

# मुंबई मेट्रो

Mumbai Metro Line 7 EIA Analysis

Om Vaknalli  
18376

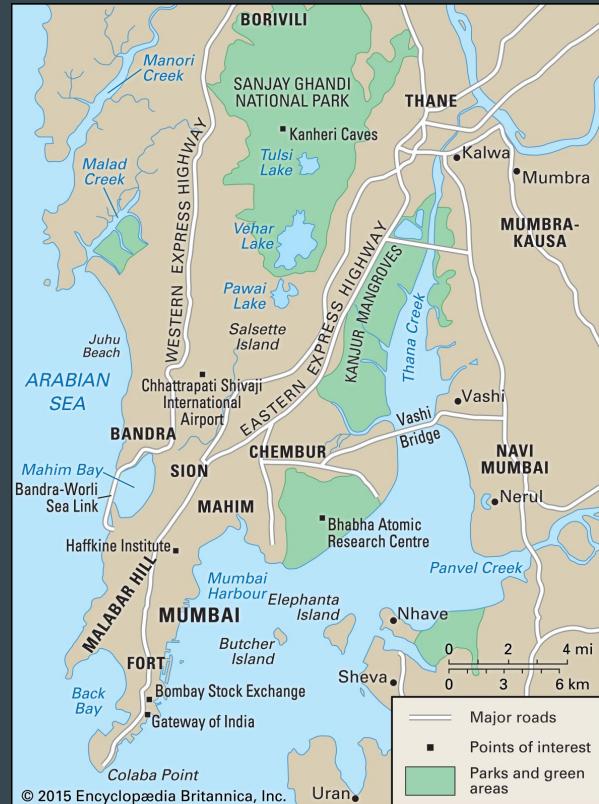
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# Introduction

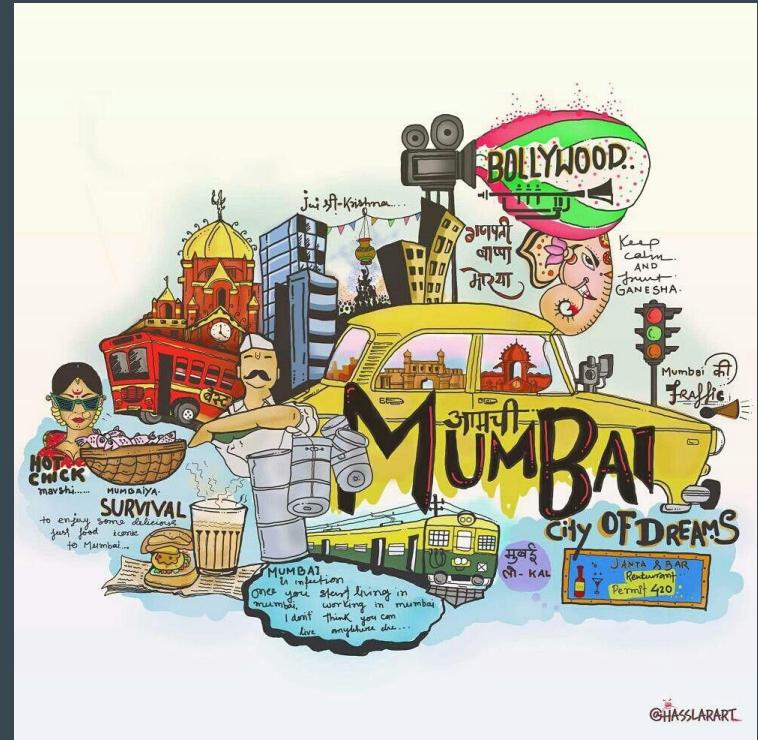
# Location Details

- **Mumbai**, formerly **Bombay** is a metro city and capital of Maharashtra state in midwestern India.
- Located on Maharashtra's coast, Mumbai is India's most populous city, and it is one of the largest and most densely populated urban areas in the world.
- The city of Mumbai occupies a peninsular site on Bombay Island, a landmass originally composed of seven islets lying off the Konkan coast of western India. Since the 17th century the islets have been joined through drainage and reclamation projects, as well as through the construction of causeways and breakwaters, to form the Bombay Island. The island consists of a low-lying plain, about one-fourth of which lies below sea level; the plain is flanked on the east and west by two parallel ridges of low hills.



# Location Details

- For a long time, it was the centre of India's cotton textile industry. Subsequently it developed a highly diversified manufacturing sector that included an increasingly important information technology (IT) component. In addition, the city's commercial and financial institutions are strong and vigorous, and Mumbai serves as the country's financial hub.
- It suffers, however, from some of the perennial problems of many large expanding industrial cities: air and water pollution, widespread areas of substandard housing, and overcrowding.



# Location Details





# Project Details

- Project Name: Andheri (E) - Dahisar (E) Corridor of Mumbai Metro
- Project Proponent: MMRDA (Mumbai Metropolitan Region Development Authority)
- EIA consultant: Fine Envirotech Engineers
- Project type: Category B (B1 is assumed)
- Project Sector: Public Transport (Railway)
- Project Location: Mumbai Metropolitan Region
- Project Duration: 60 months (expected)
- Publishing timeline of EIA report: April 2018 (EIA 2006 draft applicable)
- Date of Operations: Jan 2022 (expected)
- Line 7 = Red line

# Project Details



- Termini: (i) Golden Nest, Bhayander (ii) NSCB Ground, Andheri (iii) CSMIA T2 (Line 7A)
- Line length: 16.475 Km (elevated)
- 13 stations
- Dahisar Depot: 15 Hectares
- Project Completion Cost: Rs. 6298 Cr.
- Coach Dimensions: Width : 3.20 m, Height : 3.90 m, Length : 21.84 m
- Train Capacity: 6 coach train - 1756 persons, 8 coach train - 2244 persons
- The Asian Development Bank (ADB) will provide 43-48% of the total project cost through a loan at an interest rate of 1.4%. The Maharashtra State Government is the guarantor for the loan.

# Project Benefits

- Higher carrying capacity (50 seat+325 standing = 375 per standard Coach) compared to road transport. (Equivalent to 7 lanes of bus traffic or 24 lanes of motor car traffic)
- Higher speed (maximum speed of 80km/hr irrespective of normal time or peak time compared to bus and other road traffic which literally snarls during peak time.)
- Smooth ride as it is not affected by other vehicles, pedestrians etc. (Travel in jam packed buses is very rough.)
- Safer compared to road transport in Mumbai where road accident rate is very high.
- Occupies less land space as the Metro runs on elevated tracks which are supported on pillars; each pillar occupying a ground space of approximately
- No gaseous, liquid or solid pollution as the Metro railway is run on clean energy viz. electricity which does not emit any pollutant during the operation.
- Lower noise pollution compared to equivalent capacity of road transport. (By virtue of the state of the art technology applied for construction of the coaches and the track and by virtue of high elevation of the track (>7M) the noise nuisance caused by the Metro is far less compared to the road transport. (Noise levels of the modern Metro Rail Coaches and the track at the source is expected to be < 60 dB.

# Project Benefits

- Require 1/5th energy per passenger per km compared to road-based system.
- Causes no air pollution in the city.
- Causes lesser noise level.
- Is more reliable, comfortable and safer than road based system.
- Reduces journey time between 50% and 75% depending on road conditions.
- Improves the efficiency of the city's public transport and road networks.
- Creates a system with the flexibility to adapt to development phased over several years.
- Promote quality of life through a safe and healthy built and natural environment.
- Increases overall public transport patronage on the corridors served and achieves a mode shift from the car.
- Promotes equality of opportunity by improving accessibility to employment, goods and services.
- Improve the overall journey experience for passengers using the system by providing high quality information, better waiting and vehicle environments and enhanced safety and security.
- Assists in building vibrant, confident and cohesive communities in the city

# Scoping

# Project Area Description

## Land Environment

- Soil cover in the city region is predominantly sandy due to its proximity to the sea.
- In the suburbs, the soil cover is largely alluvial and loamy.
- The underlying rock of the region is composed of black Deccan basalt flows, and their acidic and basic variants dating back to the late Cretaceous and early Eocene eras respectively.
- Seismicity: Mumbai is located in zone III of seismic zoning map of India.

## Water Environment

- Water supply in Mumbai area is from 6 lakes. Water is drawn by Mumbai Municipal Corporation and filtered at Bhandup before supply for domestic use in the city.
- The ground water occurs under semi confined and confined conditions.
- The yield of the dugwells varies form 10 to 1000 m<sup>3</sup> /day, whereas that of borewells ranges between 50 and 1000 m<sup>3</sup> /day.
- The water quality in the area is within permissible limits as per IS: 10500.

# Project Area Description

## Meteorology

- Mumbai has a tropical climate, specifically a tropical wet and dry climate with seven months of dryness and peak of rains in July.
- The cooler season from December to February is followed by the summer season from March to June. The period from June to about the end of September constitutes the south-west monsoon season, and October and November form the post-monsoon season.

## Air Environment

- The monitoring results show that the average values of PM10 and PM 2.5 are due to the busy main road where lot of vehicular movement is observed whereas other parameters are within permissible limits.

## Noise Environment

- The noise level in the area is higher than the standards owing to the Traffic in the project area

# Project Area Description

## Vegetative Environment

- A total 241 numbers of trees exist on the metro 7 route (including stations and alignments) & 223 trees at casting yards located at Wadala and near Bandra Worli Sea link road.
- Trees have been found of common species like Pipal, Neem and Babool etc.
- Keeping the depot (At Dahisar) construction in view, may be some existing trees there can be taken into consideration later.

## Socio-Economic Environment

- Socially and culturally, Mumbai area is cosmopolitan in nature. Most of the people are working in service sector and industrial sector. The area has also witnessed a lot of migration from all parts of the country. People commute between different parts of the city very frequently for different purposes.
- At stations a few structures would get affected which will have to be compensated and resettled and rehabilitated as per the provisions of "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013."

# Methodology and Approaches

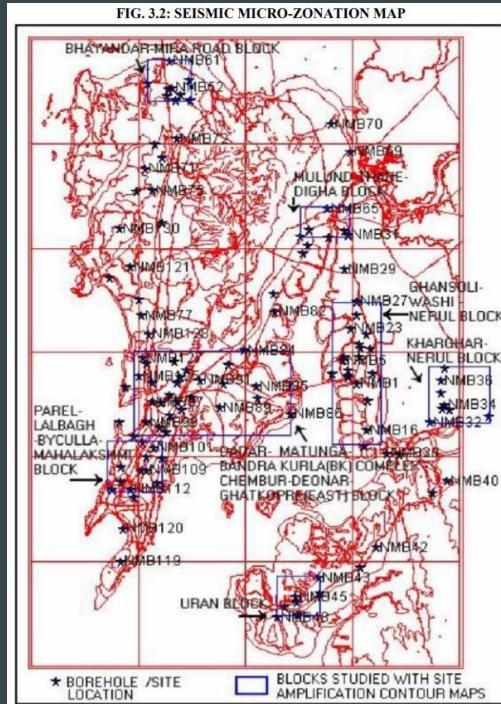
- In the analysis of alternatives, a comparison of scenario with and without the project has been made.
- The final alternative is fixed based on Technical Feasibility, Socio-economic acceptability, and Environmental sustainability for Metro Corridors.
- The impacts are to be assessed for various phases of project cycle namely:
  - Impacts due to project location
  - Impacts due to project design
  - Impacts due to project construction
  - Impacts due to project operation.
- The impacts are categorized as negative and positive.
- The changes likely to occur in different components of the environment i.e. physical, biological / ecological, environmental and socio-economic etc. will be studied, analyzed and quantified, wherever possible.
- The standard methodology for the data collection, impact assessment and formulation of management plans will be adopted.
- The national acts, legislation and laws along with guidelines will be consulted with a view to ensuring compliance with various requirements.

# Alternative Strategies and their limitations

- **Expansion of existing Railway line:** The crowded development and urbanization in Mumbai restricts the expansion of Train system due to lack of space.
- **Elevated railway tracks above the existing local railway:** This type of construction activity will require large amount of funding and will create disturbance in existing travel scenario of railway which is not at all feasible for the Mumbai city.
- **Use of electric cars:** Electric cars can be good alternatives which will provide transportation mode to the commuters travelling on Western Express Highway and also will be an eco-friendly mode of transportation. To implement this project it is necessary to encourage commuters to use the electric vehicles. This process will be a time consuming and the response for the project will solely depend on the commuters will.

# Baseline Studies: Geological

TABLE 3.3: CHEMICAL ANALYSIS OF SOIL					
Sr. No.	BH NO.	Depth(m)	PH	Sulphates (ppm)	Chlorides (ppm)
1.	BH - 12	3.50	7.16	345	810
2.	BH - 13	4.50	7.29	390	765
3.	BH - 14	2.50	7.47	350	820
4.	BH - 15	2.50	7.38	315	845
5.	BH - 16	3.50	7.22	320	720
6.	BH - 17	3.50	7.49	365	765
7.	BH - 18	3.50	7.26	370	8115
8.	BH - 19	3.50	7.38	325	860
9.	BH - 20	3.50	7.31	340	835
10.	BH - 21	3.50	7.49	335	795
11.	BH - 22	3.50	7.33	360	805
12.	BH - 23	4.50	7.29	315	840
13.	BH - 24	3.50	7.77	325	745
14.	BH - 25	3.50	7.36	370	780
15.	BH - 26	3.50	7.29	345	695
16.	BH - 27	3.50	7.22	380	810
17.	BH - 28	3.50	7.41	340	735
18.	BH - 29	4.00	7.53	355	770



Sr. No.	Test Parameters	Soil Samples					Units	Test Method
		Chainage -16200 BH No.- 12	Chainage -11475 BH No.- 17	Chainage -7820 BH No.- 21	Chainage -4520 BH No.- 25	Chainage -100 BH No.- 29)		
1.	pH (10% Solution)	6.7	6.9	6.9	6.8	6.7	--	APHA
2.	Total Kjeldhal Nitrogen	479	733	433	708	746	mg/Kg	APHA
3.	Phosphorous	98	57	62	39	62	mg/Kg	APHA
4.	Potassium	2837	3174	2836	3221	3242	mg/Kg	AAS
5.	Calcium	106	113	126	104	88	mg/Kg	APHA
6.	Magnesium	72	117	102	95	94	mg/Kg	APHA
7.	Sodium	108	156	137	142	124	mg/Kg	AAS
8.	Organic	2.9	4.8	2.96	1.55	2.6	%	APHA

Chainage is measured from Andheri end of the alignment in (m)

# Baseline Studies: Hydrological

TABLE 3.5: GROUND WATER QUALITY

Physical Parameters	Results			Limits
	Hotel Shere Punjab Andheri GW1	Goregaon GW2	Dahisar GW3	
Colour, Hazen	Colourless	Colourless	Colourless	5 (15) Max
Odour	Un objectionable	Un objectionable	Un objectionable	Un objectionable
Taste	Agreeable	Agreeable	Agreeable	Agreeable
Turbidity, NTU	2.6	3.7	3.4	1 (5) Max
pH	7.79	7.86	7.82	6.5-8.5 Max
Total Hardness as CaCO <sub>3</sub> , Mg/l	172	189	158	200 (600) Max
Chloride as Cl, Mg/l	118	137	128	250 (1000) Max
Total Iron as Fe, Mg/l	0.08	0.06	0.04	0.3 Max
Total Dissolved Solids, Mg/l	1247	1359	1179	500 (2000) Max
Sulphates as SO <sub>4</sub> , Mg/l	134	156	116	200 (400) Max
Nitrates as NO <sub>3</sub> , Mg/l	37.4	41.2	36.1	45 Max
Fluorides as F, Mg/l	2.36	2.81	2.49	1.0 (1.5) Max
Lead as Pb, Mg/l	BDL	BDL	BDL	0.01 Max
Copper as Cu, Mg/l	BDL	BDL	BDL	0.05 (1.5) Max
Manganese as Mn, Mg/l	BDL	BDL	BDL	0.1 (0.3) Max
Phenolic Compound as C <sub>6</sub> H <sub>5</sub> SO <sub>3</sub> H, Mg/l	BDL	BDL	BDL	0.001 (0.002) Max
Mercury as Hg, Mg/l	BDL	BDL	BDL	0.001 Max
Cadmium as Cd, Mg/l	BDL	BDL	BDL	0.01 Max
Selenium as Se, Mg/l	BDL	BDL	BDL	0.01 Max
Arsenic as As, Mg/l	BDL	BDL	BDL	0.05 Max
Cyanide as CN, Mg/l	BDL	BDL	BDL	0.05 Max
Zinc as Zn, Mg/l	1.08	1.17	0.96	5 (15) Max
Detergent as MBAS, Mg/l	BDL	BDL	BDL	0.2 (1.0) Max
Chromium as Cr+6, Mg/l	BDL	BDL	BDL	0.05 Max
Total Alkalinity as CaCO <sub>3</sub> , Mg/l	153.6	161.4	147.2	200 (600) Max
Aluminous as AlMg/l	BDL	BDL	BDL	0.03(2) Max
Boron as B, Mg/l	BDL	BDL	BDL	0.5(1) Max
<b>Bacteriological Analysis</b>	Nil	Nil	Nil	10 Max
Coliform, MPN/100mL E. coli/MI	Negative	Negative	Negative	Negative

TABLE 3.6: SURFACE WATER QUALITY

Sr. No.	Parameters	Unit	Water Sample - Station - W1-Goregaon	Water Sample - Station - W2-Borivali	Water Sample - Station - W3-Dahisar
1	Temperature	°C	32	32	32
2	pH	-	6.93	7.36	6.78
3	Colour	Hazen	1	1	1
4	Turbidity	NTU	25.3	17	32.9
5	TSS	mg/l	120	60	132
6	Nitrite as NO <sub>2</sub>	mg/l	<0.005	<0.005	<0.005
7	O & G	mg/l	<0.5	<0.5	<0.5
8	Total Hardness as CaCO <sub>3</sub>	mg/l	193	126	218
9	Sulphate as SO <sub>4</sub>	mg/l	27	24	26.4
10	Fluoride as F	mg/l	2.6	2.5	2.4
11	Nitrate as NO <sub>3</sub>	mg/l	2.67	2.13	2.73
12	Chloride as Cl	mg/l	129	94	174

# Baseline Studies: Meteorological

**TABLE 3.7: NORMAL TEMPERATURES AT MUMBAI**

<b>Month</b>	<b>Mean Daily Maximum Temperature, °C</b>	<b>Mean Daily Minimum Temperature, °C</b>
January	30.7	16.8
February	31.2	17.8
March	32.5	21.0
April	33.0	23.9
May	33.3	26.3
June	32.1	26.0
July	30.0	24.9
August	29.6	24.7
September	30.4	24.3
October	33.2	23.4
November	33.5	20.9
December	32.0	18.6
<b>Annual</b>	<b>31.8</b>	<b>22.4</b>

*Source: India Meteorological Department, Govt. of India*

**TABLE 3.8: MONTHWISE RAINFALL AT MUMBAI**

Sr. No.	Month	Rainfall	Peak Rainfall
1	January	0.6	
2	February	1.3	
3	March	0.2	
4	April	0.7	
5	May	12.5	
6	June	523.1	
7	July	799.7	
8	August	529.7	
9	September	312.3	
10	October	55.8	
11	November	16.8	

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*Prepared by Fine Envirotech Engineers*

*EIA report of proposed Andher (E) –Dahisar (E) Corridor of Mumbai Metro Project by MMRDA*

12	December	5.3	
Annual	Annual	2258.0	

*Source: India Meteorological Department, Govt. of India.*

# Baseline Studies: Air and Noise

FIG. 3.10: AMBIENT NOISE LEVELS

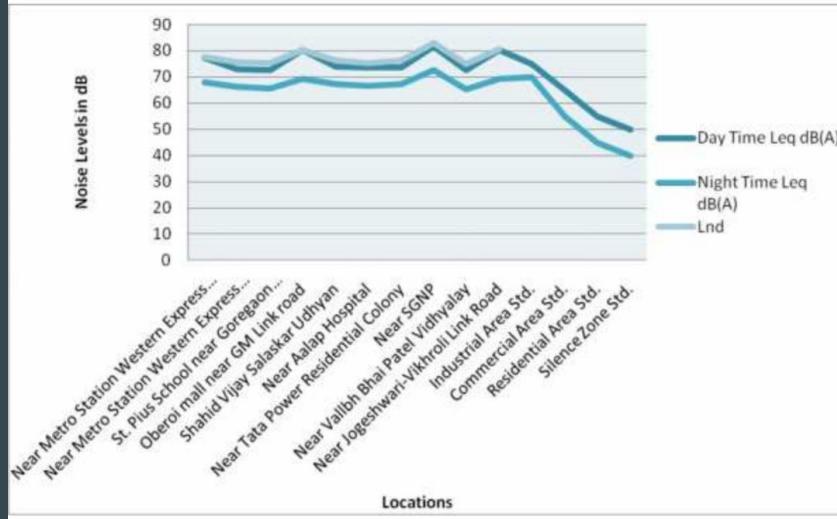
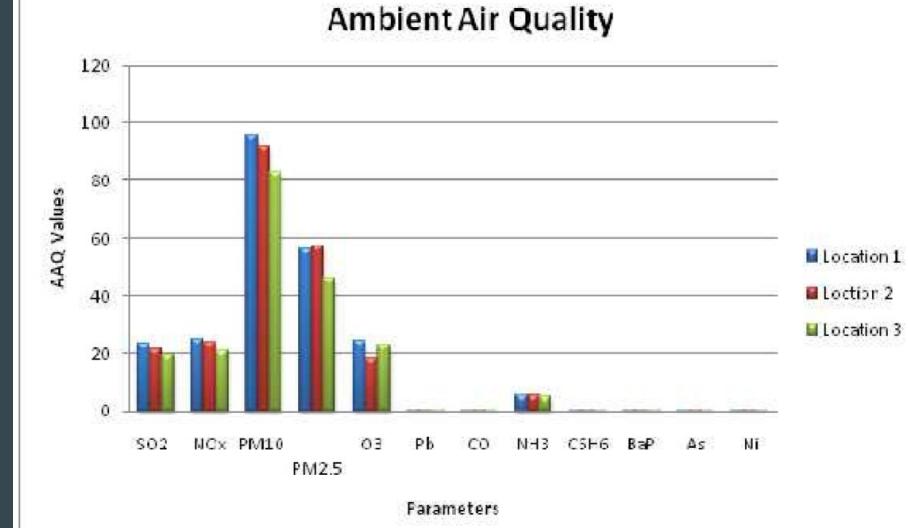


FIG. 3.8: CONCENTRATION OF AIR POLLUTANTS (AVERAGE)



# Baseline Studies: Ecological

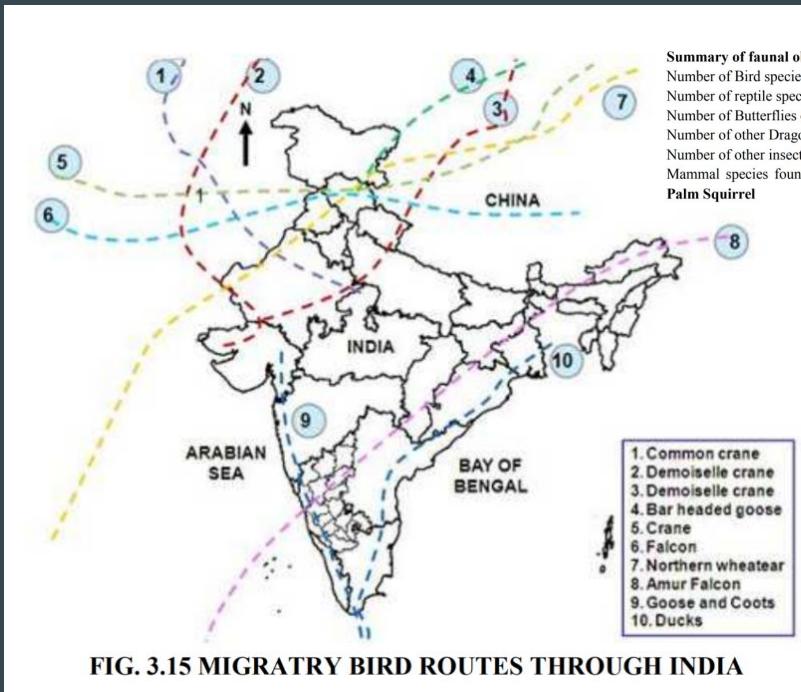
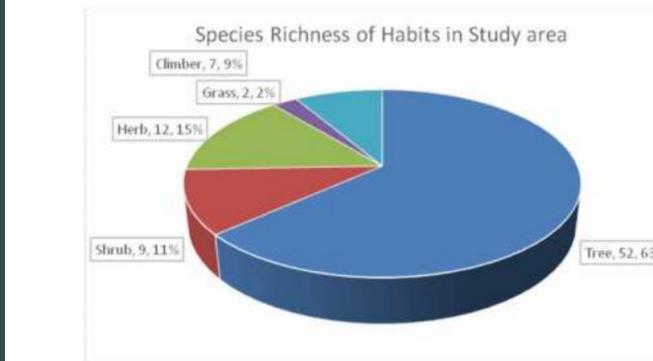


FIG. 3.15 MIGRATORY BIRD ROUTES THROUGH INDIA

TABLE 3.16: BIODIVERSITY IN THE AREA

Habitat groups	Number of species
Tree	52
Shrub	9
Herb	12
Grass	2
Climber	7
Total	<b>82</b>

Fig 3.12: COMPOSITION OF PLANT DIVERSITY SEEN IN THE STUDY AREA



# Baseline Studies: Socio-Economic

TABLE 3.29: LIST OF PARKS & GARDENS

Sr. No.	Parks and Gardens	Locations	Approx. Distance (m) from the alignment
1	Chhatrapati Rajaram Maharaj Udyan	Jogeshwari East	30
2	Swatantryaveer Vinayak Damodar Savarkar Park	Goregaon East	100
3	Ambdekar Talav Udyan	Goregaon East	100
4	Shahid Vijay Salaskar Udyan	Malad East	88
5	Thakur Memorial Park	kandivali East	64
6	Ambdekar Park	kandivali East	320
7	Ful Pavalku Udyan	Borivali East	221
8	Sanjay Gandhi National Park	Borivali East	100
9	Ratan Nagar Garden	Borivali East	150
10	Green View Garden	Borivali East	185
11	Aaji Aajoba Udyan	Dahisar East	367

TABLE 3.30(a): LIST OF HIGH RISE

Highrise buildings				
Name of the Building	Height of the building (m)	Area	Distance from Alignment (m)	Type
Omkar Alta Monte Tower A	251	Malad East	179	Residential
Lodha Fiorenza I	222	Near Hub Mall	107	Residential
Orchid Woods	190	Goregaon	560	Residential
Vasani Grandeur	172	Borivali	220	Residential
Obero Excusite	170	Goregaon	460	Residential
Obero Commrez	144	Goregaon	150	Commercial

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Prepared by Fine Envirotech Engineers

EIA report of proposed Andher (E) -Dahisar (E) Corridor of Mumbai Metro Project by MMRDA

TABLE 3.30(b): LIST OF DILAPIDATED BUILDINGS

Name of the Building	Area	Distance from Alignment (m)	Type
Vimla Bhavan	Andheri East	870	Residential
Narmada Niwas	Jogeshwari East	440	Residential
Bhagvat Ashish CHSL	Jogeshwari East	400	Residential
Stulochana Niwas	Jogeshwari East	460	Residential
Karin Manjil	Jogeshwari East	450	Residential
Dipti CHSL	Goregaon East	600	Residential
Sukh Sadan	Goregaon East	800	Residential

TABLE 3.26: LIST OF EDUCATIONAL INSTITUTIONS ALONG ALIGNMENT

Sr. No.	Educational Institutions	Locations	Approx. Distance (m) from alignment
EI -1	Tridha steiner school	Andheri East	279
EI -2	New Municipal school	Jogeshwari East	290
EI -3	Infant jesus high school	Jogeshwari East	83
EI -4	Ismail Yusuf College	Jogeshwari East	110
EI -5	St Mary High School	Jogeshwari East	138
EI -6	Shri Samartha Vidyalaya	Goregaon East	173
EI -7	Pahadi Municipal School	Goregaon East	279
EI -8	St. Pius X College	Goregaon East	260
EI -9	Vibgyor High School	Malad East	233
EI -10	Lilliput Nursery	Malad East	165
EI -11	St. Joseph High School	Malad East	250
EI -12	St. George High School	Malad East	290
EI -13	Municipal School	Malad East	290
EI -14	Uttkarsh Vidya Mandir	Malad East	178
EI -15	St. Joseph's High School	Malad East	130
EI -16	Sharda Gyanpeeth International School	Malad East	275
EI -17	Chilren's Academy School	Kandivali East	200
EI -18	Shri Raghuvir Madhyamik Vidyalaya	Kandivali East	220
EI -19	Thakur School & Jr. College	Kandivali East	370
EI -20	Chilren's Academy School	Kandivali East	150
EI -21	Nirmala Memorial College	Kandivali East	235
EI -22	St John's High School	Borivali East	196
EI -23	Municipal School Dattapada	Borivali East	360
EI -24	Xavier Child Development Center	Borivali East	102
EI -25	Seth DM High School	Borivali East	90
EI -26	Universal School	Borivali East	313
EI -27	Shalendrs High School	Dahisar East	97
EI -28	Poorna Prajna High School	Dahisar East	400
EI -29	Sardar Vallabhbhai Patel Vidyalaya	Dahisar East	73
EI -30	Vishwakarma High School	Dahisar East	293
EI -31	Navyivan Vikas Mandal School	Andheri East	200

TABLE 3.27: LIST OF HEALTH CARE FACILITIES ALONG ALIGNMENT

Sr. No.	Health and Care	Locations	Approx. Distance (m) from alignment
HC-1	Shalyak hospital	Jogeshwari East	53
HC-2	Rane hospital	Jogeshwari East	172
HC-3	Balesheb Thackrey Trauma Care Municipal Hospital	Jogeshwari East	50
HC-4	Riddhi vinayak critical care centre	Malad East	291
HC-5	Ashu hospital	Malad East	290
HC-6	Datar Nursing Home	Malad East	330
HC-7	Shradh hospital	Malad East	240
HC-8	Sancheti hospital	Kandivali East	210
HC-9	Alap hospital	Kandivali East	135
HC-10	Arogya Maternity Nursing Home	Kandivali East	550
HC-11	Gokul hospital	Kandivali East	313
HC-12	Vansh hospital	Kandivali East	420
HC-13	Adit hospital	Kandivali East	380
HC-14	Sanjeevani Hospital	Borivali East	140
HC-15	Sanjeevani hospital	Borivali East	196
HC-16	Narendra hospital	Borivali East	35
HC-17	Pramar hospital	Borivali East	132
HC-18	National hospital	Borivali East	160
HC-19	Mohit hospital	Borivali East	150
HC-20	Purnima hospital	Borivali East	260
HC-21	Vasan eye care hospital	Borivali East	70
HC-22	Siddhi hospital	Borivali East	84
HC-23	Mauli Nursing Home	Borivali East	93
HC-24	Shantivan Hospital	Borivali East	125
HC-25	Ashok hospital	Dahisar East	180
HC-26	Elite hospital	Dahisar East	182

Table 3.28: LIST OF PLACES OF WORSHIP ALONG ALIGNMENT

Sr. No.	Religious Places	Locations	Approx. Distance (m) from alignment
R-1	Jai Hanuman Sai Mandir	Andheri East	50
R-2	Omkarshwar Charitable Trust	Andheri East	90
R-3	Shree Ram Mandir & Dharmashala	Jogeshwari East	100
R-4	I.Y. Mosque	Jogeshwari East	214
R-5	Aman Masjid	Jogeshwari East	187
R-6	Masjid Madrasa Nurool	Goregaon East	114
R-7	Shiva Dham Shamshan Bhoomi	Goregaon East	150
R-8	Budha Vihar	Goregaon East	110
R-9	Ashok Nagar Mandir	Malad East	50
R-10	Rehmaniya Mosque	Malad East	190
R-11	Sai Dham Mandir	Kandivali East	30
R-12	Shree Gajanjan Mahara Mandir	Borivali East	336
R-13	Omkarsh Temple	Borivali East	73
R-14	Mahakali Mandir	Borivali East	100
R-15	Ahle Sunnat Valjamal Masjid	Dahisar East	16
R-16	Ismati Dahisar Jamatkhana	Dahisar East	220
R-17	Madarsa Talmul Quran	Dahisar East	277
R-18	Gaondevi Mandir	Dahisar East	100

# Major Impact Categories

- Impacts Due To Project Location
  - Change of Land use
  - Loss of trees/forest
  - Utility/Drainage Problems
  - Impact on Historical and Cultural Monuments
  - Risk Due to Earthquake:
- Impacts Due To Project Design
  - Platform inlets and outlets
  - Ventilation and lighting
- Impacts Due To Project Construction
  - Road traffic diversions
  - Land excavation
  - Water demand for human use
  - C&D waste such as concrete, stones and dirt
  - Noise pollution
  - Hazardous waste management
  - Construction costs
  - Vehicle operating costs
  - Air pollution
  - Employment opportunities

# Major Impact Categories

- Impacts Due To Project Operation
  - Noise pollution
  - Water demand
  - Solid waste management
  - Change in aesthetics of surroundings
  - Maintenance costs
  - Vehicle operating costs
  - Air pollution
  - Travel time of commuters
  - Quality of life of commuters
  - Employment opportunities
  - Traffic congestion
  - Net fuel consumption
  - Community welfare
- Impacts due to depot
  - Water supply
  - Oil Pollution Control
  - Sewage/Effluent Pollution Control
  - Surface Drainage
  - Green belt development
  - Rain water harvesting
  - Maintenance costs
  - Vehicle operating costs
  - Air pollution

# Impact Assessment

# Impact Assessment by Matrix Method

- From the Matrix we can see that there are going to positive as well as negative impacts due to the project.
- The project is envisaged to have some positive impacts with reference to population growth and employment.
- The scale of these impacts for the said project is as N3<P<N2<N1 which indicates that the project will have a moderate effect on the surrounding environment.

TABLE 4.10: MATRIX PROCEDURE FOR IMPACT ASSESSMENT AND QUANTIFICATION										
Public interest	Impact Categories									
	Positive effect : P		Negative effect :		Public Health		Ecology		Water Bodies	
	N1 Nil to Negligible	N2 Moderate	N1 Nil to Negligible	N2 Moderate	N1 Nil to Negligible	N2 Moderate	N1 Nil to Negligible	N2 Moderate	N1 Nil to Negligible	N2 Moderate
	N3 Major	P	N3 Major	P	N3 Major	P	N3 Major	P	N3 Major	P
	PROJECT ACTIVITIES DURING CONSTRUCTION:									
	Construction activities at Site	N3	N2	N1	N1	N1	N1	N1	N2	P
	Rearrangement of Land use	N3	N2	N1	N1	N1	N1	N1	N1	--
	Open-site for construction material	N2	N1	N1	N1	N1	N1	N1	N1	--
	Transport of construction material	N2	N2	N1	N1	N1	N1	N1	N1	P
	DURING OPERATION (Direct/ Indirect)									
Maintenance	N2	N1	N1	N1	N1	N1	N1	N1	N1	P
Spills	N1	N1	N1	N1	N1	--	--	N1	--	--
WASTES DURING CONSTRUCTION										
Air	N2	N2	N1	N1	N1	N1	N1	N2	--	P
Water	N1	N1	N2	N1	N1	N1	N1	N2	--	--
Solid Waste	N1	N1	N2	N1	N1	N1	N1	N2	--	--
Noise	N2	N1	N2	N1	N1	N1	N1	N2	--	--
RELATED DEVELOPMENTS										
Population growth	--	N1	N1	--	--	P	P	N1	--	--
Employment	P	P	--	--	N1	P	--	--	--	--
Industrial development (Ancillary)	--	--	--	--	--	--	--	--	--	--
Trade /commerce	--	--	--	--	--	--	--	--	--	--

# Mitigation Measures

- **Compensatory Afforestation:** Three saplings are to be planted for felling a single tree. Plantation program will be finalized in consultation with Forest Department and project proponent would provide the funds for compensatory afforestation as per government policy.
- **Construction Material Management - Storage and Procurement:** The material will be loaded and unloaded by engaging labour at both the locations by the contractor. The duties of the contractor will include monitoring all aspects of construction activities, commencing with the storing, loading of construction materials and equipment in order to maintain the quality. During the construction period, the construction material storage site is to be regularly inspected for the presence of uncontrolled construction waste.
- **Labour Camp:** The Contractor during the progress of work will provide, erect and maintain the necessary (temporary) living accommodation and ancillary facilities for labour to standards and scales approved by the MMRDA. Construction camps are the responsibility of the concerned contractors and these shall not be allowed in the construction areas but sited away. Adequate health care is to be provided for the workforce.
- **Energy Management:** The contractor shall use and maintain equipment so as to conserve energy and shall be able to produce demonstrable evidence of the same upon MMRDA request.

# Mitigation Measures

- **Hazardous Waste Management:** Hazardous Waste needs to be stored in a secure place. It shall be the responsibility of the contractor to ensure that hazardous wastes are stored, based on the composition, in a manner suitable for handling, storage and transport. The contractor shall approach only Authorized Recyclers for disposal of Hazardous Waste, under intimation to the MMRDA.
- **Environmental Sanitation:** Environmental sanitation is the act of keeping the working environment cleared of all unnecessary waste, thereby providing a first-line of defense against accidents and injuries. Contractor shall understand and accept that improper environmental sanitation is the primary hazard in any construction site and ensure that a high degree of environmental sanitation is always maintained.
- **Utility Plan:** A number of sub-surface, surface and overhead utility services, viz. sewers, water mains, storm water drains, telephone cables, electrical transmission lines, electric poles, traffic signals etc. already exist along the proposed alignment. These utility services are essential and have to be maintained in working order during different stages of construction by temporary / permanent diversions or by supporting in position.
- **Air Pollution Control Measures:** Certain mitigation measures shall be adopted to reduce the air pollution (not highlighted here).

# Mitigation Measures

- **Noise Control Measures:** During construction the exposure of workers to high noise levels especially near the machinery need to be minimized.
- **Management of Construction & Demolition waste:** An effort shall be made to recover embedded energy and to recycle the maximum quantity of C & D Waste to manufacture tiles, curb stones, paver block etc. The contractor shall store C&D waste separately at the site and sent to recycling facility periodically. There shall be no disposal of any waste along storm water drains, canals and/ or any other water body or depression. Rather C & D waste shall be collected and sent to any authorized waste recycling facility.
- **Traffic Diversion/Management:** In order to retain satisfactory levels of traffic flow during the construction period; traffic management and engineering measures need to be taken. They can be road widening exercises, traffic segregation, one-way movements, traffic diversions on influence area roads, acquisition of service lanes, etc. Maintenance of diverted roads in good working condition to avoid slow down and congestion shall be a prerequisite during construction period.
- **Soil Erosion Control**

# Mitigation Measures

- **Water Supply, Sanitation and Solid Waste Management:** Water should be treated before use up to national drinking water standards. The sewerage disposal systems should be adopted for sewage disposal. The water for domestic consumption shall be sourced from public water supply or alternatively designated borewells may be installed with due permission from statutory authority prior to installation of borewell. Solid waste shall be stacked at designated place and when sufficient quantity accumulates it shall be disposed off through covered trucks to landfill site designated and authorized by MMRDA.
- **Rain water harvesting:** The stations shall be provided with the facility of rainwater harvesting and artificial recharge.
- **Tree Protection:** An attempt would be made to minimize the felling of trees to the bare minimum while working and undertaking construction work. The left out trees shall be protected by providing metal or brick tree guard around the tree at a distance of one metre surrounding the tree

# Public Participation

- Public consultations with the people of different sections of the society along the project alignment, shopkeepers, and influential persons of the project area will be made. Attention shall be given to potential vulnerable people like, squatters, encroachers, schedule caste, and other backward section (OBC) of society shall be consulted to make them aware and identify adverse impacts of the project.
- The first consultation was conducted by MMRDA on 12th May 2016 mostly involving local communities and organizations. The response to the project development was based on existing Metro running along Versova to Ghatkopar. The major issue discussed during the consultation was congestion of vehicular traffic and parking due to project construction activities and operation. Disturbance to the people residing near stations and alignment were also discussed. Maintenance of the Metro stations and alignment as a part of environment management plan was also discussed. It was assured to the public present that all the points discussed will be taken care of while implementation of project and environment management plan will be implemented.
- As per Indian Environmental Regulations, public hearing is not required, as railway projects do not attract EIA Notification 2006, amended 2009.

# Grievance Redressal

**Table 7.1: Grievances on Environmental and Construction Issues**

<b>Sr. No.</b>	<b>Stage of Project</b>	<b>Nature of Likely Grievances</b>	<b>Redressal Mechanism</b>
1	Pre-construction (Planning)	Need for Metro, elevated nature of project and alignment, station locations, traffic concerns, cutting of trees	To be addressed as a part of Public Consultations
2	During Construction	Noise and air pollution, vibrations, traffic diversions, disturbances to utilities, access to road, security of properties, water logging during monsoon, loss of income	To be addressed by Grievance Redressal Committee
3	Post – Construction (Operations)	Noise and air pollution, vibrations	To be addressed by Grievance Redressal Committee for certain specified period (say one year) post commencement of operations.

# Environmental Monitoring Plan

**TABLE 8.4: ENVIRONMENTAL MONITORING PLAN**

			Monitoring				Institutional responsibility	
			Standard	Location (Chainage)	Frequency	Duration	Implementation	Supervision
Air	Construction Stage	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO, Pb	Air (Prevention and Control of Pollution) Rules, CPCB, 1994	All locations where baseline monitoring has been carried out.	During entire civil construction stage	24 hours Twice a month	Contractor	MMRDA
	Operation Stage	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO, Pb	Air (Prevention and Control of Pollution) Rules, CPCB, 1994	All locations where baseline monitoring has been carried out.	Twice a week for 2 weeks in each location in every season (except monsoons)	24 hours Twice a month	BOT Operator	MMRDA
Noise	Construction Stage	Noise levels on dB (A) scale	Noise Standard by CPCB	All locations where baseline monitoring has been carried out.	During entire civil construction stage or even later	24 hours Once a week	Contractor	MMRDA
	Operation Stage	Noise levels on dB (A) scale	Noise Standard by CPCB	All locations where baseline monitoring has been carried out.	Reading to be taken in one location once in a season.	Continuous 24 hours	BOT Operator	MMRDA
Soil	Construction Stage	Monitoring of Pb, oil and grease	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	At an accident/spill location involving	Once in a season for 3 seasons	-	Contractor	MMRDA, through an approved monitoring agency

# Environmental Monitoring Plan

	Operation Stage	Monitoring of Pb, oil and grease	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	At an accident/spill location involving bulk transport carrying hazardous material 50 m from road centre line	Once in a season for 3 seasons (except monsoons)	-	-	MMRDA, through an approved monitoring agency
Water	Construction Stage	Surface, Groundwater quality (IS 10500:1991)	Water standards by CPCB	All locations where baseline monitoring has been carried out.	During entire civil construction stage or even later	Once month	a Contractor	MMRDA
	Operation Stage	Surface, Groundwater quality (IS 10500:1991)	Water standards by CPCB	All locations where baseline monitoring has been carried out.	During entire civil construction stage or even later	Once month	a BOT Operator	MMRDA
Green Belt	Construction Stage	Monitoring of existing trees along alignment.	-	All along the corridor	During the construction phase	-	Contractor in consultation with Forest Department	BOT Operator MMRDA
	Operation Stage	Maintenance of plantation (Greenbelt)	-	Road side plantation	Every year for 3 years	-	BOT Operator	MMRDA

# Limitations of the EIA



# HOW CAN THE FOX GUARD THE CHICKEN COOP?



EIA consultant is hired by the project proponent for preparing the EIA report. The lack of government or independent assessment authority ensures this conflict of interest is legalised.

#WithdrawEIA2020

# Limitations...

- The overall EIA didn't seem as organised or elaborate as other as some others studied in the course. The seriousness of drafting the EIA is questionable as EIA consultant is proposed by the proponent itself.
- Trees at Dahisar depot have been conveniently ignored in the EIA.
- Follow through on the rehabilitation and resettlement of the displaced population is questionable after the project work has started. No counter measures are discussed within the EIA.
- Impact categories majorly lacking to take into account discharges to sea (despite Mumbai being a coastal city), health impacts, perceptions of natives, etc.
- Choice of impact categories seemed biased or neutral at best.
- EC is granted despite the cumulative quantitative negatives from the matrix method impact assessment.
- No screening step was highlighted in the EIA report EIA 2006 notification)
- Extensions from Bhayander to Mira road and Andheri to Domestic Airport are approved after the EC was granted
- Project development plan was very qualitative. No quantities or durations given.

# ...and some positives

- Baseline data sources were well documented and reliable
- Baseline data was comprehensively gathered for all major impact categories
- Analysis of more positives is ongoing...

# Scope for further analysis...



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## Identifying Positive & Negative Impacts of Mumbai Metro Line

### IV by Leopold Matrix

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#### ABSTRACT

The Environmental Impact assessment of any Infrastructure work is carried out for determining the Environment and Socio-Economic impacts prior to the commencement of construction. This thesis work assesses the Environmental impacts for the upcoming Metro Line 4(Wadala-Ghatkopar-Teen Hath Naka (Thane)-Kasarwadavli). The study mainly aims at quantifying the maximum positive and negative impacts on the Environment during and after the construction. For achieving public participation and ensuring transparency, a survey of the professionals, students, and local people from the surrounding area of work location having the background in the field of Environment was conducted. The answers to the survey questionnaire are tabulated with regards to maximum and minimum impacts and interpreted using the concept of 'Leopold's Matrix'. Based on the result from the 'Leopold's Matrix' critical impacts are decided & study with respect to those factors will be done in the future aspect of the work.

**Keywords:** Environmental Impact assessment, MoEF, Metro Line 4, Leopold's Matrix.

# Motivation for choosing topic



# References

- [Mumbai Metro Title Photograph](#)
- [Aamchi Mumbai Poster](#)
- [Mumbai Map](#)
- [Mumbai Images](#)
- [Metro Images](#)
- [EIA Report](#)
- [Comparative Study](#)

# Thank You!

