11. ECONOMIC AND FINANCIAL ANALYSIS

11.1 Financial Analysis

11.1.1 Purpose and Methodology

This section examines whether the project is financially feasible. As this project is formed as a toll road project, at least the financial requirements for operation and maintenance should be satisfied, mainly the financial feasibility of the following aspects are analysed.

- The soundness and profitability of the project cash flow will be verified by the project IRR. An analysis will be conducted in order to examine to what extent the project cash flow can cover OPEX, as well as CAPEX.

  For evaluating financial feasibility, the NHAI's "Guideline for Investment in Road Sector" will be referred to. It states that (although the project is not PPP any more) for the case of the BOT Toll Model, which is exposed to traffic demand risk, the expected Project IRR should meet 14-16%.

- A DSCR analysis will be conducted in order to determine whether the project cash flow will withstand the repayment of Yen loans provided by JICA. In each year of the loan term, the cash flow will be checked to determine whether it is sufficient for the repayment of principle and interest of the loan.

  In terms of the DSCR threshold, in general, 1.0 or higher indicates that the project has a sufficient cash flow to repay the debt services (in contrast, a DSCR less than 1.0 indicates that the project cannot replay the full amount of the debt service).

11.1.2 Assumptions for financial analysis

(1) General Assumptions and Conditions

1) Project scheme

MMRDA is responsible for the physical construction and its finance, and a concessionaire will implement operation and maintenance. MMRDA takes the ridership risk and collects fares during the whole project period to recover O&M cost.

2) Project period

The project period shall be 35 years (construction for 7 years, operation for 28 years) in consideration with the repayment period of the Yen loan Tranche 1 and Tranche 2.

- Yen loan Tranche 1: the repayment period 30 years from 2015 to 2044
- Yen loan Tranche 2: the repayment period 30 years from 2020 to 2049

3) Project schedule]

Period of construction is from 2015 to 2021. Commercial Operation Day is in 2022 and the end of project period is 2049.

4) Terms of Yen loan

It is assumed an Interest rate of 1.4%, with a grace period of 10 years, and a repayment period of 30 years. The loan is provided for two phases, Tranche 1 and Tranche 2. Interest during construction is born by MMRDA, and the Yen loan doesn't additionally provide with this.

5) Inflation rate

The inflation rate is assumed at 5%. This is estimated based on the IMF World Economic Outlook (WEO), April 2015 and others.

(2) Assumption for Cash inflow

1) Traffic volume

Traffic volume (vehicle volume, traffic growth ratio, etc.) in Chapter 4 is used for this financial analysis.

2) Toll rates

Toll rates are assumed as the following three cases.

- Case 1：It is 50% less than Case 2
- Case 2：As a base case, it is set based on the "willingness to pay survey in 2011", and it is escalated up to 2022 as the year of commercial operation day.
- Case 3：It is 50% more than Case 2

Table 11.1.1 Toll rate setting in each case

Mode	Case 1		Case 2		Case 3	
	Chirle IC - Shivaji Nagar IC	Shivaji Nagar IC - Sewri IC	Chirle IC - Shivaji Nagar IC	Shivaji Nagar IC - Sewri IC	Chirle IC - Shivaji Nagar IC	Shivaji Nagar IC - Sewri IC
	5 km	16.5 km	5 km	16.5 km	5 km	16.5 km
Car	30	90.00	55	180.00	80	270.00
Bus	60	210.00	130	420.00	190	630.00
LCV	40	120.00	70	240.00	110	360.00
HCV	60	210.00	130	420.00	190	630.00
MAV	90	300.00	180	600.00	270	900.00

Source: JICA Study Team

Revision of toll rates is done annually by applying the following formula according to the National Highways Fee (Determination of rates and collection) rules, 2008.

$$\text{Applicable rate of fee} = \text{base rate} + \text{base rate} \times \left\{\frac{\text{WPI A} - \text{WPI B}}{\text{WPI B}}\right\} \times 0.30$$

(3) Assumption for Cash outflow

1) Initial Investment cost

The total project cost, which consists of the initial investment costs (road construction costs, fee collection system and control systems, vehicles and consulting fees, price escalation, physical contingency, interest during construction, land acquisition and compensation, and tax), is used as the 2015 cost. Total investment cost is assumed at INR 180,707 million .

Table 11.1.2 Initial Investment Cost

Breakdown of Cost	Total (million INR)		
	JICA Portion (INR)	Others (INR)	Total (INR)
Package-1	66,038	0	66,038
Package-2	49,061	0	49,061
Package-3	13,074	0	13,074
Package-4	1,444	0	1,444
Package-5	0	196	196
Dispute Boads for Pkg-1/2/3/4	183	0	183
Price Escalation	5,368	0	5,368
Physical Contingency	13,517	20	13,537
Consulting Services	4,568	0	4,568
Land Acquisition	0	10,060	10,060
Administration Cost	0	4,906	4,906
VAT	0	9,208	9,208
Import Tax	0	586	586
Interest during Construction	0	2,171	2,171
Front End Fee	0	307	307
Total	153,253	27,454	180,707

Source: JICA Study Team

2) Allocation of Construction Works

The phasing for construction works (excluding land acquisition cost) is shown in the following table.

Table 11.1.3 Phasing of construction works

	Total	JICA Portion		GOI Portion
		Tranche-I	Tranche-II	
2015	3,917	0		3,917
2016	7,523	497		7,025
2017	31,461	28,684		2,777
2018	32,098	29,191		2,907
2019	32,460	29,442		3,018
2020	34,147		30,904	3,244
2021	33,821		30,518	3,303
2022	924		444	480
2023	4,329		3,548	781
2024	25		23	2
Total	180,707	87,815	65,438	27,454

Source: JICA Study Team

3) Operation & maintenance expense, and large scale rehabilitation

OPEX is divided into routine maintenance cost and large scale rehabilitation cost. The details are shown in the following table.

Table 11.1.4 Operation and Maintenance Cost

Unit: million INR

Year	MMRDA	Project Management Consultant	Inspection & Maintenance	Toll Management	Traffic Management	Others (Electricity)	Routin O/M Total	Pavement	Road marking	Touch-up painting	Repainting	Expansion device	Bearing	Bridge inspection passage	Noise barrier	Traffic Management system	Toll Management system	Periodic Maintenance	O/M Total
1	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
2	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
3	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
4	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
5	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
6	16	15	95	101	40	10	276	0	8	0	0	0	0	0	0	0	0	8	285
7	16	15	95	101	40	10	276	0	8	0	0	0	0	0	0	0	0	8	285
8	16	15	95	101	40	10	276	0	8	0	0	0	0	0	0	0	0	8	285
9	16	15	95	101	40	10	276	0	8	0	0	0	0	0	0	0	0	8	285
10	16	15	95	101	40	10	276	0	8	0	0	0	0	0	0	448	200	657	933
11	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
12	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
13	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
14	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
15	16	15	95	101	40	10	276	0	0	0	0	0	0	0	0	0	0	0	276
16	16	15	95	101	40	10	276	85	8	12	0	0	0	0	0	0	0	106	382
17	16	15	95	101	40	10	276	85	8	12	0	0	0	0	0	0	0	106	382
18	16	15	95	101	40	10	276	85	8	12	0	0	0	0	0	0	0	106	382
19	16	15	95	101	40	10	276	85	8	12	0	0	0	0	0	0	0	106	382
20	16	15	95	101	40	10	276	85	8	12	0	0	0	0	128	448	200	883	1159
21	16	15	95	101	40	10	276	0	0	12	0	33	0	24	0	0	0	69	345
22	16	15	95	101	40	10	276	0	0	12	0	33	0	24	0	0	0	69	345
23	16	15	95	101	40	10	276	0	0	12	0	33	0	24	0	0	0	69	345
24	16	15	95	101	40	10	276	0	0	12	0	33	0	24	0	0	0	69	345
25	16	15	95	101	40	10	276	0	0	12	0	33	0	24	0	0	0	69	345
26	16	15	95	101	40	10	276	0	8	0	30	0	0	0	0	0	0	39	315
27	16	15	95	101	40	10	276	0	8	0	30	0	0	0	0	0	0	39	315
28	16	15	95	101	40	10	276	0	8	0	30	0	0	0	0	0	0	39	315

Source: JICA Study Team

(4) Tax

Import tax and VAT that are imposed on the construction are included in the initial investment cost. Income tax and service tax is not taken into account in the financial analysis since MMRDA is exempted from such taxes because MMRDA is deemed to be the local official authority.

11.1.3 The result of the financial analysis

(1) Financial results

The table below shows the result of the financial analysis for Case 1. While revenues from the toll during the 28 year operation period can cover OPEX in the same period, cost recovery for the total investment cost including CAPEX cannot be realised. Project IRR is at the low rate of minus 1.13%. Average DSCR is 0.96, but minimum DSCR is 0.34. Repayment for the yen loan cannot be made in the 23 years of the whole project period.

Table 11.1.5 The result of financial analysis (Case 1)

	Amount (million INR)
Total Revenue	165,219
Total CAPEX	180,707
Total OPEX	21,801
Total Project Cost	202,508
Balance	-37,289

Project IRR	**-1.13%**
FIRR on MMRDA	N/A
DSCR	
Max DSCR	2.83
Average DSCR	0.96
Min DSCR	0.34

Source: JICA Study Team

The table below shows the result of the financial analysis for Case 2. Revenues from toll during the 28 year operation period can cover OPEX, as well as CAPEX. Project IRR is still low at 1.77%. Average DSCR is 1.73, but minimum DSCR is 0.51. Repayment for the yen loan cannot be made in the 10 years of the whole project period.

Table 11.1.6 The result of financial analysis (Case 2)

	Amount (million INR)
Total Revenue	279,211
Total CAPEX	180,707
Total OPEX	21,801
Total Project Cost	202,508
Balance	76,702

Project IRR	**1.77%**
FIRR on MMRDA	2.41%
DSCR	
Max DSCR	5.56
Average DSCR	1.73
Min DSCR	0.51

Source: JICA Study Team

The table below shows the result of the financial analysis for Case 3. Like Case 2, revenues from toll during the 28 year operation period can cover OPEX, as well as CAPEX. Project IRR is still low at 3.36%. Average DSCR is 2.39, but minimum DSCR is 0.58. Repayment for the yen loan cannot be made in the initial 8 years of the whole project period.

Table 11.1.7 The result of financial analysis (Case 3)

	Amount (million INR)
Total Revenue	375,202
Total CAPEX	180,707
Total OPEX	21,801
Total Project Cost	202,508
Balance	172,694

Project IRR	**3.36%**
FIRR on MMRDA	6.29%
DSCR	
Max DSCR	8.18
Average DSCR	2.39
Min DSCR	0.58

Source: JICA Study Team

(2) Cash flow

The table below is a cash flow for Case 2 as the base case. In addition, this section provides the table which shows toll rate, traffic (per day) and revenue (per day) in each year.

Table 11.1.8 Cash Flow (Case 2)

Mumbai Trans Harbour Link (MTHL) Project - Cash flow

IDR in million

		Cash Outflow									Cash Inflow				
	Year	CAPEX	OPEX	Principal Repayment for Tranche I	Interest for Tranche I	IDC for Tranche I (paid by MMRDA)	Principal Repayment for Tranche II	Interest for Tranche II	IDC for Tranche II (paid by MMRDA)	Total Cash Outflow	Toll revenue	Principle Borrwoing from Tranche I	Principle Borrwoing from Tranche II	Total Cash Inflow	Net Cash Flow
1	2015	3917	0		0	0	0	0	0	3917	0	0		0	-3917
2	2016	7522	0		3	-3	0	0	0	7522	0	497		497	-7025
3	2017	31461	0		208	-208	0	0	0	31461	0	28684		28684	-2777
4	2018	32098	0		613	-613	0	0	0	32098	0	29191		29191	-2907
5	2019	32460	0		1023	-1023	0	0	0	32460	0	29442		29442	-3018
6	2020	34148	0	0	1229		0	216	-216	35377	0		30904	30904	-4473
7	2021	33821	0	0	1229		0	646	-646	35050	0		30518	30518	-4532
8	2022	924	276	0	1229		0	863	-863	2430	2579		444	3023	593
9	2023	4356	290	0	1229		0	891	-891	5875	2885		3573	6458	582
10	2024		305	0	1229		0	916		2450	3229			3229	779
11	2025		320	4391	1199		0	916		6825	3617			3617	-3209
12	2026		336	4391	1137		0	916		6780	4053			4053	-2727
13	2027		363	4391	1076		0	916		6746	4545			4545	-2201
14	2028		382	4391	1014		0	916		6703	5100			5100	-1603
15	2029		401	4391	953		0	916		6660	5725			5725	-935
16	2030		421	4391	891		3272	893		9868	6431			6431	-3437
17	2031		1448	4391	830		3272	847		10788	7228			7228	-3560
18	2032		450	4391	768		3272	802		9683	8127			8127	-1556
19	2033		473	4391	707		3272	756		9598	8545			8545	-1053
20	2034		496	4391	645		3272	710		9514	8985			8985	-529
21	2035		521	4391	584		3272	664		9432	9450			9450	18
22	2036		547	4391	522		3272	618		9351	9941			9941	590
23	2037		795	4391	461		3272	573		9491	10458			10458	968
24	2038		834	4391	400		3272	527		9423	11005			11005	1582
25	2039		876	4391	338		3272	481		9358	11582			11582	2224
26	2040		920	4391	277		3272	435		9294	12191			12191	2897
27	2041		2928	4391	215		3272	389		11196	12834			12834	1639
28	2042		915	4391	154		3272	344		9075	13514			13514	4439
29	2043		961	4391	92		3272	298		9013	14233			14233	5219
30	2044		1009	4391	31		3272	252		8954	14992			14992	6037
31	2045		1059	0	0		3272	206		4537	15794			15794	11257
32	2046		1112	0	0		3272	160		4545	16643			16643	12098
33	2047		1067	0	0		3272	115		4453	17540			17540	13087
34	2048		1120	0	0		3272	69		4461	18490			18490	14029
35	2049		1176	0	0		3272	23		4471	19495			19495	15023
	Total	180707	21801	87814	20288	-1847	65439	17275	-2617	388860	279211	87814	65439	432464	43603

Assumptions

1 The project period is set for 35 years (construction for 7 years, operation for 28 years) in consideration with the repayment period of Yen loan Tranche 1 and Tranche 2.
Yen loan Tranche 1: the repayment period 30 years from 2015 to 2044
Yen loan Tranche 2: the repayment period 30 years from 2020 to 2049
It is assumed Interest rate 1.4%, grace period 10 years, and repayment period 30 years. The loan is provided for two phases, Tranche 1 and Tranche 2. Interest during construction
2 is born by MMRDA, and Yen loan don't additionally provide with this.
3 Inflation rate is assumed at 5%.
4 Toll rates is set based on "willingness to pay survey in 2011"
Revision of toll rates is annually made by applying the formula of the National Highways Fee (Determination of rates and collection) rules, 2008.
5 Import tax and VAT imposed for construction are included in initial investment cost.

Source: Study Team

Table 11.1.9 Toll rate, Traffic (per day), Revenue (per day) in each year

Toll rate

Chirle IC - Sewri IC

Years	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Car	180.00	182.57	185.18	187.83	190.51	193.23	195.99	198.79	201.63	204.51	207.43	210.40	213.40	216.45	219.54	222.68	225.86	229.09	232.36	235.68	239.04	242.46	245.92	249.44	253.00	256.61	260.28	264.00
Bus	420.00	426.00	432.09	438.26	444.52	450.87	457.31	463.84	470.47	477.19	484.01	490.92	497.94	505.05	512.26	519.58	527.00	534.53	542.17	549.91	557.77	565.74	573.82	582.02	590.33	598.77	607.32	616.00
LCV	240.00	243.43	246.91	250.43	254.01	257.64	261.32	265.05	268.84	272.68	276.58	280.53	284.53	288.60	292.72	296.90	301.15	305.45	309.81	314.24	318.73	323.28	327.90	332.58	337.33	342.15	347.04	352.00
HCV	420.00	426.00	432.09	438.26	444.52	450.87	457.31	463.84	470.47	477.19	484.01	490.92	497.94	505.05	512.26	519.58	527.00	534.53	542.17	549.91	557.77	565.74	573.82	582.02	590.33	598.77	607.32	616.00
MAV	600.00	608.57	617.27	626.08	635.03	644.10	653.30	662.63	672.10	681.70	691.44	701.32	711.34	721.50	731.81	742.26	752.86	763.62	774.53	785.59	796.81	808.20	819.74	831.45	843.33	855.38	867.60	879.99

Chirle IC - Shivaji Nagar IC

Years	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Car	55.00	55.79	56.58	57.39	58.21	59.04	59.89	60.74	61.61	62.49	63.38	64.29	65.21	66.14	67.08	68.04	69.01	70.00	71.00	72.01	73.04	74.08	75.14	76.22	77.31	78.41	79.53	80.67
Bus	130.00	131.86	133.74	135.65	137.59	139.55	141.55	143.57	145.62	147.70	149.81	151.95	154.12	156.32	158.56	160.82	163.12	165.45	167.81	170.21	172.64	175.11	177.61	180.15	182.72	185.33	187.98	190.67
LCV	70.00	71.00	72.01	73.04	74.09	75.14	76.22	77.31	78.41	79.53	80.67	81.82	82.99	84.17	85.38	86.60	87.83	89.09	90.36	91.65	92.96	94.29	95.64	97.00	98.39	99.79	101.22	102.67
HCV	130.00	131.86	133.74	135.65	137.59	139.55	141.55	143.57	145.62	147.70	149.81	151.95	154.12	156.32	158.56	160.82	163.12	165.45	167.81	170.21	172.64	175.11	177.61	180.15	182.72	185.33	187.98	190.67
MAV	180.00	182.57	185.18	187.83	190.51	193.23	195.99	198.79	201.63	204.51	207.43	210.40	213.40	216.45	219.54	222.68	225.86	229.09	232.36	235.68	239.04	242.46	245.92	249.44	253.00	256.61	260.28	264.00

Traffic (per day)

Chirle IC - Sewri IC

Years	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Car	26,772	29,885	33,360	37,239	41,569	46,403	51,798	57,821	64,545	72,050	80,428	83,306	86,287	89,375	92,573	95,886	99,317	102,871	106,552	110,365	114,314	118,405	122,642	127,030	131,576	136,284	141,161	146,212
Bus	881	912	945	978	1,013	1,049	1,086	1,124	1,164	1,205	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248
LCV	1,460	1,555	1,657	1,765	1,880	2,002	2,133	2,272	2,420	2,578	2,746	2,830	2,917	3,006	3,099	3,194	3,291	3,392	3,496	3,604	3,714	3,828	3,945	4,066	4,191	4,319	4,452	4,588
HCV	1,016	1,096	1,183	1,277	1,378	1,487	1,604	1,731	1,868	2,016	2,175	2,222	2,269	2,318	2,368	2,419	2,471	2,524	2,578	2,633	2,690	2,748	2,807	2,867	2,929	2,992	3,056	3,121
MAV	1,026	1,098	1,174	1,256	1,344	1,438	1,539	1,646	1,761	1,884	2,016	2,103	2,193	2,287	2,385	2,487	2,594	2,705	2,822	2,943	3,069	3,201	3,338	3,481	3,631	3,787	3,949	4,119

Chirle IC - Shivaji Nagar IC

Years	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Car	5,000	5,791	6,706	7,766	8,994	10,416	12,063	13,971	16,179	18,737	21,700	23,371	25,171	27,110	29,198	31,447	33,869	36,478	39,287	42,313	45,572	49,082	52,862	56,934	61,319	66,042	71,128	76,606
Bus	881	912	945	978	1,013	1,049	1,086	1,124	1,164	1,205	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248	1,248
LCV	460	490	521	554	590	628	668	711	757	805	857	886	915	946	978	1,010	1,044	1,079	1,115	1,152	1,191	1,231	1,272	1,315	1,359	1,404	1,451	1,500
HCV	349	371	395	421	448	477	507	540	575	612	651	660	669	678	687	697	706	716	726	736	746	756	767	777	788	799	810	821
MAV	90	98	106	115	125	136	148	161	175	190	206	219	232	247	262	278	296	314	333	354	376	399	424	450	478	508	539	573

Revenue (per day)

Chirle IC - Sewri IC

Years	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Car	4,818,960	5,456,150	6,177,592	6,994,428	7,919,270	8,966,400	10,151,987	11,494,339	13,014,184	14,734,992	16,683,335	17,527,194	18,413,736	19,345,120	20,323,615	21,351,603	22,431,587	23,566,198	24,758,199	26,010,493	27,326,128	28,708,310	30,160,404	31,685,946	33,288,651	34,972,423	36,741,361	38,599,775
Bus	370,020	388,606	408,125	428,625	450,155	472,766	496,513	521,452	547,644	575,152	604,042	612,671	621,423	630,301	639,305	648,438	657,701	667,097	676,627	686,293	696,097	706,042	716,128	726,358	736,735	747,260	757,935	768,763
LCV	350,400	378,581	409,029	441,926	477,468	515,869	557,358	602,185	650,616	702,942	759,477	793,943	829,973	867,637	907,011	948,172	991,201	1,036,182	1,083,204	1,132,361	1,183,748	1,237,467	1,293,624	1,352,330	1,413,699	1,477,854	1,544,920	1,615,029
Truck	426,720	467,046	511,183	559,492	612,365	670,235	733,574	802,899	878,775	961,822	1,052,717	1,090,690	1,130,032	1,170,794	1,213,026	1,256,781	1,302,115	1,349,084	1,397,747	1,448,165	1,500,402	1,554,524	1,610,597	1,668,694	1,728,885	1,791,248	1,855,861	1,922,804
MAV	615,600	668,026	724,916	786,652	853,645	926,343	1,005,232	1,090,840	1,183,738	1,284,548	1,393,943	1,474,537	1,559,792	1,649,976	1,745,375	1,846,289	1,953,037	2,065,958	2,185,407	2,311,763	2,445,425	2,586,814	2,736,379	2,894,591	3,061,950	3,238,986	3,426,257	3,624,357
Total	**6,581,700**	**7,358,409**	**8,230,846**	**9,211,122**	**10,312,902**	**11,551,613**	**12,944,664**	**14,511,715**	**16,274,958**	**18,259,457**	**20,493,513**	**21,499,035**	**22,554,956**	**23,663,829**	**24,828,332**	**26,051,283**	**27,335,641**	**28,684,519**	**30,101,185**	**31,589,075**	**33,151,801**	**34,793,157**	**36,517,132**	**38,327,918**	**40,229,921**	**42,227,771**	**44,326,334**	**46,530,727**

Chirle IC - Shivaji Nagar IC

Years	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Car	275,000	323,029	379,447	445,718	523,564	615,006	722,418	848,590	996,798	1,170,890	1,375,389	1,502,483	1,641,322	1,792,990	1,958,674	2,139,667	2,337,386	2,553,375	2,789,322	3,047,073	3,328,641	3,636,228	3,972,238	4,339,297	4,740,275	5,178,306	5,656,813	6,179,537
Bus	114,530	120,283	126,325	132,670	139,334	146,332	153,682	161,402	169,509	178,023	186,965	189,636	192,345	195,093	197,880	200,707	203,574	206,482	209,432	212,424	215,459	218,537	221,659	224,825	228,037	231,295	234,599	237,950
LCV	32,200	34,757	37,516	40,495	43,711	47,181	50,927	54,971	59,336	64,047	69,132	72,466	75,961	79,624	83,463	87,488	91,707	96,129	100,765	105,624	110,717	116,056	121,653	127,519	133,669	140,114	146,871	153,954
Truck	45,370	48,978	52,874	57,079	61,619	66,519	71,810	77,521	83,687	90,342	97,528	100,278	103,105	106,012	109,001	112,075	115,235	118,484	121,825	125,260	128,792	132,423	136,157	139,996	143,944	148,002	152,176	156,466
MAV	16,200	17,850	19,668	21,671	23,878	26,310	28,990	31,943	35,196	38,781	42,731	46,029	49,582	53,410	57,532	61,973	66,757	71,910	77,461	83,440	89,881	96,819	104,292	112,342	121,014	130,355	140,417	151,256
Total	**483,300**	**544,897**	**615,830**	**697,634**	**792,105**	**901,349**	**1,027,828**	**1,174,426**	**1,344,525**	**1,542,084**	**1,771,745**	**1,910,893**	**2,062,315**	**2,227,129**	**2,406,551**	**2,601,910**	**2,814,659**	**3,046,380**	**3,298,805**	**3,573,821**	**3,873,490**	**4,200,063**	**4,555,999**	**4,943,980**	**5,366,938**	**5,828,072**	**6,330,876**	**6,879,164**

Total (Case 2)	7,065,000	7,903,306	8,846,676	9,908,756	11,105,008	12,452,962	13,972,492	15,686,141	17,619,483	19,801,541	22,265,259	23,409,927	24,617,272	25,890,958	27,234,883	28,653,193	30,150,300	31,730,900	33,399,990	35,162,896	37,025,291	38,993,220	41,073,131	43,271,898	45,596,859	48,055,843	50,657,210	53,409,891

Source: Study Team

11.2 Economic Analysis

11.2.1 Purpose and methodology of economic analysis

(1) Methodology

Economic analysis aims to examine the effects of the project in terms of social and economic aspects, and evaluate the economic relevance of the project. Economic indicators such as the Economic Internal Rate of Return (EIRR), Net Present Value (NPV) and Cost Benefit Ratio (B/C ratio) are applied for the analysis.

Economic analysis in this study adopts one of the standard methods of cost benefit analysis, the discounted cash flow method. Cost benefit analysis is carried out by comparing economic benefit and economic cost.

(2) Basic Condition

In order to work out economic benefit, two cases are compared in this study: i.e. the “With Project” case and the “Without Project” case. Therefore, the economic benefit to be achieved by this project is defined as the difference in vehicle travel costs (e.g. VOC: vehicle operation costs and VOTT: travel time cost) between “With Project” and “Without Project” cases.

Calculation in the economic analysis in this study is carried out by a method of discounting economic benefit and project cost at its present value. The economic benefit in this study is determined by multiplying the balance between traffic demands in both “With Project” and “Without Project” cases by unit vehicle operation cost and travel time cost.

11.2.2 Project Costs

(1) Initial investment cost

In this economic analysis, the annual amount of investment is calculated based on the total amount of initial investment, 161,743 million INR (excluding price escalation and administration cost. Including the 5% physical contingency) in proportion to the phasing of the project. A 0.80 conversion rate is applied so that financial cost is converted into economic cost. The table below shows investment cost (financial cost and economic cost) and annual initial investment.

Table 11.2.1 Investment cost (financial cost and economic cost)

Financal cost

	Year	Investment	O & M,
1	2015	3628	
2	2016	6996	
3	2017	28,855	
4	2018	29,083	
5	2019	29,029	
6	2020	30,141	
7	2021	29,468	
1	2022	820	276
2	2023	3,723	276
3	2024		276
4	2025		276
5	2026		276
6	2027		285
7	2028		285
8	2029		285
9	2030		285
10	2031		933
11	2032		276
12	2033		276
13	2034		276
14	2035		276
15	2036		276
16	2037		373
17	2038		373
18	2039		373
19	2040		373
20	2041		1,149
21	2042		335
22	2043		335
23	2044		335
24	2045		335
25	2046		335

Economic cost

Conversion factor 0.8

	Year	Investment	O & M,
1	2015	2,902	
2	2016	5,597	
3	2017	23,084	0
4	2018	23,266	0
5	2019	23,223	0
6	2020	24,113	0
7	2021	23,574	0
1	2022	656	221
2	2023	2,978	221
3	2024	0	221
4	2025	0	221
5	2026	0	221
6	2027	0	228
7	2028	0	228
8	2029	0	228
9	2030	0	228
10	2031	0	746
11	2032	0	221
12	2033	0	221
13	2034	0	221
14	2035	0	221
15	2036	0	221
16	2037	0	298
17	2038	0	298
18	2039	0	298
19	2040	0	298
20	2041	0	919
21	2042	0	268
22	2043	0	268
23	2044	0	268
24	2045	0	268
25	2046	0	268

Source: JICA Study Team

(2) O&M cost and Rehabilitation cost

OPEX is divided into routine maintenance cost and large scale rehabilitation cost. The details are shown in the table in the above section on the financial analysis.

11.2.3 Benefit calculation

Benefit to be expected through implementation of the project is as follows:

- Reduction in vehicle operation cost (VOC)
- Reduction in travel time cost (TTC)
- Abatement of emissions by mitigating traffic congestion

In this economic analysis, among the above mentioned benefits, (i) the benefit to reduce Vehicle Operation Cost (VOC) and (ii) benefit to reduce Travel Time Cost (TTC) are treated as quantitative benefits.

Since traffic on MTHL to be constructed under this project is classified by 7 vehicle types, i.e. Motor Cycle, Car, Auto Rickshaw, Taxi, Bus, LCV and HCV in calculating the traffic demand

forecasts, this economic analysis also adopts such classifications. Unit value of vehicle operation cost and unit value of travel time cost on the CTS report of MMRDA (2008) are converted to 2022 prices by adjusting for inflation. As for unit value of travel time cost, unit value is annually increased by 7.29% from the commercial operational year based on real GDSP growth of 7.97% in Maharashtra which has an adjusted population growth of 0.68%.

GDSP forecast in Maharashtra

The GDSP forecast for Maharashtra is calculated by; the average ratio in the past 9 years between actual GDSP in Maharashtra and the GDP for the whole of India multiplied by the forecast for GDP in 2019 in India. As a result, the GDSP forecast for Maharashtra is 7.97%.

Table 11.2.2 GDSP Forecast for Maharashtra

		Actual (source: The Ministry of Statistics and Programme Implementation)										Forecast (source: IMF Article IV)					Source
		2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013	2014	2015	2016	2017	2018	2019	
(a)	Maharashtra	13.35	13.53	11.26	2.58	9.3	11.26	4.52	7.78	7.28	5.66	N/A	N/A	N/A	N/A	**7.97**	The Ministry of Statistics and Programme Implementation
(b)	(b)=(a)/(c)	1.40823	1.41379	1.20815	0.38393	1.08265	1.26375	0.67564	1.74049	1.53586						1.19028	
(c)	India	9.48	9.57	9.32	6.72	8.59	8.91	6.69	4.47	4.74	N/A	N/A	N/A	N/A	N/A	N/A	The Ministry of Statistics and Programme Implementation
																	http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=82
	India	8.2							4.7	5	5.8	6.3	6.5	6.6	6.7	6.7	IMF Article IV
																	https://www.imf.org/external/pubs/ft/scr/2015/cr1561.pdf

Source: For the actual ratio, refer to The Ministry of Statistics and Programme Implementation, forecast. Refer to IMF Article IV.

Forecast of population growth in Maharashtra

Forecast of population growth in Maharashtra is calculated by; the actual population growth rate in Maharashtra multiplied by the population growth forecast for the whole of India. As a result, the average of annual population growth in Maharashtra from 2020 to 2045 is 0.68%.

Table 11.2.3 Forecast of Population Growth in Maharashtra

	Average annual rate of population change (percentage)									
	Actual			Forecast (Medium Variant)						
	Source: Ministr of Home Affair, Office of the register general & cescus commissioner India http://censusindia.gov.in/2011-prov-results/data_files/india/Final_PPT_2011_chapter3.pdf			Source: United Nations, Population Division, Department of Economic and Social Affairs http://esa.un.org/unpd/wpp/DVD/						
country or area	1981-1991	1991-2001	2001-2011	2010-2015	2015-2020	2020-2025	2025-2030	2030-2035	2035-2040	2040-2045
India		1.97	1.64	1.26	1.15	1.02	0.88	0.74	0.60	0.48
percentage of the previous decade			83%	77%	92%	89%	87%	84%	81%	80%
Avarage percentage from 2020 to 2045										0.75
Maharashtra		2.07	1.49	1.14	1.05	0.93	0.80	0.67	0.55	0.44
percentage of the previous decade			72%	77%	92%	89%	87%	84%	81%	80%
Avarage percentage from 2020 to 2045										**0.68**

Source: Actual ratio refers to the Minister of Home Affairs, Office of the register general & census commissioner of India. The forecast refers to the United Nations, Population Division.

11.2.4 Cost-benefit analysis

A cost-benefit analysis was conducted on the basis of economic cost and the benefit that was estimated in the above sections. The results are shown in the table below. Project life is assumed as thirty two years (geological survey, bidding and construction period 7years + operation period 25 years)[36].

The table below shows the result of the financial analysis for Case 1. The EIRR is 13.70%, which exceeds the 12% which is generally used as the evaluation standard on the infrastructure projects in India. B/C and NPV are also over 1.3 and positive, respectively. This indicates that implementation of the project is relevant from the viewpoints of the national economy as well as the regional economy.

Table 11.2.4 Results of cost-benefit analysis in Case 1

(Unit: million INR)

Year	Investment Cost	O & M, Rehabilitation	Annual Total Cost	Benefit (VOC)	Benefit (TTC)	Total Benefit	Annual Net Benefit	Accumulated Net Benefit
2015	2,902	0	2,902			0	(2,902)	(2,902)
2016	5,597	0	5,597			0	(5,597)	(5,597)
2017	23,084	0	23,084			0	(23,084)	(23,084)
2018	23,266	0	23,266			0	(23,266)	(23,266)
2019	23,223	0	23,223			0	(23,223)	(23,223)
2020	24,113	0	24,113			0	(24,113)	(24,113)
2021	23,574	0	23,574			0	(23,574)	(23,574)
2022	656	221	877	2,405	2,664	5,069	4,192	4,192
2023	2,978	221	3,199	2,446	3,541	5,987	2,788	2,788
2024	0	221	221	2,488	4,618	7,106	6,885	9,673
2025	0	221	221	2,531	5,936	8,467	8,246	17,919
2026	0	221	221	2,575	7,541	10,116	9,896	27,814
2027	0	228	228	2,620	9,492	12,111	11,883	39,698
2028	0	228	228	2,666	11,853	14,519	14,291	53,989
2029	0	228	228	2,713	14,705	17,418	17,190	71,179
2030	0	228	228	2,761	18,141	20,903	20,675	91,854
2031	0	746	746	2,810	22,272	25,083	24,336	116,190
2032	0	221	221	8,916	27,228	36,144	35,923	152,113
2033	0	221	221	9,351	31,069	40,420	40,200	192,313
2034	0	221	221	9,803	35,449	45,252	45,031	237,343
2035	0	221	221	10,272	40,441	50,712	50,492	287,835
2036	0	221	221	10,758	46,131	56,889	56,668	344,503
2037	0	298	298	11,262	52,617	63,879	63,580	408,084
2038	0	298	298	11,785	60,009	71,793	71,495	479,579
2039	0	298	298	12,327	68,432	80,758	80,460	560,038
2040	0	298	298	12,888	78,030	90,918	90,620	650,658
2041	0	919	919	13,471	88,965	102,436	101,517	752,175
2042	0	268	268	12,901	101,424	114,324	114,056	866,231
2043	0	268	268	13,501	115,616	129,117	128,849	995,081
2044	0	268	268	14,123	131,782	145,906	145,638	1,140,718
2045	0	268	268	14,767	150,196	164,963	164,695	1,305,414
2046	0	268	268	15,434	171,167	186,601	186,333	1,491,747
		Present Value	76,592			99,134	22,541	

EIRR =	13.7%
NPV =	22,541
B/C =	1.3
Discount Rate =	12%

Source: JICA Study Team

[36] A period of 15-20 years beyond the completion of the project is generally considered for highway projects whereas in the case of expressway projects, the analysis period is considered to be up to 25 years. "MANUAL ON ECONOMIC EVALUATION OF HIGHWAY PROJECTS IN INDIA", INDIAN ROADS CONGRESS (2009)

The table below shows the result of the financial analysis for Case 2. EIRR is 13.7%, which exceeds the 12% which is generally used as the evaluation standard on the infrastructure projects in India. B/C and NPV are also over 1.3 and positive, respectively. This indicates that implementation of the project is relevant from the viewpoints of the national economy as well as the regional economy.

Table 11.2.5 Results of cost-benefit analysis in Case 2

(Unit: Million INR)

Year	Investment Cost	O & M, Rehabilitation	Annual Total Cost	Benefit (VOC)	Benefit (TTC)	Total Benefit	Annual Net Benefit	Accumulated Net Benefit
2015	2,902	0	2,902			0	(2,902)	(2,902)
2016	5,597	0	5,597			0	(5,597)	(5,597)
2017	23,084	0	23,084			0	(23,084)	(23,084)
2018	23,266	0	23,266			0	(23,266)	(23,266)
2019	23,223	0	23,223			0	(23,223)	(23,223)
2020	24,113	0	24,113			0	(24,113)	(24,113)
2021	23,574	0	23,574			0	(23,574)	(23,574)
2022	656	221	877	1,783	2,246	4,029	3,152	3,152
2023	2,978	221	3,199	1,908	3,158	5,066	1,867	1,867
2024	0	221	221	2,040	4,287	6,327	6,106	7,973
2025	0	221	221	2,179	5,678	7,857	7,636	15,609
2026	0	221	221	2,325	7,383	9,708	9,487	25,096
2027	0	228	228	2,478	9,465	11,943	11,715	36,811
2028	0	228	228	2,639	11,998	14,637	14,409	51,220
2029	0	228	228	2,808	15,068	17,877	17,649	68,868
2030	0	228	228	2,986	18,781	21,767	21,539	90,408
2031	0	746	746	3,173	23,258	26,431	25,685	116,092
2032	0	221	221	9,853	28,644	38,498	38,277	154,369
2033	0	221	221	10,116	32,445	42,561	42,340	196,710
2034	0	221	221	10,386	36,751	47,136	46,916	243,625
2035	0	221	221	10,663	41,627	52,290	52,069	295,694
2036	0	221	221	10,948	47,150	58,098	57,878	353,572
2037	0	298	298	11,241	53,406	64,647	64,349	417,921
2038	0	298	298	11,542	60,492	72,033	71,735	489,656
2039	0	298	298	11,852	68,516	80,368	80,069	569,725
2040	0	298	298	12,170	77,605	89,775	89,477	659,202
2041	0	919	919	12,498	87,898	100,396	99,477	758,678
2042	0	268	268	12,390	99,556	111,947	111,679	870,357
2043	0	268	268	12,686	112,759	125,445	125,177	995,534
2044	0	268	268	12,988	127,711	140,699	140,431	1,135,965
2045	0	268	268	13,298	144,644	157,942	157,674	1,293,639
2046	0	268	268	13,614	163,820	177,434	177,166	1,470,805
		Present Value	76,592			98,283	21,691	

EIRR =	13.7%
NPV =	21,691
B/C =	1.3
Discount Rate =	12%

Source: JICA Study Team

The table below shows the result of the financial analysis for Case 3. The EIRR is 13.3%, which exceeds the 12% which is generally used as the evaluation standard on the infrastructure projects in India. B/C and NPV are also over 1.2 and positive, respectively. This indicates that implementation of the project is relevant from the viewpoints of the national economy as well as the regional economy.

Table 11.2.6 Results of cost-benefit analysis in Case 3

(Unit: Million INR)

Year	Investment Cost	O & M, Rehabilitation	Annual Total Cost	Benefit (VOC)	Benefit (TTC)	Total Benefit	Annual Net Benefit	Accumulated Net Benefit
2015	2,902	0	2,902			0	(2,902)	(2,902)
2016	5,597	0	5,597			0	(5,597)	(5,597)
2017	23,084	0	23,084			0	(23,084)	(23,084)
2018	23,266	0	23,266			0	(23,266)	(23,266)
2019	23,223	0	23,223			0	(23,223)	(23,223)
2020	24,113	0	24,113			0	(24,113)	(24,113)
2021	23,574	0	23,574			0	(23,574)	(23,574)
2022	656	221	877	1,547	1,969	3,516	2,639	2,639
2023	2,978	221	3,199	1,611	2,814	4,424	1,225	1,225
2024	0	221	221	1,678	3,864	5,542	5,321	6,547
2025	0	221	221	1,749	5,163	6,911	6,691	13,237
2026	0	221	221	1,824	6,759	8,583	8,362	21,599
2027	0	228	228	1,903	8,713	10,616	10,388	31,987
2028	0	228	228	1,986	11,096	13,082	12,854	44,841
2029	0	228	228	2,074	13,991	16,065	15,837	60,678
2030	0	228	228	2,167	17,499	19,666	19,438	80,116
2031	0	746	746	2,265	21,737	24,001	23,255	103,371
2032	0	221	221	8,998	26,843	35,841	35,620	138,991
2033	0	221	221	9,289	30,564	39,853	39,632	178,623
2034	0	221	221	9,591	34,800	44,391	44,170	222,793
2035	0	221	221	9,904	39,621	49,525	49,304	272,097
2036	0	221	221	10,230	45,107	55,337	55,116	327,213
2037	0	298	298	10,568	51,352	61,920	61,621	388,835
2038	0	298	298	10,918	58,459	69,378	69,079	457,914
2039	0	298	298	11,283	66,548	77,831	77,532	535,446
2040	0	298	298	11,662	75,752	87,414	87,115	622,562
2041	0	919	919	12,056	86,226	98,282	97,362	719,924
2042	0	268	268	12,219	98,145	110,363	110,095	830,019
2043	0	268	268	12,622	111,706	124,328	124,060	954,079
2044	0	268	268	13,042	127,136	140,178	139,910	1,093,990
2045	0	268	268	13,478	144,692	158,170	157,902	1,251,892
2046	0	268	268	13,931	164,666	178,598	178,330	1,430,221
		Present Value	76,592			93,116	16,524	

EIRR =	13.3%
NPV =	16,524
B/C =	1.2
Discount Rate =	12%

Source: JICA Study Team

11.2.5 Sensitivity Analysis

In order to comprehend the effects on the cost-benefit analysis from uncertainties due to changes in the socio-economic situation, a sensitivity analysis was carried out. Case 2, as the basic scenario, was tested by inputting variable factors which could significantly impact the cost-benefit analysis. Specifically, the variables are; a change of ±10% of total initial investment cost 161,743 million INR and a change of ±10% of the benefit (VOC and TTC).

The worst scenario is a case of 10% increase of initial investment cost and 10% decrease of benefit. In this case, EIRR decreases to 12.3%, but this is still more than the 12% which is generally used as the evaluation standard on infrastructure projects in India. Net Present Value becomes negative, and B/C is 1.1. In another scenario, EIRR also indicates more than 12%. Therefore, the impact from these uncertainties is not significant.

Table 11.2.7 Summery of sensitivity analysis (EIRR)

		Benefit		
		-10%	Base case	+10%
Cost	-10%	13.7%	14.4%	15.1%
	Base case	13.0%	13.7%	14.3%
	+10%	12.3%	13.0%	13.7%

Source: JICA Study Team

Table 11.2.8 Summery of sensitivity analysis (NPV)

		Benefit		
		-10%	Base case	+10%
Cost	-10%	19,429	29,257	39,085
	Base case	11,862	21,691	31,519
	+10%	4,296	14,124	23,952

Source: JICA Study Team

Table 11.2.9 Summery of sensitivity analysis (B/C)

		Benefit		
		-10%	Base case	+10%
Cost	-10%	1.3	1.4	1.6
	Base case	1.2	1.3	1.4
	+10%	1.1	1.2	1.3

Source: JICA Study Team

11.2.6 Qualitative effects from the Project

There are many kinds of expected benefits other than VOC and TTC savings that are considered in the economic evaluation of this study. The following are major qualitative effects.

Reduction of traffic accidents

The improvement of travel speed and road condition due to the completion of the project leads to reduced congestion. This results in a decrease in the number of accidents on the alternative roads.

Integrating the regional economy

Through the project implementation, it is expected to contribute to expanding the economic interchange between the great metropolitan area of Mumbai and all the surrounding areas, not only between Mumbai and Navi Mumbai. Currently important large scale infrastructure projects, such as Navi Mumbai new airport, and SEZ, have been planned, and this project is expected to play a role as a part of the infrastructure network.

11.2.7 Operation and Effect Indicators

The following are Operation and Effect Indicators for the project.

Table 11.2.10 Operation and Effect Indicators

Indicator	Baseline Value in 2015	Baseline Value in 2024	Note
Travel Time	61 minutes	16.1 minutes	Section on Sewri～Chirle
Annual Average Daily Traffic (PCU/ peak hour)	8,748 PCU/peak hour	11,204 PCU/peak hour	Vashi Toll Plaza on Vashi Bridge
	-	42,647 PCU/peak hour	MTHL (Sewri IC- Shivaji Nagar IC)

Source: CONCEPT DESIGN REPORT, GHATKOPAR KOPARKHAIRNE BRIDGE, REWAS KARANJA SEA LINK (2014)

12. ENVIRONMENTAL IMPACT ASSESSMENT

12.1 Project Description

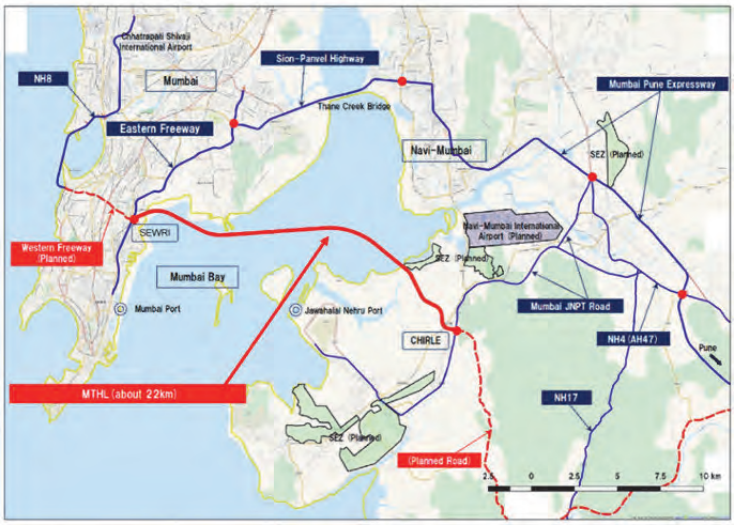
The project outline and location are shown in the Table 12.1.1 and Figure 12.1.1.

All specifications are still tentative due to the project being under review and inspection based on the Final Feasibility Report in 2012.

Table 12.1.1 Project Outline

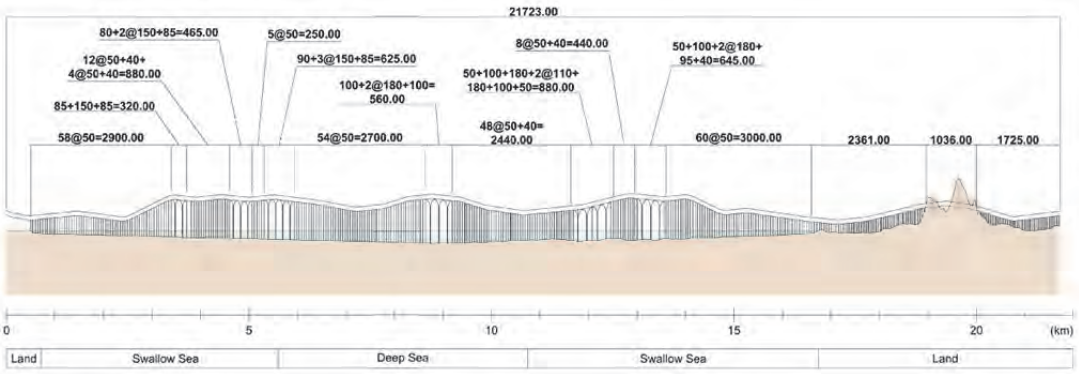
Item	Description
Project Name	Construction of Mumbai Trans Harbour Link
Type of construction Structure	- Road Type: Urban arterial road in MM Region - Type of Structure : Bridge across Mumbai bay & viaduct on land - Length: 22.5 km (App.17 km bridge over the sea) - Number of lanes: 6 lanes with paved shoulder
Location	- Starting point(Mumbai side): Sewri in Mumbai City - End Point: Chirle area in Raigad District
Road Width	- Clear width of each carriageway (viaduct portion) : 13.75m - Width of Right of Way (Navi Mumbai side): 120m - Width of Right of Way (Creek): 500m

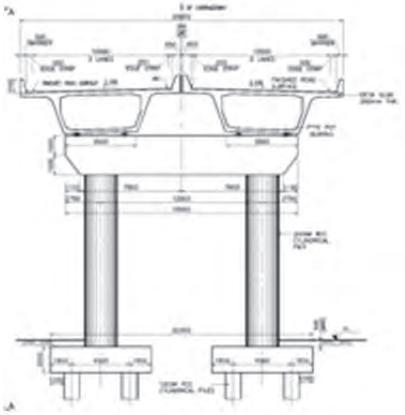
Source: JICA Study Team

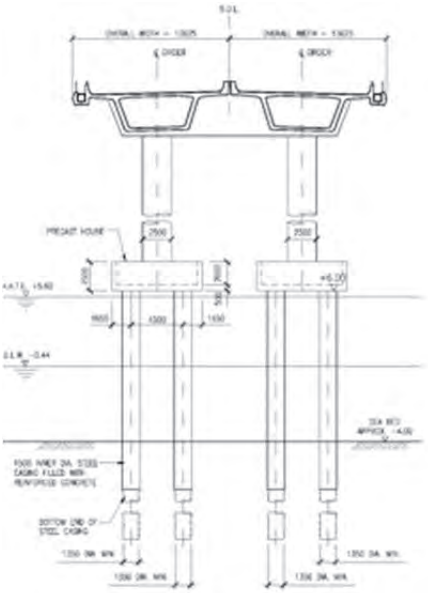


Source: JICA Study Team

Figure 12.1.1 Project Location Map







Typical Cross Section (On the Land) Typical Cross Section (Over the Sea)

Source: JICA Study Team

Figure 12.1.2 Typical Structure of the Bridge and Viaduct

12.2 Current Natural and Social Environmental Condition

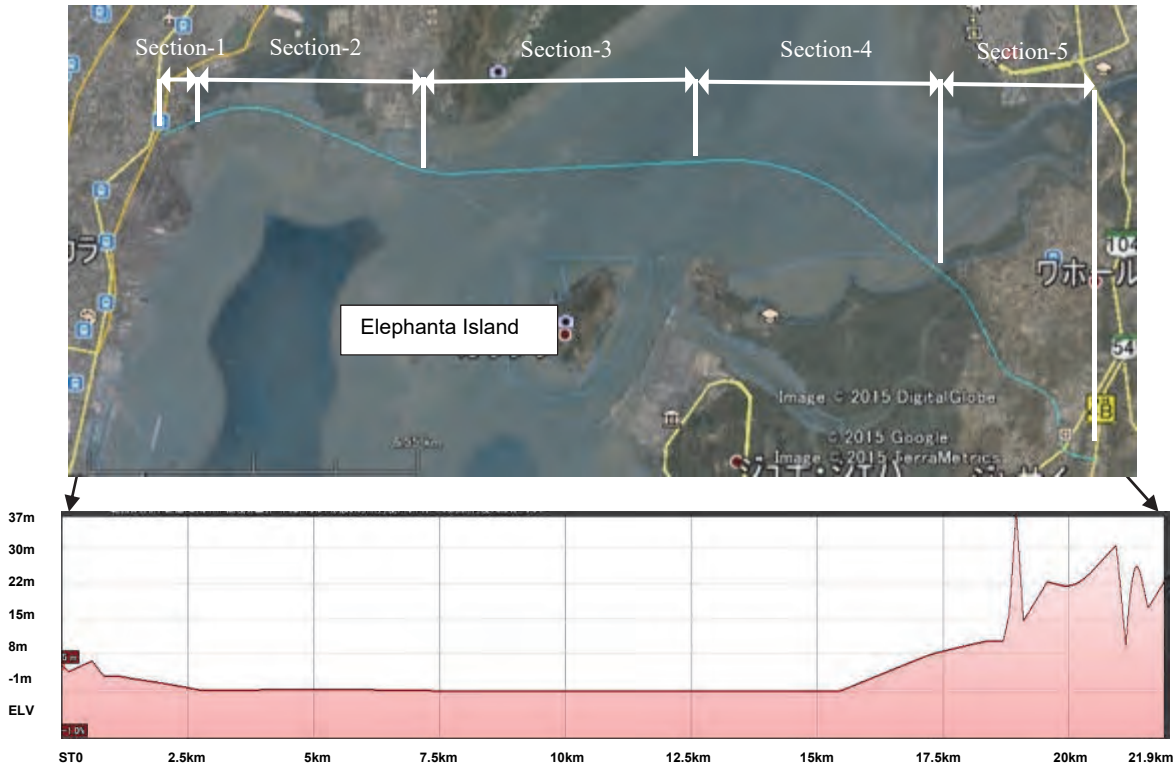
12.2.1 Topography, Geography and Hydrology

The elevation above sea level is around 5 m from CH 0km Sewri side in Mumbai to CH(Chainage) 16km at the east side in Navi Mumbai, and then the elevation increases to approximately 40m gradually at the end point in the Chirle area. The area is classified in 5 sections based on the topographic features on site.

Table 12.2.1 Topographical and Geographical Features

Section	Topographic Classification	Depth of the Sea	Topographic Feature
Section-1 (CH 0 - 0.72km)	Land (Partially Tidal Area)	-	Flat
Section-2 (CH 0.72 - 5.60km)	Tidal area	0.0m～3.0m	Flat (Partially mangrove area)
Section-3 (CH 5.60 - 10.75km)	Sea area	4.5m～7.0m	Deepest area in the creek (crossing old & New Pir Pau jetties)
Section-4 (CH 10.75 - 16.75km)	Sea area (Partially Tidal Area)	0.0m～4.0m	Flat (Partially mangrove area)
Section-5 (CH 16.75 - 21.84km)	Land	-	Hilly area (exposed basaltic rock)

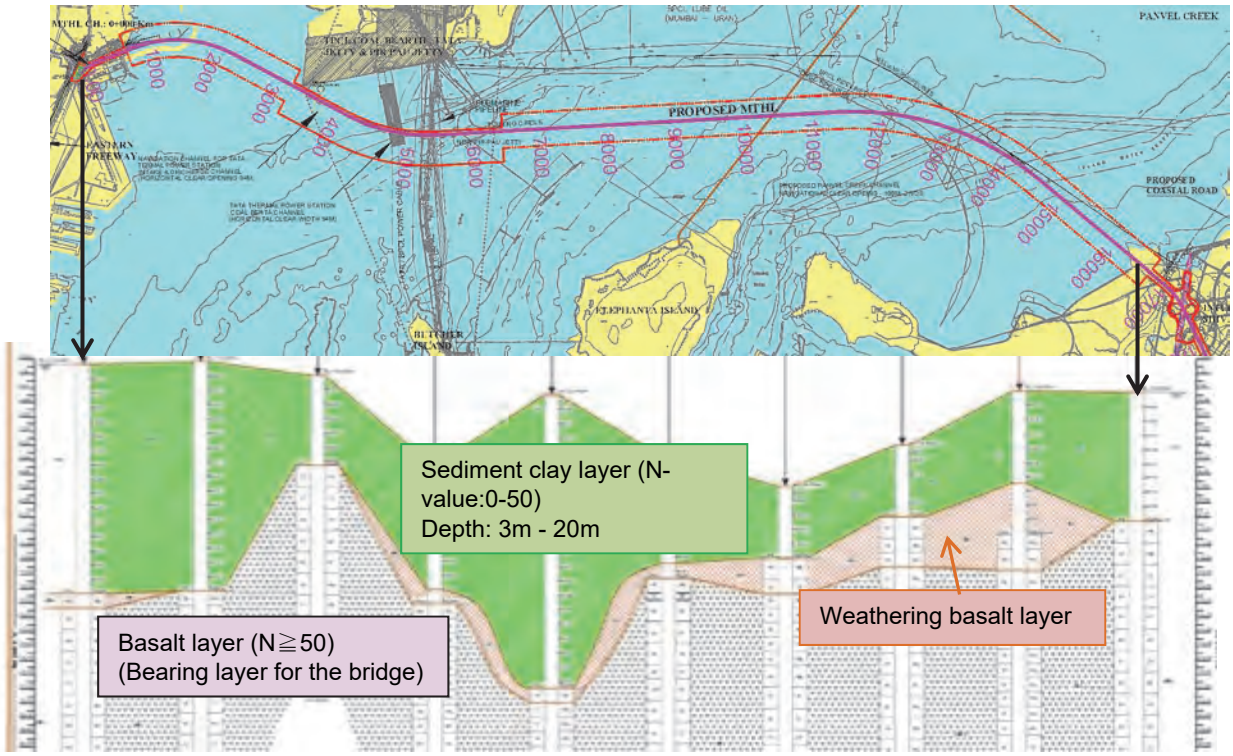
Source: JICA Study Team



Source: JICA Study Team

Figure 12.2.1 Topographic and Hydrological Features

With regard to geographic features, a sediment clay layer with 3 to 20 m thickness is located above the basalt layer in the sea section near Sewri area. The basalt layer is exposed in the Navi Mumbai Section.



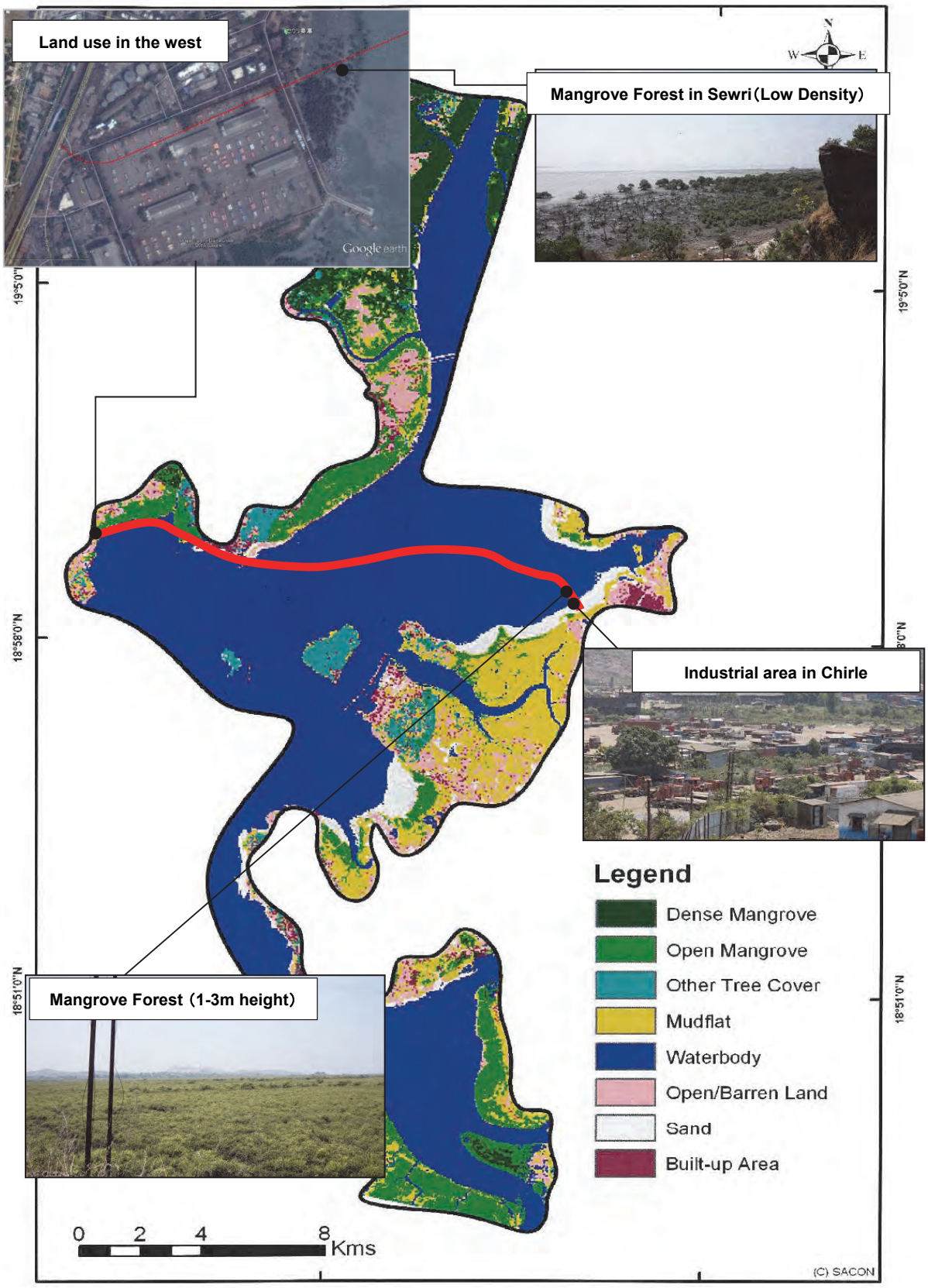
Source: JICA Study Team

Figure 12.2.2 Geographic Features

12.2.2 Land Use

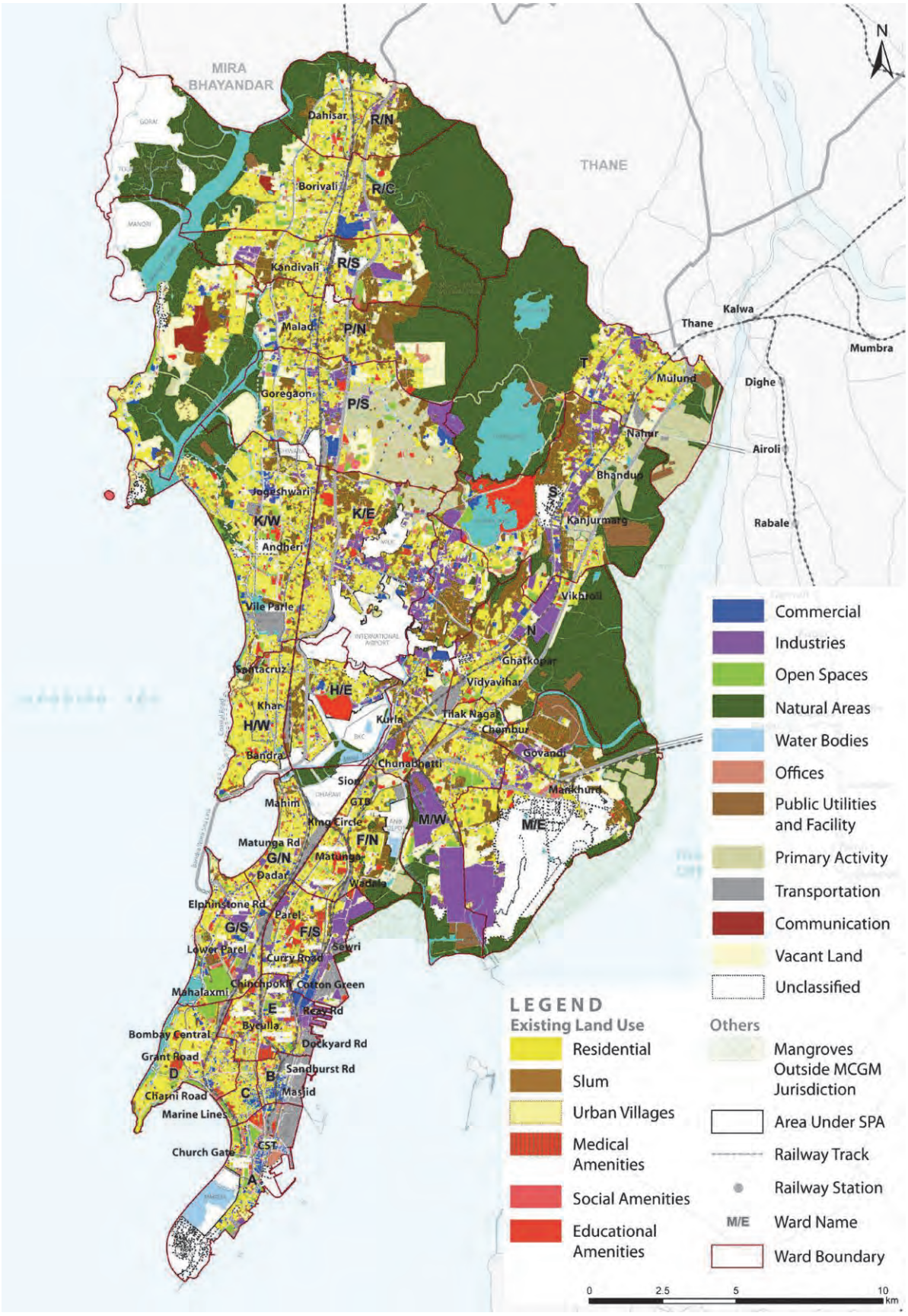
The authorities for the Development Plans are the Municipal Corporation of Greater Mumbai (MCGM) in Mumbai and the City and Industrial Development Corporation (CIDCO) on the Navi Mumbai side. The land use in the project area as of 2008 is shown in the Figure 12.2.3, and future land use is shown in Figure 12.2.4 & Figure 12.2.5 respectively.

The starting point of the project alignment is the interchange with the Eastern Freeway. Then the alignment passes through the Mumbai Port Trust (MbPT) area on the Mumbai side. The alignment on the Navi Mumbai side passes through small residential area, quarry area, container yard area and then connects with the National Highway 4B.



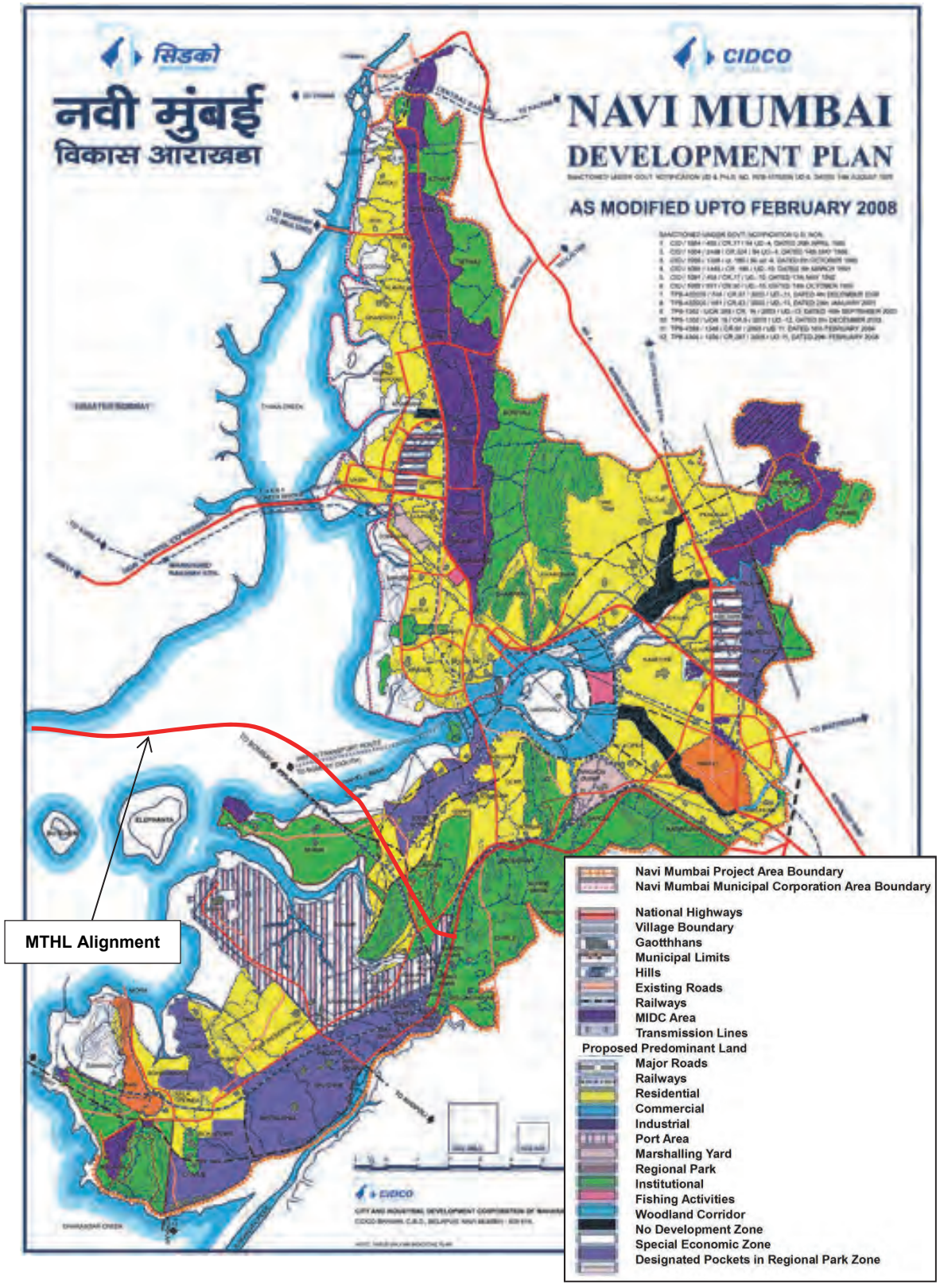
Source: Mumbai Trans Harbour Link Project Study of Flamingo and Migratory Birds Final Report 2008 December (Salim Ali Centre for Ornithology and Natural History)

Figure 12.2.3 Land Use in the Project Area



Source: Land Use Plan (draft: 2014－2034)

Figure 12.2.4 Proposed Land Use Plan in the Project Area (Mumbai Area 2014-2034)



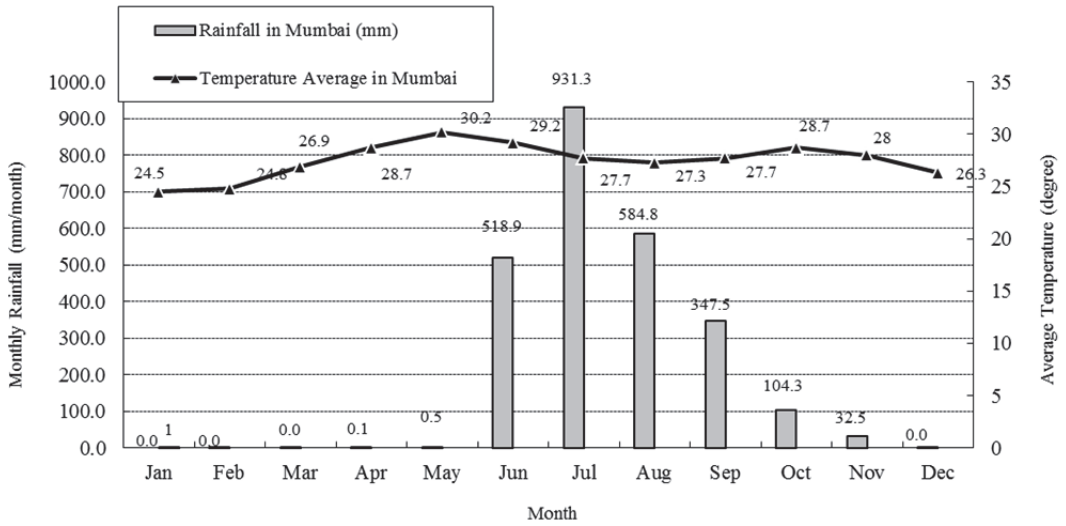
Source: Navi Mumbai Land Use Plan (CIDOCO 2008/Website)

Figure 12.2.5 Land in the Project Area in Navi Mumbai (2008)

12.2.3 Climate

The project area is categorized as a tropical monsoon climate. The Average Daily temperature varies from 24 degrees in January to 30 degrees in May (dry season). On the other hand, the monsoon season starts from June and lasts till October.

Average monthly rainfall and temperature is shown in Figure 12.2.6.



Source: India Metrological Department, Ministry of Earth Sciences (website)

Figure 12.2.6 Annual Rainfall in Mumbai (2008-2013 Average)

12.2.4 Protected Area

(1) National Park

The Sanjay Gandhi National Park is located approximately 15km away and north of the project starting point at Sewri. The project alignment falls outside the eco-sensitive zone of the Karnala Bird Sanctuary. The locations of the National Park and sanctuary are shown in Figure 12.2.7.

(2) Coastal Regulation Zone (CRZ)

The alignment passes through the Coastal Regulation Zone (CRZ). The Ministry of Environment, Forests & Climate Change (MOEF&CC) issued CRZ Clearance for the project on 25th January 2016.

The Coastal Zone Management Plans near the project locations are shown in Figure 12.2.9.

(3) Important Bird and Biodiversity Areas (IBAs)

The IBAs are part of a program proposed by Birdlife International and designates the areas to be conserved and managed. The criteria for an area is shown below in accordance with Birdlife International;

- Places of international significance for the conservation of birds and other biodiversity
- Recognised world-wide as practical tools for conservation
- Distinct areas amenable to practical conservation action
- Identified using robust, standardised criteria
- Sites that together form part of a wider integrated approach to the conservation and sustainable use of the natural environment

Three sites are located in the project area and surrounding area as shown in Figure 12.2.8.

Table 12.2.2 Outline of the IBAs in the Project Area

Item \ Site Name	1. Mahul- Sewri	2. Thane Creek	3. Sanjay Gandhi National Park
Distance from the Project Site	Lies within the aROW of alignment (for a distance of approx. 5km)	App. 7.8km	App. 15km
Location	72° 53.00' East 19° 1.00' North	72° 57.50' East 19° 7.50' North	72° 57.80' East 19° 18.58' North
IBA Criteria	A1, A4i, A4iii	A1, A4ii	A1, A2, A3
Area (ha)	1,000 ha	12,200 ha	10,308 ha
Assessment Year	2004	2004	2004

Source: Birdlife International website as of 26th Nov. 2015

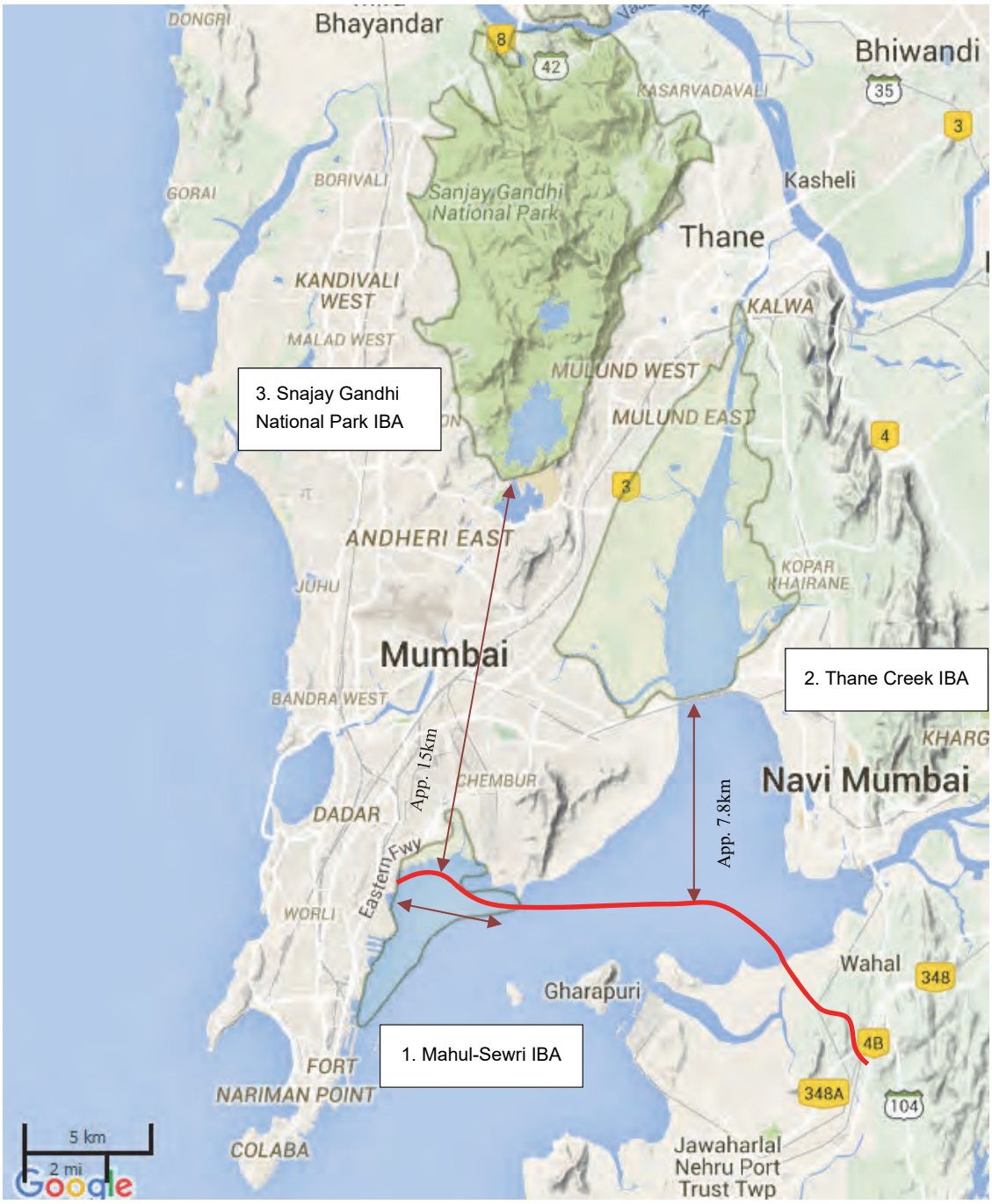
Table 12.2.3 Criteria of IBAs

Criteria	Description
A1. Globally threatened species	The site is known or thought to regularly hold significant numbers of a globally threatened species, or other species of global conservation concern.
A2. Restricted-range species	The site is known or thought to hold a significant component of a group of species whose breeding distributions define an Endemic Bird Area (EBA) or Secondary Area (SA).
A3. Biome-restricted species	The site is known or thought to hold a significant component of the group of species whose distributions are largely or wholly confined to one biome.
A4. Congregations	A site may qualify on any one or more of the four criteria listed below: i). Site known or thought to hold, on a regular basis, >1% of a biogeographic population of a congregatory water bird species. ii). Site known or thought to hold, on a regular basis, >1% of the global population of a congregatory seabird or terrestrial species. iii). Site known or thought to hold, on a regular basis, > 20,000 water birds or >10,000 pairs of seabirds of one or more species. iv). Site known or thought to exceed thresholds set for migratory species at bottleneck sites.

Source: Birdlife International website as of 26th Nov. 2015

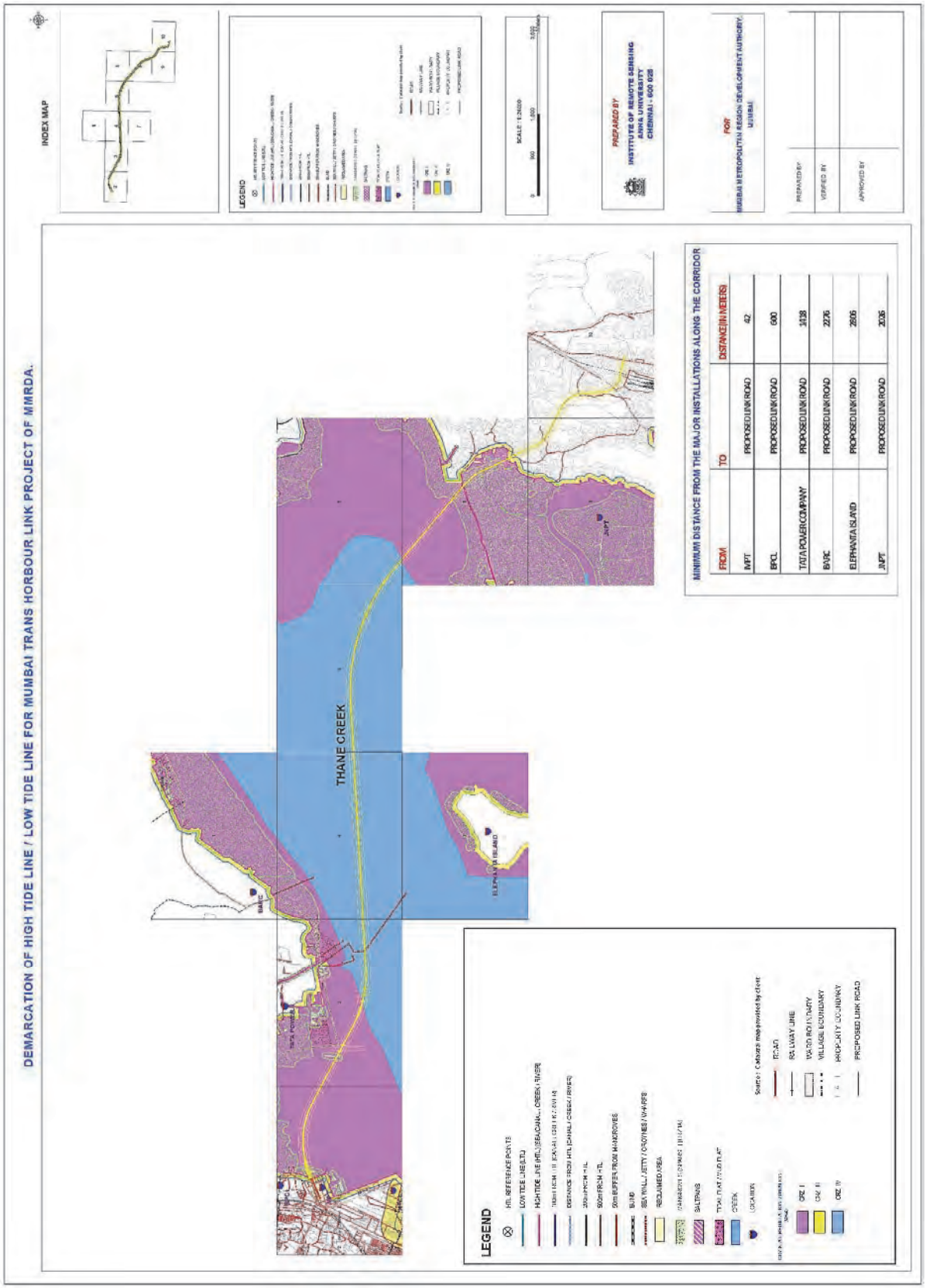
Source: JICA Study Team

Figure 12.2.7 Location map showing the Sanjay Gandhi National Park and Karnala Bird Sanctuary



Source: Birdlife International as of June 2016

Figure 12.2.8 Location of Important Birds Areas (Mahul - Sewri Creek)



Source: MMRDA

Figure 12.2.9 Coastal Zone Management Plan (Mumbai and Navi Mumbai side)

12.2.5 Fauna and Flora

According to the past surveys[37] , 81 bird species have been observed in the project area. Most of the observed species are categorized as the Least Concern (LC) class, but 5 species were categorized NT species such as the Black Headed Ibis, Painted Stork, Black Tailed Godwit, Eurasian Curlew and Lessor Flamingo, and one species was a VU species, the Greater Spotted Eagle. Additionally as per the latest bird survey in Feb. – May 2016, 147 bird species have been observed in the project area. A total of 12 species (Lesser Flamingo, Woolly-necked stork, Painted Stork, Black-headed Ibis, Greater Spotted Eagle, Indian Spotted Eagle, Pallid Harrier, Great Knot, Black-tailed Godwit, Bar-tailed Godwit, Eurasian Curlew and Alexandrine Parakeet) of the 147 species of birds identified in the field observations have been classified as NT or higher categories (EN: 1 sp., VU: 3 sp., NT: 8 sp.) in the IUCN Red List. The other 135 species have been classified LC or NE which degree of concerned and the need for conservation is low.

According to a local bird specialist, the migrating Flamingos have been observed in this location since 1994. It is supposed that one of the reasons is due to increasing the mudflat area and feeds such as plankton and algae under organic polluted environment in the basin. However Sewri are in Mumbai side is widely known as industrial area, however Lessor Flamingos and Greater Flamingos have been coming from Gujarat State every November since 1994 and staying there until June.

According to the study report conducted by MMRDA in 2008, 10,000 to 15,000flamingos are counted in a day. These flamingos eat algae and/or plankton during low tidal.

With regard to the mangroves on the Sewri and Navi Mumbai side, although the dominant specie is Avicennia marina, the surveyed density is quite low.

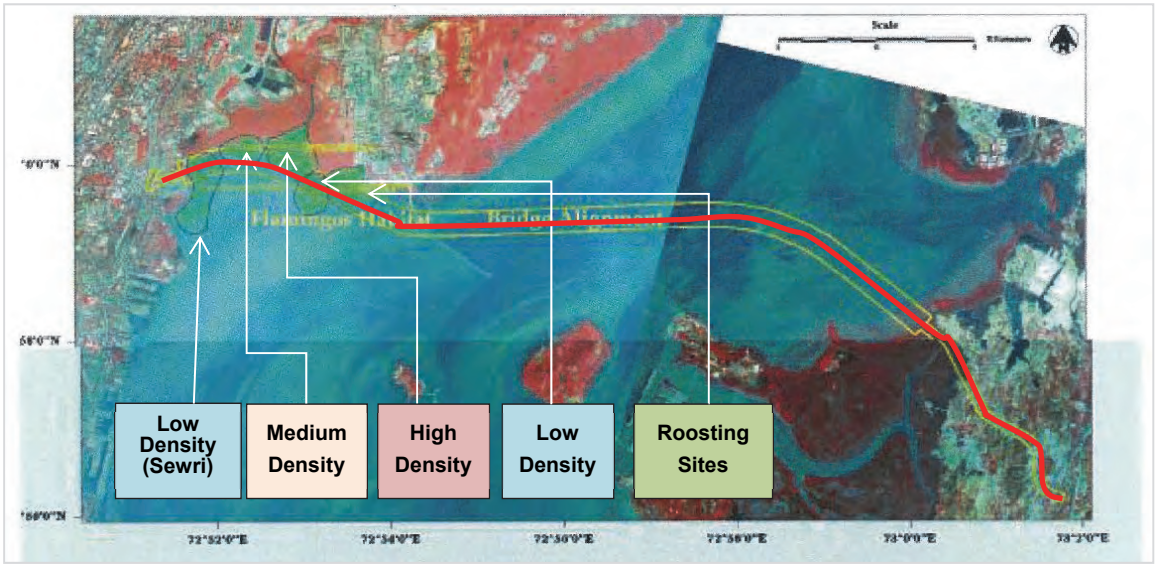
Source: JICA Study Team

Figure 12.2.10 Vegetation Community at Sewri and Navi Mumbai Site (April 2015)

[37] 1) Mumbai Trans Harbour Link Project Study of Flamingo and Migratory Birds Final Report 2008 December (Salim Ali Centre for Ornithology and Natural History) 2) Rapid EIA (MMRDA 2012)

Source: JICA Study Team

Figure 12.2.11 Observed Migratory Bird (Lessor Flamingo) in Sewri Mudflat Site



Source: Mumbai Trans Harbour Link Project Study of Flamingo and Migratory Birds Final Report 2008 December (Salim Ali Centre for Ornithology and Natural History)

Figure 12.2.12 Surveyed Flamingo Distribution (2008)

12.2.6 Cultural Heritage

The Sewri Fort is located approximately 180m north of Chainage 700m on the alignment. The Gateway of India is at 9 km distance from the alignment whereas the Elephanta Caves are 3km from the alignment. A No Objection Certificate (NOC) has been issued from the Archaeological Survey of India for the project alignment.

Source: JICA Study Team

Figure 12.2.13 Location of Registered Cultural Heritages

12.2.7 Socio-Economic

(1) Population

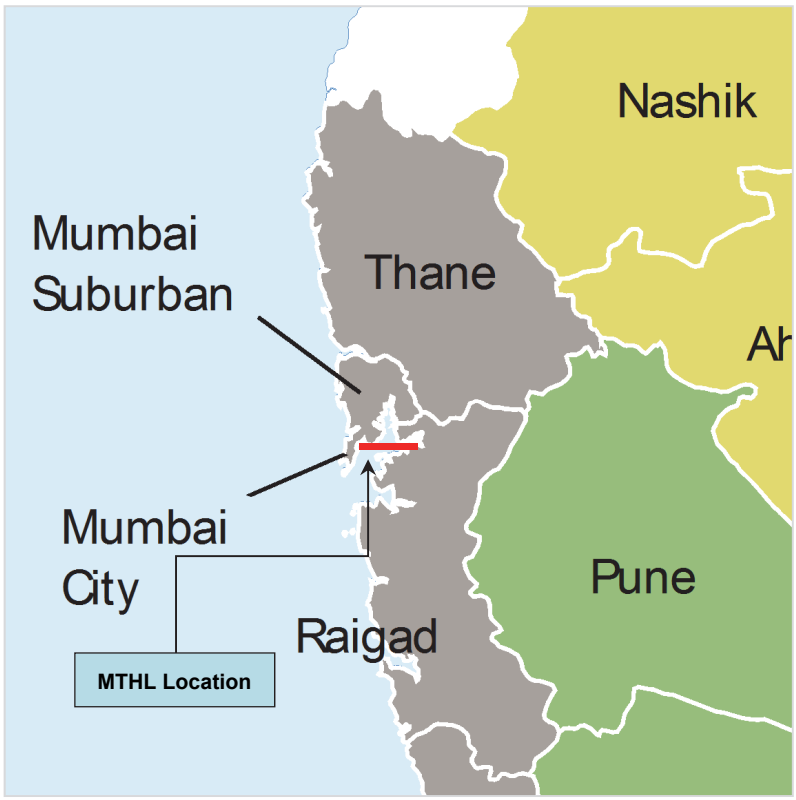
The project area is located in Konkan Division, State of Maharashtra. The starting point of the Mumbai Harbour Trans Link is in Sewri area Mumbai City, and the route crosses Mumbai Bay and connects with National Highway 4B in Raigad District.

Total area of Mumbai and Raigad District is approximately 7,750 km^2 and its total population was app. 5.8 million in the census in 2011. Population increase for 10 years from 2001 to 2011 is 4.56 % in Mumbai and app. 19% in Raigad District.

Table 12.2.4 Socio-Economic Situation in the Project Area

Name of Area	Area (km^2)	% Area	Population (2011) (Person)	Growth Rate (for 10 years)	Population Density (Person/km^2)
India	3,287,263	100.00%	1,210,193,422	14.99%	368
Maharashtra State	307,713	9.36%	112,372,972	15.99%	365
Konkan Division	30,746	0.94%	28,739,397	-	935
Mumbai City	603.4	0.02%	3,145,966	4.56%	25,851
Raigad District	7,152	0.22%	2,635,200	19.36%	368

Source: Indian Statistical Census (2011)



Source: JICA Study Team

Figure 12.2.14 Project Location on District Map

(2) Economy

GDP in India by state is indicated in Table 12.2.5. The GDP in Maharashtra ranks it the top state in India, and the GDP indicates 4,155 billion INR about 1.5 times that of Uttar Pradesh.

On the other hand, GDP per capita in Maharashtra is 114,000 INR and ranked 7th in India as shown in Table 12.2.6. Additionally GDP and GDP per capita in Mumbai, Raigad and Thane are shown in Table 12.2.7.

Table 12.2.5 GDP in India (FY2013-2014)

Unit: Billion INR.	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
1 Maharashtra	4,155	4,868	5,845	6,848	7,540	8,558	10,492	11,754	13,238	14,762
2 Uttar Pradesh	2,608	2,932	3,363	3,830	4,447	5,234	6,003	6,855	7,804	8,627
3 Tamil Nadu	2,190	2,578	3,105	3,508	4,013	4,797	5,849	6,672	7,449	8,542
4 Gujarat	2,034	2,447	2,837	3,293	3,679	4,313	5,215	5,988	6,585	7,656
5 West Bengal	2,087	2,302	2,617	2,995	3,419	3,989	4,610	5,283	6,033	7,066
29 Manipur	51	57	61	68	74	83	91	111	127	143
30 Arunachal Pradesh	35	38	41	48	57	75	90	108	118	135
31 Sikkim	17	20	22	25	32	61	74	89	105	124
32 Mizoram	27	30	33	38	46	53	64	69	84	103
33 Andaman & Nicobar Islands	18	20	25	30	35	41	43	50	56	62

Source: Census of India (2015)

Table 12.2.6 GDP PER CAPITA in India (FY2013-2014)

Unit: x 1,000 INR	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
1 Goa	77	85	95	109	136	149	168	212	201	224
2 Delhi	64	72	83	95	112	126	145	167	193	220
3 Sikkim	27	30	32	36	47	91	109	130	151	176
4 Chandigarh	74	85	98	103	108	117	127	137	142	157
5 Puducherry	48	67	69	74	79	97	101	103	114	144
6 Haryana	38	42	49	57	67	82	94	106	120	133
7 Maharashtra	36	42	50	58	62	70	85	94	104	114
8 Tamil Nadu	30	35	42	48	54	64	78	89	99	113
9 Andaman & Nicobar Islands	41	45	54	61	69	79	81	90	98	107
10 Gujarat	32	38	43	50	55	64	77	86	93	107
31 Jharkhand	19	18	20	25	25	28	35	37	40	46
32 Assam	17	18	20	21	24	28	33	36	39	44
33 Manipur	19	20	21	23	24	27	28	34	38	42

Source: Census of India (2015)

Table 12.2.7 GDP PER CAPITA in the Project Area (FY2013-2014)

	GDP (billion INR)		GDP per capita (1,000 INR)	
	2012-2013	2013-2014	2012-2013	2013-2014
1 Mumbai	28.8	33.4	166	189
2 Thane	17.8	20.0	156	173
3 Raigad	3.5	3.8	120	132

Source: Maharashtra state plan division (2015)

(3) Industry

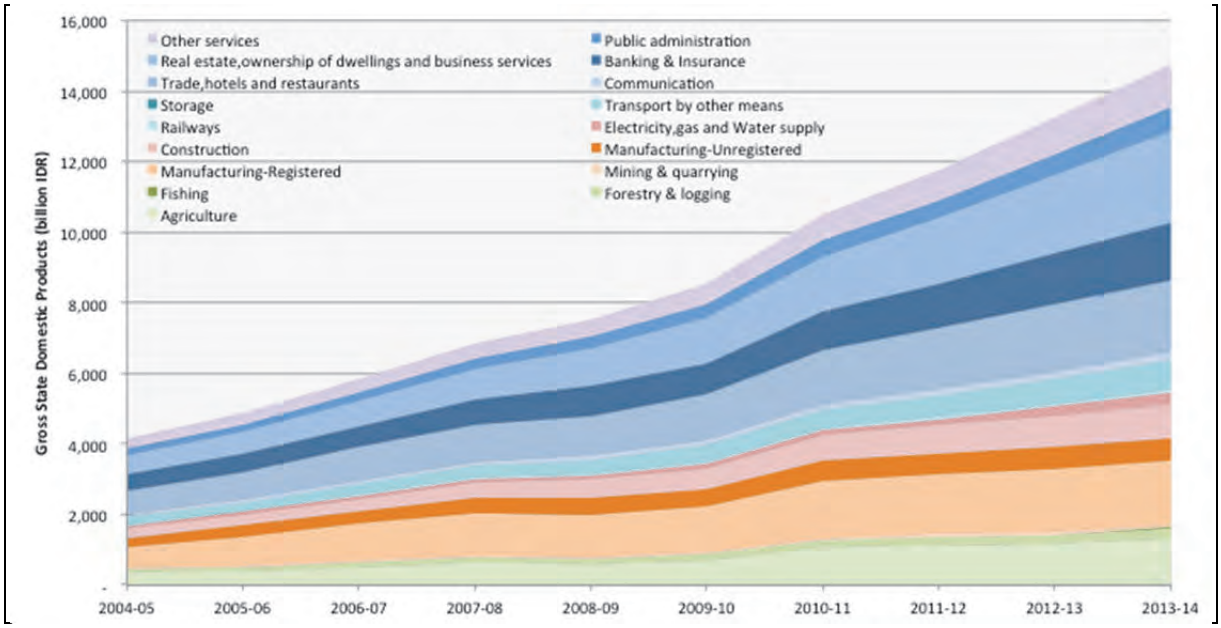
The key industries and top three sectors are shown in Table 12.2.8. The major industry in Maharashtra state is the service industry and it makes up around 63% of the total and has been increasing.

On the other hand, the industrial production was about 26% of the total in 2013-2014, and it has been decreasing. The agricultural production is stabilized around 11-12 %.

Table 12.2.8 GDP on Major Industry in Maharashtra State

Unit: % (Billion INR)	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Primary Industry	10.8 (449)	10.8 (528)	11.5 (672)	11.8 (807)	10.1 (758)	10.4 (886)	12.3 (1,293)	11.8 (1,387)	10.9 (1,442)	11.1 (1,636)
1 Agriculture	8.3	8.2	8.7	9.4	7.9	8.0	10.2	9.6	8.7	8.8
2 Forestry	2.2	2.3	2.5	2.1	2.0	2.1	1.9	1.9	1.9	2.0
3 Fishery	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.3	0.3
Secondary Industry	29.6 (1,230)	31.8 (1,547)	32.0 (1,869)	32.4 (2,216)	31.3 (2,361)	29.8 (2,551)	29.7 (3,116)	28.2 (3,317)	27.4 (3,622)	26.0 (3,845)
1 Registered manufacturing	14.1	16.8	17.7	17.3	16.0	15.1	15.4	14.3	13.5	12.4
2 Construction	6.3	6.2	5.9	6.5	7.0	6.5	6.5	6.8	6.5	6.5
3 Non-registered manufacturing	6.5	6.4	6.3	6.4	6.2	6.0	5.7	5.1	4.8	4.3
Tertiary industries	59.6 (2,475)	57.4 (2,793)	56.5 (3,303)	55.9 (3,826)	58.6 (4,420)	59.8 (5,121)	58.0 (6,082)	60.0 (7,050)	61.7 (8,173)	62.9 (9,282)
1 Real Estate	12.8	12.9	12.7	13.0	14.1	14.9	14.9	15.9	16.7	17.8
2 Trading/Hotel/ Restaurant	16.2	15.6	15.9	15.4	15.0	15.1	14.6	14.6	14.6	13.8
3 Insurance and financial	11.4	10.5	10.2	10.2	11.1	10.4	10.4	10.8	10.8	11.0

Source: Census of India (2015)



Source: Census of India (2015)

Figure 12.2.15 GDP by Industry in Maharashtra State

(4) Poverty Line

The criteria for poverty have been revises by the central government from time to time. Thus the poverty line and the number of citizens under the poverty line are not accurate

under the same criteria. According to the poverty line in 2011-2012 based on the criteria determined by the India Planning Committee in 2014, the poverty line was 1,078 INR in the agricultural area of Maharashtra and 1,560 INR in urban areas.

Table 12.2.9 Poverty Line in Maharashtra State

	Poverty Line (INR/month-capita)		Poverty Ratio (%)			Number of Poor (million)		
	Rural	Urban	Rural	Urban	Total	Rural	Urban	Total
Lakdawala Methodology								
1973-74	50.47	59.48	57.71	43.87	53.24	21.1	7.7	28.7
1977-78	58.07	73.99	63.97	40.09	55.88	25.0	8.0	33.0
1983-84	88.24	126.47	45.23	40.26	43.44	19.4	9.7	29.1
1987-88	115.61	189.17	40.78	39.78	40.41	18.6	10.9	29.6
1993-94	194.94	328.56	37.93	35.15	36.86	19.3	11.2	30.5
1999-00	318.63	539.71	23.72	26.81	25.02	12.5	10.3	22.8
2004-05	362.25	665.90	29.6	32.2	30.7	17.1	14.6	31.7
Tendulkar Methodology								
2004-05	485	632	47.9	25.6	38.1	27.7	11.6	39.3
2009-10	744	961	29.5	18.3	24.5	18.0	9.1	27.1
2011-12	967	1,126	24.2	9.1	17.4	15.1	4.7	19.8
C.Rangarajan Methodology								
2011-12	1,078.34	1,560.38	22.5	17.0	20.0	14.0	8.8	22.8

Source: India Planning Committee (2014)

12.3 Environmental Legislation

12.3.1 Environmental Impact Assessment (EIA Notification 2006)

The necessity of an environmental impact assessment is stipulated in the Environmental Protection Law of 1986, and concrete rules are described in the Environmental Impact Assessment Notification of 2006 (EIA Notification). According to the notification, prescript projects are required to obtain an Environmental Clearance before implementation of the actual construction.

Category A projects in accordance with EIA notification are required to obtain an Environmental Clearance from the Ministry of the Environment and Forests (MOEF) of the central government, on the other hand, Category B projects shall get the clearance from the State Government.

The Sr. No. 7(f) schedule of the EIA Notification 2006 is reproduced in Table 12.3.2 below. The MTHL being an urban arterial road is not covered under category A or B as defined under 7(f). Hence the project does not come under the provisions of EIA Notification 2006.

Thus MMRDA has obtained CRZ clearance only from MOEF in 2013 and 2016 through the appropriate process reviewed by state and central relevant organizations after preparation of a Rapid EIA in 2012 in accordance with CRZ Notification 2011.

Contents and summary of the Rapid EIA 2012 are shown in Table 12.3.1 and detailed surveyed data is indicated in article 12.4.5 Baseline survey result.

Table 12.3.1 Summary and Contents of Rapid EIA 2012

Chapter	Contents	Page	Detailed Item
Executive Summary	―	37	
Chap. 1 Project background	Necessity of the project and study, legal framework, project positive impacts etc.	6	
Chap.2 Project description	Project background, alternative alignment analysis, road structure, interchange plan, traffic analysis, topographic analysis, resettlement, land acquisition, toll gate, quarry, schedule and cost	25	
Chap.3 Baseline survey	Topo-geo survey result, land use plan, air, water, noise, heritage, ecosystem, migratory birds and CRZ(Coastal Regulation zone)	45	✓ Air quality on site measurement ✓ Water quality on site measurement ✓ Noise level on site measurement ✓ Biology survey in 1 season (benthos, bottom sediment quality, migratory birds, mangrove etc.) ✓ Note) Detailed data is indicated in article 12.4.5 Baseline survey
Chap. 4 Analysis and mitigation measures	Impact analysis during and after construction (including adverse impacts on mudflat)	35	✓ Quantitative forecast analysis on air, noise levels ✓ Note) Detailed data is indicated in article 12.4.5 Baseline survey ✓ Qualitative analysis on biology
Chap. Environmental Management Plan	Environmental Management Plan, Monitoring Plan and Institutional framework	12	-
Chap. Disaster Management Plan	Risk Management Plan, Disaster management plan, risk analysis	10	-
Appendix	CRZ Permission letter and condition		

Source: Rapid EIA 2012 summarized by JICA Study Team

Table 12.3.2 Part of Schedule of EIA Notification 2006

Project or Activity		Category	
		Category A	Category B
7f	Highway	i) New National Highways; and ii) Expansion of National Highways greater than 30 KM, involving additional right of way greater than 20m involving land acquisition or passing through more than one State.	i) New State High ways; and ii) Expansion of National / State Highways greater than 30 km in length involving additional right of way greater than 20m involving land acquisition.

Source: EIA Notification (MOEF 2006)

12.3.2 Coastal Regulation Zone (CRZ Notification 2011)

According to CRZ notification 2011, the following objectives for establishment of regulations are described;

“Now, therefore, in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environmental (Protection) Act, 1986 (29 of 1986), the Central Government, with a view to ensure livelihood security to the fishing communities and other local communities, living in the coastal areas, to conserve and protect coastal stretches, its unique environment and its marine area and to promote development in a sustainable manner based on scientific principles taking into account the dangers of natural hazards in the coastal areas, and sea level rise due to global warming, does hereby declare the coastal stretches of the country and the water area up to its territorial water limit, excluding the islands of Andaman and Nicobar and Lakshadweep and the marine areas surrounding these islands up to their territorial limits, as a Coastal Regulation Zone (hereinafter referred to as the CRZ) and restricts the setting up and expansion of any industry, operation, process, or manufacture or handling or storage or disposal of any hazardous substances as specified in the Hazardous Substances (Handling, Management and Transboundary Movement) Rules, 2009 in the aforesaid CRZ.”

The permitted and regulated activities are stipulated for the designated CRZ.

The Mumbai Harbour Trans Link being a trans harbour link, is permitted in the CRZ. The Ministry of the Environment, Forest & Climate Change (MoEF&CC), Govt. of India issued a CRZ clearance on 25th Jan 2016.

Relevant descriptions regarding MHTL projects on CRZ notification 2011 are shown below.

Table 12.3.3 Relevant Description on CRZ Notification 2011

No.	Name of Article	Contents
Clause "3 (iv) (Page 2).	Prohibited activities within CRZ	The activities such as Land reclamation, bunding or disturbing the natural course of seawater are declared as prohibited activities within the CRZ except those,- (a) required for setting up, construction or modernisation or expansion of foreshore facilities like ports, harbours, jetties, wharves, quays, slipways, bridges, sealinks, roads on stilts, and such as meant for defence and security purposes and for other facilities that are essential for activities permissible under the notification;"
Clause "7 (Pg 8)	Classification of the CRZ	– For the purpose of conserving and protecting the coastal areas and marine waters, the CRZ area shall be classified as follows:- (i) CRZ-I,– A. The areas that are ecologically sensitive and have geomorphological features which play a role in the maintaining the integrity of the coast,- (a) Mangroves, if the mangrove area is more than 1000 sq m, a buffer of 50meters along the mangroves shall be provided; (b) Corals and coral reefs and associated biodiversity; (c) Sand Dunes; (d) Mudflats which are biologically active; (e) National parks, marine parks, sanctuaries, reserve forests, wildlife habitats and other protected areas under the provisions of the Wild Life (Protection) Act, 1972 (53 of 1972), the Forest (Conservation) Act, 1980 (69 of 1980) or the Environmental (Protection) Act, 1986 (29 of 1986); including Biosphere Reserves; (f) Salt Marshes; (g) Turtle nesting grounds; (h) Horse shoe crab habitats; (i) Sea grass beds; (j) Nesting grounds of birds; (k) Areas or structures of archaeological importance and heritage sites. B. The area between the Low Tide Line and the High Tide Line; (ii) CRZ-II,- The areas that have been developed up to or close to the shoreline.
Clause "8 (Pg 9)	Norms for regulation of activities permissible under this notification,-	(i) The development or construction activities in different categories of CRZ shall be regulated by the concerned CZMA in accordance with the following norms:- I. CRZ-I,- (i) no new construction shall be permitted in CRZ-I except,- (e) Construction of a trans harbour sea link which is done without affecting the tidal flow of water, between LTL and HTL." "(ii) Areas between LTL and HTL which are not ecologically sensitive, necessary safety measures will be incorporated while permitting the following:- (g) Construction of trans harbour sea links, roads on stilts or pillars without affecting the tidal flow of water."

Source: Coastal Regulation Zone Notification (MOEF 2011)

Table 12.3.4 Specific Conditions in the CRZ that are issues for the MTHL project (2016)

No.	Conditions
(i)	All the terms and conditions stipulated by the MCZMA in their letter No.CRZ 2015/CR236/TC4 dated 26th November, 2015, shall be strictly complied with.
(ii)	All the terms and conditions as mentioned in the earlier CRZ Clearance dated 19th July, 2013, shall also be complied with in letter and spirit.
(iii)	The Environmental Management Plan as presented during the meeting shall be implemented in consultation with all the stakeholders.
(iv)	The project/activity shall be carried out strictly in accordance with the provisions of CRZ Notification, 2011, and shall not affect the coastal ecology of the area including flora and fauna.
(v)	The project proponent shall obtain all permissions from concerned authorities prior to commencement of the project, and shall observe all safety requirements onshore and offshore
(vi)	The project proponent shall not undertake any blasting/construction activities during night hours.
(vii)	The proposal indicates the diversion of 47.417 ha forest land for which the proponent shall obtain the requisite Forest Clearance. The project may be executed in the entire stretch in non-forest land, and while making application to get the Forest Clearance, the execution of work on non-forest land shall not be cited as a reason for grant of FC and if the FC is declined, the forest land shall be maintained in its existing condition. The PP shall submit an undertaking to this effect at the earliest to the concerned Regional Office to this Ministry.
(viii)	All the wildlife mitigation measures as proposed by BNHS in their report dated 23.09.2015 for original alignment shall be implemented with the following modification: (a) construction of jetties on both the ends passing through mud flats and mangroves must not exceed 30 months and construction of actual spans must not exceed more than a further 12 months (b) the distance between the supporting pillars shall remain 50 m as currently proposed by the MMRDA (c) MMRDA will partly bear the cost of setting of an effluent treatment plant in the region as suggested by BNHS.
(ix)	The project proponent shall not undertake any blasting / construction activities during night hours

Source: CRZ Environmental Clearance (MOEF 25th Jan. 2016)

Table 12.3.5 CRZ clearance related conditions (Jan. 25 2016)

No.	Conditions
1	The project/activity shall be carried out strictly in accordance with the provisions of CRZ Notification, 2011, and shall not affect the coastal ecology of the area including flora and fauna.
2	The project proponent shall obtain all permissions from concerned authorities prior to commencement of the project, and shall observe all safety requirements onshore and offshore.
3	The project proponent shall not undertake any blasting/construction activities during night hours.
4	Adequate provision for infrastructure facilities including water supply, fuel and sanitation must be ensured for construction workers during the construction phase of the project to avoid any damage to the environment.
5	The project proponents shall inform the Regional Office as well as the Ministry, the date of financial closure and final approval of the project by the concerned authorities and the start date of land development work.
6	All other statutory clearances such as the approvals for storage of diesel fuel from the Chief Controller of Explosives, Fire Department, Civil Aviation Department, and clearances under the Forest Conservation Act, 1980 and Wildlife (Protection) Act,1972 etc. shall be obtained, as applicable by the project proponents from the respective competent authorities.
7	The Sewri End of the Jetty should be used for transportation of construction material to avoid disturbance to the mudflats
8	MMRDA is to install noise barriers of 3 m height on both sides of the Sealink passing through CRZ I (mudflat & mangrove area) and CRZ IV area.
9	MMRDA is to ensure that all construction equipment is fully fitted with mufflers and exhaust silencers to contain the noise levels. Machinery used during construction should be properly maintained to minimize the air and noise emissions.
10	MMRDA is to ensure that minimum damage is caused to the mangroves ecosystem.
11	MMRDA is to ensure that operations in the mudflats or intertidal zone will be done using temporary jetties which will be parallel to the permanent structures in the Right of way for the transportation of labour, construction materials, precast elements, machinery etc. on both ends.
12	All the construction equipment shall be provided with exhaust silencers as committed
13	Noise containment barriers shall be provided on both sides of the birds in mudflat areas (CRZ-IA) so as to minimize the likely impacts to the migratory birds as committed.
14	There shall be no dredging or reclamation for the project.
15	Pre-stressed super structure shall be used in the mud flat area for construction as committed
16	The muck material shall be analysed prior to dumping/ disposal in the identified location with the approval of the competent authority to ensure that it does not cause any impact to the environment.
17	There shall be no water with drawl in the CRZ area
18	There shall be no disposal of solid or liquid wastes in the coastal area. Solid waste Management shall be as per Municipal Solid (Management and Handing) Rules, 2000.
19	Sewage shall be treated and the Treatment Facility shall be provided in accordance with the Coastal Regulation Zone Notification, 2011. The disposal of treated water shall conform to the regulations of the State Pollution Control Board

Source: UMBAI TRANS HARBOUR LINK PROJECT/ MoEF's CONDITIONS: TO BE INCORPORATED IN BID DOCUMENT

Table 12.3.6 The conditions related to Forest clearance; (Jan. 22 2016)

No.	Conditions
1	No labour camp shall be established on the forest land.
2	The Contractor shall provide fuels, preferably alternate fuels, to the labourers and the staff working at the site so as to avoid any damage to or pressure on the nearby forest areas.
3	The layout plan of the proposal shall not be changed without the prior approval of the Central Government.
4	The forest land shall not be used for any purpose other than that specified in the proposal.
5	No damage to the flora and fauna of the adjoining area shall be caused.
6	Felling of trees on the forest land being diverted shall be reduced to the bare minimum and the trees should be felled under strict supervision of the State Forest Department.
7	The reclamation of quarry should be done under the supervision of the State Forest Department. The quarry shall be reclaimed and afforested completely before the project is closed.
8	Overburden shall not be dumped outside the width of the road. The muck generated in the earth cutting will be disposed of at the designate dumping sites and in no case shall the muck/debris be allowed to roll down the hill slopes.
9	The User Agency will provide retaining walls, breast wall, breast wall and drainage as per requirements to make the slope stable.
10	The Contractor will undertake comprehensive soil conservation measures at the project cost in consultation with the State Forest Department.
11	The designing of culverts/bridges, if any, over the natural streams/rivers/ canals should be done in such a manner that it does not hamper the natural course of water, does not give rise to water-logging, and also does not hamper movement of wild animals
12	Any other condition that the concerned Regional Office of this Ministry may stipulate, from time to time in the interest of conservation, protection and development of forests & wildlife.
13	The Contractor shall ensure compliance to provisions of all the Acts, Rules, Regulations and Guidelines, for the time being in force, as applicable to the project.
14	Mitigation Measures implemented by the Contractor, MoEF implied the following mitigating measures to ameliorate any adverse environmental impact due to the construction/ execution of the MTHL project:
15	Construction in mud flat areas will involve use of temporary steel bridge/jetty parallel to the permanent structure for transportation of personnel, construction materials, pre-cast elements, machinery, etc on either end so as to cause minimal disturbance to the eco sensitive mud flats and mangroves.
16	No embankment is to be used in the construction of the bridge alignment; the bridge is proposed as a sea link with viaducts. Therefore, only the foot print area occupied by the piers/piles/ramps would be affected.
17	Assist MMRDA in compensatory mangrove plantation to be carried out through the Forest Department at the cost of the project proponent/MMRDA
18	Use of pre cast/fabricated units for the superstructure to avoid any effect on the mudflats by minimizing construction activity on the mud flats and also to avoid supporting system from sea bed.
19	As far as possible during construction, construction machinery movement (barges, etc) are to bypass locations having migratory birds.
20	Construction machinery/equipment is to be fitted with mufflers/exhaust silencers to contain noise produced along with provision of enclosures and intake silencers.
21	DG sets, if used, must adhere to noise standards as laid down by the MoEF.
22	Illumination of bridge carriage way in the mudflat stretches is proposed at low level (inner side of railing/noise barrier) to avoid disturbance to bird habitat at night.
23	Excavated soil to be disposed of at designated/approved dumping sites located far from the mud flat areas
24	No burning of waste in open air will be allowed during construction.

No.	Conditions
25	Implementation of surveillance management and monitoring program during construction to prevent any adverse impact on migratory birds.
26	No cable stayed bridge will be proposed to allow free and unhindered movement of birds.
27	Appointment of bird monitors during construction and even after completion of the project till the baseline levels are achieved.
28	Creation of an Environmental Monitoring Cell comprising MMRDA officials and experts to monitor the impact on the environment during construction as well as operation.
29	Debris in any form should not be dumped in the mudflat or mangrove areas of Sewri, Thane creek or Nhava or other parts of Sewri Bay under any circumstances.
30	A debris disposal plan is to be developed in which debris disposal sites are clearly demarcated.
31	As far as possible the transportation of construction material is to be facilitated from Sewri Jetty to avoid disturbance to the mudflats.
32	A clear plan for construction is to be provided before the work begins.
33	As far as possible, the spans are to be pre-fabricated at sites which are away from ecologically sensitive zones and brought in by barges
34	Utmost care is to be taken to ensure that mangroves and mudflats on either side of the bridge are not disturbed.
35	Though it is recognized that it may be beyond the mandate of MMRDA under the current project, the Maharashtra state must facilitate establishment of a mechanism to clean up the Sewri Mudflats (and Thane Creek) through integrated effluent treatment plant/plants.
36	Habitat quality assessment and monitoring of the conservation/mitigation measures during construction are to be continued till 5 years after completion so as to ascertain the impact of MTHL on the flamingo and roosting areas.
37	Construction of jetties on both the ends passing through mudflats and mangroves must not exceed 30 months and construction of the actual spans must not exceed more than a further 12 months.
38	The distance between the supporting pillars in the mudflat areas shall remain a minimum 50 m as currently proposed by MMRDA

Source: UMBAI TRANS HARBOUR LINK PROJECT/ MoEF's CONDITIONS: TO BE INCORPORATED IN BID DOCUMENT

12.3.3 Other Relevant Environmental Laws and Regulations

Other relevant environmental laws and regulations are shown in the next table.

Table 12.3.7 Other Relevant Environmental Laws and Regulations

No.	Name	Year
1	Environmental (Protection) Act	1986
2	Environment Impact Assessment Notification	2006, 2009, 2012
3	Forest Conservation Act	1927, 1980
4	National Forest Policy	1952, 1988
5	Coastal Regulation Zone Notification	2011
6	Wildlife (Protection) Act	1972
7	Land Acquisition Act	1894, 1989
8	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act	2013
9	Air (Prevention and Control of Pollution Act)	1981
10	Hazardous Waste (Management and Handling Rules)	1989, 2003
11	Municipal Solid Waste (Management and Handling Rules)	2000
12	Noise Pollution Regulation and Control Rule	2000
13	Water (Prevention and Control of Pollution Act)	1974

Source: JICA Study Team

Table 12.3.8 Other Relevant Environmental Ratification Treaties

No.	Name	Effected Year
1	United Nations Framework Convention on Climate Change	1994
2	Kyoto Protocol	2001
3	Convention on Biological Diversity	1993
4	Cartagena Protocol on Biosafety	2003
5	Vienna Convention for the Protection of the Ozone Layer	1988
6	Montreal Protocol on Substances that Deplete the Ozone Layer	2002
7	Basel Convention	1992
8	The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	2004
9	Stockholm Convention on Persistent Organic Pollutants	2004
10	United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	1996
11	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	1975
12	The Convention on Wetlands of International Importance especially as Waterfowl Habitat	1975
13	Antarctic Treaty / Protocol on Environmental Protection to the Antarctic Treaty	1961
14	Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol)	1998

Source: Ministry of Foreign Affairs in Japan (website)

12.3.4 Gaps between Rapid EIA study and JICA's Guidelines

As per the JICA's guidelines, the project is categorized as Category A. The following preliminary comparative analysis has been conducted between JICA Guidelines and "Rapid EIA in 2012" prepared by MMRDA.

According to the gap analysis, the identified gaps are the Social Impact Survey, Vibration Survey and holding Public Consultation.

Table 12.3.9 Result of Preliminary Gap Analysis between JICA Guidelines and Rapid EIA

JICA Guideline (Appendix 2. EIA Reports for Category A Projects)	Rapid EIA (2012 prepared by MMRDA)	Gaps	Policy to fill up gaps in this Study
When assessment procedures already exist in host countries, and projects are subject to such procedures, project proponents etc. must officially finish those procedures and obtain the approval of the government of the host country.	At first, the project is not required to prepare the EIA in accordance with EIA Notification 2006. However necessary environmental clearance for CRZ is obtained from MOEF by MMRDA in 2016.	- (no difference)	Not required
EIA reports (which may be referred to differently in different systems) must be written in the official language or in a language widely used in the country in which the project is to be implemented. When explaining projects to local residents, written materials must be provided in a language and form understandable to them.	Rapid EIA 2012 has been prepared in only English.	At least English and Hindi version shall be prepared. Marathi is also considered.	Supplemental EIA in English and summary version in Marathi shall be disclosed after approval of Final Supplemental EIA.
EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted.	Rapid EIA in 2012 is disclosed when any persons requests in accordance with the right to information Act 2005	Rapid EIA shall be disclosed upon request	Supplemental EIA in English and summary version in Marathi shall be disclosed after approval of Final Supplemental EIA.
In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared.	A public consultation has not been conducted on the process of Rapid EIA 2012	Either local Stakeholder meeting and public consultation has been conducted on the process of Raid EIA 2012	Two public consultations were held at the scoping and draft supplemental EIA stages
Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared.	No consultation has been conducted on the process of Rapid EIA 2012	ditto	ditto

Source: JICA Study Team

12.4 Environmental and Social Impact Assessment

In this article, alternative analysis, scoping and expected mitigation measures are described for the MTHL project.

12.4.1 Analysis of Alternatives

(1) Alternative Analysis

As explained in previous chapter 3, the route and fundamental structure have been concluded and approved by the central government from the view points of the natural & social environment, security and adjustment with other projects in 1984. In 2015, an NGO (BNHS) recommended to change the alignment in the Sewri Section and MMRDA has considered and analysed it with other relevant government organizations from the view points of the natural & social environments, however, the recommended route in Sewri was not adopted due to significant impacts on the other relevant government plans.

Thus the factors in the alternative analysis are limited as follows. As shown in Table 12.4.1, Span length and location of IC are listed as factors of the alternative analysis, however, in general, the locations of the IC are planned at the actual connected trunk roads, and hence, there are no options to shift to other areas so long as the connected road plan does not change.

Table 12.4.1 Selected Factors on Alternative Analysis

Factor/ Condition	Reason for adoption
Location of Interchange	As the MTHL needs to have effective connectivity with the Eastern Freeway and the Sewri-Worli connector, the locations of the interchanges cannot be shifted to other points. Thus “location of interchange” is not an appropriate factor in the analysis.
Span length (steel girder bridge)	Increasing the span length may reduce the footprint of the structure in the mudflat and mangrove areas. Adoption of steel girders for the superstructure enables adopting longer spans and reduction of the number of piers. Thus this factor is selected as an appropriate factor in the analysis.

Source: JICA Study Team

“Span length” is selected as a factor in the alternative analysis and is evaluated from the view points of the natural environment and economy & cost as shown in Table 12.4.2.

According to the result of the analysis, although option 1 with 60m span length can reduce the number of piers, the size of the piers becomes bigger as shown in the structural analysis. Thus option-2 with 50m span length has a slight advantage as regards the impact area on the mudflat and mangroves. Additionally 50m spans have advantages such as easier constructability, shorter construction period and lower construction cost. Thus Option-2 (50m) should be selected from the above points of view.

Table 12.4.2 Alternative Analysis (Span Length)

Item \ Option		Option-1			Option-2 (adopted)		
		60m Spans			50m Spans		
Specification	Superstructure	PC Box Girder (girder depth: 2.0m to 4.0m)			PC Box Girder (girder depth: 3.2m)		
	Substructure	62 Piers (pile cap type)			42 Piers (pile cap type)	34 Piers (pile bent type)	
		Pier: φ2,500mm-2nos			Pier: φ2,500mm-2nos	Pier: φ2,400mm-2nos	
		Pile cap: 9.0m×9.0m			Pile cap: 9.0m×9.0m	Bored pile: φ2,000mm-4nos	
		Bored pile: φ2,000mm-4nos			Bored pile: φ2,000mm-4nos		
Structural performance		High record of usage		◎	High record of usage		◎
Constructability	Construction method	Cantilever method (more difficult than span by span method)	○	○	Span by Span method (easier than cantilever method)	◎	◎
	Quality control	Normal (Cantilever method)	○		Easy (Span by span method)	◎	
Construction period		Longer than Option-2 (superstructure: cantilever method, all 62 piers: pile cap type)		△	Shorter than Option-1 (superstructure: span by span method, 42 piers: pile cap type, 34 piers: pile bent type)		◎
Environmental impact (Impact on mudflat habitat, mangrove cutting area)		Area occupied by piers inside mud flat area: **10,000m^2** (all 62 piers: pile cap type)		○	Area occupied by piers inside mud flat area: **7,000m^2** (42 piers: pile cap type, 34 piers: pile bent type)		◎
Construction cost (Approx. 4.1km within mud flat area)	Amount (crore INR)	2,560		△	2,000		◎
	Ratio	1.28			1.00		
Evaluation		Not recommended			**Recommended ○**		

Legend: ◎ Good/ Superior, ○ Moderate, △ Poor/Inferior

Source: JICA Study Team

(2) Zero Option

In the case of the “Zero Option” which does not implement the project, the following adverse negative and positive impacts are expected. Some positive impacts are expected, however, since the expected negative impacts are serious from the view of the economy and environment, the “With project case” is desirable comprehensively;

[Negative Impacts]

- The congested situation would be accelerated and prevent sound urban development. Furthermore, this “without case” will not have a synergy effect on other development plans such as the construction of Navi Mumbai Air Port.
- The accelerated congestion must make all of the vehicles decrease travelling speed, and then the volume of greenhouse gases would increase.

[Positive Impacts]

- Mangrove and mud flat is conserved
- Resettlement and land acquisition is not caused

12.4.2 Screening

As described in 12.3, obtaining the Environmental Clearance is not required in accordance with EIA Notification 2006, however CRZ clearance in accordance with CRZ Notification 2011 is required. The MoEF&CC granted CRZ Clearance to the project on 25th January 2016. JICA feels that the project may have significant impacts on the natural and social environments. Thus the project has been classified as “Category A” as per JICA’s guidelines. This requires conducting an EIA study.

12.4.3 Scoping

Scope of the EIA study for the project is discussed in this section. The environmental scoping is conducted based on an environmental reconnaissance by the JICA Study Team in April 2015.

The result of the scoping is indicated on the Leopold scoping matrix and reason tables. First of all, impact factors, impacted item and impact degree are shown on the following scoping matrix based on JICA’s Guidelines.

(1) Scoping Matrix for MTHL

As the result of the Scoping Analysis, 15 items such as Air, Water, Waste, Noise & Vibration, Biology, protected areas, Hydrology, Topography and Geography, Existing Infrastructures, Misdistribution of benefits and damage, landscape, infectious diseases and accidents are selected as items of the Rating B which has some negative impacts.

Additionally, mainly social items such as “involuntary resettlement” are evaluated as “Rating C” which has unknown impacts.

Table 12.4.3 Draft Scoping Matrix for MTHL

	No	Affected Activities / Impacted Item (JICA Guidelines)	Impacted Item (Items of the Rapid EIA 2012)	During Construction	Pre/ During Construction Phase: Land acquisition and Loss of properties and Change of Land use plan, Control of various activities by regulations for the construction	Reclamation of Wetland, etc.	Deforestation(including Mangrove)	Alteration to ground by cutting and filling, drilling, tunnel, etc.	Operation of Construction Equipment and Vehicles	Construction of Roads, tollgates, parking lots, Access roads for bridges and other related facilities	Traffic Restriction in construction area	Influx of construction workers, construction of base camp	After Construction	Operation Phase: Increase of Through Traffic and traveling speed	Appearance/ Occupancy of Roads and related building structures including tunnel and embankment	Increasing influx of settlers
Pollution	1	Air Pollution	Air quality/ Siting of borrow pits and quarry material areas	B-	D-	D-	D-	D-	B-	D-	D-	D-	B-	B-	D-	D-
	2	Water pollution	Water Quality/ Construction of labour camp/ Siting of borrow pits and quarry material areas	B-	D-	B-	D-	B-	D-	D-	D-	B-	D-	D-	D-	D-
	3	Waste	Solid waste management/ Construction of labour camp/ Topography, Soil and Geology	B-	D-	D-	B-	B-	D-	D-	D-	B-	D-	D-	D-	D-
	4	Soil contamination	Topography, Soil and Geology/ Siting of borrow pits and quarry material areas	C-	D-	D-	D-	B-	D-	D-	D-	D-	D-	D-	D-	D-
	5	Noise and Vibration	Ambient Noise	B-	D-	D-	D-	D-	B-	D-	D-	D-	B-	B-	D-	D-
	6	Ground Subsidence		D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	7	Odour		D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	8	Sediment quality	Topography, Soil and Geology(No.4)	C-	D-	D-	D-	C-	D-	D-	D-	D-	D-	D-	D-	D-
Natural Environment	9	Protected Area	Reserved Forest and Fauna	B-	D-	D-	B-	B-	B-	D-	D-	C-	B-	B-	B-	D-
	10	Ecosystem	Ecology and Biodiversity/ Ecology/Construction of labour camp	B-	D-	D-	B-	B-	B-	D-	D-	C-	B-	B-	B-	D-
	11	Hydrology		B-	D-	D-	D-	B-	D-	D-	D-	D-	B-	D-	B-	D-
	12	Topography and geology	Topography, Soil and Geology	B-	D-	D-	D-	B-	D-	D-	D-	D-	B-	D-	B-	D-

	No	Affected Activities / Impacted Item (JICA Guidelines)	(Items of the Rapid EIA 2012)	During Construction	Pre/ During Construction Phase: Land acquisition and Loss of properties and Change of Land use plan, Control of various activities by regulations for the construction	Reclamation of Wetland, etc.	Deforestation(including Mangrove)	Alteration to ground by cutting and filling, drilling, tunnel, etc.	Operation of Construction Equipment and Vehicles	Construction of Roads, tollgates, parking lots, Access roads for bridges and other related facilities	Traffic Restriction in construction area	Influx of construction workers, construction of base camp	After Construction	Operation Phase: Increase of Through Traffic and traveling speed	Appearance/ Occupancy of Roads and related building structures including tunnel and embankment	Increasing influx of settlers
Social	13	Involuntary resettlement		B-	B-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	14	The poor		C-	C-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	15	Indigenous and ethnic people		D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	16	Local economy such as employment and livelihood	Quality of Life/Fisheries	C-	C-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	17	Land use and utilization of local resources	Land use/Fisheries	C-	C-	D-	C-	D-	D-	D-	D-	D-	C-	D-	C-	D-
	18	Waste Usage	Water Quality	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	19	Existing social infrastructures and services	Utility services and community severance	B-	B-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
Social Environment	20	Social institutions such as local decision making institutions		D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	21	Misdistribution of benefits and damage	Quality of life	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	22	Local conflict of interests		B-	D-	D-	D-	D-	D-	D-	D-	B-	D-	D-	D-	D-
	23	Cultural Heritage	Archaeological /Heritage	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	24	Landscape	Aesthetics and landscape	B-	D-	D-	D-	D-	D-	B-	D-	D-	B-	D-	B-	D-
	25	Gender		C-	C-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-

	No	Affected Activities / Impacted Item (JICA Guidelines)	Impacted Item (Items of the Rapid EIA 2012)	During Construction	Pre/ During Construction Phase: Land acquisition and Loss of properties and Change of Land use plan, Control of various activities by regulations for the construction	Reclamation of Wetland, etc.	Deforestation(including Mangrove)	Alteration to ground by cutting and filling, drilling, tunnel, etc.	Operation of Construction Equipment and Vehicles	Construction of Roads, tollgates, parking lots, Access roads for bridges and other related facilities	Traffic Restriction in construction area	Influx of construction workers, construction of base camp	After Construction	Operation Phase: Increase of Through Traffic and traveling speed	Appearance/ Occupancy of Roads and related building structures including tunnel and embankment	Increasing influx of settlers
Social Environment	26	Rights of Children		D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-	D-
	27	Infectious diseases such as HIV/AIDS		B-	D-	D-	D-	D-	D-	D-	D-	B	D-	D-	D-	D-
	28	Labor environment (including work safety)		B-	D-	D-	D-	D-	D-	D-	D-	B-	D-	D-	D-	D-
Other	29	Accidents	Accident hazards and safety	B-	D-	D-	D-	D-	B-	D-	D-	D-	B-	B-	D-	D-
	30	Cross Boundary impacts and climate change		B-	D-	D-	B-	D-	B-	B-	D-	D-	C-	C-	D-	D-

Note) Rating:

A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown (serious impacts are not expected, but survey and analysis shall be done) No mark: Few impacts are expected. Detailed quantitative survey is not necessary. (+: Positive impacts, - : Negative impacts)

Source: JICA Study Team

Table 12.4.4 Reasons for Draft Scoping on MTHL

Area	No.	Impacted Item (Item on the Rapid EIA 2012)	Rating (Scoping stage)		Reasons of the Rating
			Pre/During Construction	After Construction	
Pollution	1	Air Pollution (Air quality/ Siting of borrow pits and quarry material areas)	B-	B-	**Construction phase:** Temporary negative impacts are expected on air quality due to construction machines and equipment. **Operation phase:** Negative impact is expected due to the increase in traffic numbers.
	2	Water Pollution (Water Quality/ Construction of labour camp/ Siting of borrow pits and quarry material areas)	B-	D-	**Construction phase:** Turbid water may be generated by earth works and excavation in the water where bridges are planned. Additionally Organic polluted water may be discharged from base camp. **Operation phase:** No serious impacts are expected(No service area is planned in this project)
	3	Waste (Solid waste management/ Construction of labour camp/ Topography, Soil and Geology)	B-	D-	**Construction phase:** Construction waste such as waste soil and cut trees are expected. Additionally, domestic waste and night soil may be generated from construction base camp. **Operation phase:** No serious impacts are expected(No service area is planned in this project)
	4	Soil Contamination (Topography, Soil and Geology/ Siting of borrow pits and quarry material areas)	C-	D-	**Construction phase:** Excavated soil in the mudflat and mining area may contain polluted soil such as heavy metals. **Operation phase:** No impacts are expected
	5	Noise and Vibration (Ambient Noise)	B-	B-	**Construction phase:** Noise generation is expected due to works of construction machines and equipment. **Operation phase:** Traffic Noise and Vibration is expected because of the increase in traffic numbers and travelling speed.
	6	Ground subsidence	D-	D-	**Construction and operation phase:** No impacts are expected since activities which cause ground subsidence are not expected.
	7	Odour	D-	D-	**Construction and operation phase:** No impacts are expected since no activities which cause odour are expected.
	8	Sediment quality (Topography, Soil and Geology(No.4))	C-	D-	**Construction phase:** Excavated soil in the mudflat may contain polluted soil such as heavy metals. **Operation phase:** No impacts are expected
Natural Environment	9	Protected Area (Reserved Forest and Fauna)	B-	B-	**Construction and operation phase:** There are no national parks on the alignment, however, the alignment passes through a part of the coastal regulation zone (CRZ) and Important Bird Area (IBA). Although an environmental clearance (EC) for the CRZ has been given from MOEF in 2013 and 2016, the degree of impact should be confirmed.
	10	Ecosystem (Ecology and Biodiversity/ Ecology/Construction of labour camp)	B-	B-	**Construction and Operation phase:** Some considerable species are observed in the project area. The degree of impacts will be evaluated based on literature surveys and interview surveys with specialists.
	11	Hydrology	B-	B-	**Construction and Operation phase:** Construction of bridge may change hydrological situation of the rivers.
	12	Topography and geology (Topography, Soil and Geology)	B-	B-	**Construction and operation phase:** No considerable topography or geological sites are located in the project area, thus no impact is expected. However embankment section may have risks of land slide.

Area	No.	Impacted Item (Item on the Rapid EIA 2012)	Rating (Scoping stage)		Reasons of the Rating
			Pre/During Construction	After Construction	
Social Environment	13	Involuntary resettlement	B-	D-	**Pre-Construction phase:** Illegal occupants are observed in Sewri area, and the number of affected persons will be identified on the SIA Survey. **Operation phase:** No impact is expected
Social Environment	14	The Poor	C-	D-	**Pre-Construction phase:** Impacts will be assessed based on the SIA Survey. **Operation phase:** No impact is expected
Social Environment	15	Indigenous and ethnic people	D-	D-	**Pre-Construction and Operation phase:** Few impacts are expected
Social Environment	16	Local economy such as employment and livelihood	C-	D-	**Pre-construction phase:** Livelihood of residents and shopkeepers may be affected by land clearance. The degree of impacts will be assessed on the SIA Surveys. **Operation phase:** Few impacts are expected
Social Environment	17	Land use and utilization of local resources (Quality of Life/Fisheries)	C-	C-	**Pre-construction phase:** No agriculture land is observed, but quarry sites are located on the Navi Mumbai side. Additionally, construction of bridge may affect the fishermen. Thus the degree of impacts to fishermen will be assessed by the SIA Surveys. **Operation phase:** It is not likely to have adverse impacts since appropriate land management along the road on the Navi Mumbai side is planned by CIDCO. w impacts are expected However construction of bridge may affect to fishermen in the sea. Thus the degree of impacts to fishermen will be assessed by the SIA Surveys.
Social Environment	18	Water Usage (Water Quality)	D-	D-	**Construction phase:** Few impacts are expected since the major structure is a viaduct and earthwork is limited in the project area. Furthermore, there are no residential areas in the earth work area, thus it is not likely to have any impacts on this item. **Operation phase:** Few impacts are expected.
Social Environment	19	Existing social infrastructures and services	B-	D-	**Pre-Construction and Construction phase:** Some schools, temples and public facilities may be affected by land acquisition for the road construction. Thus the degree of impacts will be assessed on the SIA Surveys. **Operation phase:** Few impacts are expected because the major structure is a viaduct.
Social Environment	20	Social institutions such as local decision making institutions	D-	D-	**Construction and operation phase:** Impacts are not expected, since the local decision making institute will continue after the road construction.
Social Environment	21	Misdistribution of benefits and damage (Quality of life)	D-	D-	**Construction and operation phase:** Misdistribution of benefits and damage caused by the road & bridge construction is not expected.
Social Environment	22	Local conflict of interests	B-	D-	**Construction phase:** Local inhabitants and local authorities may request action to ensure job opportunities as construction workers. **Operation phase:** No impact is expected
Social Environment	23	Cultural Heritage (Archaeological /Heritage)	D-	D-	**Pre-Construction and Construction Phase:** No registered cultural heritage is on the alignment. **Operation phase:** No impact is expected
Social Environment	24	Landscape (Aesthetics and landscape)	B-	B-	**Construction and operation phase:** Sewri Fort and Elephanta Island (World Cultural Heritage) is located near the alignment, thus the landscape from each site may change after construction of bridges and road.

Area	No.	Impacted Item (Item on the Rapid EIA 2012)	Rating (Scoping stage)		Reasons of the Rating
			Pre/During Construction	After Construction	
Social Environment	25	Gender	C-	D-	**Pre-Construction and Construction phase:** Male head of the household may seize the initiative in India, thus actual situation should be confirmed on SIA Survey. **Operation phase:** Few impacts are expected
	26	Rights of children	D-	D-	**Construction and operation phase:** Few impacts are expected
	27	Infectious diseases such as HIV/AIDS	B-	D-	**Construction phase:** Infectious diseases such as STDs could be spread due to inflow of construction workers. Furthermore, alteration to ground by cutting and filling may create habitats for mosquitos that can transmit dengue fever. **Operation phase:** Road operation which causes infectious diseases is not expected.
	28	Labour environment	B-	D-	**Construction phase:** Construction work environment needs to be considered in accordance with relevant laws and regulations. **Operation phase:** No impact is expected.
Other	29	Accidents (Accident hazards and safety)	B-	B-	**Construction phase:** Construction vehicles may use existing local roads near residential areas, thus the number of traffic accidents may increase. **Operation phase:** Risk of traffic accidents on the new road is expected to increase due to increase of traveling speed.
	30	Cross boundary impacts and climate change	B-	C-	**Construction phase:** Deforestation and operation of construction machines may increase greenhouse gases such as CO2. **Operation phase:** Reduction of distance between Navi Mumbai and Mumbai area will cut the amount of greenhouse gases such as CO2. Furthermore, 5 times the quantity of cut trees will be replanted, thus such replantation will have positive impacts. However construction of the sealink may generate additional traffic flow from developed areas, thus the impact should be estimated by quantitative forecast.

Note) Rating:

A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown (serious impacts are not expected, but survey and analysis shall be done) No mark: Few impacts are expected. Detailed quantitative survey is not necessary.

Source: JICA Study Team

12.4.4 Baseline Survey and Analysis Methodology

The expected baseline survey and analysis methodologies are shown below.

Mainly 1) measurement of vibration, 2) updating of statistical data and current secondary data and 3) quantitative forecast on air, noise, vibration and water quality based on the latest traffic condition will be undertaken based on the Rapid EIA 2012, and then the EIA will be modified and approved by MMRDA.

Methodologies of the baseline survey and analysis are shown in the following table.

Table 12.4.5 Draft Baseline Survey and Analysis Methodology on MTHL

Area	No.	Item (on Rapid EIA 2012)	Rating		Survey Methodology	Forecast Methodology
			Pre and during Const.	Operation		
Pollution	1	Air pollution (Air quality/ Siting of borrow pits and quarry material areas)	B-	B-	-Site Survey：Not conducted -Literature Survey： Refer to Rapid EIA in 2012 and the latest monitoring data, if any	**During Construction Phase:** Qualitative analysis **Operation Phase:** - Quantitative analysis (Puf model : calm wind model)
	2	Water pollution (Water Quality/ Construction of labour camp/ Siting of borrow pits and quarry material areas)	B-	D-	-Site Survey：Not conducted -Literature Survey： Refer to Rapid EIA in 2012 and the latest monitoring data, if any	**During Construction Phase:** Qualitative analysis and quantitative analysis based on other cases
	3	Waste (Solid waste management/ Construction of labour camp/ Topography, Soil and Geology)	B-	D-	Refer to Rapid EIA in 2012 and the preparatory survey by JICA	**During Construction Phase:** Quantitative forecast of cutting trees and excavated soil based on construction plan
	4	Soil Contamination (Topography, Soil and Geology/ Siting of borrow pits and quarry material areas)	C-	D-	-Site Survey：Not conducted -Literature Survey： Refer to Rapid EIA in 2012 and the latest monitoring data, if any	**During Construction Phase:** Qualitative forecast based on the Rapid EIA 2012
	5	Noise and Vibration (Ambient Noise)	B-	B-	-Site Survey: Noise : Not conducted Vibration: measurement at 2 points for 24 hours -Literature Survey: Refer to Rapid EIA in 2012 and the latest monitoring data	**During Construction Phase:** Quantitative or qualitative analysis based on other cases. **Operation Phase:** - Quantitative analysis (ASJ CN-Model 2008)
	6	Ground Subsidence (Topography, Soil and Geology(No.4))	D-	D-	－(surveys on this item are not required due to no impacts)	Not required because few impacts are expected
	7	Odour	D-	D-	－(surveys on this item are not required due to no impacts)	Not required because few impacts are expected
	8	Sediment Quality (Topography, Soil and Geology(No.4))	C-	D-	-Site Survey：Not conducted -Literature Survey： Refer to Rapid EIA in 2012 and the latest monitoring data, if any	**During Construction:** Qualitative analysis based on the Rapid EIA in 2012
Natural Environment	9	Protected Area (Reserved Forest and Fauna)	B-	B-	-Site Survey：Not conducted -Literature Survey： Refer to Rapid EIA in 2012 and the latest monitoring data, if any	**During Construction and Operation Phase:** Qualitative analysis based on the Rapid EIA in 2012 and relevant monitoring data, if any
	10	Ecosystem (Ecology and Biodiversity/ Ecology/Construction of labour camp)	B-	B-	-Site Survey：Not conducted -Literature Survey： Refer to Rapid EIA in 2012 and the latest monitoring data, if any Interview survey with specialist and other project study cases in Japan are referred to.	**During Construction and Operation Phase:** Qualitative analysis based on the Rapid EIA in 2012, interview survey with specialists and relevant monitoring data, if any

Area	No.	Item (on Rapid EIA 2012)	Rating		Survey Methodology	Forecast Methodology
			Pre and during Const.	Operation		
Natural Environment	11	Hydrology	B-	B-	- Site Survey: Not conducted - Literature Survey: Refer to secondary data, the latest monitoring data and results of this JICA Survey, if any	**During construction and operation phase:** Refer to other quantitative analysis
	12	Topography and geology (Topography, Soil and Geology)	B-	B-	-Site Survey：Not conducted -Literature Survey： Refer to Rapid EIA in 2012, the latest monitoring data and topo. & geo. survey result in this JICA Survey	**During construction and operation phase:** Qualitative analysis
Social Environment	13	Involuntary resettlement	B-	D-	Refer to SIA survey	**During construction phase:** Quantitative analysis based on SIA surveys
	14	The poor	C-	D-	Refer to SIA survey	**During construction phase:** Quantitative analysis based on SIA surveys
	15	Indigenous and ethnic people	C-	D-	- (surveys on this item are not required due to no impacts)	Not required because few impacts are expected
	16	Local economy such as employment and livelihood (Quality of Life/Fisheries)	C-	D-	Refer to SIA survey	**During construction phase:** Quantitative or qualitative analysis based on SIA surveys
	17	Land use and utilization of local resources (Land use/Fisheries)	C-	C-	Refer to SIA survey	**During construction phase:** Quantitative or qualitative analysis based on SIA surveys
	18	Water Usage (Water Quality)	D-	D-	- (surveys on this item are not required due to no impacts)	Not required because few impacts are expected
	19	Existing social infrastructures and services (Utility services and community severance)	B-	D-	Refer to SIA survey	**During construction phase:** Qualitative analysis based on SIA surveys
	20	Social institutions such as local decision making institutions	D-	D-	- (surveys on this item are not required due to no impacts)	Not required because few impacts are expected
	21	Misdistribution of benefits and damage (Quality of life)	D-	D-	- (surveys on this item are not required due to no impacts)	Not required because few impacts are expected
	22	Local conflict of interests	B-	D-	Refer to SIA survey	**During construction phase:** Qualitative analysis based on SIA surveys
	23	Cultural Heritage (Archaeological /Heritage)	D-	D-	- (surveys on this item are not required due to no impacts)	Not required because few impacts are expected
	24	Landscape (Aesthetics and landscape)	B-	B-	-Site Survey: Visual Survey at Sewri and Elphanta Island (April 2015)	**During Construction and Operation Phase:** Qualitative analysis or preparation of Photo montage
	25	Gender	C-	D-	Refer to SIA survey	**During construction phase:** Quantitative or qualitative analysis based on SIA surveys

Area	No.	Item (on Rapid EIA 2012)	Rating		Survey Methodology	Forecast Methodology
			Pre and during Const.	Operation		
Social Environment	26	Rights of Children	D-	D-	- (surveys on this item are not required due to no impacts)	Not required because few impacts are expected
	27	Infectious diseases such as HIV/AIDS	B-	D-	Refer to SIA survey	**During construction phase:** Qualitative analysis based on SIA surveys
	28	Labour environment including work safety	B-	D-	Legal framework regarding labour environment and safety shall be clarified and the safety shall be secured. Relevant laws and actual situation shall be discussed with relevant organizations.	Qualitative and quantitative analysis based on the construction plan
Other	29	Accidents (Accident hazards and safety)	B-	B-	Literature Survey: Statistical data from police department, if any	**During Construction and Operation Phase:** Quantitative analysis based on statistical data
	30	Cross Boundary impacts and climate change	B-	C-	Site Survey: Not conducted Literature Survey: Refer to the drawings and SIA survey results (number of cut trees)	**During Construction and Operation Phase:** Quantitative analysis based on generation of CO2

Note) Rating:

A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown (serious impacts are not expected, but survey and analysis shall be done) No mark: Few impacts are expected. Detailed quantitative survey is not necessary.

Source: JICA Study Team

12.4.5 Summary of Baseline Survey and Forecast

(1) Summary of Baseline Survey, Forecast and Evaluation

The Result of the Baseline and Forecast are shown in Table 12.4.6.

Major measured and analysed data on the Rapid EIA and Supplemental EIA are shown below in Table 12.4.6.

Table 12.4.6 Result of Baseline and Forecast on Main Items

Area	No.	Item (on Rapid EIA 2012)	Rating (Scoping Stage)		Summary of Result		
			Pre and during Const.	Operation	Baseline	Forecast	Mitigation Measures and Evaluation
Pollution	1	Air pollution (Air quality/ Siting of borrow pits and quarry material areas)	B-	B-	The value of SPM is high and fails the Indian standards and IFC standards. Other items such as CO, NO2 and SO2 are low and meet the standards. Note) SPM is between 92 (Elephanta Island) and 393 μg/m^3 (Sewri) on Rapid EIA 2012 (monitored in 2011)	[During construction] Exhaust gases including CO, NO2, SO2 and SPM are discharged from construction machines and may impact the nearby residential area. However this adverse impact is not serious because operation time is limited and most of the construction area is on the ocean. [After Construction] Forecast impacts with background density meet Indian standard and IFC.	[During const.] Exhaust gases and dust are produced by the construction activities. However the adverse impact is not serious because of long distance from residential area, bridge structure, underwater construction etc., and the impacts can be minimized by mitigation measures such as water sprinkling. [After const.] Air quality such as PM10, CO, NO2 and SO2 density increases along the road during operation phase. However the area where the concentration increases is very limited, and road-contributed density is very small, and the total density at roadside points more than meet standard values, thus it is not likely to give significant impacts on air quality.
	2	Water pollution (Water Quality/ Construction of labour camp/ Siting of borrow pits and quarry material areas)	B-	D-	DO in all Zones, at high tide Zone II and III in low tide exceeds standard values. pH range and BOD values are within the permissible range of the standard. The highest COD value was found to be 105mg/L and within acceptable limits of 250mg/L.	[During const.] Turbid water is generated by earth works and excavation. Spillage of oil and grease from machines and storage is to be avoided or mitigated by appropriate management and maintenance.	[During const.] The impacted time, duration and area is limited. And the impacts are minimized by planned mitigation measures such as sedimentation ponds and the casing. Thus, the degree of impact is acceptable level.
	3	Waste (Solid waste management/ Construction of labour camp/ Topography, Soil and Geology)	B-	D-	Domestic waste from households is disposed of in a designated dumping site. Night soil in the city area is treated in sewerage plant. Construction waste such as concrete and cut trees are used for construction material. Muck soil is tested, treated and disposed of at designated site.	[During const.] Excavated muck soil from the sea section is estimated at around 99,000 m^3. General waste soil on the land section is 2,400m^3. Cut mangrove volume is approximately 13.9m^3. Domestic waste and night soil is generated at base camp for workers, estimated volume is around 760kg/day.	[During const.] All generated construction waste and domestic waste are reused and/or disposed of under adequate mitigation measures, thus it is not likely to have significant impacts on this item.

Area	No.	Item (on Rapid EIA 2012)	Rating (Scoping Stage)		Summary of Result		
			Pre and during Const.	Operation	Baseline	Forecast	Mitigation Measures and Evaluation
Pollution	4	Soil Contamination (Topography, Soil and Geology/ Siting of borrow pits and quarry material areas)	C-	D-	According to Rapid EIA 2012, only concentration of Lead is exceeding the standard level.	[During const.] Excavated muck soil from the sea section is estimated around 99,000 m^3. General waste soil on the land section is 2,400m^3.	[During const.] All generated construction waste soil are reused and/or disposed of after soil analysis under adequate mitigation measures, thus it is not likely to give significant impacts on this item.
	5	Noise and Vibration (Ambient Noise)	B-	B-	The existing noise levels are exceeding the permissible limit except for Mahul near the power plant industrial area. All vibration levels meet traffic vibration standard of Japan. Note) daytime : Night time Noise dB(A) Leq Sewri: 75-76 : 60-62 Shivaji Nagar: 62-65 : 54-60 Vibration: dB Sewri: 48-49 : 48-49 Shivaji Nagar: 48-49 : 48-49	[During const.] Estimated construction noise is less than 85dB(A). With regard to construction vibration, it is estimated at less than 75dB. The noise and vibration during the construction of MTHL can be expected to be less than the Japanese standard. [After const.] All forecast noise and vibration levels meet Indian standard and Japanese standard. Note) Noise Standard along road: 75 dB(A) for daytime and 70 dB(A) for night time, Vibration Standard : 65dB for daytime and 60 dB for night time along the road	[During const.] In the daytime, it is expected that impacts from construction activities will be reduced by mitigation measures such as selecting low-noise equipment, reporting the construction schedule and meeting standard values, thus it is not likely to give serious impacts to surrounding area. In the night time, the construction activities will give a degree of impacts to the nearest residential area, however, implementation of the mitigation measures minimize the impacts and the degree of impacts will be at an acceptable level for inhabitants. [After const.] The forecast noise and vibration levels meet standard values, thus it is not likely to have a significant impact on this item. Since the noise-reducing effect of the noise barrier is not very high, it is not necessary to build a noise barrier.
	8	Sediment Quality (Topography, Soil and Geology(No.4))	C-	D-	According to Rapid EIA 2012, only the concentration of Lead is exceeding standard level.	[During const.] Excavated muck soil from the sea section is estimated around 99,000 m^3.	[During const.] All generated construction waste soil are reused and/or disposed of after soil analysis under adequate mitigation measures, thus it is not likely to give significant impacts.
Natural Environment	9	Protected Area (Reserved Forest and Fauna)	B-	C-	The proposed alignment passes through the Coastal Regulation Zone and Important Birds Area.	Totally 2.25km of the alignment has been classified as CRZ. CRZ-I : 2.0km CRZ-II: 0.25km The alignment is passing through Important Bird Areas for about 5km in Sewr side, and some impacts are expected.	It is not likely to give serious impacts under implementation of appropriate mitigation measures. With regard to IBA, it is confirmed that the Article 17 of IFC Performance standard 6 is complied with in accordance with JICA Guidelines. (see; （2）Detailed description regarding Ecosystem and Protected area)

Area	No.	Item (on Rapid EIA 2012)	Rating (Scoping Stage)		Summary of Result		
			Pre and during Const.	Operation	Baseline	Forecast	Mitigation Measures and Evaluation
Natural Environment	10	Ecosystem (Ecology and Biodiversity/ Ecology/ Construction of labour camp)	B-	C-	On Rapid EIA 2012, 17 bird species, 4 butterflies, 7 fauna species in benthos have been recorded. In the migratory birds survey in 2008, totally 78 bird species have been observed. Out of 78 bird species in the surveys of 2008 and 2012, 15 species are categorized as migratory birds, only 1 species, the Lessor Flamingo is categorized as NT level (Nearly Threatened). Of the other 66 species, 5 species are categorized as NT and VU (Vulnerable) However it is supposed that such 6 species are using the project area as a feeding area, not nesting area. Note) NT: 1) Black Headed Ibis, 2) Painted Stork, 3) Black Tailed Godwit and 4) Eurasian Curlew VU: Greater Spotted Eagle	[During const.] Fauna Turbid water due to activities in the river and inflowing from construction area may impact on aquatic fauna. Part of the mudflat ecosystem is lost by the implementation of development projects. The drying of the mudflat may impact on food resources of migratory birds. If the base camp and construction yard are installed near the feeding grounds of migratory birds, migratory birds may avoid the area and fly away to other mudflats in Mumbai harbour temporarily. However, in general, such birds may come back to the same place throughout a period of time. Flora Deforestation may impact on mangrove areas. However, the drying of the mudflat may increase the mangrove area in some limited areas around the piles. It is expected that mangrove cut area is 0.1176 ha in CRZ and 200m^2 out of the CRZ. The surrounding area of the piles may be dried, and it may create a condition for increase of mangrove. [After const.] Fauna Some migratory birds may be accidentally killed on the road and bridge due to increase of traffic volume. The presence of the elevated road creates a risk of inhibiting the flight path of the Flamingo. Impact on the Flamingo roost is a concern because of the road lighting. According to the result of the forecast on hydrology, existence of piers does not give significant impacts on the entire tidal flow and physical condition of the mudflat, thus it is expected that such insignificant impacts on tidal flow and physical condition of mudflat does not give adverse	[During const.] Construction activities of MTHL may cause noise during construction stage, thus some group of migratory birds may avoid the adjacent area and flyaway to other area in Mumbai basin temporarily. However since several mitigation measures will be conducted, the migratory birds may get back again gradually. Additionally turbidity from excavated area in the sea and cutting mangrove area will be minimized by appropriate mitigation measures. [After const.] Vehicle travelling, making noise and existence of viaduct may give adverse impacts for migratory birds. For minimization of these impacts, not only CRZ specification conditions, but also additional measures such as consideration of lighting system not to give impacts on Flamingo's roosting area are planned. With regard to mangrove, dried are around piles may give condition for mangrove growing, and 5 times of cutting mangrove shall be planted in the designated area under CRZ specific condition and permission of Maharashtra High-court. When unexpected events and phenomena has been confirmed after construction and during construction, appropriate to take action in consultation with relevant organizations. Thus, it is not likely to give serious impacts on project including mudflat ecosystem under implementation of appropriate mitigation measures.

Area	No.	Item (on Rapid EIA 2012)	Rating (Scoping Stage)		Summary of Result		
			Pre and during Const.	Operation	Baseline	Forecast	Mitigation Measures and Evaluation
Natural Environment						impacts on ecosystem in the mudflat. Flora The drying of the mudflat may be caused by the existence of the bridge piers, however, such area is limited to around piers and may provide an environment in which mangrove grow. With regard to distribution of mangrove seeds, since the construction of the bridge does not give impacts on tidal flow in Mumbai basin significantly, this situation means that the project does not give adverse impacts on distribution and provision of mangrove seeds in the basin.	
	11	Hydrology	B-	B-	The project area has a Savana Climate and dry-rainy seasons are distinguished clearly. Mumbai basin is 1,358 ha with some rivers and Thane creek. Tidal flow varies with location, time and depth. The nautical chart indicates currents near MTHL alignment from 1.03 to 1.54 m/s.	According to hydraulic analysis using FEM (Finite Element Method) on the report of the Central Water and Power Research Station (CWPRS), at the point nearest to the project alignment No.3 named Pir-Pau, there is negligible increase and decrease in current strength during ebb and flood tide (the difference is 0.05-0.15m/s). It was also reported that it will not have any hydraulic impact on functioning of other points.	Although Hydraulic impacts are negligible, the monitoring of the tidal level and current should be conducted at the bridge sites by installing a water alarm system during and after the construction of the bridge. Furthermore, bathymetric surveys around the MTHL should be conducted periodically to confirm that the sea bed level is higher than the design scour depth. When the sea bed gets closer to the design scour depth, the sea bed surrounding the pier must be protected by appropriate material such as riprap or geobags.
	12	Topography and geology (Topography, Soil and Geology)	B-	B-	The area is classified in 5 sections based on topographic features on site. 1: flat land 2: tidal area (partially mangrove area) 3: sea area 4: sea and tidal area (partially mangrove area) 5: hills and rocky mountainous area	No considerable topography and geological sites are located in the project area, thus no impact is expected. However the embankment sections may have risks of land slide.	Implementation of appropriate designing and mitigation measures such as slope protection and periodic monitoring & maintenance will mitigate the expected impacts. Thus it is not likely to give significant impacts on stability of the earthwork sections.

Area	No.	Item (on Rapid EIA 2012)	Rating (Scoping Stage)		Summary of Result		
			Pre and during Const.	Operation	Baseline	Forecast	Mitigation Measures and Evaluation
Social Environment	13	Involuntary resettlement	B-	D-	A total of 282 project affected families and 1,272 project affected persons are recorded.	[During const.] Total Number of PAFs and relocated persons is 282 and 1,272, respectively. They all are to be displaced and are identified based on SIA survey.	[During const.] Implementation of appropriate compensation, resettlement and social assistance will mitigate expected adverse impacts, thus it is not likely to give serious impacts on this item.
	14	The poor	C-	D-	In the Sewri area, 146 (58.9 %) of PAHs earn income ranging from 50,000 to 100,000 INR while 96.3% of the residents have yearly expenditure less than 300,000 INR. 4 PAPs are categorized as under-poverty line in the survey area Sewri Section.	[During const.] 4 PAPs under poverty line to be displaced are identified. Such displaced PAPs may have income reduction due to increase of commuting time and loss of job temporarily.	[During const.] Although the displaced house heads may have risks of income reduction, implementation of appropriate compensation and social assistance will mitigate expected adverse impacts, thus it is not likely to give serious impacts on this item.
	16	Local economy such as employment and livelihood (Quality of Life/Fisheries)	C-	D-	More than half of household heads are private service workers, and approximately 23.7% engage in business and trade activities.	[During const.] According to census and economic surrey on SIA, loss of income is expected for private sector workers and Non-fishing labourers mainly.	[During const.] Although 447 PAPs and their properties are impacted by the project, implementation of appropriate compensation and social assistance will mitigate expected adverse impacts, thus it is not likely to give serious impacts on this item.
	17	Land use and utilization of local resources (Land use/Fisheries)	C-	C-	Some areas are residential and commercial shops. Some house heads and shop owners have a lease contract with MPT in Sewri Section. Additionally, in the sea section, traditional fishermen have their own customary fishing grounds. Detailed data is shown in SIA report.	[During const.] Approximately 8.6 ha commercial and housing land will be used for a construction site and yard. In the sea section, customary fishing grounds will be reduced by the construction. [After const.] The area surrounding the MTHL may be used for commercial area and small factory compounds without any permission from authorities.	[During const.] Although totally the 8.6ha compound in Sewri area, and the customary fishing area in the sea section is affected by the project, implementation of appropriate compensation and social assistance will mitigate expected adverse impacts, thus it is not likely to give serious impacts on this item. [After const.] Appropriate land use management will give positive impacts in the affected area from the view point of economic and natural environment considerations.
	19	Existing social infrastructures and services (Utility services and community severance)	B-	D-	According to SIA survey, no sensitive receptors such as schools, hospitals or local meeting places are observed in the affected area. However community level temples, mosques and women's group accommodations are recorded in the project area.	[During const.] Traffic restriction area in the project area, inhabitants and commuting people including students will spend much more time than usual for passing such construction area. Additionally displacement of community level temples & mosques and women's group facilities may give adverse impacts on prayers and group members.	[During const.] Construction activities will give adverse impact on access to public facilities and commuting time, additionally displacement of community level temples and mosque will be caused. However implementation of mitigation measures will minimize the impacts. Thus it is not likely to give serious impacts on this item.

Area	No.	Item (on Rapid EIA 2012)	Rating (Scoping Stage)		Summary of Result		
			Pre and during Const.	Operation	Baseline	Forecast	Mitigation Measures and Evaluation
Social Environment	22	Local conflict of interests	B-	D-	According to comments in the local level stakeholder meetings and socialization meetings on SIA, local inhabitants and local authorities requested to ensure job opportunities as construction workers would be available.	[During const.] Conflicts or disputes between communities may arise if there is imbalance in hiring workers .	[During const.] The workers hired from other areas may have conflicts with inhabitants however implementation of mitigation measures will minimize the impacts. Thus it is not likely to give serious impacts on this item.
	24	Landscape (Aesthetics and landscape)	B-	B-	Sewri fort is a registered heritage site and Elephant Caves, which is designated as a World Cultural Heritage site, is located within 5 km from the project area. However visitors in the entrance of Elephanta cave cannot see the project area, thus Sewri Fort is selected as the main view point.	The landscape elements are mainly mangrove trees, mudflat and skyline of the opposite hilly area. A part of the mangrove and mudflat are obstructed by the construction of MTHL.	The changes before and after construction of Sealink are unavoidable. However the structure does not give serious impact on the skyline of the opposite hilly area. Additionally, a Non-Objection Certificate regarding passing through or near heritage sites had been issued from the relevant authority in 2003. Thus it is evaluated that the project does not give serious impacts on this item.
	25	Gender	C-	D-	--	[During const.] According to the result of a basic economic survey on SIA, no gender gaps or risks caused by the project on this item are identified.	--
	27	Infectious diseases such as HIV/AIDS	B-	D-	According to interview surveys with inhabitants, major infectious diseases are dengue fever, malaria and diarrhoea. However such statistical data is not recorded for this area.	[During const.] Hired construction workers and skilled equipment operators may have contact with the inhabitants and spread infectious diseases. Additionally puddles in the construction area and insufficient drainage could provide a habitat for mosquitos carrying dengue fever and malaria. [After const.] Insufficient maintenance of drainage and bridges may provide some puddles and small ponds, such environment may be a habitat for mosquito larva.	Inflow of workers during construction may provide an opportunity for spreading infectious diseases. Additionally, insufficient and inappropriate drainage and maintenance during and after construction may also provide habitats for mosquito larvae. However, implementation of mitigation must prevent and minimize these adverse impacts. Thus it is not likely to give serious impacts on this item.
	28	Labour environment including work safety	B-	D-		[During const.] Working without considering labour laws and regulations in the construction area may cause accidents. For instance, working without out helmets or work boots have risks to injure head and foot.	[During const.] The labour environment is secured when the contractor, under observation of general consultant, follows Indian laws and international standards.

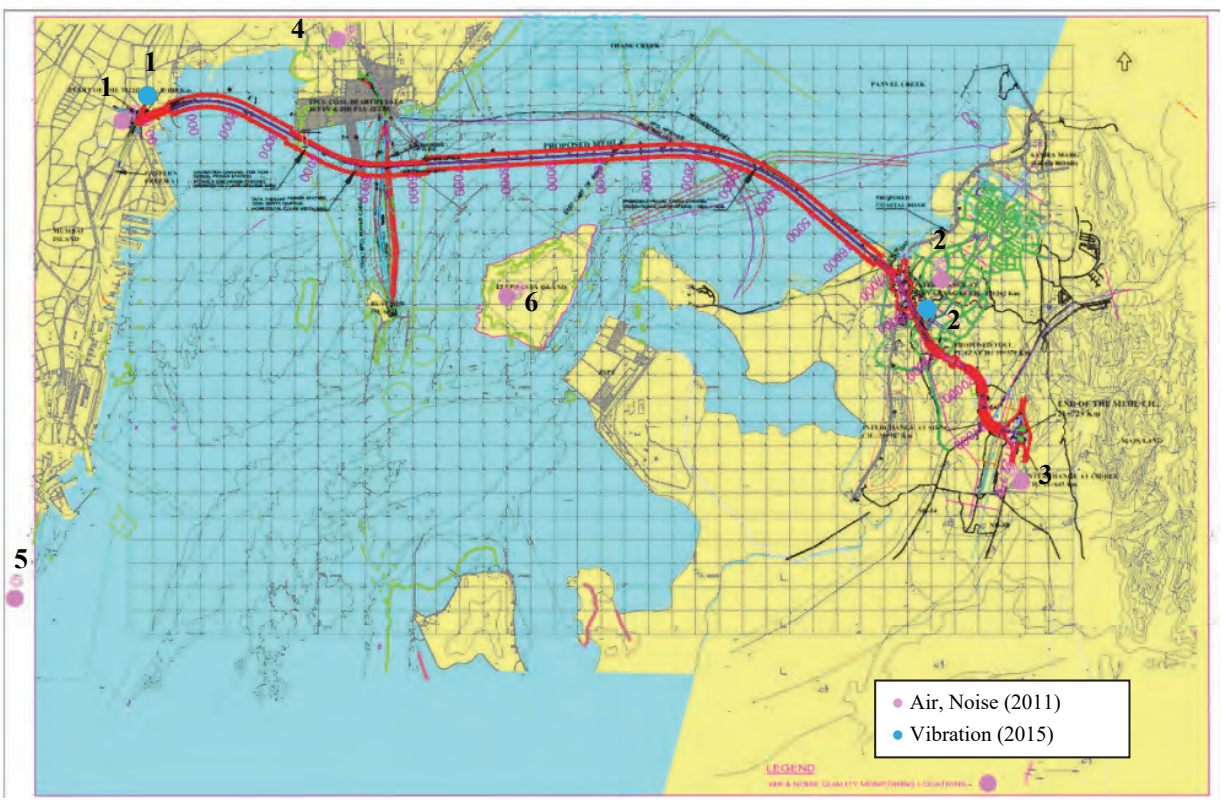
Area	No.	Item (on Rapid EIA 2012)	Rating (Scoping Stage)		Summary of Result		
			Pre and during Const.	Operation	Baseline	Forecast	Mitigation Measures and Evaluation
Other	29	Accidents (Accident hazards and safety)	B-	B-	According to statistics from the Mumbai Police Department, the number of fatal and injury cases in 2014 was 350 and 14,684 persons respectively.	[During const.] Construction machines and trucks will be operated for 4.5 years. Thus, risks of traffic accidents increase on the commuter roads. [After const.] Number of traffic accidents may increase due to the increase in traffic numbers and travelling speed after construction of MTHL.	Traffic volume will increase during and after construction of MTHL, hence, the number of accidents is expected to increase in conjunction with traffic volume. However implementation of mitigation will prevent and minimize these adverse impacts. Thus, it is not likely to give serious impacts.
	30	Cross Boundary impacts and climate change	B-	C-	--	Total generated CO2 volume is analysed with and without MTHL respectively. 1. Current Condition in 2015 With Project: ---- Without Project: 454,386 t/year 2. During Construction in 2018 With Project: 602,173 t/y Without Project: 591,914 t/year 3. During Operation Phase in 2032 With Project: 984,813 t/y Without Project: 986,574 t/year With project case, CO2 volume during construction is higher than without project case, however, this volume during operation in 2032 and 2042 gives positive impacts.	[During const.] Compensatory mangrove replanting is required in accordance with CRZ clearance on 19th July 2013. [After const.] Not required

Note) A: Serious impact is expected. B: Some impact is expected. C: Extent of impact is unknown (serious impacts are not expected, but survey and analysis shall be done) No mark: Few impacts are expected. Detailed quantitative survey is not necessary.

Source: JICA Study Team

(2) Major measured data and result of analysis

Measured and quantitative analysis data based on the Rapid EIA and Supplemental EIA 2015 is shown below.



Source: Rapid EIA 2012 by MMRDA and Supplemental EIA 2015 by JICA

Figure 12.4.1 Monitoring Points for Air, Noise and Vibration

Table 12.4.7 Monitored Ambient Air Quality (Rapid EIA 2012)

Location / Item	Chirle	Shivaji Nagar	Mahul	Sewri	Gate Way of India	Elephanta Island	UNIT	Indian Standards		(reference) IFC Standards	
								Industrial and Residential	Sensi-tive area	Mid Term	Standard Value
SPM	266.33 (exceeding)	135.58 (exceeding)	153.33 (exceeding)	393.58 (exceeding)	220 (exceeding)	92	μg/m^3	60[1)] 100[2)]	60[1)] 100[2)]	70[1)] 150[2)]	20[1)] 50[2)]
RSPM	79.92	42.83	48.42	141.00	48.5	24	μg/m^3				
SO2	53.67	31.33	32.02	66.85	37.1	12.6	μg/m^3	50[1)] 80[2)]	20[1)] 80[2)]	125[2)]	20[2)]
NO2	61.83	39.25	38.18	74.82	53.4	13.8	μg/m^3	40[1)] 80[2)]	30[1)] 80[2)]		40[1)] 200[2)]
NH3	21.97	10.15	16.70	31.32	26.2	28.5	μg/m^3	100[1)] 400[2)]	100[1)] 400[2)]		
Pb	0.61	0.33	0.47	0.82	BDL	BDL	μg/m^3	0.5[1)] 1.0[2)]	0.5[1)] 1.0[2)]		
CO	2.04	1.08	1.52	2.54	1.8	2.27	mg/m^3	2[3)] 4[4)]	2[3)] 4[4)]		
HC	1086.27	973.92	1090.42	1348.92	861	1083	μg/m^3				
O3	16.00	9.77	11.66	19.68	17.8	10.5	μg/m^3	100[3)] 180[4)]	100[3)] 180[4)]	160[3)]	100[3)]
C6H6	BDL	BDL	BDL	BDL	BDL	BDL	μg/m^3	5[1)]	5[1)]		
BaP	BDL	BDL	BDL	BDL	BDL	BDL	ng/m^3	1[1)]	1[1)]		
As	BDL	BDL	BDL	BDL	BDL	BDL	ng/m^3	6[1)]	6[1)]		
Ni	2.12	1.32	1.81	3.43	BDL	BDL	ng/m^3	20[1)]	20[1)]		

Note) 1)= Annual, 2)=24hours, 3)= 8hours, 4)=1hour, BDL: Below Detected Level

Source: Rapid EIA 2012 by MMRDA

Table 12.4.8 Ambient Air Standard in India

Pollutant	Time Weighted Average	Industrial, Residential Rural and Other Areas	Sensitive Areas
SO_2 ($\mu g/m^3$)	Annual * 24 hours**	50 80	20 80
NO_2 ($\mu g/m^3$)	Annual * 24 hours**	40 80	30 80
PM_{10} ($\mu g/m^3$)	Annual * 24 hours**	60 100	60 100
$PM_{2.5}$ ($\mu g/m^3$)	Annual * 24 hours**	40 60	40 60
O_3 ($\mu g/m^3$)	8 hours** 1 hour	100 180	100 180
Pb ($\mu g/m^3$)	Annual * 24 hours**	0.50 1.0	0.50 1.0
CO (mg/m^3)	8 hours** 1 hour**	2 4	2 4
NH_3 ($\mu g/m^3$)	Annual * 24 hours**	100 400	100 400
C_6H_6 ($\mu g/m^3$)	Annual *	05	05
BaP (ng/m^3)	Annual *	01	01
As (ng/m^3)	Annual *	06	06
Ni (ng/m^3)	Annual *	20	20

Source: Indian Pollution Control Board

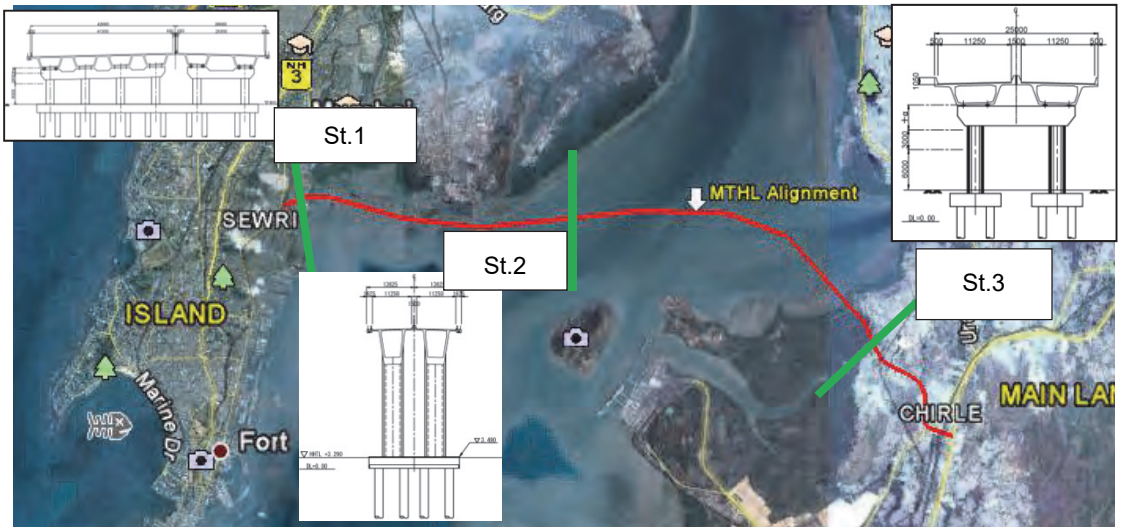
Table 12.4.9 Monitored Ambient Air Quality by MPCB and CPCB (2015)

Location / Item	Mumbai side		Navi Mumbai Side	UNIT	Indian Standards		(reference) IFC Standards	
	Bandra 24hrs; 17th Aug. 2015 by CPCB	Sion 24hrs; 17th Aug. 2015 by MPCB	Airoli 24hrs; 17th Aug. 2015 by CPCB		Industrial and Residential	Sensitive Area	Middle term objective	Guideline value
SPM	45.19 (meet standard)	-	50.88 (meet standard)	$\mu g/m^3$	100	100[2)]	150	50
RSPM		135.0	-	$\mu g/m^3$				
SO_2	16.33 (meet standard)	20.0 (meet standard)	14.37 (meet standard)	$\mu g/m^3$	80	80	125	20
NO_2	26.62	88.0	-	$\mu g/m^3$				200
CO	BDL	-	0.50 (meet standard)	mg/m^3	4	4		

Source: Rapid EIA 2012 by MMRDA

Source: Maharashtra State Pollution Control Board / Central Pollution Control Board

Figure 12.4.2 Air Quality Monitoring Locations by MPCB and CPCB



Source: JICA Study Team

Figure 12.4.3 The prediction points of Air and Noise & Vibration

Table 12.4.10 Result of Comprehensive Quantitative Forecast on Air Quality

	Point	ST-1			ST-2			ST-3			Standard
	Distance from the road	0m	10m	200m	0m	10m	200m	0m	10m	200m	
Indicator	Forecast Point										
SPM ($\mu g/m^3$)	Road surface	92.3	92.2	92.0	92.6	92.4	92.0	92.2	92.2	92.0	100[1)]
	Ground	92.3	92.2	92.0	92.2	92.2	92.0	92.2	92.1	92.0	
SO_2 ($\mu g/m^3$)	Road surface	12.9	12.9	12.6	13.5	13.2	12.7	12.9	12.8	12.6	80[1)]
	Ground	12.9	12.9	12.6	12.9	12.9	12.7	12.8	12.8	12.6	
NO_2 ($\mu g/m^3$)	Road surface	16.4	16.1	14.2	19.4	17.9	14.2	16.0	15.5	13.9	200[2)]
	Ground	16.5	16.2	14.2	16.1	15.9	14.2	15.4	15.2	13.9	
CO (mg/m^3)	Road surface	2.36	2.35	2.28	2.47	2.41	2.28	2.34	2.32	2.27	10[3)]
	Ground	2.36	2.36	2.28	2.35	2.34	2.28	2.32	2.31	2.27	

Note: 1)= Indian standard 2)=IFC standard, 3)= Japan Standard

Source: JICA Study Team

Source: Prepared by JICA Study Team based on Rapid EIA 2012

Figure 12.4.4 Water and Bottom Sedimentation Soil Quality Survey Points (Rapid EIA 2012)

Table 12.4.11 Physical & Chemical Attributes in Aquatic medium (Rapid EIA 2012)

Sites	Tide	pH [6.5-9]	Temp °C	Salinity ‰	Alkalinity ppm	Hardness mg/L	DO (mg/L) [3.0]	BOD (mg/L) [3 or 5]	COD mg/L
Zone II	High	7.5	28	32.95	14	46	1.20 **(exceeding)**	0.97	100
	Low	7.5	24.5	32.95	14	47	1.48 **(exceeding)**	1.32	105
Zone III	High	7	23.5	32.95	12	32	3.10	0.42	105
	Low	7	28	32.95	14.5	34	2.40 **(exceeding)**	0.42	76
Zone IV	High	7	26	32.95	10	36	3.03	0.83	100
	Low	7	28	32.95	9.5	30	2.05 **(exceeding)**	0.12	85

Note: [*****] standard values for Primary Water Quality Criteria for Class SW-IV Waters (For Harbour Waters)
Source: Rapid EIA 2012 by MMRDA

Table 12.4.12 Soil Quality Survey Results (Rapid EIA 2012)

Site	Monitored Item (Standard Values)						
	Zn mg/l (No Standard)	Cu µg/l (No Standard)	Total Manganese mg/l (No Standard)	Pb mg/l (0.01mg/l)	Cd mg/l (0.01mg/l)	Fe µg/l (No Standard)	Cobalt mg/l (No Standard)
Zone I (Sewri: Land)	1,800					Absent	Absent
Zone II (Sewri: Sea)	-	2,000		**0.483** (Exceeding)	0.00084 (Not exceed)	Absent	Absent
Zone III (Sea)	-		0.000053			Absent	Absent
Zone IV(Shivaji Nagar)	250	1,500	Absent	**0.498** (Exceeding)	0.0006 (Not exceed)	Absent	Absent
Zone V	-					Absent	Absent

Note: this table was made based on the description of Rapid EIA 2012
Source: Rapid EIA 2012 by MMRDA

Table 12.4.13 Ambient Noise Level (Rapid EIA 2012)

Location (Area Code)	Measured Date	Noise Levels in dB(A)							Standard
		Leq (Day)	Leq (Night)	Lmax	Lmin	L90	L50	L10	L_{eq}: day/night
1. Sewri (A)	03/10/11 to 05/10/11	76 (Exceeding)	61.1	80	50	54	72	78	75/70
	10/10/11 to 12/10/11	75.4 (Exceeding)	60.5	80	50	53	72	78	75/70
	20/10/11 to 22/10/11	75.4 (Exceeding)	61.6	80	50	53	72	78	75/70
	29/10/11 to 31/10/11	76 (Exceeding)	62.6	80	50	54	72	79	75/70
	1/12/11 to 03/12/11	75.8 (Exceeding)	61.8	80	50	53	72	79	75/70
	07/12/11 to 09/12/11	76 (Exceeding)	61.9	80	50	52	73	79	75/70
	14/12/11 to 16/12/11	75.8 (Exceeding)	61.8	80	50	52	73	79	75/70
	21/12/11 to 23/12/11	76 (Exceeding)	61.9	80	50	52	73	79	75/70
2. Shivaji Nagar (C)	03/10/11 to 05/10/11	62.6 (Exceeding)	54.6 (Exceeding)	69	44	46	59	65	55/45
	10/10/11 to 12/10/11	62.1 (Exceeding)	56.2 (Exceeding)	69	44	47	59	64	55/45
	20/10/11 to 22/10/11	62.1 (Exceeding)	56.4 (Exceeding)	69	44	48	59	64	55/45
	29/10/11 to 31/10/11	62.3 (Exceeding)	54.4 (Exceeding)	69	44	58	63	53	55/45
	1/12/11 to 03/12/11	62.2 (Exceeding)	55.3 (Exceeding)	69	44	46	59	65	55/45
	07/12/11 to 09/12/11	62.3 (Exceeding)	55.6 (Exceeding)	69	44	45	60	65	55/45
	14/12/11 to 16/12/11	65.3 (Exceeding)	59 (Exceeding)	72	47	51	62	68	55/45
	21/12/11 to 23/12/11	65.2 (Exceeding)	60 (Exceeding)	72	47	50	62	68	55/45

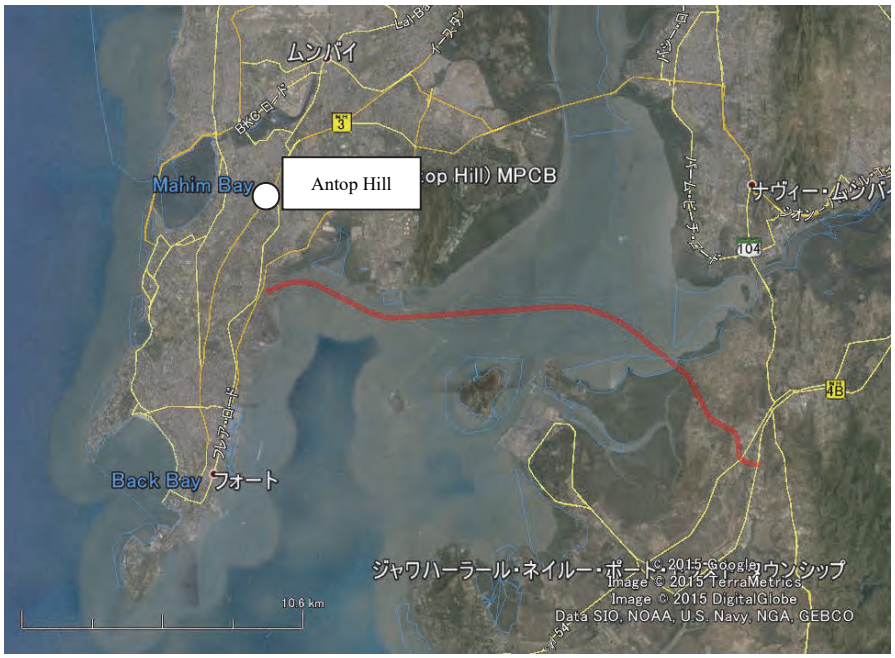
Location (Area Code)	Measured Date	Noise Levels in dB(A)							Standard
		Leq (Day)	Leq (Night)	Lmax	Lmin	L90	L50	L10	L_{eq}: day/night
3. Chirle (C)	03/10/11 to 05/10/11	67 (Exceeding)	60.4 (Exceeding)	72	49	50	63	70	55/45
	10/10/11 to 12/10/11	68 (Exceeding)	61.3 (Exceeding)	74	50	53	65	71	55/45
	20/10/11 to 22/10/11	68 (Exceeding)	61.2 (Exceeding)	75	50	53	65	70	55/45
	29/10/11 to 31/10/11	67.7 (Exceeding)	62 (Exceeding)	85	57	61	78	82	55/45
	1/12/11 to 03/12/11	68.5 (Exceeding)	62.2 (Exceeding)	75	50	52	65	71	55/45
	07/12/11 to 09/12/11	68.3 (Exceeding)	62.3 (Exceeding)	75	50	52	64	71	55/45
	14/12/11 to 16/12/11	68.7 (Exceeding)	60.8 (Exceeding)	75	50	52	62	72	55/45
	21/12/11 to 23/12/11	68.5 (Exceeding)	62.5 (Exceeding)	75	50	53	65	71	55/45
4.Mahul (I) (near power plant)	03/10/11 to 05/10/11	66.6	59.2	72	48	49	63	69	75/70
	10/10/11 to 12/10/11	67.2	59.9	74	49	51	64	70	75/70
	20/10/11 to 22/10/11	67.3	61	74	49	50	64	70	75/70
	29/10/11 to 31/10/11	67.2	59	74	49	52	64	70	75/70
	1/12/11 to 03/12/11	67.1	60.4	73	49	51	64	70	75/70
	07/12/11 to 09/12/11	67.1	61.5	74	49	52	64	69	75/70
	14/12/11 to 16/12/11	67.4	60.3	74	49	51	64	70	75/70
	21/12/11 to 23/12/11	67.7	61.6	74	49	53	64	70	75/70
5. Gate Way of India (B)	14/12/11 to 16/12/11	66.2 (Exceeding)	60.2 (Exceeding)	73	48	50	63	69	65/55
	21/12/11 to 23/12/11	66.3 (Exceeding)	59.3 (Exceeding)	73	48	52	62	69	65/55
6.Gavan (C)	14/12/11 to 16/12/11	68.8 (Exceeding)	60.4 (Exceeding)	75	50	52	65	71	65/55
	21/12/11 to 23/12/11	68.3 (Exceeding)	60.4 (Exceeding)	75	50	53	65	70	65/55

Source: Rapid EIA 2012 by MMRDA

Table 12.4.14 Ambient Noise Level (Rapid EIA 2012)

Location (Area Code)	Date and Time		Noise Levels in dB(A)						Indian Standard
			Leq	Lmax	Lmin	L90	L50	L10	L_{eq}
Antop Hills (Residential)	14th Dec. 2014 6 AM- 10 PM:	Daytime	**67.1** (exceeding)	82.1	51.0	78.0	69.5	59.6	55
	14th Dec. 2014 10 PM- 6 AM:	Night Time	**63.4** (exceeding)	82.2	51.7	73.2	61.9	54.1	45
	15th Dec. 2014 6 AM- 10 PM:	Daytime	**63.6** (exceeding)	72.6	59.0	51.3	70.5	64.7	55
	15th Dec. 2014 10 PM- 6 AM	Night Time	**60.1** (exceeding)	75.4	51.3	71.6	57.6	52.1	45

Source: Report on Ambient Noise Monitoring of Metropolitan Cities in Maharashtra 2014 (Maharashtra Pollution Control Board)



Source: JICA Study Team (Supplemental EIA 2015)

Figure 12.4.5 Ambient Noise Monitoring Locations by MPCB (2014)

Table 12.4.15 Vibration Monitoring Result at Sewri (No.1:Sewri)

Year/Date/Time 2015	Measured values	Converted values	Standard Value (Japanese Standard in dB)	Evaluation (Meet or Exceeds standard)
	Vibration velocity (mm/s)	Vibration level (dB)		
3rd May 7:00	0.080	49.1	7:00-20:00 Day Time 70	Meet Japanese Standard
8:00	0.080	49.1		
9:00	0.079	49.0		
10:00	0.077	48.7		
11:00	0.080	49.1		
12:00	0.0807	49.1		
13:00	0.080	49.1		
14:00	0.076	48.6		
15:00	0.074	48.4		
16:00	0.075	48.5		
17:00	0.080	49.1		
18:00	0.078	48.8		
19:00	0.075	48.5		
20:00	0.077	48.7		
21:00	0.078	48.8	20:00-7:00 Night Time 65	Meet Japanese Standard
22:00	0.071	48.0		
23:00	0.079	49.0		
2nd May 24:00	0.0763	48.7		
1:00	0.076	48.6		
2:00	0.077	48.7		
3:00	0.080	49.1		
4:00	0.077	48.7		
5:00	0.083	49.4		
6:00	0.076	48.6		

Source: JICA Study Team (Supplemental EIA 2015)

Table 12.4.16 Vibration Monitoring Result at Sewri (No.2:Shivaji Nagar)

Year/Date/Time 2015	Measured values	Converted values	Standard Value (Japanese Standard in dB)	Evaluation (Meet or Exceeds standard)
	Vibration velocity (mm/s)	Vibration level (dB)		
3rd May 7:00	0.079	49.0	7:00-20:00 Day Time 70	Meet Japanese Standard
8:00	0.075	48.5		
9:00	0.076	48.6		
10:00	0.0747	48.5		
11:00	0.074	48.4		
12:00	0.0805	49.1		
13:00	0.0773	48.8		
14:00	0.0728	48.2		
15:00	0.0782	48.9		
16:00	0.0744	48.4		
17:00	0.0757	48.6		
18:00	0.076	48.6		
19:00	0.077	48.7		
20:00	0.078	48.8		
21:00	0.075	48.5	20:00-7:00 Night Time 65	Meet Japanese Standard
22:00	0.072	48.1		
23:00	0.077	48.7		
2nd May 24:00	0.079	49.0		
1:00	0.0833	49.4		
2:00	0.074	48.4		
3:00	0.078	48.8		
4:00	0.081	49.2		
5:00	0.080	49.1		
6:00	0.082	49.3		

Source: JICA Study Team (Supplemental EIA 2015)

Table 12.4.17 Forecast Traffic Noise at the Station Points (with background level)

Point (land use)		ST1 Sewri (0-200m: Industry)			ST2 Elaphanta (0-200m: Right of way)			ST3 Shivaji Nagar (0-50m: Right of way 50-200m: Commercial)			Indian Standard dB(A) (Industrial and Commercial) ** IFC Standards
Distance from road		0m	10m	200m	0m	10m	200m	0m	10m	200m	
Day	Road surface	64	66	60	66	68	60	62	63	56	75 (Industrial) *65 (Commercial) ** IFC: 70 Industrial and Commercial)
	Ground (evaluated values)	56	56	57	56	56	57	55	56	*55	
Night	Road surface	60	62	57	62	64	57	58	59	54	70 (Industrial) *55 (Commercial) ** IFC: 70 (Industrial and Commercial)
	Ground (evaluated values)	54	54	55	54	54	55	54	54	*54	

Source: JICA Study Team (Supplemental EIA 2015)

Table 12.4.18 Forecast Traffic Vibration at the Station Points

Point		ST1 Sewri			ST2 Elaphanta			ST3 Shivaji Nagar			Japanese standard
Distance from road		0m	10m	200m	0m	10m	200m	0m	10m	200m	
Vibration Level (dB)	Day	48	47	45	50	48	45	46	45	42	65
	Night	48	47	45	50	49	45	46	45	42	60

Source: JICA Study Team (Supplemental EIA 2015)

(3) Detailed Description of the Ecosystem and Protected Area

The Ecosystem and Protected Area are listed as considerable items on the Supplemental EIA, the detailed description regarding evaluation is as follows.

1) Ecosystem (Fauna-Flora)

The existing information on the project area suggests that the project area does not have a rich environment due to pollution and the poor condition of the mangrove, however, there are a few places that have mangrove vegetation and many migratory birds, mainly Flamingos, are feeding on the mudflat from November to June.

[During Construction]

Construction activities of MTHL may cause noise during the construction stage, thus some groups of migratory birds may avoid the adjacent area and temporarily fly to other areas such as Thane creek and JNPT in Mumbai basin. Actually it was observed that the flamingos avoided the Vashi Bridge area during its construction, but since its completion they have returned and continue to feed in the same place.

However, since several mitigation measures will be conducted, the migratory birds may again get back to same habitat gradually. Additionally, turbidity from excavated areas in the sea and mangrove cutting area will be minimized by appropriate mitigation measures such as adoption of bored piling methodology and installation of temporary jetties in the mudflat.

[Post Construction]

On the other hand, during the operation phase, travelling vehicles generate noise and the existence of the viaduct may give adverse impacts for migratory birds in CRZ and IBA. However, in the case of Vasi and Ilori Bridge construction, Flamingos were feeding nearby before and after construction. It is supposed that no adverse impacts will be caused in the feeding area from the view point of the biota and topography. It is assumed that the Flamingo have adapted to such a noisy environment.

With regard to distribution of mangrove seeds, since the construction of the bridge does not give serious impacts on tidal flow in Mumbai basin in accordance with the quantitative

analysis by the Central Water and Power Research Station (CWPRS), this situation means that it is supposed that the project will not give adverse impacts on distribution or propagation of mangrove seeds in the basin.

However, for minimization of these impacts, not only CRZ specific conditions, but also additional measures such as consideration of lighting systems that will not give impacts on the Flamingo's roosting area are planned.

If unexpected events or phenomena are confirmed during or after construction, appropriate actions will be taken in consultation with relevant organizations such as MMRDA, the general consultant, the contractor, environmental department of Maharshtra and MoEF.

Thus, it is not likely to give serious impacts in the project area including the mudflat ecosystem under implementation of appropriate mitigation measures.

2) Protected Area

The project alignment passes through the Coastal Regulation Zone (CRZ) for a total distance of 2.25km and through the Important Bird Area, which was proposed by Birdlife International for a total distance of 5km. With regard to CRZ, the permission was granted by MoEF in 2013.

On the other hand, JICA Guidelines stipulate that IBA the Sewri Mudflat are critical habitats, and JICA has confirmed that significant impact will not be given by the project in accordance with the following conditions as shown in the article 17 of IFC Performance Standard 6.

- The alignment has been concluded in consideration of the natural environment and relevant government facilities. (see Chapter 3 of main report) According to the description in the Chapter 3, there are no viable alternatives to the proposed alignment.
- As described above in article "1) Ecosystem (Fauna-Flora)", the planned structure has been selected so as not to give significant adverse impacts to wildlife such as birds on the mudflat with mitigation measures, thus the Project does not involve significant conversion or significant degradation of critical natural habitat.
- Observed bird species in the past surveys which were classified as CR or EN identified in Sewri mud flats as described in the above article " 1) Ecosystem (Fauna-Flora)" may avoid the construction area and fly to the nearest mud flat such as Thane Creek and sanctuaries. Thus it is not predicted that there will be significant impacts such as net reduction of the number of individuals.

- Several mitigation measures shall be taken with the aim of minimizing the impact on fauna and flora living in the mud-flats. MTHL is designed to give consideration to migrating birds such as adoption of a girder bridge type instead of cable-stayed bridge, as well as installation of lighting systems in the handrail/noise barrier/view barrier. During the construction phase, a construction plan considering the lifecycle of migratory birds shall be established, and the contractor shall take measures such as adoption of excavation methodology for turbid water prevention.
- The implementation of mitigation measures for migratory birds and the baseline survey of migratory birds & habitats will be conducted during the migration peak period in 2016 under observation of Indian and Japanese specialists. In addition, a long-term monitoring and evaluation program for migratory birds & habitats till the baseline status is achieved shall be established by MMRDA and integrated into its environmental management program.

3) Major Mitigation Measures for the Ecosystem

Following are major mitigation measures;

[During Construction]

- Adoption of excavation methodology that will produce the least possible turbid water (i.e. bore casing and excavation)

Source: JICA Study Team

Figure 12.4.6 Bored Piling Methodology for Prevention of Turbid Water

- Minimization of affected area in the mangrove area and mudflat by adoption of temporary jetty construction roads

Source: JICA Study Team

Figure 12.4.7 Temporary Jetty during Construction

- Implementation of compensatory mangrove plantation in accordance with CRZ clearance specific condition on July 2013 (at least five times the number of mangroves destroyed/cut during the construction process shall be replanted)

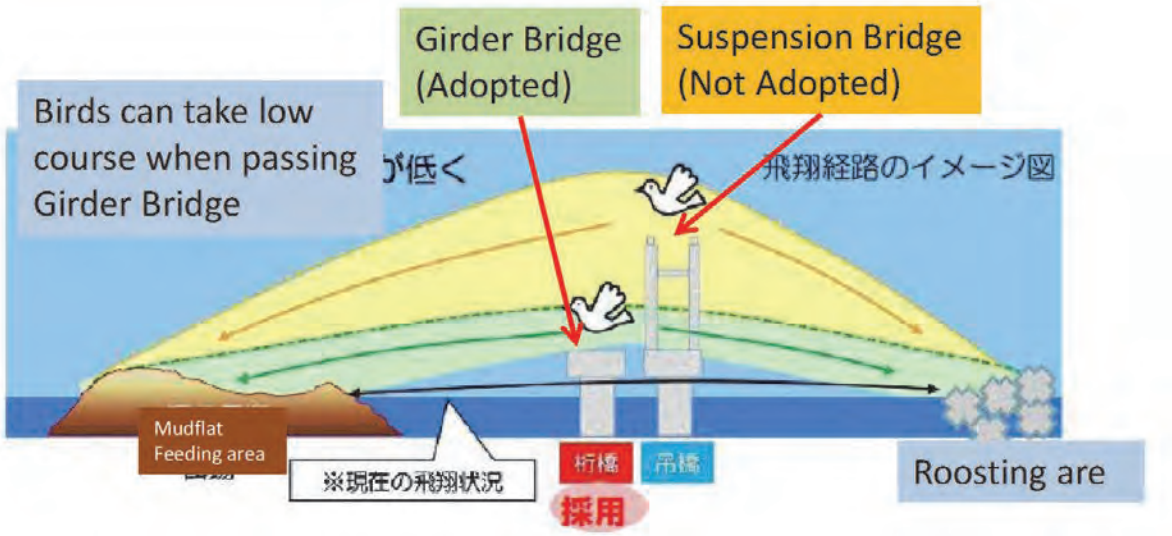
[After Construction]

- Sound barriers shall be installed on both sides of the road in CRZ area and Flaming distributed area so as to minimize the adverse impacts on the migratory birds in accordance with CRZ clearance specific conditions.
- Lighting which does not give significant adverse impacts to the roosting area of Flamingos should be installed in accordance with CRZ clearance specific condition.

Source: Panasonic Eco-solutions (Project name: Shin Meishin Expressway Asuka IC- Nabeta IC in Japan)

Figure 12.4.8 Noise Barrier with Lighting System in the handrail/noise barrier/view barrier

- Adoption of bridge type that will not give significant impacts on the migratory bird flight path in the mudflat area. Distribution area and flight path for such as Flamingo should be identified through the baseline survey prior to construction stage.
- Pre-stressed super structure shall be used in the mud flat area for construction as committed on CRZ clearance.



Source: JICA Study Team

Figure 12.4.9 Adopted Bridge Structure and Landscape from Sewri Fort (Photomontage)

12.4.6 General Environmental Management Plan

An Environmental Management Plan (EMP) has been recommended in this chapter. This EMP takes into account all the environmental impacts identified for MTHL and the corresponding mitigation measures to ameliorate the same. The EMP presented below includes:

- Specific actions to be taken vis-à-vis site-specific issues;
- Mitigation measures for abatement of the undesirable impacts caused during construction and operation stages
- Agencies responsible for its implementation & supervision;
- Post project Environmental Monitoring Program to be undertaken after commissioning of the project
- Environmental status reporting frequency; and
- Institutional arrangement, Strengthening of their capabilities, and roles.
- Mitigation measuring and monitoring plan is merged with Rapid EIA 2012 prepared by MMRDA, CRZ clearance specific condition and JICA Scoping report commented by the JICA Advisory Committee.
- The cost for all mitigation measures is included as a part of the construction cost except replanting the mangrove. The cost of replanting the mangrove in accordance with CRZ clearance will be borne by MMRDA.
- Detailed mitigation measures and monitoring plan should be establish in the future under MMRDA and the General Consultant

The environmental management plan for during the construction phase and operation phase is listed below.

Table 12.4.19 Draft Major Environmental Management Plan for MTHL

Area	No.	Item (on Rapid EIA 2012)	Mitigation Measures		Responsibility	
			During Construction	Operation	Implementation Agency	Responsible Agency
Pollution	1	Air pollution (Air quality/ Siting of borrow pits and quarry material areas)	- All vehicles and machinery shall obtain & maintain a 'Pollution under Control Certificate (PUC)'. These vehicles will be maintained so that emissions conform to the standards prescribed in the certificate. - Vehicles carrying construction material shall be covered to avoid spilling. - Asphalt mixing plant (Hot mix and batching plants) shall be over 500 m from any communities and 300 m from the road as far as possible to avoid any air emissions from these plants. - Water sprinkling shall be carried out twice or thrice each day on earth road/unpaved sections of road and construction yard near residential areas to avoid dust generation. - The exhaust of DG sets will be released at the height prescribed by MPCB (Maharashtra Pollution Control Board) so that it does not affect nearby population.	- Appropriate land use management along the road (commercial and industrial areas). - Periodically monitor ambient air quality at suggested locations. - Enforce different control measures to minimize the air pollution.	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
	2	Water pollution (Water Quality/ Construction of labour camp/ Siting of borrow pits and quarry material areas)	- Turbid waste water from earthwork area on the land shall be mitigated and treated in sedimentation ponds, if required. - In the sea section, the casing and excavation methodology shall be adopted so as not to generate significant turbid water. - There shall be no water withdrawal in CRZ area - Waste oil shall be stored and disposed of in a designated site. - Provision of sanitation facilities at the labour camps, also the location of camps will be at least 200 m away from any water sources. - Domestic waste water and night soil from base camp shall be treated and discharged. - Septic tanks will be provided in accordance with Coastal Regulation	- In the mudflat section, storm water should be collected by every pier and discharged on pile caps not to excavate mudflat area by the falling water. - Turbid water from road surface shall be collected through drainage and treated by sedimentation trench.	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)

Area	No.	Item (on Rapid EIA 2012)	Mitigation Measures		Responsibility	
			During Construction	Operation	Implementation Agency	Responsible Agency
Pollution			Zone Notification, 2011. The disposal of treated water shall conform to the regulations of MPCB (Maharashtra Pollution Control Board). - Uncontrolled digging of borrow pits will be avoided to prevent water accumulation, which results in breeding of diseases. - Providing adequate drainage structure - Avoiding obstruction of existing drainage during filling.			
	3	Waste (Solid waste management/ Construction of labour camp/ Topography, Soil and Geology)	- After considering the possibility of reuse, construction waste shall be disposed of at a designated disposal site after treating. - Garbage at workers camp and waste oil shall be brought to a designated disposal site or facility. - Water treatment facilities such as septic tanks shall be provided in the workers camp. - There will be no disposal of solid or liquid wastes in the coastal area. Solid waste Management will be as per Municipal Solid Management and Handling Rules, 2000.	Not required	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
	4	Soil Contamination (Topography, Soil and Geology/ Siting of borrow pits and quarry material areas)	- Polluted excavated soil including muck soil shall be treated and then reused and/or disposed of in a designated site in accordance relevant laws and regulations.	Not required	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
	5	Noise and Vibration (Ambient Noise)	- Selecting low-noise equipment. - Avoiding works of heavy equipment during night time. - Informing the surrounding communities of the construction schedule to obtain their consensus. - All the construction equipment shall be provided with exhaust silencers as committed. - Provision of using ear plugs by workers exposed to high noise levels.	- Proponent will propose appropriate land use plan such as commercial area along the road - Noise barriers shall be installed as required. However, the effect of the noise barrier is very limited for the ground height. - Periodic monitoring of ambient noise levels at suggested locations - Erecting signboards at sensitive and residential locations prohibiting use of horns - Growing road side plantation to lower the noise levels.	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)

Area	No.	Item (on Rapid EIA 2012)	Mitigation Measures		Responsibility	
			During Construction	Operation	Implementation Agency	Responsible Agency
Pollution	8	Sediment Quality (Topography, Soil and Geology(No.4))	- Polluted excavated soil including muck soil shall be treated, and then reused and/or disposed of in a designated site in accordance relevant laws and regulations.	Not required	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
Natural Environment	9	Protected Area (Reserved Forest and Fauna)	- Adoption of excavation methodology for turbid water prevention (i.e. bore casing and excavation) . - Temporary jetty would be constructed in the mudflats for movement of vehicles and machinery to avoid disturbance to mudflats/mangroves. - Establishment of a construction plan in consideration of the lifecycle of migratory birds such as Flamingos, if possible. - Installation of silencers on construction machines in accordance with CRZ clearance. - Implementation of monitoring for migratory birds such as Flamingos in accordance with CRZ clearance general condition. - Implementation of the compensatory mangrove plantation in accordance with CRZ clearance specific condition at least five times the number of mangroves destroyed/cut during the construction process shall be replanted: 0.1776 ha x 5 = 0.888 ha). - It is recommended that implementation of a detailed baseline survey for fauna & flora and preparation of a monitoring plan for the project area before the design-build stage.	- Installation of noise barrier to prevent "Fly-Kill" on the viaduct as required. - Noise barriers shall be installed on both sides of the road in CRZ area and Flaming distributed area in accordance with CRZ clearance specific conditions. - Adoption of bridge type which does not give significant impacts on migratory bird flight paths in the mudflat area. note) Distribution area and flight paths should be identified through a baseline survey prior to the construction stage. - Pre-stressed super structure shall be used in the mud flat area for construction as committed on CRZ clearance. - Lighting which does not give significant adverse impacts to the roosting area of the Flamingos should be installed in accordance with CRZ clearance specific condition. - Prohibit using vehicle horn in mudflat section (Installation of sign boards). - Implementation of monitoring for migratory birds such as Flamingos in accordance with CRZ clearance general condition. - Implementation of appropriate management and maintenance of mangrove plantation area.	MMRDA & Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
	10	Ecosystem (Ecology and Biodiversity/ Ecology/ Construction of labour camp)				

Area	No.	Item (on Rapid EIA 2012)	Mitigation Measures		Responsibility	
			During Construction	Operation	Implementation Agency	Responsible Agency
Natural Environment	11	Hydrology	- The monitoring of the tidal level and current should be conducted at the bridge sites by installing water alarm systems during and after the construction. - Bathymetric surveys around the MTHL should be conducted periodically, to determine whether the sea bed level is higher than the design scour depth. - Designing of bridges with sufficient capacity not to give impacts on tidal conditions. - There shall be no water withdrawal in CRZ area.	-Same monitoring and mitigation measures as during construction shall be done	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
	12	Topography and geology (Topography, Soil and Geology)	- The slope gradients are stabilized in accordance with the Guideline of earthwork (Japan Road Association). - Appropriate slope protection measures are to be adopted, as required.	Not required	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
Social Environment	13	Involuntary resettlement	- Implementation of SIA (Holding consultation meetings for understanding of compensation policy, Implementation of adequate compensation based on JICA Guidelines and Implementation of livelihood restoration program based on SIA)	- Monitoring and evaluation based on SIA policy	MMRDA	MMRDA
	14	The poor	- Implementation of SIA	- Monitoring and evaluation based on SIA policy	MMRDA	MMRDA
	16	Local economy such as employment and livelihood (Quality of Life/Fisheries)	- Implementation of SIA	- Monitoring and evaluation based on SIA policy	MMRDA	MMRDA
	17	Land use and utilization of local resources (Land use/Fisheries)	- Implementation of SIA	- Management of appropriate land use in accordance with approved land use plan along the road.	MMRDA	MMRDA (propose to MCGM and CIDCO)
	19	Existing social infrastructures and services (Utility services and community severance)	- Implementation of SIA	- Monitoring and evaluation based on SIA policy	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)

Area	No.	Item (on Rapid EIA 2012)	Mitigation Measures		Responsibility	
			During Construction	Operation	Implementation Agency	Responsible Agency
Social Environment	22	Local conflict of interests	- Local workforce is prioritized for construction. - Implementation of appropriate education for hired workers from other areas and countries.	Not required	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
	24	Landscape (Aesthetics and landscape)	- The monotone colour harmonized with the surrounding current landscape has been adopted. - Landscaping of borrow pits.	Not required	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
	27	Infectious diseases such as HIV/AIDS	- Installation of sufficient drainage facilities so as to not to provide habitat for mosquitos. - Provision of adequate temporary sanitation facilities. - Enforcement of medical screening and periodic medical check-up. - In order to prevent spread of infectious diseases such as HIV/AIDS, awareness of the labourers and local inhabitants is promoted.	- Installation of sufficient drainage facilities so as not to provide habitat for mosquitos. - Implementation of periodic maintenance for drainages and bridges.	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)
	28		- Implement and follow relevant laws and regulations including “Building And Other Construction Workers (Regulation of Employment and Conditions of Service) Act,1996” and “The building and other construction worker’s welfare cess Act, 1996” and IFC Performance Standard 2 Labour and Working Conditions	Not required	Contractor (Construction Company)	MMRDA & General Consultant (PMC & EC)

Area	No.	Item (on Rapid EIA 2012)	Mitigation Measures		Responsibility	
			During Construction	Operation	Implementation Agency	Responsible Agency
Other	29	Accidents (Accident hazards and safety)	- Secure assistance from local police for traffic control during construction phase. - Safety measures will also be undertaken by installing road signs and marking for safe and smooth movement of traffic. - Setting up of appropriate detours. - Restricting mobilization speed in the construction site. - Installation of parking for idling construction machines. - Installing gate structure at the entrance of the construction site to set up restricted area - Deploying flagman at the gate and crossing points of the construction vehicles. - Installing fence around the construction site to keep out local people such as children. - Installation of lighting in the night time near construction area. - Labourers will be equipped with proper safety gear like helmets gloves and gumboots. - Periodic health check-ups of construction workers. - Safety training for the workers and safety patrol at the construction site by supervisors. - Monthly safety meetings	- Implementation of advertisement for traffic safety campaign. - Prepare and administer a monitoring system on road accidents. - Installation of sign board and road making for speed limit. - Enforcement of traffic controls by police.	Contractor (Construction Company) in consultation with Traffic Police Department	MMRDA Traffic Police
	30	Cross Boundary impacts and climate change	- Replanting mangrove and street trees in the same amount as were cut at least five times the number of mangroves destroyed/cut during the construction process shall be replanted in CRZ in accordance with CRZ clearance specific condition)	- Maintenance of planted trees and mangroves through periodical inspection	MMRDA	MMRDA

Source: JICA Study Team

Additionally all committed specific conditions on CRZ clearance of 2013 will be conducted by MMDA as shown in the next table.

Table 12.4.20 Mitigation Measures on CRZ Clearance for MTHL

No	Conditions	Response on Mitigation Measures
1	As per the CRZ notification, 2011, shall be replanted. Mangrove plantation in an area of 30 ha shall be carried out as committed against loss of 0.1776 ha of mudflats/mangroves. Permission from the High Court of Bombay shall be obtained with respect to mangrove cutting.	MMRDA will replant at least five times the number of mangroves destroyed/cut during the construction process in the area appointed by MoEF.
2	The proponent shall provide lighting in consultation with the Bombay Natural History Society so as to minimize the likely impacts to the migratory birds.	MMRDA will setup lights inside of bridge handrail especially in CRZ and flamingo roosting area.
3	All the construction equipment shall be provided with exhaust silencers as committed.	Low noise construction machines with exhaust silencer installed will be used during construction.
4	Noise containment barriers shall be provided on both sides of the bridge in mudflat areas (CRZ-IA) so as to minimize the likely impacts to the migratory birds.	Noise barriers are to be installed in CRZ in the roosting /feeding area of migratory birds such as flamingo.
5	There shall be no dredging or reclamation for the project.	No dredging or reclamation is planned in this project in the CRZ.
6	Pre-stressed super structure shall be used in the mud flat area for construction as committed.	Pre-stressed super structure will be used in the mud flat area of the CRZ.
7	The muck materials shall be analysed prior to dumping / disposal in the identified locations with the approval of the competent authority to ensure that it does not cause any impact to the environment.	The muck soil is generated from the excavated points of the piles. The excavated soil is analysed and disposed of in designated and authorized dumping sites.
8	The proponent informed that there is no fishing activity in the area since it is a navigation channel for the nearby ports. However, a navigation channel is provided with widths of 25m for ships and 9.1 m for fishing boats.	Sufficient prescript vertical clearance under discussion with relevant authorities.
9	All the recommendations of the MCZMA shall be strictly compiled with.	All recommendation of the Maharashtra Coastal Zone Management Authority will be reflected to mitigation measures, if any.
10	There shall be no building construction beyond 20,000 sqm.	No building is planned in CRZ. Only a toll gate is planned outside of CRZ in Navi Mumbai side.
11	There shall be no water withdrawal in CRZ area.	No polluted water will be produced by the project in the CRZ. However storm water will flow down from the road in monsoon season.
12	There shall be no disposal of solid or liquid wastes in the coastal area. Solid waste Management shall be as per Municipal Solid (Management and Handling) Rules, 2000.	There are no project activities that discharge or dispose of solid or liquid waste in the CRZ.
13	Sewage shall be treated and the Treatment Facility shall be provided in accordance with the Coastal Regulation Zone Notification, 2011. The disposal of treated water shall conform to the regulations of the State Pollution Control Board.	Sewage, including polluted water and night soil, will not be generated by project activities in CRZ.
14	The project proponent shall set up a separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of a Senior Executive.	MMRDA will setup an environmental management cell for MTHLin MMRDA.
15	The funds earmarked for an environmental management plan shall be included in the budget and this shall not be diverted for any other purposes.	MMRDA will secure budge for MTHL.

Source: CRZ Environmental Clearance (MOEF 19th July 2913)

12.4.7 Environmental Monitoring Plan

An Environmental Monitoring shall be executed by the construction contractor. The contractor shall conduct prescript monitoring and report to the construction supervision consultant monthly.

The expected environmental monitoring plans are shown below.

Table 12.4.21 Environmental Monitoring Plan Pre and During Construction Phase

Area	No.	Item (on Rapid EIA 2012)	Parameter	Method	Location	Frequency a year	Cost (INR)	Standard
Pollution	1	Air pollution	SO_2, NO_2, PM_{10}, $PM_{2.5}$, O_3, Pb, CO, NH_3, C_6H_6, BaP, As, Ni, CH_4 and CO_2 (14 Items)	Same method as baseline survey Or Establish fixed monitoring stations at 2 locations	**2 Locations** where baseline monitoring was carried out. (2 locations: Sewri and Shivaji Nagar)	**4 times / year x 4.5 years** (Once every quarter – Summer, Winter, post-monsoon) (24 hr/day for 2 consecutive working days per week for 2 weeks except CO which is 8 hr/day)	1,800,000	National Ambient Air Quality Standards (NAAQS) by Central Pollution Control Board (CPCB) (Standard for 24hrs: Industrial and Residential) • SO_2: 80µg/m^3 • NO_2: 80µg/m^3 • PM_{10}: 100µg/m^3 • $PM_{2.5}$: 60µg/m^3 • O_3: 180µg/m^3 • Pb: 1.0µg/m^3 • CO: 0.4mg/m^3 • NH_3: 400µg/m^3 Following standards are for Annual • C_6H_6: 0.5µg/m^3 • BaP: 0.1µg/m^3 • As: 0.6mg/m^3 • Ni: 20mg/m^3
	2	Water pollution	pH, BOD, DO, Turbidity and O&G	Same method as baseline survey	3 Locations Near excavated area in Zone II (Sewri mudflat), Zone III and Zone IV where baseline monitoring was carried out.	4 times / year x 4.5 years Once every quarter – Summer, Winter and post-monsoon	810,000	**Marine water quality Standards – Class SW-IV Harbour Waters (MPCB)** pH : 6.5-9 DO: 3 mg/l Turbidity: 30 NTU BOD: 5 mg/l O & G: 10 mg/l
	3	Waste	Volume of waste soil, tree cuttings and domestic garbage	Record volume of generated waste	3 Locations (1. Sewri camp site 2. Mangrove cutting area 3. Navi Mumbai camp site))	4 times / year x 4.5 years	324,000	**Municipal Solid Waste Management Rules, 2013** Generated waste shall be reused or disposed of in a designated site. (The construction waste can be dumped in legally authorized dumping grounds in Navi Mumbai by CIDCO in association with Navi Mumbai Municipal Corporation (NMMC) which is located in Taloja. Remaining waste i.e. from Mumbai side, MMRDA can take care of it and dump the construction waste in association with the Municipal Corporation of Greater Mumbai (MCGM) on authorised sites i.e. Deonar, Mulund and Gorai.

Area	No.	Item (on Rapid EIA 2012)	Parameter	Method	Location	Frequency a year	Cost (INR)	Standard
Pollution	4 And 8	Soil Contaminatio n/sedimentati on	Heavy Metals & Oil & Grease (5-10 items shall be selected from the Soil pollution standards)	Same method as baseline survey	2 Locations 1. Excavated muck soil and 2. stocked soil in the yard from cutting area	1 time / year x 4.5 years	108,000	**Soil Pollution Standard in India (MOEF)** Cd: 0.01mg/l Lead: 0.01mg/l Chromium (VI): 0.05mg/l Arsenic: 0.01mg/l T-Mercury: 0.0005mg/l Copper: 125mg/kg (some items shall be selected from the total 25 standard items)
	5	Noise and vibration	Ambient and road side noise (dB(A)LAeq)	Same method as baseline survey (continuous 24 hrs)	3 Locations (1. Sewri, 2. ST migratory bird distribution area ST500-5500, 3. Shivaji Ngagar) Note) No2 and 3 locations are where baseline monitoring was carried out.	2 times / year x 4.5 years	108,000	-Construction Noise; 85dB(A) -**Ambient Noise Standards in India (dB (A) Leq)** 1.Industrial Area Day Time: 75 (6-22hr) Night Time: 70 (22-6hr) 2.Commercial Area: Day Time: 65 (6-22hr) Night Time: 55 (22-6hr) 3.Residential Area: Day Time: 55 (6-22hr) Night Time: 45 (22-6hr) 4.Silence Zone Day Time: 50 (6-22hr) Night Time: 40 (22-6hr)
			Vibration (dB L10 or mm/sec)	Same method as baseline survey (continuous 24 hrs)	↑ ditto	2 times / year x 4.5 years	54,000	- Construction vibration 75dB -**Vibration Standards** roadside 1. Commercial /Industrial Area Day Time: 70 (7-20hr) Night Time: 65 (20-7hr) 2. Residential Area: Day Time: 65 (7-20hr) Night Time: 60 (20-7hr)
Natural Environment	9	Protected Area	1.Monitoring of mudflat conditions including fauna-flora 2. Monitoring of Tree Cutting and replantation/ transplanting area 3.Monitoring of Mangrove Plantation area appointed by MoEF 4. Monitoring of sedimentation soil and ecological parameter (18items on EIA main text Table 6.1.15 for soil and 7 items	Ocular inspection and quantitative survey 1-1. Fauna-Flora Line-Point census and record number and apparent species 1-2: Mangrove density and community survey 1-3: Benthos Survey 2-1: Cutting trees confirmation	Along MTHL alignment and mangrove replant area	**4 times / year x 4.5 years**	6,480,000	Significant impacts are not caused by the project **Note)** **Detailed monitoring plan will be setup during basic design stage** Standard for Soil; Table 6.1.15 Standard for Ecological Parameter: • Net primary Productivity <1,500 mgC/m^3/day at surface • Chlorophyll-a <4mg/m^3 • Phosphate: 0.1-90µg/l • Nitrate: 1.0-500µg/l • Nitrite: <125µg/l • Particulate Organic Carbon: 10-100mg/m^3
	10	Ecosystem						

Area	No.	Item (on Rapid EIA 2012)	Parameter	Method	Location	Frequency a year	Cost (INR)	Standard
Natural Environment			such as 1)Net primary productivity, 2)Chlorophyll-a, 3)Phosphate, 4)Nitrate, 5)Nitrite, 6)Particulate Organic Carbon, 7) SiO_2)	3-1: Mangrove survey in the replanted area				• SiO2: 10-5,000μg/l
	11	Hydrology	Flooding situation	Flood level measurement during high precipitation periods	2 Locations (CRZ at Sewri and Shivaji Nagar)	4 times / year x 4.5 years	540,000	Project activities and structures do not cause flooding or impacts on tidal conditions
	12	Topography and Geology	Conditions in embankment area	Visual survey about Stability of embankment	2 Locations (1. Embankment of Inter Change in Shibaji Nagar and 2. Cutting area at toll gate in Chirle)	4 times / year x 4.5 years	The cost is included in No 17 Land use	Embankment shall be stabilized without any landslide or cracks
Social Environment	13	Involuntary resettlement	Payment and implementation of social assistance in accordance with SIA	Consultation Meeting and/or Survey with the project affected persons (PAPs)	Affected area	Refer to SIA monitoring plan	Refer to SIA monitoring plan	Compensation shall be completed and livelihood standards secured prior to actual construction activities
	14	The poor						
	16	Local economy such as employment and livelihood						
	17	Land use and utilization of local resources	Situation of establishment of land use map	Confirmation of land use map	2 Locations (Sewri and Navi Mumbai side in the Affected area)	2 times / year x 4.5 years	180,000	Designated land use shall be secured without any unplanned development by local people or developers
	19	Existing social infrastructures and services	Condition of facilities to be displaced	Ocular inspection	Affected area	Refer to SIA monitoring plan	Refer to SIA monitoring plan	Compensation shall be completed and livelihood standards secured prior to actual construction activities
	22	Local conflict of interests	Construction worker's township	Confirmation of workers list from contractor	2 Locations (camp site in Sewri and Shivaji Nagar)	4 times / year x 4.5 years	180,000	Employment opportunity shall be provided fairly
	24	Landscape	Condition of landscape	Visual inspection	1 Location (View from Sewri Fort)	1 time / year x 4.5 year (Dry season)	22,500	Color of structure shall be monotone colour harmonized with surrounding landscape
	27	Infectious diseases such as HIV/AIDS	Number of infected patients	Confirmation of health check list from contractor	2 Locations (camp sites in Sewri and Shivaji Nagar)	4 times / year x 4.5 years	180,000	Infection disease rate shall not be caused by the project

Area	No.	Item (on Rapid EIA 2012)	Parameter	Method	Location	Frequency a year	Cost (INR)	Standard
Social Environment	28	Labour Environment	Construction worker's condition	Confirmation of safety devices and conditions via interviews	2 Locations (camp site in Sewri and Shivaji Nagar)	2 times / year x 4.5 years	90,000	"Building And Other Construction Workers (Regulation of Employment and Conditions of Service) Act,1996", "The building and other construction worker's welfare cess Act, 1996" and international standards such as "IFC Performance Standard 2 Labor and Working Conditions"
Other	29	Accidents	Number of accidents	Confirmation of accident list from local government and State Traffic Police Department	2 Locations (camp site in Sewri and Shivaji Nagar)	4 times / year x 4.5 years	180,000	No accidents are caused by construction
	30	Cross Boundary impacts and climate change	Monitoring of replanting and transplanting trees and mangrove	Refer to No.9 and 10				
Total Cost during Construction : *8,145,000* for 4.5 years (during construction)								

Source: JICA Study Team

Environmental monitoring survey plan for operation phase is proposed as follows. Proposed monitoring period is at least three (3) years.

Table 12.4.22 Environmental Monitoring Plan during Operation Phase

Area	No	Item (on Rapid EIA 2012)	Parameter	Method	Location	Frequency a year	Cost (INR)	Standard
Pollution	1	Air pollution	SO_2, NO_2, PM_{10}, $PM_{2.5}$, O_3, Pb, CO, NH_3, C_6H_6, BaP, As, Ni, CH_4 and CO_2 (14 Items)	Same method as baseline survey Or Establish fixed monitoring stations at 2 locations	**2 Locations** where baseline monitoring was carried out. (2 locations: Sewri and Shivaji Nagar)	**4 times / year x 4.5 years** (Once every quarter –Summer, Winter, post-monsoon) (24 hr/day for 2 consecutive working days per week for 2 weeks except CO which is 8 hr/day)	600,000	National Ambient Air Quality Standards (NAAQS) by Central Pollution Control Board (CPCB) (Standard for 24hrs: Industrial and Residential) • SO_2: 80µg/m^3 • NO_2: 80µg/m^3 • PM_{10}: 100µg/m^3 • $PM_{2.5}$: 60µg/m^3 • O_3: 180µg/m^3 • Pb: 1.0µg/m^3 • CO: 0.4mg/m^3 • NH_3: 400µg/m^3 Following standards are for Annual monitoring • C_6H_6: 0.5µg/m^3 • BaP: 0.1µg/m^3 • As: 0.6mg/m^3 • Ni: 20mg/m^3
	2	Water pollution	pH, BOD, DO, Turbidity and O&G	Same method as baseline survey	3 Locations Zone II (Sewri mudflat), Zone III and Zone IV where baseline monitoring was carried out.	4 times / year x 3 years Once every quarter – Summer, Winter and post-monsoon	540,000	Marine water quality Standards – Class SW-IV Harbour Waters (MPCB) pH : 6.5-9 DO: 3 mg/l Turbidity: 30 NTU BOD: 5 mg/l O & G: 10 mg/l
	4 & 8	Soil Contamination / sedimentation	Heavy Metals & Oil & Grease (5-10 items shall be selected from Soil pollution standards)	Same method as baseline survey	3 Locations (Zone II, III and III)	1 time / year x 3 years	108,000	Soil Pollution Standard in India (MOEF) Cd: 0.01mg/l Lead: 0.01mg/l Chromium (VI): 0.05mg/l Arsenic: 0.01mg/l T-Mercury: 0.0005mg/l Copper: 125mg/kg (some items shall be selected from the total of 25 standard items)
	5	Noise and vibration	Ambient and road side noise (dB(A)LAeq)	Same method as baseline survey	2 Locations Sewri and Shivaji Nagar where baseline monitoring was carried out.	2 times / year x 3 years	48,000	Ambient Noise Standards in India (dB (A) Leq) 1.Industrial Area Day Time: 75 (6-22hr) Night Time: 70 (22-6hr) 2.Commercial Area: Day Time: 65 (6-22hr) Night Time: 55 (22-6hr) 3.Residential Area: Day Time: 55 (6-22hr) Night Time: 45 (22-6hr) 4.Silence Zone Day Time: 50 (6-22hr) Night Time: 40 (22-6hr) Vibration Standards (refer to Japanese
			Vibration (dB L10 or mm/sec)	Same method as baseline survey		2 times / year x 3 years	24,000	

Area	No	Item (on Rapid EIA 2012)	Parameter	Method	Location	Frequency a year	Cost (INR)	Standard
								standards along the road) 1. Commercial /Industrial Area Day Time: 70 (7-20hr) Night Time: 65 (20-7hr) 2. Residential Area: Day Time: 65 (7-20hr) Night Time: 60 (20-7hr)
Natural Environment	9 & 10	Protected Area / Ecosystem	1.Monitoring of mudflat conditions including fauna-flora 2. Monitoring of Cutting Trees and replantation/ transplanting area 3.Monitoring of Mangrove Plantation area appointed by MoEF 4. Monitoring of sedimentation soil and ecological parameters (18 items on EIA main text Table 6.1.15 for soil and 7 items such as 1)Net primary productivity, 2)Chlorophyll-a, 3)Phosphate, 4)Nitrate, 5)Nitrite, 6)Particulate Organic Carbon, 7) SiO_2)	Ocular inspection and quantitative survey 1-1. Fauna-Flora Line-Point census and record number and apparent species 1-2: Mangrove density and community survey 1-3: Benthos Survey 2-1: Cutting trees confirmation 3-1: Mangrove survey in the replanted area	Along MTHL alignment and mangrove replant area	**2 times / year x 3 years**	2,160,000	Significant impacts are not caused by the project **Note) Detailed monitoring plan will be setup during basic design stage** Standard for Soil; EIA main text Table 6.1.15 Standards for Ecological Parameter: • Net primary Productivity <1,500 mgC/m^3/day at surface • Chlorophyll-a <4mg/m^3 • Phosphate: 0.1-90µg/l • Nitrate: 1.0-500µg/l • Nitrite: <125µg/l • Particulate Organic Carbon: 10-100mg/m^3 • SiO2: 10-5,000µg/l
	11	Hydrology	Flooding situation	Flood level measurement during high precipitation periods	2 Locations (CRZ at Sewri and Shivaji Nagar)	4 times / year x 3 years	360,000	Project activities and structures do not cause flooding or impacts on tidal conditions
	12	Topography and Geology	Conditions in embankment area	Visual survey of Stability of embankment	2 Locations (1. Embankment of Inter Change in Shibaji Nagar and 2 Cut area at toll gate in Chirle)	2 times / year x 3 years	Refer to item No17	Embankment shall be stabilized without any landslide or cracks

Area	No	Item (on Rapid EIA 2012)	Parameter	Method	Location	Frequency a year	Cost (INR)	Standard
Social Environment	13	Involuntary resettlement	Payment and implementation of social assistance in accordance with SIA	Consultation Meeting and/or Survey with the project affected persons (PAPs)	Affected area	Refer to SIA Monitoring plan	Refer to SIA monitoring plan	Compensation shall be completed and secure livelihood standards prior to actual construction activities
	14	The poor						
	16	Local economy such as employment and livelihood						
	17	Land use and utilization of local resources	Situation of establishment of land use map	Confirmation of land use map	2 Locations (Sewri and Navi Mumbai side in the Affected areas)	2 times / year x 3 years	60,000	Designated land use shall be secured without any unplanned development by local people or developers
	24	Landscape	Condition of landscape	Visual inspection	1 Location (View from Sewri Fort)	1 time / year x 3 year (Dry season)	15,000	Color of structure shall be monotone colour harmonized with surrounding landscape
Other	29	Accidents	Number of traffic accidents	Confirmation of accident list from local government and State Traffic Police Department	On Mumbai Trans Harbour Link	2 times / year x 3 years	30,000	No accidents are caused by construction
	30	Cross Boundary impacts and climate change	Monitoring of replanting and transplanting trees and mangrove	Refer to No.9 and 10				
Total Cost: *3,945,000* INR for 3 years (after construction)								

Source: JICA Study Team

12.4.8 Monitoring Organization

The objectives and design of the EMP, Environmental Monitoring Plan, was described in earlier sections of this chapter. There is a necessity to form a proper 'Institutional Framework' for the effective implementation of the formulated environmental management & monitoring plan. The elements of this 'Institutional Framework' will co-ordinate and work with each other throughout the project, i.e. during pre-construction, construction & operation stage. The implementation of formulated environmental mitigation measures comes with a cost so the budgeting of EMP is necessary and also the financial source that will provide this budget, are discussed in this section.

The suggested elements of 'Institutional Framework' for implementing EMP of MTHL project will be as follows:

a) MMRDA - Project Implementing Agency (PIA) and Environmental Cell

b) Financial Source – JICA & MMRDA

c) Project Contractor – Construction Company (PC)

d) General Consultant

- Project Management Consultant (PMC)
- Environmental Consultant (EC)

e) Environmental Authorized Agency - Statutory Bodies (Authorities)

- Maharashtra State Pollution Control Board (MPCB)
- Ministry of Environment Forests

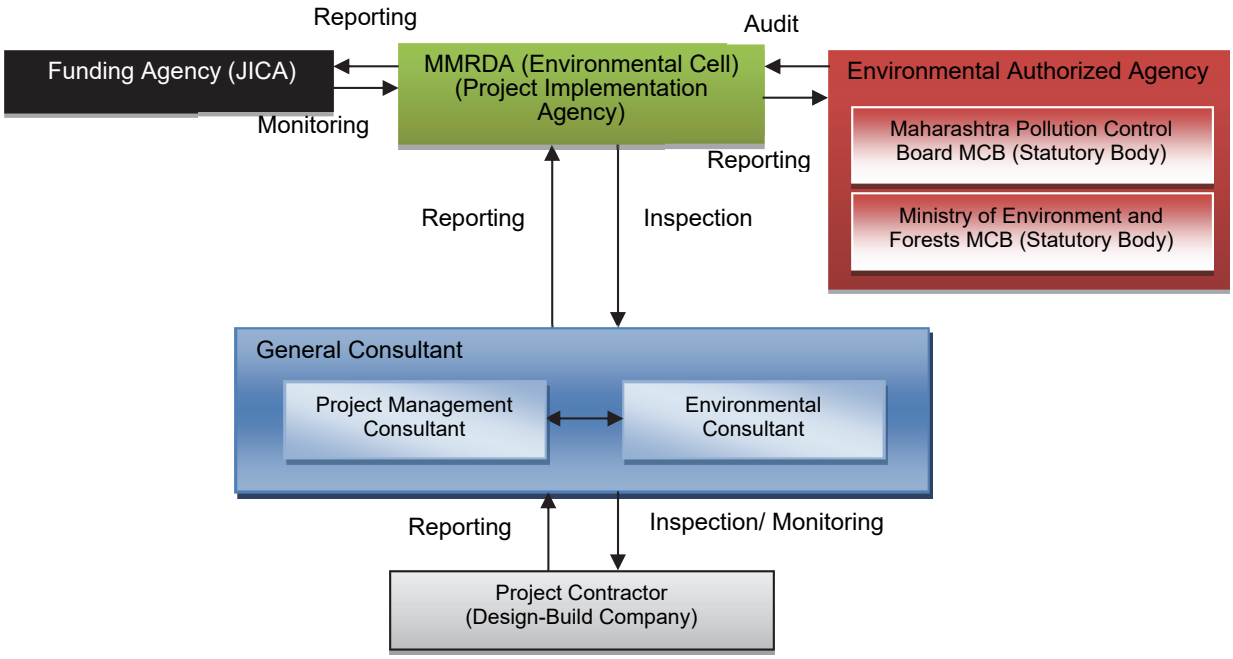
The Environmental Authorized Agency will not be a direct part of the 'Institutional framework' but it will hold controlling authority over it. It will review and approve the reports submitted by the PIA and can take necessary further actions, if any.

The above stated elements are part of the 'Institutional Framework', which will work together to effectively implement the formulated 'Environmental Management Plan'. The roles & responsibilities of these elements are given in Table 7.3.1 Roles & Responsibilities of Institutional Framework.

Table 12.4.23 Environmental Management and Monitoring Organization

Stage	Name of Organization	Roles and Responsibilities
Pre- Construction & Construction	Project Implementing Agency and Environmental cell - PIA	
	MMRDA	Initiate the co-ordinated processes among the concerned organizations (Elements of Institutional Framework) for EMP implementation. Overseeing the implementation of the EMP by the PMC Approval of '6 monthly - Environmental Compliance Reports' submitted by the EC and respond with necessary action. After Approval sending the report to the MPCB. Finalization of the SIA during detailed design. Facilitate relocation of people & monitoring actual payments of compensation to affected stakeholders such as landowners, Structure owners etc.
	General Consultant	
	Project Management Consultant (PMC)	PIA will get the EMP implanted through PMC. PMC will work in association with Project Contractor (Construction Company) & the Environmental Consultant (EC) on a full time basis at the project site office. PMC will mainly look after managing engineering & construction related activities.
	Environmental Consultant (EC)	EC will look after implementation of approved environmental measures on site. EC will be in constant touch with PMC & Project Contractor. EC will facilitate PIA to obtain mandatory 'Consent to Establish' certificate from Maharashtra State Pollution Control Board (MPCB) before start of the Construction on site. EC will get the 6 monthly environmental monitoring done from an MoEF approved laboratory. EC will prepare an 'Environmental Compliance Report (ECR)' describing the Status of the approved Environmental Mitigation measures on site (submitted by PC) and Monitoring of Environmental Attributes (submitted by MoEF Approved Laboratory) on a six monthly basis and will submit it to the PIA for their approval. PIA will then submit the approved ECR to the MPCB.
	Project Contractor - PC	
	Construction Company	PC will implement approved EMP (mitigation measures) as directed by PMC & Environmental Consultant. The PC will submit the report for all mitigation measures conducted on site to the EC on a six monthly basis.
Operation (Twice in a year x 3 years)	Project Implementing Agency – PIA	
	MMRDA	PIA will oversee the compliance status of all environmental measures through their appointed consultants.
	Consultant Appointed by MMRDA	Periodic inspection & maintenance of the MTHL. EC will facilitate PIA to obtain mandatory 'Consent to Operate' certificate from Maharashtra State Pollution Control Board (MPCB) before start of operation of the project. EC will prepare annual 'Environmental Statement (Form V)' as mandated in CRZ clearance and submit to PIA for their approval. PIA after reviewing the same will submit to the MPCB.

Source: JICA Study Team



Source: JICA Study Team

Figure 12.4.10 Proposed Environmental Management and Monitoring Implementation Organization

All costs for the environmental management plan, such as mitigation measures, are included in the physical contingency of project construction cost. On the other hand, cost for project management such as the Environmental Cell in MMRDA will be secured from MMRDA annual budget.

12.5 Stakeholder Meeting

12.5.1 Objectives of the Meeting

It is mandatory to conduct local level stakeholder meetings twice for this EIA based on the draft EIA process as per JICA Guidelines for Environmental and Social Consideration (2010).

Main objectives for holding local stakeholder meetings are shown below;

- ✓ To make stakeholders aware of the proposed MTHL project and project related proposed actions both before and after development decisions are made.
- ✓ To understand the concerns of local project affected people and others who have plausible stake in the environmental impacts of the project.
- ✓ To inform stakeholders about the environmental and social adverse and positive impacts of the project.
- ✓ To exchange opinions regarding project and environmental issues.
- ✓ To minimize probable adverse impacts of the project and to achieve speedy implementation of the project through increasing awareness among the stakeholders about the benefits of the project.

12.5.2 Meeting Notification and Language

(1) Scoping Stage

In the “First Public Consultation”, the publicity for the meeting was carried out by sending separate “Invitation Letters” to the experts in various fields (as per JICA categorization requirements) while the stakeholders were invited through telephonic as well as personal invitation. The presentation material was in English by MMRDA, explanation of the material was done in the local “Marathi” language upon request of the participants.

(2) Draft Supplemental EIA Stage

In the “Second Public Consultation”, the publication was carried out by putting an advertisement in two local newspapers about three weeks prior to the date of the public consultation meeting. The Marathi advertisement was put up in “SAKAAL” and English advertisement was put up in “HINDUSTAN TIMES” newspapers. This presentation was also given in “Marathi” language.

12.5.3 Schedule of the Meeting

The following local stakeholder meetings are scheduled in July & August-September 2015. A schedule and agenda for stakeholder meetings are shown below;

Table 12.5.1 Schedule Stakeholder Meetings on EIA and SIA

Date & Venue	Objectives of the meeting	Major Agenda	Participants
7th July, 2015 Shakha office, Near Shri Krishna Hindu Hotel, Sewri Gadi Adda, Haji-bundar road, Sewri (E), Mumbai - 400 015	To discuss the social impacts of the project with the key Stakeholders (Project affected people)	Project outline, necessity of social survey and survey items, basic compensation policy and declaration of cut-off date	MMRDA JICA Team Project Affected Persons
29th July, 2015 Committee Room, 6th Floor, MMRDA Office, B.K.C, Mumbai	To inform stakeholders about the proposed MTHL project & Explanation of draft modified Rapid EIA and formulation of basic consensus	Project outline, Benefits of the project, Predicted environmental impacts, practical mitigation measures, monitoring plan and project schedule	MMRDA JICA Team Relevant local government organizations (CIDCO, MPT & JNPT, ASI, NEERI) Project affected persons Experts from various fields as per JICA requirements
25th August 2015 (SIA 2nd PC) Sewri Koli Samaj Hall, 22/1 Koli Samaj Co.Op.Society, Sewri, Koliwada (E), Mumbai - 400015	To explain to the stakeholders about the result of BSES and Resettlement & Rehabilitation Policy of MTHL.	Background, 1st SIA Stakeholder meeting (SSM), Result of BSES, Resettlement & Rehabilitation Policy of MTHL, Resettlement Site, Requesting opinions from PAPs.	MMRDA JICA Team Project Affected Persons
15th September, 2015 Sewri Koli Samaj Hall, 22/1 Koli Samaj Co.Op.Society, Sewri, Koliwada (E), Mumbai - 400015	To inform/communicate to the stakeholders and public at large about the findings of the draft supplemental EIA. To discuss the mitigation measures as suggested in the draft EIA.	Opening Remarks, Project in Brief, Objectives & schedule of public consultation meetings, details of first public consultation of EIA, result of reformed studies, Environmental Management Plan, Environmental Monitoring Plan, Project Implementation Schedule, Exchange Opinions, Remarks	MMRDA Team JICA Team Relevant local government (CIDCO, MPT & JNPT) Experts from various fields as per JICA requirements NGOs Project affected persons

Source: JICA Study Team

12.5.4 Objectives of the Meetings

(1) Scoping Stage

1) Participants of the Meetings

Table 12.5.2 Major Participants of Public Consultation on Scoping Stage

Date & States	Major Participants	
Mumbai, Maharashtra State 29th July 2015 2.00-4.00pm (at Committee Room, 6th Floor, MMRDA office, B.K.C, Mumbai)	MMRDA	Chief Engineer, Superintending Engineer, Ex. Engineer, Chief, Social Development Cell, Deputy Engineer, Deputy Engineer
	Other Government Organizations	Scientist- NEERI, IFS- Head Mangrove Cell, Superintending Archaeologist – Archaeological Survey of India, Dy. Chief Engineer- Mumbai Port Trust, Ex. Engineer – CIDCO, Manager (EC)- JNPT
	NGO and/or Community specific group	Project Manager –Social Specialist- CEED, Representative of Teacher's Group, Representative of Women's Group
	PAPs	Local Medical Practitioner, Social Activist, Residents
	JICA Team	JICA study team and local consultant
Total Number of Participants	Government: 12, PAPs: 13, NGOs and Community Specific Group: 3, JICA Team: 6 Total: 34 (Male: 26, Female: 8)	

Source: JICA Study Team

2) Agenda

- ✓ Explanation of the objectives of the meeting by JICA Team
- ✓ Explanation of project background & project features by JICA Study Team
- ✓ Explanation of MTHL alignment by JICA Study Team
- ✓ Explanation on need for Environmental & Social consideration in this project
- ✓ Explanation on supplemental EIA and RAP outline (process, extent of impact and study schedule) by JICA Study Team
- ✓ Explanation on Study Schedule (Timeline)
- ✓ Exchange of opinions

(Note): Contents above were explained in "Marathi" language based on the materials prepared for SHM and RAP Socialization at the scoping stage

3) Major Opinion and Summary of Discussions

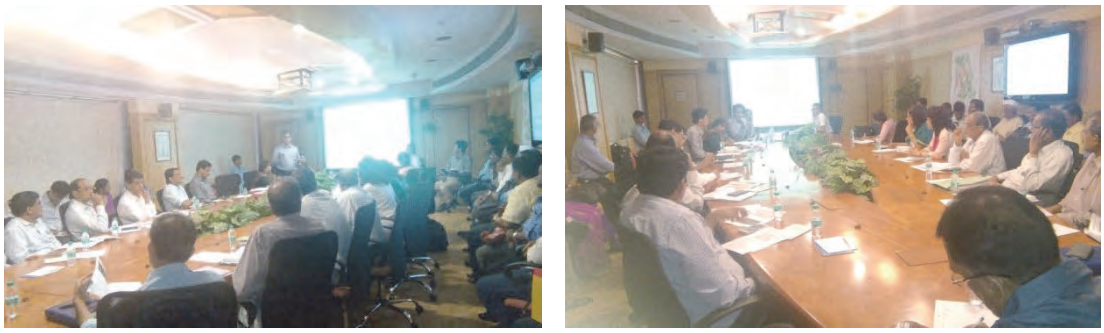
The JICA Study Team initiated the proceedings and welcomed the gathering and explained about the project in brief and the EIA studies carried out. He presented the project and EIA findings in Marathi language to the participants. The meeting then opened for a Questions & Answers session. The major opinions and discussions held in the meeting are given below:

Table 12.5.3 Major Opinions and Discussions of the Stakeholder Meeting

No	Major opinion and Answer			
	Question/Comment		Answer	
	Name/Position	Question	Name/Position	Answer
1	Scientist- NEERI Female	Who will do the funding for the project?	Mr. Kolatkar (EIA Specialist -JICA Study Team)	It is expected that the funding for the project will be from the “Japan International Cooperation Agency’’ (JICA).
2	Scientist- NEERI Female	In which season will the environmental monitoring be carried out? Whether Marine water & Air quality monitoring is covered in this Reformed Rapid EIA?	Mr. Kolatkar (EIA Specialist -JICA Study Team)	Post monsoon season monitoring was carried out in the year 2012. the JICA Study Team will use the secondary data from the Pollution Control Board, if any.
3	Scientist- NEERI Female	What activities are planned in the supplementary EIA?	Mr. Kolatkar (EIA Specialist	JICA Study Team has checked the old Rapid EIA Report 2012 based on the JICA guidelines, and will fill out the gaps. The Vibration Study and Social Impact Assessment will be covered in the Supplemental EIA.
4	EC- JNPT & Scientist- NEERI Female	Whether Mangrove Management Plan & Ecology Impacts are considered?	Mr. Kolatkar (EIA Specialist	All these will be covered in the EIA finalized in the September 2015.
5	Archaeological Survey of India male	What is the distance between the alignment and Elephanta caves? Elephanta Caves have no electric connection. If the project is passing within 1 km from Elephanta Caves then electricity should be converted.	Mr. Kolatkar (EIA Specialist)	Around 2km from the alignment to Elephanta cave. With regard to provision of power, this is a good advice and will be taken into account in the future.
6	PAP Male	Long ago the Mangrove Park was declared to be in Sewri. Is this taken into account?	Mr. Kolatkar (EIA Specialist)	JICA Study Team will check on this. (After the meeting, It was confirmed that there are any plans such as mangrove park)
7	PAP Male	Give details of Slum Rehabilitation Plan.	Mr. Kolatkar (EIA Specialist)	MMRDA carried out 100 household surveys earlier and since then a 380 household survey was carried out in the SIA survey. MMRDA will study these survey results and follow MMRDA’s Compensation Policy for Rehabilitation.
8	PAP Male	The PAP said this is a good project and that they want such project. But the rehabilitation should be in or near the same area. As per new law, they should get new and good homes and commercial units.	Mr. Vishram Patil (Chief-Social Development Cell, MMRDA)	MMRDA will take into account these points. But they cannot commit that they can shift the PAPs within the same area at the moment. But they will see the situation and try to shift the PAPs into a nearby area. MMRDA will not build the houses but will give the compensation. As the land belongs to Mumbai Port Trust and hence the revision will be done in terms of place.
9	PAP Male	What about the houses which are not in impact zones?	Mr. Vishram Patil (Chief-Social Development Cell, MMRDA)	For those who are interested in shifting, MMRDA will think positively regarding the same. MMRDA will follow the policy in view of JICA R & R policy. House in lieu of house will be as per new policy. As per rule, each house will have 225 Sq.ft of space. If more than 225 Sq.m then MUTP policy will be followed.
10	PAP Male	What about the commercial area? Because these are not taken into account.	Mr. Vishram Patil (Chief-Social Development Cell, MMRDA)	There is no commercial in lieu of commercial area policy in the Government of India Act, . Businesses may be lost, therefore, MMRDA will take into account the number of business affected persons and will consider compensation.

No	Major opinion and Answer			
	Question/Comment		Answer	
	Name/Position	Question	Name/Position	Answer
11	PAP Male	Are worship/religious places taken into account?	Mr. Vishram Patil (Chief Social Development Cell, MMRDA)	MMRDA will consider shifting of these places out of the project ROW (Right of Way). OR MMRDA will consider land compensation and hold discussions with the locals.
12	PAP Male	What if commercial area is above 3000 Sq.ft & has more than two or three properties?	Mr. Vishram Patil (Chief Social Development Cell, MMRDA)	If more than 1 shop is there, then same area will be given like 225 Sq.ft. Above that, if required then it has to be purchased. If 900 Sq.ft area is there, then 750 Sq.ft area will be given. Above this if required then PAP has to buy. If 700 Sq.ft area is there then 225 Sq,ft will be given free of cost and above that owner has to buy it. The cost to buy will be as per ready reckoner rate.
13	PAP male	If some people are not willing to shift then what will be the solution?	Mr. Vishram Patil (Chief Social Development Cell, MMRDA)	Government rules will be strictly followed during development. In many of the projects of MMRDA, it was observed that people want their homes in the same building. Temporary shifting will be given concern and discussed with Mumbai Port Trust. It will be till building construction.

Source: JICA Study Team



Source: JICA Study Team

Figure 12.5.1 Photos of the 1st Public Consultation on EIA

(2) Draft EIA Stage

1) Participants of the Meeting

Table 12.5.4 Major Participants of Public Consultation on Scoping Stage

Date & States	Major Participants	
15th September 2015	MMRDA	Additional Metropolitan Commissioner, Joint Director-Environment, Chief Engineer, Dy. Collector, Tehsildar, Superintending Engineer, DMC Co-ordination, Deputy Engineer, Deputy Engineer, Executive Engineer
	Other Government Organizations	JNPT (Chief Manager-EC), CIDCO (Assistant Chief Engineer), MPT: (Executive Engineer) and
	JICA Team	JICA study team and Local Consultants
	PAPs	Local Medical Practitioner and other PAPs
	NGO and/or Community specific group & others	Bombay Natural Historical Society , Conservation Action Trust, Architects, other groups
Number of Total Percipients	Government: 13, Experts as per JICA Categorization: 1, PAPs: 66, NGOs and Community Specific Group: 17, JICA Team: 8 Total: 105 (Male: 91, Female: 14)	

Source: JICA Study Team

2) Agenda

- ✓ Explanation of the objectives of the meeting
- ✓ Explanation of project outline by JICA Study Team
- ✓ Explanation of result/findings of the supplemental draft EIA
- ✓ Explanation of proposed mitigation measures
- ✓ Exchange of opinions

3) Major Opinion and Summary of Discussion

The JICA study team initiated the proceedings and welcomed the gathering and explained about the project in brief and the EIA studies that have been carried out. The JICA study team presented the project and EIA findings in Marathi language to the participants. The meeting then opened for a Questions & Answers session. The opinions and discussions held in the meeting are given below:

Table 12.5.5 Major Opinions and Discussions of the Stakeholder Meeting

No	Major opinion and Answer			
	Question/Comment		Answer	
	Name/Position	Question	Name/Position	Answer
1	NGO male	We want this bridge to be built as it is a good public facility, but the bridge should be realigned. Flamingos are coming here and they stay for 6 months. We should look at how we can save them. We should use the latest technology monitoring programme and design a restoration program for the mudflats so that the flamingo habitation area can be kept secure and citizens can enjoy nature.	MMRDA	Ok, we have noted these good suggestions. Note) Observation from MMRDA after the meeting. MMRDA has obtained permission for the CRZ from MoEF, and adequate mitigation measures are prepared for fauna and flora. Thus MMRDA does not have any intention to change the alignment.
2	NGO male	Bridge should start from MPT. What are the impacts of the project on: • Marine life • Migratory Birds • Fisherman and fishing activities and its period • Remedial Measures for the PAPs • Earth strata impact for such 5 years long period • The accidental release of gases • Aquatic life	JICA Study Team	The plan is to minimize the impact of the construction through construction of pillars with larger spans. Rain water & storm water will be discharged through the piles and not directly into the sea to avoid turbidity. Noise & vibration impacts will be minimized by installation of noise barriers with edge treatment so that this will also mitigate the impact of street lights on the aquatic biota, especially flamingos. Piling/boring will be there for pillars and the outcomes will be disposed of as per CRZ notification. Shorter spans will only be at interchanges where they will be approximately 50 metres.
3	PAP (fishermen society) male	Are all documents open to public and are they in Marathi? What are the impacts on fishing activities and fisherman? What are the mitigation measures?	JICA Study Team	The draft EIA will be submitted on 25th September and then it will be available on the JICA website. A committee will be formed in one week to decide the impacts and mitigation measures for Fisherman and Fishing activities.
4	NGO male	What about draft EIA reports and current status and updates. Whether detailed studies on migratory birds and fauna are being carried out? 150 species are noted in this area. 15000 flamingos for 6 to 7 months visit this place. Not only noise barriers but also trees should be planted. Project will lead to environmental degradation due to upcoming traffic on proposed link bridge. There will be impacts on mangroves due to its cutting. Modelling should be just like Bandra Worli Sea Link.	JICA Study Team	A draft EIA will be submitted on 25th September and then it will be available on the JICA website. In the area you speak of there will only be piers. There will be no erosion because of piers. Flamingos first came in 1994. They are still well noted under Vashi & Airoli bridges without any mitigation measures. But in this proposed project, except for during the construction period no such impacts are anticipated. No erosion is expected. Mangroves generally increase due to siltation. Mangrove replantation will be carried out as per CRZ clearance.
5	PAP male	What happens to public transport like trains? Were traffic studies are done? What will be the toll cost? Will it cause financial burden?	MMRDA	No railway is part of the project. Navi Mumbai already has a plan for development of an airport. Toll cost will be for all. Toll cost will be fixed in such a way that people will use the bridge.

No	Major opinion and Answer			
	Question/Comment		Answer	
	Name/Position	Question	Name/Position	Answer
6	PAP (institute) male	Are trains included in this project?	MMRDA	No, Trains are not included in this project.
7	NGO male	A sanctuary has been declared in the proposed project area. Dumping is going /operational at Kanjur & JNPT. What will be the impact if such a delineation happens?	MMRDA	There is a great distance between Thane creek and the sanctuary. We have carried out traffic studies and reported the information in an EIA. A Flamingo study was carried out by the experts and only after all this was the design finalized.
8	PAP male	Being a member of IIE, this project is very important and was first proposed a long time ago. How will this project help to cope with the increasing traffic and speed level? The balance should be achieved for positive impacts for both humans and flamingos.	MMRDA	The benefits and cost cannot be known at this stage. But yes, a balanced approached will be maintained in this project.
9	NGO male	Thane creek is far from the sanctuary. But are necessary approvals obtained for the project and have these factors been considered?	JICA Study Team	Like no other project, in this project environmental impacts are considered. It is already explained that all necessary approvals are obtained. Now international and local experts are looking and studying the flamingos. Hence all the points will be covered and reported in the supplemental EIA. New technology is proposed, but still we are open for good suggestions which will be discussed with JICA to ensure that this project will not create an environmental disaster but for further projects it will be an example.
10	NGO male	Does this project impact tidal patterns? And do the pillars cause an impact on the environment? What are the mitigation measures?	MMRDA	CWPRS carried out studies on these issues. And it is noticed that no such impacts are anticipated.

Source: JICA Study Team

Source: JICA Study Team

Figure 12.5.2 Photos of the 2nd Public Consultation

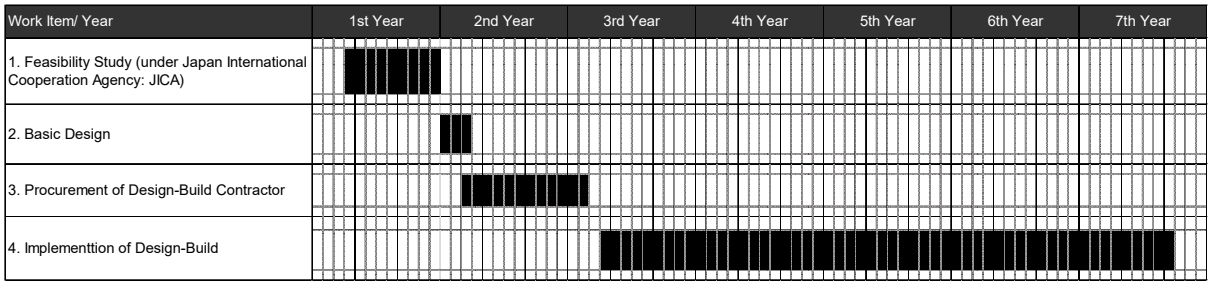
12.6 Construction Schedule

It is expected that “the design-build system” will be adopted from the view point of saving cost and time for this project after the feasibility study and basic study.

Almost 1 year is required for bidding and selection of a contractor, and 4.5 years are necessary for the detailed design and construction period.

The tentative construction schedule is given in Table 12.6.1.

Table 12.6.1 Construction Schedule (as of Feb, 2016)



Source: JICA Study Team

12.7 Other Necessary Permissions

12.7.1 Other Environmental Permissions

Other necessary permissions to be obtained by MMRDA before and during construction are shown below;

Table 12.7.1 Other Necessary Environmental Permissions

Name of Permission to be obtained		Necessity and Status as of Sep. 2015	Status / Reasons
1	Environmental Certificate (EC) for EIA by Ministry of Environment and Forests (MOEF)	Not Required	EC for EIA is not necessary on EIA notification in 2006 as of 2015. MSRDC had obtained EC under the old EIA law in 2005 with 5 years validity. Although the EIA was not necessary after 2006, MMRDA has updated this EIA as a Rapid EIA mainly for obtaining the CRZ-Environmental Certificate.
2	EC for Coastal Regulation Zone by MOEF	Not Required (Already obtained in 2013 and 2016)	The EC of CRZ had been obtained from MOEF based on the law of 2011 CRZ in 2013 with 5 years validity (Until 18th July 2018) and Jan. 2016. The EC includes mangrove cutting permission from MOEF. Law: Coastal Regulation Zone Notification 2011 Issued dates of CRZ for MTHL: 18th July 2013 (valid until 17th July 2018) and 25th January 2016
3	Mangrove Tree Cutting Permission by MOEF	Not Required (Already obtained in 2013 and 2016)	According to an interview with the person in charge of the environment in MMRDA, in general, mangrove cutting permission shall be acquired by the proponent from the Forest Department of MOEF. However CRZ-EC was approved by MOEF and mangrove cutting permission was given on the same CRZ-EC. As mentioned regarding CRZ-EF, MMRDA shall replant 5 times the number of cut mangrove trees (0.0176 x 5times = 0.888 ha) in an appointed area of 30 ha in Nhava by MOEF before the construction phase.
4	Maharashtra High Court Permission for Mangrove Cutting	Before Construction	The proponent shall have Maharashtra high-court permission for cutting mangrove after obtaining CRZ-EC from MOEF. MMRDA has not obtained this permission yet as of Sep. 2015. This permission shall be obtained before actual cutting activities begin in the construction stage based on CRZ-EC and Mangrove cutting permission. According to the person in charge of the environment in MMRDA, the process may take around 3 months after submission of an application.
5	Tree Cutting Permission by Local Government	Before Construction	All permissions shall be obtained after identification of the final affected area and number of trees based on detailed design and investigation of affected trees. The legal framework and process is shown below (Table 12.7.2)
6	Non Objection Certificate from Maharashtra Pollution Control Board (MPCB)	Before Construction	The contractor shall submit construction plans including activities and plant before actual construction activities begin, and then MPCB reviews them and issues a Non Objection Certificate in accordance with the following laws and regulations; The Water (Prevention & Control of Pollution) Act, 1974 The Air (Prevention & Control of Pollution) Act, 1981 The Hazardous Wastes (Management and Handling) Rules, 1989
7	Environmental Certificate under EIA Notification Law 2006	As required	The contractor shall have an Environmental Certificate in accordance with EIA Notification 2006 from Maharashtra State and/or Central MOEF when the contractor develops a new quarry, borrow pits or camp site, if required. Additionally, the contractor shall follow the JICA Guideline for Environmental and Social Considerations 2010

Source: JICA Study Team based on interviews with MMRDA

Table 12.7.2 Cutting Tree Permission Process

Item \ Permission		Mumbai Side	Navi Mumbai Side
1	Name of Permission	Permission for Logging of Project Affected Trees	Ditto
2	Applicable law and regulation	Maharashtra Felling of Trees (Regulations Acts, 1964) Amended in 2006	Ditto
3	Approval Authority	MCGM (Municipal Corporation for Greater Mumbai)	MCNM (Municipal Corporation for Navi Mumbai) Note)The permission is given by the affected authority
4	Due date to be approved	67 days before cutting trees	Ditto
5	Process for obtaining permission	(1) Marking of affected area after detailed design (2) Establish the affected area based on detailed design (3) Site survey of affected species, locations and numbers (4) Submission of application form and result of survey (5) Inspection and review (xx days) (6) Issue of permission	Ditto
6	Process period	(4)-(6): 3-6 months (depends on case)	Ditto

Source: JICA Study Team based on interviews with MMRDA

12.7.2 Other Necessary Development Plans

(1) Quarry Sites and Borrow Pits

The designated registered quarry sites and borrow pits are shown in Figure 12.7.1.

The contractor should use these registered quarry sites as much as they can. However, the contractor can use other designated and registered quarry sites or develop new sites after obtaining permission from the relevant authority prior to actual construction activities. Additionally, the contractor shall follow JICA Guidelines for Environmental and Social Considerations 2010, if required.

(2) Construction Yard and Labour Camp

The planned construction yard and labour camp are located on the Sewri side and Navi Mumbai side, respectively, as shown in Figure 12.7.2.

The Construction and Camp Site in Sewri is located in Mumbai Port Trust compound which is about 18 ha, on the other hand, the site on the Navi Mumbai side is located in the Right of Way of MTHL. A Part of the camp site in Shivaji Nagar has been secured by MMRDA. It is estimated that approximately 3,000 workers will be engaged in the construction each day at the peak time, and 1,000 workers will be staying in temporary accommodations on site.

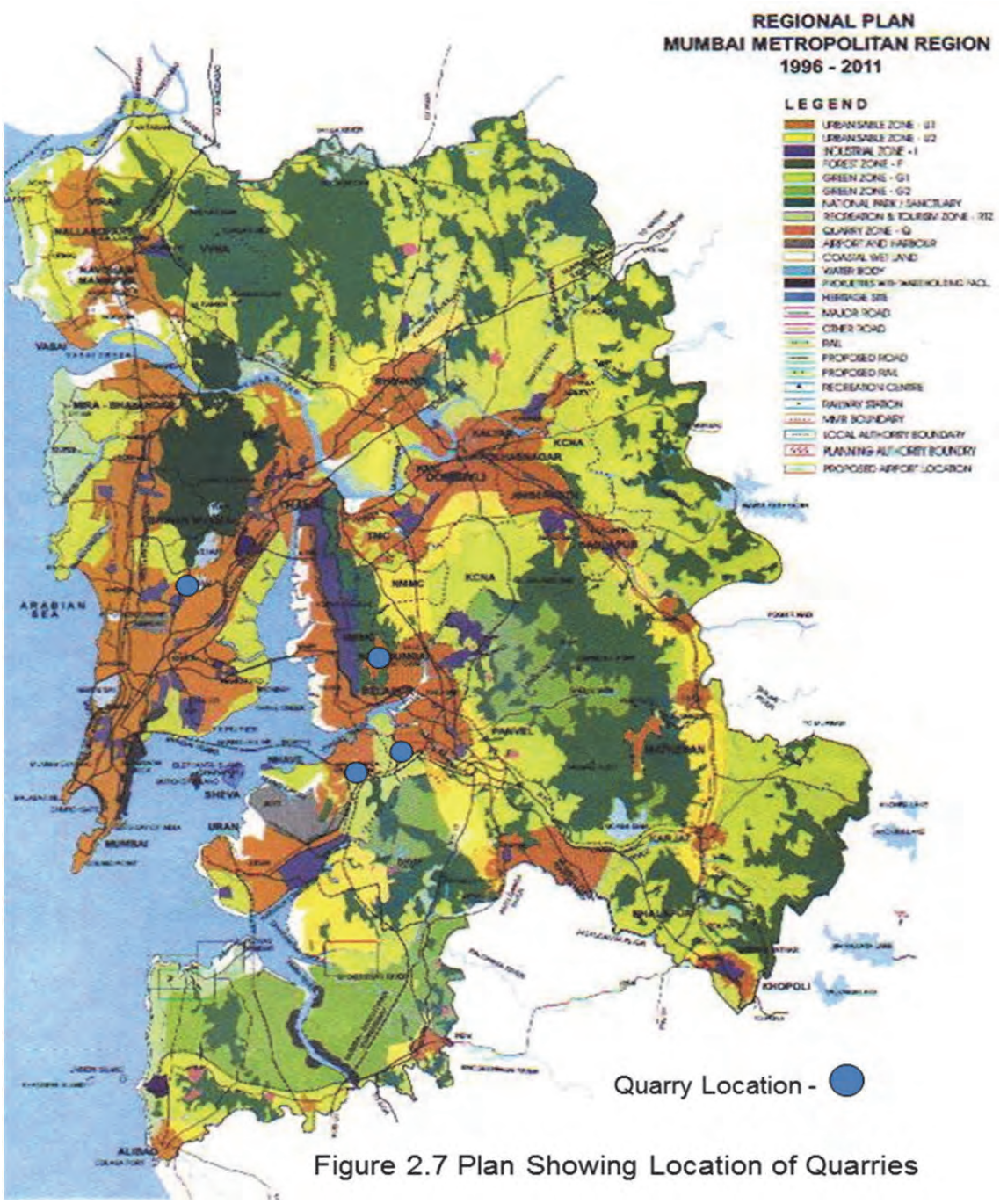
Table 12.7.3 Outline of Construction Yard

Item / Name of Site	Estimated Number of Workers (accommodated)	Function and Installed Plant
1. Sewri Construction Yard	1,540 (510)	Casting yard, material storage, workshop for construction machines and accommodation for workers
2. Shivaji Nagar Construction Yard	860 (290)	
3. Chirle Construction Yard	600 (200)	

Source: JICA Study Team

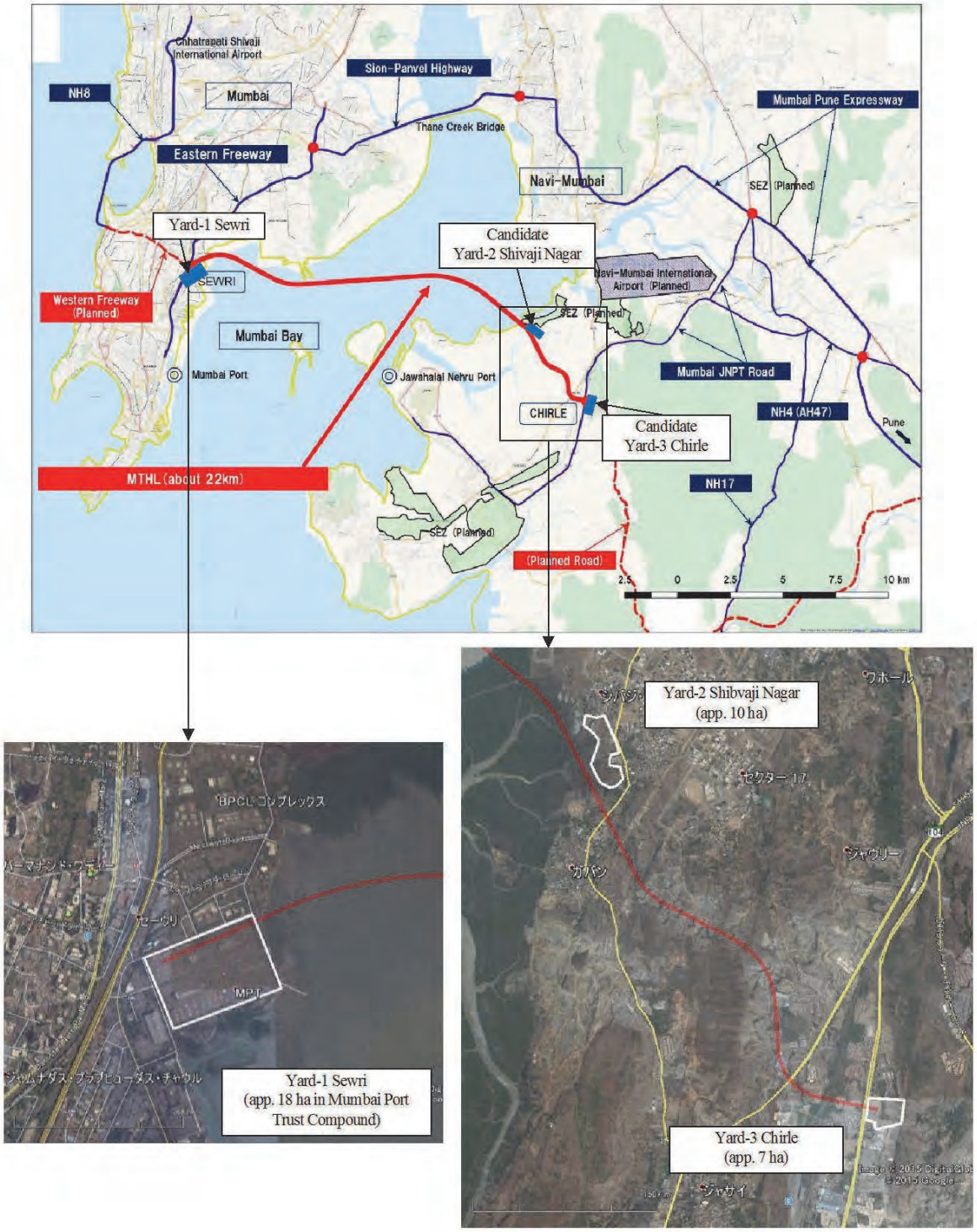
Although the entire construction yard is secured by the contractor, the contractor shall refer to the following scoping and mitigation measures and obtain necessary permissions in accordance with relevant Indian laws.

Tentative draft scoping and mitigation measures are shown in the Supplemental EIA.



Source: Rapid EIA 2012

Figure 12.7.1 Designated Quarry Sites near Project Area



Source: Rapid EIA 2012

Figure 12.7.2 Tentative Construction and Camp Site on MTHL

12.8 Recommendations on EIA

The following actions, which are to be carried out are recommended from the view point of natural and social environmental considerations. The project proponent MMRDA should discuss the following items in cooperation with other relevant organizations and agencies.

(1) Necessity of Local Environmental Management Plan including Coastal Area

Generally, environmental and social considerations on each development project, including MTHL, are reviewed and discussed between the proponent, state and central governments. Public infrastructure developers such as MMRDA and CIDCO, the Municipal Corporation and state government should establish an Environmental Management Plan from the view point of sustainable development at the regional level, including a coastal area harmonized with development and the environment.

Major Relevant Agencies: MMRDA, CIDCO, MCGM, MCNM, Maharashtra State and MOEF

(2) Appropriate Land Use Management

Accumulation of unplanned development near the interchanges may have significant adverse impacts on the natural and social environment. Thus, MMRDA should encourage other relevant organizations such as MCGM, MCNM and CIDCO to manage the land use properly.

Major Relevant Agencies: MMRDA, CIDCO, MCGM, MCNM

(3) Construction Contractor's Responsibility

The following conditions should be included in the bidding documents for the construction contractor

- The contractor shall comply with the stipulations in the Environmental Management Plan (EMP) in the Supplemental EIA and in the CRZ clearance & Clearance of diversion of Forest Land issued in January 2016
- The contractor shall comply with relevant Indian laws and JICA Guidelines for Environmental and Social Considerations (2010) when the contractor develops a construction yard, and he will then conduct appropriate mitigation measures and monitoring.

Major Relevant Agencies: MMRDA, General Consultant, Contractor

(4) Compensatory Planting of Mangrove

Implementation of compensatory planting of mangrove should be carried out under the instruction of MOEF, so as not to have adverse impacts on the surrounding ecosystem.

This detailed plantation plan should be prepared by the GC and Contractor under discussion with MMRDA, Maharashtra State and MOEF during the detailed design stage.

Major Relevant Agencies: MMRDA, GC, Contractor, Maharashtra State and MOEF

(5) Implementation of Baseline Survey before Construction Stage

For implementation of effective mitigation measures, a comprehensive ecosystem baseline survey should be carried out in the project area before detailed design.

Items to be conducted in the surveys are migratory birds, benthos, fish, mangrove and mudflat

Major Relevant Agencies: MMRDA, GC, JICA

(6) Establishment of Information and Communication Centre

It is recommended to establish an information & communication centre to disclose natural and social monitoring results and promote stakeholders to understand the project objectives and processes before and during construction.

Major Relevant Agencies: MMRDA, MCGM

13. LAND ACQUISITION AND RESETTLEMENT

13.1 Legal Frameworks of Land Acquisition and Resettlement

Although MMRDA is the solely responsible implementation agency for MTHL, applicable legal frameworks will be different among Mumbai side (Sewri section), Sea-link section, and Navi Mumbai section. Within Sewri section, Resettlement and Rehabilitation Policy for Mumbai Urban Transport Project, 2000 (R&R/MUTP) enforced by Government of Maharashtra will be applied. Within Sea-link section, a new compensation policy for project affected fishermen set by MMRDA will be applied since there are no legal frameworks for present fishing activities. For Navi Mumbai section, City and Industrial Development Corporation of Maharashtra (CIDCO)'s special policies based on the land law will be applied as CIDCO has been the solely planning and development authority of the section and acquired new development land including MTHL alignment with its policies.

Following sections reconfirm 1) the legal frameworks in India, 2) JICA's policy on involuntary resettlement, 3) gap between legal frameworks and JICA policies, and define 4) applicable policies on involuntary resettlement for the MTHL project.

13.1.1 Indian Legal Frameworks on Involuntary Resettlement

Principle legal frameworks for land acquisition in Maharashtra is Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Rehabilitation and Resettlement Act 2013 (LARR2013) that repealed Land Acquisition Act 1894 (LA1894) and Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules 2014 by Government of Maharashtra (LARR_MH2014). As the MTHL project was awarded and started land acquisition in 1980's, past land acquisition in Navi Mumbai (57.6Ha) was completed before 2000 based on LA1894 with additional compensation packages by CIDCO 12.5% scheme (CIDCO). Now, the rest of all other land acquisition shall be conducted based on LARR_MH2014 with CIDCO 12.5% scheme or solely CIDCO 22.5% scheme and other related laws and regulations in Maharashtra.

SEWRI SECTION

All Sewri section is owned and under the jurisdiction of Mumbai Port Trust (MPT). Since transfer of land ownership from MPT to MMRDA is required, negotiation has been conducted

based on the Major Port Trusts Act (MP1963) and Policy Guidelines for Land Management by Major Ports (PGLM2014). In addition, in order to support none title holders within the project area on MPT land, a social impact assessment (resettlement and rehabilitation plan) is prepared as per JICA Guidelines on Environmenta and Social Consideration (2010) and R&R/MUTP. Based on the SIA, relocation and rehabilitation support will be implemented.

SEA-LINK SECTION

As all the sea-link section is inside the harbour limit of MPT and JNPT, in general, governing legal frameworks are defined by the port related legislations by the central government and enforced by MPT and JNPT in each port. Although the sea-link section is exclusive harbour area, relevant legislation does not prohibit fishing activities except large scale mechanical fishing. Considering the fishing rights and regulatory agency, Maharashtra Department of Fisheries (DoF) would be the most relevant authority among others.

For preceding project implementation, MMRDA set a special committee on MTHL fishery compensation policy development, which was composed of relevant authorities including DoF as well as representatives of fishing societies and communities potentially affected by the project. The committee has defined and recommended MMRDA's principal policy on fishermen compensation for MTHL and MMRDA approved the compensation policy. Detail description of the compensation policy is described in section 13.3.

NAVI MUMBAI SECTION

The town planning and development has been implemented based on CIDCO's general development plan in Navi Mumbai. For MTHL, a part of CIDCO's development land will be transferred to MMRDA. Roughly 70% (69Ha) of the right of way (ROW) had been acquired before 2000. Presently the rest of the land roughly 30% (27Ha) are on the process of the final negotiation between land owners and CIDCO. Applicable policies for land acquisition, resettlement and rehabilitation in the past before 200 and present have been separately enforced as follows:

- Past Land Acquisition 69Ha before 2000: LA1894 and CIDCO12.5% scheme, and
- On-Going Land Acquisition 27Ha: LARR_MH2014 and CIDCO12.5% scheme (Land to land and/or cash) or CIDCO22.5% scheme (Land to Land only).

The principal legal frameworks are summarized below.

(1) Key Legislation Relevant to Land Acquisition for MTHL

Table 13.1.1 Key Legislation Relevant to Land Acquisition & Safeguards

Land Acquisition Act (LA1894, amendment 1984)* <applied for past land acquisition before 2000 in Navi Mumbai section (69Ha)>	• Principally applicable for public projects and specifying the responsible authorities, process of land acquisition, means of land valuation and compensation • Market price as compensation price at the time of land acquisition • No compensation for impacts of occupational & livelihood • ONLY applicable for legal landowners
Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (LARR2013) & Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Maharashtra) Rules 2014 (LARR_MH2014) <applicable in Sewri** section and on-going land acquisition in Navi Mumbai section (27Ha)>	• Applicable for all public and private (relatively large scale entities defined by Companies Act 2013) projects • Combination of LA1894 and NRRP2007 with improvement of applicability and condition of compensation with livelihood recovery support • Mandatory of SIA and Social Management Plan (SMP) by the individuals & institutions registered or empanelled in the Database of Qualified Social Impact Assessment Resource Partners and Practitioners • Appointment of the SIA team by Social Impact Assessment Unit of the appropriate government agency separate from proponents including responsible/implementation agencies of infrastructure projects
Resettlement and Rehabilitation Policy for Mumbai Urban Transport Project 1997 (amended in 2000) (R&R/MUTP)	• Adapted policy for the World Bank Mumbai Urban Transport Project, 1995 and formally adapted by GoM in 1997, and amended in 2000 • The Resettlement and Rehabilitation policy addressing and mitigating the gap between Indian legal frameworks and WB Operational Policies (OP) in involuntary resettlement WB OP 4.12 • Adapted policy for the JICA Mumbai Metro Phase III project
Major Port Trusts Act (MP1963)	• Determination of major port in India and its functions • Determination of the governing law as LA1894 in case of land acquisition for the port development
CIDCO Rehabilitation Scheme (12.5% Scheme)*** <applicable in Navi Mumbai section>	• Specially designed and applicable LAND-to-Land compensation packages in Navi Mumbai development by CIDCO since 1990's • For 100% of PAP's land (assuming undeveloped land), given 12.5% of the "Developed" land including social facilities and public utilities accounting for 3.75% (net housing/commercial land would be 8.75%) • Permissible Floor Space Index*** (FSI) for the plot allotted: 1.5 and up to 15% of build up area for commercial component
CIDCO Rehabilitation Scheme (22.5% Scheme) <ONLY applicable for limited projects**** in Navi Mumbai>	• Specially designed and applicable LAND-to-Land compensation packages ONLY for Navi Mumbai International Airport (NMIA) and MTHL without cash compensation since early 2015 • For 100% of PAP's land (assuming undeveloped land), given 22.5% of the "Developed" land including social facilities and public utilities
Mumbai Metropolitan Region Development Authority Act (MMRDA1974)	• Defining the setup of MMRDA and legal power including land acquisition for regional planning and other authorized projects • 100 times monthly productive financial values of the immediate 5years average as compensation price
MTHL– Fisher-Folks Compensation Policy 2015	• The compensation and rehabilitation policy of MTHL as per JICA Guidelines on Environmental and Social Consideration 2010 • Definition of potential project impacts and eligible project affected fishermen and their compensation • Defining the setup of separate grievance redress mechanism apart from Sewri and Navi Mumbai sections involving relevant agencies

* The LA1894 was repealed by LARR2013 on 1st of Jan. 2014. In case of approval/awarded rights by LA1894, validity remains up five(5) years excluding the period of court case suspension.
** Based on BSES, only non-title holders are in Sewri-section, but cash compensation based on LARR_MH2014 shall be applied for land owners.
*** 12.5% scheme with cash compensation had been applied for past land acquisition (69ha:70%) by CIDCO. It is still applicable for any PAPs for on-going acquiring land (27ha:30%) if PAPs prefer.
FSI: ratio between the liveable area on all floors of the building to the actual area of that plot of land
**** 22.5% scheme is ONLY applicable for on-going land acquisition (27ha:30%) for MTHL if PAPs prefer.

Source: JICA Study Team

(2) Summary of Section-Wise Primary Legal Frameworks for Involuntary Resettlement

Table 13.1.2 Project Section Wise Primary Legal Frameworks of MTHL

Sections	Sewri	Sea-link	Navi Mumbai
Primary Laws and/or Compensation Policies	• Major Port Trust Act 1963 • PGLM2014 • R&R/MUTP • LARR_MH2014 • MMRDA Act, 1974	• Major Port Trust Act 1963 • PGLM2014 • Maharashtra Fisheries Act (1981) • MMRDA Act, 1974	<Past Land Acquisition> • LA1894 • And CIDCO 12.5% Scheme <New Land Acquisition> • LARR_MH2014 & CIDCO 12.5% Scheme • Or 22.5% Scheme only
Governing Authority	• MPT • (MMRDA)	• MPT • JNPT	• CIDCO • JNPT

Source: JICA Study Team

13.1.2 JICA Policies on Involuntary Resettlement

The key principle of JICA policies on involuntary resettlement is summarized below.

(1) Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.

(2) When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.

(3) People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.

(4) Compensation must be based on the full replacement cost[38] as much as possible.

(5) Compensation and other kinds of assistance must be provided prior to displacement.

(6) For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the

[38] Description of "replacement cost" is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.

(7) In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.

(8) Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.

(9) Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

(10) Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that “JICA confirms that projects do not deviate significantly from the World Bank’s Safeguard Policies”. Additional key principle based on World Bank OP 4.12 is as follows.

(11) Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.

(12) Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.

(13) Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.

(14) Provide support for the transition period (between displacement and livelihood restoration.

(15) Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.

(16) For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc.

13.1.3 Gap between Indian Legal Frameworks and JICA Policies

Gaps between applicable legal frameworks for each section and JICA Env.Guidlines2010 are summarised below. Details of the comparison are described in the Table 6.5 of the MTHL Social Impact Assessment (SIA) report.

(1) Sewri Section

Based on Table 6.5 of SIA, it is confirmed that all conditions of R&R/MUTP meet JICA Env.Guidelines2010. R&R/MUTP was originally prepared for the compensation policy for the involuntary resettlement for the word bank funded project “Mumbai Urban Transport Project.” R&R/MUTP conforms to the World Bank operational policy on involuntary resettlement (PO4.12), which JICA Env.Guidelines2010 refers to.

(2) Sea-Link Section

In October 2015, MMRDA organized an expert committee on defining the mitigation measures for the potentially affected fishermen along the MTHL alignment and started a new compensation policy development. The committee was held four times with the presence of not only relevant authorities but also representatives of nine project affected fishing societies. In addition, a separate consultation between DoF and fishermen was held. After such communication, the MTHL principal compensation policy for project affected fisherman was approved by MMRDA in December 2015, Based on the principal compensation policy, monetary compensation for expected impacts will be paid in advance and unforeseen impacts will be confirmed through monitoring and its compensation shall be defined by a grievance redress committee. The MMRDA fisherman compensation policy complies with JICA Env.Guidelines2010.

(3) Navi Mumbai Section

As it is described previously, applicable policies are different between past land acquisition for 69Ha and on-going acquisition for 27Ha. It is confirmed that both past and on-going land acquisition meet JICA Env.Guidelines2010. Detailed comparison tables are shown in the appendix 7.

13.1.4 Applicable Policies on Involuntary Resettlement for the MTHL Project

Applicable policies on land acquisition and involuntary resettlement are as follow.

Table 13.1.3 Principals of Involuntary Resettlement Policy for MTHL

I. MMRDA applies the involuntary resettlement policy of the Government of Maharashtra - "Mumbai Urban Transport Project (2000)" (R&R/MUTP) for MTHL. However, R&R/MUTP does not cover the potential impacts of fishing activities. Thus, MMRDA applies the principal policy of fisherman compensation for MHTL, which MMRDA set as per JICA Guidelines for Environmental and Social Considerations (2010). This section states the principles of the compensation policies, and the details of the entitlements of the PAPs are described in section 13.3 of entitle matrixes.

II. Land acquisition and involuntary resettlement will be avoided where feasible, or minimized, by identifying possible alternative project designs that have the least adverse impact on the communities in the project area.

III. Where displacement of households is unavoidable, all PAPs (including communities) losing assets, livelihoods or resources will be fully compensated and assisted so that they can improve, or at least restore, their former economic and social conditions.

IV. Compensation and rehabilitation support will be provided to any PAPs, that is, any person or household or business which on account of project implementation would have his, her or their:

- Standard of living adversely affected;
- Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;
- Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected temporarily or permanently; or
- Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.

V. All affected people will be eligible for compensation and rehabilitation assistance, irrespective of tenure status, social or economic standing and any such factors that may discriminate against achievement of the objectives outlined above. Lack of legal rights to the assets lost or adversely affected tenure status and social or economic status will not bar the PAPs from entitlements to such compensation and rehabilitation measures or resettlement objectives. All PAPs residing, working, doing business and/or cultivating land within the project impacted areas as of the date of the latest census and inventory of lost assets (IOL), are entitled to compensation for their lost assets (land and/or non-land assets), at replacement cost, if available and restoration of incomes and businesses, and will be provided with rehabilitation measures sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.

VI. PAPs that lose only part of their physical assets will not be left with a portion that will be inadequate to sustain their current standard of living. The minimum size of remaining land and structures will be agreed during the resettlement planning process.

VII. People temporarily affected are to be considered PAPs and resettlement plans address the issue of temporary acquisition.

VIII. Where a host community is affected by the development of a resettlement site in that community, the host community shall be involved in any resettlement planning and decision-making. All attempts shall be made to minimize the adverse impacts of resettlement upon host communities.

IX. The resettlement plans will be designed in accordance with R&R/MUTP and LARR_MH2014 and JICA's Policy on Involuntary Resettlement.

X. The Resettlement Plan will be translated into local languages and disclosed for the reference of PAPs as well as other interested groups.

XI. Payment for land and/or non-land assets will be based on the principle of replacement cost.

XII. Compensation for PAPs dependent on agricultural activities will be land-based wherever possible. Land-based strategies may include provision of replacement land, ensuring greater security of tenure, and upgrading livelihoods of people without legal land titles. If replacement land is not available, other strategies may be built around opportunities for re-training, skill development, wage employment, or self-employment, including access to credit. Solely cash compensation will be avoided as an option if possible, as this may not address losses that are not easily quantified, such as access to services and traditional rights, and may eventually lead to those populations being worse off than without the project.

XIII. Replacement lands, if the preferred option of PAPs, should be within the immediate vicinity of the affected lands wherever possible and be of comparable productive capacity and potential[39]. As a second option, sites should be identified that minimize the social disruption of those affected; such lands should also have access to services and facilities similar to those available in the lands affected.

XIV. Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihood and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.

XV. The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status.

XVI. PAPs will be involved in the process of developing and implementing resettlement plans.

XVII. PAPs and their communities will be consulted about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

XVIII. Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period. The funds for all resettlement activities will come from the MMRDA and/or Government of Maharashtra.

XIX. Displacement does not occur before provision of compensation and of other assistance required for relocation. Sufficient civic infrastructure must be provided in resettlement site prior to relocation. Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases. (Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be on-going activities.)

XX. Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

XXI. Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system. An external evaluation group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified NGOs, research institutions or universities.

Cut-off-date of Eligibility

The cut-off-date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAPs and be eligible to Project entitlements.

FOR SEWRI SECTION in the Project, Cut-off dates for both titled and non-titled PAPs in “Sewri section” will be the completion date of the population census, known as Baseline Socio-Economic Survey (BSES), on 10th July, 2015. The BSES date was disclosed in advance to the project affected families with the MMRDA notification as well as the time of BSES survey.

FOR SEA-LINK SECTION Cut off dates shall be officially defined by MMRDA and relevant authorities (Collectors and Department of Fisheries. No official statement has not been published yet. The official notification would be published after the verification of the project affected fishermen list, the attachment to the MMRDA fisheries compensation management plan.

FOR NAVI MUMBAI SECTION in the Project, present land use and no possession of none title holders including residential use were confirmed y JICA study team in June, 2015. Thus, ONLY the present title holders for the rest of the 27Ha will be eligible for MTHL compensation policies. Thus, no cut off date is set for Navi Mumbai section, but CIDCO as the town planning and development authority will assure the prevention of non title holders’ possession within both past and on-going land acquisition areas.

[39] Agricultural land for land of equal productive capacity means that the land provided as compensation should be able to produce the same or better yield the AP was producing on his/her land prior to the project. The production should be in the planting season immediately following the land acquisition. It can be for a future period if transitional allowance equal to the household’s previous yield is provided to the AP household while waiting for the land to get back to the same productivity as the previous land.

The establishment of the eligibility cut-off date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements.

Principle of Replacement Cost

All compensation for land and non-land assets owned by households/shop owners who meet the cut-off-date will be based on the principle of replacement cost. Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction as follows:

A *Productive Land (agricultural, aquaculture, garden and forest) based on actual current market prices that reflect recent land sales in the area, and in the absence of such recent sales, based on recent sales in comparable locations with comparable attributes, fees and taxes or in the absence of such sales, based on productive value;*

B. *Residential land based on actual current market prices that reflect recent land sales, and in the absence of such recent land sales, based on prices of recent sales in comparable locations with comparable attributes; fees and taxes.*

C *Existing local government regulations for compensation calculations for building, crops and trees will be used where ever available.*

D. *Houses and other related structures based on actual current market prices of affected materials;*

E. *Annual crops equivalent to current market value of crops at the time of compensation;*

F. *For perennial crops, cash compensation at replacement cost that should be in line with local government regulations, if available, is equivalent to current market value given the type and age at the time of compensation.*

G. *For timber trees, cash compensation at replacement cost that should be in line with local government regulations, if available, will be equivalent to current market value for each type, age and relevant productive value at the time of compensation based on the diameter at breast height of each tree.*

13.2 Scope of Land Acquisition and Resettlement Impact

13.2.1 Necessity of the Land Acquisition and Involuntary Resettlement

(1) Project Components and Project Affected Area

MTHL is divided by three different sections, namely Sewri, Sea-Link, and Navi Mumbai section, and applicable conditions and policies for land acquisition are different among three sections due to the physical and jurisdictional differences. Characteristics of each section and relevant information are summarized as follow.

Table 13.2.1 Major Characteristics of Each Section and Acquisition Status

Section	Jurisdictional Authorities / Ownership of the Section	Land/Are Use Status	Acquisition Status
Mumbai/Sewri Section KM0+000-KM0+720 (8.6 Ha)	MPT, MMRDA / MPT	Exclusive/restricted port area, MPT related businesses, residence	• Principle agreement between MPT and MMRDA has been made. Legal process of land transfer has been on the process. • The resettlement & rehabilitation plan (SIA) for both legal title holders and none title holder is competed and approved by MMRDA.
Sea-Link Section KM0+720-KM16+750 (810 Ha)	MPT, JNPT , MMRDA / MPT, JNPT	Port and navigation channel, gas/oil pipelines, submarine cables, tidal zones (mud flat, river mouth, mangrove)	• Principle agreement with all authorities including MPT & JNPT has been made. • MMRDA's principal policy on fishermen compensation for MTHL is set and approved by MMRDA. Detail survey for project affected fishermen confirmed eligible fishermen for the advanced monetary compensation.
Navi Mumbai Section KM16+750-KM21+840 (96 Ha)	MMRDA, CIDCO, JNPT / CIDCO, JNPT, private, Indian Railways	Wetland, Unused land (already acquired by CIDCO), Mining (rock & sand), temporal storage, railway	• CIDCO has already acquired 69ha（70%）. The rest of 27Ha（30%） is on the process of final negotiation as of November 2015. • Approval of bridge over railway has already awarded by Indian railways.

Source: MMRDA, CIDCO, JICA Study Team

Table 13.2.2 Major Components of MTHL

Section	General Description of Project Component
Mumbai/Sewri Section KM0+000-KM0+720	• Interchange and ramps to connect existing roads and future planned roads • Widest row with to bundle all connecting roads toward east and gradual reduction of row • Except ramps and connecting roads, all section with concrete bridge • Construction yards at Sewri jetty and back yards (presently container yards) during construction
Sea-Link Section KM0+720-KM16+750	• Concrete and metal bridges • Temporal jetties on mud flats during construction for both Sewri and Navi Mumbai sections
Navi Mumbai Section KM16+750-KM21+840	• Interchange and ramps to connect existing roads and future planned roads • Concrete bridges • Construction yards at Shivaji Nagar Mud- flat (presently mangrove and mudflat) during construction

Source: JICA Study Team

Considering the ownership of the land throughout the Project, out of 104.9Ha land acquisition, only 27Ha is under private ownership and 77.9Ha is government possession. All sea-link section is either MPT or JNPT's possession.

Table 13.2.3 Overall Project Impacts

	IMPACT	Sewri	Sea Link	Navi Mumbai	Total
1	**Acquisition of Land/Water (Ha)**	**8.6**	**810**	**96**	**914.6**
1.1	Private Land/Water (Ha)	0	0	85.0	85.0
1.2	Government Land/Water (Ha)	8.6	810	11.0	826.6
2	**Land Lease (Ha)**	**13.8**	**810**	**19.0**	**824.8**
2.1	Private Land (Ha)	0	0	0	0
2.2	Government Land (Ha)	13.8	810	19.0	842.8
3	**Impact on Structure (No.)**	**317**			**317**
3.1	Loss of Residence (No.)	229		NA**	229
3.2	Loss of Business (No.)	53	NA		53
3.3	Impact on community structures (no.)	10			10
3.4	Impact on government structures (no.)	25		1	26
4	**Project Affected Persons (No.)**	**1,554**	**7,545**		**9,099**
4.1	Households/ Businesses (No.)	282	0		282
4.2	Affected Persons (No.)	1,272	7,545		8,817
5	**Legal Title Holders/Lessee (No.)**	**0**	NA	NA**	**0**
6	**None tile Holders (No.)**	**282**			**282**
7	**Vulnerable Group Household (No.)**	**58**	**95***		**58**

NA – Not applicable
***** Detailed surveys for project affected fishermen were completed in October 2016 and confirmed the number of affected fishermen
****** It is confirmed that no residential use and no livelihood recovery are required through the field observation in 2015 and consultation with responsible CIDCO officials. It might be required to acquire a part of a public school land.

Source: MMRDA, CIDCO & BSES data from JICA study team

SEWRI SECTION

Based on a property survey by MMRDA in 2013, a BSES was conducted for all project affected households. Resettled households and businesses will be 282, and number of project affected persons will be 1,272. Among 282 project affected households, 58 households are recognized as vulnerable group.

Considering the project affected structures, number of the structures is 317 and majority of the affected structures is resident. Some religious and community facilities (community hall and toilet) will be also relocated.

Table 13.2.4 Acquired Property in Sewri Section

Type	Relocate Property (No.)	Responses by the owner during BSES
Resident	229	224
Businesses	53	47
Temple	5	5
Mosque	1	1
Female Community Hall (WSHG)	3	3
MPT Buildings/Warehouse/etc.	25	25
Public Toilet	1	1
Total	**317**	**306**

Source: JICA study team

Table 13.2.5 Number of Full or Partial Affected Properties

Type	Full Acquisition	Partial Acquisition	Total
Resident	210	19	229
Business	52	1	53
Other	34	1	35
Total	**296**	**21**	**317**

Source: JICA study team

SEA-LINK SECTION

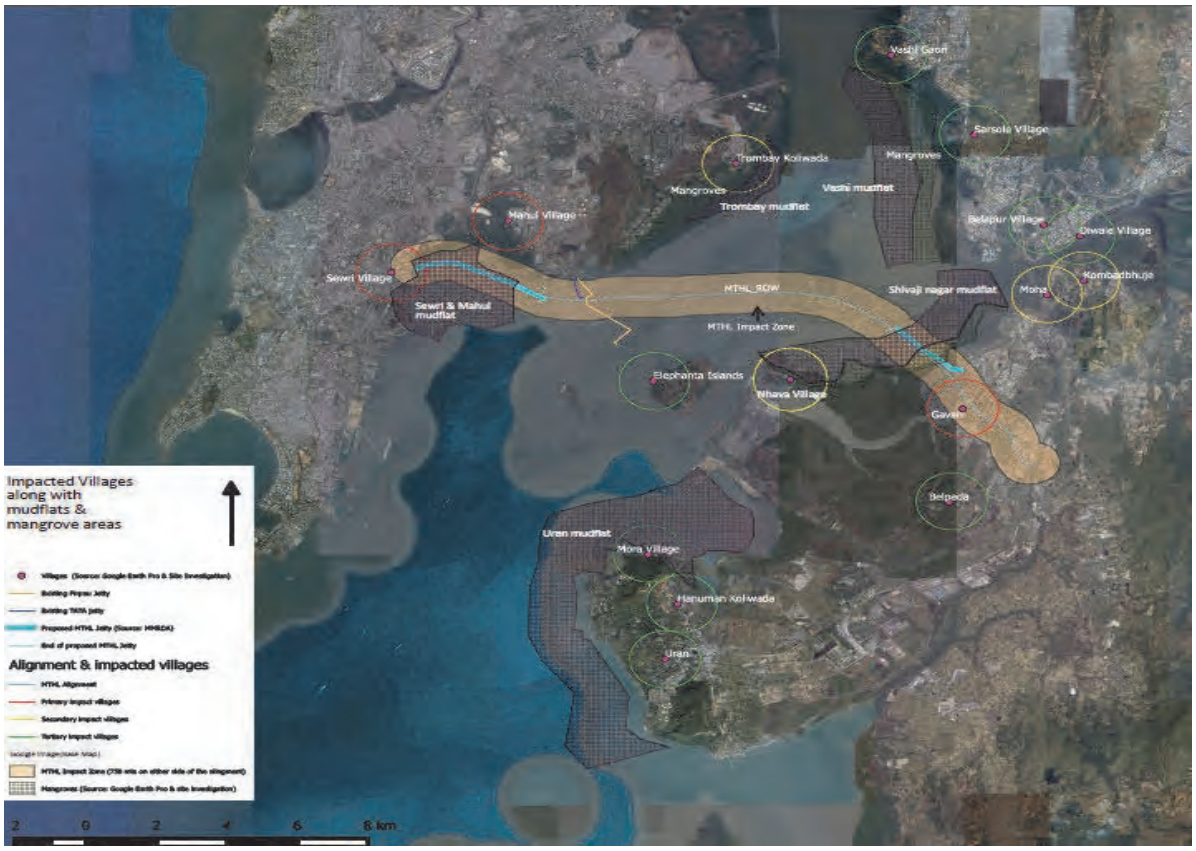
After MMRDA approved the “MTHL– Fisher-Folks Compensation Policy” in December 2015, detailed fisheries surveys including secondary data analysys and fishermen household surveys were conducted at “Potentially” project affected communities. Based on the compensation policy, detailed fisheris survey was originally planned at 9 itendified fishing villages in the compensation policy. However, due to the recommendations by relevant authories (department of fisheries and Collector of each district), seven more fishing villages were added as potentially project affected villages.

Table 13.2.6 Potentially Impacted Villages Recommended by Authorities

Village Name	Fishing Type*	Fishing Ground/Location
1 Mahul	Artisanal, Subsistence and Commercial, Maximum Dol nets in the project affected area belongs to fishers from this village	The entire fishing ground comes in the Impact Zone. Location is Sewri-Mahul Mudflats.
2 Sewri	Artisanal and subsistence fishers	The entire fishing ground comes in the Impact Zone. Location is Sewri-Mahul Mudflats.
3 Trombay	Artisanal, commercial and subsistence	The fishing grounds for subsistence fishers are 7 km away from the Impact Zone. Some Artisanal fishers operate in Impact Zone or near to it on the Northern side. The main fishing grounds are near trombay Jetty. The Artisanal fishers go up to Ferry Wharf.
4 Nhava	Artisanal, Commercial, Subsistence	Commercial fishers are not affected as the village is located on south side of the Impact Zone. Subsistence and artisanal fishers operate in the Impact zone or in it's proximity. Fishing Grounds are spread from Nhava mudflats to Shivajinagar.
5 Uran Koliwada*	Artisanal and subsistence	Fishing grounds are 9-11 kms away from the Impact zone on South side. Fishing grounds are located near JNPT and Uran village.
6 Gavan Koliwada*	Artisanal & subsistence	Fishing grounds are between Shivajinagar and Nhavakhadi. Partial fishing in the Gavhan creek
7 Belpada Koliwada*	Artisanal & Subsistence	Not affected as the only connection to the sea is from Gavhan Creek. Main fishing area is the Gavhan creek.
8 Hanuman Koliwada*	Artisanal & Subsistence	Not affected as the village is about 7 kms away from the impact zone. Main fishing area is Boripakhadi to JNPT. Part fishing in Sewri Bay.
9 Moha	Artisanal & Subsistence	Main Fishing area is Panvel creek and Thane Creek up to Shivaji Nagar.
10 Kombadbhuja	Artisanal & Subsistence	Main Fishing area is Panvel creek and Thane Creek up to Shivaji Nagar.
11 Sarsole	Artisanal & Subsistence	Fishing area is more than 6 kms away from the Impact Zone on North side. Fishing area is on the Northern side of the Panvel creek.
12 Diwale	Artisanal & Subsistence	Fishing area is more than 6 kms away from the Impact Zone on North side. Fishing area is on the Northern side of the Panvel creek.
13 Belapur	Artisanal & Subsistence	Fishing area is more than 6 kms away from the Impact Zone on North side. Fishing area is on the Northern side of the Panvel creek.
14 Elephanta Isl.	Artisanal & Subsistence	Fishing area around the Elephanta islands and JNPT area.
15 Mora	Artisanal, Subsistence & Commercial	Fishing area restricted between Mora and JNPT
16 Vashi	Artisanal, Subsistence & Commercial	Fishing area restricted between Vashi Jetty to Panvel creek.

* **Artisanal:** traditional fishing with mall boats with/without engine, **Subsistence:** self consumption with small canoes/hand picking, **Commercial:** mechanized large boats mainly fishing in Arabian sea or far south of MTHL

Source: JICA study team



Source: JICA study team

Figure 13.2.1 Potentially Impacted Villages Recommended/Instructed by Authorities

In parallel with detailed fisheries study (census and socioeconomic study of the fisheries' households), fisheries activities and fishing ground surveys had been conducted along with department fisheries and Collector officers in charge. The surveys found that not all recommended fishing villages would be affected. As shown in the Table 13.2.6 above, many of the recommended villages primary use fishing grounds far from the project affected area so that few impacts are expected for those fishermen except detour due to the construction safety zone.

Based on the type and location of the fishing harbour, those identified/suggested fishing villages are divided into three groups namely, 1) significant impact, 2) partial impact, and 3) unlikely impact but some possibility. As a result, MMRDA decided to conduct detailed fishing surveys in 1) significant impact and 2) partial impact villages (mandatory) prior to the construction in July 2016. MMRDA will conduct the same detailed fishing surveys in 3) unlikely impacted villages (optional) only in case of a written request by the concerned fishermen and its relevance to the expected project impacts.

In case of the survey requests by the potentially affected fishermen in the unlikely impacted villages category prior to the construction, MMRDA shall conduct the detailed fishing survey. The eligibility shall be confirmed by the Department of Fisheries as same manner as others.

After the commencement of the construction, all other fishermen including unlikely impacted villages are able to claim their losses through the GRM, specially established for the sea-link section by MMRDA and other relevant authorities

Table 13.2.7 Grouping of the Identified Fishing Villages

Impact	Fishing Type, Location, Villages
Significant Impact	Type: Artisanal, Subsistence, Commercial location: Sewri mudflat, Shivajinagar mudflat Village: Mahul, Sewri, Gavhan
Partical Impact	Type: Artisanal, Commercial location: 750m in and out of MTHL alignment Village: Trombay, Moha, Kombadbhuja, Nhava
Unlikely Impact but Some Possibility	Type: Artisanal location: From 5 kms and beyond the ROW on both sides of the bridge, along the Navi Mumbai side Village: Diwale, Sarsole, Belapur, Vashi, Belpada, Hanuman Koliwada, Uran Koliwada, Mora, Elephanta Island

Source: JICA study team

Based on the detailed fishermen survey, categorywise impacts are as follow.

Table 13.2.8 Project Affected Fishermen in Sea-Link Section

Impact Type	Expected Impacts	Expected Number
C1: Permanent	Loss of fishing and livelihood due to removal of fishing stakes (‘sus’) and nets in the ROW	95 households
C2: Permanent	Permanent decrease of revenue due to decline in fish catches and changed seawater currents	2,485 households
C3: Permanent	Loss due to restricted movement of subsistence level fishermen for hand picking of fishery organisms	4,965 households
C4: Temporary	Loss of fishing time and increased operating cost (fuel) to reach fishing grounds from their hamlets due to MTHL during construction phase	Commercial 300 boats Artisanal 175 boats
C5: Temporary	Loss of fish due to increased turbidity during construction phase	Artisanal150 boats Subsistence boats
C6: Accident	Damage of fishing boats and nets due to construction activities and movements of barges, vessels, machinery materials & men along the ROW	200 times /5 years

Source: MMRDA Principal Compensation Policy for Fisherman and Fifhermen Compensation Plan

NAVI MUMBAI SECTION

Except the interchanges and construction yards, project components of the MTHL would be bridge structures in Navi Mumbai section. Due to the completion of 70% land acquisition and old stone quarries and non-farmland, the impacts are limited to the mangrove, wetland and unused land.

The Navi Mumbai section of the alignment is about 5.5 km in length. The project would require 96 hectare of land and CIDCO has already acquired 65Ha. CIDCO is presently on the process of acquiring remaining 27Ha, of which CIDCO has already acquired 8Ha as of November, 2015.

Table 13.2.9 MTHL Project Land Acquisition Details

Sr. No.	Village Name	Type of land in hectare					Total (Ha)
		Private	Govt.	Forest	JNPT	Central Railway	
1	Ghavan	49.080	2.298	0.87	-	-	52.248
2	Jasai	30.157	5.38	-	1.99	0.245	37.772
3	Chirle	6.155	0.173	-	-	-	6.328
4	Total	85.392	7.851	0.87	1.99	0.245	96.348

Source: CIDCO

Table 13.2.10 CIDCO's Land Acquisition Status for MTHL

Sr. No.	Village Name	Land in hectare		
		Private Land Acquired	Govt. Land Transferred	Total Land Acquired
1	Ghavan	41.42	2.136	43.556
2	Jasai	14.366	5.38	19.746
3	Chirle	1.825	0.173	1.998
	Total	**57.611**	**7.689**	**65.30**

Source: CIDCO

13.2.2 Population Census

As per JICA.Env.Guidelines2010, a census survey for all project affected households was conducted in Sewri section only. In Sea-link section, another census survey for all potentially affected households is conducted at this moment. In Navi Mumbai section, no census survey was conducted due to no need for rehabilitation.

Table 13.2.3 showed the general profile of project affected persons (PAPs) in Sewri section, following table shows the socio-demographic profile of the PAPs in Sewri section.

Table 13.2.11 Socio-Demographic Profile of Sewri Section

	Elements	Number PAF or PAPs	Percentage (%)
1	Sex ratio (550 females per 722 males)		
	Females	550	43
	Males	772	57
	Total	**1,272**	**100**
2	religious group		
	Hindu	177	63.9
	Muslim	93	33.5
	Others	7	2.5
3	Social Group		
	ST	2	0.7
	SC	6	2.2
	OBC	26	9.4
	General	83	30.1
	Others (Specify)	159	57.6
4	Mother Tongue/ Language spoken		
	Hindi	196	64.5
	Marathi	92	30.3
	English	5	1.6
	Guajarati	9	3.0
	Kokani	0	0.0
	Other	2	0.7
5	Age group		
	above 15 year	1045	82.2
	below 15 year	277	17.8
6	Education		
	Illiterate	211	17.3
	Primary (Class 5)	255	20.9
	Secondary (6-10)	502	41.1
	Higher (Graduate)	247	20.2
	Technical	7	0.6
	Vocational	0	0.0

Source: JICA Study Team

13.2.3 Livelihood and Economic Condition

SEWRI SECTION

Based on the BSES, majority of the PAPs are engaged in private services (58.8%) followed by small business/trade (23.6%) and Non Fishing Labour (9.4%). Each share of the other types is less than 3% in share. Considering the location of work, fixed work place account for 45.5% followed by no fixed place as per work requirement (34.9%), and home (19.7%). Considering the distance to the work, walking accounts for 45.5% followed by train (39.4%) and bus (15.1%).

Table 13.2.12 Employment Status of Sewri Section

	Element	No. of PAPs	Percentage (%)
1	**Nature of Employment**		
	Private Service	257	58.8
	Business /Trade	106	23.6
	Non Fishing Labour	42	9.4
	Govt. Service	10	2.3
	Maid Service	8	2.0
	Fishing	2	0.4
	Others	22	5.0
2	**Location for work**		
	Office or fixed place	173	45.4
	No specific place	133	34.9
	At home	75	19.7
3	**Distance of work**		
	Walking	181	45.5
	Train	157	39.4
	Bus	60	15.1

Source: JICA Study Team

In total, 47 commercial establishments have been covered under the BSES. The type of commercial establishment and number of employees are shown in Table 13.2.13. The majority of the commercial activities are self-employed tea stall and small vender shops for consumer goods accounting for 53.2% of affected businesses. The proposed MTHL project shall have cumulative impacts on both the affected commercial establishments as well as 40 employees in such affected businesses. In terms of license from the competent authorities to run the business, merely 8.5% of commercial establishments have the licenses.

Table 13.2.13 Commercial & Self Employment Activities

	Types	Number	%	Employee (No.)
1	Tea Stall	5	10.6	6
2	Grocery (Kirana)/ General Store	8	17.0	6
3	Pan/ cigarette shop	7	14.9	1
4	Lubricant shop	5	10.6	0
5	Waste Recycler (Kabari) shop	1	2.1	0
6	Hotel/ Restaurant/ Motel	3	6.4	0
7	Handicrafts	1	2.1	4
8	Medical Shop	2	4.3	3
9	STD/PCO	1	2.1	0
10	Others	14	29.8	12
	Total	47	100	40

Source: JICA Study Team

The economic condition of PAPs is studied from the family annual income and expenditure. The income represents the sum of the all earning members and expenditure represents all

family expenditure. The majority of the project affected families (PAFs) fall in the below INR100,000/y accounting for 70.2% followed by 100,000-500,000/y group (28.6) and over 500,0000/y group (1.2%). Despite more than 70% of PAFs earn less than INR100,000/y, only 46.8% of the PAFs spend less than INR100,000/y and the rest spend INR100,000-500,000/y (53.2%). Such deficient balance should be carefully monitored during the post resettlement monitoring.

Table 13.2.14 Annual Income Profile in Sewri Section

Annual Income (INR)	No. of PAPs	Percentage (%)
Less than 100,000	174	70.2
100,000 – 500,000	71	28.6
Over 500,000	3	1.2
Total	**248**	**100**

Source: JICA Study Team

Table 13.2.15 Annual Expenditure Profile in Sewri Section

Annual Expenditure (INR)	Number PAPs	Percentage (%)
Less than 1,00,000	105	46.8
1,00,000 to 5,00,000	119	53.2
Over 5,00,000	0	0
Total	**224**	**100**

Source: JICA Study Team

SEA-LINK SECTION

There are three types of fishermen in this area.

Commercial: They reside in the villages but do not fish in the creek area (project affected area). They have large trawlers for fishing in the deep sea.

Artisanal Fishers: These are traditional fisher-folks fishing in the area for generations. Different types of fishing nets namely, dol, gill or drift are used. Artisanal fishing in this area provides primary source of household income. However, these fishermen families usually supplement their income during the non-fishing months in varied business sectors as seasonal workers. Most of their catches are sold in the local markets. A small portion of the catch is kept in the cold storage for higher value trading.

Subsistence Fishers: These are daily fish catchers who catch the fish generally by hand picking. Large number of women are also involved in subsistence fishing. This group is highly unorganized and hence qualifies for maximum care and special attention during the compensation distribution. Dut to the scattered activities, there are no official records for the subsistence fishers.

Based on the primary socio-economic surveys at seven villages with significant impacts or partial impacts are summarised as follows. Detailed survey results are given in Chapter 4 of the MMRDA Fisheries Compensation Management Plan (2016).

Employment status of the family member: Fishing and Fishing Labour are the primary occupation patterns of all surveyed communities.

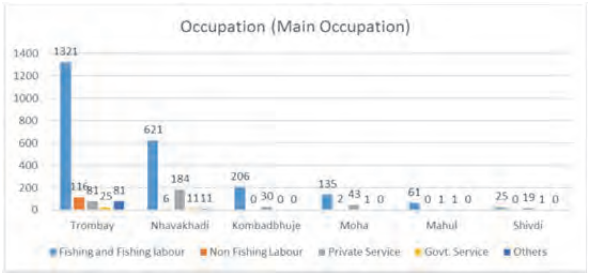
Monthly income: Except trombay, majority of the monthly income level is more than Rs. 6,000. While in Trombay, less than Rs. 6,000, expecially less than 4,000 is the highest among other income level.

Annual income: Except Trombay and Moha, majoriy of the annual income level is Rs. 50-100K. The highest number in Moha is annual income of 500K and above while highest number in Trombay is less than Rs. 50K.

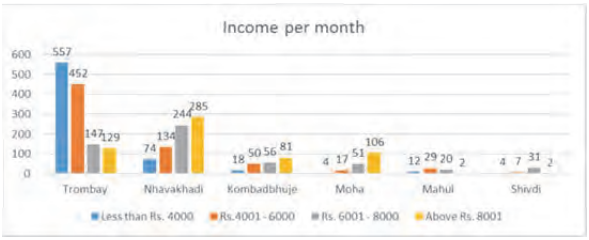
Peson engaged in fishing per family: Only one person is commonly engaged in fishing in three villages (Kombadbhuje, Nhavakhadi and Trombay). The others are either 2-5 persons/family or 11-20 persons/family.

Boat ownership Status: Except Nhavakhadi, most of the fisherman owns a boat per household. In Nhavakhadi, roughly 80% of the fishermen do not own a boat per household.

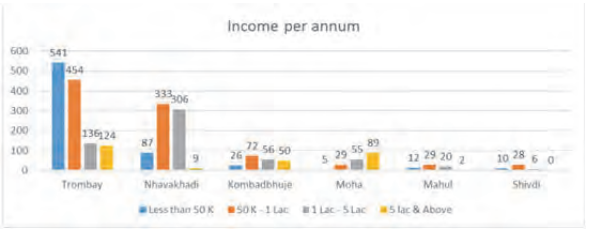
Fishing Boat Type: The most common type of fishing boats are small boats. In Nhavakhadi and Kombadbhuje, fishermen own other boat category, which might be mechanically operated boats or row boats.



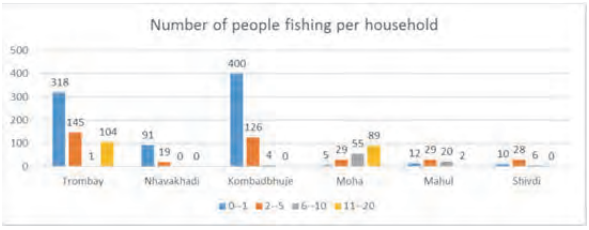
Type of Occupation



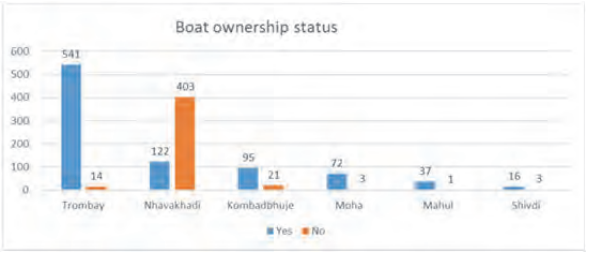
Monthly Income



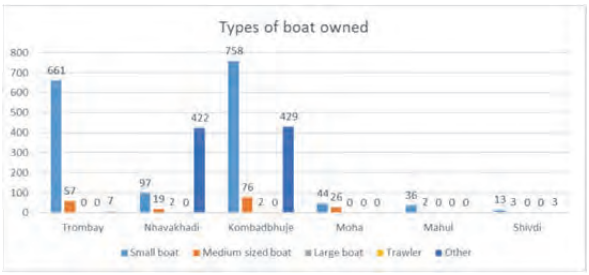
Annual Income



Person Engaged in Fishing / Family



Boat Ownership Status



Fishing Boat Type

Source: JICA Study Team

Figure 13.2.2 Livelihood and Economic Condition of Fishing Societies

NAVI MUMBAI SECTION

Due to the no resettlement need in Navi Mumbai section, PAPs' livelihood and economic condition was not studied. However in general overview along the Navi Mumbai section, economic activities are limited to the old quarries, temporary container storage, and truck yards due to the hilly unproductive land.

13.2.4 Vulnerable Group of People

Based on the census survey in Sewri section, 58 (21%) out of 282 project affected households belong to the vulnerable group (scheduled cast (SC) or scheduled tribes (ST) set by either the Constitution or relevant policies, below poverty line[40], women headed, and family with handicap persons). Results of the census survey confirmed that the living standard and condition of the SC and ST are as same level as other PAPs.

[40] India Planning Comission defined the BPLs in 2014. The BPL for the rural area is 1,078 INR/month and urben area is 1,560 INR/month.

Considering the gender issues in the Sewri section, it is also confirmed that there are no discrimination between male and female. Female family members have certain roles and equally participate decision making in the family and society.

The ground floor allotment to families with handicapped persons will be provided subject to availability of such tenements.

Table 13.2.16 Vulnerable Group Profile in Sewri Section

Category	No. of PAH	%
Scheduled Cast (SC)	6	10
Scheduled Tribes (ST)	2	4
Below Poverty Line (BPL)*	4	7
Widow Headed Household + Widows	28 (2 + 26)	48
Divorce Headed Household	5	9
Women Headed Household	10	17
Family with Handicap	3	5
Total	**58**	**100**

Source: JICA Study Team

13.3 Mitigation Measures for Project Affected Stakeholders

The rehabilitation/mitigation measures for PAPs and project affected businesses (PABs) shall be enforced based on R&R/MUTP in Sewri section, MMRDA principal compensation policy for MTHL in Sea-link section, and LARR_MH2014 with CIDCO 12.5% scheme or CIDCO 22.5% scheme in Navi Mumbai section.

13.3.1 Property Compensation

SEWRI SECTION

The R&R/MUTP offers two resettlement options to PAPs (i: township plot of 25 sq.m. with cash compensation for the existing housing structures, and ii: a tenement of 20.91 sq.m. in multi-storeyed buildings without cash compensation). However, there is no available land for township in metropolitan area. Thus, at this moment, MMRDA is planning to apply tenement option only at Bhakti Park, which has already constructed and distributed for other PAPs by MMRDA projects. The transport of the PAPs' properties in the existing houses will be either arranged by MMRDA or PAPs themselves for free of charge.

In case, a PAH belongs to the vulnerable group and meets some conditions, their preference shall be considered by MMRDA as shown below:

- Ground floor allotment for family with handicap members subject to availability and/or
- Preference in sanctioning of loans from the "Community operated fund."

SEA-LINK SECTION

As there are no allotment of fishing rights and properties affected by MTHL, property compensation is not applicable.

NAVI MUMBAI SECTION

As there are no residential or farmland acquisition in Navi Mumbai, compensation for only land will be conducted. There two options for the land compensation:

1) 12.5% Scheme: Land owner will receive benefits defined by new land law (LARR_MH2014) with monetary compensation (200% of authorized land value (Ready Reckoner Rate)) and CIDCO's developed land for residents and businesses (12.5% of acquired land). The CIDCO's developed land includes utilities, public facilities, school, and religious places. Such land for utilities and other facilities accounting for 30% will be deducted from the 12.5%. Thus, the actual possession of the development land will be 8.75% of the acquired land.
2) 22.5% Scheme: Land owner will only receive CIDCO's developed land for residents and businesses (22.5% of acquired land) without monetary compensation. It also deducts the common and public area accounting for 30%. Thus, the actual possession of the development land will be 15.75% of the acquired land. Although this scheme does not have advanced monetary compensation, majority of the land owners prefer 22.5% scheme due to the high expectation of value escalation in Navi Mumbai (CIDCO official).

13.3.2 Livelihood Recovery

SEWRI SECTION

As per R&R/MUTP, all PAPs will receive house, additional commute transport allowance. In case a PAP permanently loses the source of livelihood, one year income compensation with vocational training will be provided. Social Development Cell (SDC) of MMRDA will evaluate the status of the PAPs' livelihood recovery within 6 months after completion of resettlement. The Govt. Schemes mentioned are various welfare schemes for the needy, vulnerable and disadvantaged persons, which are not necessarily related to rehabilitation. Further, information on all such schemes is not necessarily available with MMRDA but will be obtained and provided by the MMRDA.

SEA-LINK SECTION

As Sea-link section is active fishing area, MMRDA set a special compensation development committee to define the appropriate compensation policy for the PAPs. Throughout the discussion among relevant authorities and representatives from primary project affected fishing societies as well as inputs from the experienced experts in fishermen compensation in

the region, the committee proposed the principal compensation policy and MMRDA approved the recommended principal policy in December 2015. Based on the principal compensation policy, eligible fishermen will be compensated by advanced monetary compensation depending on the imapact categories (ref. Table 13.3.2 Entitle Matrix of Sea-Link Section). In case of accidents or unforeseen impacts by the project activities, damages will be evaluated by GRC and compensated by MMRDA separately.

NAVI MUMBAI SECTION

There would be no need for livelihood recovery assistances as land owners do not live or conduct economic activities on their acquired land at this moment.

13.3.3 Resettlement Site Development Plan for Sewri PAPs

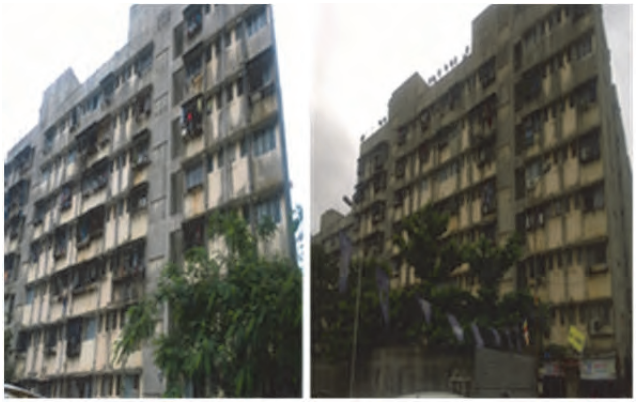
MMRDA has proposed the tenement compensation at Bhakti Park that is roughly 3km from the Sewri-section adjacent to commercial and recreational facilities and good access to the public transportation (monorails and buses). Since Bhakti Park is the closest tenement community from the Sewri section, the expected impacts shall be minimum for the PAPs.

As MMRDA originally developed Bhakti Park for other projects, PAPs from other projects have already lived in the park. There are still large numbers of tenements available so that all PAPs in Sewri section could move in the same area in the park. In addition, project affected businesses will receive business tenements on the ground floor so that they could continue businesses in Bhakti Park.

Resettlement Site at Bhakti Park, Wadala (Google map)

1	Total Area of the Plot	34249.60 Sq.m.
2	No. of Buildings constructed	11
3	Type of Construction	G+7
4	Total number of Residential Tenements	1540
5	Carpet area each of residential tenement	225 Sq.ft.
6	Cost per residential tenements	Land and buildings procured from Private Developer against TDR. Estimated Land + Building cost of tenement as per Ready Reckoner, 2012 is Rs. 19,46,721/- (Rs. 93,100/ sq. m.)
7	Total number of shops constructed	193
8	Cost per commercial tenements	Land and buildings procured from Private Developer against TDR. Estimated Land + Building cost of tenement as per Ready Reckoner, 2012 is Rs. 23,37,738/- (Rs.1,11,800/- sq. m.)
9	Social amenities	A Society Office, Balwadi and Welfare Centre for 100 tenements

Details of the Resettlement Buildings



Entry Gate & G + 7 Bldg. structures

Facilities of Commercial shops

Source: Google maps 2015 & JICA study team

Figure 13.3.1 Available Resettlement Site, Bhakti Park Clooney for Sewri Section

13.3.4 Entitle Matrix of MTHL

Since applicable compensation policies are different among three sections, the entitle matrix of each section is shown below.

Table 13.3.1 Entitle Matrix of Sewri Section

	Category of PAP	Monetary Compensation	House/Structure Compensation	Price to be Charged
1.	**Non-resident land owners or Lessee**			
	Non-resident land owners (Including farmers and horticulturists)	Market value of land and buildings as per LARR_MH2014	N/A	
	Non-resident lessees	Apportionment of compensation for the valid lease period as per LARR_MH2014	N/A	
2.	**Resident landlord or Lessee**			
	Resident landlord (land and building) (including farmers and horticulturists)	Market value of land and buildings as per LARR_MH2014	Cash supplement equivalent to cost of construction of floor space (subject to a max. of 20.91 sq.m.) occupied prior to resettlement. OR Floor space equal to self-occupied floor area, subject to maximum of 70 sq.m., irrespective of use of floor space	First 20.91 sq.m. of floor space free of cost and at actual cost for the area in excess thereof.
	Resident lessee of land and building	Apportionment of compensation for the valid lease period as per LARR_MH2014	Floor space equal to self-occupied floor area, subject to maximum of 70 sq.m., irrespective of use of floor space	
3.	**Resident lessees, tenants or sub-tenants of buildings**	Shifting charges as per LARR_MH2014	Floor space equal to self-occupied floor area, subject to a maximum of 70 sq., irrespective of use of floor space.	
4.	**Squatters (Non title holders)**			
	Non-Resident structure owners	Replacement Cost of structures	N/A	
	Resident structure owners	Replacement Cost of structures	**Township Option**: Residential: floor space of 20.91 sq.m.	Same as #2 (resident landlord or lessee)
	Resident structure owners or Tenants	N/A	**PH/HD/SRD Option**: Residential floor space of 20.91 sq.m.	Free of cost.
			Shops & Business Area equivalent to existing area with a maximum of 70 sq.m. out of which 20.91 sq.m. is free of cost.	Same as #2 (resident landlord or lessee)
5.	**Pavement dwellers (Non title holders)**			
	Pavement dwellers	N/A	Same as #4 Squatters (Township, PH/HD/SRD, Shops & Business)	

	Category of PAP	Monetary Compensation	House/Structure Compensation	Price to be Charged
6.	**Employees and entrepreneurs**			
	(a) Employees residing in the affected community and working at some other place	Amount equivalent to the fare of twelve quarterly season tickets for excess distance by suburban railway	N/A	
	(b) Non-resident employees			
	(c) Employees and entrepreneurs who permanently lose their source of livelihood.	Lump sum compensation equivalent to one year's income, determined by the R&R Agency's valuation committee.	The rehabilitation package shall include access to employment information through employment exchange, and training facilities for appropriate skills to be provided through on-going government programs, and credit through, community operated fund.	

Source: R&R/MUTP

Table 13.3.2 Entitle Matrix of Sea-Link Section

Category &Type of loss		Nature of Loss	Compensation
C1	Permanent	• Loss of livelihood (removal of fishing stakes and nets in the ROW) • Not possible to move to adjacent area due to overcrowded yet	Onetime payment of Rs 5,84,000/- per *unit as per the survey conducted under clause nos. 2.3to 2.7
C2	Permanent	• Decline of fish catches and fish resources due to current change	Onetime paymentof 50% amount provided in code C1
C3	Permanent	• Loss of fishing/catching area due to permanent and construction yards • Particularly subsistence level fisher-folks for hand picking	Onetime paymentof 50% amount provided in code C1
C4	Temporary	• Loss of fishing time and increased operating cost (fuel) to due to restricted entry of fishing ground and detour	The compensation shall be based on average travel time as compared to the period before construction and as determined during construction survey at Rs 500/- per hr. for Artisanal and Rs 1000/- per.hr. Commercial
C5	Temporary	• Loss of fish due to increased turbidity during construction phase	Equal to the loss of average catch as compared to the period before construction and determined in during construction survey.
C6	Incidental	• Damage of fishing boats and nets due to construction activities	The actual cost of damages to boats, gear , etc. and for the loss of time as evaluated by the evaluation committee with the office of the commissioner of fisheries /MMB.

Source: MMRDA Fisheries Compensation Plan (Drafted in November 2016 and subject to the MMRDA Fisheries compensation committee's approval and final approval by MMRDA)

Table 13.3.3 Entitle Matrix of Navi Mumbai Section

Type of loss	Monetary Compensation	Land Compensation
Non-resident land owners (Including farmers and horticulturists)	• N/A	**CIDCO 22.5% Scheme:** • CIDCO's developed land for residents and businesses (22.5% of acquired land) including the common area accounting for 30% • The actual possession of the development land: 15.75% of the acquired land
	• Resettlement allowances as per LARR_MH2014 • 200% of Ready Reckoner Rate	**CIDCO 12.5% Scheme:** • CIDCO's developed land for residents and businesses (12.5% of acquired land) including the common area accounting for 30% • The actual possession of the development land: 8.75% of the acquired land

Source: CIDCO

13.4 Grievance Mechanism

Grievance Redress Mechanism will be enforced three-phases as follows:

I) Responsible field officer in charge of PAPs, Social Development Cell (SDC) will try to solve the issues with a pretesting PAP on demand bases,

II) If the SDC officers' solution is not satisfactory, MMRDA sets a Field Level Grievance Redress Committee (FLGRC) as the second phase mediation. FLGRC will be comprised of one committee member and independently set within MMRDA.

III) If the FLGRC's solution is not satisfactory, MMRDA sets a Senior Level Grievance Redress Committee (SLGRC) as the third phase mediation. SLGRC will be comprised of one committee member and independently set within MMRDA.

After the third phase without satisfactory, the protesting PAP may approach the regional court. If a protesting PAP prefers to appeal in the court, the case can be brought to the court in any time. Considering the reason of one committee member in FLGRC and SLGRC, it is MMRDA's timely solution from past good practices. In the past, multi member committees took long time and could not reach the solutions in many cases.

For MTHL project, MMRDA will apply FLGRC and SLGRC, except the Sea-link section. Due to the necessity of the special knowledge in fishing and its damage compensation, MMRDA will form a grievance redress committee as follows:

Chairman	Chief, Social Development Cell of MMRDA
Member	Assistant Commissioner, Fisheries (Marine) Mumbai Suburb District
Member	Assistant Commissioner, Fisheries (Marine) Thane and Raigad District
Member	Deputy Collector, Mumbai District
Member	Deputy Collector, Raigad District
Secretary	Superintending Engineer, Engineering Division of MMRDA

Source: MMRDA Principal Compensation Policy (2016)

13.5 Organization Structure of Land Acquisition and Resettlement Assistance

The implementation of Resettlement and Rehabilitation (R&R) requires involvement of various institutions at different stages of project cycle. The institutions to be involved in the process of R&R implementation are summarized in this section. Expected major organizations are as follows.

Primary Agencies	Project Management Unit (PMU) of MMRDA	Project Management in general
	SDC of MMRDA	Resettlement matters in general
Other	Grievance Redress Mechanismf	FLGRC, SLGRC under SDC
	CIDCO	Land acquisition and monitoring in Navi Mumbai section
	MPT	Juridical authority of Sewri section and sea-link section
	JNPT	Juridical authority of the coast in Navi Mumbai section and sea-link section
	Department of Revenue	Payment of compensation
	Department of Fisheries	Fishing compensation (including GRC of Sea-link section)

The implementation structure of R&R is based on the structure of the environmental management in chapter 12 with addition of management structure of land acquisition, resettlement and rehabilitation, and fishing compensation (figure 13.5.1). More detailed structure and components' relationship is shown in figure 13.5.2. Although all R&R components will be in MMRDA, each component's independency will be assured.

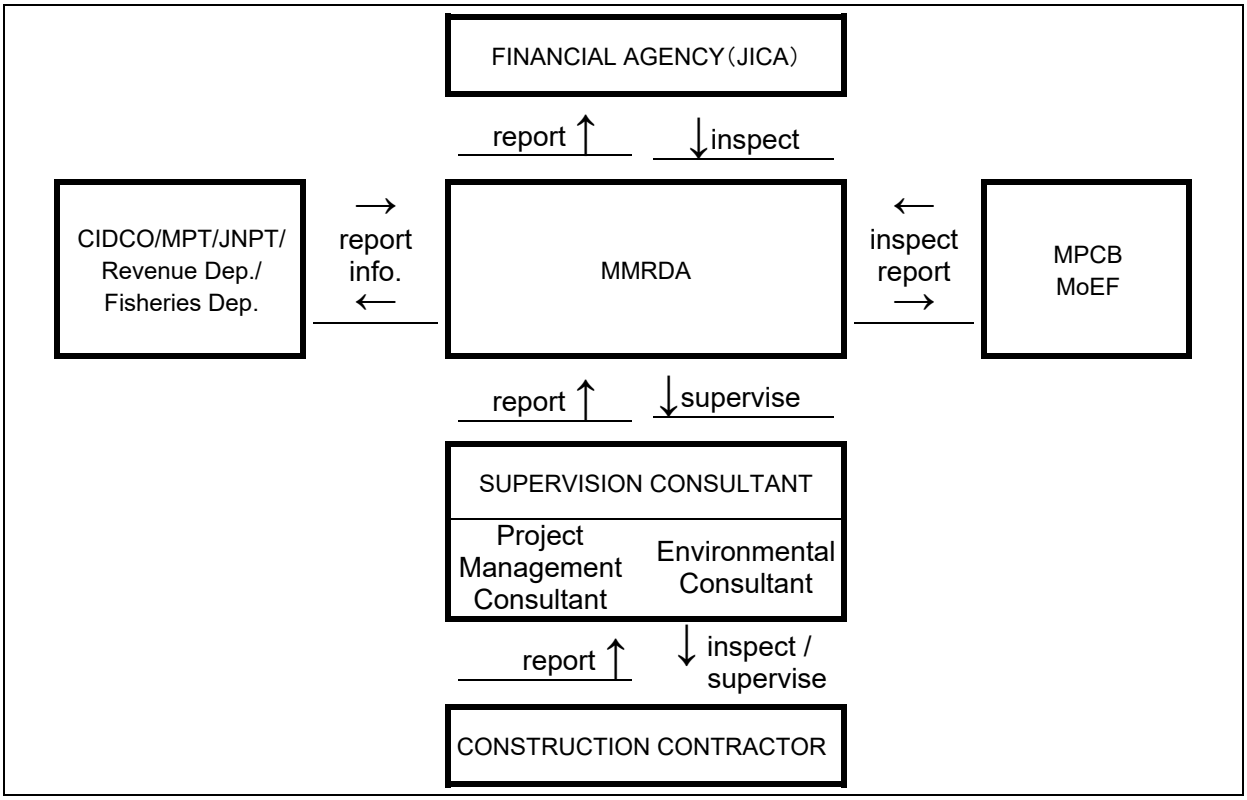


Figure 13.5.1 Organization Structure of Environmental Management and R&R

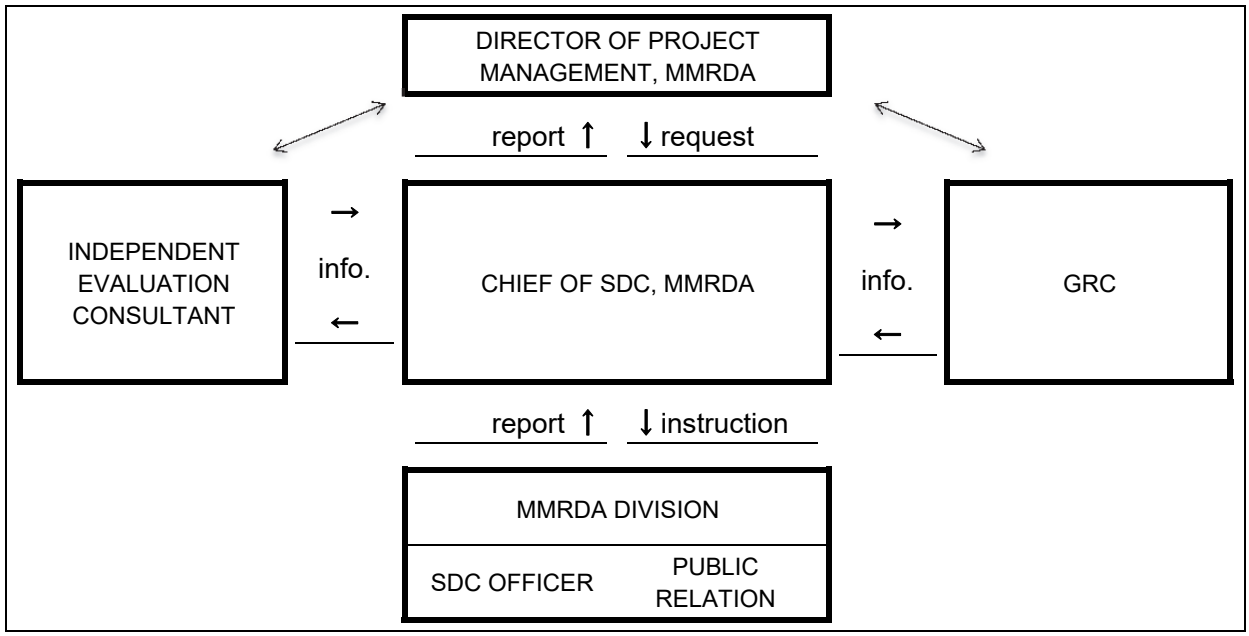


Figure 13.5.2 Organization Structure of Land Acquisition, R&R, Fishermen Compensation

Table 13.5.1 Role of Stakeholders for Implementation of R&R

Position	Responsibilities
Project Director-(PMU), MMRDA	• Overall planning and supervision of all project activities; • Exercise of administrative approval for finance & execution related activities; Supervision and control over responsible officers in PMU • Coordination with JICA, Govt. of India, Govt. of Maharashtra and other concerned agencies.
Social Development Cell, MMRDA	• Planning, supervision and implementation of R&R components; Report to Project Director, PMU; • Supervision and control over the Managers, Officers and support staff in SDC; • Liaison and coordination with PMU, Land and Estate Management Cell, Engineering Cell, NGOs, PAPs & other stakeholders; • Prepare and submit all reports and communication to Project Director; The administrative domain of Chief-SDC include: ✓ Approval of eligibility list ✓ Approval of Progress Reports ✓ Procurement of Consultancy services for R&R components; ✓ Disclosure of information to requesters and external agencies
Public Relation Unit	• Disclosure of R&R activities; • Assurance of information to PAPs and other stakeholders; • Publication of internal R&R monitoring report and home page updates.
Grievance Redress Committee	• FLGRC address grievances relating to individual eligibility and entitlement; • SLGRC review decisions of FLGRC on grievance petitions filed by PAPs,
Independent Evaluation Consultant	• Mid-term and post evaluation (external evaluation) for livelihood recovery • Evaluate the implementation of the various provisions and activities planned in the SIA; • Review the internal monitoring report for evaluating progress of R&R implementation

Source: JICA Study Team

13.6 Schedule of Land Acquisition and Resettlement Assistance

Proposed implementation schedule for R&R activities for MTHL including various sub tasks and time line matching with civil work is shown below.

Table 13.6.1 Proposed Implementation Schedule for R&R

	Task Designation	Start Date	Completion Date
SEWRI SECTION			
1	**Preparation of Final SIA**	May 2016	February 2016
1.1	MMRDA Approval		December 2015
1.2	JICA Approval	December 2015	January 2016
1.3	Posting of project information on MMRDA web sites	December 2015	
1.4	Translation and disclosure of entitlement policy in local language to all APs	February 2016	Completion of post project evaluation
2	**Resettlement and Rehabilitation Implementation**		
2.1	Setting up grievance redress FLGC/SLGC	August, 2016	August, 2016
2.2	Recruitment of R&R evaluation consultant	Mid-term and post-completion	
2.3	Preparation and issue of PAP ID card	August, 2016	August, 2016
2.4	Notice to APs for shifting (Sewri Section)	September, 2016	October, 2016
2.5	Allotment of dwelling units to APs	September, 2016	October, 2016
2.6	Shifting of APs to resettlement Colony	November, 2016	December, 2016
2.7	Transfer of compensation/allowances/assistance to APs	November, 2016	November, 2016
2.8	Creation of Community Revolving fund (within 3 months post handing over)	January, 2017	February, 2017
2.9	Evaluation of livelihood recovery (after 6 months after handing over)	June, 2017	July, 2017
2.10	Registration of co-operative housing societies, transfer of maintenance funds. (6 months period).	December, 2016	June, 2017
2.11	Signing of Civil Contract		N/A
2.12	Notice for Civil works to proceed		N/A
3	**Monitoring & Evaluation**		
3.1	Internal Monitoring – Monthly/Quarterly progress report	November, 2016	January 2017 (till the end of resettlement)
3.2	Independent Evaluation Mid-term and Final evaluation	Mid-term (roughly 2.5years after the construction)	post evaluation after the construction
SEA-LINK SECTION			
4	**Formulation of Fishermen Compensation Policy**		
4.1	Formulation of final principal compensation policy and MMRDA approval of the principal policy	December 2015	December 2015
4.2	Stakeholder meeting at all fishing societies	December 2015	October 2016
4.3	Detail survey and eligibility list	December 2015	October 2016
5	**Advanced Monetary Compensation**		
5.1	Grievance redress mechanism established	December 2016	Completion of construction
5.2	Recruitment of R&R evaluation consultant	six months post evaluation by MMRDA	on demand basis
5.3	Preparation and issue of PAP ID card	December 2016	January 2017
5.4	Payment of compensation	December 2016	January 2017

	Task Designation	Start Date	Completion Date
6	**Monitoring & Evaluation**		
6.1	MMRDA internal monitoring (confirming complaints monthly, and quarterly report)	December 2016	Completion of construction
6.2	Independent Evaluation	Mid-term (roughly 2.5years after the construction)	post evaluation after the construction
NAVI MUMBAI SECTION			
7	**Land Acquisition**		
7.1	Grievance redress mechanism established	Available in CIDCO / Available in MMRDA	Completion of acquisition
7.2	Payment of land acquisition	On going	December 2016
8	**Monitoring & Evaluation**		
8.1	MMRDA internal monitoring (prepared by CIDCO monthly, and quarterly report)	November, 2016	Completion of acquisition
8.2	Independent Evaluation Mid-term and Final evaluation	Mid-term (roughly 2.5years after the construction)	post evaluation after the construction

Source: JICA Study Team

13.7 Cost and Source of Land Acquisition and Resettlement Assistance

Summary of the land acquisition, resettlement and rehabilitation cost is shown in this section. Due to the on-going process of negotiation between MMRDA and port authorities (MPT and JNPT) at the time of reporting, the most updated costs were taken from the MPT and JNPT's letters in 2015. Since the estimated cost for land and property is based on Ready Reckoner Rates 2015, some cost may increase based on the Ready Reckoner Rates at the time of the construction.

In addition, price escalation shall apply different rates on each item so that the budget should be considered as "Indicative." All costs shall be reconfirmed and updated at the time of project commencement. The costs may be also adjusted to address the inflation of costs and personnel expenses over the four years of construction period. Detailed description of the each cost shall be referred to Chapter 10 of Social Impact Assessment report (MMRDA, 2015).

13.7.1 Land Acquisition

SEWRI SECTION

Compensation for MPT; As all ROW in Sewri section is the jurisdiction of MPT, costs of land transfer will be paid to MPT. Based on the latest negotiation records between MMRDA (#MMRDA/MTHL/MbPT/Land charges/Rev/2015 dated 9/SEP/2015) and MPT (#CE.MTHL/92/2460 (G) dated 27AUG/2015), some corrections and updates are still

expected. As stated in MPT letter, we assumed the land acquisition (land & water area) cost is INR3,595.9 million for 30years plus some contract charge.

Compensation for Land Titleholders; As BSES did not identify any legal titleholders including official lessees of MPT properties in Sewri section, we assume no costs for titleholders.

Compensation for Non-Titleholders; Based on the BSES, all PAPs are categorised as non-titleholders. As per R&R/MUTP, no monetary compensation is given to PAPs.

Demolition/Land Clearing; All structure shall be cleared before handing over to the contractor, we assumed the cost of demolition and disposal based on the present market rates. Based on the rough estimation, volume of the debris for the existing structure would be 10,746m^3 costing roughly INR1.5 million.

SEA-LINK SECTION

No land acquisition is involved in the Sea-Link section. Thus, only cost for ROW on the water surface is considered.

Compensation for MPT and JNPT; The cost for the sea area within MPT jurisdiction is counted in Sewri section. Thus, we counted only JNPT's cost stated in JNPT letter (JNPT/PP&D/MMRDA/MTHL/2015/819 dated 14AUG/2015). The land acquisition (water area) cost is INR1,688.4 million for 99years plus some contract charge.

NAVI MUMBAI SECTION

Compensation for CIDCO; Based on the agreement between MMRDA and CIDCO in 2013, CIDCO will rent the previously acquired land (69Ha) for IND1/y, so we omitted the cost for the 69Ha in the total cost. The rest of the acquiring land (27Ha) will be acquired by CIDCO on behalf of MMRDA in advance. However, CIDCO has not completed the land acquisition and there were no assumption given by CIDCO. We conservatively assumed the cost of the 27Ha land as value of the CIDCO's developed land for CIDCO22.5% scheme. The calculation of the land value is shown as follow:

a) Area (Ha)	b) Net developed land* (m^2) /Ha	c) Total developed land (m^2) = a) x b)	d) Ready Reckoner/ m^2	Total Land Value (INR) = c) x d)
27.80	1,575	43,787	2,430	106,400,000

*as per CIDCO22.5% scheme

Demolition/Land Clearing; There is a possibility to acquire a part of public school on CIDCO's public land. Although small adjustment of the alignment could avoid the land acquisition and resettlement of a school, we tentatively assume the demolition and land clearing. As it is public land, cost of the land is not considered. Based on the rough estimation, the cost of land clearing would account for INR181,413.

13.7.2 Resettlement and Replacement of Property

SEWRI SECTION

Compensation for MPT; Based on the agreement between MMRDA and MPT, MMRDA is required to relocate some abandoned and presently used MPT buildings in ROW. As not all properties are used at this moment, we conservatively assumed the replacement cost of all structure. Detailed calculation shall be referred to the Annexure 10.4 of SIA report. The replacement cost of MPT structure is INR192,249,137.

Compensation for Non-Titleholders; Based on the BSES, all PAPs are categorised as non-titleholders. No monetary compensation is given to PAPs as per R&R/MUTP for public housing scheme. Due to the no availability of public land in metropolitan region, township option of R&R/MUTP is no longer valid.

SEA-LINK SECTION

No property is affected in the Sea-Link section.

NAVI MUMBAI SECTION

Compensation for CIDCO; There is a possibility to acquire a part of public school on CIDCO's public land. As stated above, we conservatively counted the cost of the public school relocation. Based on the rough estimation, the cost of the new school construction would be INR45,215,226.

13.7.3 Land Lease During Construction

SEWRI SECTION

Compensation for MPT; Based on MPT letter (#CE.MTHL/92/2460 (G) dated 27AUG/2015), annual cost for the temporary yard and jetty in Sewri section is INR332,336,835. We conservatively assumed the land lease period for 5years. The land lease cost would be INR1,800,043,497 for 5years. Annual escalation of lease is expected, but it is not considered at this time.

Compensation for Land Titleholders; As BSES did not identify any legal titleholders including official lessees of MPT properties in Sewri section, we assume no costs for titleholders.

SEA-LINK SECTION

Water surface lease is already considered in the section of land acquisition. No further lease cost is expected.

NAVI MUMBAI SECTION

Compensation for CIDCO; Based on the agreement between MMRDA and CIDCO in 2013, CIDCO will rent the 19Ha of construction yard for INR1/y, so we omitted the cost for the 19Ha lease in the total cost. No further cost for lease is expected.

13.7.4 Compensation and Post Assistance for Livelihood Recovery

SEWRI SECTION

Compensation for PAPs; As per R&R/MUTP, PAPs will have choices to receive some benefits by monetary allowance or in kind. In addition, MMRDA will provide necessary assistance once MMRDA confirms the need of additional support for PAPs during post monitoring. Such undefined cost is not estimated (shown TBD in the summary table). Known costs are shown below:

- Commute allowance (additional travel cost assistance for 335 PAPs): INR3,859,200
- Community revolving fund (micro credit scheme for recovery assistance for 282 PAPs): 282,000

SEA-LINK SECTION

Based on the detailed fishing survey to determine the eligible fishermen for compensation, all identified affected fishermen are categorized in to four categories (C1 –C4). All compensation shall be paid prior to the construction except C4 of detour/longer traveling time. C4 shall be paid before the construction of the affecting sections and based on the affecting periods. Sum of the fishermen compensation are INR2,231 Million.

Disbursement of compensation shall be made as follow:

<table>
<tr><th colspan="2">Category</th><th>No. of instalments</th><th colspan="5">Year wise disbursement in %</th></tr>
<tr><td rowspan="2">C1
C2
C3</td><td rowspan="2">Permanent</td><td rowspan="2">1</td><td>Y1</td><td>Y2</td><td>Y3</td><td>Y4</td><td>Y5</td></tr>
<tr><td>60%</td><td>20%</td><td>20%</td><td>0%</td><td>0%</td></tr>
<tr><td>C4</td><td>Temporary</td><td rowspan="2">At the end of every Qtr (4)</td><td colspan="5">Depending on the actual loss</td></tr>
<tr><td>C5</td><td>Temporary</td><td colspan="5">On the account of construction phase and identified impacts</td></tr>
<tr><td>C6</td><td>Incidental</td><td>On account of the incidence</td><td colspan="5">Within 3 months of the occurrence of the incidence</td></tr>
</table>

NAVI MUMBAI SECTION

Due to the land acquisition only, no livelihood recovery assistance is expected.

13.7.5 Monitoring and Post Resettlement Activities

SEWRI SECTION

Monitoring & Evaluation; Based on the past experiences in the region for similar scale resettlement projects, we assumed the total cost for monitoring including MMRDA's internal administrative costs and consultants. The sum of the cost would be INR1,700,000.

Post Resettlement Support; As per R&R/MUTP, post resettlement support to initiate the property management by PAFs shall be provided by MMRDA. Post Resettlement Support (New community management account for 282 PAFs): INR5,640,000.

SEA-LINK SECTION

Monitoring & Evaluation;

13.7.6 Summary of the Land Acquisition and Rehabilitation Support

The costs for implementation of Resettlement and Rehabilitation Plan are summarized as follow. The s total cost for R&R implementation plan is roughly INR.9,063 million.

Table 13.7.1 Costs for Land Acquisition and Resettlement & Rehabilitation

	Description	Quantity	(Unit)	Rate (INR)	Cost	
					(INR)	(INR/Year)*
1	**Land Acquisition (Total)**				**5,392,381,413**	**1**
1	Sewri		sq.m		3,595,900,000	
	Demolition / Land Clearing cost				1,500,000	
2	Sea-Link		sq.m		1,688,400,000	
3	Navi Mumbai	43,786.57	sq.m	2,430	106,400,000	1
	Demolition / Land Clearing cost				1,81,413	
2	**Resettlement/ Replacement (Total)**				**273,464,363**	
1.1	Sewri-Residential	NA**	sq.m		0	
1.2	Sewri-commercial	NA**	sq.m		0	
1.3	Sewri-MPT Structure	lump sum			192,249,137	
2	Sea-Link	0	sq.m	0	0	
3	Navi Mumbai	lump sum			45,215,226	
3	**Land Lease Total (5years)**				**1,800,043,497**	
1	Sewri*				1,800,043,497	332,336,835
2	Sea-Link	NA ***				0
3	Navi Mumbai	NA ****				0
4	**Resettlement and Rehabilitation**				**2,234,739,200**	
1	Sewri					
	Livelihood recovery assistance				TBD	
	Moving allowance				TBD	
	Commute allowance*****	335		11,520	3,859,200	
2.1	Sea-link (Compensation C1)	95	family	584,000	55,480,000	
2.2	Sea-link (Compensation C2)	2,485	family	292,000	725,620,000	
2.3	Sea-link (Compensation C3)	4,965	family	292,000	1,449,780,000	
3	Navi Mumbai	0			0	

	Description	Quantity	(Unit)	Rate (INR)	Cost	
					(INR)	(INR/Year)*
5	**Contribution towards Community Revolving Fund****** (Total)**				**282,000**	
1	Sewri	282		1000	282,000	
6	**Construction Stage Monitoring (Total)**				**8,200,000**	
1	NGO Cost	lump sum			2,500,000	
2.1	Cost for Monitoring & Evaluation	lump sum			700,000	Sewri&Navi MB
2.2	Cost for Monitoring & Evaluation	lump sum			3,500,000	Sea-Link
3	Cost of Public Relation Consultant	lump sum			1,500,000	
7	**Post Resettlement Activity**	**282**		**20,000**	**5,640,000**	
	Sub-Total (1 to 7)				9,678,750,473	
	Miscellaneous items @ 10% of sub total				967,875,047	
	GRAND TOTAL (Round @1,000)				**10,646,626,000**	

* Annual escalation 2-4% (ANNEXURE-II, #CE.MTHL/92/2460(G) of MPT Letter to MMRDA dated 27AUG, 2015)
** R&R/MUTP entitle matrix #4. Resident structure owner: PH/DH/SRD Option of 20.91m^2 in multi-story buildings without cash compensation for the existing housing structures.
*** Not applicable as for the Sea-link section the cost of acquisition is already considered as per the Agreement between both the Govt. Organizations.
**** Not applicable as the Navi Mumbai land will be cleared by CIDCO & handed over to the MMRDA.
***** For Livelihood recovery employees are provided with Railway fare transport on yearly basis, as per the R&R/MUTP
****** Revolving fund is as per the R&R/MUTP
TBD: To Be Defined

Source: JICA Study Team

13.8 Resettlement Monitoring Plan

MMRDA's compensation policy in Sewri section (R&R/MUTP) was originally developed for the Mumbai Urban Transport Project (MUTP) funded by the World Bank group so that detailed rules for the monitoring are also provided. As the implementation agency of the MUTP, MMRDA has been applying the R&R/MUTP for long time. MMRDA has conducted following two types of monitoring:

- Internal Monitoring: Mainly monitoring the progress of land acquisition and resettlement,
- Independent evaluation: Evaluating the status of PAPs' livelihood recovery (right after resettlement, mid, and completion of construction).

Internal monitoring will be conducted by the Project Management Unit (PMU) or Social Development Cell (SDC) off MMRDA while the independent evaluation will be conducted by independent evaluation unit of MMRDA or external experts. Especially independent evaluation is important since R&R/MUTP does not provide special benefits to vulnerable group of PAPs.

In case, monitoring activities and/or PAPs' requests recognize the need of additional assistance, SDC of MMRDA will take necessary actions..

13.8.1 Internal Monitoring

SEWRI SECTION & NAVI MUMBAI SECTION

The internal monitoring for R&R implementation will be carried out by MMRDA or appointed consultants on behalf of MMRDA with monthly basis till the completion of the land acquisition and resettlement in Sewri and Sea-link section. For the Navi Mumbai section, CIDCO will conduct the monitoring and MMRDA will compile and report the results. The main objectives of internal monitoring are to:

- measure and report progress against the SIA schedule;
- verify that agreed entitlements are delivered in full to affected people;
- identify issues and propose solution related to land acquisition and resettlement timely;
- monitor the effectiveness of the grievance system
- periodically measure the satisfaction of project affected people.

Table 13.8.1 Indicators for Internal Monitoring (Sewri and Navi Mumbai Section)

Category	Parameters
Physical / Statistical	Number identity card prepared and distributed Number of structures dismantled Number of relocated PAHs and PABs Number of received tenement by PAHs and PABs Number of PAHs and PABs already receiving moving allowance/arrangement by MMRDA Number of provided commute allowance by PAPs Number of PAPs eligible for fishermen compensation
Financial	Amount of compensation paid for PAPs and other benefits such as railway passes Amount paid for training and capacity building of supporting staffs
Social	Area and type of house and facility at resettlement site PAPs knowledge about their entitlements Communal harmony Recovery status of vulnerable PAPs
Economic	Entitlement of PAPs-land/cash Number of business re-established Livelihood recovery schemes usage
Grievance	Number of community level meeting Number of GRC meetings Number of cases disposed by MMRDA to the satisfaction of PAPs Number of grievances referred and addressed by GRC

Source: JICA Study Team

The internal monitoring is expected to start after the loan agreement or initiation of R&R, whichever sooner till the completion of each resettlement activities and the advanced fishermen compensation. PMU of MMRDA will make a quarterly monitoring report and submit it to MMRDA and JICA. The format for the internal monitoring of R&R implementation is given in ANNEXURE 11.1 of Social Impact Assessment report.

SEA-LINK SECTION

Monitoring by the Fisher Folks Compensation Committee (FCC), whichi is the primary inter-authority committee for supervision of implementing Fisheries Compensation Management Plan, shall be done on Month/ Quarterly basis.

Table 13.8.2 Indicators for Internal Monitoring (Sewri and Navi Mumbai Section)

Category	Parameters
Input indicators	resources in terms of people, equipment and materials that go into the FCP
Output indicators	activities that are generated by the inputs such as a database for tracking compensation agreements; and the actual delivery of compensation projects to correct or offset any economic displacement suffered
Process indicators	the change in the quality and /or quantity of the activities aimed at maintenance or improving livelihoods
Outcome indicators	the delivery of compensation, indemnity and other mitigation to avoid economic displacement caused by the project

Source: MMRDA Fisheries Compensation Management Plan

13.8.2 Independent Evaluation

The independent evaluation shall be conducted for the purpose of confirming recovery of the PAPs' livelihood and necessity of additional assistances independently. An Independent Evaluation Agency (IEA) will be hired by MMRDA for mid and end term evaluation. Detailed Terms of Reference for IEA is presented in Annexure 11.2 of the MTHL SIA report. The main objectives of external evaluation are to;

- Verify results of internal monitoring,
- Assess whether resettlement objectives have been met, specifically, whether livelihoods and living standards have been restored or enhanced,
- Assess resettlement efficiency, effectiveness, impact and sustainability, drawing lesions as a guide to future resettlement policy making and planning,
- Ascertain whether the resettlement entitlements were appropriate to meeting the objectives, and whether the objectives were suited to affected persons' conditions,
- This comparison of living standards will be in relation to the baseline information available in the BSES. If some baseline information is not available then such information should be collected on recall basis during the evaluation.

The following aspects shall be considered in evaluation of R&R implementation in the project. The list of impact performance indicators is shown in the following table.

Table 13.8.3 Indicators for Qualitative Independent Evaluation

Objectives	Risk Factor	Outcomes and Impacts
− The negative impact on persons affected by the project will be minimized. − Persons losing assets to the project shall be compensated at replacement cost. − The project-affected persons will be assisted in improving or regaining their standard of living. − Vulnerable groups will be identified and assisted in improving their standard of living.	− Resettlement plan implementation may take longer time than anticipated − Institutional arrangement may not function as efficiently as expected − Implementing agency may not perform the task as efficiently as expected − Unexpected number of grievances − Finding a suitable rehabilitation site for displaced population − PAPs falling below their existing standard of living	− Satisfaction of land owners with the compensation and assistance paid − Type of use of compensation and assistance by land owners − Satisfaction of structure owner with compensation and assistance − Type of use of compensation and assistance by structure owner − Satisfaction of PAPs with the new relocation site, facilities there in − Impact of relocation on employment and income of families − Impact of relocation on studies of students − Evaluation of safety in living in apartment as compared to slum − % of PAPs adopted the skill acquired through training as only economic activity − % of PAPs adopted the skill acquired through training as secondary economic activity − % of PAPs reported increase in income due to training − % PAPs got trained in the skill of their choice − Role of implementing agency in helping PAPs in selecting trade for skill improvement − Type of use of additional assistance money by vulnerable group − Types of grievances received − No. of grievances forwarded to GRC and time taken to solve the grievances − % of PAPs aware about the GRC mechanism − % of PAPs aware about the entitlement frame work mechanism − PAPs opinion about MMRDA approach and accessibility

Source: JICA Study Team

13.9 Result of Stakeholder Meetings with Project Affected Households

13.9.1 Sewri Section

In order to adequately disclose the project information and encourage PAPs participation in the resettlement process, MMRDA conducted two stakeholder meetings with participation of representatives of Sewri community, PAPs, and JICA study team. Throughout the meetings, it is confirmed that PAPs generally accept the resettlement and desire to relocate as soon as possible.

(1) SIA - 1st Explanatory Meeting

The explanatory document was prepared in Marathi, the official language of Maharashtra to follow the government of Maharashtra's policy on official language at the public places and notifications. The content of the explanatory documents were originally prepared by JICA study team and authorised by the responsible officer of the MMRDA before the 1st meeting. The contents of the explanatory document are summarized as follows.

Table 13.9.1 Contents of the 1st SIA Explanatory Meeting

BACK GROUND	• Back ground information after the MMRDA's nomination as the MTHL implementation agency
PROJECT FEATURES	• General description of project scale and infrastructure
ALIGNMENT OF MTHL	• MMRDA's Determined ROW on the Map
Social Impact Assessment	• General description of SIA and process of determining the present status by Basis Social Economic Survey (BSES) • Eligibility of the compensation and livelihood recovery support including the effective date of cut off date • Contents of BSES
SIA Schedule	• Schedule and general description of the 1st explanatory meeting, the 2nd stakeholder meeting, and expected final
Opinions from PAPs	• Comments from key stakeholders for projects and BSES

Source: MMRDA and JICA Study Team

Roughly fifteen key stakeholders in the community of the Sewri section attended the first meeting including the two representatives from the women society. From the MMRDA, host side, two relevant officers from Social Development Cells of MMRDA, one environmental and social expert of JICA study team, and three local environmental consultants attended and organized the meeting (pictures bellow). Including the host's presentation and opinions from the key stakeholders, it was roughly one hour meeting and completed calmly with attendants general understanding.




Host & Venue

Key Stakeholders

Table 13.9.2 Key Stakeholders' Comments 1st SIA Explanatory Meeting

Type of Comments	Summary of the Comments
Compensation	• Beneficial stakeholders should be ALL households and businesses in the Communities in the Sewri section on MPT instead of only ROW. • Some families have lived more than 50years in the project affected area. Such families should be able to claim the land ownership instead of only land lease and/or none title status for compensation package. • What would be the compensation packages for the PAPs? • What would be the compensation packages for the businesses? • Please confirm the property and BSES at the same time (assuming some difference from last survey in 2013). • Will PAPs get land/houses as same size as what the PAPs have now?
New Resettlement Site	• New resettlement site should be close to the present location. • New resettlement site(s) should accommodate a school and a hospital as it is now as well as close distance from railway station.
BSES	• Why BSES is necessary and what is the benefit of the BSES?
Schedule	• When the resettlement shall be started? • How long will PAPs have displacement time?

Source: MMRDA and JICA Study Team

(2) 2nd Consultation Meeting with Project Affected Households

The 2nd SIA consultation was conducted on August 25th with prior notices in the project affected communities and phone call invitations to the key stakeholders presented in the 1st consultation. In order to accommodate more PAPs rather than just key stakeholders, a conference room that is able to accommodate more than 400 persons were used for the 2nd consultation meeting. A short presentation was prepared in Marathi and oral explanation was given in Marathi by the local expert of the JICA study team. Contents of the presentation are as follows:

- Result of BSES[41],
- Compensation policies for properties' losses,
- Compensation policies for livelihood recovery, and
- Development plan or/and description of resettlement housing.

After the presentation, opinions from PAPs were raised and responsible representatives of MMRDA and JICA Study Team responded accordingly. In addition to the onsite verbal communication, written comment forms were given at the initial registration and accepted at the site. Summary of the comments and their responses are given in the following table.

Table 13.9.3 Summary of PAPs and Responses at 2nd SIA Consultation Meeting

Opinions from PAPs	Responses of MMRDA*
Compensation Policy and Conditions	
• Is JICA using Resettlement & Rehabilitation policy of the World Bank? • Is R&R/MUTP also complying the World Bank policy?	• Yes, JICA has its guidelines but referring to the World Bank OP 4.12 <JICA Study Team>. • Yes, the R&R/MUTP was originally formulated for the World Bank funded "Mumbai Urban Transport Project." Then, the present R&R/MUTP was formally approved by GoM in 2000 as compensation policy of Maharashtra.
• Some PAPs are official lessees of MPT structures in ROW. Will they be considered as legal title holders under the entitlement matrix? • What is the agreement between MPT and MMRDA?	• It is understood from the experience of the MMRDA/Eastern Freeway project that claimed lessees in structures on MPT land mostly did not have legally valid rights. However, the concerned PAPs should submit the relevant documents to prove the legal validity of claims. Entitlements in such cases will be considered. • The execution of the project will be carried out with the final approval of MPT.
• How will the occupants of partially affected structures resettled? • Can people staying in the same settlement but not affected by the project be resettled?	• In case of partially affected structures, the PAPs would have a choice of either shifting to resettlement site or remaining the rest of structures without any entitlement. • It is not responsibility of the MMRDA. However, if unaffected persons want to relocate with PAPs, such persons should formally request such desires to MMRDA. MMRDA will consider the possibility and make a decision after consultations.
New Resettlement Site	
• Is there any area for resettlement other than Bhakti Park? Preferably more close to the Sewri	• The Bhakti Park resettlement site was suggested due to the nearest site from Sewri. Other resettlement sites are located at farther locations. It will be possible to choose other resettlement sites if PAPs request MMRDA formally. • MMRDA does not own any land or other possible sites adjacent to Sewri.
• What are the details of other resettlement sites?	• All resettlement sites including Bhakti Park are developed in accordance with the applicable Development Control Regulations for Greater Mumbai and provided various amenities and facilities complying with such rules. • The other resettlement sites are at Mankhurd, Mahul, Govandi, Oshiware etc. • All resettlement sites are planned and developed under the same Regulations and most of the stock of tenements is of 225 sq.ft. carpet area.
Schedule	
• When is the project implementation likely to start?	• At present details of the project and its funding are studied and various arrangements are yet to be finalized. Thus, it is not possible to indicate accurate project schedule now.

* In case of specific questions for JICA Study Team, <JICA Study Team> is shown.

Source: MMRDA and JICA Study Team

[41] Basic Socio Economic Survey required by MMRDA to set the cut off date

2nd Consultation Notices in the PAP's Community (right column of building)

Consultation Room

Registration

PAPs

Presentation Given By JICA Study Team (BEIPL)

MMRDA/Local Representative/JICA Study Team/JICA Study Team (Local)

Questioned by Local Representative

Discussion After the Consultation

13.9.2 Sea-Link Section

Throughout the field observations (June and July, 2015) and communication with key officials in Department of Fisheries (DoF), Maharashtra, JICA study team confirmed that almost all alignment of MTHL (Sea-Link section) is active fishing area. However, there are no applicable safeguard laws, regulations and policies for the concerned fisheries compensation in Maharashtra. Thus, MMRDA set a fiesheries compensation policy development committee in association with relevant authorities. For the process of defining the appropriate policy, series of committee meetings were conducted with the authorities as well as representatives of potentially affected fishermen.

The 1st and 2nd fisheries compensation policy development committee had focused on the facts of fishing activities and project impacts, necessity of the compensation policy, and development of the first draft policy. The representatives from potentially affected fishing villages, recommended by Department of Fisheries, participated the committee from the 3rd committee meeting. The communication between fishermen and MMRDA and/or relevant authorities are summarised as follows.

Table 13.9.4 1st Consultation Meeting with Representatives of Fishing Societies

Place / Date	Aquarium Hall, DoF / 23rd November, 2015
Chairman	Commissioner (Marine) , DoF
Department of Fisheries	• JT. COMMISSIONER OF FISHERIES, (MARINE) MUMBAI • ASST. COMMISSIONER OF FISHERIES, MUMBAI CITY • ASST. COMMISSIONER OF FISHERIES, MUMBAI SUBURB DISTRICT. • ASST. COMMISSIONER OF FISHERIES, THANE & PALGHAR DISTRICT.
Representatives of Fishing Societies	Representatives of 9 potentially affected fishing communities
Observer	• MMRDA: Deputy Engineer • JICA study team: Local Expert

ITINERARY
- Objective of the meeting and role of the DoF in the process (DoF)
- Project description and summary of the potential impacts and its draft compensation policy (Local expert of JICA study team)
- Q & A

CONFIRMED TOPICS
- General understanding of objectives and draft compensation policy
- Acceptance and support of detailed fishermen survey requested for the MMRDA fishermen compensation policy development committee by JICA study team
- DoF's key roles to coordinate key stakeholders for the compensation development

Questions and opinions from representatives of fishermen	Responses by DoF (JICA study team local expert for some cases)
Fishermen compensation in general	
• Overall fishing businesses have been declined due to water pollution. Reduction of the fish resource productivities by MTHL should be compensated. • Will the compensation given be sufficient to cover life-time losses?	• As per JICA Env.Guideline2010, MMRDA's compensation policy ensures the living standard of project affected fishermen. The draft policy adapted the compensation level of the recent National Green Tribunal case, which is as same condition as the highest compensation case. • The compensation will be commensurate with the losses.
• Dredging activity may affect the spawning of fishes and other aquatic species.	• The technology for piling is not likely to create a lot of turbidity. However, adequate area will be covered as prime impact zone to cover the affected fishermen for the potential turbidity loss.
• Subsistence fishermen must be eligible for compensation.	• Subsistence fishermen will be adequately covered
• In some cases, fishing is prohibited around the bridge pillars. Is the fishing around piles restricted? How long is the restricted area in case of restriction?	• The MMRDA fishermen compensation policy committee comprises the safety experts. Safety regulation matter shall be discussed and defined in the following committee meetings.
• Illegal waste disposal may impact fishing.	• MTHL it self does not create such waste and illegal disposal is not expected from the passing vehicles and trucks.
Compensation Timing / Means	
• Advanced compensation must be done.	• Detailed procedure shall be defined later, but advanced compensation will be given.
• Are vocational training and new job arrangement for PAPs included?	• Only monetary compensation is considered at this moment.

Aquarium Hall, DoF

JICA study team local expert: draft policy explanation

DoF explanation

Representatives of fishing communities/societies

Table 13.9.5 3rd MMRDA Fishermen Compensation Policy Development Committee

Place / Date	MMRDA Board Room / 1st December, 2015
Chairman	• MMRDA: ADDITIONAL METROPOLITAN COMISSIONER – II
Committee members	• DOF: COMMISSIONER (MARINE) • MAHARASHTRA MARITIME BOARD: CHIEF EXECUTIVE OFFICER • MUMBAI DISTRICT: COLLECTOR • RAIGAD DISTRICT: COLLECTOR • POLICE: DEPUTY COMMISSIONER (COVERING SEWRI) • POLICE: DEPUTY COMMISSIONER (NAVI MUMBAI-SHIVAJI NAGAR) • EXTERNAL COMPENSATION EXPERT: PRINCIPAL RESEARCHER OF CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
Committee secretary	• MMRDA： ENGINEERING IN CHIEF
Representatives from fishing communities/societies (all 9 societies)	• MAHUL, TROMBAY, URAN KOLIWADA, BELPADA KOLIWADA, HANUMAN KOLIWADA, GAVHAN KOLIWADA, BELAPUR, SARSOLE, DIWALE
Observer	• DOF: JT. COMMISSIONER (MARINE) • MMRDA: OFFICERS OF ENGINERING DIVISION • JICA STUDY TEAM LOCAL EXPERT
ITINERARY • Objective of the meeting and MMRDA Fishermen Compensation Policy Committee • Potential impacts and its draft compensation policy (Local expert of JICA study team) • Q & A CONFIRMED TOPICS • Requests and opinions from fishing communities/societies (verbal and request letters) • Appreciation of fishermen's involvement in compensation policy development and support for detailed fishermen survey • General understanding of objectives and draft compensation policy • Methodologies of detailed fishermen survey and process of finalizing the compensation policy • Exclusion of the compensation from other project in the past within the MTHL project affected area	

During the 3rd MMRDA Fishermen Compensation Policy Committee, general understanding of the draft MMRDA principal compensation policy of MTHL by fishing communities was confirmed. As the result, committee members approved the principal compensation policy at the 4th committee (10th December, 2015). Then, MMRDA approved the principal compensation policy of MTHL on 23rd of December, 2015. Subsequently, with the support of Collector and Department of Fisheries, MMRDA had held the 1st stakeholder meetings at 9 potentially affected fishing villages to explain the objectives of the detailed fisheries survey prior to the survey.

During the 1st stakeholder meetings, main opinions given by the fishermen were severe reduction of fish catch due to the water pollution and area development in the past and public infrastructure development without fisheries compensation. For the responses to those issues, difference approaches with the MMRDA Fishermen Compensation Policy were explained comprehensibly by the experts contributing to the development of the compensation policy. Such explanation included cash compensation and grievance redress mechanism. comprehensible explanation

The detailed fisheries surveys were conducted at six villages that accepted the detailed fisheries survey during the 1st stakeholder meetings. On the centrally, except the Elepanta Island, the rest of the villages had rejected the acceptance of the detailed fisheries surveys due to the disagreement of the compensation policy. Although MMRDA had continuously discussed with those villages mediated by the relevant authorities, no compromises were made and discussion remained little progress. Since those fishermen had demanded equal compensation for all members of their fishing societies even without any project impacts, MMRDA, as the government of Maharashtra, could not be able to compromise over such demands. Considering the Elephanta Island, even the 1st stakeholder meeting could not be able to hold due to the suspension of the commuter ferry during the monsoon seasons.

During the continuous discussions with those uncooperative villages, fisheries status and fishing ground surveys had been conducted along with relevant authorities (Collector and Department of Fisheries). As a result, it is found that many of those fishing villages will not be affected by the MTHL. Therefore, fishing types and their fishing grounds at all recommended fishing villages were studied (table 13.2.6) and categorised into three groups. As described previously, MMRDA decided to conduct the detailed fisheries survey at fishing villages with only 1) significant impacts and 2) partial impacts. Thus, the 2nd stakeholder meetings had been held jointly or individually at the surveyed villages. At the village with 3) unlikely impacted, the detailed fisheries surveys shall be conducted up on the written requests by potentially eligible fishermen. However, there have been no such requests as of December 2016.

During the 2nd stakeholder meetings, MMRDA especially focused on the findings of the detailed survey, compensation schemes for the losses, and grievance redress mechanism

for the unforeseen issues. For the appropriate arrangement of the 2nd stakeholder meetings, MMRDA firstly consulted with each village representatives and fishing societies for setting preferable date and time for the 2nd stakeholder meetings. Once MMRDA confirmed the preferable date, time, and place, MMRDA issuded a consultation notice and placed the notice in the concerned villages. Detailed methodologies and records of the stakeholder meetings were presented at Chapter 9 of MMRDA Fisheries Compensation Management Plan (9.Consultation and Information Disclosure). Extraction of the 2nd stakeholder meeting records are shown in Appendix 19 and main opinions raised at the 2nd stakeholder meetings are summarised as follows.

Table 13.9.6 Summary of 2nd Stakeholder Meetings at 7 Project Affected Villages

Place / Date	Mahul/Sewri/Trombay: Mahul Gram Samiti hall 11th August 2016 Nhava: Shankar Mandir, Near Nhava Public School / 12th August 2016 Moha:, Village hall nearby vicinity of the PAPs / 8th August 2016 Gavhan: 13th October 2016 in Gavhan Gram Panchayat office
Chairman	MMRDA officer(s) in charge
Technical Support	JICA study team (Local Experts)
Representatives of Fishing Societies	Mahul/Sewri/Trombay: 125 attendants Mahul Fishing Business and Other Works Community Service Organization Ltd.: a representative and 45 project affected fishermen of Mahul and Sewri village Turbhe Fishers and Other works Community Service Organization Ltd : chairman) and about 60 project affected fishermen from Trombay village
	Nhava: 25 attendants Chairman of Nhava fishing society) along with the village head and fishermen and village representatives (not fishermen)
	Moha: 50 attendants Chairman of Moha fishing society along with Chairwoman of Kombadbhuja fishing Society and 48 fishermen
	Gavhan: 57 attendants Representatives of Gavhan (local political leaders) amd Representatives from Gavhan Fishing Committee
MAIN TOPICS • MMRDA Fisheries Compensation Scheme, Greivance Mechanism • Findings of the Detailed Fisheries survey • Q & A	

Questions and opinions from representatives of fishermen	Responses by MMRDA
Entitlement Conditions	
• The 750 meters impact zone on both sides is not enough. Some construction activities such as vibrations will affect the fish of that particular area. • The buffer zone should be 2km for both side instead of 750m for both side.	• The category C4, C5 and C6 of the compensation policy have been designed for such unforeseen issues during the construction.
• Reasons of the lesser compensation for category C3 • even if they were using drag nets and SUS nets, change in the current would eventually decrease the population of fish available	• Fishermen in the C3 category won't be affected gravely, which is why the compensation given to them is lesser. • The Central Water and Power Research Station (CWPRS), Pune (CWPRS) studied and concluded the change in the current would be minimal approximately about 10 % and care will be taken during construction. The turbidity monitoring will be conducted to bare minimum by constant water sampling.

• Handpicking fishermen will be affected more because their fishing grounds will get disturbed • Compensation for the subsistence fishermen is not enough • C1 Compensation (Rs 5,84,000) isn't enough and should be increased	• all fishermen who were going to be impacted were to be compensated according the severity of the impact including the subsistence fishermen. • MMRDA noted all the points. Those requests will be considered at Commissioner level
• The compensation promised instead of incase of any grave accidents hasn't been declared yet. The amount should be declared beforehand.	• MMRDA noted all the points. Those requests will be considered at Commissioner level
• All affected fishermen should get equal amounts of money. There should be no categorization	• MMRDA noted all the points. Those requests will be considered at Commissioner level
• Definition of the one family unit in the compensation scheme and its written notice	• All people in the family, the wife and kids who are dependent on the man of the house will be counted as one unit. • Families having children who are earning and have families of their own will be counted as different family unit. • MMRDA will states definitions in the compensation plan.
Grievance Redress Mechanism	
• The process of approaching the grievance redress committee if any fishermen had to go through the process.	• The process was fairly easy for all fishermen to follow and all the officials were available for any concerns that the fishermen would have for the process of compensation.
Job Creation/Offer	
• The boats are available for rental during the construction. • Educated people are available in the village. So the Government should try and create more jobs	• MMRDA will seek for potentiality to offer some jobs
Others	
• No restrictions zone should not be placed for MTHL as same as Bhabha Atomic Research Centre (BARC) and the TATA jetty.	• Point was noted by MMRDA.

13.9.3 Navi Mumbai Section

As the planning and development authority of the Navi Mumbai, CIDCO had acquired land in and around MTHL since 1980s with CIDCO 12.5% scheme through district corrector. The negotiations of land acquisition had been individually conducted between the district corrector and the land owners or those two with CIDCO. With the CIDCO12.5% scheme, CIDCO completed around 70% of the land acquisition in Navi Mumbai before 2000.

The rest of the 30% land acquisition has been conducted based on individual negotiation as same manner as past land acquisition before 2000. During the fact finding mission #2 of JICA on 19 November 2015, it is confirmed that CIDCO has already acquired agreement from 8Ha of the rest of 27Ha. The rest of the land acquisition is on the process of negotiation and negotiation will be conducted individually as same manner as previous acquisition between the land owner and the district corrector with CIDCO.

14. CONSIDERATION FOR CLIMATE CHANGE

14.1 Vulnerability due to Climate Change

South Asia is believed to be highly vulnerable to climate change with India as one of the countries with the highest vulnerability. According to a research on the risks of climate change to development in South Asia which was commissioned by the World Bank to Potsdam Institute for Climate Impact Research and Climate Analytics, India is already experiencing a warming climate and Mumbai, which has large parts of the city built on reclaimed land below the high-tide mark, was confirmed as having the world's largest population exposed to coastal flooding. Moreover, its rapid and unplanned urbanization further increases the risks of sea water intrusion.

14.1.1 UN Intergovernmental Panel on Climate Change (IPCC)

The Intergovernmental Panel on Climate Change (IPCC) was established by the United Nations in 1988 to IPCC produces reports that support the United Nations Framework Convention on Climate Change (UNFCCC), which is the main international treaty on climate change. The ultimate objective of the UNFCCC is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [i.e., human-induced] interference with the climate system". In a presentation made at the Sixth Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) (COP-6), Robert T. Watson, Chair of the IPCC, defined vulnerability as the extent to which a natural or social system is susceptible to sustaining damage from climate change, and is a function of the magnitude of climate change, the sensitivity of the system to changes in climate and the ability to adapt the system to changes in climate. Hence, a highly vulnerable system is one that is highly sensitive to modest changes in climate and one for which the ability to adapt is severely constrained. In the case of the Mumbai Trans Harbor Link, vulnerability is considered from 2 aspects:

- Vulnerability of the structure itself
- Additional perturbation to the natural system due to change in the environment caused by the proposed bridges

14.1.2 India's National Action Plan on Climate Change (NAPCC)

In 2008, the Indian Government released India's first National Action Plan on Climate Change (NAPCC) outlining existing and future policies and programs addressing climate mitigation and adaptation. The plan identifies measures that promote India's development objectives while also yielding co-benefits for addressing climate change effectively.

14.1.3 Scenario of Climate Change

The IPCC has postulated global warming projections for various scenarios. The common scenarios are shown in Table 14.1.1.

Table 14.1.1 Scenarios of Global Warming postulated by IPCC

Scenarios	Assumptions	Temperature Change (degrees Celsius)		Sea Level Rise (cm)
		Most likely value	Most likely Range	Most likely Range
Scenario A1B (A balanced emphasis on all energy sources)	General Considerations: * Rapid economic growth. * A global population that reaches 9 billion in 2050 and then gradually declines. * The quick spread of new and efficient technologies. * A convergent world - income and way of life converge between regions. Extensive social and cultural interactions worldwide.	2.8 °C	1.7 to 4.4 °C	21 to 48 cm
Scenario A1F1 (An emphasis on fossil-fuels)		4.0 °C	2.4 to 6.4 °C	26 to 59 cm
Scenario A1T (Emphasis on non-fossil energy sources)		2.4 °C	1.4 to 3.8 °C	20 to 45 cm
Scenario A2	General Considerations: * A world of independently operating, self-reliant nations. * Continuously increasing population. * Regionally oriented economic development. * Slower and more fragmented technological changes and improvements to per capita income.	3.4 °C	2.0 to 5.4 °C	23 to 51 cm
Scenario B1	General Considerations: * Rapid economic growth as in A1, but with rapid changes towards a service and information economy. * Population rising to 9 billion in 2050 and then declining as in A1. * Reductions in material intensity and the introduction of clean and resource efficient technologies. * An emphasis on global solutions to economic, social and environmental stability	1.8 °C	1.1 to 2.9 °C	18 to 38 cm
Scenario B2	General Considerations: * Continuously increasing population, but at a slower rate than in A2. * Emphasis on local rather than global solutions to economic, social and environmental stability. * Intermediate levels of economic development. * Less rapid and more fragmented technological change than in A1 and B1.	2.4 °C	1.4 to 3.8 °C	20 to 43 cm

Source: JICA Study Team

14.2 Basic Concept

14.2.1 Need for Adaptation Options

The Project is to newly construct a road approximately 22km long on the sea across the Mumbai Bay between Sewari in Greater Mumbai and Chirle in Navi-Mumbai with the approach sections on land including interchanges and the other necessary facilities for full access-controlled motorway and marine bridges. Approximately 17km of the road will run on a PC box girder and steel box girder in the sea. It is therefore necessary to consider the safety of the road and all related structures so as to ensure traffic safety from the effects of climate change.

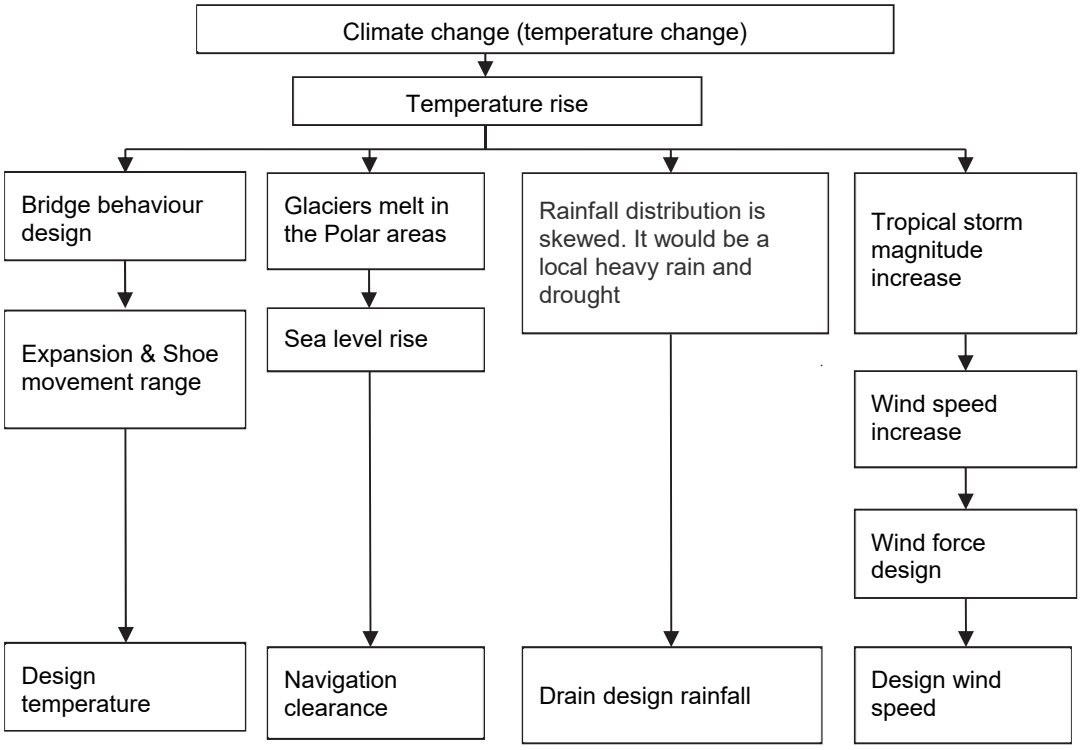
While there are various types of climate change in the global climate system, the most significant influence of global climate change for this Project which is located in India is global warming and its related changes. Of concern to us is temperature rise and its related sea level rise, rainfall rise, drought and tropical storm magnitude which are not independent climate phenomenon.

The influences of temperature change are as follows;

- The air temperature rises at the bridge site, which will raise the bridge temperature.
- The global temperature causes de-icing of the polar area. This leads a rise of sea level.
- The air temperature rise leads to an increase in rain fall due to the rise in humidity from the sea water temperature rise.
- The temperature rise leads to an increase in tropical storm magnitudes. This leads to a rise in wind speed.

The reasons for the consideration of the effects of climate change as they impact this project are as follows;

- The bridge shape can easily be deformed by temperature change.
- The clearance under the bridge must be secured for vessel passage.
- The bridge must bear the natural forces. A wind speed rise could be generated by climate change.
- The bridge must drain the deck surface for traffic.



Source: JICA Study Team

Figure 14.2.1 Scope of Consideration

14.2.2 Adaptation Options

Adaptation options are divided into two categories. One is design considerations and the other is operation considerations. The adaptation options for climate change in India due to the above mentioned causes are selected as follows;

- Temperature change due to bridge design
- Sea level rise due to temperature change
- Rain fall due to temperature change
- Wind speed increase due to the rise in cyclone magnitude due to the temperature rise

14.2.3 Target Year of Climate Change

The target year of climate change is based is to be based on the service life of the bridges. Based on the design criteria, the service life of the bridge is 100 years. Therefore the project target year will range between 2120 and 2122 depending on the completion date of construction.

14.3 Climate Change Data for This Project

Data is collected from existing reports and nearby weather stations maintained by the India Meteorological Department (IMD) while predicted data is also collected from various existing reports available from various sources including IPCC, UNFCCC, Ministry of Environment, Forest and Climate (MEFC), India's First National Communication on Climate Change (NATCOM) and Indian Institute of Tropical Meteorological (IITM).

14.3.1 Temperature

There are various kinds of predictions for temperature. According to the IPCC (2013), the global climate has shown warming of 0.89 [0.69 to 1.08] °C over the period 1901–2012 which is mainly attributed to anthropogenic activities. Temperature projections at the end of the 21st century are shown in Table 14.3.1.

Table 14.3.1 Projected Global Average Surface Warming at the End of the 21st Century by IPCC

Case	Temperature change (°C at 2090-2099 relative to 1980-1999) [a, d]	
	Best estimate	*Likely* range
Constant year 2000 concentrations[b]	0.6	0.3 – 0.9
B1 scenario	1.8	1.1 – 2.9
A1T scenario	2.4	1.4 – 3.8
B2 scenario	2.4	1.4 – 3.8
A1B scenario	2.8	1.7 – 4.4
A2 scenario	3.4	2.0 – 5.4
A1FI scenario	4.0	2.4 – 6.4

Source: JICA Study Team

According to reports released by IMD (2012), increasing temperature trends of the order of 0.60°C during last 112 years have been observed over India. Changes temperatures have also been reported by Dash *et al.* (2009), Arora *et al.*(2005), De *et al.* (2005), Guhathakurta and Rajeevan (2008), MoEF (2010), Jones and Briffa (1992), Kothawale *et al.* (2010), Tyagi and Goswami (2009) and others. Long-term changes in surface temperature and precipitation in India were analyzed using observational records of IMD from 1951 to 2010. In this study, 282 stations shown in Figure 14.3.1 free from highly influence of urbanization and having continuous temperature records from 1951 onwards were selected to estimate long term temperature trends.

Figure 14.3.1 Distribution of 282 Surface Meteorological Stations used for State Level Temperature Trend Analysis for 1951-2010

The data collected from these stations was used to prepare the state level temperature time-series for 1951-2010. Based on this analysis, it was confirmed that annual mean temperatures have increased significantly over most states in India including the project location as shown in Figure 14.3.2.

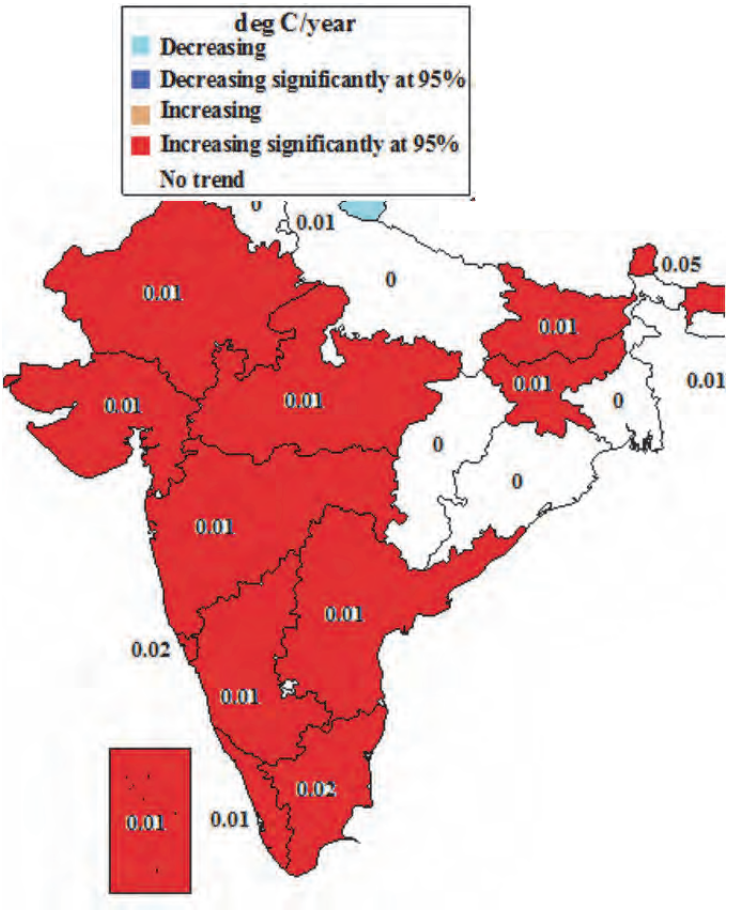


Figure 14.3.2 State Level Annual Mean Temperature Trends

As reported in India's Second National Communication to the United Nations Framework Convention on Climate Change, climate change scenarios have been developed using the second generation Hadley Centre Regional Model (HadRM2) and the IS92a future scenarios of increased GHG concentrations shown in Figure 14.3.3 The projections indicate that above 25°N latitude, the maximum temperature may rise by 2-4°C during the 2050s and in the northern region the increase in maximum temperature may exceed 4°C. The minimum temperature in the 2050s is expected to rise by 4°C all over India, with a further rise in temperature in the southern peninsula.

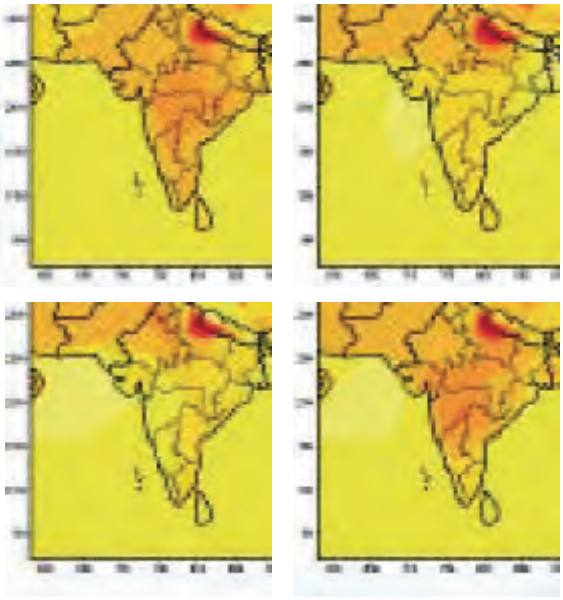


Figure 14.3.3 Seasonal Temperature Projections for the 2050s

Analysing the above, it is estimated that temperature will rise by 4^{o} in 50 years, Therefore , following the same trend, the temperature rise in 2120 (our target year) will be less than 10^{o}C.

14.3.2 Sea Level Rise

Sea level rise is also described by IPCC for 6 scenarios as shown in Table 14.3.2.

Table 14.3.2 Projected Global Average Sea Level Rise at the End of the 21st Century

Item	Scenarios					
	B1	A1T	B2	A1B	A2	A1FI
Sea Level Rise	0.18 – 0.38	0.20 – 0.45	0.20 – 0.43	0.21 – 0.48	0.23 – 0.51	0.26 – 0.59

According to the MoEF, the absence of protection, Asthana (1994) showed that a one metre rise in sea level will affect an area of 5763 km^2 and put 7.1 million people at risk. 83% of all damages will be because of land loss, but the extent of vulnerability will also depend upon physical exposure and the level of economic activity in the region. TERI (1996) developed a district-level ranking of vulnerability to one-metre sea level rise by constructing a weighted index shown in Figure 14.3.4. Based on this figure, the vulnerability to sea level rise of Mumbai in which our project is located is very high.

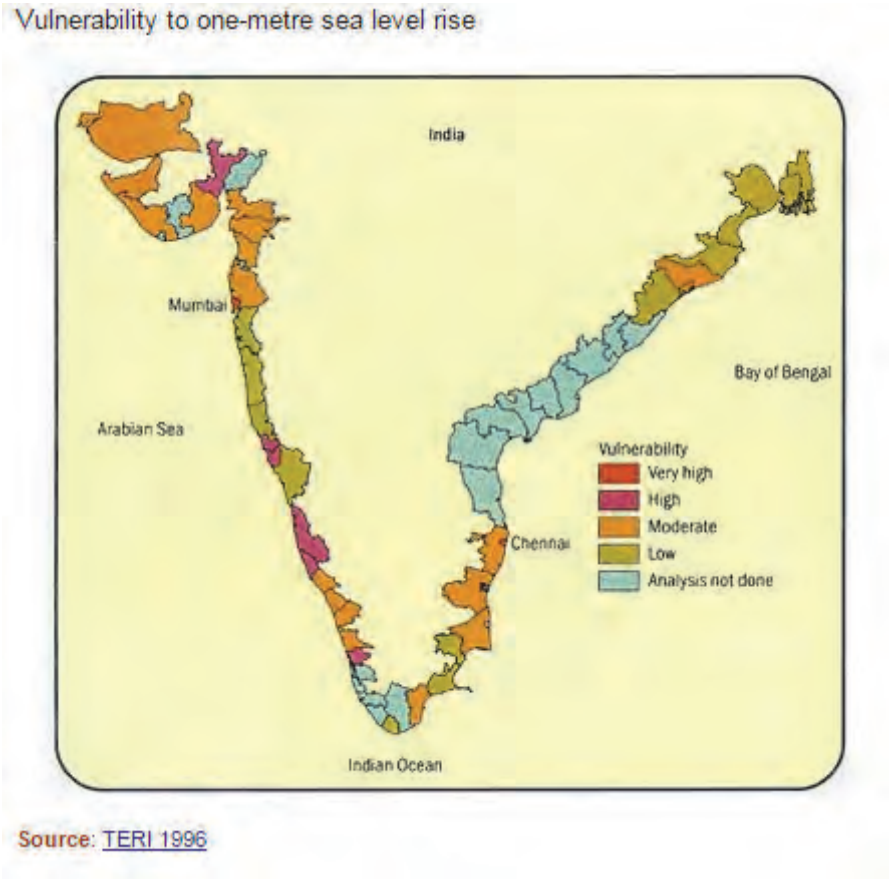


Figure 14.3.4 Vulnerability to One-Meter Sea Level Rise

Based on the above, the sea level is expected to rise by 60cm in the most severe case.

14.3.3 Rainfall

According to the IMD, increase in heavy rainfall events and decrease in low and medium rainfall events (Goswami et al. 2006) over India have been observed while changes in rainfall and temperatures have also been reported by Dash et al. (2009), Arora et al. (2005), De et al. (2005), Guhathakurta and Rajeevan (2008), MoEF (2010), Jones and Briffa (1992), Kothawale et al. (2010), Tyagi and Goswami (2009) and others. Long-term changes in precipitation in India were analyzed using observational records of IMD from 1951 to 2010. In this study, 1451 stations (Figure 14.3.5) were selected to determine long term temperature trends.

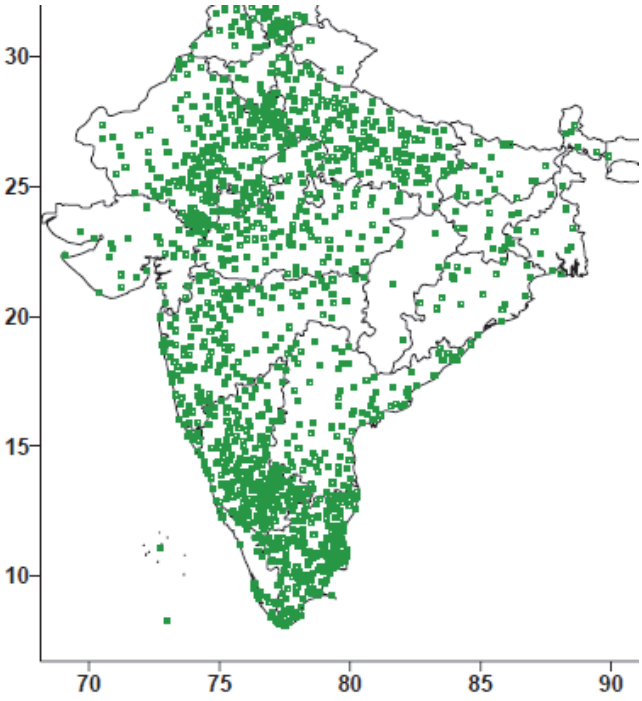


Figure 14.3.5 Distribution of 1451 Stations Used for State Level Rainfall Trend Analysis for 1951 -2010

The data collected from these stations was used to prepare the state level temperature time-series for 1951-2010 shown in Figure 14.3.6. Based on this analysis, it was confirmed that annual rainfall has decreased over some states in India including Maharashtra in which our project is located.

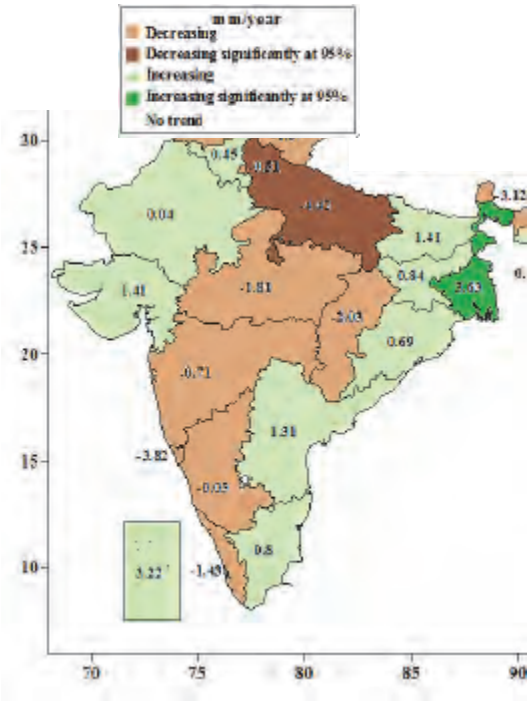


Figure 14.3.6 State Level Annual Trends

Climate change scenarios have also been developed using the second generation Hadley Centre Regional Model (HadRM2) and the IS92a future scenarios of increased GHG concentrations as shown in Figure 14.3.7. The projections indicate at an all-India level, little change in monsoon rainfall is projected up to the 2050s. However, there is an overall decrease in the number of rainy days over a major part of the country. This decrease is greater in the western and central parts (by more than 15 days), while near the Himalayan foothills (Uttaranchal) and in the Northeast the number of rainy days may increase by 5-10 days. Increase in rainy day intensity by 1-4 mm/day is expected all over India, except for small areas in the northwest where rainfall intensities are expected to decrease by 1 mm/day.

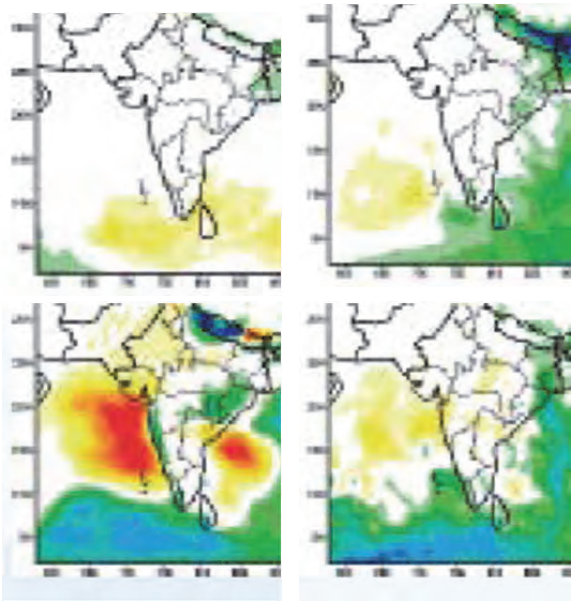


Figure 14.3.7 Seasonal Precipitation Projections for 2050s

Furthermore, hydrological modelling (using the SWAT model) of 12 river basins in India in combination with the outputs of the HadRM2 run on the IS92a scenario indicate that in the 2050s there is likely to be a general reduction in the quantity of available runoff with extreme water stress conditions in the western and south western river basins and rare water stress conditions in the river basins in central and eastern regions (Figure 14.3.8). The severity of droughts and intensity of floods in various parts of India are likely to increase by the 2050s.

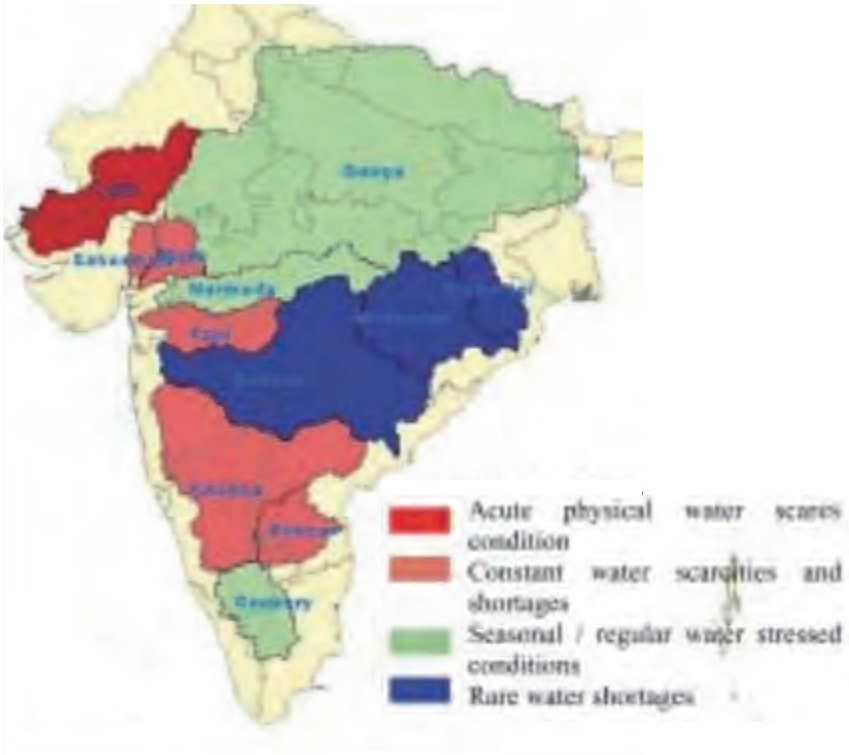


Figure 14.3.8 Projections of River Run Off in the 2050s for Major River Basins in India

Based on the above, it is projected that precipitation will decrease in the western side of India.

14.3.4 Wind Speed

The monsoon wind speed was used in the design of MTHL bridge. As discussed in section 14.3.3, little change in monsoon rainfall is projected up to the 1950s. Assuming this trend continues, it is unlikely that significant increase in monsoon wind speeds will occur. The likelihood of significant change in wind speed in the next 100 years is therefore extremely low.

14.3.5 Consideration of Mitigation Measures for Climate Change

(1) Contribution to Climate Change for MTHL

The affected area of sea level rise because of the climate changes and the large cyclones is the lowland area at the start point and the end point along the Vashi Bridge. This lowland area is the most vulnerable area in connecting Mumbai and Navi Mumbai.

The MTHL which is constructed on the sea between Mumbai and Navi Mumbai is the elevated road. The MTHL have enough navigation clearance to pass under the MTHL by the fishing boats and the large ships. The MTHL does not receive the affected sea level rise because of climate changes and large cyclones. Therefore the passengers can use the MTHL without affected sea level rise.

(2) Disadvantage and Mitigation Measure of Climate Change

There are two points of view of the vulnerable from climate change.

- The vulnerable of the viaducts by itself
- The vulnerable of the viaducts from changes in the natural environment

The MTHL is designed by design standard in which design life is 100 years. Therefore the viaducts by itself is not vulnerable. On the other hand, there are below factor of changes in the natural environment for the MTHL.

- Temperature rise
- Sea level rise
- Increase for rainfall and storm
- Increase for wind speed
- Storm surge, tsunami

1) Affected MTHL and Mitigation Measure by Temperature Rise

The maximum temperature rise between the design life of bridge is under 10 degrees Celsius. The almost of all viaduct part in MTHL is the concrete brigde. The concrete bridge is generally less susceptible to the effects from temperature. The steel bridges are applied some special part. The steel bridge is generally susceptible to the effects from temperature. Therefore the amount of movement of expansion joint is a little bit larger. The expansion joint is replaced if the temperature rised.

2) Affected MTHL and Mitigation Measure by Sea Level Rise

The sea level rise is affected through under the MTHL by fishing boats and large ships. It is assumed the sea level rise is 60 cm, however the navigation clearance has to pass under the MTHL by the fishing boats and large ship. For the conclusion, the mitigation measure in the MTHL does not need sea level rise.

3) Affected MTHL and Mitigation Measure by Increase for Rainfall and Storm

It is assumed the rainfall is decreased around Mumbai area. The mitigation measure in the MTHL does not need the increase for rainfall.

The MTHL is installed the CCTVs and the meteorological equipements because the MTHL which is high-standard road is controlled to access. When the rainfall is harder, the CCTVs and the meteorological tell the some information to the traffic control center. Then the traffic control center tells the passengers the information of speed limits and road closed etc. through the VMS. Therefore the MTHL can be made the countermeasures for harder rainfall.

4) Affected MTHL and Mitigation Measure by Increase for Wind Speed

It is assumed the wind speed is not increased around Munbai area because the rainfall is decreased around this area. The cyclones sometimes come to western Mumbai but the MTHL has the countermeasures to the passengers.

The steel bridges make the vibration cause of the wind. The countermeasure for hard wind is to installe the fairing at the end of girder and/or the vibration control devices in the girder.

(3) Mitigation Measure by Other Factor

- The exhaust gas is decreased because of shortening travel time from Sewri to Chilre
- The exhaust gas is decreased because the traffic jam is resolved in Mumbai indirectly

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15. CONCLUSION AND RECOMMENDATION

15.1 Conclusions

The conclusions of the Survey are as follows;

- It is concluded that the project is technically and economically feasible and is acceptable from the viewpoints of environment and social consideration. The necessary mitigation measures are included as a part of the Project implementation.
- The final MTHL alignment, which connects the Eastern Freeway at Sewri in Mumbai side with National Highway 4B at Chirle in the Navi Mumbai including four interchanges, was carefully set considering all constraints such as including navigation channels, pipelines, jetties and minimizing adverse impacts of both environment and resettlement including the flamingos and the World Heritage site of the Elephanta Island. This is an only alignment that enables to avoid the land occupancy of MbPT port yard and facility with keeping, its function as highway at 100km/h of design speed.
- As per the result of the future traffic demand forecast, construction of 6 lane (three lanes each bound) MTHL shall be constructed in single phase is justified.
- While Pre-stressed Concrete box girder superstructure is suitable for 50 m spans in portion with no obligatory spans, steel box girder superstructure is suitable for obligatory spans (max.180m). For the viaduct on the land the Pre-stressed Concrete box girder is suitable for 30m span. Steel girder type superstructure is adopted for the Railway over Bridges (ROBs).
- ITS facility and equipment is an indispensable component for the MTHL project which is a fully access-controlled toll road. Accordingly, the ITS shall be installed on viaducts and Bridge portion from commencement of operation.
- MMRDA is an appropriate implementation agency for the Project as they have vast experience in infrastructure works and have carried out the feasibility study for the Project.

15.2 Recommendations

The recommendations of the Survey are as follows;

- It is recommended that Project Management Office should be established within MMRDA before commencement of the Project implementation in order to clarify the responsibility of the Project implementation and deal with arrangement and coordination activities with a large number of various stakeholders.
- It is necessary for MMRDA to complete land acquisition within the ROW, compensation to the Project affected people and also acquiring the land required for casting yard before commencement of the construction works. This would enable MMRDA to hand over the lands within ROW to the contractor after conclusion of the work contract and to adhere to the designated construction schedule.
- Although it is principally recommendable to apply the FIDC Red Book “Conditions of Contract for Works of Civil Engineering Construction”, for the Project, which the construction works are conducted by the Contractor according to the detailed design output prepared by the Employer, considering its largeness of the project scale because its application is able to minimize risks that the contractor side owe. However, it is allowable to apply the Design-Built scheme due to the strong request on earlier completion of the Project from the Indian side because; firstly, the Design-Built method enables the contractor to carry out the detailed design and construction preparation simultaneously thus resulting into earlier commencement of the work. Secondly, MMRDA has experience of implementation of the projects on Design-Built method (including the metro project). However, it is necessary to consider the risk shares between the client and the contractor as the Design-Built method may result into higher bid price as no detailed design are available at the bidding stage.
- It is recommended that the project be implemented on the Design-Built basis. The Design-Build method enables the contractor to carry out the detailed design and construction preparation simultaneously thus resulting into earlier commencement of the work. Secondly, MMRDA has experience of implementation of the projects on Design-Built method (including the metro project). However, it is necessary to consider the risk shares between the client and the contractor as the Design-Built method may result into higher bid price as no detailed design are available at the bidding stage.
- It is recommended to separate the Project into three packages, two on the marine section and one on the land section at the Navi Mumbai side, considering availability of construction yards, accessbility to the construction site on the sea and avoidance of inconsistency of the viaduct design.
- Various provisions against the severe-saline environment, through which the bridge passes, shall be made in the technical specifications in the bid documents. These

would include use of anti-corrosive coating to the rebars and Prestressing Cables for prestressed concrete bridge, thick anti-corrosive coat for steel bridge etc. As the project implementation would involve Technology Transfer for maintenance method for steel bridge on the sea, it is recommended to provide for such scheme of Technology Transfer by JICA before starting the operation of MTHL.

- Pipelines carrying the fuel have been identified crossing the project alignment. It is very important for MMRDA and the Contractor to identify the exact location of the pipelines so as to avoid damages to the pipelines during the foundation work.
- According the traffic demand forecast, 6 booths are required to deal with toll collection at Shivaji Nagar IC in 2042. Since the present widths of ROW can only accommodate the space up to four booths, it is necessary to consider shifting the toll collection place according to the actual increase in traffic volume in future.
- As MTHL is expected to implement with the help of Japanese ODA loan, it is important to decide appropriate toll fees to attract vehicles on the link as well as to ensure adequate revenue towards repayment of loan and the necessary operation and maintenance expenses.
- Although operation and maintenance for MTHL is planned to be entrusted to concessionaire after completion, MMRDA is full responsibility of operation and maintenance of MTHL. Furthermore, in case that traffic demand is less than expected, the financial support should be considered from State Government.
- MTHL is expected to be a landmark project in Mumbai & India for its landscape. In order to develop the flamingo habitat, it is recommended to develop the coastal areas at both ends as park or bird-watching place.