

# Stage 1 Report

To Improve Road Connectivity between IGNOU Road and 100 Futa Road (Chhatarpur)

Name of work: - Improvement of road connectivity between IGNOU Road and 100 Futa Road (Chhatarpur)



CLIENT:



PUBLIC WORKS DEPARTMENT

CONSULTANT:



DHRUPAD CONSULTANTS PVT. LTD

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## **1. Introduction**

### **1.1 Understanding of the Project**

The Chhatarpur Enclave located around 100 futa road (Chhatarpur) is an unauthorized colony on agricultural land that came up unchecked in little over a decade, which has out grown its rural characteristics to adopt urban features without up gradation of infrastructure. The area has seen a growth in high end commercial activities such as restaurants, retail stores and workshops for all group of society. On the other side Indira Gandhi National Open University along the IGNOU road is a distance learning national university located in IGNOU road, Maidan Garhi, New Delhi, India. Of the main utilities, transport is a sector which needs to be looked into immediately since a consequence of increase in commercial activity would be increase in traffic. As a result a need is felt to improve the connectivity of the 100 futa road (Chhatarpur) to IGNOU road.

The project of to explore the possibilities of improving road connectivity between IGNOU Road to 100 Futa Road (Chhatarpur) had been initiated by the Public Works Department. The study will include topographic Survey for counting of trees as per Forest definition. The project has been conceived for scope of services as follows:

- a) Background of the connectivity.
- b) Importance of the connectivity.
- c) Detailed Land use and Land Ownership (Khasra/Khatauni Maps) of the proposed connectivity.
- d) Layout plan for proposed Road Alignment.
- e) Land acquisition details for proposed alignment.
- f) All requirements as per n-principle approval from Forest Department and other land owing agencies.
- g) Possible options for proposed road alignment.
- h) SWOT analysis of all the options.

Dhrupad Consultants Pvt. Ltd. has been entrusted with providing consultancy service for pre-feasibility study to explore the possibilities of improving road connectivity between IGNOU Road and 100 Futa Road ( Chhatarpur).

## 1.2 Background of the existing Alignment (Zonal context and recommendations in the zonal Plan)

The present alignment provides connectivity of 100 futa Road to Anuvrat Marg and IGNOU Road to Mehrauli Badarpur Road. The present alignment if followed connects the 100 Futa Road, Ambedkar Colony, Chhatarpur Enclave to IGNOU Road, which is around 7 km apart via Anuvrat Marg, Mehrauli-Badarpur Road and IGNOU Road. The width of the road varies between 30m - 45m road. Internal Roads of Maidan Garhi Internal Roads of rural character of Maidan Garhi are also an important link to the IGNOU Road from 100 futa road of chhatarpur.

Map 1: Existing Alignment



Source: Google Map, Dhrupad Consultants, Aug 2016

The site falls in zone J, under the Master Plan, Delhi, 2021. To preserve and enhance the green character of the South Delhi Ridge and identify and conserve the historical monuments in the zone were few of the main objectives of the Zonal Development Plan. Under the MPD, 2021 the proposals for this zone were as follows:

- a) Improve and provide accessibility / connectivity to both, Existing Urban Areas and Proposed Urban Extension

- b) Balanced development of the zone and integration with existing Urban Areas;
- c) Preservation of the natural resources and Eco-system,
- d) Conservation of Heritage and Archaeological sites

### **1.3 Importance of the existing alignment**

The existing alignment is important as it provides accessibility to the landmark Qutub Minar Metro Station and further ahead is the arterial link of the settlement to the main road of Anuvrat Marg, Sri Aurobindo Marg or Mehrauli Badarpur Road. As the settlement lacks in public amenities and utilities maximum people access the surrounding area for the same. The only link they have to the surrounding areas is through the existing alignment or the internal roads of Maidhan Garhi. It is also a crucial link to important workplaces such as haуз Khas, Munirka, Nehru Place, Haуз Khas, AIIMS etc.

## **2. Objectives**

- Understanding the background of the existing alignment and establishing it's importance
- Developing alignment alternatives
- Studying the detailed land use and land ownership of the proposed corridors
- SWOT analysis in terms of legal, technical, physical, socio-economic and cultural feasibility of all the options

## **3. Scope of Work**

- a) Background of the connectivity.
- b) Importance of the connectivity.
- c) Detailed Land use and Land Ownership (Khasra/Khatauni Maps) of the proposed connectivity.
- d) Layout plan for proposed Road Alignment.
- e) Land acquisition details for proposed alignment.
- f) All requirements as per n-principle approval from Forest Department and other land owing agencies.

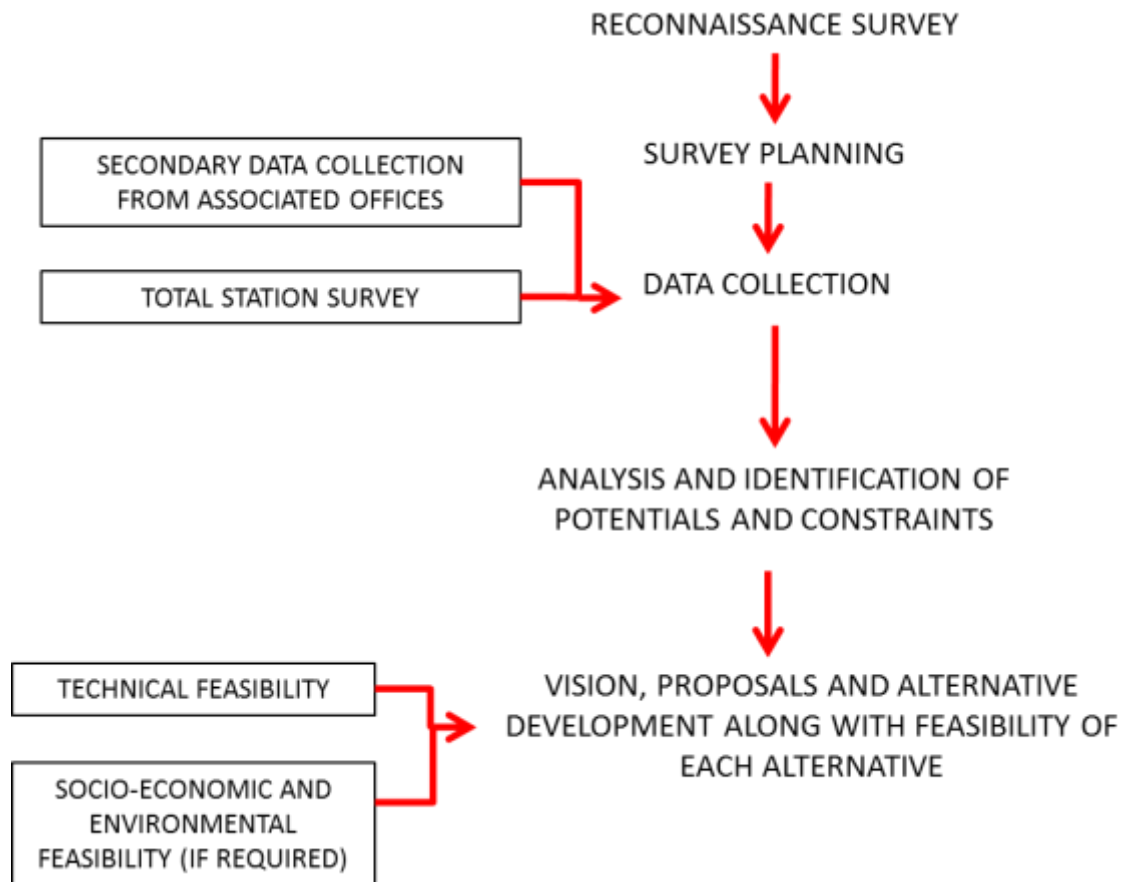
- g) Possible options for proposed road alignment.
- h) SWOT analysis of all the options.

*Understanding of the Consultant:* Assistance shall be provided by the Client to facilitate availability of this data in forms of request letters to appropriate authorities and guidance.

- *Establishing feasibility of the alternatives by means of SWOT analysis with respect to legal, physical, technical, socio-economic and cultural aspects.*

*Understanding of the Consultant:* Financial aspects shall not be dealt with at all.

## 4. Methodology



## 5. Reconnaissance Survey

### 5.1 Site Description

IGNOU Road and 100 Futa Road of Chhatarpur lies in the South district of Delhi at 28°30'07"N , 77°11'53"E and 28°30'11"N , 77°11'08"E respectively. To its north lies Saket, Sultan Pur lies to its West, Sainik Farms lies to its East and Rajpur khurd Village to its south.



Source: Google Map, Dhruvad Consultants Pvt. Ltd., Aug 2016

The site taken for feasibility study lies in East of 100 Futa Road of Mehrauli and West of IGNOU Road.

### 5.2 Area and Boundary

The site is located to the East of 100 Futa Road of Mehrauli and West of IGNOU Road, approximate area being 50 Hectares. 85% of the site is a part of Forest Boundary of South Delhi, which is a conservation zone.

The boundaries of the site are defined by,

- 100 Futa Road of Chhatarpur to West
- Forest Area of South Delhi to North
- IGNOU Road to East
- Chhatarpur Enclave to South.

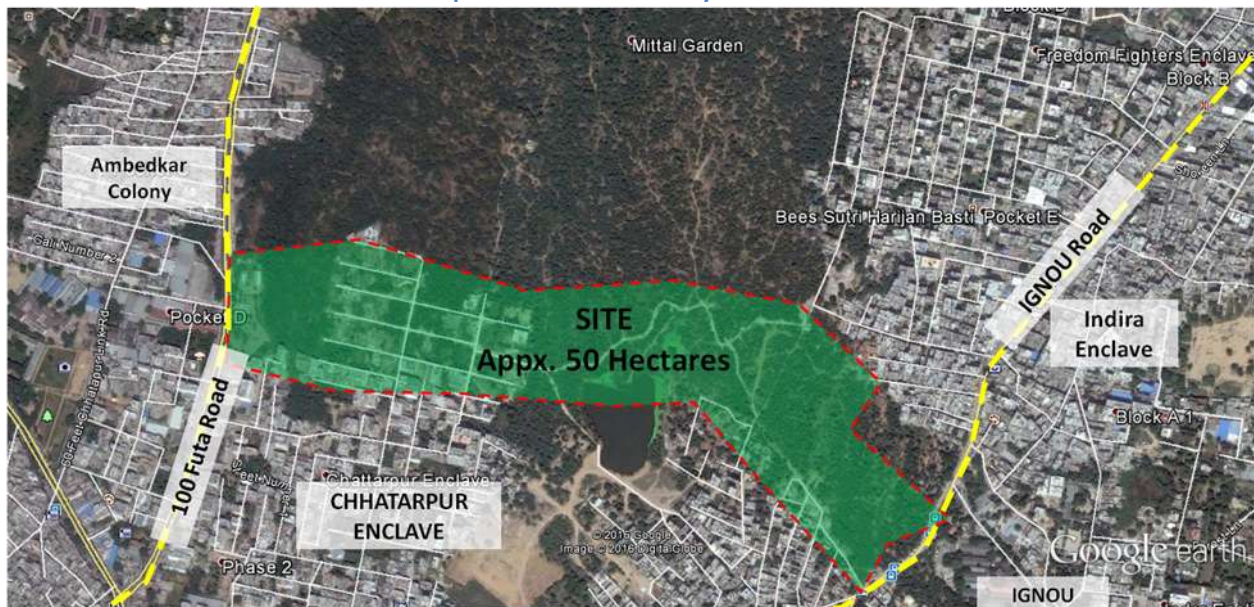
### 5.3 Land Ownership

The area is divided among the following managing agencies,

- Forest Department
- Delhi development Authority
- Others

Thus, feasibility of the alignment will have to be assessed in terms of Land Ownership.

Map 3: Area and Boundary of the Site



Source: Google Earth, Dhruvad Consultants Pvt. Ltd., Aug 2016

Connectivity of Site to important landmarks are as follows:

- I.G. International Airport is approximately 14 km.
- 18 km approximately from New Delhi Railway Stations
- Nearest Metro Station is Saket & Qutab Minar Metro Station.

## 6. Physical Conditions

### 6.1 Accessibility

The Site is accessible only from West and East. There are four entry and exits to the site from 100 futa road and IGNOU road. Two from the West that is from 100 Futa Road and two from the East that is from IGNOU Road. The site can also be accessed from inner roads of chhatarpur enclave. Since the site is a part of forest/ridge area entries are from the broken or missing Forest boundary wall.

Figure 6-1: Entrance to the site from 100 Futa Road is through Landfill Site at Cremation Ground



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

Map 4: Entry/ Exits to the Site



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

### 6.1.1 Levels and Slope variation

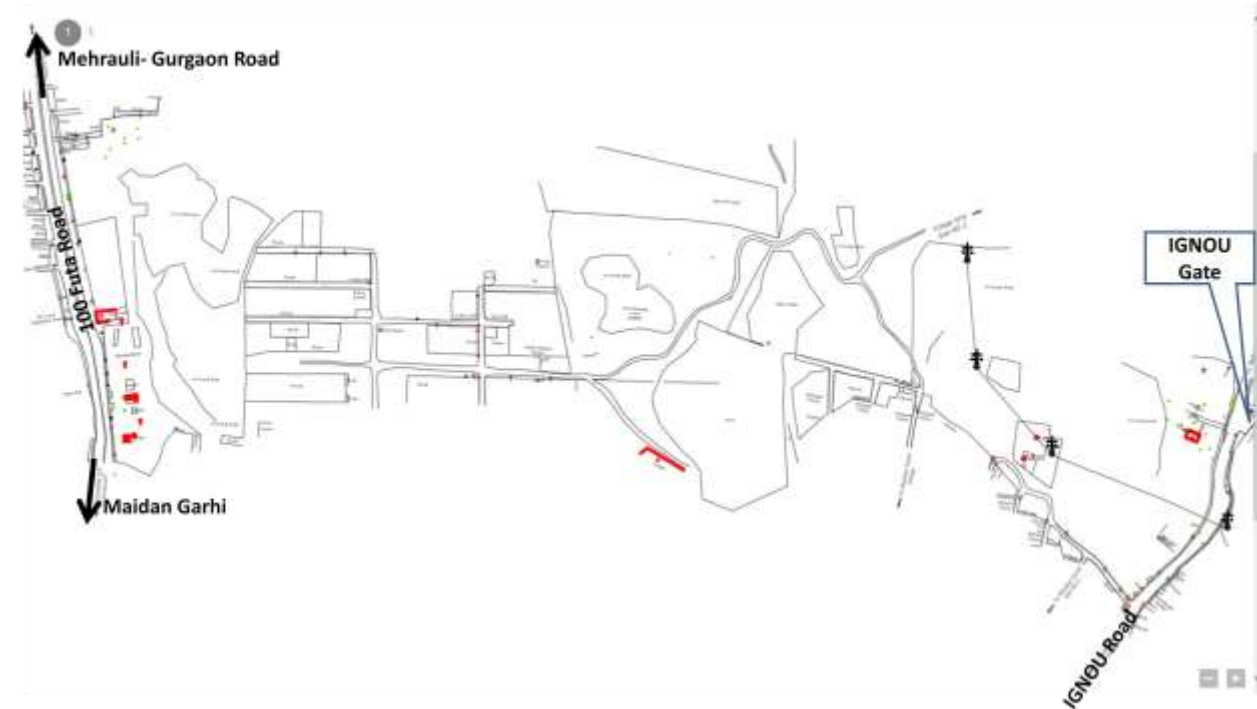
Considering the Slope level at near settlements is around 810 ft, the minimum slope level of the site dips to 800 ft and maximum level rises up to 875 ft. Site is undulating in nature.

### 6.1.2 Monuments and Religious Structures

The Site contains no such religious structure or Monuments except few around the site are listed below:

- A water body in the form of pond.
- Temple of Inspiration.
- Mehrauli Cremation Ground.

Map 5: Existing Temples/ Religious structures in the site



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

All temples in the site are shown in Red Color. Detail Map Attached at the end of drawing as annexure by Drawing No. **DCPL/PWD/TP/2016/31**.

### 6.1.3 Encroachments

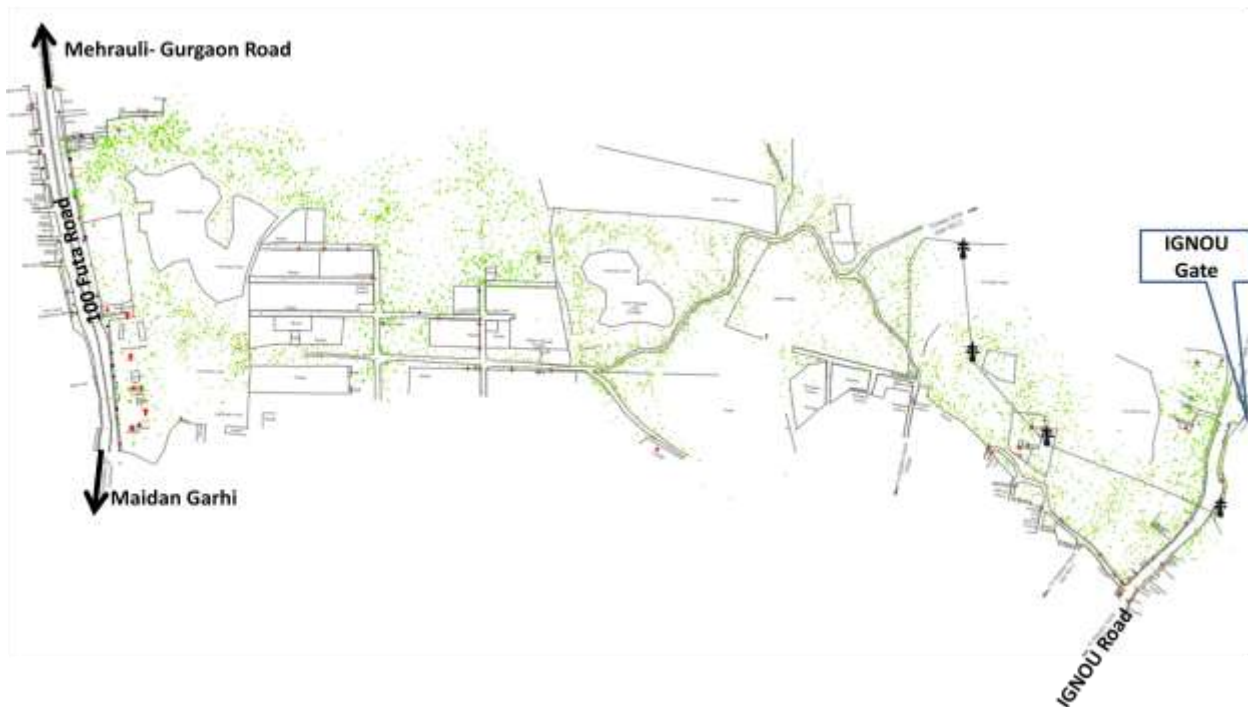
Site has been encroached peripherally on three sides, particularly with Chhatarpur Enclave and other settlements on the south, 100 Futa Road of Chhatarpur and Cremation ground of Chhatarpur on West and IGNOU Road on the East of the site, whereas on the north of the site is the forest or ridge area. Encroachments are in the form of huts, some of the permanent structures have also been built. Within the site.

## 6.2 Natural features

### 6.2.1 Flora and Fauna

The flora on the site consists of Dhak, Khair, Khejri, Kumattha, Desi Keekar, Hingot, Ronjh, Bistendu, and Siri. But due to water table going down these trees are becoming extinct and *Prosopis Juliflora* trees are rapidly growing.

Map 6: Existing Flora Cover in the site



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

Detail Map Attached at the end of drawing as annexure by Drawing No. DCPL/PWD/TP/2016/31

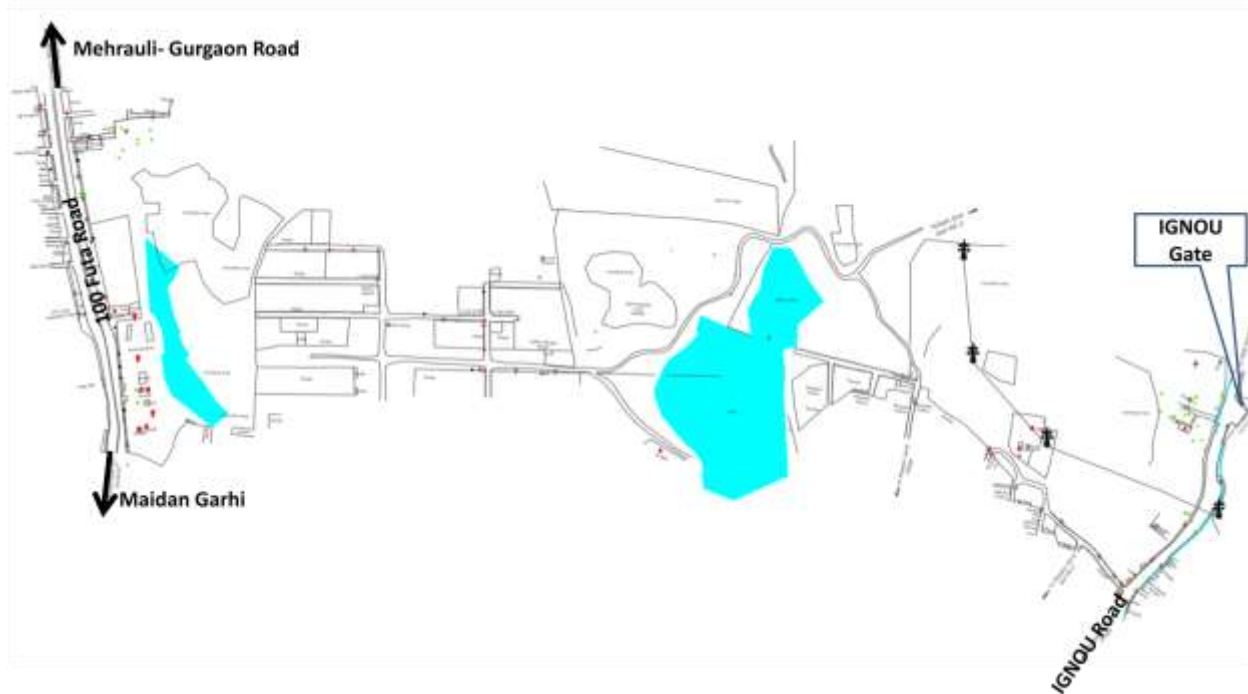
### 6.2.2 Wild Life

Wild life present in site comprises mostly of Nilgai, Fox, Peacocks etc. and that too in very few numbers.

### 6.2.3 Water Body

There is one water body in the site, and is naturally occurring. A seasonal water body in the form of drain is present near the Cremation Ground wall.

Map 7: Existing Water Bodies/Drains in the site



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

Detail Map Attached at the end of drawing as annexure by Drawing No. **DCPL/PWD/TP/2016/31**

### 6.2.4 Water Table

The water level has gone down in the recent past ranging between 45 m to 50 m due to rise in population in the nearby areas.

### 6.2.5 Soil

The soil is of sandy loam to loam texture.

## 6.2.6 Climate

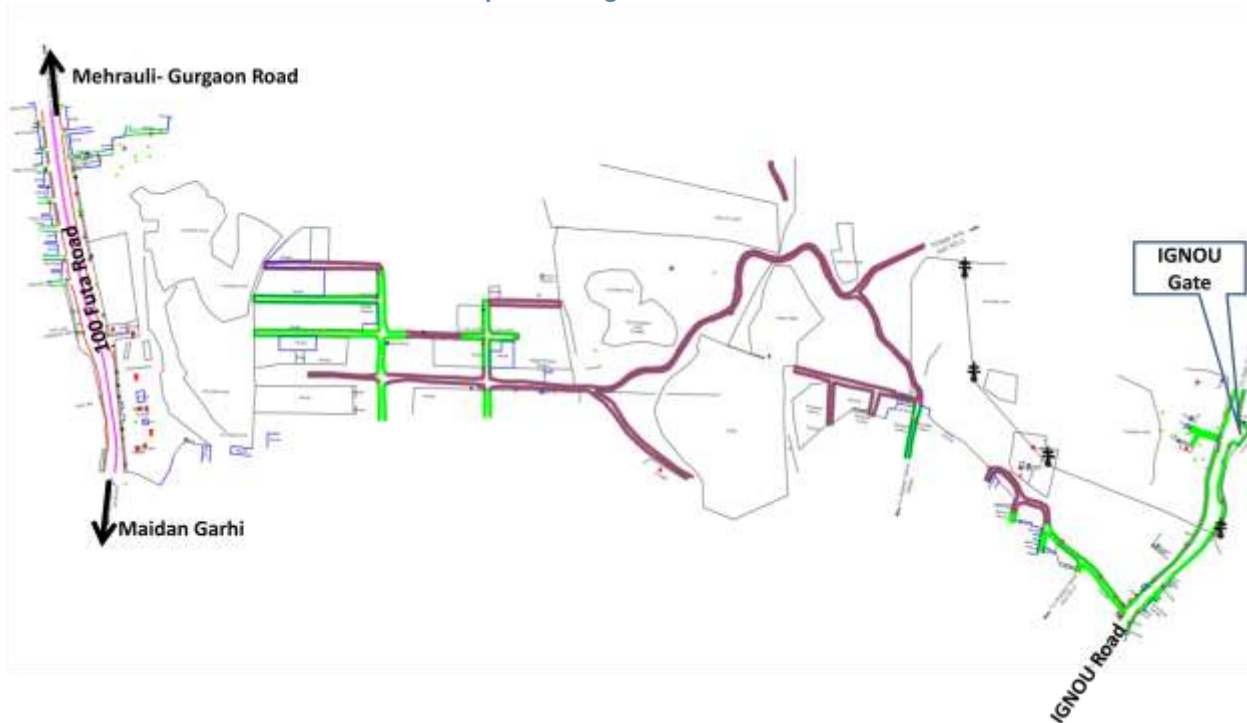
Site surroundings has a semi-arid climate with high variation between summer and winter temperatures. While the summer temperatures may go up to 46 °C, the winters can seem freezing to people used to a warm climate with near 0 °C.

## 6.3 Infrastructure and Utilities

### 6.3.1 Trail

Walking trails are present in most of the part of site. Width of the trail varies from 1-3 meters. At some places trails are not continuous and dead ends are created. Trails exist only in the area leading to 100 futa road or IGNOU roads.

Map 8: Existing Trails in the Site



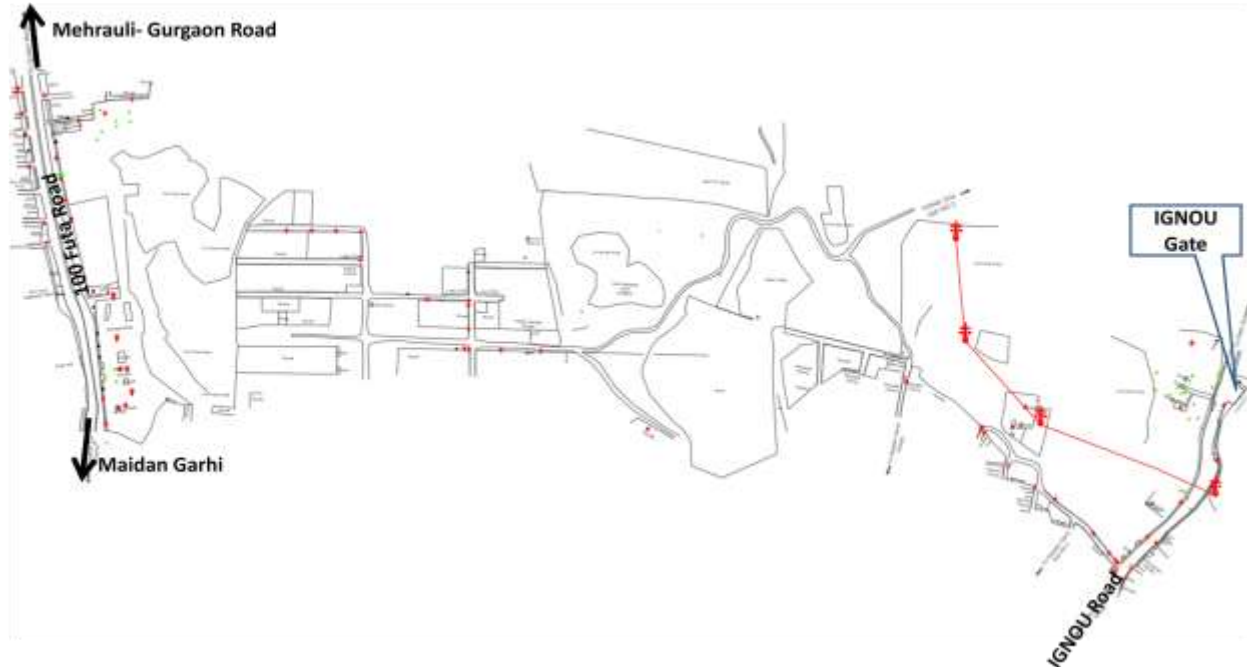
Source: Dhruvad Consultants Pvt. Ltd., Aug 2016

Existing Trails are shown in Violet and Green color. Detail Map Attached at the end of drawing as annexure by Drawing No. **DCPL/PWD/TP/2016/31**

### 6.3.2 Electric poles

Electric poles of High Tension wire are present on the northern periphery of the site.

Map 9: Existing Poles/High Tension Line in Site



Source: Dhruvad Consultants Pvt. Ltd., Aug 2016

Existing Poles are shown in Red Color. Detail Map Attached at the end of drawing as annexure by Drawing No. **DCPL/PWD/TP/2016/31**.

## 7. Surrounding Conditions

Map 10 : Surrounding Conditions



Source: Google Earth, Dhruvad Consultants Pvt. Ltd., Aug 2016

Site is surrounded by Reserved areas as well as Settlements and encroachments,

- Towards West: 100 Futa Road of Chhatarpur, Ambedkar Colony, Mehrauli-Gurgaon Road
- Towards North: Anuvrat Marg, Qutub Minar Metro Station, Kutub Golf Course, Shri Aurobindo Marg.
- Towards East: Indira Enclave, IGNOU Road, Indira Gandhi National Open University
- Towards South: Chhatarpur Enclave, Indira Gandhi Open University.

IGNOU, the largest university in the world with over 4 million students, was founded to impart education by means of distance and open education. Major Arterial Roads in and around the site are Anuvrat Marg, IGNOU Marg, Mehrauli Badarpur road, 100 Futa Road and Sri Aurobindo Marg.

Most of the area in and around the site are reserved Forest and is rich in Water bodies, Flora and Fauna, Wild Life, Congested settlements, etc.

## 8. Photographic Documentation

Map 11: Photographic Documentation



Source: Google Earth, Dhrupad Consultants Pvt. Ltd., Aug 2016

Figure 8-1: Entry to site under High Tension Line



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

Figure 8-2: Entry to Site near Cremation Ground



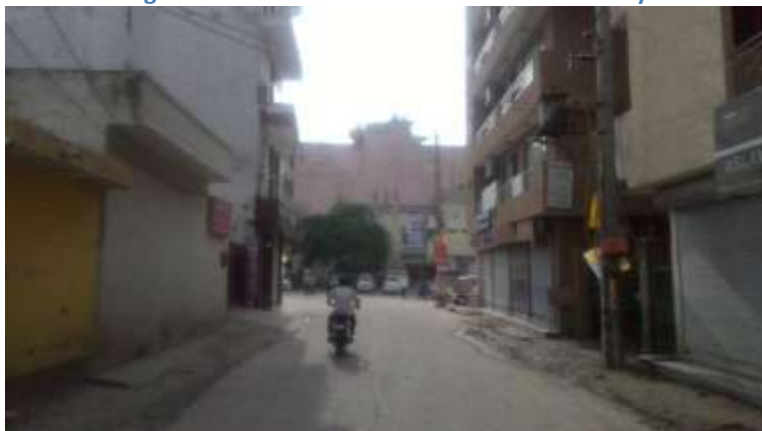
Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

Figure 8-3: Cremation Ground Chhatarpur along Site



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

Figure 8-4: Internal Roads of Ambedkar Colony



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

**Figure 8-5: Signage for Lnadmark Temple of Inspiration**



*Source: Dhrupad Consultants Pvt. Ltd., Aug 2016*

**Figure 8-6: Internal Area of Site**



*Source: Dhrupad Consultants Pvt. Ltd., Aug 2016*

**Figure 8-7: Kutcha Roads at Site**



*Source: Dhrupad Consultants Pvt. Ltd., Aug 2016*

**Figure 8-8: Marked Forest Boundary at Site**



*Source: Dhrupad Consultants Pvt. Ltd., Aug 2016*

**Figure 8-9: Entry To site from IGNOU Road**



*Source: Dhrupad Consultants Pvt. Ltd., Aug 2016*

**Figure 8-10: Entry to the Site from IGNOU Road**



*Source: Dhrupad Consultants Pvt. Ltd., Aug 2016*

## **9. Potentials and Constraints**

### **9.1 Potentials of Site**

- Part of existing Kutcha Roads within site can be used for connecting the linkages from 100 futa road to IGNOU Road.
- Area between the existing Southern Trail and the Boundary wall of the Forest Area forms a prominent possible path alignment.
- Unique character of the area can be utilized to develop a landmark circulation network.
- The contours and foliage can be used to create a network which would be in harmony with the landscape of the area and with adequate sound buffer so as to create minimum disturbance to the surrounding.
- Possibilities to create shorter routes between the 100 Futa Road and IGNOU Road using present trails within the site.

### **9.2 Constraints of Site**

- Presence of Conserved Forest area being a big Part of the site are major constraints, since all this part is environmental sensitive.
- Site is undulating in nature. Thus leveling or other techniques of utilizing the contour will have to be thought of.
- Presence of Water bodies (Natural Ponds and manmade Tanks) on the site.
- Presence of informal settlements in an ad-hoc pattern.
- Presence of various encroachments within the site.
- Presence of high density settlements leave very little scope of road widening

### 9.3 Perspective for Alternatives (vision)

Our vision for developing these proposals would be to propose a rational solution increasing mobility of vehicles, putting to optimum use the environmental character of the site, guiding pattern of development and creating an harmonious landmark.

Figure 9-1: Preserving the Historic Character of the site



Figure 9-2: In harmony with the natural setting



**Figure 9-3: State of the Art Transportation Network**



**Figure 9-4: Smooth flow of traffic using shortest route**

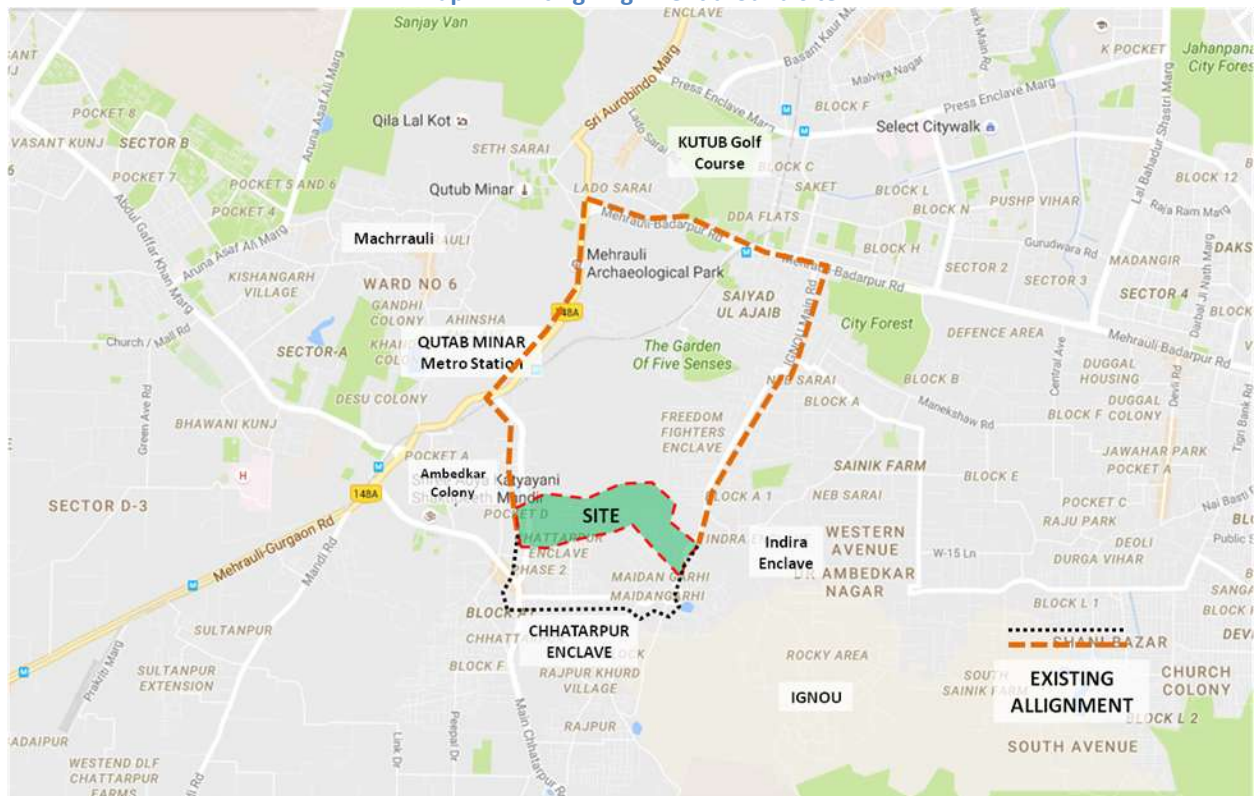


## 10. Proposed Alignment and Justification

At present the travel distance on the existing alignment is of 7 Km. Running Speed is a average as 30Km/Hr. However, due to congestion delays occur of almost 15-25 min. Whereas travel distance through internal linkages is around 2.5 Km.

Keeping in mind the importance of the link it is crucial to develop alternate connection between the 100 Futa Road of Chhatarpur and IGNOU Road as to decrease the travel time and distance between the two destinations and this will greatly reduce mobility on the present link. Also the commercial activity, leading to on street parking and informal commercial set ups, further congests and slows down the traffic. The existing route via Mehrauli Badarpur Road is used but the distance travelled is more than 7 Km. As a result it becomes difficult for vehicles because of travel long link from 100 Futa Road to IGNOU Road.

Map 12: Existing Alignment around site



Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

Few of the problems assessed for route via internal Roads of Maidan garhi were:

- Another present linkage from Maidan garhi Road which is used as a 2 way road but its width varies greatly from 7m to 9m throughout its length. As a result it becomes difficult for large vehicles to ply on it.
- The road has a number of turnings, making navigation even more difficult
- On street parking further reduces the carriageway
- The road has no provisions for safe pedestrian movement
- Commercial activity along adjacent to the road attracts traffic of pedestrians as well as vehicle, further increasing congestion
- The road further leads to the lanes within the settlement, which are only as wide as 2-4m. In case of fire or other emergencies it becomes difficult for Fire Engines or Ambulances to reach close to the settlement. Many such incidences were reported by the inhabitants of the village.

Thus it is established that a direct link to IGNOU Road would increase accessibility to the settlement thus making it safer, well connected and would increase its potential for development.

Existing streets and roads cannot be widened as there is highly dense residential development along the streets. Moreover there are no other options feasible to improve the connectivity except the proposal to develop a road through the Forest land.

**Map 13: Proposed Elevated Alignment**



*Source: Dhrupad Consultants Pvt. Ltd., Aug 2016*

Detail Drawing of Proposed Alignment is attached as annexure at the end of report. **Drawing No. DCPL/PWD/TP/2016/32.**

## 11. Detail of Land Ownership for Proposed Alignment

Alignment from IGNOU Road to 100 futa Road of Chhatarpur passes from the forest land. Justification for the proposal to develop a road through the Forest land is given in previous chapter. Detail of Khasra No., Division, Sub-division and Land Ownership is given below in the table.

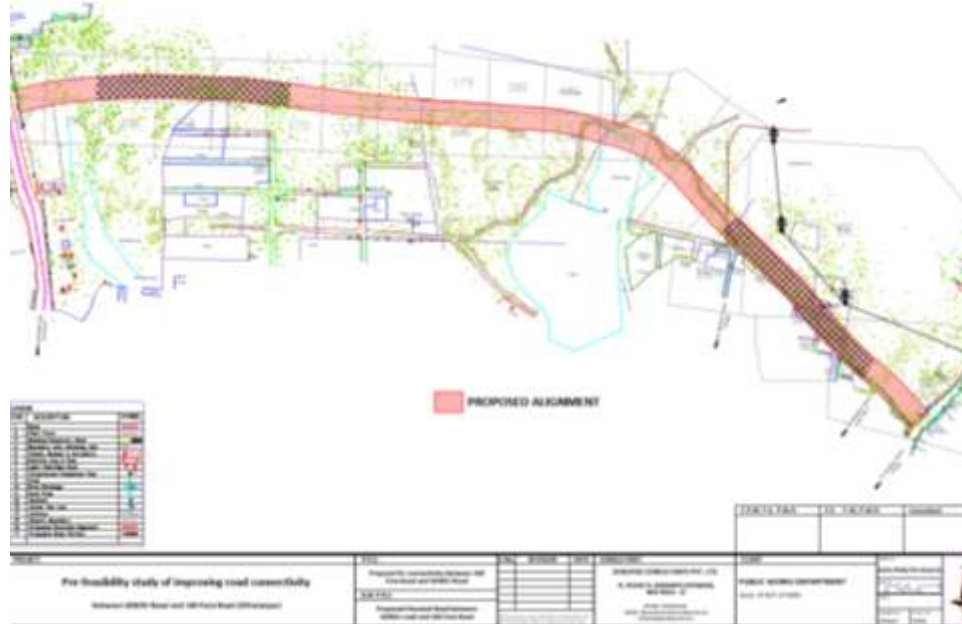
The proposed alignment passes through two different villages, Chhatarpur village in South District and Maidan Garhi Village in South District. The length of the proposed alignment is approximate 1.34 Km and the area it covers is approximate 3.86 Ha.

Figure 11-1: Land-Ownership details in Proposed Alignment

S.No.	Khasara No.	District	Sub-Division	Village	Area on Alignment (Sq.M)	Area in Hectares	Ownership
1	141	South	Saket	Chattarpur	609.79	0.06	Forest Dept.
2	142/2	South	Saket	Chattarpur	489.75	0.05	Gram Sabha
3	154	South	Saket	Chattarpur	1890.62	0.19	Forest Dept.
4	153	South	Saket	Chattarpur	269.58	0.03	Forest Dept.
5	155	South	Saket	Chattarpur	2165.11	0.22	Forest Dept.
6	163	South	Saket	Chattarpur	2168.63	0.22	Forest Dept.
7	167	South	Saket	Chattarpur	2148.73	0.21	Forest Dept.
8	172	South	Saket	Chattarpur	178	0.02	Forest Dept.
9	171	South	Saket	Chattarpur	1983.95	0.20	Forest Dept.
10	176	South	Saket	Chattarpur	1472	0.15	Forest Dept.
11	173	South	Saket	Chattarpur	696.65	0.07	Forest Dept.
12	175	South	Saket	Chattarpur	1029	0.10	Forest Dept.
13	174	South	Saket	Chattarpur	1111	0.11	Forest Dept.
14	179	South	Saket	Chattarpur	815.5	0.08	Gram Sabha
15	186	South	Saket	Chattarpur	1344.58	0.13	Gram Sabha
16	180	South	Saket	Chattarpur	576.29	0.06	Gram Sabha
17	185	South	Saket	Chattarpur	1585.29	0.16	Gram Sabha
18	181	South	Saket	Chattarpur	210.57	0.02	Gram Sabha
19	184	South	Saket	Chattarpur	2000.15	0.20	Gram Sabha
20	183	South	Saket	Chattarpur	1406.11	0.14	Gram Sabha
21	2	South	Saket	Maidan Garhi	4669.78	0.47	Forest Dept.
22	687/570	South	Saket	Maidan Garhi	9808.98	0.98	Forest Dept.
<b>Total</b>					<b>38630.06</b>	<b>3.86</b>	

Source: Dhrupad Consultants Pvt. Ltd., Aug 2016

Figure 11-2: Drawing showing Khasra Details for Proposed Alignment

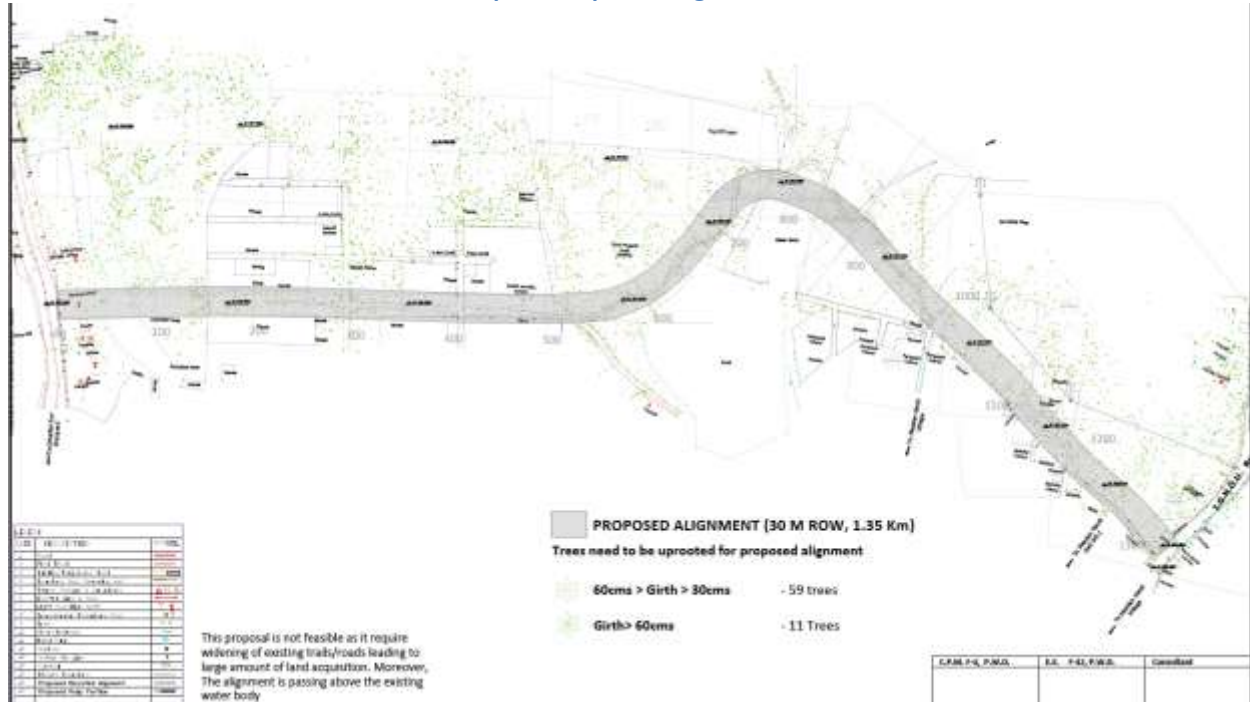


Source: Dhruvad Consultants Pvt. Ltd., Aug 2016

Detail Drawing showing Khasra Details for the proposed Alignment is attached as annexure at the end of the report. **Drawing No. DCPL/PWD/TP/2016/32.**

## 12. Alternate Proposal

Map 14: Proposed Alignment 2



Source: Dhruvad Consultants Pvt. Ltd., Oct, 2016

Alternatives have been examined and detailed drawing is attached by **Drawing No. DCPL/PWD/TP/2016/33**. The alternate proposal is not feasible as it requires widening of existing trails/roads leading to large amount of land acquisition from existing settlement. Moreover, The alignment is passing above the existing water body, therefore alternate alignment is not recommended.

### **13. Generation of Employment**

A major impact of roads manifests in employment generation. The construction and maintenance of roads is itself employment oriented. It generates employment within its own sector i.e., road and road transport. It also opens new opportunities within the area by setting up more & new industrial units, and other infrastructural facilities like electrification, & other utility services. The Impact of construction of roads on employment generation is as follows.

Employment likely to be generated

(i). Whether the Project is likely to generate employment?: Yes

(ii). Permanent/Regular Employment(Number of persons): 3

Length of the proposed alignment is 1.34 KM, permanent employment will be in terms of persons required to maintain/cleaning of the road. Average of 3 persons will be required on daily basis for maintenance of the proposed alignment.

(iii). Temporary Employment(Number of person-days): 25

Temporary Employment will be in terms of persons involved in construction of road for 2 years, daily persons required for construction of elevated road will be around 25.

Other types of employment will also take place which will be indirectly linked to the alignment, such as

**(a) Increase in Employment Opportunities in other sectors**

Creation of this road will generate greater benefits in terms of accessibility to employment opportunities in the areas. Roads also make the access easier for the working people who travel outside their context area for their jobs on daily basis.

**(b) Increase in Employment Opportunities outside the village due to greater mobility**

Construction of peripheral road will result in increase in accessibility to employment opportunities outside the context area of site. The people employed in various sectors on wage employment and salaried jobs travel to the other parts of Delhi/NCR and market places on a daily basis. A large number of people especially women and aged avoid traveling outside when travel conditions are not congenial. The development of all weather roads facilitates easier and faster movement of people to their place of employment.

**(c) Improvement in access to raw material**

Creation of this alignment is crucial in the supply of inputs to the industry in areas of Chhatarpur Enclave, Ambedkar Colony and Indira Enclave. It results in uninterrupted flow of raw material in all seasons and also at a cheaper transport cost. However area under the study, have very less industrial activity and a very few number of small units were present in the study area.

**(d) Improvement in access to market for finished goods**

Provision of this alignment will have very significant impact on improvement in access to the markets for the products of industries. It can cause improvement in terms of reaching distant marketplaces at reduced costs.

**(e) Change in number of local industries**

Benefits such as lower cost of raw materials, expansion of markets and improved access can result in increase in number of new enterprises coming up in the area.

**(f) Change in technology and patterns**

Provision of this elevated road can enable easier access to better technology and knowledge and can significantly impact the change in the patterns of the production cycle. The improvements in volumes and savings due to connectivity can also catalyze such changes for better productivity.

**(g) Improvement in Quality of life**

Construction of this peripheral road will also help in increasing the Quality of life of the nearby residents.

## **14. Cost-Benefit Analysis**

### **14.1 Introduction**

The Cost Benefit analysis is defined as a systematic process for calculating and comparing benefits and costs of the project. Broadly, Cost Benefit analysis has two main purposes:

1. To determine if an investment/decision is sound (justification/feasibility) – verifying whether its benefits outweigh the costs, and by how much.
2. To provide a basis for comparing projects – which involves comparing the total expected cost of each option against its total expected benefits.

Cost Benefit analysis attempts to measure the positive or negative consequences of the project, which include:

1. Effects on users or participants
2. Effects on non-users or non-participants
3. Externality effects
4. Option value or other social benefits.

### **14.2 Parameters included for Cost Benefit Analysis**

Cost-Benefit Analysis (CBA) estimates and totals up the equivalent money value of the benefits and costs to the community of project to establish whether they are worthwhile. The below mentioned parameters are included for estimating CBA of the proposed alignment between 100 Futa Road and IGNOU Road.

1. Time Saving
2. Fuel Saving
3. Emission Control

### 14.2.1 Time Saving

#### Existing Travel Time

Distance from IGNOU Road and 100 Futa Road via Existing Road Network= 7 Km.

Average Running Speed on the existing Road Network = 30 kmph

Ideal Time Taken = Distance/Avg. Running Speed

= (7 /30) Hour

**=14 Minutes**

#### Proposed Travel Time

Distance from IGNOU Road and 100 Futa Road via Proposed Road = 1.4Km.

Average Running Speed on the Proposed Road = 50 kmph

Ideal Time Taken = Distance/Avg. Running Speed

= (1.4/50) Hour

**=1.7 Minutes**

#### Time Saved by Proposed Alignment

Total PCU travelling from 100 Futa Road towards IGNOU road and Vice versa as per sample survey =  
(7,845 + 9,432)= 17,277 PCU

Total Population that will derive benefit or use the proposed alignment assuming 2 people per PCU =  
34,554 People

#### Cost of Man-Hours

Time saved by one person in a round-trip in a day = 2 x (Ex. Travel Time - Pr. Travel Time)

=2 x (14 – 1.7) Minutes

**= 24.6 Minutes**

Total Time Saved by all user of the proposed alignment in a day = 34,554 people x24.6 Minutes

=14,167 Hours

Assuming average salary earned by a person in Delhi is Rs. 15,000 per month or Rs. 500 per day.

Average Salary earned in a hour (assuming 8 working hours a day) = Rs. 62.5 per hour

**Thus in a day Rs. 9 Lac can be saved and Rs. 24 Crore can be saved per year.**

(Assuming for 280 working days)

### 14.2.2 Fuel Saving

Utilization of Fuel can be optimized by ensuring

- Lesser idling time
- Better fuel economy

#### Lesser Idling Time

**Via Existing Road/s**

Distance = 7 km

Avg. Delay Time = 5.6 min

Average Delay time in a round trip = 11.2 Min

Avg. PCUs that will use proposed alignment = 17,277 PCU/day (assumed in section 2.1.3)  
= 34,554 PCU/day for round trip  
= 1,440 PCU/Hour

Assuming 80% of the vehicles have their engine & A.C on during delays

Avg. fuel consumed while idling = 600 mL / hr. (refer assumptions next page)

Avg. Delay time = 11.2 Min

Thus, fuel consumed per hr = **129 Liters** ( $11.2/60 \times 1440 \times 0.8 \times 0.6$ )

#### **Assumption:**

Petrol consumed while idling and ac on is 100ml/10min

Source: <http://www.team-bhp.com/forum/technical-stuff/6250-fuel-consumption-while-standing-still.html>

Source: <http://oee.nrcan.gc.ca/cars-light-trucks/driving/more-fuel-saving-tips/17868>

Estimate that it takes about 5 hp to run the AC. Five hp = 3.728 kW. That equates to 12,729 BTUs. One gallon of gasoline contains 115,000 BTUs. So, running the AC takes (115,000/12,729) or just under an

additional 0.10 gal gasoline per hr or about 12 oz per hr. So, idling your car without AC takes about 19 oz gasoline per hour. With AC, it takes a total of 31 oz gasoline per hr (about 1 qt.)]

Source: <http://answers.yahoo.com/question/index?gid=20100907062250AALs6hW>

**With 1,440 vehicles on the road every hour as in 2016 assumptions, we can save almost 3,096 Litres (129 x 24) of the Fuel in a day.**

**Assuming each litre of fuel costs Avg. Rs. 60. Thus Rs.1.86 Lacs can be saved each day and Rs. 5.20 Cr per year.** (Assuming for 280 days)

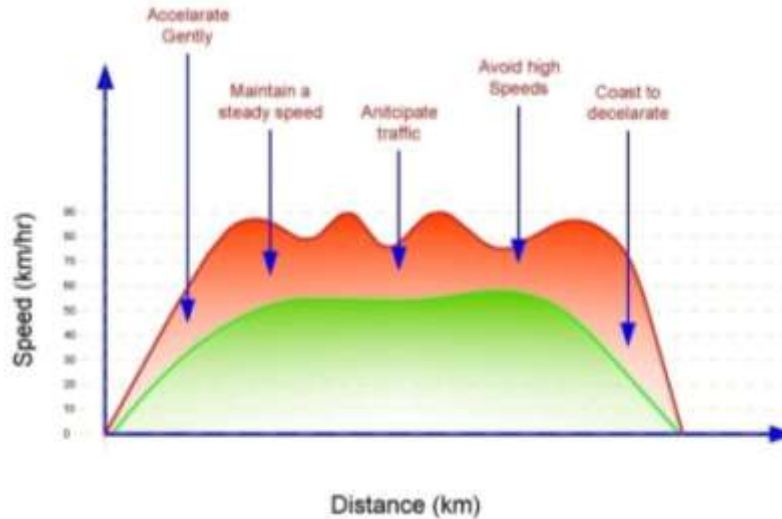
### **Better Fuel Economy**

The **fuel economy** of an automobile is the fuel efficiency relationship between the distance travelled and the amount of fuel consumed by the vehicle.

Consumption can be expressed in terms of volume of fuel to travel a distance, or the distance travelled per unit volume of fuel consumed. Since fuel consumption of vehicles is a great factor in air pollution, and since importation of motor fuel is a large part of a nation's foreign trade, many countries impose requirements for fuel economy.

Five universally accepted driving techniques to cut your fuel consumption by as much as 25 percent:

- Accelerate gently
- **Maintain a steady speed**
- Anticipate traffic
- Coast to decelerate
- **Speed Range**

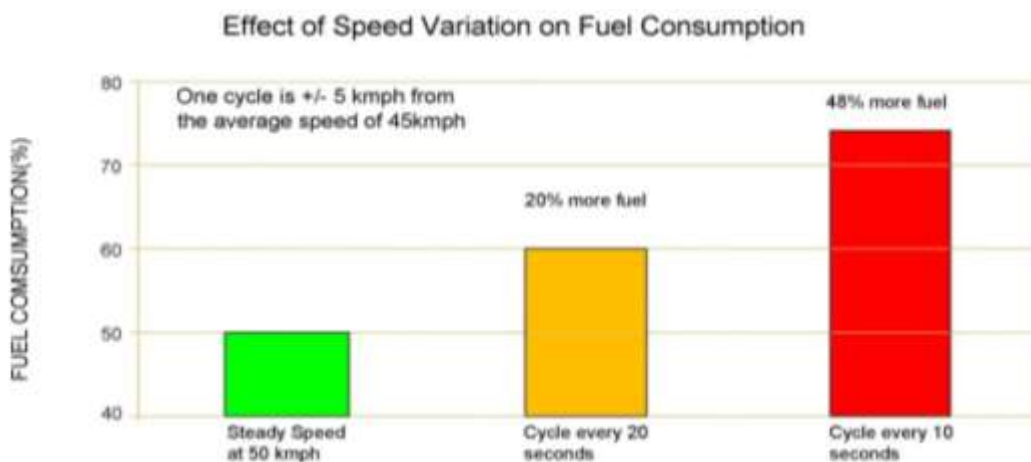


Source: Energy Conservation center, Japan

Of these 5 factors, two are countable ones, namely **maintaining constant speed** and **avoiding high speeds**.

### Maintain a Steady Speed

This calls for being consistent while on the move. Unintentional dips in speed and sudden bursts of acceleration to keep pace take a toll on your tank and your wallet. In fact, varying your speed up and down between 45 km/h and 55 km/h every 20 seconds increases your fuel consumption by 20 percent.

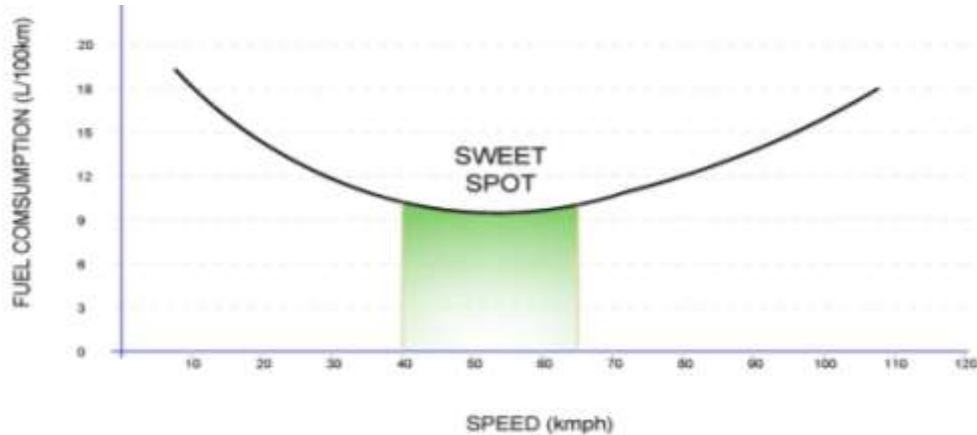


Source: Energy Conservation center, Japan (<http://www.nrcan.gc.ca/science/story/6774>)

### Speed Range

Heed the speed limit and save! Cars, vans, SUVs and pick-up trucks operate most fuel efficiently when travelling between 40 and 60 km/h. above this optimal speed zone, vehicles consume increasingly more

fuel the faster they go. So is the case when a car is moving at speeds lower than the range specified. Not only does it **increase the fuel consumption** (as at lower gears the vehicle is not at its optimum efficiency), but it also adds to **driving discomfort**.



Source: Energy Conservation center, Japan (<http://oee.nrcan.gc.ca/cars-light-trucks/driving/fuel-efficient-driving-techniques/avoid-high-speeds/17834>)

Thus, it is desired to have a vehicle moving within the “Sweet Spot”.

Present Avg. Running Speed on existing roads = 10 kmph

Desired Avg. Journey Speed (when proposed road is developed) = 50.0 kmph

#### **Fuel consumption at 50 kmph (Desired speed)**

10L for traversing 100km

Thus for travelling 1.4 km, a vehicle would consume **0.14 Litres** of fuel.

#### **Fuel consumption at 30 kmph (Avg. Running Speed)**

12.5 L for traversing 100km

Thus for travelling 7 km, a vehicle would consume **0.87 Litres** of fuel.

Hence, fuel saving (per PCU per one-way trip) = 0.87 Ltrs – 0.14 Ltrs = 0.73 Ltrs

The traffic density is 17,277 PCU/day (assumed in section 2.1.3)

Fuel saved by one-way trips in a day = 12,612 Ltrs

Fuel saved by round-trips in a day = 25,224 Ltrs

Money Saved per day = 15.13 lacs (25,224 x 60)

*(Assuming: Avg. price of fuel = INR.60)*

**17,277 vehicles plying round-trip in a day would save Rs. 15.13 Lacs in a day  
& Rs. 42.37 Cr. in a year.**

**Thus, total money by fuel saving in a year is Rs. 47.57 Cr (42.37 + 5.20) (idling  
time & Better fuel economy)**

### 14.2.3 Emission Control/Savings

Adding to the loss in time and fuel while traversing through the urban traffic another factor that adds to worsen our urban environ is the heat produced by the vehicles while they are on road. While we can't help, but with better technology, reduce the heat produced while travelling a certain distance, we can of course have a greater control over the enormous amounts of heat produced during idling. With the wide uncovered roads generating URBAN HEAT the idling cars make things worse. It becomes a tiring for pedestrians and cyclist to move in this heated environ.

The Distribution of Vehicles over the corridor has been calculated by observing distribution over the peak time in a sample survey and generating average composition for the stretch. Thus the distribution would be as follows:

Vehicle Type	CAR/4W	3-Wheeler	2-Wheeler	Cycle	Others
Percentage	23	08	61	2.5	5.5

To calculate the emission of vehicles over the stretch it is required to assess the power ratings of different kinds of vehicles, as it gives us an idea of the relation of engine power of vehicles and the amount of emission. Thus, the power ratings are as follows:

Type	Manufacturer	Model	KW	Avg. KW
Car	Maruti	Wagon R	50	68.70
		Alto	40	
		SX4	74	
		Swift	92	
	Tata	Indigo	74	
		Indica	51	
		Safari	105	
	Hyundai	i10	48	
		i20	59	
Accent		94		
Two-wheeler	Hero Honda	Splendor	5.5	9.02
	Honda	Unicorn	9.9	
	TVS	Apache	11.7	
	Bajaj	Pulsar 180	12.28	
Three Wheeler	Bajaj	Auto rickshaw	5.15	5.15

Following various norms and standards such as CPCB Vehicle exhaust norms for diesel vehicle, Indian Norm 2000, Bharat Stage II, III and IV the emission factors for various kinds of pollutants have been generated, calculations of which are as follows:

Norms	CO( g/kwhr)	HC (g/kwhr)	NOx (g/kwhr)	PM(g/kwhr)
1991Norms	14	3.5	18	-
1996 Norms	11.2	2.4	14.4	-
India stage 2000 norms	4.5	1.1	8	0.36
Bharat stage-II	4	1.1	7	0.15
Bharat Stage-III	2.1	1.6	5	0.1
Bharat Stage-IV	1.5	0.96	3.5	0.02
<b>Avg. of Bharat stage II,III,IV</b>	<b>2.5</b>	<b>1.2</b>	<b>5.2</b>	<b>0.1</b>

Carbon Dioxide (CO <sub>2</sub> ) Emission Factors (gm/km)	
Car	223.6
Two-wheeler	26.6
Auto	60.3
Bus	515.2
Truck	515.2

### Assumptions

- Existing vehicles operating on road are either Bharat Stage-II or III or IV
- Avg. of Bharat Stage- II,III,IV is taken for calculating pollution emission factor
- Same emission standards for both diesel and petrol vehicles have been considered

Source: Emissions from India's transport sector: Statewise synthesis, T.V.Ramachandra

[http://en.wikipedia.org/wiki/Bharat\\_Stage\\_emission\\_standards](http://en.wikipedia.org/wiki/Bharat_Stage_emission_standards)

#### Vehicle Emissions fall into five main categories:

- CO<sub>2</sub>** Carbon Dioxide (CO<sub>2</sub>), which is an inevitable product of burning a fuel which contains carbon (as all petroleum products do). CO<sub>2</sub> does not pollute the air we breathe, but it is a main contributor to Global Warming and therefore has to be reduced. This means either using fuels containing less (or no) carbon (see the section on Alternative Fuels), or making vehicles and their engines more efficient – or both.
- CO** Carbon Monoxide (CO), which is produced when a carbon-based fuel is burnt incompletely. In high concentrations it is poisonous and has to be controlled. It can be reduced by more efficient combustion in the engine (so that CO<sub>2</sub> is produced instead of CO) and further reduced by oxidising after combustion, in a Catalytic Converter.  $[2xCO + O_2 = 2xCO_2]$
- HC** Hydrocarbons (HC), also known as "Volatile Organic Compounds (VOC) are really unburned fuel. They can be a problem to people with breathing difficulties and are a contributor to "Photochemical Smog" in certain climatic conditions. They can be reduced by more efficient combustion in the engine and further reduced by oxidising after combustion, in a Catalytic Converter.  $[4HxCy + (x+4y)O_2 = 2xH_2O + 4yCO_2]$
- NO<sub>x</sub>** Oxides of Nitrogen (NO<sub>x</sub>) are produced when air (which is mainly a mixture of Nitrogen and Oxygen) is heated as it is in an engine. NO<sub>x</sub> is a contributor to both Photochemical Smog and Acid Rain and can be an irritant to the lungs. Unlike CO and HC it cannot be removed by oxidation. The opposite process – the removal of Oxygen, known as "Reduction" is necessary to convert it back to Nitrogen and Oxygen.
- PM** Particulate Matter (PM) is very small particles, mostly of unburnt Carbon.

### 14.3 Emission savings in an hour

Vehicular Emissions without project (gm)					
Vehicle Type	CO2	CO	HC	Nox	PM
Two-Wheeler	9867	6055	2916	12348	215
Auto	4194	648	312	1322	23
Car / Jeep / Taxi	41472	23057	11104	47024	819
Bus/Truck	8655	4621	2225	9424	164
<b>Total</b>	<b>64188</b>	<b>34380</b>	<b>16557</b>	<b>70118</b>	<b>1221</b>

Vehicular Emissions with project (gm)					
Vehicle Type	CO2	CO	HC	Nox	PM
Two-Wheeler	1201	737	355	1503	26
Auto	511	79	38	161	3
Car / Jeep / Taxi	5049	2807	1352	5725	100
Bus/Truck	692	370	178	754	13
<b>Total</b>	<b>7453</b>	<b>3993</b>	<b>1923</b>	<b>8143</b>	<b>142</b>

Savings in Vehicular Emissions (gm)					
Vehicle Type	CO2	CO	HC	Nox	PM
Two-Wheeler	8666	5317	2561	10845	189
Auto	3683	569	274	1161	20
Car / Jeep / Taxi	36423	20250	9752	41299	719
Bus/Truck	7963	4251	2047	8670	151
<b>Total</b>	<b>56735</b>	<b>30388</b>	<b>14634</b>	<b>61975</b>	<b>1080</b>

Hence CO<sub>2</sub> emission saved in an hour by assumed average traffic that will use proposed road is 0.06 Tonnes.

**CO<sub>2</sub> Emission saved in a year is 403 Tonnes.**

An average tree can intake 9Kg/year of CO<sub>2</sub> throughout its lifecycle, the number of trees that would be required if the proposed road is not built to absorb the excess CO<sub>2</sub> is 44,777.

**Carbon credits earned for the emission saving would be 403 credits in a year.**

**One Carbon credit earns USD 10, thus the project will earn USD 4,030 equivalent to Rs. 2.70 Lac. (As per February, 2017 Exchange rate)**

## 14.4 Summary Cost-Benefit Analysis

Cost of construction of Proposed Elevated Road of 1.4 Km length is equal to Rs. 168,00 Lacs.

<b>Savings in 1st, 2nd and 3rd year</b>	
<b>Cost of Project</b>	<b>Rs. 1,68,00,00,000</b>
<b>Time Savings</b>	<b>Rs. 24,00,00,000</b>
<b>Fuel Savings</b>	<b>Rs. 47,57,00,000</b>
<b>Emission Savings</b>	<b>Rs. 2,27,000</b>
<b>Total Savings</b>	<b>Rs. 71,59,27,000</b>
Cost of Project - Savings in first year	Rs. 96,40,73,000
Cost of Project - Savings in second year	Rs. 24,81,46,000
Cost of Project - Savings in third year	<b>Rs. -46,77,81,000</b>

Since savings from the project are high by third year as compared to the cost of the project, the project is highly recommended.

## 15. National Park/Sanctuary and Wildlife Clearance

### 15.1 Part 1 of form for National Park/Sanctuary and Wildlife Clearance

1. **Name of the Organization** : Public Works Department
2. **Aims and Objective of the Proposed Project**

#### Aim

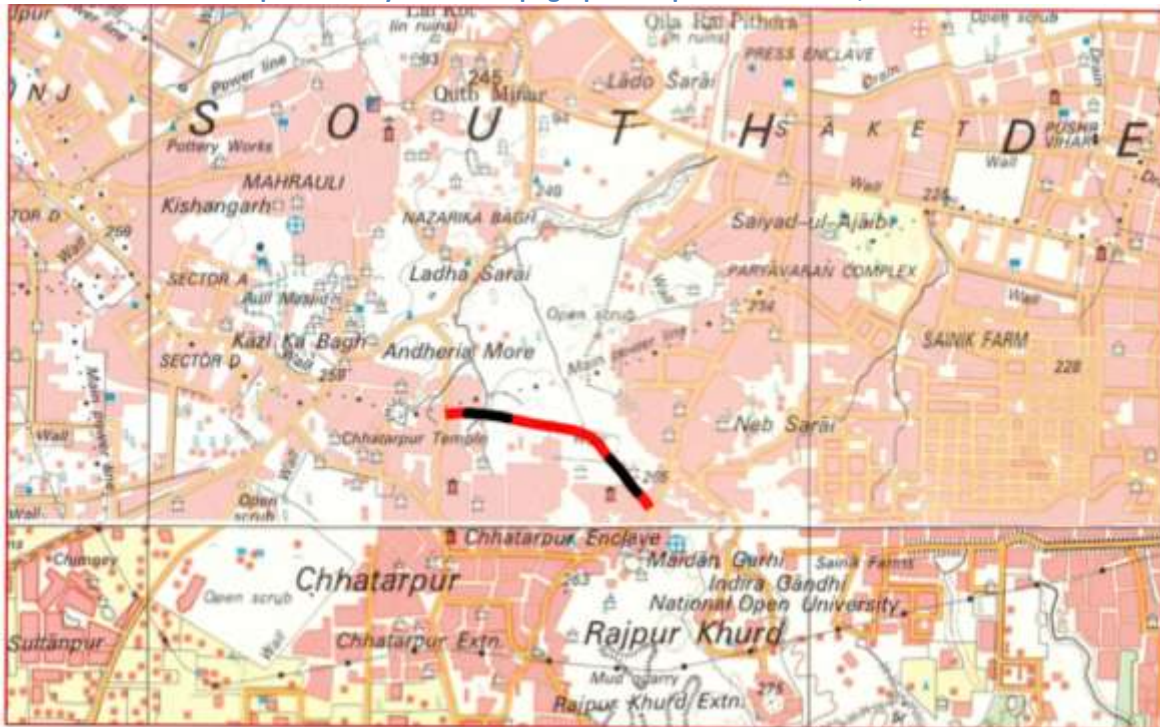
- (a) To explore the possibilities of improving road connectivity between IGNOU Road to 100 Futa Road (Chattarpur)
- (b) To propose a rational solution for increasing mobility of vehicles with optimum use the environmental character of the site along with guiding pattern of development and creating an harmonious landmark.

### Objectives

- a) Understanding the background of the existing alignment and establishing its importance
  - b) Developing alignment alternative
  - c) Studying the detailed land use and land ownership of the proposed alignment.
  - d) SWOT analysis in terms of legal, technical, physical, socio-economic and cultural feasibility of the option of proposed alignment.
3. **Location and Map (1:50,000 scale) of the area duly authenticated by the competent authority to be investigated / surveyed.**

Detailed drawing of proposed alignment by Drawing No. **DCPL/PWD/TP/2016/32** and Survey of India Topographic Map at scale of 1:50,000 Drawing No. **DCPL/PWD/TP/2016/30 (1)** duly authenticated by the competent authority to be investigated / surveyed is attached as annexure at the end of report.

**Map 15: Survey of India Topographic Map at scale of 1:50,000**



Source: Survey of India Topographic Maps, Dhrupad Consultants Pvt. Ltd., Aug 2016

4. **Whether investigation / survey requires clearing of vegetation**

Yes, Vegetation Clearing is required for implementation of the proposed alignment.

5. **If yes, please specify the extent (in Ha.)**

3.86 Ha.

**6. Opinion of the Officer In Charge of the NP / WLS (Attach signed copy)**

Not in the scope of PWD and its consultant, to be provided by Officer in Charge of NP/WLS

**7. Opinion of the Chief Wildlife Warden (Attach signed copy). The following be included in the opinion:**

Not in the scope of PWD and its consultant, to be provided by Chief Wildlife Warden.

- I. Brief history of the protected area*
- II. Current status of wildlife.*
- III. Current status of pressures on protected areas.*
- IV. Projected impacts of projects on wildlife, habitat management and access / use of resources by various stakeholders.*
- V. Contiguous wildlife area which would benefit wildlife if added to NP/WLS.*
- VI. Others areas in the State which have been recommended by State Govt., Wildlife Institute of India, BNHS (Bombay Natural History Society), SACON (Salim Ali Centre for Ornithology and Natural History), IISC (Indian Institute of Sciences), IUCN (International union for Conservation of Nature) or other expert body for inclusion in protected area network.*

## **15.2 Part 2 of form for National Park/Sanctuary and Wildlife Clearance**

**1. Project Details:**

- i. Copy of the Investigation and Survey Report. (The report should include the dates of survey and the names of investigators, surveyors and all officials of the concerned NP/WLS who remain present during the period)**

Copy of Stage 1 Report with Drawings attached. **Drawing No. DCPL/PWD/TP/2016/31** (duly signed by investigators {PWD, Delhi} and surveyors {Consultants}, it is further to be signed by officials of concerned NP/WLS)

- ii. Self contained and factual project report for which NP/WLS area is required.**

- i. (Enclose copy of the Project Appraisal document)**

Copy of Stage 1 Report attached

- iii. Map (duly authenticated by the Divisional / District Head of the Department dealing with Forests and Wildlife) on a scale of 1:50,000 showing the boundaries of NP/WLS, (delineating the area in question in red colour)**

Map attached, but it is to be duly authenticated by the Divisional / District Head of the Department dealing with Forests and Wildlife **DCPL/PWD/TP/2016/30 (2)**

- iv. **Self contained and factual report of at least two alternatives considered by the project authorities along with technical and financial justification for opting national park/sanctuary area.**

Alternative Proposal is attached by **DCPL/PWD/TP/2016/33**. Justification provided, since no other option is feasible as Existing streets and roads cannot be widened as there is highly dense residential development along the streets. Moreover there are no other alternative feasible to improve the connectivity, except the proposal to develop an elevated road through the Forest land.

- v. **Copy of the Bio diversity Impact Assessment report in case the proposal involves diversion more than 50 ha. NP/WLS area.**

Not Applicable, since the proposal involves diversion of 3.86 Hectare area which is less than 50 Hectares NP/WLS area.

**2. Location of the Project/Scheme**

- i. **State/Union Territory**  
Delhi, (Union Territory)
- ii. **District**  
South Delhi, Delhi
- iii. **Name of the National Park/ Sanctuary**  
Southern Ridge Forest

**3. Detail of the area required (in Hectares only)**

- i. **(Provide breakup of the land use under the project, e.g Construction of dam, submergence, housing for staff, road, etc.)**

Construction of Elevated Road which includes total diversion of 3.86 hectare Land, out of which 3.02 hectare land falls under Forest/Ridge Landuse. The proposed alignment passes through two different villages, Chhattarpur village in South District having an area of 2.42 Hectare out of which 1.57 Ha. Is forest land and 0.84 Ha. Is non-forest Land and Maidan Garhi Village in South District having an area of 1.45 Ha.(Forest land) The length of the proposed alignment is approximate 1.34Km.

Detail Map with Proposed Alignment attached by drawing no. **DCPL/PWD/TP/2016/32**

**4. Details of displacement of people, if any, due to the project**

- i. Total number of families involved in displacement**
- ii. Number of scheduled caste/ Schedule tribe families involved in displacement.**
- iii. Detailed rehabilitation plan**

No Displacement of People is there due to project.

**5. Any other information relevant to the proposal but not covered in any of the columns above.**

No other information.