

## CHAPTER –3 ENVIRONMENTAL BASELINE DATA

### 3.1 GENERAL

The information presented in the Chapter stems from various sources. Data on land use has been collected and compiled from various reports, field survey and monitoring. The majority of data on Physiography, infrastructure, soil and geological features have been taken from the feasibility report of MRTS prepared by RITES (**Annexure1 Ref.2**), while data on population, water quality, ground water hydrology, vegetation and fauna, air and noise quality was collected during field studies. Climatological data was collected from meteorological office. The data has also been compared with data collected by RITES few years back. Efforts have been made to compile the data from other sources. Additional data was collected from various reports (**Annexure –1**) The project area is divided in two parts by river Yamuna. New Ashok Nagar and Anand Vi-har in East Delhi; Jahangirpuri in North Delhi to Qutub Minar in South Delhi; and Mundka in West Delhi. The construction of second phase will integrate east with west and south with north. About 6 places passengers will have inter changing facilities.

### 3.2 PHYSIOGRAPHY

The project area is situated in Delhi, the capital of India. The average elevation of Delhi plain is 198 m to 200 m above the mean sea level (amsl). The ridge, however has a higher elevation going upto 250 m above mean sea level (amsl) and is about 15 to 20 m above the surrounding plains. The Shahdara area drains from East to West into Yamuna River. Similarly Delhi and New Delhi areas also drain in Yamuna River through various drains such as Najafgarh drain. Many small watercourses intersect the terrain causing a variation in relief. However, the average gradient of terrain is gentle, in the order of 1 to 3 m per km. Delhi area is generally flat except for a gentle rise to form a central ridge from North-North-East to South-South-West. The ridge almost touches the East-West alignment near Jhandewalan Station.

### 3.3 GEOLOGY AND SOILS

The area under study is part of the Yamuna basin comprising the newer alluvium made-up of fine to medium, sands, silts, gravel, clay and canker. The surface beds are admixed with wind blown sediments of recent age. These alluvial sediments are known to be underlined by hard formations of Delhi system of rock. Following is the general sequence of formations met within the area:

- Recent to Sub-Recent : Alluvium
- Post Delhi Intrusive : Pegmatic and Basic Intrusive
- Algonkian (Delhi System) : Alwar Quartzites

RITES has carried out detailed investigations by drilling a series of boreholes throughout the alignment/project area during 2000-2001 and 2003-2004. The area has mature topography with scattered isolated hillocks where rocks are exposed. The bedrock comprises of Quartzites with intercalated beds of mica-Schists

belonging to Alwar formation of Delhi group of pre-Cambrian age. Quartz Veins and pegmatites boudins are seen along some of the major horizontal fractures. The regional strike of the Alwar quartzite's varies from North-North-East to North West and South-South-West to South-East and has 35 degrees to 80 degrees dip towards East to North-East directions.

The over burden is mostly clay of low plasticity containing high percentage of silt are available in all corridors. The STP values vary from 6 to 107. The soils strata soft to stilt to hard and loose to medium dense. The properties of soil strata are summarised in **Table 3.1**.

**TABLE 3.1  
PROPERTIES OF OVER BURDEN SOIL STRATA**

S. NO	SECTION	TYPE OF SOIL	SALIENT PROPERTIES	
			SPT Value	Consistency/ Relative Density
1	Viswa Vidyalaya- Jahangiri Puri	Sandy Silt	6-57	Soft to stiff to hard loose to very dense
2	Central Secretariat- Qutub Minar	Sandy Silt (SM, ML-CL/CL)	77-107	Firm to stiff-hard loosed to dense
3.	Shahdara- Dilshad Garden-NOIDA	Sandy Silt (ML- CL)	15-30	Medium hard, loose to medium dense.
4.	Indraprastha – New Ashok Nagar	Sandy Silt (ML-CL)	15-20	Medium Hard, Loose to Medium Dense
5.	Yamuna Bank – Anand Vihar	Sandy Silt (SM)	6-30	Soft to Medium hard
6.	Kirti Nagar - Mundka	Sandy Silt (CL)	8-82	Soft to very stilt to hard loose

CL: Fine grained soils with more than 50% soil particles (by weight) passing through 75 micron IS Sieve when shaken. Low compressibility and liquid limit less than 35%. The soil contains in organic clay of low plasticity.

SM: Sandy soil with more than 50% particles (by weight) passing through 4.75 mm IS Sieve and retained by 75 microns IS Sieve. This soil contains more than 12% fines and is named as silty sand. This is relatively coarser.

SC: Clayey sand, relatively coarser with more than 50% soil particles (by weight) passing through 4.75 mm IS Sieve and retained by 75 microns sieve and having more than 12 % fines.

The soil samples have been analysed. The results so obtained are reported in **Table 3.2**. The soils are slightly alkaline in nature. The soils are mainly sandy to sandy clay in texture. Nitrogen content is more in open areas. Organic content in soils vary from 0.34 to 7.48%.

### 3.4 GROUND WATER HYDROLOGY

Delhi receives two seasonal rainfalls. These are due to South West and North-East monsoons. About 75% of rainfall occurs during July to September due to South-West monsoon. The North East monsoon is active during December-April. The annual rainfall is about 660 mm. The ground water occurs in silty to sandy layers of the alluvial sediments and also in the jointed quartzite having secondary permeability under unconfined conditions. Semi confined aquifer zones are present below 150 m depth. The permeability varies from 0.5 to 8 m per day and transmissivity from 10 to

100 m<sup>2</sup>/day. The depth of water table is observed between 4.5 to 21.6 m below ground level as indicated in **Table 3.3.** The slope of the water table is away from the ridge on either side and the ridge acts as ground water divider between the eastern and western parts of Delhi. The hydraulic gradient is gentle and of the order of 1.8 to 2.0 m per km. Based on the analysis of soil and water data it could be concluded that the sub soil and underground water are unlikely to have any deteriorating effect on under ground MRTS structures and foundation.

**TABLE 3.2  
PHYSIO-CHEMICAL CHARACTERISTICS OF SOILS**

S. NO	SAMPLE / PARAMETER	SAMPLE LOCATIONS									
		1	2	3	4	5	6	7	8	9	10
1	pH	8.01	8.05	8.49	8.82	8.01	7.99	7.11	7.96	7.57	8.1
2	Texture										
	Sand (%)	59.03	81.23	68.26	76.30	78.24	60.00	59.03	65.98	66.25	70.5
	Silt (%)	11.10	3.03	15.44	9.15	10.24	19.14	10.83	12.71	14.24	10.7
	Clay (%)	29.87	15.74	16.30	14.55	11.52	20.86	30.14	21.31	19.51	18.8
3	Nitrogen (kg/hectare)	545.65 ppm	734.79ppm	1030	347.47	500.18	2054.0	3397.69	1098.82	844.54	955.12
4	Phosphorus(kg/hectar)	31.32ppm	123.16ppm	605	57.09	84.24	17.93	32.05	7.94	10.12	11.15
5	K (meq/100gm)	----	-----	0.74	1.75	2.5	1.51	1.86	1.28	1.87	2.15
6	Ca(meq/100gm)	5.12ppm	2.41ppm	25.12	148.00	152	9.99	9.73	10.8	11.15	13.24
7	Mg (meq/100gm)	1.21ppm	1.81ppm	15.49	15.83	21	1.82	2.41	3.24	2.74	3.15
8	Na (meq/100gm)	5.44ppm	4.43ppm	3.15	5.58	2	0.7	2.63	2.30	2.87	3.10
9	Organic matter (%)	0.65	7.48ppm	0.69	0.34	0.74	2.15	3.28	0.88	1.42	1.8

1. Panchwati Chowk, 2-Lal Bagh Azadpur, 3-AIIMS, 4-Qutub Minar, 5-Near Karkardum flyover, 6-Yuman River area, 7-Near Sanjay Park, 8-New Ashok Nagar Station, 9-Near Punjabi Bagh, 10-Near Mundaka

**TABLE 3.3  
DEPTH OF GROUND WATER**

S. NO.	SECTION	DEPTH (M)
1	Viswa Vidyalaya-Jahangiri Puri	5.5 - 7.0
2	Central Secretariat-Qutub Minar	8 – 22.0
3.	Shahdara - Dilshad Garden -NOIDA	5.5 - 8.0
4.	Indraprastha - New Ashok Nagar	4.5 – 8.0
5.	Yamuna Bank - Anand Vihar ISBT	4.7 – 6.2
6.	Kirti Nagar - Mundka	5.5 - 9.0

### 3.5 WATER QUALITY

Water availability and its quality will play a significant role in this project. Water supply to Delhi is made from Yamuna River. Water quality of Yamuna water at Wazirabad is good while at Ring Road, down stream; it had deteriorated due to addition of various polluted drains/streams in the river. About 3000-million litres of water per day is supplied to Delhi from this river through water works. In addition to this, about 230-million litres per day of ground water is also exploited for use. It was expected that water demand in Delhi will be about 4300 mld by end of 9<sup>th</sup> Plan (2002). It is reported that Delhi treats about 2000-million litres of sewage, which is treated at 17 different treatment plants of Delhi. In addition about 6500-tonnes of solid waste is also generated in Delhi. This is disposed at specified sites approved by regulatory agency. RITES has collected ground water and river samples. The results so obtained are reported in **Table 3.4.** The analyses have indicated that water is slightly alkaline in nature. In most of the samples, the total dissolved solids are also high. These high values may be due to excess withdrawal of ground water. Few samples has indicated more concentration of chlorides and sulphates specially in Mayur Vihar area. The project is planning to utilise the water during construction and operation from ground water source or river Yamuna through water works. The

construction and operation activity of this project will have a negligible impact on Yamuna water quality.

**TABLE 3.4  
CHEMICAL ANALYSIS OF WATER SAMPLES**

S NO	PARAMETER	SAMPLE LOCATIONS										
		1	2	3	4	5	6	7	8	9	10	11
1	pH	7.51	7.64	8.09	7.67	7.85	8.14	8.07	8.23	8.2	8.46	8.02
2	TDS (mg/l)	709.20	1224.74	1125	646	124	785	315	734	734	772.83	800.2
3	TSS (mg/l)	1.20	8.50	1.8	0.6	4.90	15.2	1.6	8.6	8.6	2.2	5
4	Calcium as Ca (mg/l)	40.00	327.67	108.21	73.67	32.03	443	45	36	36	47.95	50.23
5	Chloride as Cl (mg/l)	60.00	311.69	283.72	139.86	8.00	108	28	119	119	123.88	100.24
6	Sulphates as SO <sub>4</sub> (mg/l)	141.58	383.33	249.99	16.35	23.31	74	9.68	99.72	99.7	121.81	151.2
7	Fluorides as F (mg/l)	2.47	0.85	0.94	0.27	0.05	0.15	0.62	0.02	0.02	0.8	1.5
8	Iron as Fe (mg/l)	0.16	0.30	0.11	0.02	0.48	0.52	0.94	0.15	0.15	0.08	0.1
9	Nitrates as NO <sub>3</sub> (mg/l)	22.75	0.12	24.1	31.09	2.77	2.52	ND	15.06	15	2.6	2.5
10	BOD (mg/l)	2.20	1.50	0.3	ND	ND	<2	ND	ND	ND	<2	ND
11	Phosphates as PO <sub>4</sub> (mg/l)	0.17	N.D	ND	ND	ND	ND	ND	ND	ND	ND	ND

1-Ground Water Model Town Crossing, 2-Bypass chowk near Sanjay Gandhi Tower, 3-Lal Bagh near Azadpur, 4- Nagaland House, 5-AIIMS, 6-Adihini Village, 7-New Ashok Nagar station, 8-Near Sanjay Park, 9-Yamuna River, 10-Near Punjabi Bagh, Mundaka Area.

### 3.6 FORESTRY

Tree survey was carried out along the proposed alignment. As such, no forest area exists along the MRTS alignment or its corridor. Most of the trees were planted along the roads in the past. The main species are Pipal, Neem, Kikar, Eucalyptus, Ashok, Ficus and Bakaan, etc. No rare or endangered species of trees have been noticed during field studies. An inventory of trees, likely to be lost is presented in **Table 3.5**. About 3147 trees are existing on the proposed alignment with an average of 51 trees/km. In addition about 2000 trees are existing on the land likely to be used for Depot near proposed Yamuna Bank Railway Station. The total numbers of trees are 5147. The length wise trees in the corridors are report in **Table 3.6**.

**TABLE 3.5  
TREES IN CORRIDORS**

S. NO	SECTION	NO. OF TREES			TOTAL
		LEFT	MIDDLE	RIGHT	
1	Viswa Vidyalaya-Jahangiri Puri	124	---	240	364
2	Central Secretariat-Qutub Minar	479	387	418	1284
3.	Shahdara-Dilshad Garden	75	---	56	131
4.	Indraprastha-New Ashok Nagar	111	---	84	195
5.	Yamuna Bank-Anand Vihar ISBT	143	50	144	337
6.	Kirti Nagar-Mundka	281	244	253	778
7.	Inderlok – Shivaji Park	26	---	32	58
8.	Depot at Yamuna Bank	---	---	---	2000
<b>TOTAL</b>		<b>1239</b>	<b>681</b>	<b>1227</b>	<b>5147</b>

**TABLE 3.6  
TREES IN CORRIDOR LENGTH WISE**

S. NO.	CHAINAGE IN KM		NO. OF TREES		
	FROM	TO	Left	Middle	Right
<b>Viswavidyalaya – Jahangirpuri (Total route length = 6.362km)</b>					
1	10.015	9.527 (CL of GTB Nagar)	0	-	0
2	9.527	8.281 (CL of Derawal nagar Station)	8	-	10
3	8.281	7.451 (CL of Model Town Railway Station)	1	-	2
4	7.451	6.714 (CL of Azadpur Railway Station)	4	-	6

S. NO.	CHAINAGE IN KM		NO. OF TREES		
	FROM	TO	Left	Middle	Right
5	6.714	5.854(CL of Azadpur mandi Railway Station)	27	-	25
6	5.854	4.778(CL of Mool chand Nagar Railway Station)	22	-	85
7	8.281	4.778 (CL of Jahangirpuri Railway Station)	62	-	111
8	4.778	3.653 (End of the alignment)	0	-	1
			124		240
<b>Average number of trees per km = 57No.</b>					
<b>Central Secretariat - Qutab Minar (Total route length = 10.87km)</b>					
9	20.25	20.970 (CL of Udyog Bhawan Rly stn.)	12	15	25
10	20.970	22.300 (CL of Race Course Rly. Stn.)	60	16	87
11	22.300	23.500 (CL of Jor Bagh Rly. Stn.)	101	13	52
12	23.500	24.850 (CL of INA Rly. Stn.)	89	101	81
13	24.850	25.910 (CL of AIIMS Rly. St.)	24	42	19
14	25.910	26.850 (CL of Green Park Rly. Stn.)	41	25	14
15	26.850	28.15 (CL of IIT Rly.Stn.)	26	20	55
16	28.15	29.500 (CL of PT School Rly. Stn.)	73	49	27
17	29.5	30.95 (CL of Qutub Minar Rly. Stn.)	21	58	43
18	30.95	Final end (32.38)	32	48	15
			479	387	418
<b>Average number of trees per km = 110 No.</b>					
<b>Shahdara - Dilshad Garden (Total route length = 3.094km)</b>					
19	0.00	1.14 (C.L of GTB enclave station)	10	--	--
20	1.14	2.15 (C. L of Jhilmil station)	33	--	33
21	2.15	3.56 (Dend of the alignment of Dilshad Garden)	32	--	33
			75	--	66
<b>Average number of trees per km = 40 No.</b>					
<b>Indraprastha - New Ashok Nagar (Total route length = 8.074km)</b>					
22	3.52	(CL of Yamuna Depot Station Rly stn.) 5.158	82	-	56
23	5.158	(CL of Games village station) 6.784km	10	-	12
24	6.784	(CL of Mayur vihar phase – I) 8.59km	9	-	0
25	8.59	(CL of Mayur vihar phase – I ext.) 9.659	10	-	11
26	9.659	(New Ashok Nagar station) 11.594	0	-	5
			111	-	84
<b>Average number of trees per km = 24 No.</b>					
<b>Yamuna Bank - Anand Vihar ISBT (total length 6.155km)</b>					
27	5.158	(CL of Laxmi Nagar station ) 6.547	5	-	7
28	6.547	(C. L .of Scope tower station) 7.688	5	-	10
29	7.688	(C. L. of Preet Vihar station ) 8.612	36	-	40
30	8.612	(C. L . Karkarduma station) 9.889	47	-	37
31	9.889	(C. L. of Anand Vihar station dead end) 11.433	50	50	50
			143	50	144
<b>Average number of trees per km = 55 No.</b>					
<b>Kirti Nagar – Mundka (Total route length = 14.284km)</b>					
32	7.466	(C. L. of New Moti Nagar ) 8.877	160	-	19
33	8.877	(C. L .of Pujabi Bagh station) 9.866	35	-	6
34	9.866	(C. L. of Shivaji park station) 11.209	6	9	6
35	11.209	(C. L. of Madipur station) 12.194	2	4	13
36	12.194	(C. L. of Paschim Vihar station) 12.915	7	10	4
37	12.915	C. L. of Sahdev park station) 13.915	2	5	67
38	13.915	(C. L. of Peera Garhi station) 14.837	11	59	11
39	14.837	(C. L. of Udyog vihar station) 16.019	2	6	53
40	16.019	(C. L. of Suraj mall stadium station) 16.721	4	52	13
41	16.721	(C. L. of Nangloi station) 17.55	8	29	19
42	17.55	(C. L. of Nangloi r.station) 18.424	27	12	10
43	18.424	(C. L. of Rajdhani park station) 19.637	13	51	22
44	19.637	(C. L. of Mundka station and to the dead end) 21.750	4	7	10
			281	244	253
<b>Average number of trees per km = 55 No</b>					
<b>Inderlok –Shivaji park station (total route length = 4.168km)</b>					
45	11.209* (0Km)	(C. L. of Punjabi Bagh east ) 1.701	10	-	10
46	1.701	(C. L .of Ashok park station) 2.701	6	-	7
47	2.701	(C. L. of Inderlok –II station) 4.168	10	-	15
			26	-	32
<b>Average number of trees per km = 14No</b>					
<b>Average number of trees per km considering all the corridors of total length of 53.778km</b>			<b>= 51No</b>		

### 3.7 AIR QUALITY

Little work was done before 1984 for measurement of air pollution in Delhi. National Environmental Engineering Research Institute (NEERI), Nagpur and Central Pollution Control Board, New Delhi have monitored ambient air quality in Delhi from time to time. These studies have indicated worst affected areas as Delhi gate, Azadpur, ITO and Rajendra Place. However, load due to vehicular pollution would be very high in congested areas like Azad Market, Delhi Gate, Darya Ganj, Connaught Place etc due to entrapping of air between high rise buildings. The main fuel used in vehicles are petrol, diesel and CNG Gas. The main pollutants that come out from the exhaust tail of vehicular engines are:

- Carbon dioxide;
- Carbon monoxides;
- Oxides of Nitrogen,
- Oxides of Sulphur,
- Hydrocarbon, and
- Particulate Matter.

In addition to above pollutants, unburnt products like aldehydes, formaldehydes, acrolein, acetaldehyde and smoke would also be emitted from petrol and diesel operated vehicles. The concentration of these pollutants in the engine exhaust varies with the type of engine namely, spark ignition (petrol engine) or compression ignition (diesel engine) two stroke or four stroke engines; and also mode of engine operation. **Table 3.7** gives the emission factor of various major pollutants from petrol (SI), diesel (CI) and CNG engines.

Diesel exhaust concentration of hydrocarbons is more than that of SI engine exhaust. Carbon monoxide concentrations in diesel engine exhaust is negligible to that of SI engines. Concentrations of oxides of nitrogen is more in diesel exhaust. Thus diesel engine exhaust contains lower concentrations of harmful pollutants like hydrocarbons, carbon monoxide and therefore, it is less hazardous. **Table 3.8** summarises the comparative emissions from CNG and Diesel engines. From this table it could be concluded that CO, NO<sub>x</sub> and PM are about 45 to 300% higher in diesel vehicles than CNG vehicles.

The atmospheric concentrations of air pollutants were monitored by setting up ambient air quality monitoring stations at locations as shown in **Figure 3.1** for parameters SPM, CO, SO<sub>2</sub> and NO<sub>x</sub> under ambient air quality monitoring (AAQM). The monitoring was carried out during September 2003 to November 2004. The results so obtained in Delhi are reported in **Table 3.9** and in reported corridors in **Table 3.10**. The ambient air quality data indicates much higher values of suspended particulate matter, than the prescribed limits established by CPCB at all the monitoring stations. However the values of SO<sub>2</sub>, NO<sub>x</sub> and CO are within the permissible limits. These values have been compared with the available previous years data. There is an improvement in the concentration of suspended particulate matter in and around Delhi. This improvement is due to change of fuel from Diesel and petrol to CNG. The Central Pollution Control Board (CPCB) ambient air quality standards are reported in **Table 3.11**.



**TABLE 3.7  
EMISSION FACTORS FOR DIFFERENT VEHICLES**

TYPE	NORMS	CO	HC	NO <sub>x</sub>	PM
PCG/MUVG Passenger Car gasoline (PGCL) Multilevel Utility Vehicle Gasoline (MUVG)	India Stage 2000 norms (Euro-I)	2.4	0.48	0.39	0.04
	Bharat Stage-II (Euro-II)	1.98	0.25	0.2	0.03
	Bharat Stage-III (Euro-III)	1.39	0.15	0.12	0.02
	Bharat Stage-IV (Euro-IV)	1.0	0.126	0.127	0.016
PCD/MUVD Passenger Car Diesel (PCD) Multi utility Vehicle Diesel (MUVD)	India Stage 2000 norms (Euro-I)	1.0	0.25	0.59	0.14
	Bharat Stage-II (Euro-II)	0.9	0.13	0.5	0.07
	Bharat Stage-III (Euro-III)	0.58	0.05	0.45	0.05
	Bharat Stage-IV (Euro-IV)	0.50	0.056	0.5	0.05
LCV	India Stage 2000 norms (Euro-I)	5.1	0.14	1.28	0.2
	Bharat Stage-II (Euro-II)	0.72	0.063	0.59	0.07
	Bharat Stage-III (Euro-III)	0.64	0.056	0.50	0.05
	Bharat Stage-IV (Euro-IV)	0.50	0.030	0.025	0.025
Trucks	India Stage 2000 norms (Euro-I)	3.6	0.87	6.3	0.28
	Bharat Stage-II (Euro-II)	3.2	0.97	5.5	0.12
	Bharat Stage-III (Euro-III)	2.8	0.77	5.0	0.10
	Bharat Stage-IV (Euro-IV)	1.4	0.39	2.45	0.06
Bus	India Stage 2000 norms (Euro-I)	3.6	0.87	12.6	0.56
	Bharat Stage-II (Euro-II)	3.2	0.87	11.0	0.24
	Bharat Stage-III (Euro-III)	2.8	0.77	10.0	0.24
	Bharat Stage-IV (Euro-IV)	1.4	0.39	4.9	0.22
2 Wheelers 2 stroke	2001-2005 norms (India Stage 2000 norms)	2.2	2.13	0.06	0.05
	2005-2010 norms (Bharat Stage –II norms)	1.4	1.32	0.07	0.05
2 Wheelers 4 stroke	2001-2005 norms (India Stage 2000 norms)	2.2	0.7	0.3	0.05
	2005-2010 norms (Bharat Stage –II norms)	2.4	0.7	0.3	0.05
3 Wheelers 2 stroke	2001-2005 norms (India Stage 2000 norms)	4.3	2.05	0.11	0.08
	2005-2010 norms (Bharat Stage –II norms)	2.45	0.75	0.12	0.08
CNG Bus	2001 Norms	0.66	2.75	9.87	0.05
3 Wheeler 2 Stroke	2001 Norms	0.29	1.45	0.02	---
3 Wheeler 4 stroke	2001 Norms	0.29	2.40	0.75	---

**TABLE 3.8  
EMISSION FACTORS COMPARISON**

FUEL	EMISSION IN G/JN				RATIO OF PM
	CO	NMVOC	NO <sub>x</sub>	PM	
Low sulphur Diesel (500 ppm)	1.32	0.50	14.72	0.22	440% Higher
ULSD (50 ppm)	1.41	0.52	14.32	0.16	320% Higher
CNG	0.66	2.75	9.87	0.05	----

**TABLE 3.9**  
**AIR QUALITY IN AND AROUND PROJECT SITE**

S. NO.	LOCATION	SPM $\mu\text{g}/\text{m}^3$	SO <sub>2</sub> $\mu\text{g}/\text{m}^3$	NOx $\mu\text{g}/\text{m}^3$	CO $\text{mg}/\text{m}^3$
1	Guru Teg Bahadur Chowk	1016-1552	18-31	35-63	2.4-2.7
2	Bhamshah Chowk	710-1172	16-34	31-59	2.1-2.8
3	Azadpur Chowk	799-1655	15-37	41-53	2.4-3.6
4	Sarai Chowk	1107*-1443	23-35	35-44	2.7-3.9
5	Opp. GT Karnal Road DTC Depot	870-1233	22-38	41-56	2.6-3.2
6	Sanjay Gandhi TPT Nagar	642-1187	20-33	43-58	1.8-2.4
7	Central Secretariat	619	16	32	1.7
8	Akbar Road crossing	295	17	40	1.6
9	Akbar road –Prithviraj Road crossing	494	17	35	1.6
10	INA Market	1045	26	46	2.5
11	Gulmohar Park-Green Park crossing	1111.	27	50	3.3
12	Outer ring road	818	27	43	2.3
13	Navjeevan Vihar crossing	753	27	35	2.0
14	Andheria Mor	538-758	13-34	25-31	1.4-2.1
15	Vasant Kunj Sector A	720-1147	15-28	30-44	1.5-1.8
16	Rangpuri	406-752	23-27	34-40	1.3-1.8
17	Indraprastha station	549 – 818	3 -9	5.3 –7.3	3.2 -4.3
18	Near Railway crossing at Shakarpur	588 –716	2 -9	8.4 –9.2	2.3 -2.5
19	Pandav Nagar petrol pump	431 – 588	3 -5	2.0 –9.2	2.4 - 3.0
20	Near New Ashok Nagar	2174 *-2654	<3	7.0 –9.4	5.0 -6.0
21	Near Dharmashila cancer hospital	592 – 1020	<3	6.7- 7.2	2.0 -2.2
22	Near Kotla proposed station	497 –881	<3	4.7 –5.4	1.8 -2.8
23	Near Atta market	752* -1001	<3 - 14	4.3 –8.4	1.1 -1.2
24	Near Noida City center	589 - 664	2 -6	5.3 –9.6	1.0 - 1.2

Note: \* SPM values are high due to dusty atmosphere

**TABLE 3.10**  
**AIR QUALITY AT PROJECT SITE ( $\mu\text{g}/\text{m}^3$ )**

S. NO.	LOCATION	SPM $\mu\text{G}/\text{M}^3$	SO <sub>2</sub> $\mu\text{G}/\text{M}^3$	CO $\text{MG}/\text{M}^3$	NOX $\mu\text{G}/\text{M}^3$
<b>Viswavidyalaya - Jahangirpuri</b>					
1	Guru Teg Bahadur Chowk	1016-1552*	18-31	2.4-2.7	35-63
2	Bhamshah Chowk	710-1172	16-34	2.1-2.8	31-59
3	Azadpur Chowk	799-1655*	15-37	2.4-3.6	41-53
<b>Central Secretariat - Qutab Minar</b>					
4	Central Secretariat	619*	16	1.7	32
5	Akbar road crossing	295	17	1.6	40
6	Akbar Road – Prithviraj Road Crossing	494	17	1.6	35
7	INA Market	1045*	26	2.5	46
8	Gulmohar park green park crossing	1111*	27	2.3	50
9	Outer ring road	818*	27	2.3	43
10	Navajeevan Vihar crossing	753	27	2.0	35
<b>Shahdara - Dilshad Garden</b>					
11	Near GTB enclave	497 -881	<3	1.8 -2.8	47 -54
<b>Indraprastha - New Ashok Nagar</b>					
12	Indraprastha station	549 - 818	<3 -9	3.2 -4.3	53 -73
13	Near New Ashok Nagar	2174 - 2654	<3	5.0 -6.0	70 -94
14	Near Dharmashila cancer hospital	592 - 1020	<3	2.0 -2.2	67- 72
<b>Yamuna Bank - Anand Vihar ISBT</b>					
15	Near Karkarduma flyover	588 -716	2 -9	2.3 -2.5	84 -92
16	Depot Site (Proposed)	215-300	<4	<4	20-31
<b>Kirti Nagar – Mundka</b>					
17	Near Surajmall stadium pump	431 - 588	<3 -5	2.4 -3.0	20 -92
18	Near Nangloi	500 - 642	<4	1.2 -5.0	15 –89

S. NO.	LOCATION	SPM μG/M <sup>3</sup>	SO <sub>2</sub> μG/M <sup>3</sup>	CO MG/M <sup>3</sup>	NOX μG/M <sup>3</sup>
<b>Inderlok –Shivaji Park</b>					
19	Near Punjabi Bagh area	450 - 580	<4	1.3-1.8	25-85

Note: \* SPM values are high due to dusty atmosphere

**TABLE 3.11  
AMBIENT AIR QUALITY STANDARDS**

S. NO.	Category of Area	Concentration in μg/m <sup>3</sup>			
		SPM	NO <sub>x</sub>	SO <sub>2</sub>	CO
1	Industrial and Mixed use	500	120	120	5000
2	Residential and Rural	200	80	80	2000
3	Sensitive	100	30	30	1000

### 3.8 SEISMICITY

The project area falls in Zone-IV of Seismic Zoning Map of India.. Delhi region shows active and prolonged seismic history. Earthquakes of 3 to 6.7 magnitude on Richter scale have occurred in past around Delhi. Most of the shocks are interpreted to have shallow focus and have locations to the West of Delhi. Maximum concentrations of the earthquakes epicentre have been around Sonapat, Rohtak and Gurgaon. The seismic factor needs to be appropriately incorporated while finalising civil designs

### 3.9 NOISE

RITES have measured noise levels at different places in Delhi at 2m away from source as per standard practice. The noise levels so obtained during monitoring in 2003-04 for metro corridors are summarised in **Table 3.12** and **Table 3.13**. It could be concluded that the noise levels recorded at various places are higher than prescribed permissible levels of 65-dBA (day) and 55-dBA (night). The noise level standards are documented in **Table 3.14**.

**TABLE 3.12  
NOISE LEVELS IN AND AROUND DELHI (Leq)**

LOCATION (TYPE OF AREA)	TIME	L <sub>eq</sub>	L <sub>max</sub>	L <sub>10</sub>	L <sub>50</sub>	L <sub>90</sub>	L <sub>min</sub>	L <sub>day</sub>	L <sub>night</sub>
Andheria More (Residential)	09-10	73.60	97.50	75.20	68.10	59.00	48.10	75.1	65.95
	18-19	76.60	100.60	78.40	69.90	62.20	49.00		
	00-01	66.50	88.30	67.70	61.60	51.60	41.70		
	04-05	65.4	88.3	67.80	61.80	51.90	41.80		
	Average	70.53	93.68	72.28	65.35	56.18	45.15		
Vasant Sector A (Residential)	09-10	79.80	105.70	81.60	73.80	64.00	52.20	79.95	66.80
	18-19	80.10	105.20	82.00	73.10	65.00	51.30		
	00-01	69.40	90.00	69.00	62.90	52.60	42.50		
	04-05	64.20	85.40	65.60	59.70	50.10	40.40		
	Average	73.38	96.58	74.55	67.38	57.93	46.60		
Rangpuri (Residential)	09-10	76.40	101.2	78.10	70.70	61.30	50.00		
	18-19	75.80	99.50	77.60	69.20	61.50	48.50		

LOCATION (TYPE OF AREA)	TIME	L <sub>eq</sub>	L <sub>max</sub>	L <sub>10</sub>	L <sub>50</sub>	L <sub>90</sub>	L <sub>min</sub>	L <sub>day</sub>	L <sub>night</sub>
	00-01	67.50	84.30	64.60	58.80	49.30	39.80	76.10	64.80
	04-05	62.10	83.40	64.00	58.30	49.00	39.40		
	Average	70.45	92.10	71.08	64.25	55.28	44.43		
Noida City Center Station (Commercial)	09: -10	68.8	91.2	70.3	63.6	55.2	45.0	70.7	54.1
	18-19	71.5	93.9	73.2	65.3	58.1	45.8		
	04-05	58.2	81.2	62.4	56.8	47.7	38.4		
	00-01	60.2	76.3	58.5	53.2	44.6	36.0		
	Average	64.7	85.7	66.1	59.7	51.4	41.3		
Atta Chowk (Commercial)	09: -10	69.5	92.1	71.0	64.3	55.7	45.5	73.2	57.3
	18-19	76.1	99.9	77.9	69.5	61.8	48.7		
	04-05	55.8	77.7	59.7	54.4	45.7	36.8		
	00-01	56.3	73.6	56.4	51.4	43.0	34.8		
	Average	64.4	85.8	66.3	59.9	51.6	41.5		
New Ashok Nagar (Residential)	09: -10	72.4	95.9	74.0	67.0	58.1	47.3	72.0	54.9
	18-19	82.1	107.8	84.1	75.0	66.7	52.5		
	04-05	49.2	70.5	54.2	49.3	41.4	33.4		
	00-01	60.5	70.5	54.1	49.2	41.2	33.3		
	Average	66.1	86.2	66.6	60.1	51.9	41.6		
Near Dharamsheela Hospital (Silence Zone)	09: -10	72.3	95.8	73.9	66.9	58.0	47.3	70.4	60.0
	18-19	74.4	97.7	76.2	67.9	60.4	47.6		
	04-05	55.2	75.7	58.2	53.0	44.5	35.8		
	00-01	66.5	84.8	65.0	59.2	49.6	40.1		
	Average	67.1	88.5	68.3	61.8	53.1	42.7		
Sanjay Lake Park (Residential)	09: -10	68.5	90.8	70.0	63.4	54.9	44.8	65.8	55.9
	18-19	66.3	87.1	67.9	60.5	53.8	42.4		
	04-05	55.1	76.7	58.9	53.6	45.0	36.3		
	00-01	58.2	69.4	53.2	48.5	40.6	32.8		
	Average	62.0	81.0	62.5	56.5	48.6	39.1		
Near Pandav Nagar Petrol Pump (Commercial)	09: -10	77.0	102.0	78.7	71.2	61.8	50.4	71.5	58.9
	18-19	75.0	98.5	76.8	68.5	60.9	48.0		
	04-05	54.3	82.8	63.6	57.9	48.7	39.2		
	00-01	60.2	76.3	58.3	53.2	44.6	36.0		
	Average	66.6	89.9	69.4	62.7	54.0	43.4		

**Note:** L<sub>10</sub>, L<sub>50</sub> and L<sub>90</sub> are the sound level, which is exceeded 10%, 50% & 90% of the total time

**TABLE 3.13**  
**NOISE LEVELS IN DELHI (Leq)**

LOCATION (TYPE OF AREA)	TIME	L <sub>eq</sub>	L <sub>max</sub>	L <sub>10</sub>	L <sub>50</sub>	L <sub>90</sub>	L <sub>min</sub>
<b>Viswavidyalaya – Jahangirpuri</b>							
Guru Teg Bahadur Chowk (Commercial)	09-10	83.6	110.8	85.4	77.3	67.0	54.7
	18-19	81.4	106.9	83.4	74.3	66.1	52.1
	00-01	84.6	113.2	86.8	79.0	66.2	53.5
	04-05	66.2	88.6	68.1	62.0	52.0	44.3
	Average	79.0	104.9	80.9	73.2	62.8	51.2
Bhamshah Chowk (Commercial/Industrial)	09-10	68.4	90.6	69.9	63.3	54.9	44.7
	18-19	76.3	100.2	78.1	69.7	62.0	48.8
	00-01	68.6	91.8	70.4	64.1	53.6	43.4
	04-05	70	93.7	72	65.5	55	44.3
	Average	70.8	94.1	72.6	65.7	56.4	45.3
Azadpur Chowk (Commercial)	09-10	77.2	102.3	78.9	71.4	61.9	50.5
	18-19	77.4	101.6	79.3	70.7	62.8	49.5
	00-01	70.0	93.7	71.8	65.4	54.7	44.2
	04-05	70	93.7	72	65.5	55	44.3
	Average	73.7	97.8	75.5	68.3	58.6	47.1
<b>Central Secretariat - Qutab Minar</b>							
Central Secretariat (Commercial)	09-10	74.3	98.4	75.9	68.7	59.6	48.6
	18-19	74.2	97.4	76.0	67.7	60.3	47.5
	00-01	65.8	87.4	67.0	61.0	51.1	41.3
	04-05	64.6	88.7	68.2	62.1	52.1	42.0
	Average	69.7	93.0	71.8	64.9	55.8	44.9
Akbar road crossing (Residential)	09-10	72.6	96.2	74.2	67.2	58.2	47.5
	18-19	74.5	97.8	76.3	68	60.5	47.7
	00-01	66.2	86	66	60.1	50.3	40.6
	04-05	62.2	84.8	65.2	59.3	49.8	40.1
	Average	68.9	91.2	70.4	63.7	54.7	44.0
Akbar Road – Prithviraj Road (Residential)	09-10	78.3	103.7	80	72.4	62.8	51.2
	18-19	80.4	105.6	82.3	73.4	65.3	51.5
	00-01	62.1	84.8	65	59.2	49.6	40.1
	04-05	65.3	86.2	66.2	60.3	50.6	40.8
	Average	71.5	95.1	73.4	66.3	57.1	45.9
INA market (Commercial)	09-10	75	99.4	76.7	69.4	60.2	49.1
	18-19	84	110.3	86	76.7	68.2	53.8
	00-01	72.7	94.5	72.4	65.9	55.2	44.6
	04-05	69	92.3	70.3	64.6	54.2	43.5
	Average	75.2	99.1	76.4	69.2	59.5	47.8
Green park – Gulmohar park (Commercial)	09-10	78.3	103.7	80	72.4	62.8	51.2
	18-19	76.2	100.1	78	69.6	61.9	48.8
	00-01	69.3	90.3	69.3	63	52.8	42.7
	04-05	65.2	88.7	68.2	62.1	52.1	42
	Average	72.3	95.7	73.9	66.8	57.4	46.2
Outer ring road crossing (Commercial)	09-10	78.4	103.9	80.1	72.5	62.9	51.3
	18-19	78	102.4	79.9	71.2	63.3	49.9
	00-01	68.7	88.8	68.1	62	51.9	42
	04-05	66.4	86	66.1	60.2	50.5	40.7
	Average	72.9	95.3	73.6	66.5	57.2	46.0
Navjeevan crossing (Residential)	09-10	74.5	98.7	76.1	68.9	59.7	48.7
	18-19	77.4	101.6	79.3	70.7	62.8	49.5
	00-01	70	93	71.3	64.9	54.3	43.9

LOCATION (TYPE OF AREA)	TIME	L <sub>eq</sub>	L <sub>max</sub>	L <sub>10</sub>	L <sub>50</sub>	L <sub>90</sub>	L <sub>min</sub>
	04-05	67.3	88.8	68.3	62.2	52.2	42
	Average	72.3	95.5	73.8	66.7	57.3	46.0
<b>Shadra-Dilshad Garden</b>							
Near GTB Enclave (Residential)	09-10	68.5	90.8	70.0	63.4	54.9	44.8
	18-19	66.3	87.1	67.9	60.5	53.8	42.4
	00-01	64.3	89.5	69.2	63.2	52.3	43.0
	04-05	55.1	76.7	58.9	53.6	45.0	36.3
	Average	63.6	86.0	66.5	60.2	51.5	41.6
<b>Indraprastha - New Ashok Nagar</b>							
New Ashok Nagar (Residential)	09-10	72.4	95.9	74.0	67.0	58.1	47.3
	18-19	82.1	107.8	84.1	75.0	66.7	52.5
	00-01	60.5	70.5	54.1	49.2	41.2	33.3
	04-05	49.2	70.5	54.2	49.3	41.4	33.4
	Average	66.1	86.2	66.6	60.1	51.9	41.6
Near Dharamsheela Hosp (Silence Zone)	09: -10	72.3	95.8	73.9	66.9	58.0	47.3
	18-19	74.4	97.7	76.2	67.9	60.4	47.6
	04-05	55.2	75.7	58.2	53.0	44.5	35.8
	00-01	66.5	84.8	65.0	59.2	49.6	40.1
	Average	67.1	88.5	68.3	61.8	53.1	42.7
<b>Yamuna Bank - Anand Vihar ISBT</b>							
Near Karkarduma flyover (Residential +commercial)	09-10	72.3	95.8	73.9	66.9	58.0	47.3
	18-19	74.4	97.7	76.2	67.9	60.4	47.6
	00-01	66.5	84.8	65.0	59.2	49.6	40.1
	04-05	55.2	75.7	58.2	53.0	44.5	35.8
	Average	67.1	88.5	68.3	61.8	53.1	42.7
<b>Kirti Nagar – Mundka</b>							
Near Suraj mall stadium (Residential)	09-10	72.00	108.0	76.2	70.8	62.4	51.8
	18-19	74.0	102	74.4	69.25	60.8	46.4
	00-01	60.3	71.2	53.2	48.5	42.2	34.3
	04-05	58.3	95	62.1	56.7	49.4	40.30
	Average	66.2	94.1	66.5	61.3	53.7	43.2
Near Nangloi area (Residential)	09-10	75.4	99.7	72.4	70.4	61.8	50.14
	18-19	72.1	80.5	5.4	70.1	59.4	45.2
	00-01	62.2	83.8	65.2	58.4	48.3	42.1
	04-05	60.2	80.7	66.1	56.8	50.1	40.1
	Average	67.5	86.2	52.3	63.9	54.9	44.4
<b>Inderlok-Shivaji Park</b>							
Near Punjabi bagh area (Commercial)	09-10	72.1	84.2	72.4	69.5	60.1	51.4
	18-19	65.2	75.4	5.4	69.5	58.5	46.2
	00-01	64.2	87.3	67.3	61.5	52.3	44.0
	04-05	58.5	70.4	66.1	55.4	49.5	41.5
	Average	65.0	79.3	52.8	64.0	55.1	45.8

**Note:** L<sub>10</sub>, L<sub>50</sub> and L<sub>90</sub> are the sound level, which is exceeded 10%, 50% & 90% of the total time

**TABLE 3.14  
NOISE LEVELS STANDARDS dB (A)**

S.No.	Standard For	DAY	NIGHT
1	Industrial Area	75	70
2	Commercial Area	65	55
3	Residential Area	55	45
4	Silence Zone	50	40

### 3.10 SOCIO-ECONOMICS

A detailed socio-economic study has been carried out for the project involving about 10% of the affected population (the population with in the right of way). The sample performa used for such study has been enclosed as **Annexure 3.1**. No public hearing has, however been conducted during the study. In order to keep acquisition of private land to the barest minimum, the alignment has been so chosen, that it remains mostly within the government land. However, at few locations private land is required for entry, exit and other facilities of station and running section. The private land requirements will be about 4.22 ha. The details of land permanently required for the project are given in **Table 3.15**.

**TABLE 3.15  
LAND REQUIREMENT**

SL. NO.	CORRIDOR NAME	TYPE OF LAND TO BE ACQUIRED (HA)		TOTAL
		GOVERNMENT	PRIVATE	
1	Viswavidyalaya – Jahangiripuri	5.67	0.09	5.76
2	Central Secretariat – Qutab Minar	31.19	0.08	31.198
3	Shahdara – Dilshad Garden	5.67	2.12	7.79
4	Indraprastha – New Ashok Nagar	16.97	0	61.97
5	Depot	45.00	---	---
6	Yamuna Bank – Anand Vihar ISBT	29.47	0.32	29.79
7	Kirti Nagar – Mundka along with Shivaji Park - Inderlok	21.93	1.68	23.61
<b>TOTAL LAND</b>		<b>155.90</b>	<b>4.22</b>	<b>160.12</b>

During social survey we made some observations on land details along the all corridors, which are as follows:

- i) ***In Viswa Vidyalaya to Jahangirpuri corridor***, it was only few small shops area to be acquired for the purpose of entry to Guru Tegh Bahadur Nagar Station. Other than these shops, no displacement is likely to take place. However, these shops were covered under social survey in order to know their socio-economic status.
- ii) ***In Central Secretariat - Qutab Minar corridor***, in private land there are a few shops on Plot No. FP-6 (96.87 sqm.) at Green park Station, which need relocation. Private plots of land area to be acquired at Hauz khas Station at GP-1 & 2 (545.55 sqm.), Institutional land at IIT station HP-1 (402.63 sqm). The shops can be relocated in the plot areas, proposed for acquisition for Traffic integration at stations, as the areas required are small.

- iii) ***In Shahdara - Dilshad Garden alignment***, only at location *i.e.* near GTB enclave the proposed station starting from railway crossing near Vishwamedha setu to the end of the fly over, private land needs to be acquired. It was observed during the field study that people in Jhilimil industrial area would be affected due to development of metro project from Shahdara to Dilshad Garden. The primary data for the study was collected through interviews with the project-affected people using the help of pre-tested structured interview schedule. These have been covered for the purpose of this study.

At these locations there are about 75 small-scale industries manufacturing mostly the copper wire, paper products etc., the average number of persons employed in each industry is about 10 –15. It is also observed that most of the industries are handling the hazardous waste and have obtained the valid clearance from state pollution control committee. The average area of each industry is about 1000m<sup>2</sup>. During the survey, negative response from the owners has been received.

- iv) ***In Indraprastha - New Ashok Nagar corridor***, the alignment passes through the cultivated land for the total area of 60.55ha starting from Yamuna Bank to Mayur Vihar phase –I area. No private buildings are getting affected due to the alignment. About 312 Jhuggis in the running section of Yamuna khadir area on DDA land also requires relocation along the Indraprastha to new Ashok Nagar corridor alignment. Other than these, no displacement is likely to take place.
- v) ***Along the Yamuna Bank - Anand Vihar ISBT corridor*** no loss of private land is getting affected due to the proposed corridors. Hence, no social survey is anticipated due to the project.
- vi) ***Along the Kirti Nagar Mundka corridor*** there are few shops and houses in private land is getting affected due to the proposed station near by Mundka Bus Stop. These shops and houses were covered under social survey.
- vii) ***Along the Inderlok to Shivaji park station corridor***, the alignment passes there are about 100 Jhuggis in the running section of near Amar park area on Railway land which are getting affected and requires relocation. As such near 650-700 semi pucca houses are existing near Amar Park area. However, for the metro alignment, it is estimated that about 100 families will be affected. Sample surveys have been carried out accordingly. It is observed that most of the project-affected people in the area are working in telephone exchange and as daily wages. Near by no primary school exists for children and have to cross the railway line.

### 3.10.1 Survey Design

The present study is based on descriptive survey design. This descriptive design was picked up for portraying accurately the socio-economic characteristics of project-

affected families. It was observed during the field study that people in Central Secretariat – Qutab Minar, Indraprastha- New Ashok Nagar, Shahdara- Dilshad Garden and Indralok –Shivaji park areas would be affected due to development of metro project. It is therefore decided to conduct a social survey in these affected areas along the alignment by using random sampling method. The sample size in each area is presented in **Table 3.16**. About 94 project affected families were randomly selected. The primary data for the study was collected through interviews with the project-affected people using the help of pre-tested structured interview schedule. Almost all the residential dwellings are pucca houses and have been constructed with brick-mortar except along Inderlok to Shivaji park line near Amar Park where most of the houses are built in Railway land in semi pucca houses.

**TABLE 3.16  
SAMPLE SPECTRUM OF PAFS**

NAME OF CORRIDORS	TOTAL PAFS	SAMPLE SIZE	PERCENTAGE
Vishwa Vidyalaya-Jahangirpuri	20	5	25.0
Central Secretariat –Qutab Minar	63	24	39.0
Shahdara –Dilshad Garden	75	10	13.0
Indraprastha to New Ashok Nagar	312	32	10.0
Inderlok –Shivaji park	102	13	13.0
Kirti Nagar-Mundka	86	10	12.0
<b>TOTAL</b>	<b>658</b>	<b>94</b>	

### 3.10.2 Socio-Economic Profile of the PAFs

**Table 3.17** shows sex wise distribution of project-affected people. As many as 56.1% people are male as against 43.9% female. Male to Female ratio is 1.28:1 maximum number of male in Kirti Nagar to Mundka corridor being 65%. It is also observed that male people preponderate in all corridors.

**TABLE 3.17  
SEX WISE DISTRIBUTION OF FAMILY MEMBERS**

Sl. No	Sex	Central Secretariat – Qutab Minar (N=115)		Indraprastha to New Ashok Nagar (N=142)		Shahdara – Dilshad Garden (N=40)		Inderlok – Shivaji park (N=58)		Kirti Nagar-Mundka (N=46)		Vishwa Vidyalaya-Jahangirpuri (N=38)		Total (N=439)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
		1	Male	65	56.5	78	54.9	21	52.5	35	60.0	30	65.2	17	44.7
2	Female	50	43.5	64	45.1	19	47.5	23	40.0	16	34.8	21	55.3	193	43.9

Maximum number of people (40.1 %) falling in the age group of 15-35 years, 33.9% belong to the age of 36-60 years. Remaining 20.7% and 5.2 % people belong to the age of below 14 years and above 60 years respectively. The mean average age of the people is 30.34 years. Age wise distribution in corridors is presented in **Table 3.18**.

**TABLE 3.18**  
**AGE-WISE DISTRIBUTION OF PAPs**

SI No	Age Group (years)	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar - Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=115)		(N=142)		(N=40)		(N=58)		(N=46)		(N=38)		(N=439)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	0 - 14	13	11.3	34	23.9	11	27.5	23	39.6	7	15.2	3	7.9	91	20.7
2	15 - 35	69	60.0	42	29.6	15	37.5	10	17.2	26	66.5	14	36.8	176	40.1
3	36 - 60	29	25.2	52	36.6	14	35	23	39.6	12	26.1	19	50.0	149	33.9
4	60 & Above	4	3.48	14	9.8	0	0	2	3.5	1	2.2	2	5.3	23	5.2
	<b>Mean</b>	29.98		32.56		28.10		23.36		29.02		36.92		30.91	
	<b>S.D</b>	3.94		3.55		6.75		5.86		6.36		6.76		1.97	

**Table 3.19** shows that majorities of population are Hindu (92.5%). The proportion of the people belonging to Muslim (6.4%) and Jain (1.1%) religions. Hindu family dominates in all surveyed corridors.

**TABLE 3.19**  
**RELIGIOUS GROUP**

SL. No.	Religious group	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Hindu	24	100	29	90.6	8	80	11	85	10	100.0	5	100.0	87	92.5
2	Muslim	0	0	3	9.4	1	10	2	15	0	0	0	0.0	6	6.4
3	Jain	0	0	0	0	1	10.0	0	0	0	0	0	0.0	1	1.1

The analysis of data reveals that the majority of the people (42.6%) are belongs to General Castes. But the second largest group of the people belongs to Scheduled Castes (38.3%), followed by those coming from other Backward Castes (19.1%). Mixed scenario is observed from this analysis. The caste distribution of PAFs is presented in **Table 3.20**. There was no schedule Tribe among the surveyed families.

**TABLE 3.20**  
**CASTE WISE DISTRIBUTION OF PAFS**

SI No	Caste	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	SC	1	4.17	25	78.2	1	10	6	46.2	3	30.0	0	0.0	36	38.3
2	OBC	1	4.17	5	15.6	1	10	7	53.8	4	40.0	0	0.0	18	19.1
3	General	22	91.6	2	6.2	8	80	0	0	3	30.0	5	100.	40	42.6

**Table 3.21** shows that 25.5% of project affected people studied up to college, 21.2% up to middle, 19.8 % up to primary and 19.6% up to high school. It is important to note that remaining 13.9% are illiterate. Thus it is evident from the analysis that in most of the areas people have completed middle school.

**TABLE 3.21  
LEVEL OF EDUCATION AMONG THE PAPs**

SI No	Education level	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=115)		(N=142)		(N=40)		(N=58)		(N=46)		(N=38)		(N=439)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Illiterate	11	11	25	17.6	3	7.5	17	29	5	10.9	0	0.0	61	13.9
2	Primary	12	11	39	27.4	1	2.5	24	41	9	19.5	2	5.3	87	19.8
3	Middle	31	31	40	28.1	14	35.0	0	0	6	13.0	2	5.3	93	21.2
4	High	26	12	15	10.5	2	5.0	16	28	13	28.3	14	36.8	86	19.6
5	College	35	35	23	13.3	20	42.5	1	2	13	28.3	20	52.6	112	25.5

So far as marital status of family members are concerned it is observed from **Table 3.22** that out of 439 project affected people, majority of them (59.7%) are unmarried and 40.3 % are married.

**TABLE 3.22  
MARITAL STATUS OF PROJECT AFFECTED PEOPLE**

SI No	Marital Status	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=115)		(N=142)		(N=40)		(N=58)		(N=46)		(N=38)		(N=439)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Married	45	39.1	48	33.8	19	47.5	27	46.6	21	45.6	17	44.7	177	40.3
2	Unmarried	70	60.9	94	66.2	21	52.5	31	53.4	25	54.4	21	55.3	262	59.7

**Table 3.23** indicates that the occupation of majority OF people (53.2%) are engaged in business activities and remaining 40.4% and 6.4% of them are engaged in daily wages activities and service respectively.

**TABLE 3.23  
OCCUPATION WISE DISTRIBUTION OF PROJECT AFFECTED FAMILIES**

SI No	Occupation	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Labour	0	0	30	93.7	0	0.0	6	46.2	2	20.0	0	0.0	38	40.4
2	Business	24	100	2	6.3	10	100	2	15.4	7	70.0	5	100	50	53.2
3	Service	0	0	0	0	0	0.0	5	38.5	1	10.0	0	0.0	6	6.4

About 38.3% of families have their income less than Rs. 25,000/-, 44.7% of them have an income of Rs.25001-100,000/- per annum. About 12.7 % of the families have an income range between Rs.100,000 to 200,000 per annum. Remaining 4.2% of the families have an income more than Rs. 200,000/- per annum (**Table 3.24**).

**TABLE 3.24**  
**FAMILY INCOME OF PROJECT AFFECTED FAMILIES (PER annum)**

SI No	Income	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	0-25000	4	16.6	25	78.1	1	10.0	5	38.5	1	10.0	0	0.0	36	38.3
2	25001-50000	14	58.3	5	15.6	0	0.0	5	38.5	6	60.0	0	0.0	30	31.9
3	50001-100000	2	8.34	0	0.0	5	50.0	3	23.0	1	10.0	1	20.0	12	12.8
4	100001-150000	1	4.16	2	6.2	0	0.0	0	0.0	1	10.0	4	80.0	8	8.5
5	150001-200000	0	0.0	0	0.0	4	40.0	0	0.0	0	0.0	0	0.0	4	4.2
6	>200000	3	12.5	0	0.0	0	0.0	0	0.0	1	10.0	0	0.0	4	4.2
<b>Mean</b>		<b>60417.02</b>		<b>23437.61</b>		<b>108750.45</b>		<b>36538.77</b>		<b>63750.4</b>		<b>115000.5</b>		<b>52925.82</b>	
<b>S.D</b>		<b>41607.74</b>		<b>35839.10</b>		<b>66514.57</b>		<b>68175.51</b>		<b>65093.38</b>		<b>85201.99</b>		<b>17670.1</b>	

**Table 3.25** indicates that 56.4% families are nuclear consisting of husband, wife and children, while 42.5% are joint families. The percentage of joint families is more in Central Secretariat- Qutab Minar (87.5%). Only 1.1% of them are individual.

**TABLE 3.25**  
**FAMILY PATTERN OF PAFs**

SI No	Family Pattern	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Ngar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Joint	21	87.5	7	21.8	1	10	5	38	3	30	3	60	40	42.5
2	Nuclear	3	12.5	25	78.2	9	90	7	54	7	70	2	40	53	56.4
3	Individual	0	0	0	0	0	0	1	8	0	0	0	0	1	1.1

Family size has been classified into four categories i.e., individual, small (2-4), medium (5-7) and large (7& above). Most of the families are small 47.9%, 30.8 % are medium, 11.7% are large in size and remaining 9.6 % are individual. The mean average size of family is 4 members (**Table 3.26**).

**TABLE 3.26**  
**FAMILY SIZE OF PAFs**

SI No	Size of Family	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Individual	2	8.33	5	15.6	1	10	1	7.7	0	0	0	0	9	9.6
2	Small (2to 4)	11	45.83	20	62.5	4	40	5	38.4	3	30	2	40	45	47.9
3	Medium (5 to7)	6	25.00	5	15.6	5	50	6	46.1	5	50	2	40	29	30.8
4	Large (7&above)	5	20.84	2	6.25	0	0	1	7.7	2	20	1	20	11	11.7
<b>Mean</b>		<b>4.42</b>		<b>3.41</b>		<b>4.30</b>		<b>4.5</b>		<b>5.30</b>		<b>5</b>		<b>4.2</b>	
<b>S.D</b>		<b>1.00</b>		<b>0.86</b>		<b>1.59</b>		<b>1.39</b>		<b>1.74</b>		<b>2.5</b>		<b>.52</b>	

Type of Structure to be acquired from project-affected families is given in **Table3.27**. On private land about 46.8% are houses, 41.5% are shops and 9.6% are house and shop. Whereas 2.1 % are revenue land including house.

**TABLE 3.27  
TYPE OF STRUCTURE**

SI No	Type of Structure	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	House	0	0	30	93.7	1	10.0	10	77	2	20.0	1	20.0	44	46.8
2	Shop	24	100	0	0	7	70.0	3	23	1	10.0	4	80.0	39	41.5
3	House & Shop	0	0	0	0	2	20.0	0	0	7	70.0	0	0.0	9	9.6
4	Others	0	0	2*	6.3	0	0	0	0	0	0.0	0	0.0	2	2.1

\*Revenue land including house

Most of the structures of the project-affected families are semi-pucca (48.9%), pucca (46.8%) and remaining 4.2% are kutchha in nature. However, along the Indraprastha to New Ashok Nagar corridor, mostly cultivated lands are getting affected through which the project alignments have been proposed (**Table3.28**).

**TABLE 3.28  
CONSTRUCTION OF STRUCTURE**

SI No	Construction Structure	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Kuchha	0	0	0	0	1	00.0	3	23	0	0.0	0	0.0	4	4.2
2	Semi-pucca	3	12.5	30	93.7	2	30.0	10	77	1	10.0	0	0.0	46	48.9
3	Pucca	21	87.5	2	6.3	7	70.0	0	0	9	90.0	5	100.0	44	46.8

It is also to be noted from **Table 3.29** that most of the project affected families (44.7%) are squatters have been staying on the government land whereas 30.8% and 24.5% of people having structure in leased and in their owned land respectively. Squatters have been observed along the corridors of Indraprastha to New Ashok Nagar & Inderlok to Shivaji park corridor.

**TABLE 3.29  
OWNERSHIP OF STRUCTURE**

SI No	Ownership Of Structure	Central Secretariat – Qutab Minar		Indraprastha to New Ashok Nagar		Shahdara – Dilshad Garden		Inderlok – Shivaji park		Kirti Nagar- Mundka		Vishwa Vidyalaya- Jahangirpuri		Total	
		(N=24)		(N=32)		(N=10)		(N=13)		(N=10)		(N=5)		(N=94)	
		F	%	F	%	F	%	F	%	F	%	F	%	F	%
1	Owned	4	16.6	2	6.3	7	70.0	1	7.7	5	50.0	4	80.0	23	24.5
2	Leased	20	83.3	0	0	3	30.0	0	0	5	50.0	1	20.0	29	30.8
3	Squatters	0	0	30	93.7	0	0.0	12	92.3	0	0.0	0	0.0	42	44.7

### 3.11 EPILOGUE

Based on environmental baseline data documented in this chapter and project features reported in **Chapter 2**, the environmental impacts are described in **chapter 4**.