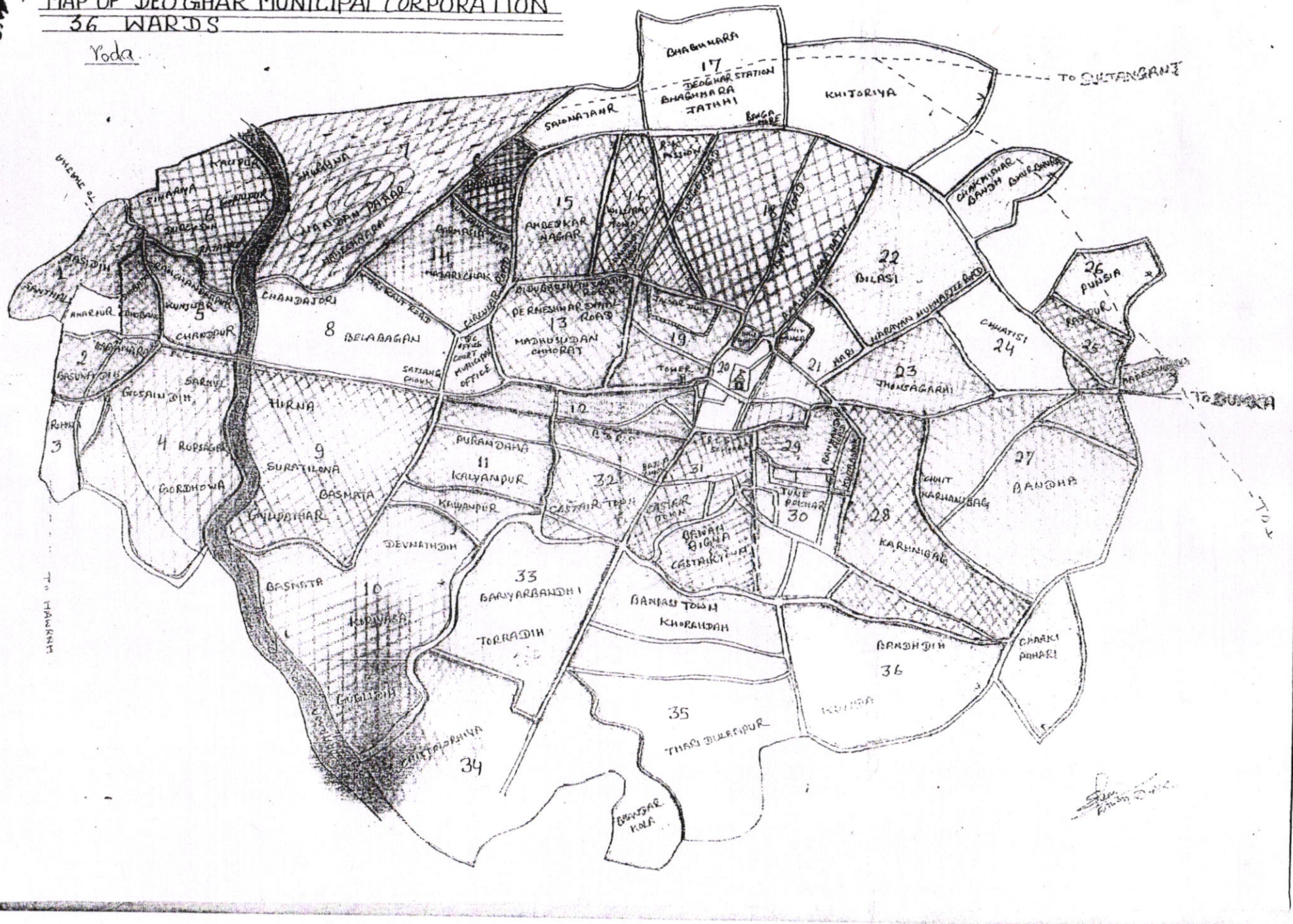
*****

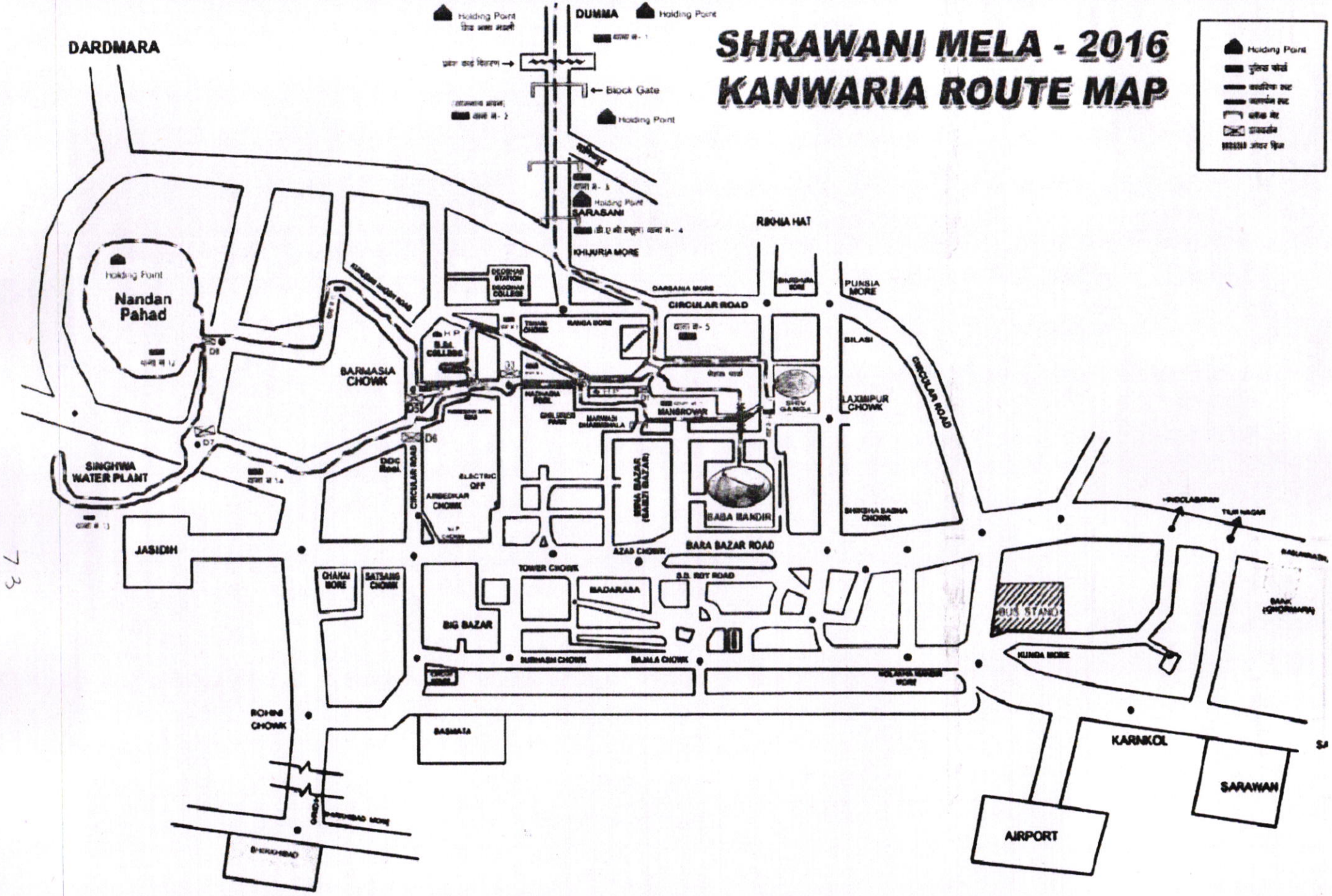
ANNEXURE - 2

DEOGHAR ROADS

MAP OF DEOGHAR MUNICIPAL CORPORATION
36 WARDS

Yoda




SHRAWANI MELA - 2016
KANWARIA ROUTE MAP
DARDMARA
DUMMA
Holding Point
Block Gate
SARASANI
KHIJURIA MORE
RIKHIA HAT
Nandan Pahad
BARMASIA CHOWK
SINGHWA WATER PLANT
JASIDIH
CIRCULAR ROAD
DARSANIA MORE
PUNSIA MORE
BILASI
LAXMIPUR CHOWK
MANSAROWR
SHIV GANGA
BABA MANDIR
BARA BAZAR ROAD
AZAD CHOWK
TOWER CHOWK
BADARASA
BIG BAZAR
BAJALA CHOWK
GHANA MORE
SATSANG CHOWK
ROHINI CHOWK
BASMATA
BHAGALPUR
BUS STAND
KUNDA MORE
KARNKOL
SARAWAN
AIRPORT

ANNEXURE - 3

DEOGHAR POPULATION

जिला गजट

झारखण्ड सरकार
देवघर समाहरणालय

जिला दण्डाधिकारी, देवघर द्वारा प्रकाशित

माघ कृष्ण पक्ष – 05 * सम्वत् 2071

असाधारण अंक संख्या – 01 * दिनांक 09 जनवरी, 2015

अधिसूचना संख्या – 18 / जि0पं0

दिनांक – 07 जनवरी, 2015

अधिसूचना

मैं अमीत कुमार, भा.प्र.से., जिला दण्डाधिकारी –सह– उपायुक्त, देवघर झारखण्ड सरकार नगर विकास विभाग की अधिसूचना संख्या–381, दिनांक 26.08.2014 तदनुसार झारखण्ड नगरपालिका अधिनियम, 2011 की धारा 15(2)(क) एवं धारा 8 तथा झारखण्ड नगरपालिका निर्वाचन एवं चुनाव याचिका नियमावली, 2012 के नियम 3 (1) (क) एवं 4 (1) (घ) तथा राज्य निर्वाचन आयोग, झारखण्ड, रांची के पत्रांक 14, दिनांक–06.01.2015 के अध्यधीन प्रदत्त शक्तियों का प्रयोग करते हुए अग्रांकित विवरणी के अनुसार देवघर नगर निगम के प्रादेशिक निर्वाचन क्षेत्रों (वार्डों) का अन्तिम प्रकाशन प्रपत्र–1 में करता हूँ :–

प्रादेशिक निर्वाचन क्षेत्रों (वार्डों की सूची

पृष्ठ संख्या 1 – 9

क्रमांक	प्रादेशिक निर्वाचन क्षेत्र की संख्या / नाम	जनसंख्या	प्रादेशिक निर्वाचन क्षेत्र का विस्तार
1	2	3	4
1	VIII देवघर / 01 देवघर नगर निगम–01	5482	जसीडीह बाजार, संथाली उत्तरी, संथाली सम्पूर्ण दक्षिणी भाग उ0–देवघर चकाई रोड सिनेमा हॉल मोड़ तक। द0–संथाली दक्षिणी सीमा एवं रायडीह। पू0–जसीडीह हावड़ा रेलवे लाईन का पश्चिमी भाग। प0–इण्डियन ऑयल एवं बदलाडीह का पूर्वी सीमा।

2	VIII देवघर/01 देवघर नगर निगम–02	5397	जसीडीह बाजार (धोबिया गली) पूर्वी भाग, बसुआडीह रायडीह अंश, बाघमारा, धौबनी, मित्रा गार्डेन रोड उ0 भाग, ढीबाडीह उ0–देवघर जसीडीह रोड द0–मित्रा गार्डेन रोड (उ0भाग) पू0–देवघर जसीडीह रोड प0–जसीडीह दुमका रेलवे ट्रैक एवं जसीडीह हावड़ा रेलवे लाईन ट्रैक।
3	VIII देवघर/01 देवघर नगर निगम–03	5690	रोहिणी अंश, मिश्रा टोला, पथलचपटी उ0–रोहिणी शहीद स्थल एवं मित्रागार्डेन रोड द0–रोहिणी दक्षिणी सीमा एवं नावाडीह पू0–पथलचपटी पूर्वी सीमान्त प0–बसुवाडीह, रोहिणी हटिया रोड
4	VIII देवघर/01 देवघर नगर निगम–04	5591	सारमूल, गोसाईडीह, रूपसागर छींट, रूपसागर, मालेडीह, नारायणपुर, खवासडीह, रोहिणी अंश पश्चिमी भाग (हटिया से इण्डियन हैरिटेज स्कूल के पश्चिमी मोड़ तक) उ0–बसुआडीह (द0 सीमा) एवं बाघमारा द0–शहीद स्मारक पू0–डढ़वा नदी प0–धरवाडीह रोड
5	VIII देवघर/01 देवघर नगर निगम–05	5844	रामचन्द्रपुर उ0भाग, रामचन्द्रपुर द0भाग, कुंजीसार, चाँदपुर उ0–कुंजीसार सीमा द0–देवघर जसीडीह रोड एवं सारमूल का उत्तरी सीमान्त पू0–डढ़वा नदी प0–हीलव्यू कॉलोनी बगल वाली रोड का पूर्वी भाग।
6	VIII देवघर/01 देवघर नगर निगम–06	5852	कालीपुर, गोपालपुर, सिमरिया, रतनपुर, दूबेडीह, रतनडीह, धर्मपुर उ0–गोपालपुर सीमा एवं नदी एवं टाभाघाट द0–धर्मपुर उत्तरी सीमा पू0–डढ़वा नदी प0–टाभाघाट रोड एवं देवघर जसीडीह पथ
7	VIII देवघर/01 देवघर नगर निगम–07	5382	बरमसिया सर्कुलर रोड(अंश)(यादव टोला मोड़ से एकलव्य स्कूल के मोड़ तक), बरमसिया, नन्दन पहाड़, हरिपुर, महेशमारा उ0–हरिपुर सीमा ग्रामीण सीमान्त द0–कुमुदनी घोष रोड पू0–एकलव्य पब्लिक स्कूल रोड प0–डढ़वा नदी

8	VIII देवघर/01 देवघर नगर निगम–08	5593	बेलाबगान (सम्पूर्ण), श्रीकान्त रोड (अंश), सिंघवा, चंदाजोरी, कचहरी कैम्पस उ0–कुमुदनी घोष रोड द0–देवघर जसीडीह रोड पू0–सुरेन्द्रनाथ सरकार रोड प0–डढ़वा नदी
9	VIII देवघर/01 देवघर नगर निगम–09	5758	महावीर कॉलोनी, सत्संग नगर, हिरणा,–गुलीपाथर, बसमत्ता (अररवाटांड़) उ0–देवघर जसीडीह रोड द0–रोहिणी रोड पू0–आर0 एन0 बोस रोड प0–डढ़वा नदी
10	VIII देवघर/01 देवघर नगर निगम–10	5711	सत्संग नगर एवं कल्याणपुर अंश (यादव पाड़ा), सत्संग कॉलोनी, देवनाडीह (नारायण कॉलोनी), बसमत्ता अंश (पूर्वी भाग), गुगलीडीह, कोरियासा उ0–काजल दा हॉस्पिटल के बगल वाली गली एवं देवनाडीह (नारायण कॉलनी रोड) द0–डढ़वा नदी। पू0–जमुनाजोर (नाला) प0–रोहिणी रोड (सर्किट हाउस के मोड़ से डढ़वा नदी तक।)
11	VIII देवघर/01 देवघर नगर निगम–11	5686	कल्याणपुर, आर0 एन0 बोस रोड, पुरनदाहा(द0भाग), पुरनदाहा–नयपास रोड, कमल कोठी उ0–देवघर जसीडीह रेलवे ट्रैक द0–काजल दा हॉस्पिटल के बगल वाली गली एवं देवनाडीह (नारायण कॉलनी रोड) पू0–जमुनाजोर (नाला) प0–आर0 एन0 बोस रोड
12	VIII देवघर/01 देवघर नगर निगम–12	5517	हरानचन्द्र चटर्जी रोड, जसीडीह रोड, शिशिर कुमार घोष रोड, आर0एन0बोस रोड, कचहरी रोड अंश (बी0आई0पी0 चौक से पुल तक), आदर्श पथ, शैलवाला राय रोड, ब्रह्मसमाज रोड, नेताजी रोड, कचहरी रोड अंश (पुल से लेकर टावर चौक तक), शिव नाथ राय रोड, आसाम एक्सेस रोड(अंश) (राय एण्ड कम्पनी मोड़ से बजरंगी चौक तक), एस0एम0 जालान रोड अंश (अवन्तिका गली मोड़ से महाराजा होटल तक) उ0–देवघर जसीडीह रोड एवं एस0 बी0 राय रोड (टावर चौक + अवन्तिका गली तक) द0–देवघर जसीडीह रेलवे ट्रैक एवं शिवनाथ राय रोड, उ0भाग पू0–सेठ सूरजमल जालान रोड प0–आर0एन0बोस रोड (सत्संग चौक + पटरी)

13	VIII देवघर/01 देवघर नगर निगम–13	5548	विलियम्स टाउन, दुर्गा बाड़ी रोड, सिंचाई कॉलोनी, बृजभान सिंह पथ, सुरेन्द्र नाथ सरकार रोड, छोटेलाल मोदी पथ, विधुभूषण सरकार रोड का दक्षिणी भाग (बरमसिया स्कूल मोड़ से हदहदिया पुल तक), बरमसिया, परमेश्वर दयाल रोड उ0–विधुभूषण सरकार रोड द0–कोर्ट रोड एवं देवघर जसीडीह रोड पू0–कॉलेज रोड प0–सुरेन्द्र नाथ सरकार रोड एवं सर्कुलर रोड
14	VIII देवघर/01 देवघर नगर निगम–14	5538	श्रीकान्त रोड (अंश), मदारी चक, साकेत बिहार, कुमुदनी घोष रोड, बरमसिया, बरमसिया सर्कुलर रोड (प0 भाग) उ0–कुमुदनी घोष रोड द0–श्रीकान्त रोड पू0–सर्कुलर रोड (सत्संग चौक से कुमुदनी घोष रोड) प0–नन्दन पहाड़ रोड (कालीबाड़ी से नन्दन पहाड़ चौक तक)
15	VIII देवघर/01 देवघर नगर निगम–15	5589	विधुभूषण सरकार रोड उत्तरी भाग (म0वि0 बरमसिया से सुपर्ब स्कॉलर स्कूल के सामने मोड़ तक), विलियम्स टाउन, अम्बेदकर नगर, बरमसिया, बरमसिया सर्कुलर रोड अंश (बरमसिया स्कूल से जटाही मोड़ तक) उ0–राम कृष्ण मिशन रोड द0–विधुभूषण सरकार रोड (म0वि0 बरमसिया से सुपर्ब स्कॉलर स्कूल के सामने मोड़ तक) पू0–विलियम्स टाउन रोड (बी0 एड0 कॉलेज के पीछे वाली रोड) प0–सर्कुलर रोड
16	VIII देवघर/01 देवघर नगर निगम–16	5564	हनुमान टिकरी कॉलेज रोड (अंश), विलियम्स टाउन (अंश), कॉलेज रोड (अंश), विलियम्स टाउन रानी कोठी, विलियम्स टाउन (अंश) उ0–सर्कुलर रोड (जटाही मोड़ से कॉलेज गेट तक) द0–विधुभूषण सरकार रोड एवं चिल्ड्रेन पार्क) पू0–हनुमान टिकरी रोड एवं कॉलेज रोड (चिल्ड्रेन पार्क मोड़ से कॉलेज गेट तक) प0– विलियम्स टाउन रोड (बी0 एड0 कॉलेज के पीछे वाली रोड)
17	VIII देवघर/01 देवघर नगर निगम–17	5466	सलौनाटांड़, बाघमारा, जटाही, खिजुरिया, सलौना अंश उ0 भाग (बरमसिया सर्कुलर रोड अंश से लेकर एकलव्य स्कूल मोड़ से गिधनी मोड़ तक) उ0–सुल्तानगंज रोड (बाघमारा एवं खिजुरिया सीमा तक) द0–सर्कुलर रोड पू0–खिजुरिया पूर्वी सीमा एवं जरूवाडीह प0–एकलव्य पब्लिक स्कूल रोड

18	VIII देवघर/01 देवघर नगर निगम–18	5548	मत्स्य विभाग रोड, प0बी0एन0झा पथ, पोखना टिल्हा, विश्वनाथ मिश्र लेन, कॉलेज रोड, बमबम पथ, गोमस्ता गली, चैतन्य नाथ जजवाड़े पथ का उत्तरी भाग, शिवगंगा लेन उ0–सर्कुलर रोड द0–चैतन्य नाथ जजवाड़े पथ एवं मत्स्य विभाग रोड पू0–बम बम बाबा पथ प0–हनुमान टिकरी रोड एवं कॉलेज रोड
19	VIII देवघर/01 देवघर नगर निगम–19	5498	जलसार रोड अंश, जलसार रोड (चौवाबाड़ी), कचौड़ी गली, हरि किसुन साह लेन, मेघलाल पुरी लेन प0 भाग, मत्स्य विभाग रोड अंश, चैतन्य नाथ जजवाड़े पथ अंश, भोला पंडा पथ, रामरतन बक्सी रोड, कॉलेज रोड, जलसार रोड उ0–मत्स्य विभाग रोड द0–कोर्ट रोड़ पू0–श्याम गंज रोड एवं मेघलाल पुरी लेन एवं पंडित बी0 एन0 झा पथ (बाटा से केशरवानी तक एवं मेघलाल पुरी लेन से कांवर संघ होते हुए तरंग सदन तक) प0–राम रतन बक्सी रोड एवं कॉलेज रोड
20	VIII देवघर/01 देवघर नगर निगम–20	5596	बृज बिहारी लेन, एस0बी0राय रोड, एस0एम0 जालान रोड, प0 भाग, सी0 पी0 डोलिया रोड, गंगा हरि लेन, मेघलाल पुरी लेन, हरिकिशुन साह लेन एवं गजाधर साह लेन, पेड़ा गली एवं सरदार पंडा लेन, चन्द्र शेखर ओझा पथ, बानेश्वर बाबु गली, शिवगंगा लेन अंश, नारायण झा नरौने पथ, इमली बाड़ी, सुत्ता पट्टी, बड़ा बाजार, एस0बी0राय रोड, बैद्यनाथ प्रेस गली, गणपत राय जोशी लेन, कबुतर धर्मशाला गली, श्याम गंज रोड, चैतन्य नाथ जजवाड़े पथ उ0–चैतन्य नाथ जजवाड़े पथ द0–आसाम एक्सेस रोड (बजरंगी चौक से बृज बिहारी लेन मोड़ तक) पू0–बृज बिहारी लेन एवं नारायण झा नरौने पथ एवं शिवगंगा लेन का अंश (सिंह दरवाजा से चन्द्रशेखर ओझा पथ के मोड़ तक) प0–श्याम गंज रोड एवं मेघलालपुरी लेन (पूर्वी भाग)

21	VIII देवघर/01 देवघर नगर निगम–21	5904	शिवगंगा लेन अंश, खुशी दत्त द्वारी लेन, आशुतोष भगत लेन, चक्रवर्ती लेन, लक्ष्मी चरण द्वारी पथ, गोविन्द खवाड़े लेन, आर0 एल0 सर्राफ पथ, हरि नारायण मुखर्जी रोड, बैद्यनाथ लेन, हरिहर बाड़ी, श्यामा चरण मिश्र लेन, नारायण झा नरौने पथ, लोक नाथ ठाकुर लेन, बाबुलाल झा लेन उ0–यतीन्द्र नाथ द्वारी पथ एवं हरिहर बाड़ी पोखर से शिवगंगा लेन तक द0–एस0 बी0 राय रोड पू0–आर0 एल0 सर्राफ पथ एवं हरि नारायण मुखर्जी रोड प0–नारायण झा नरौने पथ एवं शिवगंगा लेन (श्मसान घाट गेट तक) एवं बमबम बाबा पथ।
22	VIII देवघर/01 देवघर नगर निगम–22	5762	बमबम बाबा पथ, प्रोफेसर कॉलोनी, नीलकंठपुर, शीतल मल्लिक रोड, हरिहरबाड़ी, चन्द्रशेखर दत्त द्वारी पथ, चकमिश्र बांध (पूर्ण), भुरभुरा उ0–सर्कुलर रोड एवं चकमिश्र बांध सीमा एवं भुरभुरा सीमा एवं जरूवाडीह सीमाना, द0–यतीन्द्र नाथ द्वारी पथ एवं हरिहर बाबा तालाब से शिव गंगा उत्तरी पिंड तक पू0–हरि नारायण मुखर्जी रोड प0–बम बम बाबा पथ (शौचालय + मोड़ तक)
23	VIII देवघर/01 देवघर नगर निगम–23	5920	दुखी साह रोड, हरि नारायण मुखर्जी रोड, दुमका रोड, आर0 एल0 सर्राफ पथ, जगदम्बा बलियासे पथ, शिवपुरी, बिलासी अंश, परम प्रकाशानन्द झा पथ अंश, झाँसीगढ़ी, दुमका रोड, रघुनाथ रोड, देवी हरिदासी लेन, महावीर नायक रोड, सिमरगढ़ा, जगदम्बा बलियासे पथ, धानुक टोला, चंडी चरण मिश्र गली (चंडी चरण मिश्र गली से छत्तीसी पुल तक) उ0–चंडी चरण मिश्र की गली छत्तीसी पुल तक द0–दुमका रोड (शिक्षा सभा चौक से निरंजन बथवाल के घर तक) पू0–ब्लूमिंग बर्ड स्कूल से छत्तीसी मोड़ तक) प0–आर0 एल0 सर्राफ पथ एवं हरि नारायण मुखर्जी रोड
24	VIII देवघर/01 देवघर नगर निगम–24	5917	श्याम बीड़ी उत्तर बैद्यनाथपुर, बैद्यनाथपुर, निवारण चरण राय रोड, परम प्रकाशानन्द झा पथ, छत्तीसी, बिलासी अंश, गांधी नगर(बिलासी) उ0–सर्कुलर रोड द0–नाला पू0–सनराईज द्वारिका एकेडमी वाली रोड प0–हरि नारायण मुखर्जी रोड एवं दुमका रोड

25	VIII देवघर/01 देवघर नगर निगम–25	5886	रामपुर, महेशमारा, बंधा अंश, रिफ्यूजी कॉलोनी उ0–रामपुर सीमा द0–बंधा अंश सीमा एवं रिफ्यूजी कॉलोनी सीमा /जोरिया पू0–महतवाईनडीह ग्रामीण क्षेत्र प0–रिफ्यूजी कॉलोनी का प0 सीमा
26	VIII देवघर/01 देवघर नगर निगम–26	5706	पुनसिया (पूर्ण), रामपुर (अंश) उ0–बलसरा ग्रामीण क्षेत्र द0–रामपुर सीमा एवं बंधा सीमा पू0–अमगड़िया पश्चिमी सीमा प0–रिखिया रोड
27	VIII देवघर/01 देवघर नगर निगम–27	5596	बंधा अंश, छींट करनीबाग (अंश), हाथी पहाड़ (अंश) उ0–दुमका रोड एवं जोरिया द0–जोरिया (नाला) पू0–छींट करनीबाग पूर्वी सीमा एवं नाला प0–सनराईज द्वारिका एकेडमी वाली रोड
28	VIII देवघर/01 देवघर नगर निगम–28	5375	करनीबाग अंश, बसंत कुमार दे लेन, कुष्ठाश्रम रोड एवं सुन्दरबांध रोड, मातृ कॉलोनी एवं शास्त्री नगर, कर्नल नवीन झा की गली, माली टोला (जागृति नगर), कालीराखा, शहीद आश्रम रोड, दुमका रोड अंश, करनीबाग छींट (हाथी पहाड़) उ0–दुमका रोड द0–सारवाँ रोड पू0–शहीद आश्रम रोड प0–कुष्ठाश्रम रोड
29	VIII देवघर/01 देवघर नगर निगम–29	5840	कुष्ठाश्रम, राम मंदिर रोड, तारणी चौधरी लेन, माथा बांध एवं महेश्वरी ऑयल मील गली, जून पोखर उत्तरी भाग एवं रतिनाथ बसु पथ, दुमका रोड अंश, तारणी ठाकुर लेन पूर्वी भाग, आसाम एक्सेस रोड अंश उ0–एस0 बी0 राय रोड एवं दुमका रोड द0–तारणी चौधरी लेन पू0–कुष्ठाश्रम रोड प0–बृज बिहारी लेन
30	VIII देवघर/01 देवघर नगर निगम–30	5563	जून पोखर, बसंत कु0 दे लेन, भैरो राय गली, रतिनाथ बसु पथ, हरिजन कॉलोनी, तारणी चौधरी लेन द0भाग, पुराना मीना बाजार उ0–तारणी चौधरी लेन (द0 भाग) द0–सारवाँ रोड (हरिजन कॉलोनी मोड़ से बसंत कुमार दे लेन मोड़ तक) पू0–बसंत कु0 दे लेन एवं कालीराखा से मिडिल स्कूल मोड़ तक) प0–सारवाँ रोड (बस स्टैण्ड रोड)

205

31	VIII देवघर/01 देवघर नगर निगम–31	5489	करनीबाग (राजबाड़ी गली प0 भाग), बावनबीघा (पूर्ण) , कास्टर टाउन, उमापति बनर्जी रोड द0 भाग उ0–आसाम एक्सेस रोड (बजरंगी चौक से फब्बारा चौक तक) एवं सारवाँ रोड (प्रिंस लॉज मोड़ से राजबाड़ी मोड़ तक) द0–जमुना जोर (नाला) पू0–राजबाड़ी रोड (ठाढ़ी रोड) प0–सेठ सूरजमल जालान रोड (बजरंगी चौक से बम्पास टाउन पुल तक) एवं ओल्ड सारवाँ रोड (पुराना मीना बाजार चौक से प्रिंसलॉज मोड़ तक)
32	VIII देवघर/01 देवघर नगर निगम–32	5567	डॉ0राजेन्द्र प्रसाद रोड, सुन्दरलाल मिश्रा रोड, चाँदकोठी, रेलवे कॉलोनी, हरिजन कॉलोनी, श्याम कीर्तन मंडल, एस0 एम0 जालान रोड (महाराजा होटल मोड़ से बाजला चौक तक), कास्टर टाउन, मालगोदाम रोड, बिहारी लाल चक्रवर्ती रोड उ0–रेलवे ट्रैक एवं विश्वनाथ मिश्रा लेन द0–राजेन्द्र प्रसाद रोड पू0–एस0 एम0 जालान रोड प0–जमुनाजोर (नाला)
33	VIII देवघर/01 देवघर नगर निगम–33	5716	डा0राजेन्द्र प्रसाद रोड(अंश) (द0 भाग), सुशीला रोड, बरियारबाँधी, बम्पास टाउन, धनगौर उ0–राजेन्द्र प्रसाद रोड (पुल से बाजला चौक तक) द0–सुरेखा मार्ग पू0–सेठ सूरजमल जालान रोड (बाजला चौक से सुरेखा मार्ग मोड़ तक) प0–जमुनाजोर (नाला)
34	VIII देवघर/01 देवघर नगर निगम–34	5795	देवसंघ, चित्तोलीढ़िया, भण्डार कोला उ0–देवसंघ द0–डढ़वा नदी पू0–ठाढ़ीदुलमपुर रोड (पार्क रोड) प0–जमुनाजोर (नाला)
35	VIII देवघर/01 देवघर नगर निगम–35	5572	ठाढ़ीदुलमपुर, खोरादह, एस0 एम0 जालान रोड (नागेन्द्र भवन मोड़ से देवसंघ मोड़ तक), बम्पास टाउन (पूर्ण) उ0–जमुनाजोर (नाला) द0–ठाढ़ी दुलमपुर सीमा एवं कटिया ग्रामीण क्षेत्र पू0–ठाढ़ी रोड प0–एस0 एम0 जालान रोड

36	VIII देवघर/01 देवघर नगर निगम–36	5665	चरकी पहाड़ी, हथगढ़, कानीजोर, बाघडीह, कुंडा, छींट करनीबाग उ0–चरकीपहाड़ी सीमा एवं सारवाँ रोड (राजाबाड़ी से पुराना कुण्डा थाना बजरंगी चौक तक) द0–मेदनीडीह एवं सोनारी ग्रमीण क्षेत्र पू0–बहमपुरा प0–ठाढ़ी रोड

ह0/–
(अमीत कुमार)
जिला दण्डाधिकारी,
देवघर।

ANNEXURE - 4

EXISTING TELECOM INFRA STRUCTURE

DEOGHAR, JHARKHAND

List of Requirements from TSPs/ ISPs

Sl. No.	Requirement	Response
A	Operator Name	**AIRCEL**
	SPOC	
1	Subscriber base in City as per attached Annexure A	42576
2	Existing Fiber details	NA
3	Route plan of existing ducts in the city	NA
4	Future Expansion plans	NO
5	Any New specific Area of Interest (for FTTx)	NO
6	Details of Services being offered Area wise and Telecom Infrastructure as per attached Annexure B	NA
7	Existing Fibre Leasing , if any and the existing rates	NA

DEOGHAR, JHARKHAND

Annexure A

Sl. No.	Description	As on 31.12.2013	As on 31.12.2014	As on 31.12.2015
	Operators Name	AIRCEL		
a	Mobile Subscribers (nos.)	29,853	34,084	42,576
b	Mobile Subscribers (ARPU)	95.38	81.37	73.93
c	Broadband Subscribers (nos.)			
d	Broadband Subscribers (ARPU)			
e	Fixed Landline Subscribers (nos.)			
f	Fixed Landline Subscribers (ARPU)			

DEOGHAR, JHARKHAND

Annexure B

			Telecom Infrastructure being used viz. Optical Fibre, Microwave/ BTS etc.		
Sl. No.	Area Name	Services	Optical Fibre Length (KM)	No. of BTS	Microwave
AIRCEL					
1	Deoghar Town	2G & 3G	NA	13	14

DEOGHAR, JHARKHAND

List of Requirements from TSPs/ ISPs

Sl. No.	Requirement	Response
A	Operator Name	**AIRTEL**
	SPOC	
1	Subscriber base in City as per attached Annexure A	71558
2	Existing Fiber details	38KM
3	Route plan of existing ducts in the city	
4	Future Expansion plans	1. 2G Expansion-06 nos 2. 3G Expansion-07 nos 3. 4G Expansion-20 nos 4. Fiber approx-20 km
5	Any New specific Area of Interest (for FTTx)	FTTB for Corporate Business Unit & Airtel Business Unit Customer
6	Details of Services being offered Area wise and Telecom Infrastructure as per attached Annexure B	2G+3G
7	Existing Fibre Leasing , if any and the existing rates	NA

DEOGHAR, JHARKHAND

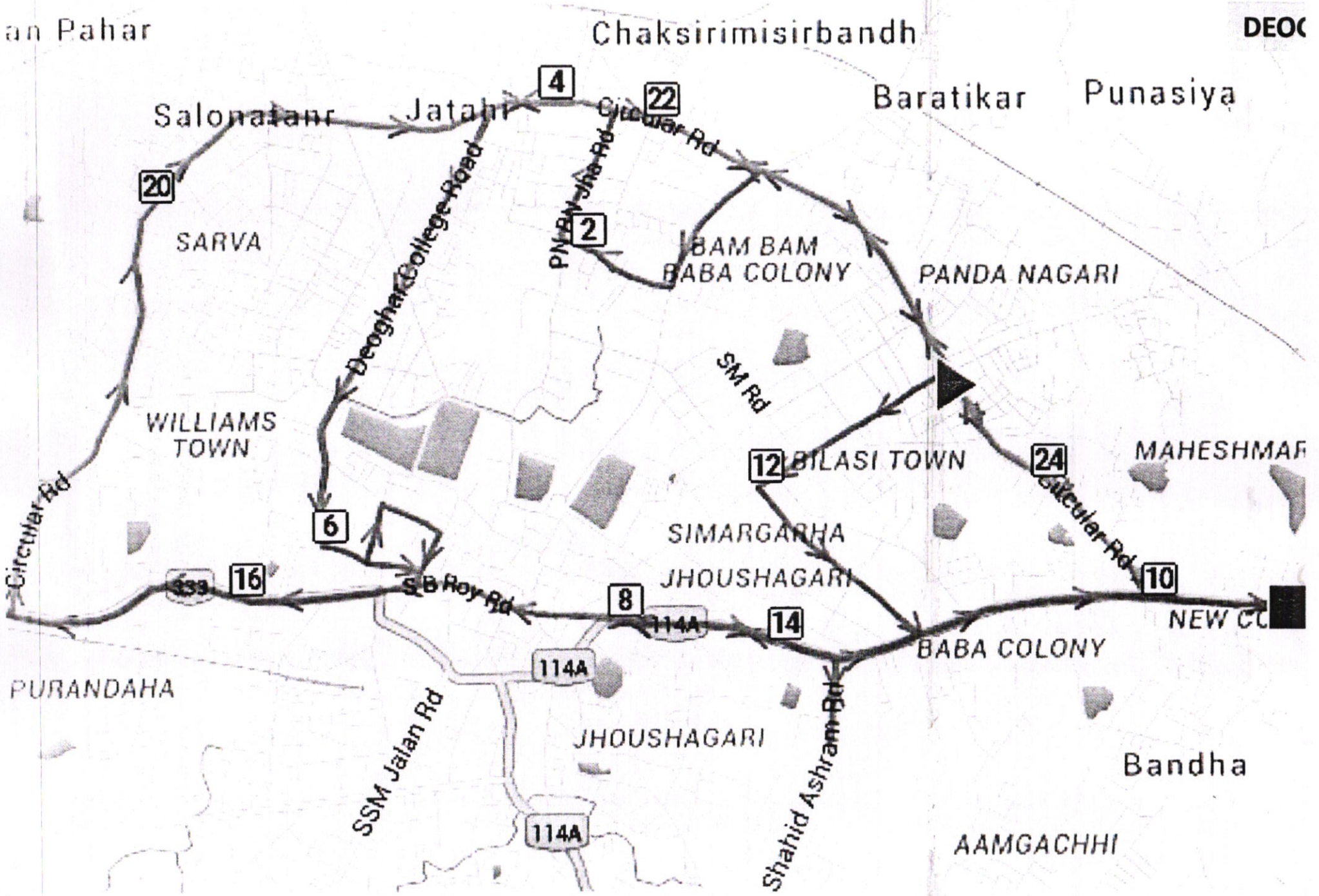
Annexure A

Sl. No.	Description	As on 31.12.2013	As on 31.12.2014	As on 31.12.2015
	Operators Name	AIRTEL		
a	Mobile Subscribers (nos.)	51,695	56,942	71,558
b	Mobile Subscribers (ARPU)	172.77	193.30	175.76
c	Broadband Subscribers (nos.)			
d	Broadband Subscribers (ARPU)			
e	Fixed Landline Subscribers (nos.)			
f	Fixed Landline Subscribers (ARPU)			

DEOGHAR, JHARKHAND

Annexure B

			Telecom Infrastructure being used viz. Optical Fibre, Microwave/ BTS etc.		
Sl. No.	Area Name	Services	Optical Fibre Length (KM)	No. of BTS	Microwave
AIRTEL					
1	Deoghar	2G+3G	38	25	230


an Pahar
Chaksirimisirbandh
DEOC
Baratikar
Punasiya
Salonatanr
Jatahi
4
22
Circular Rd
20
SARVA
Deoghar College Road
PN BN Jha Rd
2
BAM BAM
BABA COLONY
PANDA NAGARI
SM Rd
WILLIAMS
TOWN
12
BILASI TOWN
24
MAHESHMAR
Circular Rd
6
SIMARGARHA
JHOUSHAGARI
16
S B Roy Rd
8
10
NEW C
114A
14
BABA COLONY
PURANDAHA
SSM Jalan Rd
JHOUSHAGARI
Shahid Ashram Rd
Bandha
AAMGACHHI

DEOGHAR, JHARKHAND

List of Requirements from TSPs/ ISPs

Sl. No.	Requirement	Response
A	Operator Name	**BSNL**
	SPOC	
1	Subscriber base in City as per attached Annexure A	available
2	Existing Fiber details	available
3	Route plan of existing ducts in the city	No
4	Future Expansion plans	YES
5	Any New specific Area of Interest (for FTTx)	Karnibagh,CASTERTOWN,PURANDAHA,BOMPASS TOWN,WILLIMSTOWN,VIP AREA,BILASI,Anand Bihar
6	Details of Services being offered Area wise and Telecom Infrastructure as per attached Annexure B	available
7	Existing Fibre Leasing , if any and the existing rates	Dhanbad to Deoghar by RAILTEL(2.5G)

DEOGHAR, JHARKHAND

Annexure A

Sl. No.	Description	As on 31.12.2013	As on 31.12.2014	As on 31.12.2015
	Operators Name	BSNL		
a	Mobile Subscribers (nos.)	NA	NA	NA
b	Mobile Subscribers (ARPU)	NA	NA	NA
c	Broadband Subscribers (nos.)	907	710	728
d	Broadband Subscribers (ARPU)	Rs.529	Rs.525	Rs.603
e	Fixed Landline Subscribers (nos.)	3,399	3,473	3,493
f	Fixed Landline Subscribers (ARPU)	Rs.40	Rs.41	Rs.42

DEOGHAR, JHARKHAND

Annexure B

			Telecom Infrastructure being used viz. Optical Fibre, Microwave/ BTS etc.		
Sl. No.	Area Name	Services	Optical Fibre Length (KM)	No. of BTS(2G+3G+WIMAX)	Microwave
BSNL					
1	Main City Area	2G,3G,BB,LANDLINE ,LEASE LINE	33	15+14+1	4

DEOGHAR, JHARKHAND

List of Requirements from TSPs/ ISPs

Sl. No.	Requirement	Response
A	Operator Name	**IDEA**
	SPOC	
1	Subscriber base in City as per attached Annexure A	22058
2	Existing Fiber details	No Intracity OFC
3	Route plan of existing ducts in the city	
4	Future Expansion plans	4.5 KM
5	Any New specific Area of Interest (for FTTx)	Ward No-2/Deoghar(Lat/Log: 24.4918/86.7016
6	Details of Services being offered Area wise and Telecom Infrastructure as per attached Annexure B	GSM
7	Existing Fibre Leasing , if any and the existing rates	NA

DEOGHAR, JHARKHAND

Annexure A

Sl. No.	Description	As on 31.12.2013	As on 31.12.2014	As on 31.12.2015
	Operators Name		IDEA	
a	Mobile Subscribers (nos.)		13,614	21,432
b	Mobile Subscribers (ARPU)		97.54	109.43
c	Broadband Subscribers (nos.)			
d	Broadband Subscribers (ARPU)			
e	Fixed Landline Subscribers (nos.)			
f	Fixed Landline Subscribers (ARPU)			

DEOGHAR, JHARKHAND

Annexure B

			Telecom Infrastructure being used viz. Optical Fibre, Microwave/ BTS etc.		
Sl. No.	Area Name	Services	Optical Fibre Length (KM)	No. of BTS	Microwave
IDEA					
1	Deoghar		0	20	23

Existing and Proposed OFC Routes – Deoghar Intracity

DEOGHAR, JHARKHAND

List of Requirements from TSPs/ ISPs

Sl. No.	Requirement	Response
A	Operator Name	RCOM
	SPOC	
1	Subscriber base in City as per attached Annexure A	
2	Existing Fiber details	
3	Route plan of existing ducts in the city	
4	Future Expansion plans	
5	Any New specific Area of Interest (for FTTx)	
6	Details of Services being offered Area wise and Telecom Infrastructure as per attached Annexure B	
7	Existing Fibre Leasing , if any and the existing rates	

DEOGHAR, JHARKHAND

Annexure A

Sl. No.	Description	As on 31.12.2013	As on 31.12.2014	As on 31.12.2015
	Operators Name	RCOM		
a	Mobile Subscribers (nos.)	City wise bifurcation is not available with us.		
b	Mobile Subscribers (ARPU)	City wise bifurcation is not available with us.		
c	Broadband Subscribers (nos.)			
d	Broadband Subscribers (ARPU)			
e	Fixed Landline Subscribers (nos.)			
f	Fixed Landline Subscribers (ARPU)			

DEOGHAR, JHARKHAND

Annexure B

			Telecom Infrastructure being used viz. Optical Fibre, Microwave/ BTS etc.		
Sl. No.	Area Name	Services	Optical Fibre Length (KM)	No. of BTS	Microwave
RCOM					
1	Deoghar	RCOM	17.5	10	6

DEOGHAR, JHARKHAND

List of Requirements from TSPs/ ISPs

Sl. No.	Requirement	Response
A	Operator Name	**TATA TELESERVICES LIMITED**
	SPOC	
1	Subscriber base in City as per attached Annexure A	28121
2	Existing Fiber details	
3	Route plan of existing ducts in the city	
4	Future Expansion plans	No plan at present
5	Any New specific Area of Interest (for FTTx)	NA
6	Details of Services being offered Area wise and Telecom Infrastructure as per attached Annexure B	Voice + Data (2G +HSIA)
7	Existing Fibre Leasing , if any and the existing rates	NO

DEOGHAR, JHARKHAND

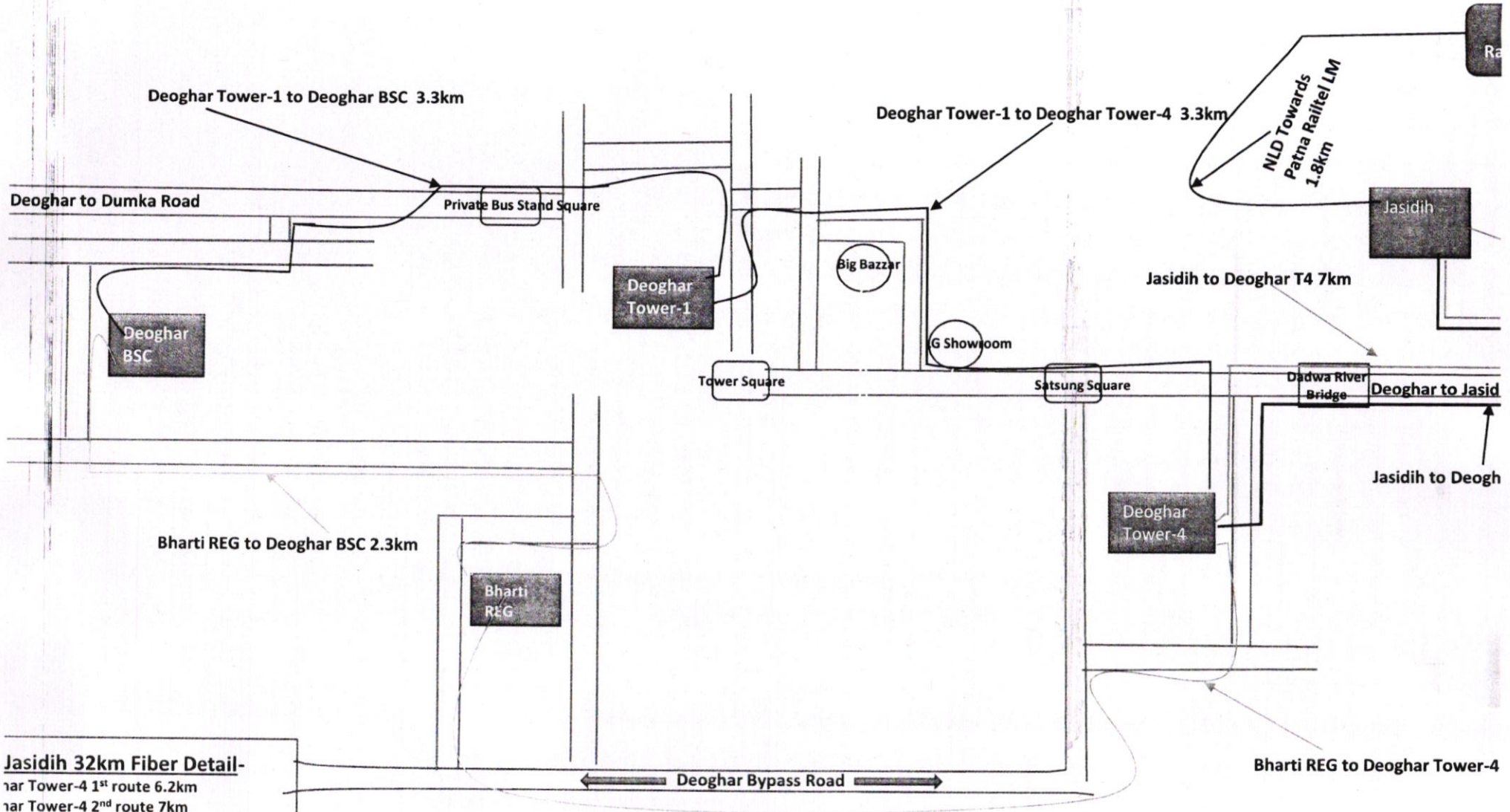
Annexure A

Sl. No.	Description	As on 31.12.2013	As on 31.12.2014	As on 31.12.2015
	Operators Name	TATA TELESERVICES LIMITED		
a	Mobile Subscribers (nos.)	16,724	28,074	28,121
b	Mobile Subscribers (ARPU)	161.71	156.08	144.63
c	Broadband Subscribers (nos.)			
d	Broadband Subscribers (ARPU)			
e	Fixed Landline Subscribers (nos.)			
f	Fixed Landline Subscribers (ARPU)			

DEOGHAR, JHARKHAND

Annexure B

			Telecom Infrastructure being used viz. Optical Fibre, Microwave/ BTS etc.		
Sl. No.	Area Name	Services	Optical Fibre Length (KM)	No. of BTS	Microwave
TATA TELESERVICES LIMITED					
1	Deoghar	VOICE + Data	19.2	17 GSM & 07 CDMA BTS	26



Jasidih 32km Fiber Detail-

- har Tower-4 1st route 6.2km
- har Tower-4 2nd route 7km
- -4 to Bharti REG via bypass Road 7.2km
- Bharti REG via Bilasi 2.3km
- -4 to Deoghar Tower-1 3.3km
- Deoghar Tower-1 3.3km
- om Jasidih to Railtel POP 1.8km
- om Jasidih to Railtel POP 0.9km

DEOGHAR, JHARKHAND

List of Requirements from TSPs/ ISPs

Sl. No.	Requirement	Response
A	Operator Name	**TELENOR**
	SPOC	
1	Subscriber base in City as per attached Annexure A	54003
2	Existing Fiber details	Nil (Leased Media)
3	Route plan of existing ducts in the city	NA
4	Future Expansion plans	Not Applicable - Leased Media envisaged
5	Any New specific Area of Interest (for FTTx)	NIL
6	Details of Services being offered Area wise and Telecom Infrastructure as per attached Annexure B	Only offering pre-paid mobile service
7	Existing Fibre Leasing , if any and the existing rates	NIL

DEOGHAR, JHARKHAND

Annexure A

Sl. No.	Description	As on 31.12.2013	As on 31.12.2014	As on 31.12.2015
	Operators Name	TELENOR		
a	Mobile Subscribers (nos.)	NA	NA	54,003
b	Mobile Subscribers (ARPU)	NA	NA	84.00
c	Broadband Subscribers (nos.)			
d	Broadband Subscribers (ARPU)			
e	Fixed Landline Subscribers (nos.)			
f	Fixed Landline Subscribers (ARPU)			

DEOGHAR, JHARKHAND

Annexure B

			Telecom Infrastructure being used viz. Optical Fibre, Microwave/ BTS etc.		
Sl. No.	Area Name	Services	Optical Fibre Length (KM)	No. of BTS	Microwave
TELENOR					
1	Deogarh	Pre-Paid Mobile	Leased Media (MPLS)	22	NIL

DEOGHAR, JHARKHAND

List of Requirements from TSPs/ ISPs

Sl. No.	Requirement	Response
A	Operator Name	VODAFONE
	SPOC	
1	Subscriber base in City as per attached Annexure A	18545
2	Existing Fiber details	12.5KM
3	Route plan of existing ducts in the city	Purandaha - Satsang Chawk - Bela Bagan
4	Future Expansion plans	
5	Any New specific Area of Interest (for FTTx)	
6	Details of Services being offered Area wise and Telecom Infrastructure as per attached Annexure B	2G+3G
7	Existing Fibre Leasing , if any and the existing rates	

DEOGHAR, JHARKHAND

Annexure A

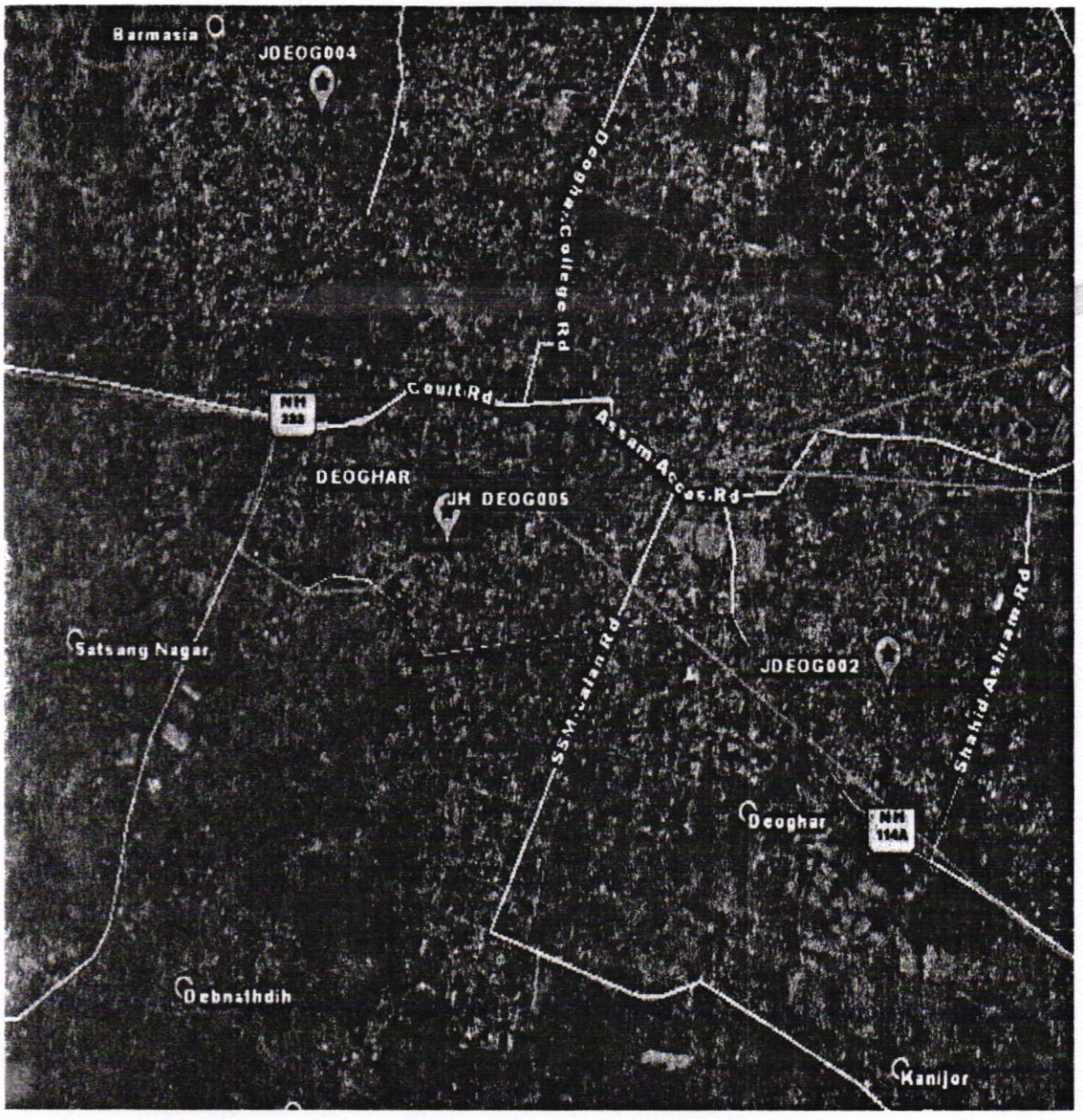
Sl. No.	Description	As on 31.12.2013	As on 31.12.2014	As on 31.12.2015
	Operators Name	VODAFONE		
a	Mobile Subscribers (nos.)	17,600	17,415	18,545
b	Mobile Subscribers (ARPU)	114.00	117.00	102.00
c	Broadband Subscribers (nos.)			
d	Broadband Subscribers (ARPU)			
e	Fixed Landline Subscribers (nos.)			
f	Fixed Landline Subscribers (ARPU)			

DEOGHAR, JHARKHAND

Annexure B

			Telecom Infrastructure being used viz. Optical Fibre, Microwave/ BTS etc.		
Sl. No.	Area Name	Services	Optical Fibre Length (KM)	No. of BTS	Microwave
VODAFONE					
1	Deoghar Town	Telecom	12.5	27	30

DEOGHAR TOWN – FIBRE ROUTE MAP



ANNEXURE - 5

DEOGHAR INSTITUTIONS

Deoghar Institutions

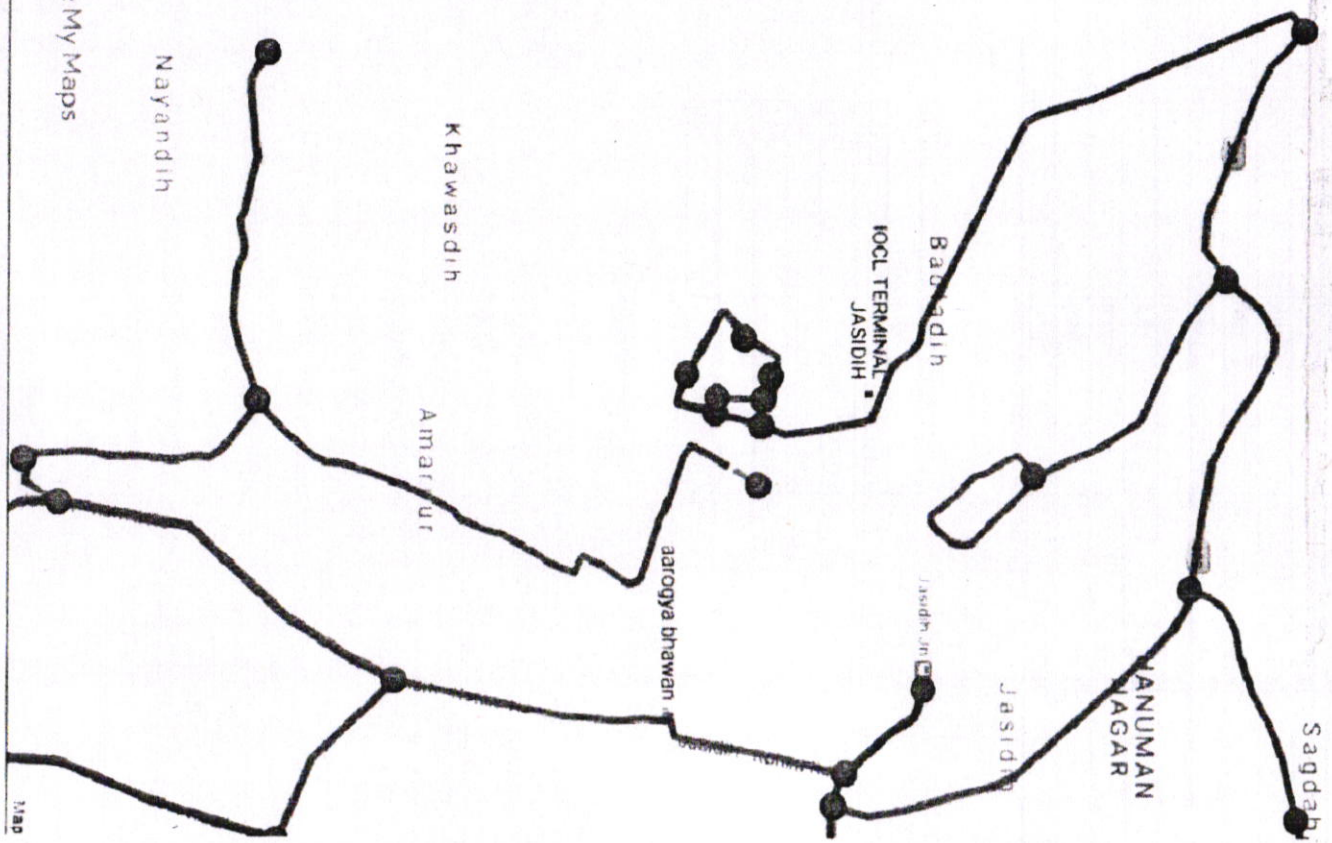
SN	Name of the Department	Address
1	Jharkhand Government Tourism Office	Meena Bazar, Deogarh
2	Water Department	Municipal office, Deogarh
3	Post Office	Near Tower Chowk, Deogarh
4	Electricity Department	
5	Department of Road Development	Near Satsang Chowk, Deoghar
6	Municipal Offices	1.Deoghar Municipal Corporation, Court Road, Near VIP Chowk, Deoghar
7	Courts	1.Civil Court, Deoghar
8	PWD offices	1.Department of Road Construction, Deoghar
		2.PWD office, Circular Road, Deoghar
		3.Water Resource Department, Deoghar
9	Post Offices	1. Deoghar Head Post Office, Near Tower Chowk, Deogarh
		2.Baba Mandir Sub Post Office, Deogarh
		3.Deoghar Court Sub Post Office, Deoghar
		4.Jhaunsagarhi Sub Post Office, Jhaunsagarhi, Deogarh
10	Hospitals	1.Sadar Hospital, Near Tower Chowk
		2.MAA Lalilta Hospitals & Research Center, Bawan Bigha, Castairs Town, Deoghar
		3.Shiv Lok Hospital, K.K. Stadium, Deoghar
		4.Navjivan Hospital & Research Centre, Srikant Road, Deoghar
		5.Maa Gaytri Health Center, Bus Stand, Deoghar
		6. Parvati Devi Shishu Aspatal, Court Raod, Deoghar
11	School/Colleges	1. IGNOU Center, Deoghar
		2.Saint Francis School, Jasidih
		3.Deovalley High School, Karnibagh, Deoghar
		4.The Ramkrishna Vivekanada Vidyamandir, Jasidih
		5. Ramakrishna Mission Vidyapith, Deoghar
		6. Saint Francis School, carstairs Town, Deoghar
		7.Red Rose School, Carstairs Town, Deoghar
		8. Geeta Devi DAV Public School, Carstairs Town, Deogarh
		9.Deoghar College, Deogarh
		10. Satsang College, Satsang Nagar, Deogarh
		11.Rama Devi Bazla Mahila College, Bajla Chowk, Deoghar
		12.BIT Mesra Deoghar Campus, Jasidih
		13. Hindi Vidyapith, B.N. Jha Road, Deoghar
		14.DIPSER College of Education, Bompass Town, Deogarh

12	Main Market/ Malls	1.Central Plaza, Williams Town, Deoghar
		2. Big Bazaar, Deoghar
13	Movie Theaters	1.Eylex
		2.Shankar Talkies, Billasi Town, Deoghar
		3.Bhagwan Talkies, Deoghar
14	Banks	1.Allahabad Bank
		2.Axis Bank
		3.Bank of India
		4.Canara Bank
		5.Corporation Bank
		6.HDFC Bank
		7.IDBI Bank
		8.Indian Overseas Bank
		9.Syndicate Bank
		10.Union Bank of India
		11.Vijaya Bank
		12.Andhra Bank
		13.Bank of Baroda
		14.Bank of Maharastra
		15.Central Bank of India
		16.Dena Bank
		17. ICICI Bank
		18.Indian Bank
		19.State Bank of India
		20.UCO Bank
		21.United Bank of India
		22. Oriental Bank of Commerce
		23. Punjab National Bank
		24. Syndicate Bank
15	Tourist Places	1.Baba Baidyanath Dham, Deoghar
		2.Trikuta Parvata, Deoghar
		3.Naulakha Mandir, Deogarh
		4.Nandan Pahar, Deogarh
		5.Ramakrishna Mission Vidyapith, Deogarh
		6.Rikhia Yogashram, Deogarh
		7. Baiju Temple, Deogarh
		8. Pagla Baba Ashram, Deogarh
		9.Satsang Ashram, Deogarh
		10. Tapovan, Deogarh
		11. Shivganga, Deoghar
		12. Jalsar Childresn's Park, Deoghar
		13. Harila Jori, Deoghar

ANNEXURE – 6

DUCT ROUTES

Ward 1



Summary	
Total Route (Mtr)	13069
Primary Route (Mtr)	4267
Secondary Route (Mtr)	741
Tertiary Route (Mtr)	8061
Chambers	20

Primary Route

Secondary Route

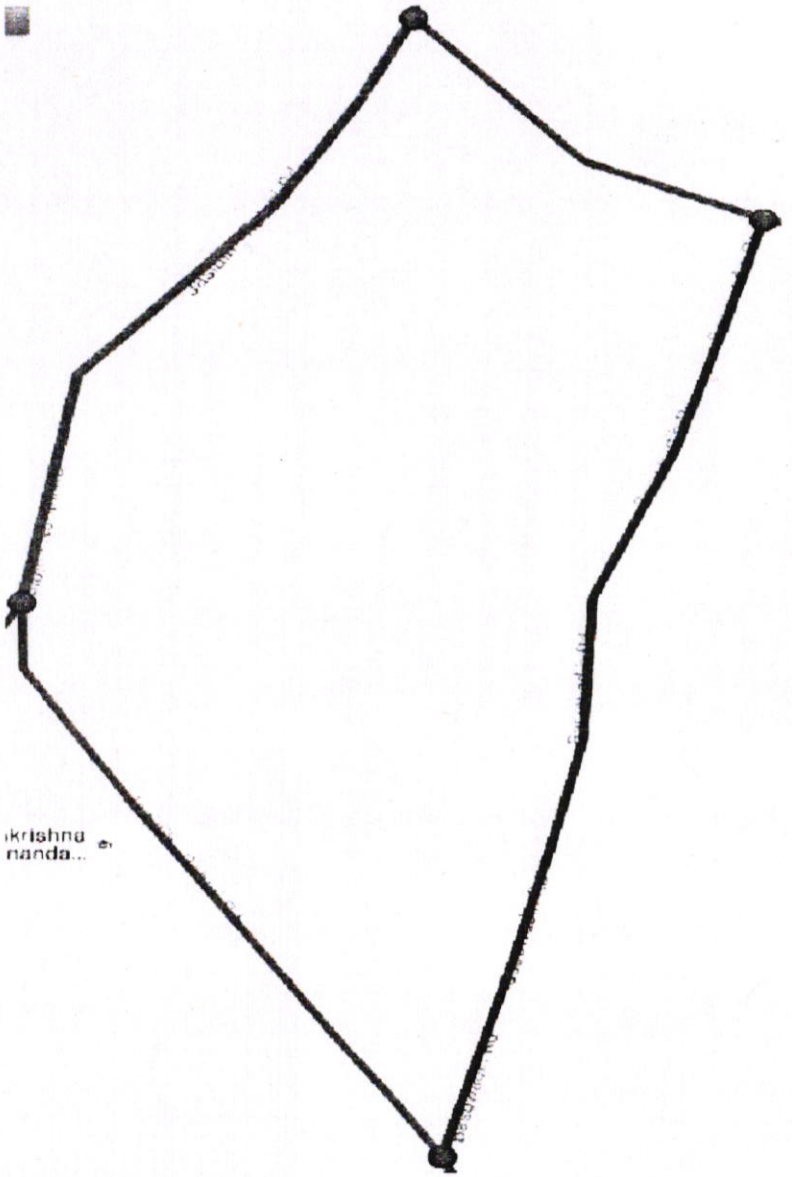
Tertiary Route

Ward No. 1

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	1-1	1-2	1210	4	P	
2	1-2	1-3	923	4	P	
3	1-3	1-4	756	4	P	
4	1-1	1-15	98	4	P	
5	1-15	2-3	1280	4	P	
6	5-11	1-1	428	4	S	
7	1-15	1-16	313	4	S	
8	1-3	1-14	774	4	T	
9	1-14	1-14	749	4	T	
10	1-4	1-5	2004	4	T	
11	1-7	1-8	150	4	T	
12	1-8	1-9	284	4	T	
13	1-9	1-10	194	4	T	
14	1-5	1-10	129	4	T	
15	1-6	1-11	124	4	T	
16	1-17	2-2	168	4	T	
17	1-17	1-18	715	4	T	
18	1-18	1-19	960	4	T	
19	1-18	1-20	1810	4	T	

Summary	
Total Route	13069
Primary Route	4267
Secondary Route	741
Tertiary Route	8061
Chambers	20

Ward 2



Summary	
Total Route (Mtr)	5177
Primary Route (Mtr)	3637
Secondary Route (Mtr)	1540
Tertiary Route (Mtr)	
Chambers	4

Primary Route

Secondary Route

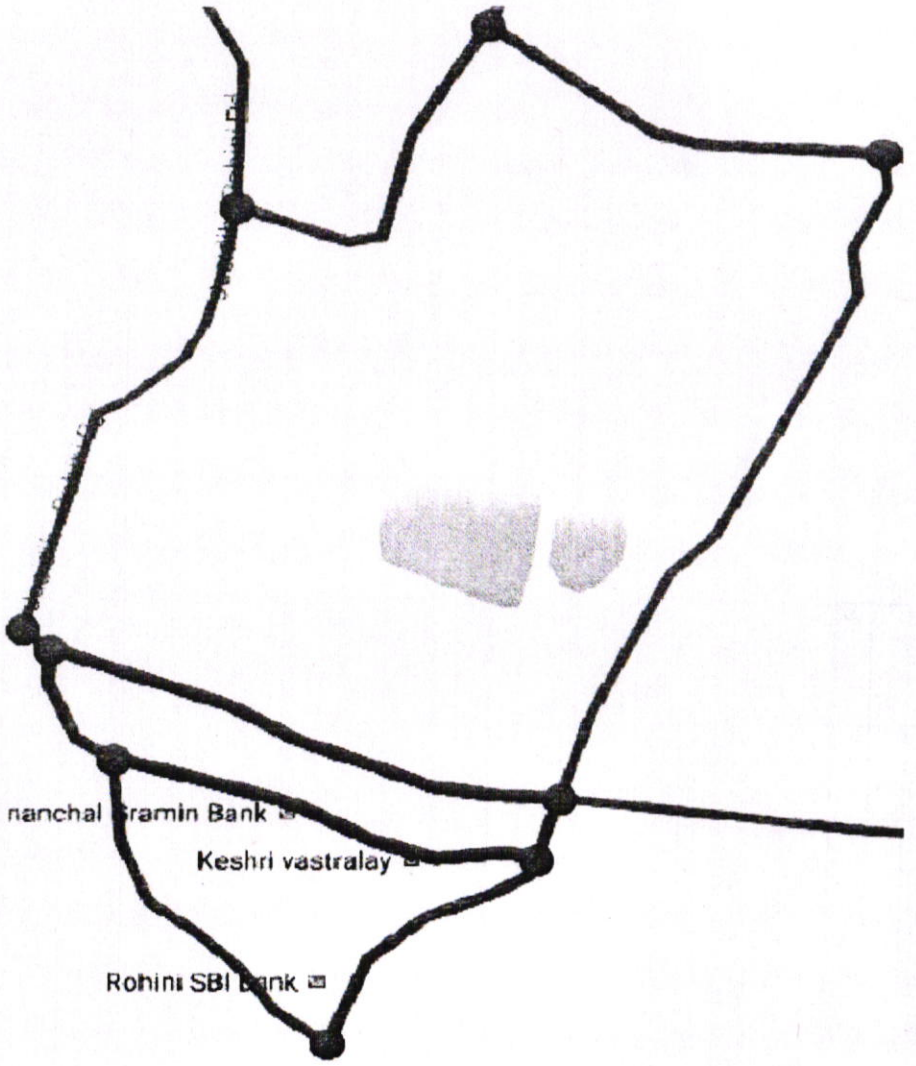
Tertiary Route

Ward No. 2

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	3-6	2-1	569	4	P	
2	2-1	2-2	1030	4	P	
3	2-2	2-3	1060	4	P	
4	2-3	2-4	542	4	P	
5	2-4	4-5	436	4	P	
6	2-1	2-4	1540	4	S	

Summary	
Total Route	5177
Primary Route	3637
Secondary Route	1540
Tertiary Route	
Chambers	4

Ward 3



Summary	
Total Route (Mtr)	2909
Primary Route (Mtr)	1899
Secondary Route (Mtr)	1010
Tertiary Route (Mtr)	
Chambers	6

Primary Route

Secondary Route

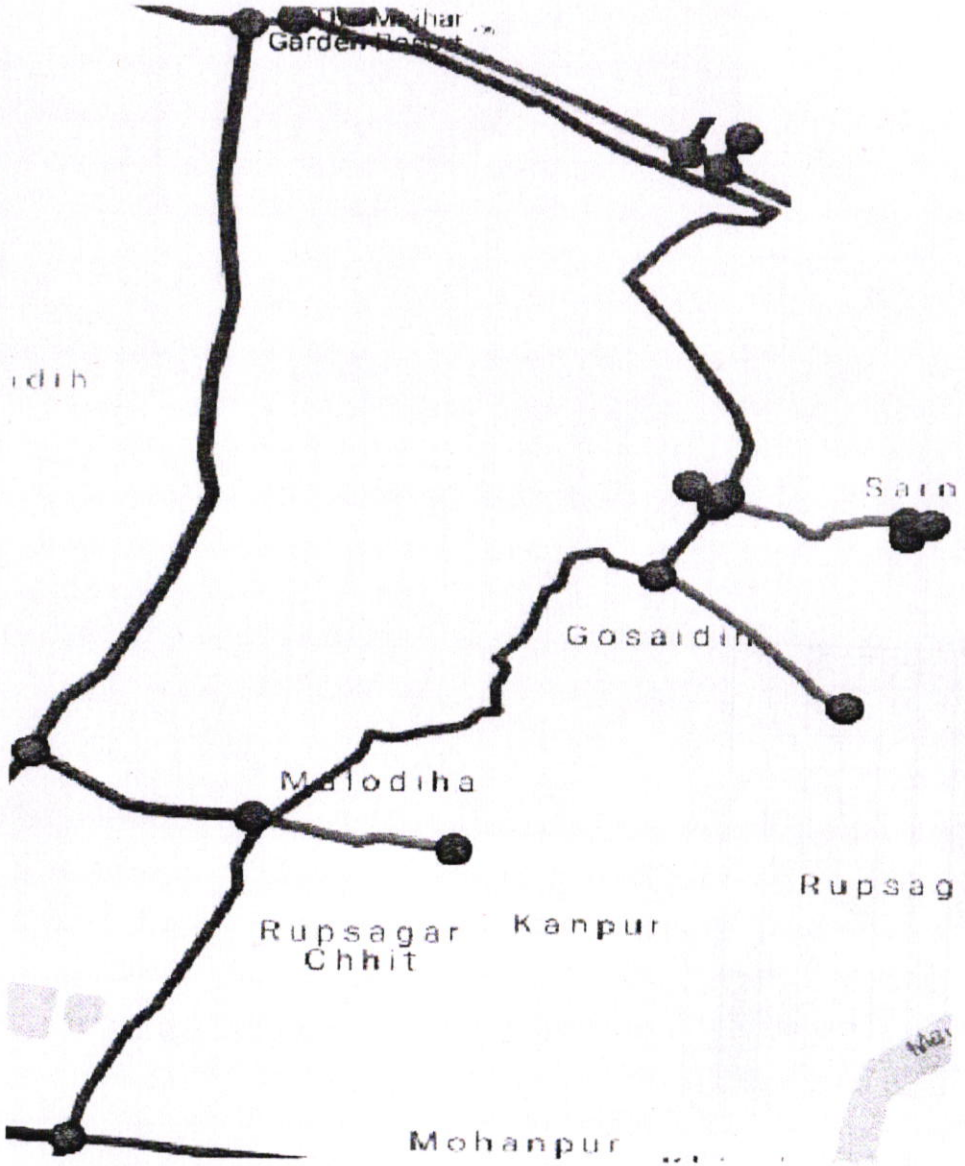
Tertiary Route

Ward No. 3

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	3-1	3-2	319	4	P	
2	3-2	3-3	414	4	P	
3	3-3	3-4	154	4	P	
4	3-4	3-5	34	4	P	
5	3-5	3-6	552	4	P	
6	3-6	4-4	426	4	P	
7	3-1	3-3	453	4	S	
8	3-4	4-1	557	4	S	

Summary	
Total Route	2909
Primary Route	1899
Secondary Route	1010
Tertiary Route	
Chambers	6

Ward 4



Summary	
Total Route (Mtr)	7712
Primary Route (Mtr)	6354
Secondary Route (Mtr)	149
Tertiary Route (Mtr)	1209
Chambers	17

Primary Route

Secondary Route

Tertiary Route

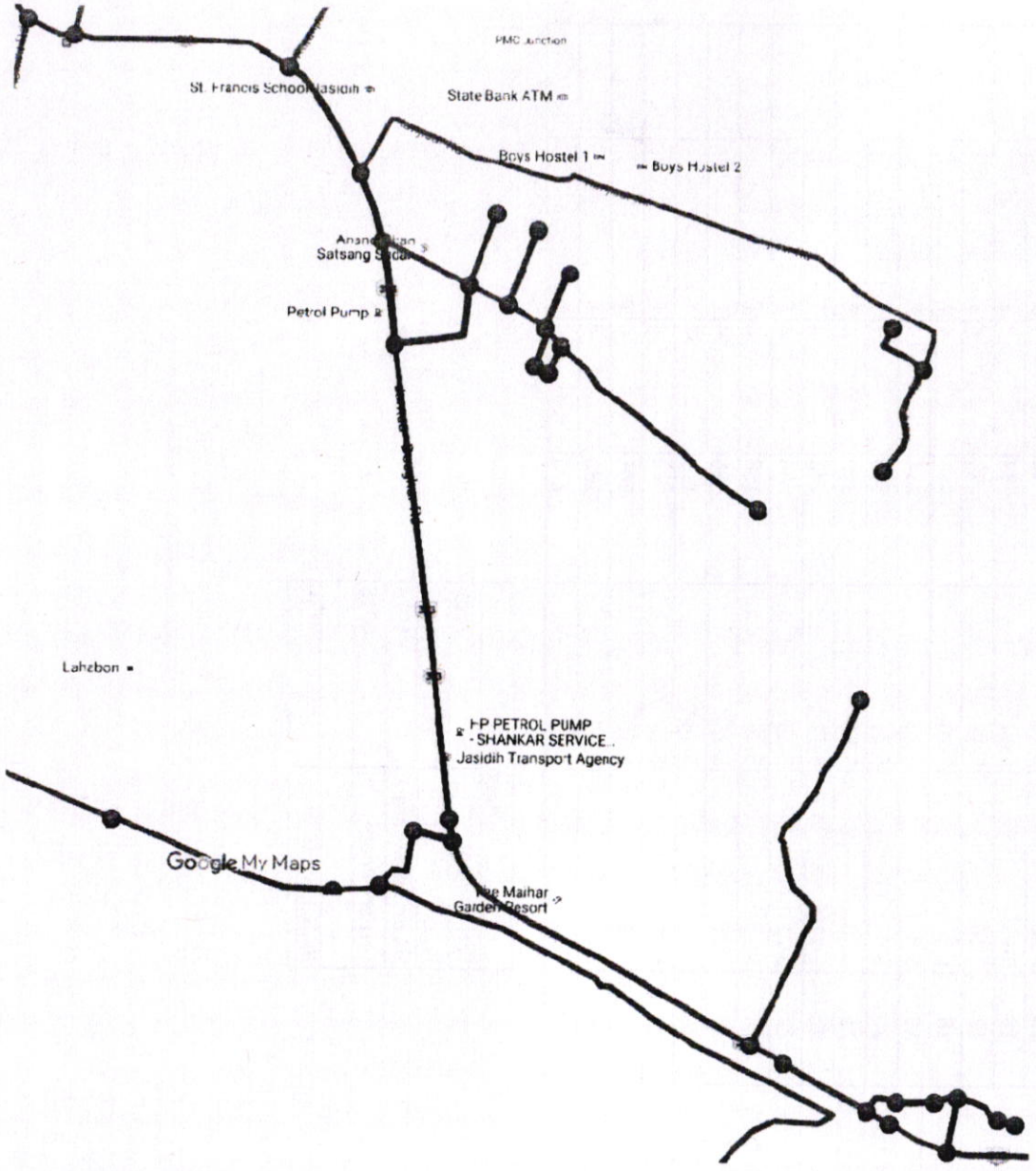
123

Ward No. 4

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	4-1	4-2	829	4	P	
2	4-2	4-6	1140	4	P	
3	4-4	4-5	1770	4	P	
4	4-4	3-6	426	4	P	
5	4-5	4-14	87	4	P	
6	4-6	4-8	193	4	P	
7	4-8	4-13	29	4	P	
8	4-13	4-14	1880	4	P	
9	4-14	4-15	149	4	S	
10	4-2	4-3	381	4	T	
11	4-6	4-7	446	4	T	
12	4-10	4-13	382	4	T	

Summary	
Total Route	7712
Primary Route	6354
Secondary Route	149
Tertiary Route	1209
Chambers	17

Ward 5



Summary	
Total Route (Mtr)	7669
Primary Route (Mtr)	1677
Secondary Route (Mtr)	1976
Tertiary Route (Mtr)	4016
Chambers	33

Primary Route

Secondary Route

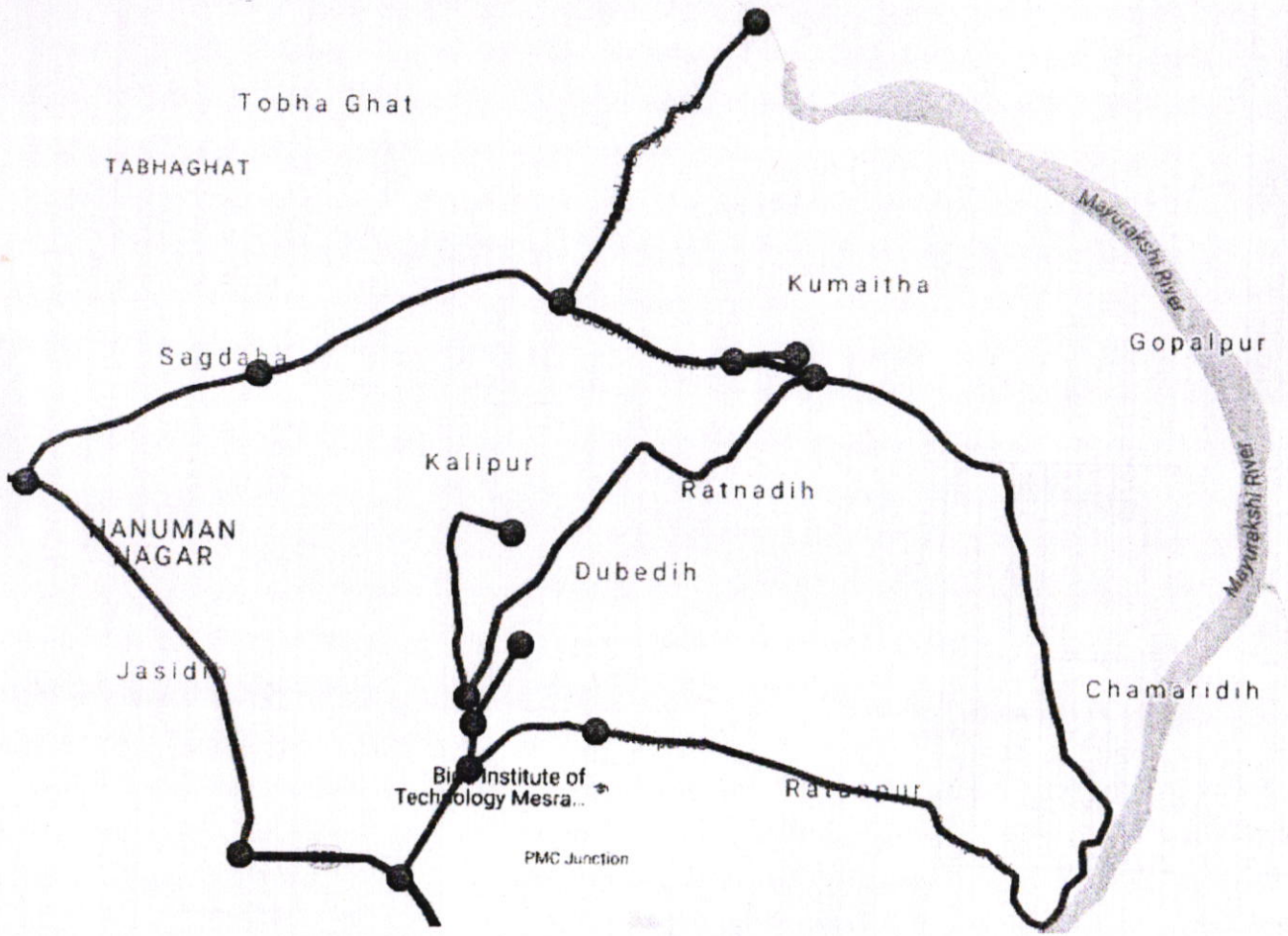
Tertiary Route

Ward No. 5

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	5-1	5-2	124	4	P	
2	5-2	5-3	50	4	P	
3	5-3	5-4	187	4	P	
4	5-4	5-5	73	4	P	
5	5-5	5-6	710	4	P	
6	5-1	8-1	533	4	P	
7	5-1	5-12	103	4	S	
8	5-3	5-18	69	4	S	
9	5-6	5-7	45	4	S	
10	5-7	5-8	928	4	S	
11	5-8	5-9	200	4	S	
12	5-9	5-10	138	4	S	
13	5-10	5-11	247	4	S	
14	5-12	5-13	91	4	S	
15	5-12	5-16	48	4	S	
16	5-13	5-14	34	4	S	
17	5-16	5-18	73	4	S	
18	5-5	5-20	761	4	T	
19	5-8	5-21	234	4	T	
20	5-9	5-21	190	4	T	
21	5-10	5-31	1340	4	T	
22	5-21	5-22	146	4	T	
23	5-21	5-23	84	4	T	
24	5-23	5-24	158	4	T	
25	5-23	5-25	86	4	T	
26	5-25	5-26	119	4	T	
27	5-25	5-28	44	4	T	
28	5-28	5-30	501	4	T	
29	5-31	5-32	130	4	T	
30	5-31	5-33	223	4	T	

Summary	
Total Route	7669
Primary Route	1677
Secondary Route	1976
Tertiary Route	4016
Chambers	33

Ward 6



Summary	
Total Route (Mtr)	8426
Primary Route (Mtr)	2500
Secondary Route (Mtr)	4158
Tertiary Route (Mtr)	1768
Chambers	12

Primary Route

Secondary Route

Tertiary Route

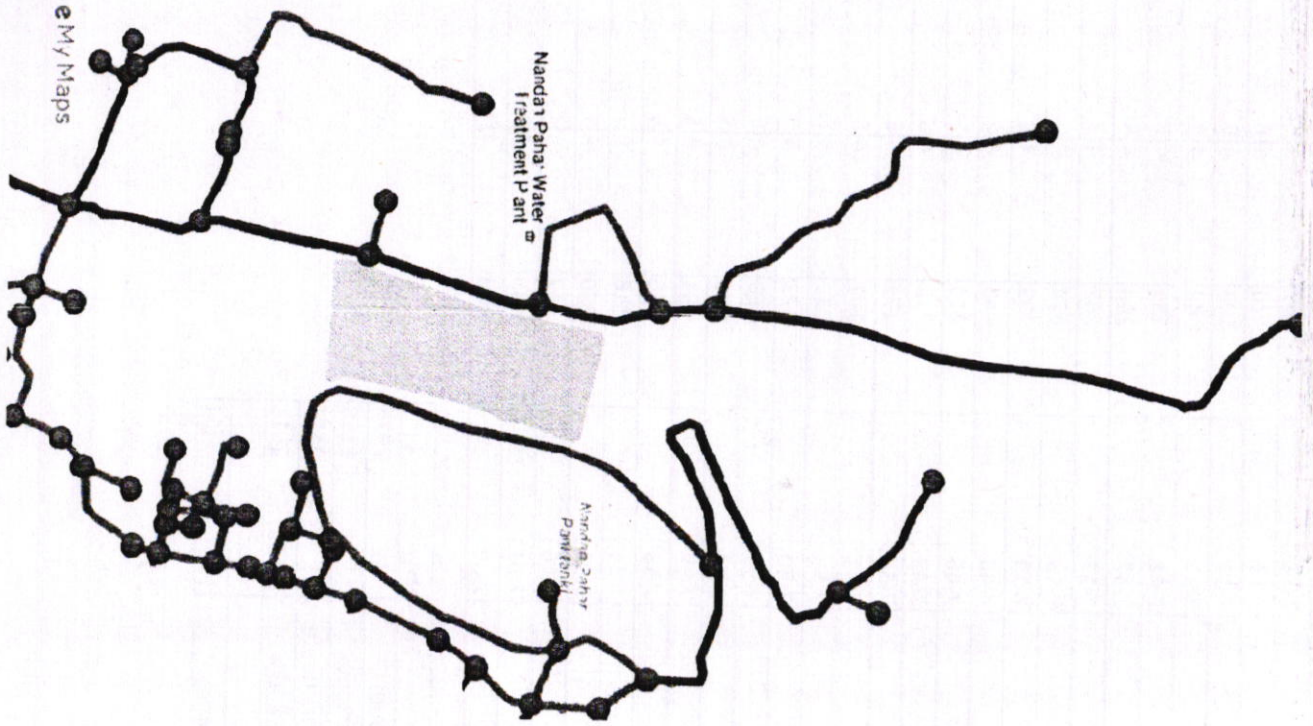
127

Ward No. 6

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	1-2	6-1	703	4	P	
2	6-1	6-2	868	4	P	
3	6-2	6-3	929	4	P	
4	6-6	6-7	224	4	S	
5	6-7	6-8	169	4	S	
6	5-11	6-4	339	4	T	
7	6-4	6-5	367	4	T	
8	6-5	6-6	3270	4	T	
9	6-4	6-9	117	4	T	
10	6-9	6-10	243	4	T	
11	6-11	6-12	630	4	T	
12	6-11	6-6	1410	4	T	

Summary	
Total Route	8426
Primary Route	2500
Secondary Route	4158
Tertiary Route	1768
Chambers	12

Ward 7



Summary	
Total Route (Mtr)	7925
Primary Route (Mtr)	1158
Secondary Route (Mtr)	4156
Tertiary Route (Mtr)	2611
Chambers	61

Primary Route

Secondary Route

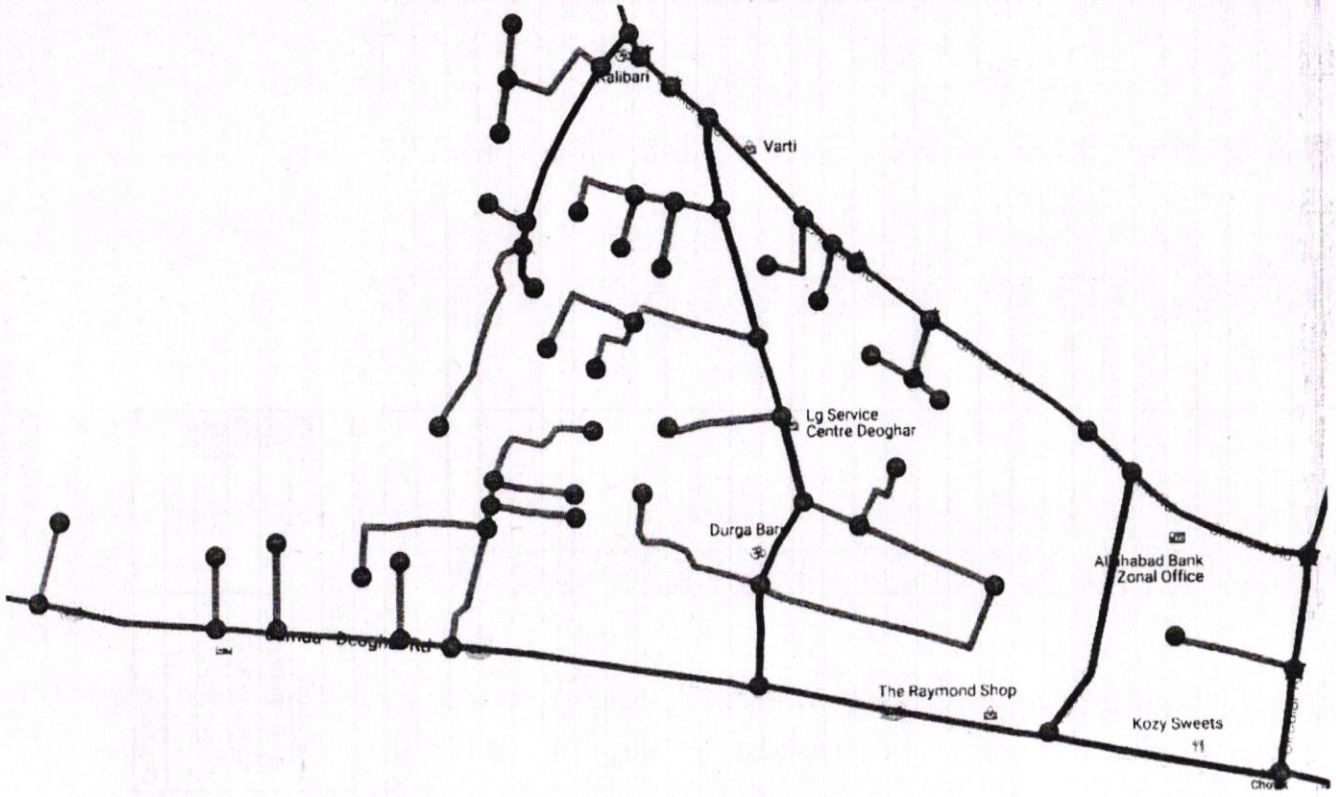
Tertiary Route

Ward No.7

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	7-1	8-53	36	4	P	
2	7-1	7-2	79	4	P	
3	7-2	7-3	54	4	P	
4	7-3	7-4	155	4	P	
5	7-4	7-5	40	4	P	
6	7-5	7-6	85	4	P	
7	7-6	7-7	54	4	P	
8	7-7	7-8	27	4	P	
9	7-8	7-9	26	4	P	
10	7-9	7-10	49	4	P	
11	7-10	7-11	63	4	P	
12	7-11	7-12	139	4	P	
13	7-12	7-13	70	4	P	
14	7-13	7-14	102	4	P	
15	7-37	7-39	44	4	P	
16	7-39	7-42	135	4	P	
17	7-1	7-37	163	4	S	
18	7-16	7-17	262	4	S	
19	7-17	7-18	674	4	S	
20	7-18	7-19	223	4	S	
21	7-42	7-43	445	4	S	
22	7-42	7-46	216	4	S	
23	7-46	7-48	18	4	S	
24	7-48	7-50	178	4	S	
25	7-50	7-51	102	4	S	
26	7-52	7-53	259	4	S	
27	7-52	7-60	123	4	S	
28	7-53	7-55	268	4	S	
29	7-55	7-56	186	4	S	
30	7-56	7-57	83	4	S	
31	7-57	7-58	956	4	S	
32	7-33	7-34	116	4	T	
33	7-21	7-17	1280	4	T	
34	7-21	7-16	157	4	T	
35	7-50	7-61	435	4	T	
36	7-57	7-59	623	4	T	

Summary	
Total Route	7925
Primary Route	1158
Secondary Route	4156
Tertiary Route	2611
Chambers	61

Ward 8



Summary	
Total Route (Mtr)	4772
Primary Route (Mtr)	2188
Secondary Route (Mtr)	1028
Tertiary Route (Mtr)	1556
Chambers	65

Primary Route

Secondary Route

Tertiary Route

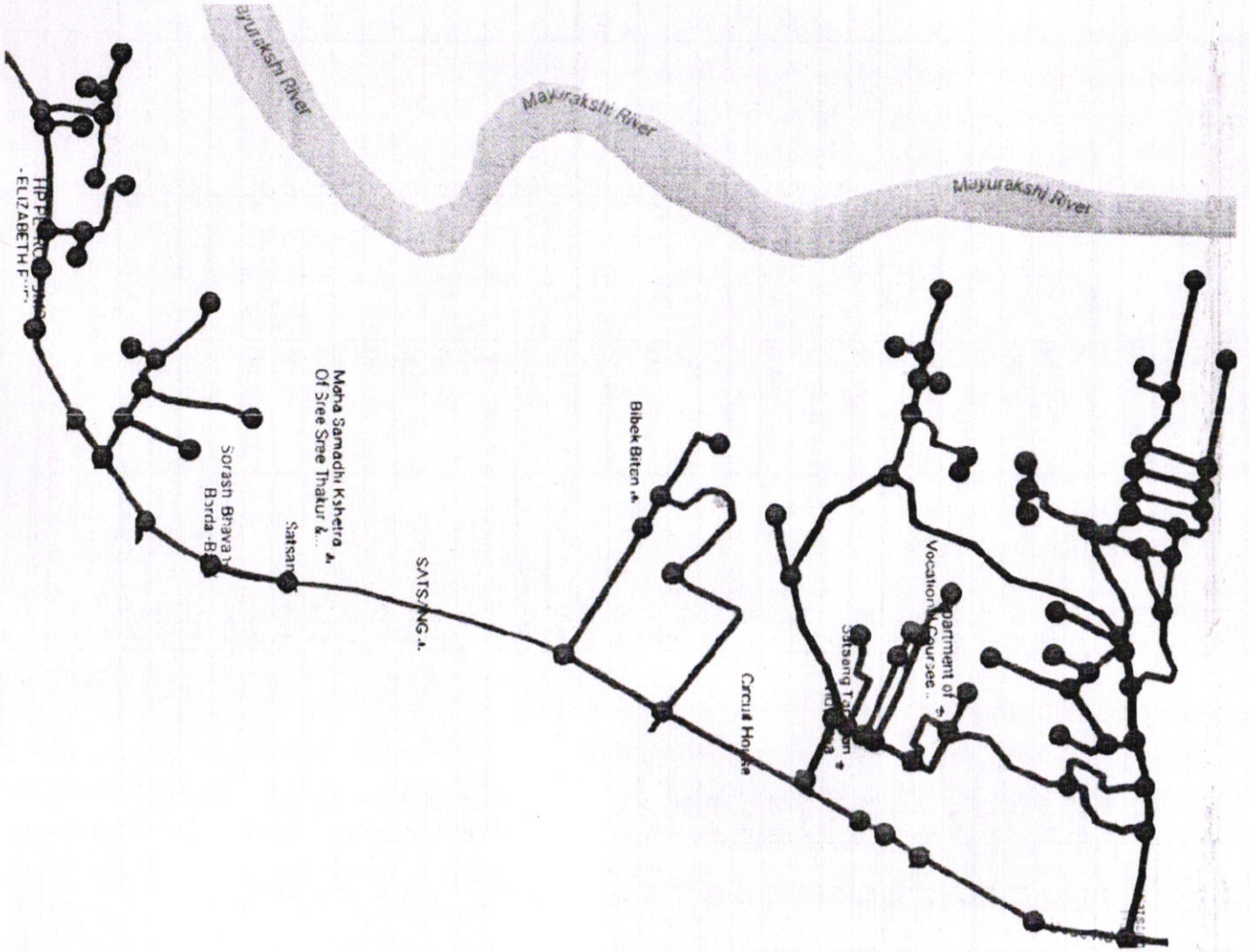
131

Ward No. 8

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	8-1	8-2	78	4	P	
2	8-2	8-3	160	4	P	
3	8-3	8-4	55	4	P	
4	8-4	8-5	109	4	P	
5	8-5	8-6	68	4	P	
6	8-6	8-18	276	4	P	
7	8-50	8-51	43	4	P	
8	8-51	8-52	38	4	P	
9	8-52	8-53	23	4	P	
10	8-48	8-50	123	4	P	
11	8-46	8-48	35	4	P	
12	8-45	8-46	28	4	P	
13	8-44	8-45	83	4	P	
14	8-43	8-44	171	4	P	
15	8-42	8-43	54	4	P	
16	8-41	8-42	177	4	P	
17	8-39	8-41	102	4	P	
18	8-37	8-38	210	4	P	
19	8-37	8-38	93	4	P	
20	8-18	8-37	262	4	P	
21	8-18	8-19	90	4	S	
22	8-19	8-23	83	4	S	
23	8-23	8-24	78	4	S	
24	8-24	8-26	72	4	S	
25	8-26	8-31	120	4	S	
26	8-31	8-50	82	4	S	
27	8-53	8-54	38	4	S	
28	8-54	8-58	154	4	S	
29	8-37	8-42	247	4	S	
30	8-58	8-60	23	4	S	
31	8-60	8-61	41	4	S	
32	8-6	8-11	112	4	T	
33	8-11	8-12	151	4	T	
34	8-15	8-17	120	4	T	
35	8-19	8-20A	158	4	T	
36	8-19	8-20	254	4	T	
37	8-20	8-21	131	4	T	
38	8-24	8-25	103	4	T	
39	8-26	8-27	120	4	T	
40	8-27	8-29	113	4	T	
41	8-54	8-55	108	4	T	
42	8-60	8-62	186	4	T	

Summary	
Total Route	4772
Primary Route	2188
Secondary Route	1028
Tertiary Route	1556
Chambers	65

Ward 9



Summary	
Total Route (Mtr)	10748
Primary Route (Mtr)	2967
Secondary Route (Mtr)	1736
Tertiary Route (Mtr)	6045
Chambers	104

Primary Route

Secondary Route

Tertiary Route

Ward No. 9

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	9-1	9-2	156	4	P	
3	9-2	9-3	220	4	P	
4	9-3	9-4	67	4	P	
5	9-4	9-5	47	4	P	
6	9-5	9-6	377	4	P	
7	9-6	9-7	192	4	P	
8	9-7	9-8	475	4	P	
9	9-8	9-9	131	4	P	
10	9-9	9-10	131	4	P	
11	9-10	9-11	130	4	P	
12	9-11	9-12	77	4	P	
13	9-12	9-13	168	4	P	
14	9-13	9-14	100	4	P	
15	9-14	9-15	64	4	P	
16	9-15	9-16	178	4	P	
17	9-16	9-17	24	4	P	
18	9-17	9-18	381	4	P	
19	9-1	13-15	85	4	P	
20	9-1	9-43	182	4	S	
21	9-43	9-44	75	4	S	
22	9-44	9-45	80	4	S	
23	9-45	9-46	92	4	S	
24	9-46	9-47	60	4	S	
25	9-47	9-48	26	4	S	
26	9-48	9-83	498	4	S	
27	9-51	9-52	76	4	S	
28	9-79	9-80	112	4	S	
29	9-79	9-81	256	4	S	
30	9-81	9-83	247	4	S	
31	9-6	9-39	335	4	T	
32	9-7	9-35	249	4	T	
33	9-17	9-20	106	4	T	
34	9-20	9-21	111	4	T	
35	9-25	9-27	126	4	T	
36	9-28	9-29	124	4	T	
37	9-30	9-31	193	4	T	
38	9-32	9-33	132	4	T	
39	9-35	9-37	59	4	T	
40	9-37	9-38	159	4	T	
41	9-37	9-39	296	4	T	
42	9-43	9-65	172	4	T	
43	9-44	9-65	189	4	T	
44	9-46	9-49	194	4	T	
45	9-48	9-92	198	4	T	
46	9-48	9-96	110	4	T	
47	9-49	9-50	90	4	T	

Ward No. 19

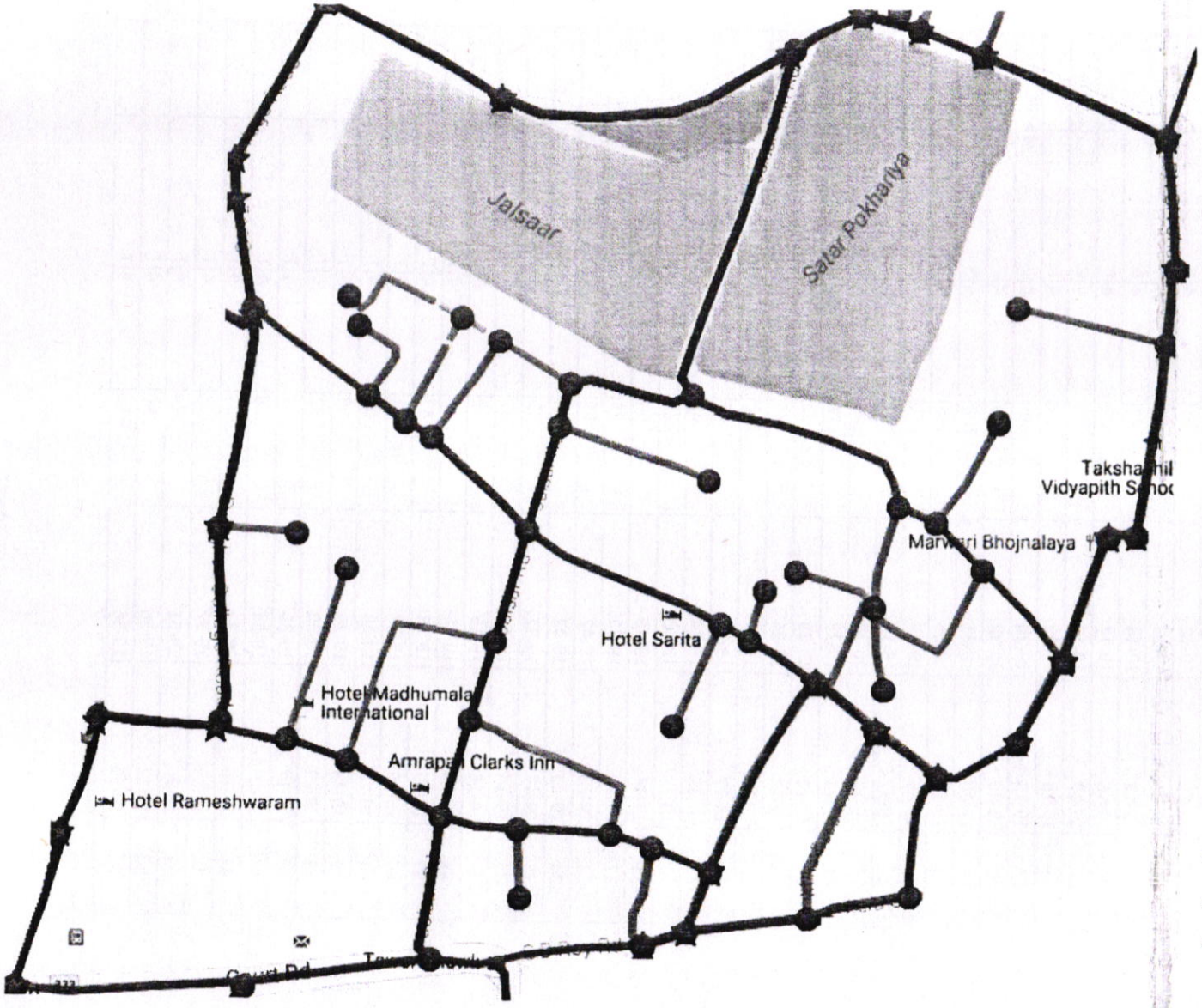
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
52	19-54	19-55	30	4	T	
53	19-56	19-58	128	4	T	
54	19-16	19-44	58	4	T	
55	19-43	19-44	26	4	T	
56	19-53	19-54	182	4	T	
57	19-47	19-48	118	4	T	
58	19-42	19-43	159	4	T	
59	19-37	19-38	107	4	T	
60	19-38	19-40	33	4	T	
61	19-40	19-41	24	4	T	
62	19-41	19-42	96	4	T	
63	19-50	19-51	108	4	T	

Summary	
Total Route	6197
Primary Route	2652
Secondary Route	1155
Tertiary Route	2390
Chambers	61

Ward No. 19

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	19-1	19-2	149	4	P	
2	19-2	19-3	230	4	P	
3	19-3	19-4	57	4	P	
4	19-4	19-5	44	4	P	
5	19-5	19-6	51	4	P	
6	19-6	19-7	149	4	P	
7	19-7	19-8	97	4	P	
8	19-8	19-9	57	4	P	
9	19-9	19-10	143	4	P	
10	19-10	19-11	20	4	P	
11	19-11	19-12	99	4	P	
12	19-12	19-13	69	4	P	
13	19-13	19-14	67	4	P	
14	19-16	19-17	161	4	P	
15	19-17	19-18	49	4	P	
16	19-18	19-19	34	4	P	
17	19-19	19-20	158	4	P	
18	19-20	20-32	156	4	P	
19	19-20	19-21	308	4	P	
20	19-24	19-35	145	4	P	
21	19-35	19-37	164	4	P	
22	19-37	13-1	245	4	P	
23	19-14	20-35	93	4	P	
24	19-21	19-22	118	4	S	
25	19-22	19-23	92	4	S	
26	19-23	19-24	94	4	S	
27	19-20	19-27	112	4	S	
28	19-27	19-34	74	4	S	
29	19-33	19-34	62	4	S	
30	19-3	19-53	273	4	S	
31	19-44	19-46	40	4	S	
32	19-52	19-53	94	4	S	
33	19-33	19-42	85	4	S	
34	19-42	19-47	80	4	S	
35	19-47	19-52	31	4	S	
36	19-14	19-15	57	4	T	
37	19-15	19-16	57	4	T	
38	19-24	19-25	53	4	T	
39	19-25	19-26	47	4	T	
40	19-26	19-27	81	4	T	
41	19-27	19-28	59	4	T	
42	19-28	19-29	69	4	T	
43	19-29	19-30	32	4	T	
44	19-17	19-30	47	4	T	
45	19-29	19-34	158	4	T	
47	19-26	19-33	181	4	T	
48	19-25	19-32	133	4	T	
49	19-9	19-61	114	4	T	
50	19-12	19-56	90	4	T	
51	19-55	19-56	50	4	T	

Ward 19



Summary	
Total Route (Mtr)	6197
Primary Route (Mtr)	2652
Secondary Route (Mtr)	1155
Tertiary Route (Mtr)	2390
Chambers	61

Primary Route

Secondary Route

Tertiary Route

Ward No. 18

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
75	18-51	18-52	41	4	T	
76	18-57	18-58	82	4	T	
77	18-59	18-60	37	4	T	
78	18-60	18-68	40	4	T	
79	18-64	18-66	89	4	T	
80	18-66	18-74	82	4	T	
81	18-68	18-71	47	4	T	
82	18-71	18-74	21	4	T	
83	18-74	18-75	32	4	T	
84	18-74	18-77	35	4	T	
85	18-77	18-78	139	4	T	
86	18-93	18-94	113	4	T	
87	18-94	18-95	23	4	T	
88	18-94	18-119	100	4	T	
89	18-95	18-96	141	4	T	
90	18-95	18-113	133	4	T	
91	18-96	18-97	40	4	T	
92	18-96	18-115	74	4	T	
93	18-97	18-98	29	4	T	
94	18-103	18-105	101	4	T	
95	18-108	18-110	86	4	T	
96	18-110	18-111	156	4	T	
97	18-110	18-117	176	4	T	
98	18-111	18-112	128	4	T	
99	18-112	18-115	104	4	T	
100	18-113	18-114	119	4	T	
101	18-113	18-115	41	4	T	
102	18-126	18-127	152	4	T	

Summary	
Total Route	9124
Primary Route	1556
Secondary Route	3421
Tertiary Route	4147
Chambers	127

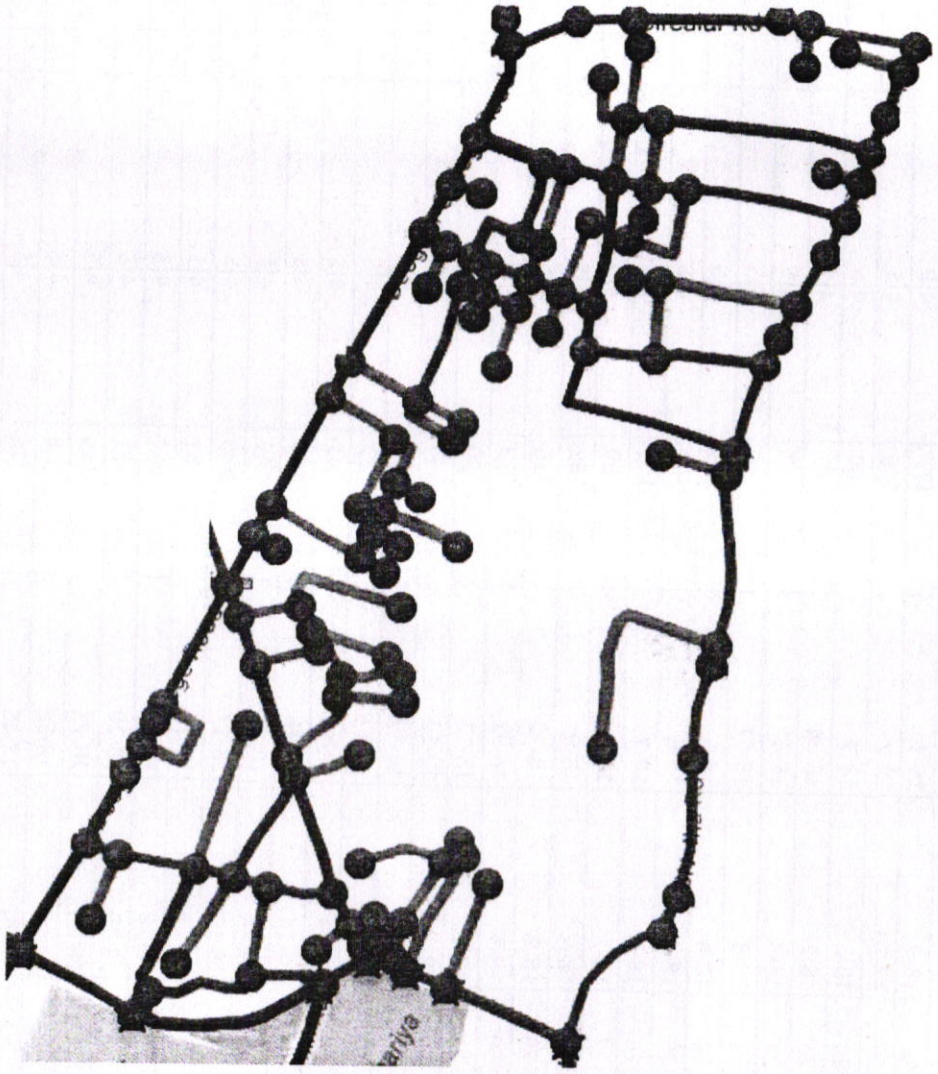
Ward No. 18

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
46	18-39	18-40	42	4	S	
47	18-40	18-41	86	4	S	
48	18-41	18-43	43	4	S	
49	18-42	18-43	29	4	S	
50	18-42	18-31	40	4	S	
51	18-43	18-44	59	4	S	
52	18-43	18-11	123	4	S	
53	18-44	18-45	94	4	S	
54	18-45	18-46	39	4	S	
55	18-52	18-59	142	4	S	
56	18-52	18-63	56	4	S	
57	18-58	18-59	54	4	S	
58	18-63	18-64	27	4	S	
59	18-110	18-113	45	4	S	
60	18-4	18-75	30	4	T	
61	18-7	18-89	118	4	T	
62	18-14	18-108	40	4	T	
63	18-17	18-112	83	4	T	
64	18-18	18-98	18	4	T	
65	18-19	18-106	149	4	T	
66	18-20	18-107	127	4	T	
67	18-26	18-128	268	4	T	
68	18-29	18-57	127	4	T	
69	18-31	18-55	158	4	T	
70	18-33	18-50	182	4	T	
71	18-35	18-46	245	4	T	
72	18-44	18-13	122	4	T	
73	18-50	18-51	45	4	T	
74	18-50	18-54	132	4	T	

Ward No. 18

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	18-21	18-22	177	4	P	
2	18-22	18-23	43	4	P	
3	18-23	18-24	162	4	P	
4	18-24	18-25	102	4	P	
5	18-24	18-27	198	4	P	
6	18-25	18-26	23	4	P	
7	18-27	18-28	27	4	P	
8	18-28	18-29	105	4	P	
9	18-29	18-30	35	4	P	
10	18-31	18-32	66	4	P	
11	18-32	18-33	47	4	P	
12	18-33	18-34	45	4	P	
13	18-34	18-35	37	4	P	
14	18-35	18-36	43	4	P	
15	18-36	18-37	58	4	P	
16	18-37	18-38	30	4	P	
17	18-38	18-39	123	4	P	
18	18-9	16-2	177	4	P	
19	17-30	18-2	116	4	S	
20	18-2	18-3	60	4	S	
21	18-2	18-64	82	4	S	
22	18-3	18-4	63	4	S	
23	18-3	18-67	35	4	S	
24	18-4	18-5	169	4	S	
25	18-5	18-6	48	4	S	
26	18-6	18-7	141	4	S	
27	18-7	18-8	39	4	S	
28	18-8	18-9	61	4	S	
29	18-9	18-10	156	4	S	
30	18-9	18-92	39	4	S	
31	18-10	18-11	20	4	S	
32	18-10	18-12	143	4	S	
33	18-11	18-12	32	4	S	
34	18-12	18-13	37	4	S	
35	18-13	18-14	92	4	S	
36	18-14	18-15	146	4	S	
37	18-15	18-16	149	4	S	
38	18-16	18-17	230	4	S	
39	18-17	18-18	61	4	S	
40	18-18	18-19	44	4	S	
41	18-19	18-20	51	4	S	
42	18-20	18-21	149	4	S	
43	18-28	18-58	264	4	S	
44	18-29	18-18	76	4	S	
45	18-34	18-45	39	4	S	

Ward 18



Summary	
Total Route (Mtr)	9124
Primary Route (Mtr)	1556
Secondary Route (Mtr)	3421
Tertiary Route (Mtr)	4147
Chambers	127

Primary Route

Secondary Route

Tertiary Route

163

Ward No. 17

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	
83	17-118	17-120	295	4	T	
84	17-120	17-121	141	4	T	
85	17-123	17-125	35	4	T	
86	17-125	17-126	26	4	T	
87	17-126	17-141	42	4	T	
88	17-127	17-128	143	4	T	
89	17-127	17-129	192	4	T	
90	17-128	17-141	31	4	T	
91	17-137	17-138	142	4	T	
92	17-137	17-140	68	4	T	
93	17-140	17-141	170	4	T	
94	17-140	17-142	27	4	T	
95	17-140	17-153	100	4	T	
96	17-142	17-144	68	4	T	
97	17-144	17-145	202	4	T	
98	17-147	17-148	86	4	T	
99	17-148	17-153	100	4	T	
100	17-149	17-153	104	4	T	

Summary	
Total Route	11595
Primary Route	1737
Secondary Route	2405
Tertiary Route	7453
Chambers	157

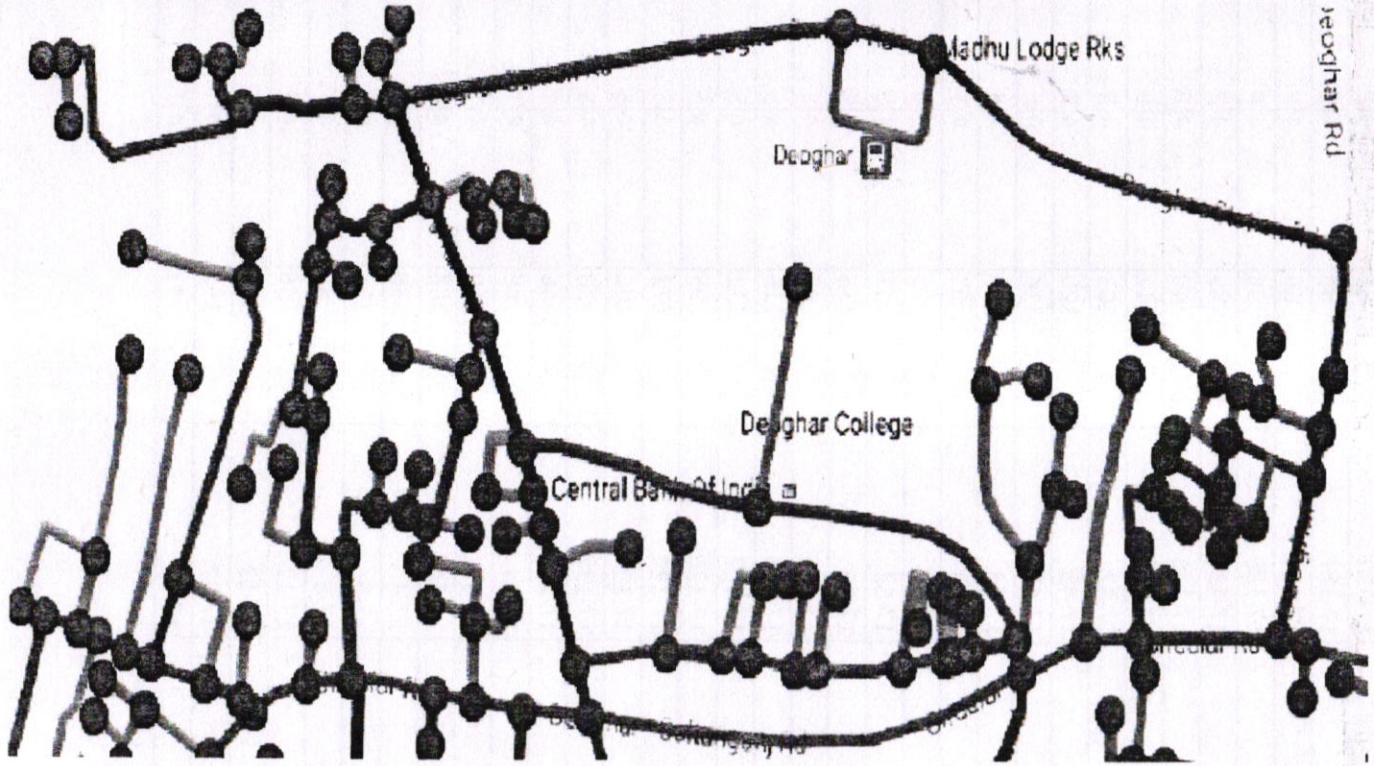
Ward No. 17

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	
42	17-14	17-16	70	4	T	
43	17-17	17-18	35	4	T	
44	17-17	17-23	92	4	T	
45	17-23	17-24	30	4	T	
46	17-24	17-26	57	4	T	
47	17-28	17-29	252	4	T	
48	17-31	17-39	356	4	T	
49	17-31	17-69	55	4	T	
50	17-32	17-36	183	4	T	
51	17-39	17-40	210	4	T	
52	17-39	17-41	288	4	T	
53	17-48	17-89	44	4	T	
54	17-51	17-53	108	4	T	
55	17-53	17-54	108	4	T	
56	17-53	17-55	68	4	T	
57	17-55	17-56	33	4	T	
58	17-55	17-57	103	4	T	
59	17-56	17-59	54	4	T	
60	17-59	17-61	28	4	T	
61	17-61	17-63	101	4	T	
62	17-63	17-64	142	4	T	
63	17-67	16-69	23	4	T	
64	17-76	17-77	61	4	T	
65	17-76	17-80	303	4	T	
66	17-87	17-110	135	4	T	
67	17-89	17-91	41	4	T	
68	17-91	17-93	119	4	T	
69	17-93	17-95	25	4	T	
70	17-95	17-97	36	4	T	
71	17-97	17-105	80	4	T	
72	17-100	17-103	115	4	T	
73	17-104	17-105	115	4	T	
74	17-105	17-106	49	4	T	
75	17-106	17-108	123	4	T	
76	17-108	17-110	27	4	T	
77	17-110	17-111	112	4	T	
78	17-112	17-113	52	4	T	
79	17-114	17-116	18	4	T	
80	17-116	17-117	45	4	T	
81	17-117	17-118	68	4	T	
82	17-118	17-123	32	4	T	

Ward No. 17

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	
1	17-16	17-17	35	4	P	
2	17-26	17-27	167	4	P	
3	17-26	17-78	65	4	P	
4	17-28	17-30	82	4	P	
5	17-30	17-31	31	4	P	
6	17-30	17-52	532	4	P	
7	17-52	17-99	139	4	P	
8	17-99	17-157	48	4	P	
9	17-104	17-112	56	4	P	
10	17-104	17-157	99	4	P	
11	17-112	17-114	69	4	P	
12	17-114	17-130	66	4	P	
13	17-130	17-134	85	4	P	
14	17-136	17-146	40	4	P	
15	17-146	17-147	141	4	P	
16	17-1	17-42	103	4	S	
17	17-41	17-48	120	4	S	
18	17-41	17-49	114	4	S	
19	17-42	17-48	132	4	S	
20	17-42	17-83	65	4	S	
21	17-49	17-51	95	4	S	
22	17-51	17-52	51	4	S	
23	17-74	17-76	135	4	S	
24	17-85	17-87	41	4	S	
25	17-104	17-105	115	4	S	
26	17-106	17-107	112	4	S	
27	17-119	17-120	295	4	S	
28	17-123	17-124	272	4	S	
29	17-125	17-139	206	4	S	
30	17-136	17-137	80	4	S	
31	17-1	17-2	546	4	T	
32	17-1	17-74	48	4	T	
33	17-2	17-3	110	4	T	
34	17-2A	17-3A	264	4	T	
35	17-3	17-4	538	4	T	
36	17-4	17-5	121	4	T	
37	17-5	17-6	54	4	T	
38	17-6	17-12	46	4	T	
39	17-12	17-13	110	4	T	
40	17-12	17-27	152	4	T	
41	17-13	17-14	47	4	T	

Ward 17



Summary	
Total Route (Mtr)	11595
Primary Route (Mtr)	1737
Secondary Route (Mtr)	2405
Tertiary Route (Mtr)	7453
Chambers	157

Primary Route

Secondary Route

Tertiary Route

Ward No. 16

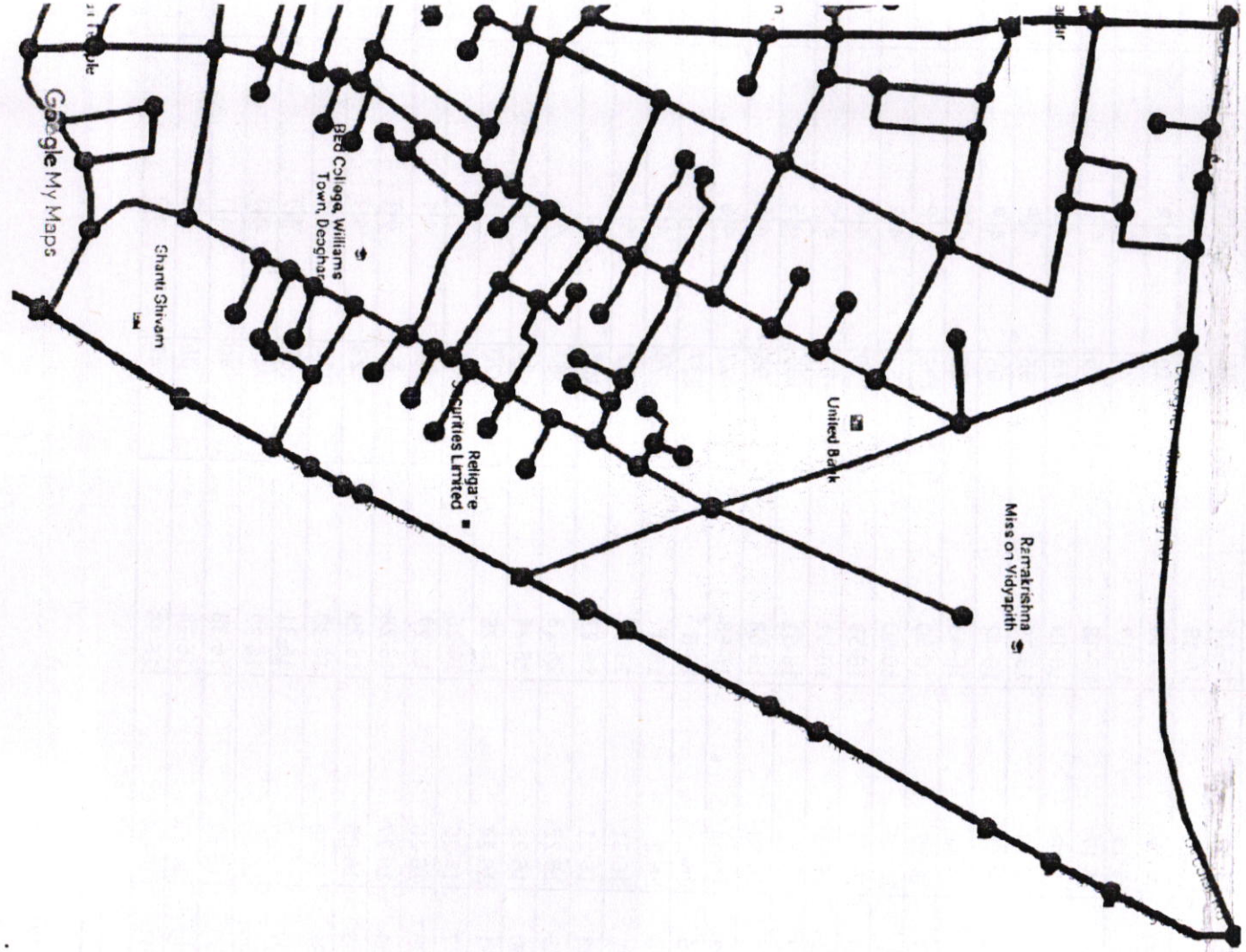
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
42	16-35	16-36	57	4	T	
43	16-36	16-37	46	4	T	
44	16-37	16-38	56	4	T	
45	16-1	16-38	84	4	T	
46	16-50	16-51	119	4	T	
47	16-45	16-50	160	4	T	
48	16-44	16-45	179	4	T	
49	16-43	16-44	41	4	T	
50	15-38	16-43	121	4	T	
51	15-39	16-46	64	4	T	
52	16-46	16-47	34	4	T	
53	16-45	16-47	103	4	T	
54	16-38	16-45	132	4	T	
55	16-34	16-73	104	4	T	
56	16-34	16-72	101	4	T	
57	16-19	16-22	150	4	T	
58	16-22	16-54	82	4	T	
59	16-54	16-55	46	4	T	
60	16-55	16-56	37	4	T	
61	16-56	13-39	57	4	T	
62	16-52	16-53	121	4	T	
63	16-14	16-63	125	4	T	
64	16-12	16-67	78	4	T	
65	16-31	16-67	76	4	T	
66	16-15	16-85	70	4	T	
67	16-13	16-85	71	4	T	
68	16-47	16-48	124	4	T	

Summary	
Total Route	5222
Primary Route	1483
Secondary Route	440
Tertiary Route	3299
Chambers	89

Ward No. 16

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	17-52	16-1	210	4	P	
2	16-1	16-2	229	4	P	
3	16-4	16-8	45	4	P	
4	16-8	16-9	43	4	P	
5	16-9	16-10	46	4	P	
6	16-10	16-11	36	4	P	
7	16-11	16-12	19	4	P	
8	16-12	16-13	17	4	P	
9	16-13	16-14	26	4	P	
10	16-14	16-15	53	4	P	
11	16-15	16-16	40	4	P	
12	16-16	16-17	25	4	P	
13	16-17	16-18	26	4	P	
14	16-18	16-19	73	4	P	
15	16-19	13-35	95	4	P	
16	16-41	16-42	93	4	P	
17	16-42	16-43	89	4	P	
18	16-35	16-50	132	4	P	
19	16-49	16-50	82	4	P	
20	16-26	16-53	30	4	P	
21	15-43	16-51	103	4	S	
22	16-32	16-51	135	4	S	
23	16-10	16-68	95	4	S	
24	16-32	16-68	77	4	S	
25	16-2	16-3	237	4	T	
26	16-2	16-4	74	4	T	
27	16-21	13-38	57	4	T	
28	16-21	16-22	106	4	T	
29	16-22	16-23	43	4	T	
30	16-23	16-24	48	4	T	
31	16-24	16-25	20	4	T	
32	16-25	16-26	19	4	T	
33	16-26	16-27	69	4	T	
34	16-27	16-28	50	4	T	
35	16-28	16-29	23	4	T	
36	16-29	16-30	19	4	T	
37	16-30	16-31	37	4	T	
38	16-31	16-32	45	4	T	
39	16-32	16-33	40	4	T	
40	16-33	16-34	36	4	T	
41	16-34	16-35	42	4	T	

Ward 16



Summary	
Total Route (Mtr)	5222
Primary Route (Mtr)	1483
Secondary Route (Mtr)	440
Tertiary Route (Mtr)	3299
Chambers	89

Primary Route

Secondary Route

Tertiary Route

Ward No. 15

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
47	15-7	15-31	187	4	T	
48	15-9	13-44	168	4	T	
49	15-9	15-11	127	4	T	
50	15-12	15-14	225	4	T	
51	15-14	15-15	64	4	T	
52	15-15	15-16	102	4	T	
53	15-19	15-20	39	4	T	
54	15-19	15-23	40	4	T	
55	15-20	15-21	101	4	T	
56	15-20	15-28	70	4	T	
57	15-23	15-24	42	4	T	
58	15-24	15-26	98	4	T	
59	15-30	15-43	128	4	T	
60	15-35	15-89	123	4	T	
61	15-38	15-103	116	4	T	
62	15-38	15-106	125	4	T	
63	15-63	15-69	123	4	T	
64	15-67	15-68	125	4	T	
65	15-67	16-53	111	4	T	
66	15-82	15-83	31	4	T	
67	15-83	15-84	31	4	T	
68	15-84	15-87	47	4	T	
69	15-87	15-89	32	4	T	
70	15-89	15-94	114	4	T	
71	15-90	15-93	111	4	T	
72	15-94	15-95	72	4	T	
73	15-93	15-102	49	4	T	
74	15-102	15-103	45	4	T	
75	15-99	15-101	118	4	T	
76	15-102	15-103	45	4	T	
77	15-103	15-106	68	4	T	
78	15-106	15-107	33	4	T	

Summary	
Total Route	6316
Primary Route	1805
Secondary Route	1494
Tertiary Route	3017
Chambers	108

Ward No. 15

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	13-1	15-1	122	4	P	
2	15-1	15-2	205	4	P	
3	15-2	15-3	28	4	P	
4	15-3	15-4	147	4	P	
5	15-4	15-5	20	4	P	
6	15-5	15-6	68	4	P	
7	15-6	15-7	35	4	P	
8	15-7	15-8	48	4	P	
9	15-8	17-147	65	4	P	
10	15-26	15-27	21	4	P	
11	15-40	15-49	39	4	P	
12	15-44	15-79	125	4	P	
13	15-44	15-90	24	4	P	
14	15-78	15-79	27	4	P	
15	15-78	15-81	52	4	P	
16	15-84	15-98	112	4	P	
17	15-89	15-90	78	4	P	
18	15-90	17-146	132	4	P	
19	15-93	15-94	76	4	P	
20	15-94	15-96	37	4	P	
21	15-96	15-98	41	4	P	
22	15-98	15-99	67	4	P	
23	15-16	15-17	62	4	S	
24	15-16	15-59	82	4	S	
25	15-26	15-78	200	4	S	
26	15-27	15-28	32	4	S	
27	15-28	15-75	91	4	S	
28	15-31	15-35	32	4	S	
29	15-38	15-39	76	4	S	
30	15-38	17-104	117	4	S	
31	15-39	15-40	154	4	S	
32	15-40	15-41	59	4	S	
33	15-41	15-42	158	4	S	
34	15-42	15-43	42	4	S	
35	15-42	15-82	128	4	S	
36	15-43	15-44	32	4	S	
37	15-59	15-60	53	4	S	
38	15-60	15-66	42	4	S	
39	15-66	15-69	42	4	S	
40	15-68	15-69	28	4	S	
41	15-75	15-76	50	4	S	
42	15-76	15-77	65	4	S	
43	15-78	15-82	117	4	S	
44	15-103	15-106	68	4	S	
45	15-2	15-12	42	4	T	
46	15-4	15-19	65	4	T	

Ward 15

Summary	
Total Route (Mtr)	6316
Primary Route (Mtr)	1805
Secondary Route (Mtr)	1494
Tertiary Route (Mtr)	3017
Chambers	108

Primary Route

Secondary Route

Tertiary Route

153

Ward No. 14

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
87	14-67	14-69	30	4	T	
88	14-58	14-67	134	4	T	
89	14-47	14-58	75	4	T	
90	14-43	14-47	38	4	T	
91	14-41	14-43	50	4	T	
92	14-38	14-41	76	4	T	
93	14-37	14-38	19	4	T	
94	14-36	14-37	41	4	T	
95	14-73	7-5	204	4	T	
96	14-1	14-3	14	4	T	
97	14-3	14-5	58	4	T	
98	14-5	14-7	103	4	T	
99	14-10	14-11	44	4	T	
100	14-11	14-14	270	4	T	
101	14-14	14-15	31	4	T	
102	14-11	14-12	23	4	T	
103	14-179	14-181	126	4	T	
104	14-176	14-190	131	4	T	
105	14-120	15-5	192	4	T	
106	17-117	14-118	126	4	T	
107	14-115	14-116	114	4	T	
108	14-018	14-109	129	4	T	
109	14-58	14-57	128	4	T	
110	8-45	14-20	105	4	T	
111	14-12	14-13	104	4	T	
112	14-41	14-45	115	4	T	
113	14-70	14-72	108	4	T	
114	7-9	14-201	197	4	T	
115	14-160	14-164	136	4	T	
116	14-111	14-112	164	4	T	
117	14-195	14-196	104	4	T	
118	14-197	14-199	217	4	T	
119	14-152	14-153	106	4	T	

Summary	
Total Route	10168
Primary Route	
Secondary Route	1191
Tertiary Route	8977
Chambers	209

Ward No. 14

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
44	14-103	15-1	70	4	T	
45	14-107	14-203	204	4	T	
46	14-180	14-181	47	4	T	
47	14-181	14-204	209	4	T	
48	14-204	7-14	37	4	T	
49	14-175	14-177	98	4	T	
50	14-169	14-175	72	4	T	
51	14-168	14-169	85	4	T	
52	14-176	7-13	101	4	T	
53	14-175	14-176	110	4	T	
54	14-162	7-11	71	4	T	
55	14-160	14-162	38	4	T	
56	14-158	14-160	47	4	T	
57	14-157	14-158	50	4	T	
58	14-150	14-157	161	4	T	
59	14-148	14-150	94	4	T	
60	14-147	14-148	22	4	T	
61	14-147	14-191	115	4	T	
62	14-191	14-197	19	4	T	
63	14-196	14-197	20	4	T	
64	14-93	13-3	156	4	T	
65	14-93	14-95	123	4	T	
66	14-95	14-97	30	4	T	
67	14-97	14-111	145	4	T	
68	14-108	14-102	36	4	T	
69	14-101	14-102	27	4	T	
70	14-99	14-101	62	4	T	
71	14-95	14-99	53	4	T	
72	14-33	14-34	54	4	T	
73	14-34	14-36	28	4	T	
74	14-36	14-87	51	4	T	
75	14-87	14-88	134	4	T	
76	14-88	14-89	26	4	T	
77	14-89	14-91	25	4	T	
78	14-91	14-93	80	4	T	
79	14-83	14-84	34	4	T	
80	14-84	14-87	22	4	T	
81	14-80	14-83	68	4	T	
82	14-80	14-79	29	4	T	
83	14-79	14-78	54	4	T	
84	14-74	7-14	52	4	T	
85	14-73	14-74	98	4	T	
86	14-69	14-73	44	4	T	

Ward No. 14

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	14-120	15-3	143	4	S	
2	14-119	14-120	119	4	S	
3	14-119	14-121	26	4	S	
4	14-121	14-123	99	4	S	
5	14-123	14-125	220	4	S	
6	14-125	14-178	20	4	S	
7	14-190	14-204	27	4	S	
8	14-179	14-190	80	4	S	
9	14-179	14-177	25	4	S	
10	14-177	14-178	17	4	S	
11	14-82	13-5	116	4	S	
12	14-82	14-83	79	4	S	
13	14-7	14-9	87	4	S	
14	14-9	14-10	30	4	S	
15	14-9	14-12	60	4	S	
16	14-183	14-184	43	4	S	
17	14-1	8-43	52	4	T	
18	14-19	8-44	126	4	T	
19	14-25	14-27	107	4	T	
20	14-132	15-8	182	4	T	
21	14-132	14-133	52	4	T	
22	14-133	14-135	22	4	T	
23	14-135	14-140	65	4	T	
24	14-140	14-142	315	4	T	
25	14-142	14-145	77	4	T	
26	14-140	14-141	156	4	T	
27	14-135	14-136	106	4	T	
28	14-133	14-134	101	4	T	
29	14-137	14-139	100	4	T	
30	14-132	14-128	136	4	T	
31	14-178	14-180	133	4	T	
32	14-180	14-183	27	4	T	
33	14-183	14-185	74	4	T	
34	14-185	14-187	89	4	T	
35	14-117	14-119	53	4	T	
36	14-115	14-117	31	4	T	
37	14-114	14-115	39	4	T	
38	14-111	14-114	71	4	T	
39	14-110	14-111	58	4	T	
40	14-108	14-110	53	4	T	
41	14-107	14-108	58	4	T	
42	14-105	14-107	45	4	T	
43	14-103	14-105	36	4	T	

Ward 14

Summary	
Total Route (Mtr)	10168
Primary Route (Mtr)	
Secondary Route (Mtr)	1191
Tertiary Route (Mtr)	8977
Chambers	209

Primary Route

Secondary Route

Tertiary Route

Ward No. 13

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
97	13-75	13-115	73	4	T	
98	13-135	13-152	177	4	T	
99	13-32	13-89	106	4	T	
100	13-33	13-90	264	4	T	
101	13-57	13-58	84	4	T	
102	13-100	13-101	151	4	T	
103	13-105	13-108	152	4	T	
104	13-21	13-111	144	4	T	
105	13-23	13-109	108	4	T	
106	13-109	13-110	102	4	T	
107	13-108	13-109	82	4	T	
108	13-26	13-108	110	4	T	
109	13-28	13-105	157	4	T	
110	13-100	13-105	40	4	T	
111	13-95	13-99	136	4	T	
112	13-86	13-88	167	4	T	
113	13-76	13-77	117	4	T	
114	13-69	13-70	120	4	T	
115	13-70	13-71	72	4	T	
116	13-71	13-72	29	4	T	
117	13-72	13-75	124	4	T	
118	13-82	13-85	134	4	T	
119	13-112	13-113	138	4	T	
120	13-12	13-153	154	4	T	
121	13-136	13-145	26	4	T	
122	13-147	13-148 Additional	166	4	T	
123	13-144	13-145	65	4	T	
124	13-144	13-146	23	4	T	
125	13-142	13-146	55	4	T	
126	13-16	13-142	33	4	T	

Summary	
Total Route	11036
Primary Route	3072
Secondary Route	2299
Tertiary Route	5665
Chambers	155

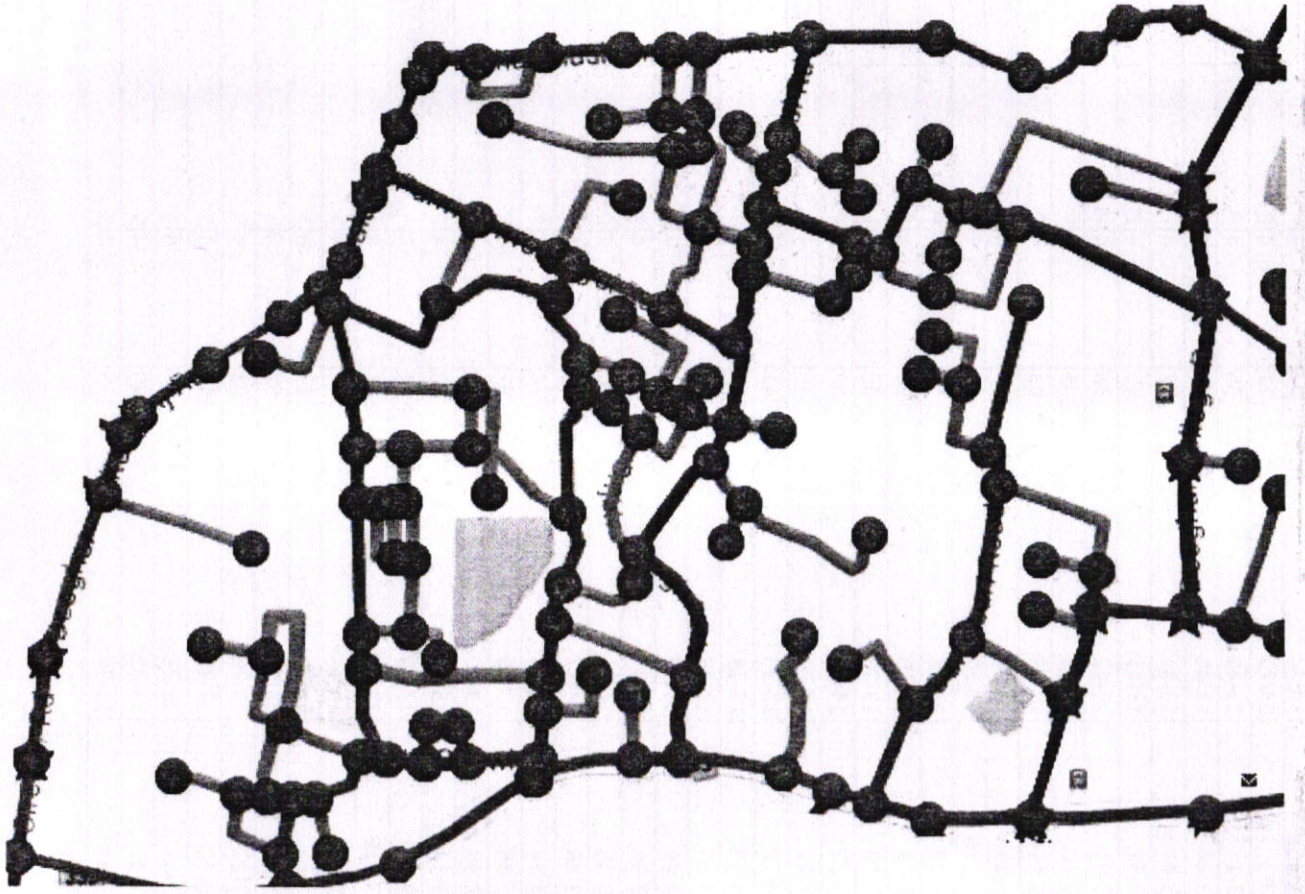
Ward No. 13

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
49	13-40	13-64	99	4	S	
50	13-62	13-64	30	4	S	
51	13-61	13-62	42	4	S	
52	13-59	13-61	34	4	S	
53	13-57	13-59	29	4	S	
54	13-56	13-57	68	4	S	
55	13-124	13-125	66	4	S	
56	13-137	13-138	38	4	S	
57	13-139	13-140	36	4	S	
58	13-31	13-95	207	4	S	
59	13-91	13-93	52	4	S	
60	13-93	13-96	74	4	S	
61	13-90	13-95	36	4	S	
62	13-90	13-91	21	4	S	
63	13-61	13-97	97	4	S	
64	13-96	13-97	26	4	S	
65	13-56	13-80	82	4	S	
66	13-80	13-84	42	4	S	
67	13-84	13-85	115	4	S	
68	13-85	13-112	149	4	S	
69	13-20	13-112	77	4	S	
70	13-4	13-52	106	4	T	
71	13-44	13-45 additional	118	4	T	
72	13-50	13-51	178	4	T	
73	13-50	13-60	104	4	T	
74	13-52	13-53	84	4	T	
75	13-53	13-54	114	4	T	
76	13-53	13-68	18	4	T	
77	13-55	13-68	101	4	T	
78	13-55	13-56	77	4	T	
79	13-69	13-119	138	4	T	
80	13-7	13-119	20	4	T	
81	13-119	13-120	112	4	T	
82	13-119	13-121	80	4	T	
83	13-121	13-123	118	4	T	
84	13-123	13-151	116	4	T	
85	13-121	13-122	60	4	T	
86	13-122	13-126	53	4	T	
87	13-75	13-125	114	4	T	
88	13-126	13-128	128	4	T	
89	13-128	13-135	34	4	T	
90	13-135	13-136	93	4	T	
91	13-136	13-137	38	4	T	
92	13-137	13-139	42	4	T	
93	13-139	13-141	67	4	T	
94	13-114	13-141	49	4	T	
95	13-113	13-114	84	4	T	
96	13-113	13-115	39	4	T	

Ward No. 13

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	13-13	13-14	102	4	P	
2	13-12	13-13	167	4	P	
3	13-11	13-12	63	4	P	
4	13-10	13-11	25	4	P	
5	13-9	13-10	83	4	P	
6	13-8	13-9	83	4	P	
7	13-7	13-8	49	4	P	
8	13-6	13-7	36	4	P	
9	13-5	13-6	67	4	P	
10	13-4	13-5	26	4	P	
11	13-3	13-4	47	4	P	
12	13-2	13-3	52	4	P	
13	13-1	13-2	21	4	P	
14	13-1	13-45	46	4	P	
15	13-44	13-45	65	4	P	
16	13-43	13-44	77	4	P	
17	13-42	13-43	45	4	P	
18	13-41	13-42	30	4	P	
19	13-40	13-41	105	4	P	
20	13-114	13-15	93	4	P	
21	13-115	13-16	267	4	P	
22	13-116	13-17	111	4	P	
23	13-17	13-18	153	4	P	
24	13-18	13-19	99	4	P	
25	13-19	13-20	43	4	P	
26	13-20	13-21	102	4	P	
27	13-21	13-22	49	4	P	
28	13-22	13-23	41	4	P	
29	13-23	13-24	61	4	P	
30	13-24	13-25	99	4	P	
31	13-29	13-30	151	4	P	
32	13-34	13-35	92	4	P	
33	13-35	13-36	60	4	P	
34	13-36	13-37	43	4	P	
35	13-37	13-38	74	4	P	
36	13-38	13-39	91	4	P	
37	13-39	13-40	125	4	P	
38	13-143	15-17	88	4	P	
39	13-12	13-153	154	4	S	
40	13-119	13-120	112	4	S	
41	13-7	13-119	20	4	S	
42	13-25	13-26	121	4	S	
43	13-26	13-27	87	4	S	
44	13-27	13-29	88	4	S	
45	13-30	13-31	159	4	S	
46	13-31	13-32	86	4	S	
47	13-32	13-33	29	4	S	
48	13-33	13-34	135	4	S	

Ward 13



Summary	
Total Route (Mtr)	11036
Primary Route (Mtr)	3072
Secondary Route (Mtr)	2299
Tertiary Route (Mtr)	5665
Chambers	155

Primary Route

Secondary Route

Tertiary Route

Ward No. 12

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
99	12-68	12-67	43	4	T	
100	12-70	12-73	175	4	T	
101	12-66	12-70	144	4	T	
109	12-91	12-129	160	4	T	
110	12-92	12-130	128	4	T	
112	12-127	12-128	114	4	T	
119	12-112	12-122	100	4	T	
120	12-113	12-123	101	4	T	
133	12-150	12-23	112	4	T	
136	12-95	12-96	111	4	T	
152	12-144	12-160	111	4	T	
156	12-158	12-159	180	4	T	
157	12-159	12-166	83	4	T	
158	12-166	12-18	64	4	T	
169	12-40	12-44	79	4	T	
170	12-44	12-65	90	4	T	
171	12-65	12-57	54	4	T	
172	12-56	12-57	46	4	T	
174	12-65	12-63	74	4	T	
175	12-62	12-63	34	4	T	
176	12-60	12-62	119	4	T	
185	12-48	12-50	104	4	T	
186	12-43	12-44	30	4	T	
187	12-43	12-50	75	4	T	
188	12-50	12-51	46	4	T	
189	12-85	12-65	114	4	T	
191	12-86	12-89	156	4	T	
			9128			

Summary	
Total Route	9128
Primary Route	2255
Secondary Route	1075
Tertiary Route	5798
Chambers	165

Ward No. 12

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
52	12-81	12-83	104	4	T	
53	12-83	12-84	106	4	T	
54	12-83	12-89	125	4	T	
55	12-89	12-90	76	4	T	
56	12-90	12-91	29	4	T	
57	12-91	12-92	67	4	T	
58	12-92	12-93	50	4	T	
59	12-93	12-94	51	4	T	
60	12-31	12-94	50	4	S	
61	12-71	12-95	70	4	S	
62	12-95	12-98	30	4	S	
63	12-98	12-100	34	4	S	
64	12-100	12-112	50	4	S	
65	12-112	12-113	21	4	S	
66	12-109	12-113	34	4	S	
67	12-109	12-114	36	4	S	
68	12-114	12-119	28	4	S	
69	12-119	12-120	28	4	S	
70	12-120	12-146	36	4	S	
71	12-141	12-146	17	4	S	
72	12-141	12-142	36	4	S	
73	12-142	12-144	19	4	S	
74	12-144	12-150	33	4	S	
75	12-22	12-150	64	4	S	
76	12-7	12-40	110	4	T	
77	12-40	12-41	37	4	T	
78	12-41	12-45	36	4	T	
79	12-45	12-48	34	4	S	
80	12-48	12-53	31	4	T	
81	12-53	12-151	127	4	T	
82	12-151	12-152	31	4	T	
83	12-152	12-155	43	4	T	
84	12-155	12-120	91	4	T	
85	12-94	12-132	94	4	T	
86	12-132	12-134	34	4	T	
87	12-134	12-135	68	4	T	
88	12-135	12-136	144	4	T	
89	12-136	12-139	25	4	T	
90	12-139	12-141	76	4	T	
91	12-126	12-134	230	4	T	
92	12-121	12-126	111	4	T	
93	12-95	12-121	140	4	T	
94	12-121	12-124	18	4	T	
95	12-124	12-127	52	4	T	
96	12-127	12-90	175	4	T	
97	12-24	12-70	110	4	T	
98	12-70	12-68	53	4	T	

Ward No. 12

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	13-20	12-1	69	4	P	
2	12-1	12-2	110	4	P	
3	12-2	12-3	70	4	P	
4	12-3	12-4	51	4	P	
5	12-4	12-5	50	4	P	
6	12-5	12-6	48	4	P	
7	12-6	12-7	79	4	P	
8	12-7	12-8	98	4	P	
9	12-8	12-9	50	4	P	
10	12-9	12-10	80	4	P	
11	12-10	12-11	18	4	P	
12	12-11	12-12	75	4	P	
13	12-12	12-13	17	4	P	
14	12-13	12-14	134	4	P	
15	12-14	12-15	40	4	P	
16	12-15	12-16	15	4	P	
17	12-16	12-17	53	4	P	
18	12-17	12-18	102	4	P	
19	12-18	12-19	34	4	P	
20	12-19	12-20	36	4	P	
21	12-20	12-21	36	4	P	
22	12-21	12-22	59	4	P	
23	12-22	12-23	69	4	P	
24	12-23	12-24	33	4	P	
25	12-24	12-25	130	4	P	
26	12-25	12-26	31	4	P	
27	12-26	12-27	19	4	P	
28	12-27	12-28	47	4	P	
29	12-28	12-29	20	4	P	
30	12-29	12-30	63	4	P	
31	12-30	12-31	121	4	P	
32	12-31	12-32	121	4	P	
33	12-32	12-33	32	4	P	
34	12-33	12-34	43	4	P	
35	12-34	12-35	56	4	P	
36	12-35	12-36	80	4	P	
37	12-36	20-30	66	4	P	
39	12-2	12-38	130	4	T	
43	13-22	12-66	133	4	T	
44	12-66	12-67	227	4	T	
45	12-67	12-71	112	4	T	
46	12-73	12-74	169	4	S	
47	12-72	12-73	88	4	S	
48	12-71	12-72	40	4	S	
49	12-72	12-75	111	4	T	
50	12-75	12-78	34	4	T	
51	12-78	12-81	118	4	T	

Ward 12

Summary	
Total Route (Mtr)	9128
Primary Route (Mtr)	2255
Secondary Route (Mtr)	1075
Tertiary Route (Mtr)	5798
Chambers	165

Primary Route

Secondary Route

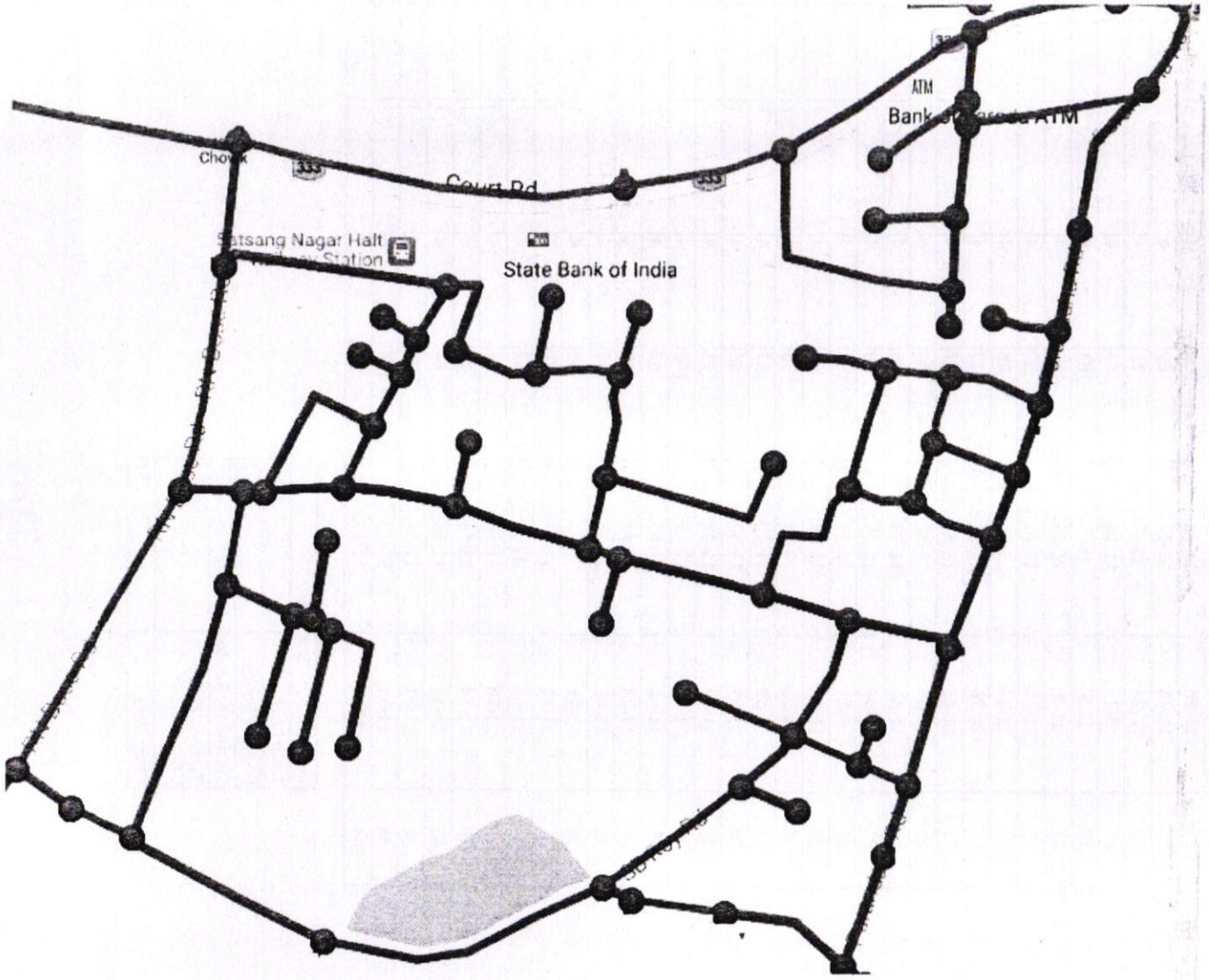
Tertiary Route

Ward No. 11

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	12-10	11-1	93	4	P	
2	11-1	11-2	63	4	P	
3	11-2	11-3	22	4	P	
4	11-3	11-4	200	4	P	
5	11-4	11-5	146	4	P	
6	11-5	11-6	47	4	P	
7	11-6	9-3	46	4	P	
8	11-15	11-16	15	4	S	
9	11-16	11-17	53	4	S	
10	11-17	11-18	77	4	S	
11	11-18	11-19	95	4	S	
12	11-19	11-20	19	4	S	
13	11-20	11-23	100	4	S	
14	11-23	11-24	60	4	S	
15	11-24	12-7	75	4	S	
16	9-2	11-15	43	4	S	
17	11-5	11-7	183	4	T	
18	11-3	11-27	116	4	T	
19	11-27	11-25	50	4	T	
20	11-25	11-24	86	4	T	
21	11-16	11-31	117	4	T	
22	11-17	11-31	47	4	T	
23	11-31	11-32	40	4	T	
24	11-32	11-34	26	4	T	
25	11-34	11-36	38	4	T	
26	9-1	11-36	156	4	T	
27	11-36	11-38	67	4	T	
28	11-30	11-39	58	4	T	
29	11-39	11-40	57	4	T	
30	11-19	11-42	50	4	T	
31	11-40	11-42	71	4	T	
32	11-42	11-43	143	4	T	
33	11-44	11-45	46	4	T	
34	11-23	11-44	108	4	T	
35	11-45	11-46	42	4	T	
36	11-47	12-4	65	4	T	
37	11-46	11-47	46	4	T	
38	11-54	12-1	117	4	T	
39	13-18	11-56	47	4	T	
40	11-54	11-56	17	4	T	
41	11-52	11-54	64	4	T	
42	11-51	11-52	49	4	T	
43	11-51	13-17	188	4	T	
44	11-7	11-15	63	4	T	

Summary	
Total Route	3311
Primary Route	617
Secondary Route	537
Tertiary Route	2157
Chambers	57

Ward 11



Summary	
Total Route (Mtr)	3311
Primary Route (Mtr)	617
Secondary Route (Mtr)	537
Tertiary Route (Mtr)	2157
Chambers	57

Primary Route

Secondary Route

Tertiary Route

Ward No. 10

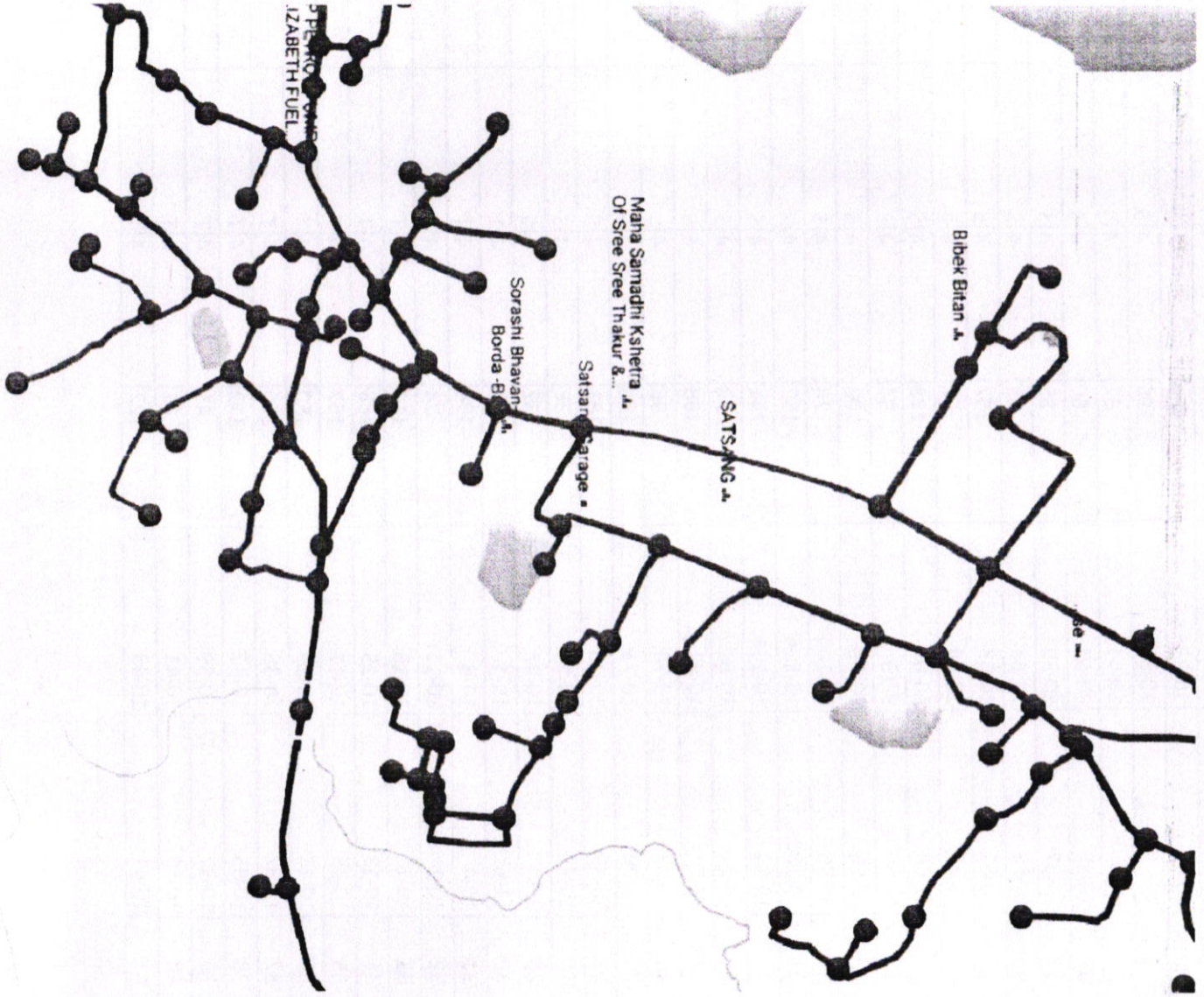
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
42	10-43	10-44	198	4	T	
43	10-44	10-45	22	4	T	
44	10-45	10-47	21	4	T	
45	10-47	10-51	67	4	T	
46	10-51	10-52	24	4	T	
47	10-52	10-53	122	4	T	
48	10-104	10-105	240	4	T	
49	10-74	10-78	99	4	T	
50	10-78	10-81	233	4	T	
51	10-71	10-73	92	4	T	
52	10-71	10-75	146	4	T	
53	10-75	10-77	198	4	T	
54	10-67	10-70	114	4	T	
55	10-66	10-67	99	4	T	
56	10-64	10-66	141	4	T	
57	10-70	10-72	175	4	T	
58	10-90	10-92	84	4	T	
59	10-24	10-25	130	4	T	
60	10-26	10-27	124	4	T	
61	9-6	10-24	158	4	T	
62	10-30	10-31	175	4	T	
63	10-43	10-44	106	4	T	
64	9-9	10-54	107	4	T	
65	10-55	10-56	101	4	T	
66	10-96	10-97	102	4	T	
67	10-78	10-79	136	4	T	

Summary	
Total Route	8173
Primary Route	0
Secondary Route	3307
Tertiary Route	4866
Chambers	103

Ward No. 10

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	10-1	10-2	24	4	S	
2	10-2	10-3	176	4	S	
3	10-3	11-4	78	4	S	
4	10-1	10-22	75	4	S	
5	10-22	10-24	167	4	S	
6	10-24	10-26	103	4	S	
7	10-26	10-30	190	4	S	
8	10-30	10-32	165	4	S	
9	10-32	10-33	166	4	S	
10	9-8	10-33	196	4	S	
11	9-10	10-55	32	4	S	
12	10-55	10-57	60	4	S	
13	10-57	10-59	55	4	S	
14	10-59	10-61	23	4	S	
15	10-61	10-63	157	4	S	
16	10-63	10-64	57	4	S	
17	10-64	10-65	198	4	S	
18	10-96	9-13	54	4	S	
19	10-96	10-98	108	4	S	
20	10-98	10-100	78	4	S	
21	10-100	10-104	162	4	S	
22	10-84	10-104	261	4	S	
23	10-82	10-84	77	4	S	
24	10-74	10-82	168	4	S	
25	10-73	10-74	96	4	S	
26	10-70	10-71	130	4	S	
27	10-63	10-70	181	4	S	
28	10-72	10-90	38	4	S	
29	9-12	10-92	32	4	S	
30	11-6	10-1	283	4	T	
31	10-4	10-6	194	4	T	
32	10-2	10-11	74	4	T	
33	10-11	10-13	114	4	T	
34	10-13	10-15	188	4	T	
35	10-15	10-17	167	4	T	
36	10-17	10-19	150	4	T	
37	10-32	10-35	166	4	T	
38	10-35	10-37	112	4	T	
39	10-37	10-39	41	4	T	
40	10-39	10-41	41	4	T	
41	10-41	10-43	122	4	T	

Ward 10



Summary	
Total Route (Mtr)	8173
Primary Route (Mtr)	0
Secondary Route (Mtr)	3307
Tertiary Route (Mtr)	4866
Chambers	103

Primary Route

Secondary Route

Tertiary Route

136

Ward No. 9

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
48	9-49	9-56	108	4	T	
49	9-50	9-51	48	4	T	
50	9-52	9-53	37	4	T	
51	9-52	9-59	122	4	T	
52	9-53	9-54	36	4	T	
53	9-53	9-60	117	4	T	
54	9-54	9-55	181	4	T	
55	9-54	9-61	115	4	T	
56	9-57	9-58	52	4	T	
57	9-57	9-92	29	4	T	
58	9-58	9-59	38	4	T	
59	9-59	9-60	38	4	T	
60	9-60	9-61	41	4	T	
61	9-61	9-62	104	4	T	
62	9-62	9-64	189	4	T	
63	9-65	9-66	231	4	T	
64	9-66	9-68	107	4	T	
65	9-68	9-69	71	4	T	
66	9-69	9-70	192	4	T	
67	9-69	9-76	21	4	T	
68	9-74	9-76	144	4	T	
69	9-76	9-77	31	4	T	
70	9-77	9-78	170	4	T	
71	9-77	9-79	26	4	T	
72	9-81	9-82	109	4	T	
73	9-83	9-84	107	4	T	
74	9-84	9-90	131	4	T	
75	9-84	9-85	60	4	T	
76	9-85	9-87	45	4	T	
77	9-87	9-89	110	4	T	
78	9-92	9-93	135	4	T	
79	9-99	9-101	113	4	T	
80	9-101	9-102	140	4	T	

Summary	
Total Route	10748
Primary Route	2967
Secondary Route	1736
Tertiary Route	6045
Chambers	104

Ward 20

Summary	
Total Route (Mtr)	10462
Primary Route (Mtr)	2953
Secondary Route (Mtr)	2386
Tertiary Route (Mtr)	5123
Chambers	130

Primary Route

Secondary Route

Tertiary Route

Ward No. 20

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	20-1	20-2	50	4	P	
2	20-2	20-3	163	4	P	
3	20-3	20-4	58	4	P	
4	20-4	20-5	57	4	P	
5	20-5	20-6	49	4	P	
6	20-6	20-60	59	4	P	
7	20-60	20-7	68	4	P	
8	20-7	20-8	101	4	P	
9	20-8	20-9	21	4	P	
10	20-9	20-10	143	4	P	
11	20-9	20-12	78	4	P	
12	20-10	20-11	58	4	P	
13	20-12	20-13	67	4	P	
14	20-26	20-27	125	4	P	
15	20-27	20-28	76	4	P	
16	20-28	20-29	111	4	P	
17	20-29	20-30	87	4	P	
18	20-30	20-31	38	4	P	
19	20-31	20-65	144	4	P	
20	20-32	20-65	95	4	P	
21	20-33	20-1	34	4	P	
22	20-74	20-76	151	4	P	
23	20-73	20-74	69	4	P	
24	20-72	20-73	64	4	P	
25	20-72	21-7	76	4	P	
26	20-76	20-77	117	4	P	
27	20-77	20-78	30	4	P	
28	20-78	20-79	29	4	P	
29	20-79	20-80	20	4	P	
30	20-25	20-80	120	4	P	
31	18-38	20-63	81	4	P	
32	20-63	20-64	81	4	P	
33	20-64	20-65	75	4	P	
34	20-65	20-66	45	4	P	
35	20-66	20-67	99	4	P	
36	20-67	20-84	27	4	P	
37	20-84	20-68	68	4	P	
38	20-68	20-69	71	4	P	
39	20-69	20-71	48	4	P	
40	20-22	20-23	57	4	S	
41	20-23	20-24	26	4	S	
42	20-24	20-25	51	4	S	
43	20-29	20-51	35	4	S	
44	20-1	20-34	90	4	S	
46	20-44	20-45	92	4	S	
47	20-45	20-47	34	4	S	
48	20-47	20-50	51	4	S	
49	20-50	20-51	89	4	S	
50	20-56	20-57	32	4	S	
51	20-57	20-58	65	4	S	

Ward No. 20

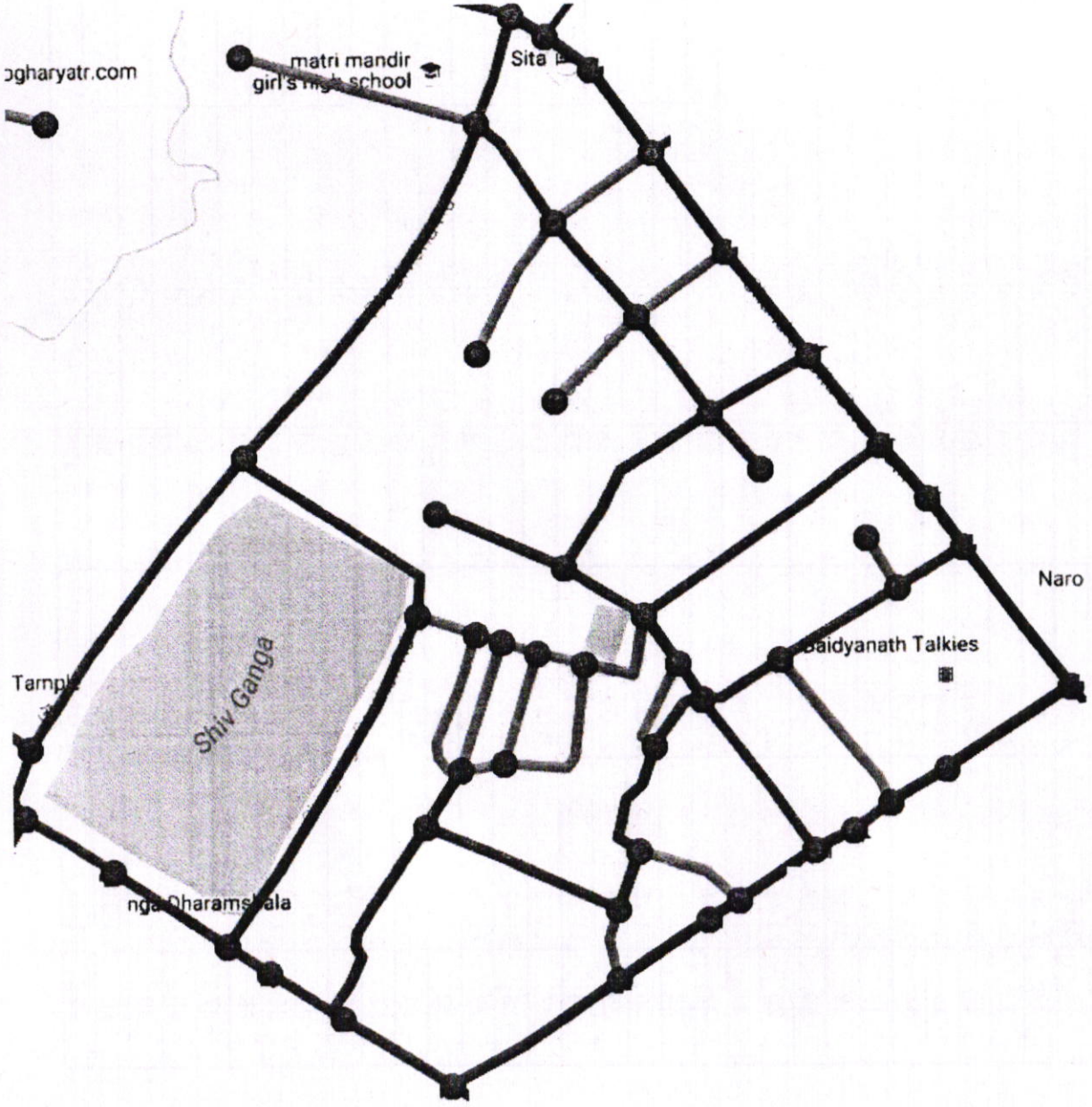
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
52	20-58	20-59	57	4	S	
53	20-59	20-44	55	4	S	
54	20-34	20-56	45	4	S	
55	20-76	20-81	45	4	S	
56	20-22	20-84	77	4	S	
57	20-80	20-84	58	4	S	
58	20-22	20-44	114	4	S	
59	20-70	20-71	44	4	S	
60	20-71	20-72	35	4	S	
61	20-72	20-73	55	4	S	
62	20-73	20-74	30	4	S	
63	20-74	20-75	15	4	S	
64	20-75	20-76	22	4	S	
65	20-76	20-77	95	4	S	
66	20-77	20-78	98	4	S	
67	20-78	20-79	96	4	S	
68	20-79	20-80	59	4	S	
69	20-80	20-81	22	4	S	
70	20-81	20-82	111	4	S	
71	20-83	21-23	184	4	S	
72	18-28	20-108	107	4	S	
73	20-108	20-109	49	4	S	
74	20-109	20-114	63	4	S	
75	20-114	20-116	33	4	S	
76	20-116	20-121	34	4	S	
77	20-121	20-123	101	4	S	
78	20-80	20-123	60	4	S	
79	20-15	20-61	81	4	T	
80	20-15	20-17	61	4	T	
81	20-18	20-19	64	4	T	
82	20-19	20-20	28	4	T	
83	20-20	20-21	49	4	T	
84	20-21	20-22	44	4	T	
85	20-25	20-26	117	4	T	
86	20-32	20-33	150	4	T	
87	20-45	20-46	128	4	T	
88	20-31	20-55	141	4	T	
89	20-27	20-46	124	4	T	
90	20-11	20-62	266	4	T	
91	20-18	20-68	63	4	T	
92	20-67	20-69	136	4	T	
93	20-66	20-81	178	4	T	
94	20-71	20-75	110	4	T	
95	20-84	20-85	101	4	T	
96	20-38	20-43	102	4	T	
97	20-36	20-38	124	4	T	
98	20-6	20-39	105	4	T	
99	19-15	20-34	151	4	T	
100	20-54	20-58	140	4	T	
101	20-53	20-59	131	4	T	

Ward No. 20

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
102	20-48	20-88	134	4	T	
103	20-14	20-15	104	4	T	
104	19-14	20-16	125	4	T	
105	20-76	20-105	266	4	T	
106	20-68	20-72	144	4	T	
107	20-111	20-113	52	4	T	
108	20-109	20-111	77	4	T	
109	20-96	20-109	135	4	T	
110	20-82	20-125	112	4	T	
111	20-88	20-89	113	4	T	
112	20-86	20-87	102	4	T	
113	20-90	20-91	39	4	T	
114	20-64	20-91	43	4	T	
115	20-92	20-93	99	4	T	
116	20-93	20-94	86	4	T	
117	20-94	20-95	20	4	T	
118	18-30	20-94	170	4	T	
119	18-36	20-63	145	4	T	
120	20-78	20-103	129	4	T	
121	20-95	20-96	55	4	T	
122	21-24	20-127	163	4	T	
123	20-68	20-81	178	4	T	
124	20-61	21-2	38	4	T	

Summary	
Total Route	10462
Primary Route	2953
Secondary Route	2386
Tertiary Route	5123
Chambers	130

Ward 21



Summary	
Total Route (Mtr)	4671
Primary Route (Mtr)	1009
Secondary Route (Mtr)	1171
Tertiary Route (Mtr)	2491
Chambers	50

Primary Route

Secondary Route

Tertiary Route

Ward No. 21

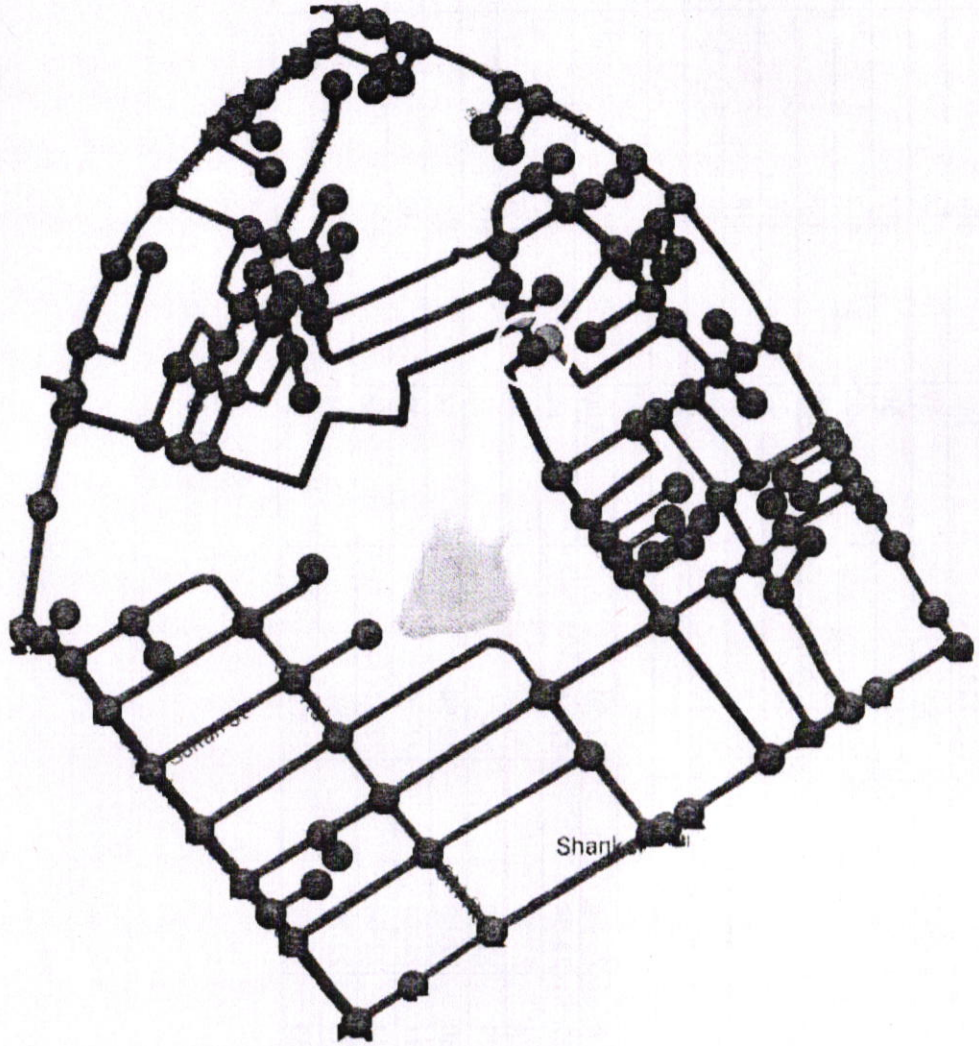
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	21-1	21-2	45	4	P	
2	21-2	21-3	70	4	P	
3	21-3	21-4	92	4	P	
4	21-4	21-5	34	4	P	
5	21-5	21-6	58	4	P	
6	21-6	21-7	86	4	P	
7	21-12	21-13	31	4	P	
8	21-23	21-24	76	4	P	
9	21-24	21-25	274	4	P	
10	21-25	21-1	243	4	P	
11	21-7	21-8	133	4	S	
12	21-8	21-9	73	4	S	
13	21-9	21-10	24	4	S	
14	21-10	21-11	62	4	S	
15	21-11	21-12	29	4	S	
16	21-13	21-14	45	4	S	
17	21-14	21-15	99	4	S	
18	21-15	21-16	119	4	S	
19	21-16	21-46	40	4	S	
20	21-46	21-17	48	4	S	
21	21-17	21-18	78	4	S	
22	21-18	21-19	89	4	S	
23	21-19	21-20	84	4	S	
24	21-20	21-21	69	4	S	
25	21-21	21-22	38	4	S	
26	21-22	21-23	27	4	S	
27	21-42	21-43	29	4	S	
28	21-42	21-31	40	4	S	
29	21-25	21-26	165	4	T	
30	21-26	21-4	257	4	T	
31	21-24	21-27	86	4	T	
32	21-27	21-28	84	4	T	
33	21-27	21-52	103	4	T	
34	21-28	21-29	83	4	T	
35	21-29	21-48	51	4	T	
36	21-29	21-30	148	4	T	
37	21-29	21-18	76	4	T	
38	21-30	21-50	94	4	T	
39	21-30	21-31	62	4	T	
40	21-31	21-17	196	4	T	
41	21-35	21-36	108	4	T	

Ward No. 21

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
42	21-37	21-32	113	4	T	
43	21-38	21-6	147	4	T	
44	21-38	21-39	142	4	T	
45	21-39	21-40	42	4	T	
46	21-40	21-41	86	4	T	
47	21-41	21-43	43	4	T	
48	21-43	21-44	59	4	T	
49	21-43	21-11	123	4	T	
50	21-44	21-13	122	4	T	
51	21-44	21-45	94	4	T	
52	21-45	21-16	52	4	T	

Summary	
Total Route	4671
Primary Route	1009
Secondary Route	1171
Tertiary Route	2491
Chambers	50

Ward 22



Summary	
Total Route (Mtr)	8826
Primary Route (Mtr)	1821
Secondary Route (Mtr)	1155
Tertiary Route (Mtr)	5850
Chambers	119

Primary Route

Secondary Route

Tertiary Route

Ward No. 22

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	22-1	22-2	34	4	P	
2	22-2	22-3	23	4	P	
3	22-3	22-4	112	4	P	
4	22-4	22-5	38	4	P	
5	22-5	22-6	127	4	P	
6	22-6	22-7	71	4	P	
7	22-7	22-8	194	4	P	
8	22-8	22-9	123	4	P	
9	22-9	22-10	18	4	P	
10	22-10	22-11	30	4	P	
11	22-11	22-12	26	4	P	
12	22-12	22-110	27	4	P	
13	22-110	22-111	49	4	P	
14	22-111	22-112	89	4	P	
15	22-112	22-113	49	4	P	
16	22-13	22-113	110	4	P	
17	22-113	22-14	37	4	P	
18	22-14	22-15	56	4	P	
19	22-15	22-16	52	4	P	
20	22-16	22-114	110	4	P	
21	22-114	22-115	33	4	P	
22	22-115	22-17	18	4	P	
23	22-17	22-18	212	4	P	
24	22-18	22-116	110	4	P	
25	22-13	24-1	73	4	P	
26	22-16	22-34	200	4	S	
27	22-34	22-44	66	4	S	
28	22-44	22-49	26	4	S	
29	22-50	22-52	33	4	S	
30	22-52	22-54	54	4	S	
31	22-54	22-64	171	4	S	
32	22-64	22-77	43	4	S	
33	22-77	22-81	491	4	S	
34	22-81	22-82	34	4	S	

Ward No. 22

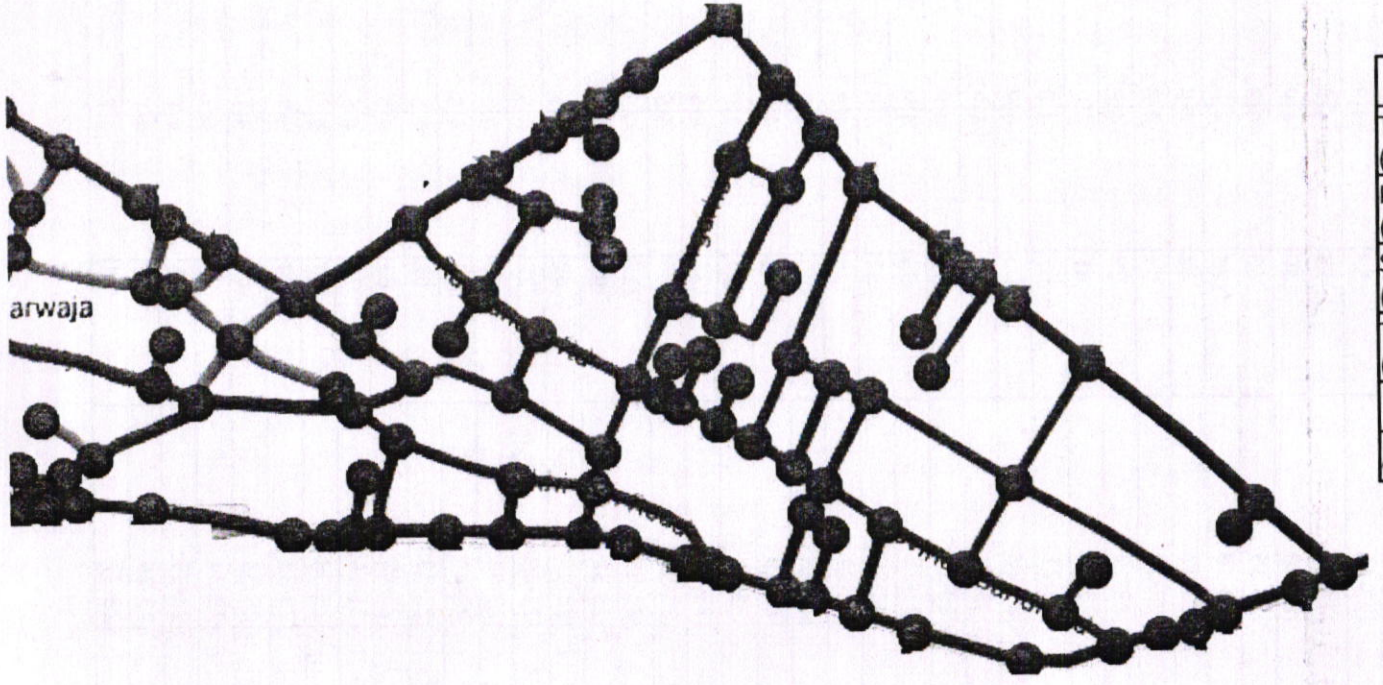
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
35	22-82	22-83	37	4	S	
36	22-17	22-21	106	4	T	
37	22-20	22-21	83	4	T	
38	22-20	22-32	217	4	T	
39	22-32	22-34	160	4	T	
40	22-34	22-35	77	4	T	
41	22-35	22-36	50	4	T	
42	22-36	22-117	48	4	T	
43	22-117	22-12	92	4	T	
44	22-14	22-37	154	4	T	
45	22-36	22-37	46	4	T	
46	22-36	22-43	82	4	T	
47	22-43	22-55	121	4	T	
48	22-53	22-54	107	4	T	
49	22-53	22-25	26	4	T	
50	22-55	22-56	44	4	T	
51	22-56	22-57	43	4	T	
52	22-57	22-58	31	4	T	
53	22-8	22-58	44	4	T	
54	22-15	22-35	206	4	T	
55	22-17	22-33	114	4	T	
56	22-32	22-33	85	4	T	
57	22-24	22-32	294	4	T	
58	22-18	22-19	117	4	T	
59	22-19	22-20	80	4	T	
60	22-20	22-24	86	4	T	
61	22-24	22-25	84	4	T	
62	22-25	22-27	84	4	T	
63	22-27	22-29	169	4	T	
64	21-21	22-29	84	4	T	
65	22-16	22-19	186	4	T	
66	22-19	22-33	215	4	T	
67	22-42	22-56	119	4	T	
68	22-74	22-75	102	4	T	
69	22-60	22-63	190	4	T	
70	22-63	22-66	127	4	T	
71	22-76	22-80	272	4	T	
72	22-75	22-80	236	4	T	
73	22-79	22-98	166	4	T	
74	22-86	22-87	104	4	T	
75	22-89	22-91	49	4	T	

Ward No. 22

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
76	22-91	22-94	106	4	T	
77	22-77	22-94	106	4	T	
78	22-94	22-95	34	4	T	
79	22-91	22-92	42	4	T	
80	22-92	22-95	40	4	T	
81	22-95	22-101	195	4	T	
82	22-52	22-53	149	4	T	
83	22-50	22-51	101	4	T	
84	22-27	21-20	189	4	T	
85	22-25	21-19	188	4	T	

Summary	
Total Route	8826
Primary Route	1821
Secondary Route	1155
Tertiary Route	5850
Chambers	119

Ward 23



Summary	
Total Route (Mtr)	6727
Primary Route (Mtr)	1655
Secondary Route (Mtr)	1045
Tertiary Route (Mtr)	4027
Chambers	89

Primary Route

Secondary Route

Tertiary Route

Ward No. 23

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	23-1	20-26	65	4	P	
2	23-1	23-2	133	4	P	
3	23-2	23-5	85	4	P	
4	23-5	23-6	140	4	P	
5	23-6	23-7	37	4	P	
6	23-7	23-8	23	4	P	
7	23-8	23-9	24	4	P	
8	23-9	23-10	66	4	P	
9	23-10	23-11	58	4	P	
10	23-11	23-12	73	4	P	
11	23-12	23-14	40	4	P	
12	23-14	23-15	66	4	P	
13	23-15	23-16	20	4	P	
14	23-16	23-17	18	4	P	
15	23-17	23-18	59	4	P	
16	23-18	23-19	28	4	P	
17	23-19	23-20	45	4	P	
18	23-20	23-21	61	4	P	
19	23-21	23-22	109	4	P	
20	23-22	23-23	90	4	P	
21	23-23	23-24	47	4	P	
22	23-24	23-25	33	4	P	
23	23-25	23-26	32	4	P	
24	23-26	23-27	78	4	P	
25	23-27	23-28	40	4	P	
26	23-28	23-29	59	4	P	
27	23-29	23-30	126	4	P	
28	23-30	23-31	134	4	S	
29	23-28	23-53	105	4	S	
30	23-52	23-53	212	4	S	
31	23-47	23-52	93	4	S	
32	23-46	23-47	42	4	S	
33	23-45	23-46	22	4	S	
34	23-44	23-45	20	4	S	
35	23-38	23-44	104	4	S	
36	23-38	23-39	62	4	S	
37	23-39	23-40	67	4	S	
38	23-40	21-15	79	4	S	
39	23-37	23-38	87	4	S	
40	23-31	23-32	47	4	T	
41	23-32	23-33	165	4	T	
42	23-33	23-34	87	4	T	
43	23-34	23-35	175	4	T	
44	23-35	23-36	53	4	T	
45	23-36	23-37	65	4	T	

Ward No. 23

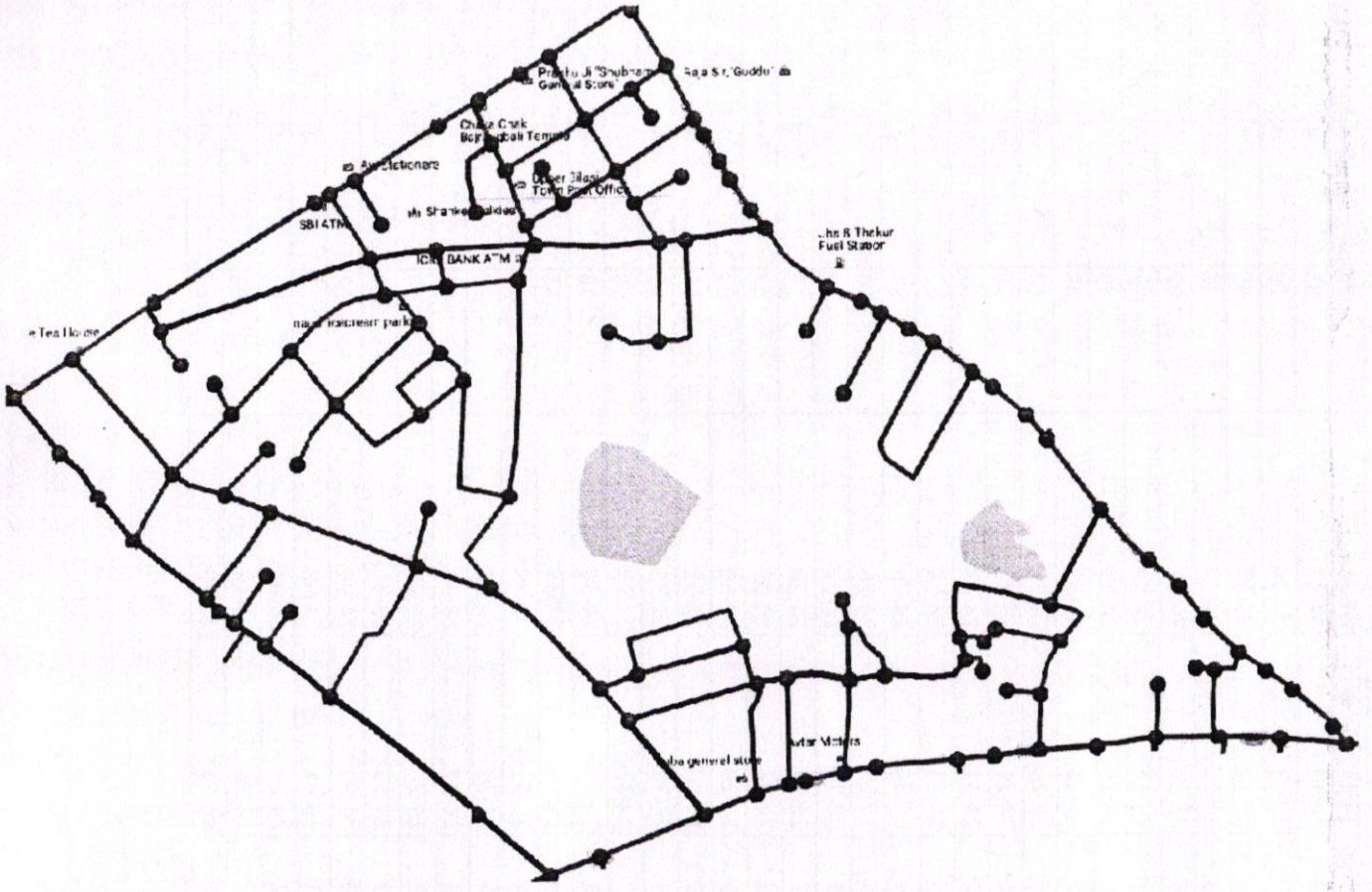
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
46	23-37	22-116	169	4	T	
47	23-26	23-55	238	4	T	
48	23-55	23-63	166	4	T	
49	23-63	23-64	39	4	T	
50	23-64	23-67	46	4	T	
51	23-38	23-67	181	4	T	
52	23-66	23-67	89	4	T	
53	23-23	23-57	62	4	T	
54	23-56	23-57	104	4	T	
55	23-56	23-59	90	4	T	
56	23-59	23-62	69	4	T	
57	23-62	23-65	35	4	T	
58	23-65	23-66	47	4	T	
59	23-66	23-74	38	4	T	
60	23-73	23-74	41	4	T	
61	23-72	23-73	23	4	T	
62	23-71	23-72	28	4	T	
63	23-71	23-78	102	4	T	
64	23-78	23-79	71	4	T	
65	23-79	21-8	96	4	T	
66	23-40	23-41	85	4	T	
67	23-41	23-70	150	4	T	
68	23-70	23-71	86	4	T	
69	23-71	23-82	74	4	T	
70	23-82	23-83	37	4	T	
71	23-12	23-83	45	4	T	
72	23-34	23-52	180	4	T	
73	23-52	23-55	136	4	T	
74	23-55	23-56	96	4	T	
75	23-35	23-44	119	4	T	

Ward No. 23

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
76	23-42	23-69	146	4	T	
77	23-68	23-69	100	4	T	
78	23-79	23-86	100	4	T	
79	23-81	23-82	106	4	T	
80	23-84	23-85	120	4	T	
81	23-16	23-83	139	4	T	

Summary	
Total Route	6727
Primary Route	1655
Secondary Route	1045
Tertiary Route	4027
Chambers	89

Ward 24



Summary	
Total Route (Mtr)	6521
Primary Route (Mtr)	1811
Secondary Route (Mtr)	1427
Tertiary Route (Mtr)	3283
Chambers	96

Primary Route

Secondary Route

Tertiary Route

Ward No. 24

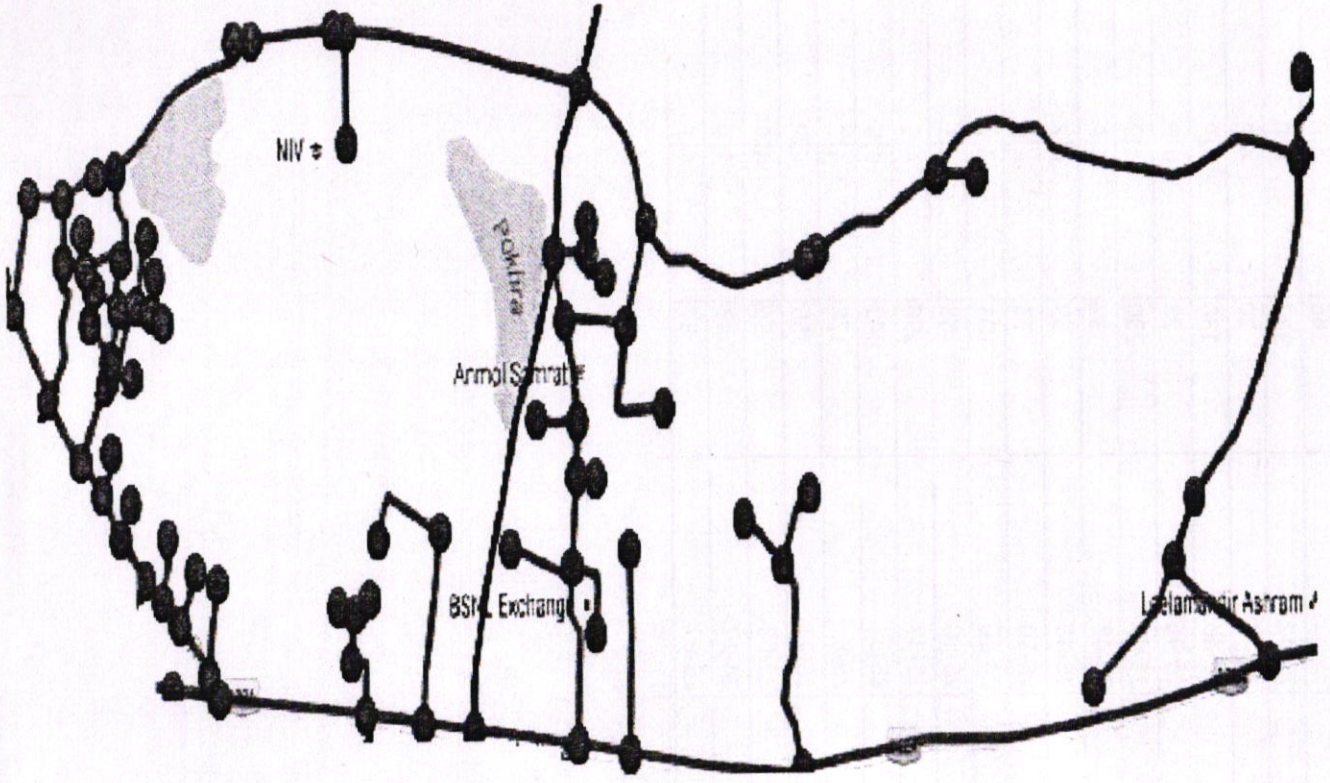
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	24-1	24-2	68	4	P	
2	24-2	24-3	20	4	P	
3	24-3	24-4	33	4	P	
4	24-4	24-5	23	4	P	
5	24-5	24-6	43	4	P	
6	24-6	24-7	26	4	P	
7	24-7	24-8	97	4	P	
8	24-8	24-9	40	4	P	
9	24-9	24-10	25	4	P	
10	24-10	24-11	36	4	P	
11	24-11	24-12	31	4	P	
12	24-12	24-13	55	4	P	
13	24-13	24-14	29	4	P	
14	24-14	24-15	49	4	P	
15	24-15	24-16	36	4	P	
16	24-16	24-17	97	4	P	
17	24-17	24-18	77	4	P	
18	24-18	24-19	45	4	P	
19	24-19	24-20	48	4	P	
20	24-20	24-21	53	4	P	
21	24-21	24-22	35	4	P	
22	24-22	24-23	37	4	P	
23	24-23	24-24	63	4	P	
24	24-24	24-25	24	4	P	
25	24-25	24-26	74	4	P	
26	24-26	24-27	68	4	P	
27	24-27	24-28	70	4	P	
28	24-28	24-29	67	4	P	
29	24-29	24-30	63	4	P	
30	24-30	24-31	51	4	P	
31	24-31	24-32	42	4	P	
32	24-32	24-33	90	4	P	
33	24-33	24-34	36	4	P	
34	24-34	24-35	43	4	P	
35	24-35	24-36	18	4	P	
36	24-36	24-37	38	4	P	
37	24-37	23-30	61	4	P	
38	24-7	24-45	90	4	S	
39	24-93	23-31	149	4	S	
40	24-92	24-93	32	4	S	
41	24-91	24-92	71	4	S	
42	24-88	24-91	39	4	S	
43	24-86	24-88	98	4	S	
44	24-84	24-86	26	4	S	

Ward No. 24

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
45	24-77	24-84	168	4	S	
46	24-17	24-77	119	4	S	
47	24-44	24-45	29	4	S	
48	24-44	24-54	139	4	S	
49	24-54	24-57	110	4	S	
50	24-56	24-57	73	4	S	
51	24-56	24-61	247	4	S	
52	24-61	22-18	37	4	S	
53	24-30	24-80	64	4	T	
54	24-78	24-80	64	4	T	
55	24-77	24-78	73	4	T	
56	24-64	23-37	93	4	T	
57	24-63	24-64	96	4	T	
58	24-60	24-63	126	4	T	
59	24-58	24-60	68	4	T	
60	24-58	24-59	81	4	T	
61	24-54	24-59	47	4	T	
62	24-53	24-54	26	4	T	
63	24-52	24-53	65	4	T	
64	24-50	24-52	32	4	T	
65	24-50	22-15	54	4	T	
66	24-59	24-74	239	4	T	
67	24-33	24-74	127	4	T	
68	24-12	24-13	317	4	T	
69	24-10	24-76	100	4	T	
70	24-8	24-75	53	4	T	
71	24-40	24-52	105	4	T	
72	24-44	24-46	109	4	T	
73	24-45	24-46	143	4	T	
74	24-2	24-41	104	4	T	
75	24-68	24-72	125	4	T	
76	24-71	24-74	173	4	T	
77	24-67	24-68	128	4	T	
78	24-94	24-95	120	4	T	
79	24-94	24-95 (ADDITIONAL)	199	4	T	
80	24-37	24-93	128	4	T	
81	24-36	24-92	119	4	T	
82	24-34	24-91	105	4	T	

Summary	
Total Route	6521
Primary Route	1811
Secondary Route	1427
Tertiary Route	3283
Chambers	96

Ward 25



Summary	
Total Route (Mtr)	7619
Primary Route (Mtr)	3980
Secondary Route (Mtr)	667
Tertiary Route (Mtr)	2972
Chambers	68

Primary Route

Secondary Route

Tertiary Route

Ward No. 25

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	
1	24-25	25-1	233	4	P	
2	25-1	25-2	95	4	P	
3	25-2	25-3	81	4	P	
4	25-3	25-4	165	4	P	
5	25-4	25-5	85	4	P	
6	25-5	25-6	275	4	P	
7	25-6	25-7	757	4	P	
8	25-11	25-12	612	4	P	
9	25-12	25-14	207	4	P	
10	25-15	25-16	272	4	P	
11	25-16	25-41	166	4	P	
12	25-41	25-42	377	4	P	
13	25-42	25-44	20	4	P	
14	25-44	25-45	130	4	P	
15	25-45	25-46	28	4	P	
16	25-46	25-47	230	4	P	
17	25-47	25-48	32	4	P	
18	25-48	25-49	59	4	P	
19	25-49	25-50	53	4	P	
20	25-50	24-16	103	4	P	
21	25-8	25-10	68	4	S	
22	25-41	25-37	156	4	S	
23	25-37	25-3	443	4	S	
24	25-7	25-8	178	4	T	
25	25-10	25-11	356	4	T	
26	25-49	25-68	56	4	T	
27	25-68	24-17	133	4	T	
28	25-68	25-67	37	4	T	
29	25-67	25-66				

Ward No. 25

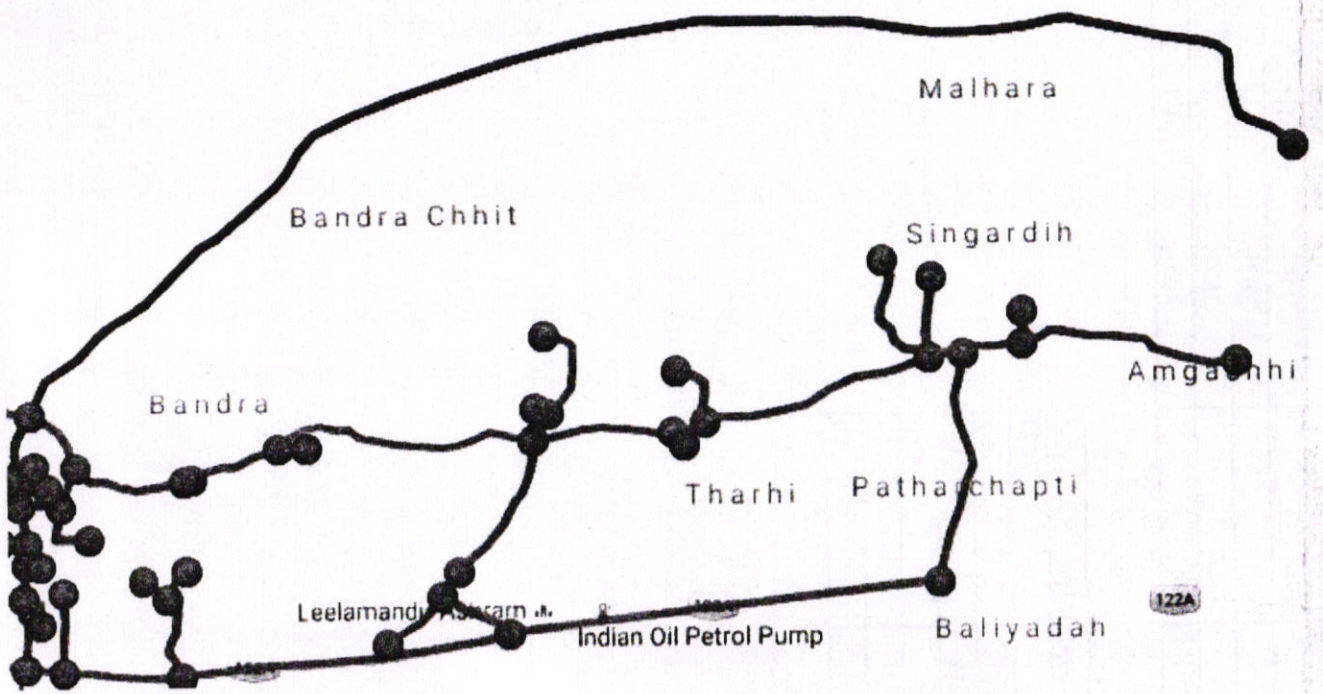
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	
1	24-25	25-1	233	4	P	
2	25-1	25-2	95	4	P	
3	25-2	25-3	81	4	P	
4	25-3	25-4	165	4	P	
5	25-4	25-5	85	4	P	
6	25-5	25-6	275	4	P	
7	25-6	25-7	757	4	P	
8	25-11	25-12	612	4	P	
9	25-12	25-14	207	4	P	
10	25-15	25-16	272	4	P	
11	25-16	25-41	166	4	P	
12	25-41	25-42	377	4	P	
13	25-42	25-44	20	4	P	
14	25-44	25-45	130	4	P	
15	25-45	25-46	28	4	P	
16	25-46	25-47	230	4	P	
17	25-47	25-48	32	4	P	
18	25-48	25-49	59	4	P	
19	25-49	25-50	53	4	P	
20	25-50	24-16	103	4	P	
21	25-8	25-10	68	4	S	
22	25-41	25-37	156	4	S	
23	25-37	25-3	443	4	S	
24	25-7	25-8	178	4	T	
25	25-10	25-11	356	4	T	
26	25-49	25-68	56	4	T	
27	25-68	24-17	133	4	T	
28	25-68	25-67	37	4	T	
29	25-67	25-66	57	4	T	
30	25-66	25-47	90	4	T	
31	25-66	25-60	45	4	T	
32	25-60	25-58	49	4	T	
33	25-58	25-56	21	4	T	
34	25-56	25-18	78	4	T	
35	25-56	25-62	67	4	T	
36	25-62	25-65	63	4	T	
37	25-37	25-19	53	4	T	
38	25-19	25-20	92	4	T	
39	25-20	25-22	46	4	T	
40	25-25	25-24	81	4	T	
41	25-24	25-4	162	4	T	
42	25-16	25-17	98	4	T	

Ward No. 25

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	
43	25-17	25-19	97	4	T	
44	25-2	25-31	173	4	T	
45	25-31	25-32	129	4	T	
46	25-5	25-27	180	4	T	
47	25-6	25-28	203	4	T	
48	25-8	25-9	174	4	T	
49	25-17	25-18	152	4	T	
50	25-24	25-26	102	4	T	

Summary	
Total Route	7619
Primary Route	3980
Secondary Route	667
Tertiary Route	2972
Chambers	68

Ward 26



Summary	
Total Route (Mtr)	7471
Primary Route (Mtr)	993
Secondary Route (Mtr)	3439
Tertiary Route (Mtr)	3039
Chambers	16

Primary Route

Secondary Route

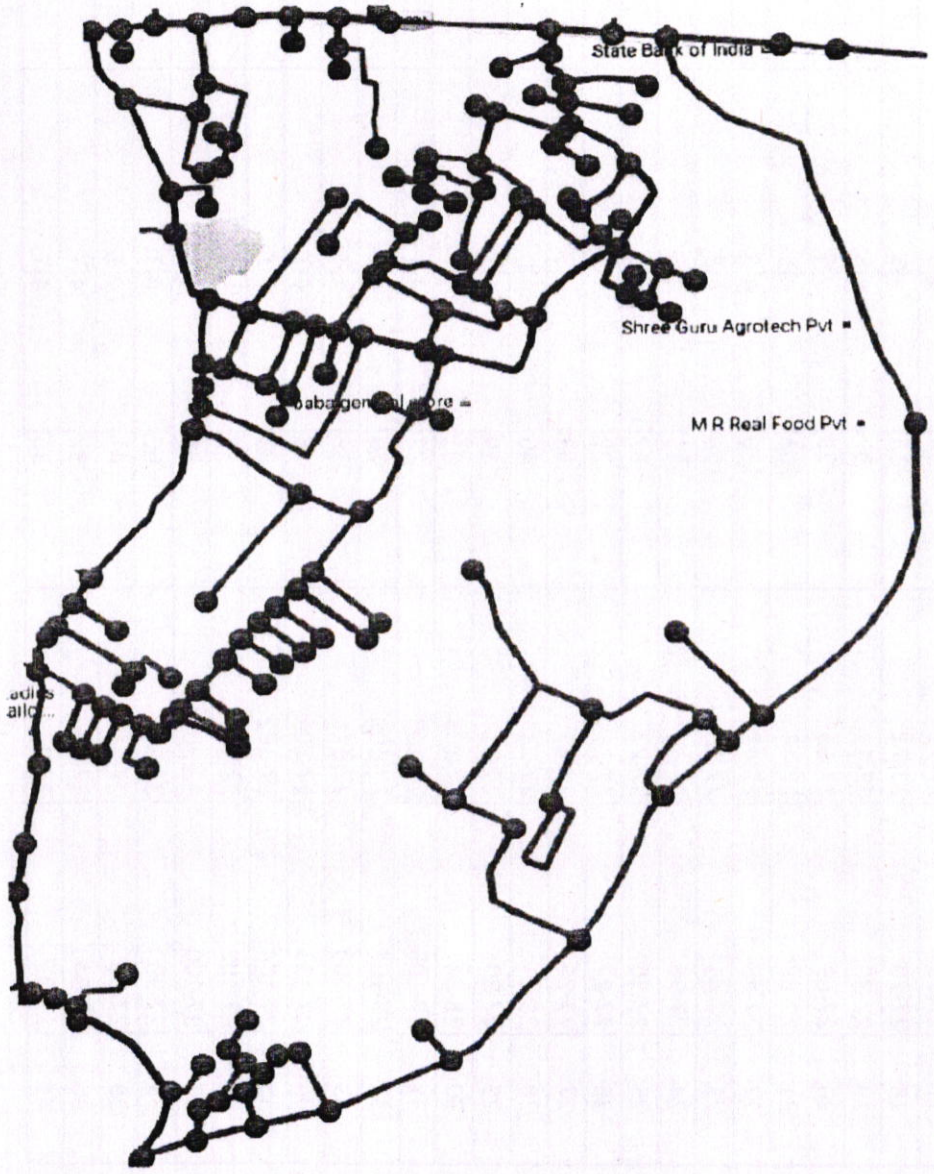
Tertiary Route

Ward No. 26

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	25-7	26-16	993	4	P	
2	26-5	26-7	79	4	S	
3	25-41	26-1	3360	4	S	
4	25-11	26-5	331	4	T	
4	26-7	26-9	540	4	T	
5	26-9	26-12	77	4	T	
6	26-12	26-13	138	4	T	
7	26-13	26-15	519	4	T	
9	26-12	26-16	544	4	T	
10	26-2	26-4	245	4	T	
11	26-7	26-8	162	4	T	
12	26-9	26-10	187	4	T	
13	26-9	26-11	296	4	T	

Summary	
Total Route	7471
Primary Route	993
Secondary Route	3439
Tertiary Route	3039
Chambers	16

Ward 27



Summary	
Total Route (Mtr)	12252
Primary Route (Mtr)	2588
Secondary Route (Mtr)	1494
Tertiary Route (Mtr)	8170
Chambers	141

Primary Route

Secondary Route

Tertiary Route

Ward No. 27

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	25-3	27-1	774	4	P	
2	27-1	27-2	565	4	P	
3	27-2	27-3	62	4	P	
4	27-3	27-4	131	4	P	
5	27-4	27-5	266	4	P	
6	27-5	27-6	275	4	P	
7	27-6	27-7	198	4	P	
8	27-7	27-8	111	4	P	
9	27-8	27-9	91	4	P	
10	27-9	27-10	82	4	P	
11	28-24	27-10	33	4	P	
12	28-22	27-122	185	4	S	
13	27-122	27-10	117	4	S	
14	28-4	27-75	61	4	S	
15	27-75	27-74	68	4	S	
16	27-74	27-73	34	4	S	
17	27-73	27-71	34	4	S	
18	27-70	27-71	35	4	S	
19	27-70	27-69	97	4	S	
20	27-69	27-68	25	4	S	
21	27-68	27-48	206	4	S	
22	27-48	27-41	170	4	S	
23	27-41	27-36	165	4	S	
24	27-36	27-30	111	4	S	
25	27-30	27-27	37	4	S	
26	27-27	27-25	27	4	S	
27	27-25	27-23	63	4	S	
28	25-1	27-23	40	4	S	
29	27-30	27-31	19	4	S	
30	28-14	27-105	81	4	T	
31	27-105	27-107	33	4	T	
32	27-107	27-109	29	4	T	
33	27-109	27-111	36	4	T	
34	27-111	27-104	26	4	T	
35	27-104	27-102	33	4	T	
36	27-102	27-100	18	4	T	
37	27-100	27-98	38	4	T	
38	27-98	27-96	66	4	T	
39	27-96	27-94	41	4	T	
40	27-94	27-92	37	4	T	
41	27-92	27-90	36	4	T	

Ward No. 27

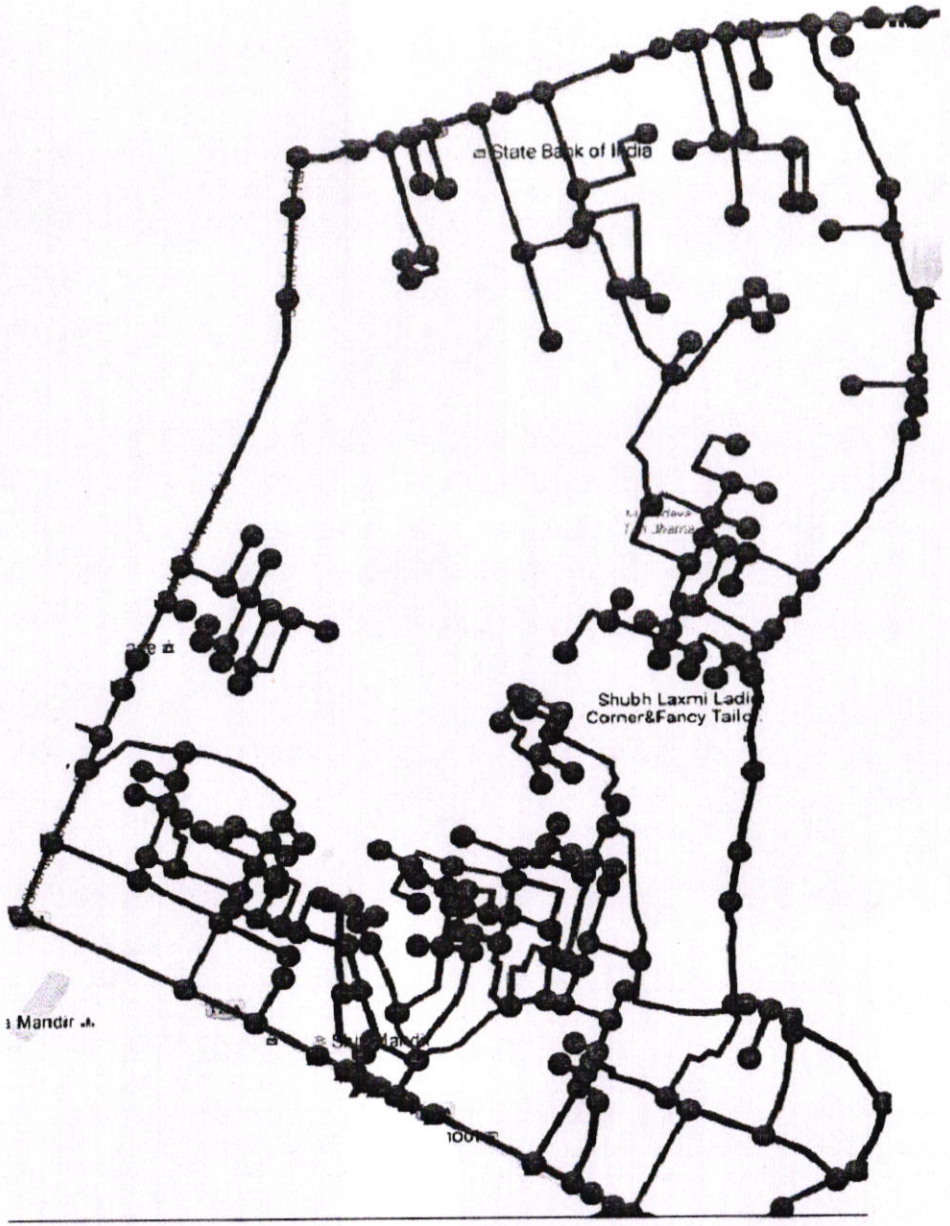
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
42	27-90	27-88	42	4	T	
43	27-88	27-86	36	4	T	
44	27-86	27-82	124	4	T	
45	28-8	27-83	189	4	T	
46	27-83	27-82	98	4	T	
47	27-82	27-79	201	4	T	
48	27-79	27-68	94	4	T	
49	28-7	27-70	389	4	T	
50	28-5	27-76	32	4	T	
51	27-76	27-77	67	4	T	
52	27-77	27-78	35	4	T	
53	27-73	27-78	120	4	T	
54	24-29	27-12	100	4	T	
55	27-12	27-13	46	4	T	
56	28-1	27-13	106	4	T	
57	27-41	27-42	74	4	T	
58	27-42	27-44	58	4	T	
59	27-44	27-46	32	4	T	
60	27-41	27-46	99	4	T	
61	27-31	27-32	104	4	T	
62	27-32	27-54	88	4	T	
63	27-54	27-53	99	4	T	
64	27-53	27-52	25	4	T	
65	27-39	27-52	129	4	T	
66	27-39	27-41	35	4	T	
67	27-37	27-39	49	4	T	
68	27-37	27-36	107	4	T	
69	27-48	27-49	46	4	T	
70	27-49	27-50	54	4	T	
71	27-50	27-51	25	4	T	
72	27-51	27-65	128	4	T	
73	27-65	27-67	27	4	T	
74	27-67	27-71	104	4	T	
75	27-3	27-139	51	4	T	
76	27-138	27-139	190	4	T	
77	27-135	27-138	306	4	T	
78	27-134	27-135	99	4	T	
79	27-5	27-134	273	4	T	
80	27-25	27-26	123	4	T	
81	27-20	27-22	211	4	T	
82	27-12	27-14	139	4	T	

Ward No. 27

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
83	27-13	27-17	123	4	T	
84	27-75	27-142	226	4	T	
85	27-63	27-64	168	4	T	
86	27-57	27-61	119	4	T	
87	27-53	27-51	163	4	T	
88	27-52	27-50	154	4	T	
89	27-66	27-67	113	4	T	
90	27-49	27-66	116	4	T	
91	27-74	27-77	109	4	T	
92	27-75	27-76	100	4	T	
93	27-83	27-85	225	4	T	
94	27-86	27-87	129	4	T	
95	27-88	27-89	132	4	T	
96	27-102	27-103	109	4	T	
97	28-11	27-114	137	4	T	
98	28-21	27-121	106	4	T	
99	27-7	27-132	107	4	T	
100	27-138	27-141	217	4	T	
101	27-138	27-137	163	4	T	
102	27-137	27-137	268	4	T	
103	27-139	27-4	171	4	T	
104	27-2	27-140	187	4	T	

Summary	
Total Route	12252
Primary Route	2588
Secondary Route	1494
Tertiary Route	8170
Chambers	141

Ward 28



Summary	
Total Route (Mtr)	13506
Primary Route (Mtr)	268
Secondary Route (Mtr)	3470
Tertiary Route (Mtr)	9768
Chambers	199

Primary Route

Secondary Route

Tertiary Route

Ward No. 28

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	28-24	28-25	93	4	P	
2	28-25	28-26	135	4	P	
3	32-48	28-26	31	4	P	
4	24-32	28-1	127	4	S	
5	28-1	28-2	165	4	S	
6	28-2	28-3	67	4	S	
7	28-3	28-4	130	4	S	
8	28-4	28-5	104	4	S	
9	28-5	28-6	37	4	S	
10	28-6	28-7	33	4	S	
11	28-7	28-8	38	4	S	
12	28-8	28-9	295	4	S	
13	28-9	28-10	48	4	S	
14	28-10	28-11	45	4	S	
15	28-11	28-12	23	4	S	
16	28-12	28-13	41	4	S	
17	28-13	28-14	23	4	S	
18	28-14	28-15	155	4	S	
19	28-15	28-16	129	4	S	
20	28-16	28-17	80	4	S	
21	28-17	28-18	168	4	S	
22	28-18	28-19	19	4	S	
23	28-19	28-20	36	4	S	
24	28-20	28-21	35	4	S	
25	28-21	28-22	21	4	S	
26	28-23	28-24	129	4	S	
27	30-5	28-116	140	4	S	
28	28-116	28-117	141	4	S	
29	28-117	28-96	29	4	S	
30	28-23	28-27	116	4	S	
31	28-27	28-34	38	4	S	
32	28-34	28-35	133	4	S	
33	28-35	28-36	19	4	S	
34	28-36	28-39	54	4	S	
35	28-89	28-91	79	4	S	
36	28-91	28-93	24	4	S	
37	28-93	28-94	36	4	S	
38	28-94	28-96	42	4	S	
39	32-57	28-31	139	4	S	
40	28-31	28-32	25	4	S	
41	28-32	28-35	21	4	S	

Ward No. 28

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
42	28-161	28-164	35	4	S	
43	28-48	28-44	39	4	S	
44	28-82	28-84	91	4	S	
45	28-141	28-143	18	4	S	
46	28-199	28-77	67	4	S	
47	28-77	28-86	72	4	S	
48	28-86	28-87	87	4	S	
49	28-87	28-89	77	4	S	
50	28-22	28-23	174	4	T	
51	24-34	28-191	170	4	T	
52	24-35	28-192	163	4	T	
53	28-191	28-192	39	4	T	
54	23-29	28-179	166	4	T	
55	28-179	28-178	49	4	T	
56	28-178	28-175	126	4	T	
57	28-175	28-169	166	4	T	
58	28-169	28-163	237	4	T	
59	28-163	28-162	156	4	T	
60	28-162	28-156	73	4	T	
61	28-156	28-157	18	4	T	
62	28-157	28-12	116	4	T	
63	28-161	28-162	49	4	T	
64	28-160	28-161	33	4	T	
65	28-160	28-158	33	4	T	
66	28-158	28-9	101	4	T	
67	28-156	28-154	45	4	T	
68	28-154	28-149	22	4	T	
69	28-149	28-147	49	4	T	
70	28-147	28-145	80	4	T	
71	28-145	28-13	27	4	T	
72	29-3	28-121	72	4	T	
73	28-121	28-123	40	4	T	
74	28-123	28-125	37	4	T	
75	28-125	28-126	34	4	T	
76	28-126	28-127	54	4	T	
77	28-125	28-128	103	4	T	
78	28-126	28-128	128	4	T	
79	28-108	28-107	162	4	T	
80	28-107	28-109	49	4	T	
81	28-109	28-111	40	4	T	
82	28-111	28-113	89	4	T	

Ward No. 28

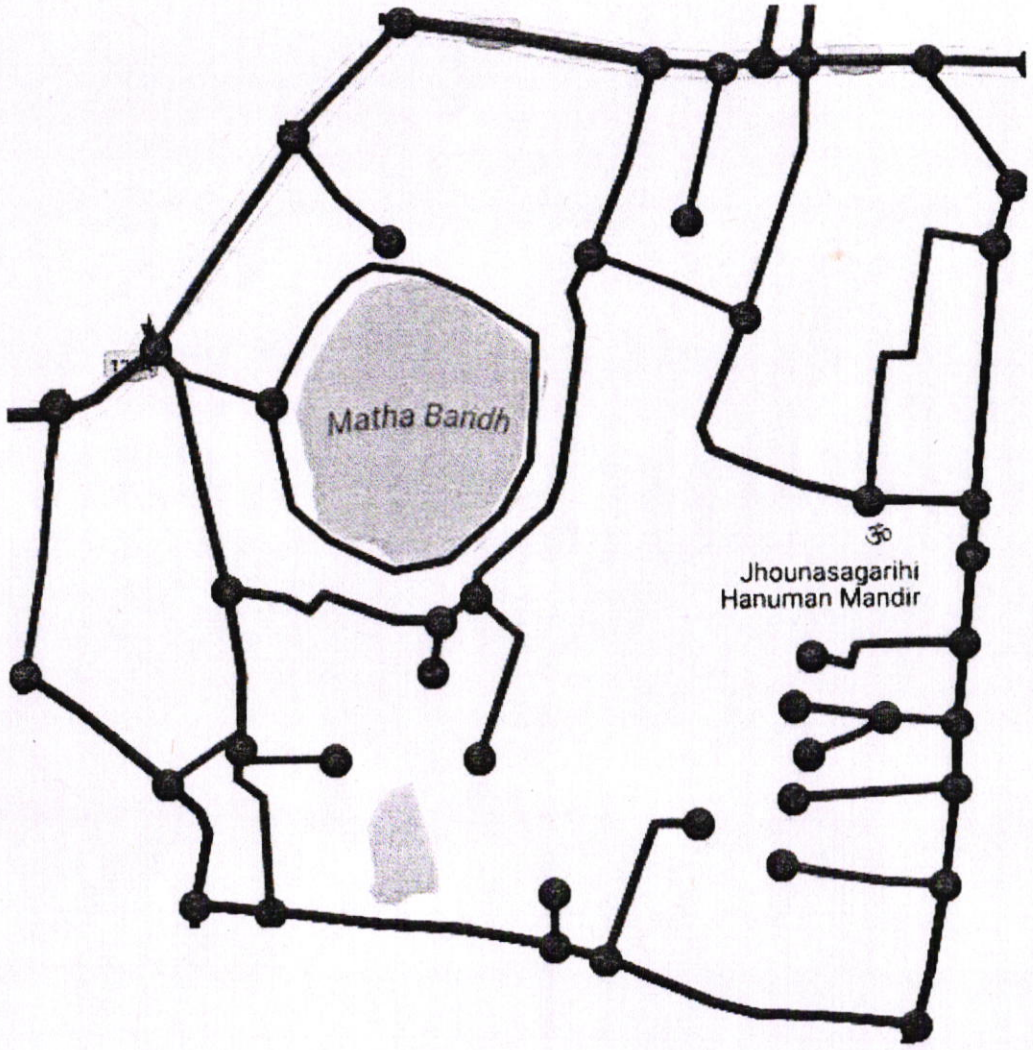
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
83	28-113	28-116	39	4	T	
84	32-86	28-117	118	4	T	
85	28-96	28-97	28	4	T	
86	28-97	28-98	46	4	T	
87	28-98	28-101	45	4	T	
88	28-101	28-105	36	4	T	
89	28-107	28-105	215	4	T	
90	28-97	28-114	100	4	T	
91	28-113	28-114	47	4	T	
92	28-39	28-41	73	4	T	
93	28-41	28-42	29	4	T	
94	28-42	28-43	53	4	T	
95	28-43	28-77	165	4	T	
96	28-76	28-77	86	4	T	
97	28-76	28-78	120	4	T	
98	28-78	28-89	33	4	T	
99	28-98	28-99	35	4	T	
100	28-99	28-93	103	4	T	
101	32-52	28-27	187	4	T	
102	23-24	28-186	193	4	T	
103	23-27	28-181	231	4	T	
104	28-181	28-183	149	4	T	
105	28-179	28-180	179	4	T	
106	28-178	28-176	210	4	T	
107	28-192	28-197	121	4	T	
108	28-194	28-196	108	4	T	
109	28-169	28-171	159	4	T	
110	28-163	28-164	108	4	T	
111	28-166	28-168	155	4	T	
112	28-157	28-160	107	4	T	
113	28-151	28-152	103	4	T	
114	28-117	28-118	111	4	T	
115	28-34	28-18	216	4	T	
116	28-18	28-47	216	4	T	
117	28-44	28-41	67	4	T	
118	28-48	28-49	94	4	T	
119	28-47	28-50	239	4	T	
120	28-72	28-77	183	4	T	
121	28-73	28-76	138	4	T	
122	28-72	28-73	42	4	T	
123	28-70	28-72	28	4	T	

Ward No. 28

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
124	28-70	28-71	24	4	T	
125	28-68	28-71	39	4	T	
126	28-64	28-68	26	4	T	
127	28-62	28-64	27	4	T	
128	28-61	28-62	37	4	T	
129	28-61	28-82	78	4	T	
130	28-82	28-83	52	4	T	
131	28-62	28-63	48	4	T	
132	28-43	28-69	118	4	T	
133	28-69	28-70	43	4	T	
134	28-66	28-69	47	4	T	
135	28-66	28-67	30	4	T	
136	28-67	28-68	39	4	T	
137	28-64	28-67	73	4	T	
138	28-60	28-66	59	4	T	
139	28-60	28-61	92	4	T	
140	28-58	28-60	35	4	T	
141	28-58	28-54	36	4	T	
142	28-43	28-46	151	4	T	
143	28-42	28-46	72	4	T	
144	28-46	28-65	54	4	T	
145	28-65	28-66	61	4	T	
146	28-60	28-65	135	4	T	
147	28-45	28-53	150	4	T	
148	28-53	28-54	71	4	T	
149	28-53	28-51	26	4	T	
150	28-50	28-51	61	4	T	
151	28-50	28-134	35	4	T	
152	28-134	28-135	186	4	T	
153	28-85	28-86	20	4	T	
154	28-81	28-85	34	4	T	
155	28-85	28-88	122	4	T	
156	28-88	28-89	81	4	T	

Summary	
Total Route	13506
Primary Route	268
Secondary Route	3470
Tertiary Route	9768
Chambers	199

Ward 29



Summary	
Total Route (Mtr)	7034
Primary Route (Mtr)	833
Secondary Route (Mtr)	1717
Tertiary Route (Mtr)	4484
Chambers	69

Primary Route

Secondary Route

Tertiary Route

202

Ward No. 29

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	23-22	29-1	80	4	P	
2	29-1	29-2	147	4	P	
3	29-2	29-3	460	4	P	
4	29-16	20-26	146	4	P	
5	29-3	29-4	84	4	S	
6	29-4	29-5	48	4	S	
7	29-5	29-6	117	4	S	
8	29-6	29-7	26	4	S	
9	29-7	29-8	98	4	S	
10	29-8	29-9	104	4	S	
11	29-9	29-10	67	4	S	
12	29-10	29-11	175	4	S	
13	29-11	29-12	28	4	S	
14	29-12	29-13	155	4	S	
15	29-13	29-14	43	4	S	
16	29-14	29-15	75	4	S	
17	29-15	29-16	97	4	S	
18	29-31	29-30	34	4	S	
19	23-10	29-30	82	4	S	
20	29-31	29-32	141	4	S	
21	29-29	29-32	57	4	S	
22	29-32	29-33	28	4	S	
23	29-33	29-35	47	4	S	
24	29-35	29-37	43	4	S	
25	29-27	29-41	35	4	S	
26	29-41	29-43	54	4	S	
27	29-43	29-10	79	4	S	
28	29-61	29-62	32	4	S	
29	23-1	29-20	72	4	T	
30	29-20	29-20	478	4	T	
31	23-1	29-19	139	4	T	
32	29-19	29-17	87	4	T	
33	29-17	29-13	96	4	T	
34	29-19	29-21	124	4	T	
35	29-21	29-23	24	4	T	
36	29-23	29-26	207	4	T	
37	29-26	23-6	110	4	T	
38	29-26	29-28	90	4	T	
39	29-28	23-9	145	4	T	
40	29-28	29-29	168	4	T	
41	29-29	29-31	198	4	T	
42	29-10	29-53	74	4	T	

Ward No. 29

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
43	29-53	29-57	265	4	T	
44	29-54	29-8	68	4	T	
45	29-53	29-54	35	4	T	
46	29-52	29-53	267	4	T	
47	29-50	29-52	36	4	T	
48	29-49	29-50	63	4	T	
49	29-47	29-49	69	4	T	
50	29-30	29-47	108	4	T	
51	29-49	29-63	98	4	T	
52	29-23	29-61	32	4	T	
53	29-59	29-61	31	4	T	
54	23-17	29-59	108	4	T	
55	29-2	29-57	449	4	T	
56	29-57	29-5	100	4	T	
57	29-54	29-55	119	4	T	
58	29-11	29-45	103	4	T	
59	29-23	29-24	102	4	T	
60	23-14	29-47	133	4	T	
61	23-21	29-69	109	4	T	
62	29-66	29-52	145	4	T	

Summary	
Total Route	7034
Primary Route	833
Secondary Route	1717
Tertiary Route	4484
Chambers	69

Ward 30

Summary	
Total Route (Mtr)	5446
Primary Route (Mtr)	1041
Secondary Route (Mtr)	1739
Tertiary Route (Mtr)	2666
Chambers	75

Primary Route

Secondary Route

Tertiary Route

Ward No. 30

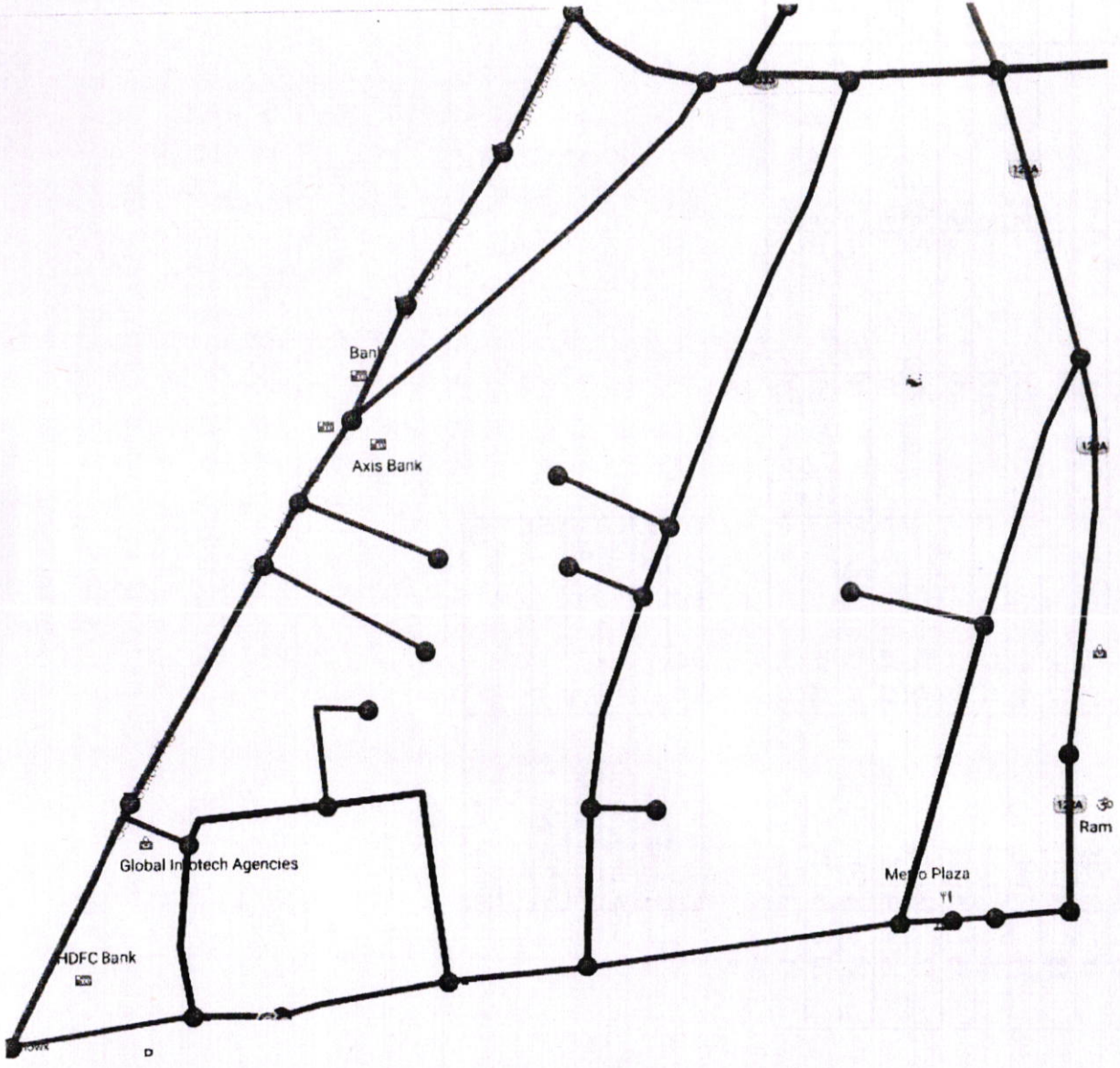
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	29-3	30-1	63	4	P	
2	30-1	30-2	100	4	P	
3	30-2	30-3	51	4	P	
4	30-3	30-4	84	4	P	
5	30-4	30-5	185	4	P	
6	30-5	32-87	125	4	P	
7	30-6	29-16	74	4	P	
8	30-6	30-7	32	4	P	
9	30-7	30-8	47	4	P	
10	30-8	30-9	43	4	P	
11	30-9	30-10	61	4	P	
12	30-10	30-11	74	4	P	
13	30-11	32-99	102	4	P	
14	30-53	30-59	25	4	P	
15	30-7	30-13	115	4	S	
16	30-13	29-14	26	4	S	
17	30-13	30-71	159	4	S	
18	30-71	30-67	29	4	S	
19	30-62	30-67	33	4	S	
20	30-60	30-62	155	4	S	
21	30-59	30-60	50	4	S	
22	30-52	30-53	89	4	S	
23	30-51	30-52	51	4	S	
24	30-90	30-51	116	4	S	
25	30-90	30-91	123	4	S	
26	30-5	30-91	150	4	S	
27	29-8	30-72	58	4	S	
28	30-72	30-51	123	4	S	
29	30-51	30-50	109	4	S	
30	30-50	30-48	54	4	S	
31	30-48	30-46	62	4	S	
32	30-45	30-46	116	4	S	
33	32-89	30-45	96	4	S	
34	30-71	30-69	47	4	T	
35	30-69	30-63	88	4	T	
36	30-63	30-61	70	4	T	
37	30-61	30-58	80	4	T	
38	30-58	30-55	27	4	T	
39	30-54	30-55	46	4	T	
40	30-52	30-54	105	4	T	
41	30-3	30-87	83	4	T	
42	30-82	30-87	50	4	T	

Ward No. 30

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
43	30-80	30-82	20	4	T	
44	30-78	30-80	30	4	T	
45	30-76	30-78	40	4	T	
46	29-5	30-76	116	4	T	
47	29-4	30-87	217	4	T	
48	30-44	30-45	44	4	T	
49	30-42	30-44	20	4	T	
50	30-41	30-42	142	4	T	
51	30-37	30-41	29	4	T	
52	30-36	30-37	27	4	T	
53	30-34	30-36	35	4	T	
54	32-91	30-34	91	4	T	
55	32-93	30-22	67	4	T	
56	30-22	30-23	15	4	T	
57	30-23	30-25	37	4	T	
58	30-35	30-30	171	4	T	
59	30-30	30-32	22	4	T	
60	30-11	30-17	101	4	T	
61	30-10	30-16	101	4	T	
62	30-9	30-15	110	4	T	
63	30-91	30-92	107	4	T	
64	30-42	30-43	184	4	T	
65	30-25	30-27	108	4	T	
66	30-53	30-54	117	4	T	
67	30-60	30-61	119	4	T	

Summary	
Total Route	5446
Primary Route	1041
Secondary Route	1739
Tertiary Route	2666
Chambers	75

Ward 31



Summary	
Total Route (Mtr)	2009
Primary Route (Mtr)	1066
Secondary Route (Mtr)	943
Tertiary Route (Mtr)	428
Chambers	24

Primary Route

Secondary Route

Tertiary Route

Ward No. 31

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	12-30	31-1	82	4	P	
2	31-1	31-14	39	4	P	
3	31-14	31-2	75	4	P	
4	31-2	31-3	61	4	P	
5	31-3	31-4	140	4	P	
6	31-4	31-15	23	4	P	
7	31-15	31-16	19	4	P	
8	31-16	31-5	33	4	P	
9	31-5	31-6	70	4	P	
10	31-6	31-7	176	4	P	
11	31-7	28	132	4	P	
12	31-25	12-34	216	4	P	
13	31-7	31-8	125	4	S	
14	31-4	31-8	137	4	S	
15	31-10	31-11	212	4	S	
16	31-11	31-12	33	4	S	
17	31-12	31-13	96	4	S	
18	31-3	31-13	70	4	S	
19	31-1	31-17	74	4	S	
20	31-17	31-18	69	4	S	
21	31-2	31-18	127	4	S	

Summary	
Total Route	2009
Primary Route	1066
Secondary Route	943
Tertiary Route	0
Chambers	24

Ward 32

Summary	
Total Route (Mtr)	23185
Primary Route (Mtr)	6642
Secondary Route (Mtr)	6888
Tertiary Route (Mtr)	9655
Chambers	398

Primary Route

Secondary Route

Tertiary Route

Ward No. 32

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	32-86	32-87	270	4	P	
2	32-85	32-86	118	4	P	
3	32-84	32-85	104	4	P	
4	32-82	32-84	48	4	P	
5	32-82	32-79	33	4	P	
6	32-79	32-77	23	4	P	
7	32-77	32-75	51	4	P	
8	32-75	32-74	42	4	P	
9	32-75	32-57	167	4	P	
10	32-57	32-56	63	4	P	
11	32-56	32-50	128	4	P	
12	32-50	32-49	79	4	P	
13	32-49	32-48	31	4	P	
14	32-18	32-17	32	4	P	
15	32-17	32-16	26	4	P	
16	32-16	32-15	36	4	P	
17	32-15	32-13	111	4	P	
18	32-13	32-209	117	4	P	
19	32-208	32-209	82	4	P	
20	32-12	32-208	48	4	P	
21	32-14	32-40	136	4	P	
22	32-39	32-40	47	4	P	
23	32-38	32-39	128	4	P	
24	32-37	32-38	18	4	P	
25	32-36	32-37	505	4	P	
26	32-35	32-36	33	4	P	
27	32-34	32-35	62	4	P	
28	32-34	32-33	210	4	P	
29	32-32	32-33	143	4	P	
30	32-29	32-32	140	4	P	
31	32-28	32-29	84	4	P	
32	32-14	32-48	123	4	P	
33	32-26	32-28	119	4	P	
34	32-24	32-26	82	4	P	
35	32-22	32-24	120	4	P	
36	32-21	32-22	221	4	P	
37	32-20	32-21	455	4	P	
38	32-18	32-20	210	4	P	
39	32-5	32-101	67	4	P	
40	32-99	32-101	200	4	P	
41	32-89	32-90	56	4	P	
42	32-90	32-91	160	4	P	
43	32-91	32-92	44	4	P	
44	32-92	32-93	42	4	P	
45	32-93	32-94	119	4	P	

Ward No. 32

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
46	32-94	32-95	77	4	P	
47	32-95	32-97	49	4	P	
48	32-97	32-98	53	4	P	
49	32-98	32-99	40	4	P	
50	32-87	32-88	174	4	P	
51	32-88	32-89	60	4	P	
52	32-262	32-397	98	4	P	
53	32-397	32-396	23	4	P	
54	32-396	32-305	71	4	P	
55	12-30	32-235	37	4	P	
56	32-235	32-237	63	4	P	
57	32-237	32-239	21	4	P	
58	32-239	32-241	32	4	P	
59	32-241	32-244	30	4	P	
60	32-244	32-247	16	4	P	
61	32-247	32-249	34	4	P	
62	32-249	32-251	35	4	P	
63	32-251	32-252	31	4	P	
64	32-252	32-259	34	4	P	
65	32-258	32-259	38	4	P	
66	32-258	32-262	27	4	P	
67	32-305	32-300	43	4	P	
68	32-300	32-306	57	4	P	
69	32-306	32-309	39	4	P	
70	32-309	32-310	34	4	P	
71	32-310	32-322	39	4	P	
72	32-322	32-324	61	4	P	
73	32-324	32-358	49	4	P	
74	32-358	32-359	61	4	P	
75	32-359	32-361	32	4	P	
76	32-13	32-361	51	4	P	
77	32-75	32-72	73	4	S	
78	32-70	32-72	22	4	S	
79	32-68	32-70	39	4	S	
80	32-68	32-63	67	4	S	
81	32-57	32-58	132	4	S	
82	32-58	32-66	102	4	S	
83	32-64	32-66	27	4	S	
84	32-63	32-64	156	4	S	
85	32-28	32-193	629	4	S	
86	32-193	32-184	105	4	S	
87	32-183	32-184	100	4	S	
88	32-183	32-191	83	4	S	
89	32-191	32-92	25	4	S	
90	32-200	32-201	172	4	S	

Ward No. 32

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
91	32-200	32-202	183	4	S	
92	32-142	32-200	238	4	S	
93	32-94	32-142	95	4	S	
94	32-142	32-134	69	4	S	
95	32-133	32-134	163	4	S	
96	32-133	32-143	46	4	S	
97	32-143	32-155	122	4	S	
98	32-155	32-157	39	4	S	
99	32-156	32-157	19	4	S	
100	32-123	32-156	38	4	S	
101	32-122	32-123	26	4	S	
102	32-120	32-122	42	4	S	
103	32-118	32-120	28	4	S	
104	32-116	32-118	26	4	S	
105	32-113	32-116	89	4	S	
106	32-112	32-113	25	4	S	
107	32-103	32-112	49	4	S	
108	32-103	32-104	30	4	S	
109	31-4	32-104	60	4	S	
110	31-15	32-105	58	4	S	
111	32-104	32-105	35	4	S	
112	32-105	32-103	76	4	S	
113	32-101	32-102	58	4	S	
114	31-16	32-102	71	4	S	
115	32-100	32-106	115	4	S	
116	32-106	32-108	14	4	S	
117	32-108	32-110	23	4	S	
118	32-110	32-112	72	4	S	
119	32-110	32-111	36	4	S	
120	32-106	32-107	33	4	S	
121	32-108	32-109	41	4	S	
122	32-113	32-115	48	4	S	
123	32-100	32-152	29	4	S	
124	32-152	32-154	22	4	S	
125	32-152	32-153	36	4	S	
126	32-99	32-150	61	4	S	
127	32-98	32-149	66	4	S	
128	32-148	32-149	41	4	S	
129	32-149	32-150	36	4	S	
130	32-150	32-151	56	4	S	
131	32-97	32-146	83	4	S	
132	32-146	32-147	38	4	S	
133	32-146	32-145	76	4	S	
134	32-134	32-135	61	4	S	
135	32-135	32-137	72	4	S	

Ward No. 32

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
136	32-137	32-139	31	4	S	
137	32-139	32-129	33	4	S	
138	32-129	32-127	34	4	S	
139	32-127	32-124	31	4	S	
140	32-123	32-124	92	4	S	
141	32-131	32-133	35	4	S	
142	32-129	32-131	96	4	S	
143	32-129	32-130	59	4	S	
144	32-135	32-136	41	4	S	
145	32-137	32-138	57	4	S	
146	32-139	32-141	44	4	S	
147	32-131	32-132	118	4	S	
148	32-143	32-144	61	4	S	
149	32-127	32-128	48	4	S	
150	32-124	32-126	41	4	S	
151	32-124	32-125	173	4	S	
152	32-120	32-121	35	4	S	
153	32-118	32-119	82	4	S	
154	32-208	32-169	116	4	S	
155	32-169	32-168	22	4	S	
156	32-168	32-167	20	4	S	
157	32-167	32-159	19	4	S	
158	32-159	32-160	24	4	S	
159	32-160	32-161	28	4	S	
160	32-161	32-162	19	4	S	
161	32-162	32-163	51	4	S	
162	32-163	32-165	38	4	S	
163	32-165	32-175	68	4	S	
164	32-175	32-176	16	4	S	
165	32-139	32-140	53	4	S	
166	32-176	32-177	20	4	S	
167	32-177	32-178	34	4	S	
168	32-178	32-179	34	4	S	
169	32-155	32-164	70	4	S	
170	32-164	32-166	34	4	S	
171	32-166	32-171	204	4	S	
172	32-328	32-329	37	4	S	
173	32-12	32-370	83	4	S	
174	32-370	32-372	86	4	S	
175	32-372	32-373	34	4	S	
176	32-11	32-373	244	4	S	
177	32-37	32-45	77	4	T	
178	32-45	32-44	45	4	T	
179	32-43	32-41	23	4	T	
180	32-41	32-40	49	4	T	

Ward No. 32

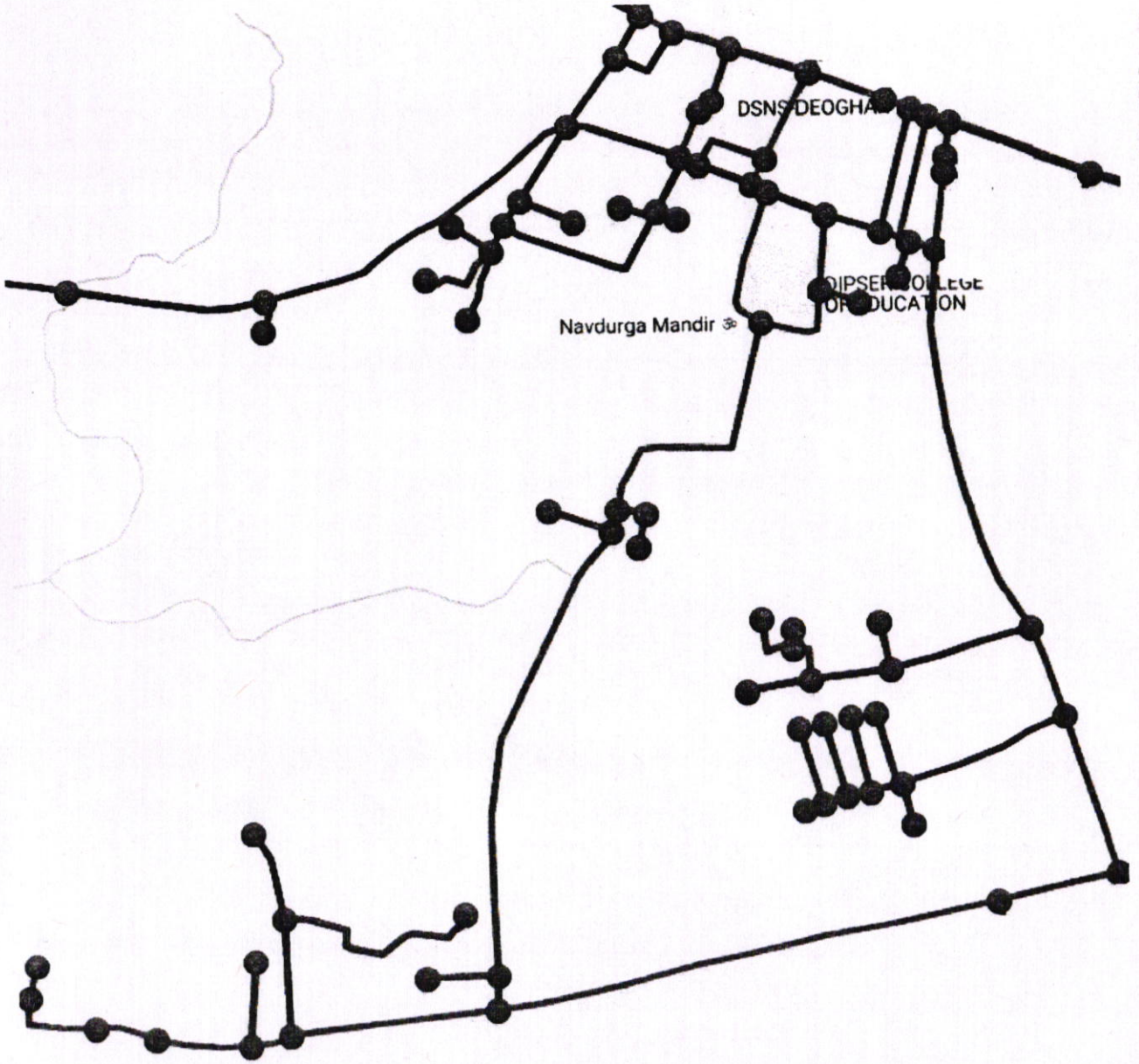
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
181	32-256	32-394	137	4	T	
182	32-396	32-290	154	4	T	
183	32-377	11-1	147	4	T	
184	32-377	32-378	121	4	T	
185	32-1	12-11	108	4	T	
186	12-14	32-3	112	4	T	
187	32-41	32-42	203	4	T	
188	32-44	32-43	129	4	T	
189	32-50	32-51	178	4	T	
190	32-53	32-54	167	4	T	
191	32-72	32-73	196	4	T	
192	32-84	32-181	485	4	T	
193	32-31	32-32	107	4	T	
194	32-197	32-198	291	4	T	
195	32-197	32-199	378	4	T	
196	32-182	32-88	214	4	T	
197	32-186	32-185	121	4	T	
198	32-182	32-184	132	4	T	
199	32-194	32-195	139	4	T	
200	32-193	32-196	145	4	T	
201	32-116	32-117	111	4	T	
202	32-122	32-168	130	4	T	
203	32-158	32-167	127	4	T	
204	32-157	32-160	116	4	T	
205	32-155	32-161	113	4	T	
206	32-164	32-163	100	4	T	
207	31-1	32-233	106	4	T	
208	31-14	32-232	101	4	T	
209	32-233	32-234	131	4	T	
210	32-241	32-242	111	4	T	
211	32-168	32-228	124	4	T	
212	32-252	32-253	117	4	T	
213	32-205	32-176	137	4	T	
214	32-206	32-178	137	4	T	
215	32-207	32-203	107	4	T	
216	32-178	32-174	124	4	T	
217	32-330	32-332	137	4	T	
218	32-346	32-347	183	4	T	
219	32-343	32-341	100	4	T	
220	32-339	32-341	126	4	T	
221	32-328	32-336	153	4	T	
222	32-327	32-328	121	4	T	
223	32-262	32-263	178	4	T	
224	32-263	32-264	117	4	T	
225	32-326	32-358	160	4	T	

Ward No. 32

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
226	32-12	32-369	118	4	T	
227	32-366	32-369	283	4	T	
228	32-309	32-311	106	4	T	
229	32-364	32-366	223	4	T	
230	32-366	32-367	117	4	T	
231	32-293	32-366	150	4	T	
232	32-300	32-298	103	4	T	
233	32-297	32-290	149	4	T	
234	32-293	32-6	305	4	T	
235	32-288	32-289	159	4	T	
236	12-19	32-276	149	4	T	
237	32-275	32-287	164	4	T	
238	12-17	32-279	209	4	T	
239	32-279	32-280	109	4	T	
240	32-282	32-283	112	4	T	
241	32-282	32-283	121	4	T	

Summary	
Total Route	23185
Primary Route	6642
Secondary Route	6888
Tertiary Route	9655
Chambers	398

Ward 33



Summary	
Total Route (Mtr)	8009
Primary Route (Mtr)	3729
Secondary Route (Mtr)	3058
Tertiary Route (Mtr)	1222
Chambers	59

Primary Route

Secondary Route

Tertiary Route

Ward No. 33

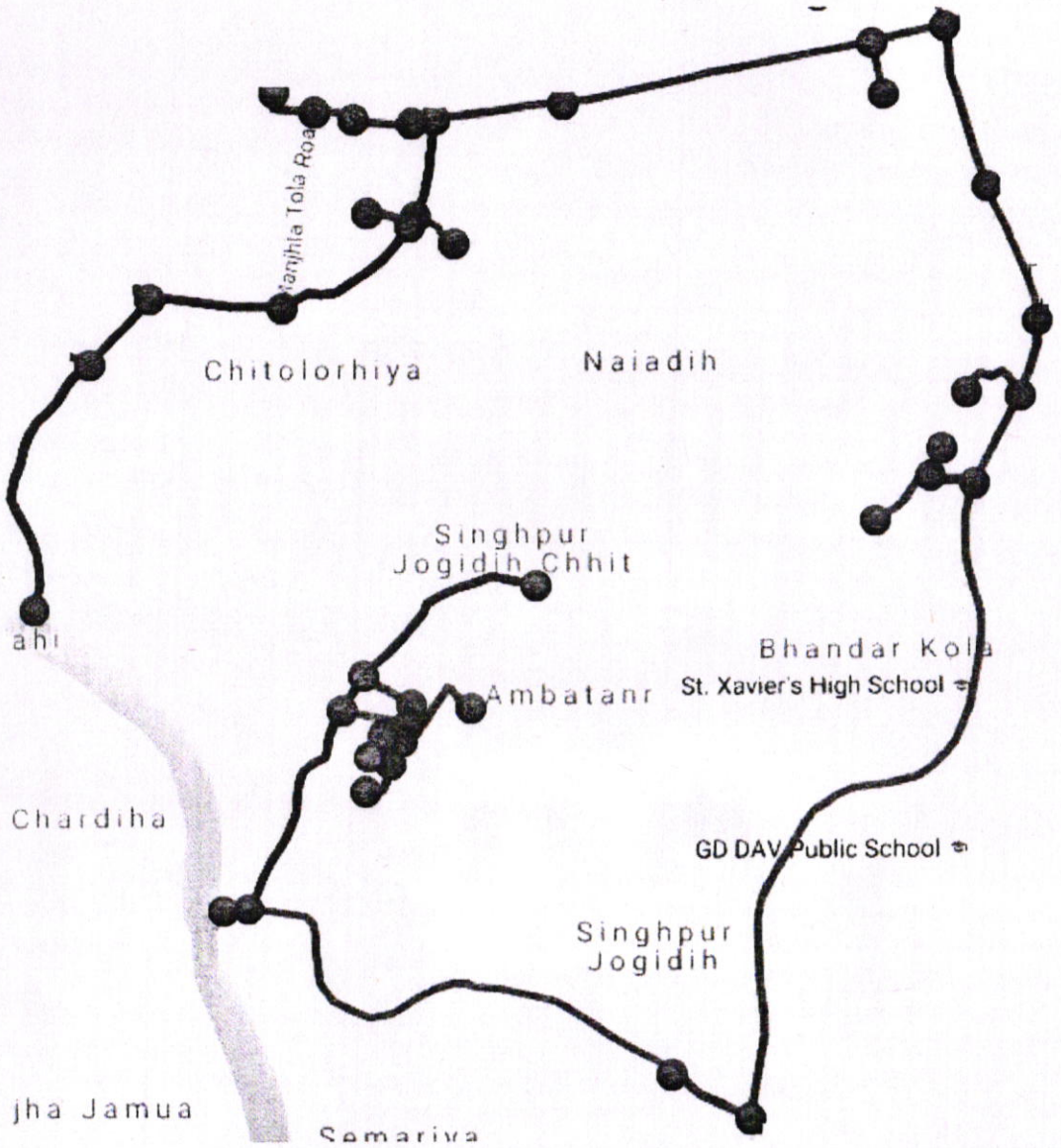
Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	32-13	33-7	134	4	P	
2	33-7	33-8	38	4	P	
3	32-18	33-56	177	4	P	
4	33-48	33-56	553	4	P	
5	33-48	33-37	129	4	P	
6	33-37	33-35	231	4	P	
7	33-34	33-35	172	4	P	
8	33-33	33-34	715	4	P	
9	33-31	33-33	48	4	P	
10	33-17	33-31	658	4	P	
11	33-14	33-17	31	4	P	
12	33-13	33-14	398	4	P	
13	33-13	33-9	206	4	P	
14	33-10	33-11	106	4	P	
15	33-11	33-13	133	4	P	
16	32-12	33-1	68	4	S	
17	32-208	33-1	112	4	S	
18	33-1	33-3	116	4	S	
19	33-3	33-23	123	4	S	
20	33-22	33-23	40	4	S	
21	33-25	33-22	42	4	S	
22	33-25	33-26	100	4	S	
23	33-3	33-29	494	4	S	
24	33-29	10-65	276	4	S	
25	33-3	33-4	161	4	S	
26	33-4	33-5	29	4	S	
27	33-5	33-8	80	4	S	
28	33-8	33-9	25	4	S	
29	33-9	33-10	84	4	S	
30	33-10	33-59	79	4	S	
31	33-59	33-57	43	4	S	
32	33-57	33-56	38	4	S	
33	33-4	33-19	82	4	S	
34	33-19	33-22	273	4	S	
35	33-48	33-49	204	4	S	
36	33-49	33-51	111	4	S	
37	33-51	33-55	92	4	S	
38	33-37	33-38	246	4	S	
39	33-38	33-41	44	4	S	
40	33-41	33-43	34	4	S	
41	33-43	33-45	34	4	S	

Ward No. 33

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
42	33-45	33-47	28	4	S	
43	32-17	33-57	169	4	T	
44	32-16	33-59	174	4	T	
45	33-7	33-5	115	4	T	
46	33-25	33-27	118	4	T	
47	33-31	33-32	102	4	T	
48	33-34	33-36	123	4	T	
49	33-38	33-40	102	4	T	
50	33-41	33-42	106	4	T	
51	33-43	33-44	105	4	T	
52	33-45	33-46	108	4	T	

Summary	
Total Route	8009
Primary Route	3729
Secondary Route	3058
Tertiary Route	1222
Chambers	59

Ward 34



Summary	
Total Route (Mtr)	10308
Primary Route (Mtr)	5003
Secondary Route (Mtr)	3094
Tertiary Route (Mtr)	2211
Chambers	65

Primary Route

Secondary Route

Tertiary Route

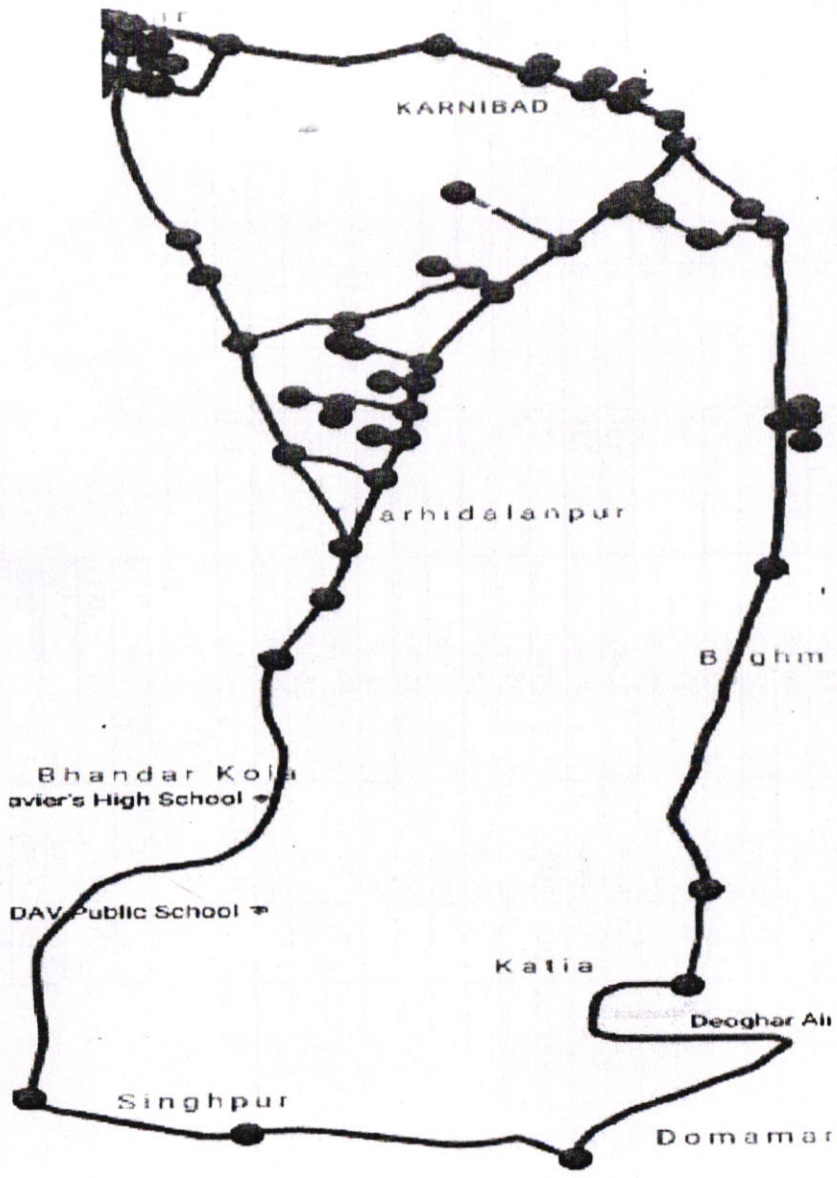
Ward No. 34

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	33-35	34-43	377	4	P	
2	34-43	34-44	327	4	P	
3	34-44	34-45	176	4	P	
4	34-45	34-47	224	4	P	
5	34-47	34-51	1700	4	P	
6	34-51	34-52	202	4	P	
7	34-52	34-53	1190	4	P	
8	34-53	34-54	62	4	P	
9	33-33	34-1	289	4	P	
10	34-1	34-5	59	4	P	
11	34-5	34-7	130	4	P	
12	34-7	34-9	90	4	P	
13	34-9	34-13	130	4	P	
14	34-13	34-15	47	4	P	
15	34-2	34-4	127	4	S	
16	34-1	34-2	164	4	S	
17	34-1	34-21	219	4	S	
18	34-21	34-23	26	4	S	
19	34-23	34-33	358	4	S	
20	34-33	34-34	299	4	S	
21	34-34	34-40	203	4	S	
22	34-40	34-42	621	4	S	
23	34-53	34-55	512	4	S	
24	34-55	34-56	89	4	S	
25	34-56	34-65	476	4	S	
26	34-56	34-57	128	4	T	
27	34-55	34-58	152	4	T	
28	34-58	34-59	209	4	T	
29	34-62	34-64	107	4	T	
30	34-40	34-41	231	4	T	
31	34-34	34-35	125	4	T	
32	34-35	34-36	136	4	T	
33	34-35	34-37	143	4	T	
34	34-21	34-22	110	4	T	
35	34-5	34-6	119	4	T	
36	34-2	34-3	307	4	T	
37	34-47	34-48	105	4	T	
38	34-48	34-50	169	4	T	
39	34-45	34-46	170	4	T	

Ward No. 34

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
	Summary					
	Total Route	10308				
	Primary Route	5003				
	Secondary Route	3094				
	Tertiary Route	2211				
	Chambers	65				

Ward 35



Summary	
Total Route (Mtr)	8835
Primary Route (Mtr)	5350
Secondary Route (Mtr)	1958
Tertiary Route (Mtr)	1527
Chambers	47

Primary Route

Secondary Route

Tertiary Route

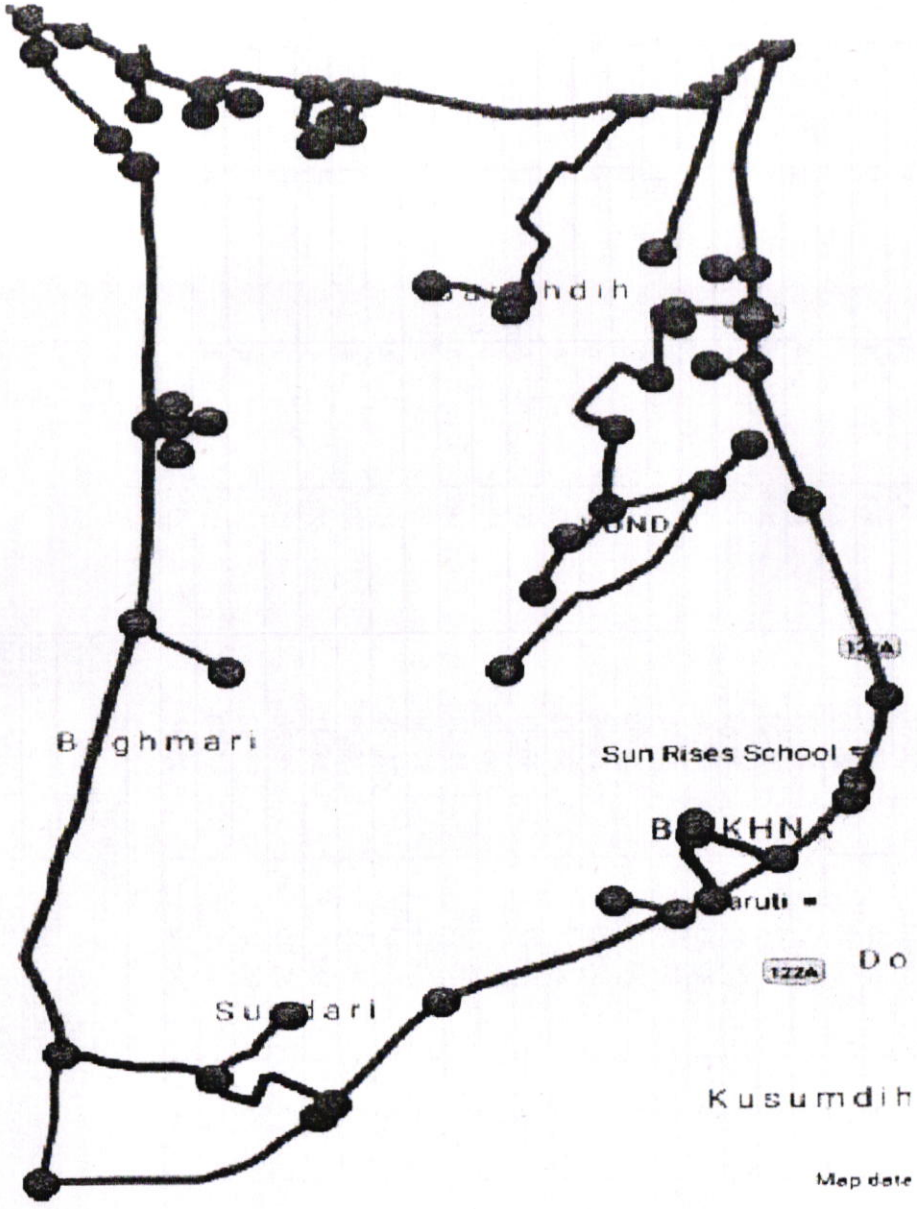
223

Ward No. 35

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	32-28	35-9	80	4	P	
2	35-9	35-22	257	4	P	
3	35-22	35-23	80	4	P	
4	35-23	35-46	629	4	P	
5	35-46	35-47	481	4	P	
6	35-47	35-45	1009	4	P	
7	34-44	34-45	316	4	P	
8	35-43	35-44	1320	4	P	
9	35-42	35-43	696	4	P	
10	34-51	35-42	482	4	P	
11	32-20	35-7	253	4	S	
12	35-5	35-7	35	4	S	
13	33-56	35-5	46	4	S	
14	35-9	35-10	177	4	S	
15	35-10	35-16	37	4	S	
16	35-16	35-17	36	4	S	
17	35-17	35-24	158	4	S	
18	35-24	35-26	202	4	S	
19	35-26	35-29	276	4	S	
20	35-29	35-33	62	4	S	
21	35-33	35-35	96	4	S	
22	35-35	35-39	90	4	S	
23	35-39	35-41	135	4	S	
24	34-44	35-41	234	4	S	
25	35-26	35-27	72	4	S	
26	35-16	35-18	49	4	S	
27	34-43	35-41	208	4	T	
28	35-35	35-36	151	4	T	
29	35-29	35-30	153	4	T	
30	35-24	35-25	279	4	T	
31	35-27	35-31	296	4	T	
32	33-35	35-31	232	4	T	
33	35-18	35-19	37	4	T	
34	35-21	35-23	171	4	T	

Summary	
Total Route	8835
Primary Route	5350
Secondary Route	1958
Tertiary Route	1527
Chambers	47

Ward 36



Summary	
Total Route (Mtr)	8768
Primary Route (Mtr)	3728
Secondary Route (Mtr)	1618
Tertiary Route (Mtr)	3422
Chambers	50

Primary Route

Secondary Route

Tertiary Route

Ward No. 36

Sl. No.	From	To	Length (Mtr)	Width (Mtr)	Primary/ Secondary/ Tertiary	Remarks
1	32-14	36-44	545	4	P	
2	36-29	36-44	103	4	P	
3	36-29	36-28	36	4	P	
4	36-27	36-28	101	4	P	
5	36-27	36-27	340	4	P	
6	36-26	36-25	497	4	P	
7	36-25	36-24	213	4	P	
8	36-24	36-23	43	4	P	
9	36-23	36-20	198	4	P	
10	36-19	36-20	161	4	P	
11	36-19	36-17	78	4	P	
12	36-17	36-16	486	4	P	
13	36-16	36-15	322	4	P	
14	36-15	36-14	38	4	P	
15	35-44	36-14	567	4	P	
16	32-38	36-48	594	4	S	
17	36-48	36-50	35	4	S	
18	36-15	36-12	308	4	S	
19	35-45	36-12	291	4	S	
20	36-19	36-21	176	4	S	
21	36-20	36-21	186	4	S	
22	36-41	36-43	28	4	S	
23	32-31	36-1	103	4	T	
24	32-34	36-4	177	4	T	
25	36-48	36-49	164	4	T	
26	32-39	36-45	416	4	T	
27	36-12	36-13	211	4	T	
28	35-47	36-11	204	4	T	
29	36-17	36-18	123	4	T	
30	36-29	36-31	142	4	T	
31	36-31	36-33	206	4	T	
32	36-34	36-35	196	4	T	
33	36-35	36-39	200	4	T	
34	36-39	36-41	605	4	T	
35	36-35	36-36	116	4	T	
36	36-36	36-38	141	4	T	
37	36-39	36-40	124	4	T	
38	36-33	36-34	294	4	T	

Summary	
Total Route	8768
Primary Route	3728
Secondary Route	1618
Tertiary Route	3422
Chambers	50

ANNEXURE - 7

BANDWIDTH ESTIMATION

BW Estimation for Deoghar City

SN	Description	Applications	Nos / Qty in 2016	Current BW Requirement (2016)		No/Qty in 2026	BW Required After 10 Yrs (Mbps) 2026		No/Qty in 2036	BW Required After 20 Yrs (Mbps) 2036	
				Unit BW	Total BW		Unit BW	Total BW		Unit BW	Total BW
1	Households	Voice, Internet Access	46,330	2	3,089	59,200	4	7,893	76,000	10	25,333
	Sub total 1 (HH)				**3,089**			**7,893**			**25,333**
2	PWD offices	Voice, Internet Access, ERP, NMS etc	3	4	12	4	8	32	8	10	80
3	MCD offices	Voice, Internet Access, e-Governance	1	10	10	6	8	48	10	10	100
4	Courts	Voice, Internet Access, e-Courts	1	10	10	4	20	80	6	40	240
5	Post offices	Voice, Internet Access, e-money, insurance etc	4	4	16	10	8	80	14	10	140
6	Police stations	Voice, Internet Access, CCTNS & other applications	3	4	12	6	8	48	8	10	80
7	Water authority offices	Voice, Internet Access, ERP, NMS etc	1	4	4	6	8	48	8	10	80
8	Electricity authority offices	Voice, Internet Access, ERP, CRM, EMS etc	1	4	4	6	8	48	8	10	80
	Sub total 2 (Gov.)				**68**			**384**			**800**
9	Offices (Telecom/Cable/ISP)	Voice, Internet Access, NMS, CRM, etc	26	4	104	40	8	320	60	10	600
10	Main markets/malls/movie theater	Voice, Internet Access, E-commerce applications	5	100	500	15	200	3,000	25	500	12,500
10	Colleges	Voice, Internet Access, Tele-education	6	4	24	10	8	80	14	10	140
11	Schools	Voice, Internet Access, Tele-education	10	4	40	30	8	240	40	10	400
11	Hospitals	Voice, Internet Access, Tele-medicine	6	4	24	14	8	112	20	10	200
12	Primary health centers	Voice, Internet Access, Tele-medicine	4	4	16	8	8	64	20	10	200
12	Banks	Voice, Internet Access, Banking & e-commerce	27	10	270	35	20	700	40	40	1,600
13	Tourist Places	Voice, Internet Access	13	4	52	12	8	96	16	10	160
13	Tourist Office	Voice, internet	1	4	4	4	4	16	6	8	48
14	Pvt. Offices and Corporates	Voice, Internet Access	20	4	80	30	8	240	50	10	500
	Sub total 3 (Inst. & offices)				**1,114**			**4,868**			**16,348**
15	Backhaul Req. for Mobile	For providing wireless broadband	8	300	2,400	15	600	9,000	20	900	18,000
16	Floating bandwidth for tourist season				500			1,000			2,000
17	CCTV Surveillance Network for Police	For Surveillance of sensitive / areas of the city	100	30	3,000	200	30	6,000	400	30	12,000
	Sub total 4 (Others)				**5,900**			**16,000**			**32,000**
	Grand total (Mbps)				**10,171**			**29,145**			**74,481**
	Grand total (Gbps)				**10**			**30**			**75**

226

ANNEXURE - 8

BUSINESS VIABILITY

Business Plan Assumptions:

Parameter	Value	Unit
Debt : Equity Ratio	50:50	50:50
Debt Interest Rate	12%	p.a.
Debt Payback Period	10	Yrs
Depreciation Duct	10%	p.a
Opportunity Loss	10%	p.a
Corporate Tax	33%	p.a
Business Cycle	10	Yrs
Project Cycle	20	Yrs
Max Sale	70%	
Initial Sale	25%	
Incremental Sale	5%	p.a.
Maintenance Cost	3%	p.a.

	Item	Unit	Qty	Total Cost
	Materials	KM	1086	20,81,78,037
	Services	KM	1086	23,54,50,000
				44,36,28,037
	RoW cost	KM	300	1,50,00,000
	Total Ducting Cost			**45,86,28,037**
	No. of Micro Ducts	KM	7602	7 no. of micro ducts
	Saleable No. of Micro Ducts	KM	5321	Assuming 70% Sale
	Unit Cost Price	KM	1	60,330
	Loaded Cost Price	KM	1	86,186

		Total Units	7,602	7,602	7,602							
		Unit SP (Cr)	2,50,000	2,75,000	3,00,000							
		Total Income (Cr)	1,90,05,00,000	2,09,05,50,000	2,28,06,00,000							
Year	**Yr 0**	**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Yr 5**	**Yr 6**	**Yr 7**	**Yr 8**	**Yr 9**	**Yr 10**	**Total**
% Sale		25%	5%	5%	5%	5%	5%	5%	5%	5%	5%	**70%**
Revenue @ SP 1	-	47,51,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	**1,33,03,50,000**
Revenue @ SP 2	-	52,26,37,500	10,45,27,500	10,45,27,500	10,45,27,500	10,45,27,500	10,45,27,500	10,45,27,500	10,45,27,500	10,45,27,500	10,45,27,500	**1,46,33,85,000**
Revenue @ SP 3	-	57,01,50,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,000	**1,59,64,20,000**

Outflow - TRAI Deogarh

Duct Supply Cost (Rs.)	20,81,78,037
Duct Laying Cost (Rs.)	23,54,50,000
RoW Cost (Rs.)	1,50,00,000
Total Cost	**45,86,28,037**

Debt	50%	22,93,14,019
Equity	50%	22,93,14,019

Years			Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Total
Depreciation														
Ducts		10.00%	-	4,58,62,804	4,58,62,804	4,58,62,804	4,58,62,804	4,58,62,804	4,58,62,804	4,58,62,804	4,58,62,804	4,58,62,804	4,58,62,804	**45,86,28,037**
Dividend														
Opportunity Loss		10.00%		2,29,31,402	2,29,31,402	2,29,31,402	2,29,31,402	2,29,31,402	2,29,31,402	2,29,31,402	2,29,31,402	2,29,31,402	2,29,31,402	**22,93,14,019**
Interest														
Opening Balance	10 Yrs		-	22,93,14,019	21,62,46,751	20,16,11,411	18,52,19,830	16,68,61,260	14,62,99,662	12,32,70,671	9,74,78,202	6,85,90,636	3,62,36,562	
EYI			-	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	**40,58,49,499**
Interest @12% p.a.		12.00%	-	2,75,17,682	2,59,49,610	2,41,93,369	2,22,26,380	2,00,23,351	1,75,55,959	1,47,92,481	1,16,97,384	82,30,876	43,48,387	**17,65,35,481**
Principal Payment			-	1,30,67,268	1,46,35,340	1,63,91,581	1,83,58,570	2,05,61,599	2,30,28,991	2,57,92,469	2,88,87,566	3,23,54,074	3,62,36,562	**22,93,14,019**
Closing balance			-	21,62,46,751	20,16,11,411	18,52,19,830	16,68,61,260	14,62,99,662	12,32,70,671	9,74,78,202	6,85,90,636	3,62,36,562	0	
Total Expenditure for Profit (Dep, Dividend, Int)			-	**9,63,11,888**	**9,47,43,816**	**9,29,87,575**	**9,10,20,585**	**8,88,17,557**	**8,63,50,165**	**8,35,86,686**	**8,04,91,590**	**7,70,25,082**	**7,31,42,593**	**86,44,77,536**
Total Outflow for Cash Flow (EMI)			-	**4,05,84,950**	**4,05,84,950**	**4,05,84,950**	**4,05,84,950**	**4,05,84,950**	**4,05,84,950**	**4,05,84,950**	**4,05,84,950**	**4,05,84,950**	**4,05,84,950**	**40,58,49,499**

Profit, Cash Flow, Taxes & IRR

For Sale Price 1 **2,50,000**

FOR PROFIT	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Total
Income	-	47,51,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	**1,33,03,50,000**
Expenditure	45,86,28,037	9,63,11,888	9,47,43,816	9,29,87,575	9,10,20,585	8,88,17,557	8,63,50,165	8,35,86,686	8,04,91,590	7,70,25,082	7,31,42,593	**1,32,31,05,573**
PBT (profit before tax)	- 45,86,28,037	37,88,13,112	2,81,184	20,37,425	40,04,415	62,07,443	86,74,835	1,14,38,314	1,45,33,410	1,79,99,918	2,18,82,407	**72,44,427**
Cumulative PBT	- 45,86,28,037	- 7,98,14,925	- 7,95,33,740	- 7,74,96,315	- 7,34,91,900	- 6,72,84,457	- 5,86,09,622	- 4,71,71,308	- 3,26,37,898	- 1,46,37,980	72,44,427	**72,44,427**
Corporate Tax @33%	-	-	-	-	-	-	-	-	-	-	23,90,661	**23,90,661**
PAT (profit after tax)	- 45,86,28,037	37,88,13,112	2,81,184	20,37,425	40,04,415	62,07,443	86,74,835	1,14,38,314	1,45,33,410	1,79,99,918	1,94,91,746	**48,53,766**
Cumulative PAT	- 45,86,28,037	- 7,98,14,925	- 7,95,33,740	- 7,74,96,315	- 7,34,91,900	- 6,72,84,457	- 5,86,09,622	- 4,71,71,308	- 3,26,37,898	- 1,46,37,980	48,53,766	**48,53,766**
FOR CASH FLOW												
Inflow	45,86,28,037	47,51,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	**1,78,89,78,037**
Outflow	45,86,28,037	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,05,84,950	4,29,75,611	**86,68,68,197**
Net Cash Flow	-	43,45,40,050	5,44,40,050	5,44,40,050	5,44,40,050	5,44,40,050	5,44,40,050	5,44,40,050	5,44,40,050	5,44,40,050	5,20,49,389	**92,21,09,840**
Cummulative Cash Flow	-	43,45,40,050	48,89,80,100	54,34,20,150	59,78,60,200	65,23,00,251	70,67,40,301	76,11,80,351	81,56,20,401	87,00,60,451	92,21,09,840	**92,21,09,840**
FOR IRR												
	- 45,86,28,037	37,88,13,112	2,81,184	20,37,425	40,04,415	62,07,443	86,74,835	1,14,38,314	1,45,33,410	1,79,99,918	2,18,82,407	**72,44,427**
IRR	**0.70%**											

Profit, Cash Flow, Taxes & IRR

For Sale Price 1	2,75,000						
FOR PROFIT	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6
Income	-	52,26,37,500	10,45,27,500	10,45,27,500	10,45,27,500	10,45,27,500	10,45,27,5
Expenditure	45,86,28,037	9,63,11,888	9,47,43,816	9,29,87,575	9,10,20,585	8,88,17,557	8,63,50,1
PBT (profit before tax)	- 45,86,28,037	42,63,25,612	97,83,684	1,15,39,925	1,35,06,915	1,57,09,943	1,81,77,3
Cumulative PBT	- 45,86,28,037	- 3,23,02,425	- 2,25,18,740	- 1,09,78,815	25,28,100	1,82,38,043	3,64,15,3
Corporate Tax @33%	-	-	-	-	8,34,273	51,84,281	59,98,5
PAT (profit after tax)	- 45,86,28,037	42,63,25,612	97,83,684	1,15,39,925	1,26,72,642	1,05,25,662	1,21,78,8
Cumulative PAT	- 45,86,28,037	- 3,23,02,425	- 2,25,18,740	- 1,09,78,815	16,93,827	1,22,19,489	2,43,98,3
FOR CASH FLOW							
Inflow	45,86,28,037	47,51,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,000	9,50,25,0
Outflow	45,86,28,037	4,05,84,950	4,05,84,950	4,05,84,950	4,14,19,223	4,57,69,231	4,65,83,4
Net Cash Flow	-	43,45,40,050	5,44,40,050	5,44,40,050	5,36,05,777	4,92,55,769	4,84,41,5
Cummulative Cash Flow	-	43,45,40,050	48,89,80,100	54,34,20,150	59,70,25,928	64,62,81,696	69,47,23,2
FOR IRR							
	- 45,86,28,037	42,63,25,612	97,83,684	1,15,39,925	1,35,06,915	1,57,09,943	1,81,77,3
IRR	12.50%						

235

Profit, Cash Flow, Taxes & IRR

For Sale Price 1	3,00,000						
FOR PROFIT	Yr 0	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6
Income	-	57,01,50,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,00
Expenditure	45,86,28,037	9,63,11,888	9,47,43,816	9,29,87,575	9,10,20,585	8,88,17,557	8,63,50,16
PBT (Profit Before Tax)	- 45,86,28,037	47,38,38,112	1,92,86,184	2,10,42,425	2,30,09,415	2,52,12,443	2,76,79,83
Cumulative PBT	- 45,86,28,037	1,52,10,075	3,44,96,260	5,55,38,685	7,85,48,100	10,37,60,543	13,14,40,37
Corporate Tax @33%	-	50,19,325	63,64,441	69,44,000	75,93,107	83,20,106	91,34,34
PAT (Profit After Tax)	- 45,86,28,037	46,88,18,787	1,29,21,744	1,40,98,425	1,54,16,308	1,68,92,337	1,85,45,48
Cumulative PAT	- 45,86,28,037	1,01,90,750	2,31,12,494	3,72,10,919	5,26,27,227	6,95,19,564	8,80,65,05
FOR CASH FLOW							
Inflow (Income)	45,86,28,037	57,01,50,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,000	11,40,30,00
Outflow (EMI+Tax)	45,86,28,037	4,56,04,275	4,69,49,391	4,75,28,950	4,81,78,057	4,89,05,056	4,97,19,29
Net Cash Flow	-	52,45,45,725	6,70,80,609	6,65,01,050	6,58,51,943	6,51,24,944	6,43,10,70
Cummulative Cash Flow	-	52,45,45,725	59,16,26,335	65,81,27,384	72,39,79,328	78,91,04,271	85,34,14,97
FOR IRR							
	- 45,86,28,037	46,88,18,787	1,29,21,744	1,40,98,425	1,54,16,308	1,68,92,337	1,85,45,48
IRR	18.31%						

Summary

Duct Sale Price (Per KM) (Rs)	After 10 Years			Break Even	IRR
	Income (Cr.)	Expenditure (Cr.)	Profit (Cr.)		
2,50,000	1,33,03,50,000	1,32,31,05,573	72,44,427	10 Yrs	0.70%
2,75,000	1,46,33,85,000	1,32,31,05,573	14,02,79,427	4 Yrs	12.50%
3,00,000	1,59,64,20,000	1,32,31,05,573	27,33,14,427	1 Yr	18.31%

ANNEXURE - 9

TRAI FEEDBACK ON DRAFT REPORT

सत्यमेव जयते

भारतीय दूरसंचार विनियामक प्राधिकरण
TELECOM REGULATORY AUTHORITY OF INDIA
भारत सरकार/Government of India
महानगर दूरसंचार भवन, जवाहर लाल नेहरू मार्ग,
Mahanagar Doorsanchar Bhawan, Jawahar Lal Nehru Marg
(पुराना मिन्टो रोड) नई दिल्ली/(Old Minto Road), New Delhi-110002
फैक्स/Fax : +91-11-23213294, ईपीबीएक्स नं0/ EPBX No. : +91-11-23664145

TRAI

No. 5-4/2016-BB&PA

Date: 18.4.2017

To

Ms Shivalini Sinha, Group GM(Telecom Consultancy),
M/s TCIL,
TCIL Bhavan, Greater Kailash-I,
New Delhi – 110048.

Sub: Submission of draft report by M/s TCIL on 'Feasibility study for Common Duct Policy in Deoghar, Jharkhand" - reg.

Please refer to your letter no. TCIL/51/134/2016/TRAI Deoghar, dated 29.08.2016 regarding submission of draft report on "Feasibility study for Common Duct Policy in Deoghar, Jharkhand". On perusal of the report, the following preliminary observations have been made:

I. In the list of customers in Para 2.6.2, DTH operators have been listed as possible customers who would be keen to buy/lease the micro duct for their needs. The same needs clarification (page 16).
II. The route maps and route tables for 23 wards have been submitted. The same for the balance 13 wards should be included in the final report (page-29).
III. Chapter 10 on Challenges & Risks needs to be completed (page-64).
IV. Review of bandwidth estimation in view of smart city applications.

2. It is requested to take into account the above observations before submission of final report to TRAI in this matter.

(Kapil Handa)
Col
Jt. Advisor(BB&PA)-II