

2. RIDERSHIP ASSESSMENT

2.1 BACKGROUND

System planning and a number of station facilities including the passenger dispersal, train operation plan, rake requirement, depot planning and cost estimates require a reasonably accurate assessment of number of passengers who are expected to use the System in various horizon years. The ridership figures are also required to make a realistic assessment of fare box revenue. The exercise has been carried out based on available secondary data and primary traffic surveys in the catchment area of the Corridor.

2.2 PRIMARY TRAFFIC SURVEYS

A number of traffic surveys were conducted in the immediate catchment area of the corridor to update the available data and to appreciate and quantify the traffic & transport characteristics of commuter travel. The details were presented in the Traffic Survey Report submitted in August 2012. The main results are summarized in the following paragraphs.

2.2.1 RAIL PASSENGER BOARDING ALIGHTING SURVEYS

To assess the present pattern of sub-urban rail passenger volume traveling along the Corridor, a survey of the major passenger/ suburban trains during peak hours was carried out, on a fair weather working day. The results are presented in **Table 2.1**.

Table 2.1 Observed Rail Passenger Sectional Loads, Panvel - Virar Corridor

Time: 09:20					
Direction: Panvel to Vasai					
Station Name	Boarding	Alighting	Section Name		Section Load
			From	To	
Panvel	1351	0	Panvel	Kalamboli	1351
Kalamboli	324	29	Kalamboli	Navade Road	1646
Navade Road	110	26	Navade Road	Taloja Panchanand	1730
Taloja Panchanand	176	47	Taloja Panchanand	Nilaje	1859
Nilaje	121	24	Nilaje	Dativali	1956
Dativali	113	63	Dativali	Kopar	2006
Kopar	1109	123	Kopar	Bhivandi Road	2992
Bhivandi Road	131	949	Bhivandi Road	Kharbao	2174
Kharbao	74	15	Kharbao	Kaman Road	2233
Kaman Road	66	13	Kaman Road	Juchandra Road	2286
Juchandra Road	86	26	Juchandra Road	Vasai	2346
Vasai	0	2346			
Time: 19:15					



Direction: Vasai to Panvel					
Station Name	Boarding	Alighting	Section Name		Section Load
			From	To	
Vasai	1444	0	Vasai	Juchandra Road	1444
Juchandra Road	37	16	Juchandra Road	Kaman Road	1465
Kaman Road	32	23	Kaman Road	Kharbao	1474
Kharbao	21	27	Kharbao	Bhivandi Road	1468
Bhivandi Road	826	212	Bhivandi Road	Kopar	2082
Kopar	181	651	Kopar	Dativali	1612
Dativali	66	53	Dativali	Nilaje	1625
Nilaje	24	19	Nilaje	Taloja Panchanand	1630
Taloja Panchanand	63	57	Taloja Panchanand	Navade Road	1636
Navade Road	21	32	Navade Road	Kalamboli	1625
Kalamboli	106	43	Kalamboli	Panvel	1688
Panvel	0	1688			
Time: 18:35					
Direction: Panvel to Virar					
Station Name	Boarding	Alighting	Section Name		Section Load
			From	To	
Panvel	1382	0	Panvel	Kalamboli	1382
Kalamboli	36	26	Kalamboli	Navade Road	1392
Navade Road	31	18	Navade Road	Taloja Panchanand	1405
Taloja Panchanand	16	20	Taloja Panchanand	Nilaje	1401
Nilaje	24	15	Nilaje	Dativali	1410
Dativali	30	14	Dativali	Kopar	1426
Kopar	780	744	Kopar	Bhivandi Road	1462
Bhivandi Road	721	660	Bhivandi Road	Kharbao	1523
Kharbao	24	15	Kharbao	Kaman Road	1532
Kaman Road	10	13	Kaman Road	Juchandra Road	1529
Juchandra Road	60	177	Juchandra Road	Vasai	1412
Vasai	356	425	Vasai	Nalasopara	1343
Nalasopara	311	592	Nalasopara	Virar	1062
Virar	713	596	Virar	Vaitarna	1179

Source: RITES Primary Surveys, 2012

2.2. 2 ROAD PASSENGER VOLUMES ALONG THE CORRIDOR

Directional classified mode-wise traffic volume surveys along with sample passenger occupancy surveys were conducted at major mid-block road locations along the Corridor. The assessed Peak hour passenger trips at various locations are presented in **Table 2.2**.



Table 2. 2 Peak Hour Passenger Trips at Mid-Block Locations

Peak Passengers Trips												
Loc. No.	Mor/ Eve	N-S / E-W	Car	Jeep/ Van	Taxi	MOTORISED			Bus			Total (Nos.)
						2-Wh	Auto	S. Auto	Bus	Mini Bus	School Bus	
1	Mor	S-N	240	124	29	107	72	0	155	0	0	726
	Eve		239	133	52	421	158	0	62	0	0	1065
	Mor	N-S	240	120	31	394	162	0	217	0	0	1165
	Eve		220	67	16	99	102	0	124	0	0	627
2	Mor	N-S	175	125	24	112	127	0	116	0	0	678
	Eve		420	74	26	588	265	0	203	0	0	1576
	Mor	S-N	482	260	50	834	508	0	116	17	0	2267
	Eve		229	69	33	178	193	0	232	0	0	934
3	Mor	S-N	1429	130	23	1037	155	0	1092	0	0	3866
	Eve		128	127	29	658	138	0	273	0	0	1353
	Mor	N-S	176	135	17	806	143	0	156	12	0	1444
	Eve		1542	208	17	1149	157	0	897	0	0	3970
4	Mor	S-N	479	406	104	616	210	0	1650	20	0	3485
	Eve		388	399	122	345	142	0	2220	10	0	3626
	Mor	N-S	292	495	358	361	129	0	2040	30	0	3704
	Eve		488	363	104	633	202	0	1890	20	0	3700
5	Mor	E-W	1777	1680	484	842	157	0	2552	65	0	7557
	Eve		2261	1794	250	992	88	0	2581	0	0	7965
	Mor	W-E	2033	1971	484	1089	59	0	2436	0	0	8072
	Eve		1732	1911	268	842	152	0	2668	78	0	7651
6	Mor	N-S	876	872	54	1010	678	0	1407	30	0	4927
	Eve		992	780	56	611	326	0	924	0	0	3689
	Mor	S-N	577	923	59	966	352	0	1197	15	0	4089
	Eve		859	670	84	940	442	0	1512	15	0	4521
7	Mor	S-N	382	310	12	406	233	0	1344	0	0	2686
	Eve		450	116	39	636	104	0	1080	26	0	2452
	Mor	N-S	412	95	9	606	74	0	1056	26	0	2278
	Eve		436	322	9	437	262	0	1344	0	0	2810
8	Mor	N-S	300	98	44	611	72	0	1700	90	0	2914
	Eve		436	189	90	765	139	0	1224	75	0	2917
	Mor	S-N	362	163	48	722	104	0	1224	60	0	2684
	Eve		248	143	108	795	105	0	1666	75	0	3141
9	Mor	N-S	349	248	18	727	152	0	1240	14	0	2747
	Eve		544	400	183	920	319	0	1680	28	0	4074
	Mor	S-N	556	425	198	785	279	0	1800	56	0	4099
	Eve		349	180	13	656	189	0	1440	14	0	2842
10	Mor	E-W	652	247	157	850	267	0	1050	0	0	3221
	Eve		814	522	225	925	219	0	1715	0	0	4419
	Mor	W-E	846	547	231	890	284	0	1610	0	0	4409
	Eve		834	247	140	731	224	0	1330	0	0	3504
11	Mor	W-E	106	111	0	220	244	0	0	0	0	681
	Eve		103	127	0	220	169	0	0	0	0	618
	Mor	E-W	101	114	0	258	241	0	0	0	0	713



Peak Passengers Trips												
Loc. No.	Mor/ Eve	N-S / E-W	Car	Jeep/ Van	Taxi	MOTORISED			Bus			Total (Nos.)
						2-Wh	Auto	S. Auto	Bus	Mini Bus	School Bus	
	Eve		112	133	0	207	266	0	0	0	0	718
12	Mor	W-E	634	317	48	448	356	0	3045	140	20	5006
	Eve		914	442	116	705	266	0	3780	380	0	6603
	Mor	E-W	883	330	29	771	299	0	2835	120	0	5268
	Eve		829	353	69	525	308	0	3080	60	0	5223
13	Mor	S-N	306	189	18	683	199	0	0	0	0	1394
	Eve		223	156	20	551	217	0	0	0	0	1168
	Mor	N-S	179	159	15	620	276	0	0	0	0	1250
	Eve		198	183	10	581	232	0	0	0	0	1204
14	Mor	S-N	158	71	9	375	126	0	200	13	0	951
	Eve		242	105	13	409	122	0	40	13	0	943
	Mor	N-S	350	122	13	540	108	0	160	13	0	1306
	Eve		192	77	6	442	149	0	280	0	0	1145
15	Mor	W-E	392	324	78	1287	788	0	333	0	0	3202
	Eve		357	126	49	746	378	0	148	0	0	1805
	Mor	E-W	198	177	39	952	370	0	333	0	0	2069
	Eve		426	294	94	1332	758	0	518	0	0	3421
16	Mor	S-N	101	110	15	157	36	0	70	0	0	489
	Eve		113	120	13	126	25	0	140	0	0	537
	Mor	N-S	148	100	10	138	31	0	70	0	0	497
	Eve		112	122	15	160	42	0	140	0	0	591
17	Mor	N-S	186	115	3	202	66	0	32	0	0	605
	Eve		123	173	13	167	68	0	64	0	0	608
	Mor	S-N	150	205	5	150	55	0	64	0	0	629
	Eve		137	86	3	184	59	0	32	0	0	502
18	Mor	N-S	102	100	2	282	134	0	86	0	0	707
	Eve		121	163	4	216	83	0	43	0	0	630
	Mor	S-N	131	180	4	209	74	0	86	0	0	684
	Eve		101	112	4	268	123	0	86	0	0	694
19	Mor	N-S	89	67	2	190	84	0	160	0	0	593
	Eve		144	148	26	243	116	0	320	0	0	996
	Mor	S-N	101	93	7	196	67	0	80	0	0	543
	Eve		95	130	2	221	90	0	80	0	0	618
20	Mor	E-W	540	358	234	601	256	0	351	24	0	2364
	Eve		640	123	39	260	282	0	468	12	0	1823
	Mor	W-E	716	321	278	288	395	0	624	36	0	2658
	Eve		603	256	190	572	196	0	585	12	0	2415
21	Mor	E-W	83	32	9	99	60	0	0	0	0	283
	Eve		51	69	5	79	45	0	0	0	0	249
	Mor	W-E	76	52	5	81	58	0	0	0	0	272
	Eve		74	20	7	116	38	0	0	0	0	254
22	Mor	S-N	442	286	64	1184	1754	0	1980	108	0	5817
	Eve		199	212	18	1183	1580	0	1944	72	0	5207
	Mor	N-S	376	249	84	1026	1976	0	1944	24	0	5678



Peak Passengers Trips												
Loc. No.	Mor/ Eve	N-S / E-W	Car	Jeep/ Van	Taxi	MOTORISED			Bus			Total (Nos.)
						2-Wh	Auto	S. Auto	Bus	Mini Bus	School Bus	
	Eve		541	252	52	1026	1251	0	1872	36	0	5030
23	Mor	E-W	230	112	46	768	1412	0	1120	40	0	3728
	Eve		196	86	81	773	1605	0	1050	60	0	3851
	Mor	W-E	159	75	39	700	1588	0	805	30	0	3397
	Eve		224	101	41	713	1410	0	1260	10	0	3759
24	Mor	W-E	361	126	9	936	1106	0	300	33	0	2872
	Eve		348	181	12	819	866	0	330	33	0	2589
	Mor	E-W	353	167	31	894	870	0	270	66	0	2651
	Eve		243	164	12	736	862	0	300	11	0	2328
25	Mor	W-E	1081	75	11	376	153	0	76	11	0	1783
	Eve		206	80	9	310	126	0	76	22	0	829
	Mor	E-W	197	102	9	330	123	0	38	0	0	798
	Eve		145	89	4	167	103	0	114	0	0	622

Source: RITES Primary Surveys, 2012

2.2.3 PASSENGER OPINION SURVEY

The opinion survey of passengers traveling along the Corridor by different modes has revealed useful insights into the travel characteristics and opinions of the passengers.

- Bus passengers have an average trip length of about 18 Km, for suburban rail passengers it is about 35 Km, 18 Km for taxi, 13 Km for auto, 22 Km for car, while it is 19 Km for two-wheelers. Overall average trip length by all modes was found to be about 30 Km.
- Walk is the predominant feeder mode for the main Public Transport/ IPT journey, followed by auto and bus.
- On a scale of 1 to 10, all the passengers rated journey time (8.52) seat availability (7.54), comfort (7.31) and personal safety (7.12) as the most important factors to be considered for their journey. Importance of air-conditioning had a comparatively much lower overall score at 5.77. Among all modes, the suburban rail passengers gave the most importance to journey time and comfort — reflecting the aspirations for a comfortable and fast mass transport mode.
- On a scale of 1 to 10, the passengers rated walking distance to/ from the stations for the access/ egress journey (7.95), personal safety (7.88) and Crowding in trains/ buses (7.85) as the most important reasons for not using suburban rail or public transport on a regular basis. Lack of Parking at stations (2.99), lack of air- conditioning (3.23) in trains/ buses and interchange time at stations (3.02) were the least important reasons. The issues of access/ egress distances, personal safety and capacity constraints will be adequately addressed



by the new suburban corridor on account of increased number of stations and much better frequency throughout the day. Therefore, a large proportion of private mode passengers are likely to shift to the new system as compared to the CSTM - Panvel Corridor.

- On a scale of 1 to 10, the passengers rated journey time - which will be much reduced (8.12), comfort (7.09) and personal safety (6.89) as the most important factors that would encourage them to shift to the proposed system. Among the most important factors, the private mode passengers gave the highest rating to journey time (8.34) and comfort (7.69) - which indicates their primary incentive to shift to the proposed system.
- Bus passengers desired a time saving of about 10 minutes, 18 minutes for suburban rail passengers, 10 minutes for Taxi, 9 minutes for Auto, 11 minutes for Car, while it is 8 minutes for Two-wheelers. Overall average desired time saving by passengers of all modes was found to be 15 minutes. The proposed system is expected to provide a similar saving in overall travel time for the passengers.
- The bus passengers are willing to pay upto Rs 6, for Suburban rail passengers it is Rs 7, Rs 8 for taxi, Rs 6 for auto, Rs 13 for car, while it is Rs 7 for two-wheelers per 15 minute reduction in their journey time. Overall average figure for passengers by all modes was found to be Rs 7. These values give an indication of the monetary value attached by the passengers to their time.
- It is observed that the bus passengers are willing to pay upto Rs 1.21, for Suburban rail passengers it is Re 0.77, Rs 2.18 for taxi, Rs 2.00 for auto, Rs 1.55 for car, while it is Rs 1.06 for two-wheelers per km for a comfortable journey Overall average figure for passengers by all modes was found to be Rs 1.00.
- The stated figures indicate the desire for a better system by public transport users even at much higher than present costs in view of the presently inadequate public transport. At the same time, IPT and private mode passengers are willingly to pay comparatively higher price (although it is lower than their present travel cost - a reflection of the trade-off for the foregone higher convenience and comfort levels offered by their original modes) for the proposed system. The actual cost per km that the passengers might be willing to spend might be marginally lower than the stated costs. However, it compares well above the anticipated fare levels on the proposed system and establishes that even higher journey fares are unlikely to be an impediment for people to travel on the proposed system.

2.3 PRESENT TRAFFIC CHARACTERISTICS

2.3.1 RAIL PASSENGER TRAFFIC

Mumbai Division on Central Railway has one of the biggest Suburban networks in the World running 1360 Services per day and carrying about 3.5 million commuters over 84 Stations.

As per available ticket sales data, Panvel - Virar Corridor with 15 existing stations



presently carries only about 11,000 passengers per day, with significant numbers of passengers interchanging enroute at Kopar, Bhiwandi Road and Vasai Road stations.

The available details in terms of daily station loads for passengers moving along Panvel - Virar Rail Corridor during 2011-12 are presented in **Table 2.3**.

Table 2. 3 Present Daily Station Loads based on Passenger Ticket Sales

S. No.	Station	Avg. Daily Virar - Panvel Corridor Passengers
1	VR	1545
2	NSP	1072
3	BSR	1476
4	JCNR	64
5	KARD	346
6	KHBV	133
7	BIRD	1868
8	KOPR	2007
9	DTCC	10
10	DIVA	781
11	NILJ	10
12	TPND	155
13	NVRD	8
14	KLMG	48
15	PNVL	1482
	Total	11142

Source: MRVC

As per the on-board passenger count surveys (**Table 2.4**) - during Peak Hour, the Corridor is observed to carry a maximum passenger load of about 3000 Peak Hour Peak Direction Trips (PHPDT).

Table 2. 4 Observed Peak Hour Rail passenger Section Loads based on On-Board Passenger Count surveys, 2012

S. No.	Section	Peak Hour Peak Direction Trips (PHPDT)	Peak Hour Non-Peak Direction Trips (PHNPDT)
1	Virar - Vasai Road - Diva/ Kopar (50 Km)	3000	1600
2	Divia/ Kopar - Panvel (26 Km)	2000	1400

Source: RITES Primary Surveys, 2012

2.3. 2 ROAD PASSENGER TRAFFIC

As per the results of the road traffic volume count and passenger occupancy surveys (**Table 2.5**) - during Peak Hour, the Corridor is observed to carry a maximum passenger load of about 3000 Peak Hour Peak Direction Trips (PHPDT).

Table 2. 5 Observed Peak Hour Road passenger Section Loads based on Road Traffic Surveys, 2012

S. No.	Section	Peak Hour Peak Direction Trips (PHPDT)	Peak Hour Non-Peak Direction Trips (PHNPDT)
1	Virar - Vasai Road - Diva/ Kopar (50 Km)	2500	2000
2	Divar/ Kopar - Panvel (26 Km)	3000	2000

Source: RITES Primary Surveys, 2012

2.4 APPROACH FOR RIDERSHIP ASSESSMENT

System planning and a number of station facilities and including the passenger dispersal, train operation plan, rake requirement, depot planning and cost estimates require a reasonably accurate assessment of number of passengers who are expected to use the System in various horizon years. The ridership figures are also required to make a realistic assessment of fare box revenue.

The ridership assessment in urban environment is a complex exercise involving a large number of parameters - important ones being the population, employment, school enrolments and transport systems (with their accessibility, speed & capacity) - and warrants the development of a landuse transport model for whole of Mumbai Metropolitan Region (MMR). A commuter decides on his/ her selection of travel mode considering a number of parameters including accessibility of travel mode from the house, total travel time, total cost of travel, convenience/ comfort of travel and cost/ convenience for reaching the destination at the other end of the main journey. The commuter evaluates the merits and demerits of all possible alternative modes and their combinations before deciding on the final selection of travel mode(s).

Transport demand is a function of landuse and the growth of demand in various years vary depending upon the interrelationship of various landuse and traffic intensity in future years. Some of the major inputs to a urban transport demand model are;

1. *Delineation of study area into smaller traffic zones (in this case the total Mumbai Metropolitan Region would be Study Area as the influence area of project Corridor would be quite large)*
2. *Population (existing and proposed at traffic zone level)*
3. *Employment (existing and proposed at traffic zone level)*
4. *School enrolment (existing and proposed at traffic zone level)*
5. *Transport network and system (alongwith their respective carrying capacity and speed of each type of network/ system)*
6. *Speed and frequency of operation of the proposed System*
7. *Inter-modal integration facilities available and time required for passengers to interchange from one mode to another. This will also include the walking time required to access a particular System*
8. *Fare sensitivity for alternative modes*



MMRDA has carried out a Comprehensive Transport Study (CTS) for Mumbai Metropolitan Region which includes the detailed analysis of travel demand in different alternatives scenarios of population, environment and network development for various horizon years.

RITES, with the help of MRVC had requested MMRDA to carry out a traffic assignment exercise on the proposed Panvel - Virar suburban rail Corridor by using their transport demand model and provide us the ridership figures for various horizon years.

An alternate method of ridership assessment was also adapted to work out ridership figures based on the data available from secondary sources as well as collected from primary surveys carried out as part of the study.

The ridership assessment from both methods is presented in the subsequent sections.

2.5 CTS TRANSPORT MODEL RESULT

The proposed two Rail Corridors were added to the CTS transport Network for assessing the ridership levels upto horizon year 2031 using the updated Transport Demand model. The following assumptions have been made;

- CTS proposed Road and Rail network for horizon years 2021 & 2031 are considered
- The proposed Panvel - Virar Suburban Corridor with 25 stations (as against the 15 stations along the present rail Corridor) is considered
- 3 minutes headway for 2021 & 2031 horizon years is considered for Virar - Panvel Suburban corridor.
- Commercial Speed is taken as 35 KMPH
- Fare levels similar to other suburban rail Corridors in MMR
- All figures are for Morning Peak Hour,
- Peak Hour ridership estimated to be 10 % of Daily passenger traffic.

This exercise by MMRDA has given the results as presented in **Table 2.6** and **Table 2.7** for horizon years 2021 and 2031 respectively. Beyond 2031, the results are not available from the CTS model, as the landuse parameters have not been firmed up.

As per the CTS model results, the proposed Suburban Corridor is expected to have a maximum PHPDT of 26,500 in 2021, which is projected to increase upto 29000 by 2031. The corridor is expected to have a peak hour ridership of 66,000 and daily ridership of 6.6 lakh in 2021, which is projected to increase upto peak hour ridership of 1,01,500 and daily ridership of 10.2 lakh by 2031 This is based on the landuse development projections adopted in the CTS model upto 2031.



Table 2. 6 Projected Peak hour Ridership for Panvel - Virar Suburban Corridor (CTS Model), 2021

Boarding	Alighting	Volume Panvel-Virar	Station Name	Volume Virar-Panvel	Boarding	Alighting
2488	0	2488	Panvel	0	0	9690
0	0	2488	New Panvel	9690	0	0
0	0	2488	Tembode	9690	0	0
525	0	3013	Kalamboli	9690	0	1223
0	0	3013	Navade Road	10912	0	0
105	0	3118	Pindhar	10912	0	626
1451	0	4569	Taloje	11538	0	4112
472	0	5041	Dhansar/Pisarve	15651	0	1254
0	0	5041	Nighu	16905	0	0
53	0	5094	Narivali	16905	0	496
472	0	5566	Nilaje	17400	0	375
533	185	5915	Nandavali	17775	566	724
3595	418	9091	Kopar	17934	1730	5098
2477	395	11173	New Dombivli	21302	1835	1747
42	0	11215	Pimplas	21214	1	0
7101	6758	11557	Bhiwandi Road	21213	10948	16145
0	0	11557	Kalwar	26411	0	0
0	0	11557	Dunge	26411	0	0
47	0	11604	Kharbao	26411	0	88
582	1787	10398	Paye Gaon	26498	1644	1644
0	35	10364	Kaman Road	26498	112	0
188	3812	6740	Juchandra	26387	4633	847
412	3307	3845	Vasai Road	22600	6850	995
377	1802	2420	Nalasopara	16745	8510	265
0	2420	0	Virar	8500	8500	0
		11604	Maximum Volume (PHPDT)	26498		
20918	20918				45328	45327
		66245	Ridership	66245		

Table 2. 7 Projected Peak hour Ridership for Panvel - Virar Suburban Corridor (CTS Model), 2031

Boarding	Alighting	Volume Panvel-Virar	Station Name	Volume Virar-Panvel	Boarding	Alighting
6760	0	6760	Panvel	0	0	9440
1099	0	7859	New Panvel	9440	0	1082
0	0	7859	Tembode	10522	0	0
1028	1046	7841	Kalamboli	10522	921	1782
0	774	7067	Navade Road	11382	286	0
512	302	7277	Pindhar	11096	142	2493
1512	1890	6900	Taloje	13447	2340	3367
218	0	7119	Dhansar/Pisarve	14473	0	464
0	0	7119	Nighu	14938	0	0
102	128	7092	Narivali	14938	88	644
721	429	7385	Nilaje	15494	1528	430
589	413	7561	Nandavali	14396	688	626
3005	837	9728	Kopar	14334	1910	3196
6182	584	15327	New Dombivli	15620	1683	6067
97	0	15424	Pimplas	20003	6	138
12277	8711	18990	Bhiwandi Road	20135	11060	18000
0	0	18990	Kalwar	27075	0	0
0	0	18990	Dunge	27075	0	0
62	0	19053	Kharbao	27075	0	80
1051	2615	17489	Paye Gaon	27154	1779	1976
0	116	17373	Kaman Road	27351	221	0
2701	8860	11214	Juchandra	27130	7163	9012
1076	5519	6772	Vasai Road	28979	9448	2012
987	2815	4943	Nalasopara	21543	9782	794
0	4943	0	Virar	12556	12556	0
		19053	Maximum Volume (PHPDT)	28979		
39979	39980				61601	61602
		101581	Ridership	101582		

2. 6 RIDERSHIP ASSESSMENT BASED ON AVAILABLE/ COLLECTED DATA

The passengers on the proposed Suburban Corridor would come from two sets of existing transport systems;

- Shift of passengers from existing MEMU/ DEMU rail services (likely to be entirely replaced with the proposed suburban rail services)
- Shift of passengers travelling within the immediate influence area on the parallel major roads along the Corridor by various road modes including bus, taxi, auto and private modes



However, a major component of the expected ridership on the proposed Corridor will come from the natural growth of passengers due to future developments/ landuses in the immediate catchment areas of the Corridor/ Stations.

Presently, very limited MEMU/ DMU services operate on the Corridor, which are predominantly used for long-distance and freight trains. Over the entire day, per direction - the Corridor is served by only 1 service for complete Panvel - Virar Stretch, 3 services for Vasai Road - Panvel Stretch and 7 services for Vasai Road - Diva/ Dativali/ Dombivali Stretch.

Other transport projects planned in the vicinity include the Multi-Modal Corridor and the Dedicated Freight Corridor (which is not planned to carry passenger trains). However, the Multi-Modal Corridor may not be a competing transport project, as the proposed Suburban Corridor is likely to be considered part of the same.

The database utilized for this exercise include the Comprehensive Transportation Study for Mumbai Metropolitan Area by MMRDA, population/ employment projections of MMRDA, Central Railway Data on passenger traffic, discussions/ consultations with MRVC, MMRDA & CIDCO officials and the passenger traffic and opinion survey of passengers conducted by RITES Ltd. along the Corridor.

As the development along the Corridor is yet to pick up, the passenger growth rate along the Corridor is relatively slow (as compared to other suburban Corridors in MMR). The future passenger demand on the Corridor would largely be development driven or the development will come once the rail mass transit system is available.

As per the details available on future planning, the catchment area is poised to grow tremendously in the coming decades. The present pace of landuse development is slow, but is likely to pick up in the near future. The availability of the proposed suburban Corridor will also act as a catalyst to spur the development pace in the catchment area within the construction period.

The MMRDA's CTS Study projects the following population/ employment numbers for the sub-regions forming the catchment area of the Study Corridor.

Table 2. 8 Projected Population in Catchment Areas of Panvel - Virar Suburban Corridor (CTS Study)

Sub-Region Year →	Population (In million)						
	2016	2021	CAGR	2026	CAGR	2031	CAGR
Mira/ Bhayander	0.94	1.08	2.89%	1.23	2.58%	1.36	2.03%
Vasai -Virar	1.68	1.95	3.01%	2.08	1.33%	2.20	1.13%
Bhiwandi	1.02	1.15	2.50%	1.23	1.28%	1.31	1.27%
Thane	2.02	2.23	2.01%	2.42	1.62%	2.62	1.60%
Kalyan	3.23	3.75	3.00%	4.30	2.80%	4.67	1.64%
CIDCO/ Navi Mumbai	2.29	2.66	3.00%	3.05	2.78%	3.30	1.59%
Total	11.19	12.82	2.77%	14.31	2.22%	15.46	1.55%

Table 2. 9 Projected Employment in Catchment Areas of Panvel - Virar

Sub-Region Year →	Employment (In million)						
	2016	2021	CAGR	2026	CAGR	2031	CAGR
Mira/ Bhayander	0.41	0.50	4.23%	0.58	2.93%	0.70	3.83%
Vasai -Virar	0.47	0.61	5.53%	0.73	3.66%	0.91	4.46%
Bhiwandi	0.41	0.47	2.82%	0.51	1.65%	0.60	3.30%
Thane	0.84	1.05	4.52%	1.23	3.25%	1.49	3.84%
Kalyan	1.07	1.30	3.81%	1.51	3.12%	1.76	3.11%
CIDCO/ Navi Mumbai	1.23	1.54	4.51%	1.80	3.24%	2.17	3.81%
Total	4.43	5.46	4.28%	6.36	3.10%	7.62	3.69%

It is seen that Vasai - Virar Region is expected to grow the fastest. The above figures indicate that the expected growth rate of population in the catchment area is about 2.75 % (compounded annually) during 2016- 2021, 2.25 % during 2021 - 2026 and 1.5 % during 2026 - 2031, while employment is expected to grow @4.25 %, during 2016-2021, 3.0% during 2021 -2026 and 3.75% during 2026-2031. A reconnaissance of the catchment area of the Corridor and consultations with MMRDA indicate that the growth in this area has not been as expected/ planned. However, the development of the proposed suburban corridor is expected to act as a catalyst for speeding up the development much faster. Even a formal announcement of the Project will ensure faster development of the area. Past experience in urban traffic growth in Indian Cities indicates that passenger traffic generally grows at twice the growth rate of employment. Based on all the considerations, the passenger traffic can be expected to grow @ about 10 % p.a. upto 2021 and about 8 % p.a. during 2021 -2031.

A preliminary ridership assessment exercise was made as part of the pre-feasibility report submitted for the Study. There are certain changes in the ridership assessment now as we have definite traffic figures from our surveys, as against reconnaissance/ estimates which formed the basis of the earlier report. The expected growth rates for horizon years have also been modified based on the additional details available and in consultation with MRVC and planning agencies. RITES has carried out some primary traffic surveys along the existing Suburban Rail Corridor during peak hours on a typical working day. Based on these, the estimated section-wise loads are presented in **Table 2.10**.

Table 2. 10 Peak Hour Passenger Section Loads, 2012

S. No.	Section	Peak Hour Peak Direction Trips (PHPDT)			Peak Hour Non-Peak Direction Trips (PHNPDT)		
		Rail	Road	Total	Rail	Road	Total
1	Virar - Vasai Road – Diva/ Kopar (50 Km)	3000	2500	5500	1600	2000	3600
2	Divia/ Kopar - Panvel (26 Km)	2000	3000	5000	1400	2000	3400



The assessment of the commuters who would shift from existing suburban rail Corridor has been done by considering the following;

Presently only second class passenger rail services are available on the Corridor - with MEMU/ DMU fares which are comparable to suburban second class rail fares (being marginally lower by about Rs 1 - 3 per single journey ticket and Rs 10 for an MST - due to non-levying of MUTP charges). Although running speed is slower, the journey speed (69 Km in 2 hours @ 34.5 KPH over the entire Panvel - Virar through service) of the present train services is comparable to suburban train services - owing to only 13 stations along the through Rail Corridor. With proposed total 24 stations and higher running speed of the suburban rail service, the overall journey time along the proposed Suburban Corridor is expected to be almost the same. The passengers will be provided with a more frequent sub-urban rail service that will also serve a larger catchment, due to higher number of stations which will replace the existing DEMU/ MEMU services translating into all non - long distance rail passengers traveling on the proposed Suburban Corridor. Moreover, additional induced passengers due to better accessibility provided by the increased number of stations will also travel on the proposed Suburban Corridor.

Some passengers who are presently using buses, autos, taxis and private modes are also expected to shift to the proposed Suburban Corridor because of the advantages with respect to travel time and comfort. These will largely comprise the bus and taxi/ auto passengers who are more habitual to the additional interchange time and effort associated with public transport travel. Although the time saving by the new system would be substantial, yet it may not be able to match the comfort level of a personalised mode of transport - leading to a lower proportion of private mode road passengers shifting to the Suburban Corridor. The shift from various road modes is expected to be upto 50% of the total road passenger traffic. This assumption also takes into account the increased level of congestion in the years to come.

The number of induced passengers due to the larger catchment is expected to be about 50 % of the total estimated shift from existing rail passengers. The above factors indicate a favourable patronage of the proposed suburban Corridor. Analysis of passenger opinion surveys also supports this view.

Accordingly, for the base year i.e. 2012, the expected shift from suburban rail and road based modes to the proposed Suburban rail Corridor (peak hour peak direction) is estimated as follows;

Table 2. 11 Expected Peak Hour Peak Direction Passenger Section Loads on the Panvel - Virar Suburban Corridor, 2012

Section	Shift from Rail	Shift from Road	Total Shift	Induced Passengers Due to increased Catchment and better facilities	Total PHPDT
Virar - Vasai Road - Diva/ Kopar	3000	1250	4250	1500	5750
Divia/ Kopar - Panvel	2000	1500	3500	1000	4500



As the initial ridership is low, the development of this Corridor may not be fast-tracked. It will be reasonable to suggest that the Corridor is made available to commuters by 2021. Significant ridership on the proposed Corridor will come from new Developments in the Catchment Area. However, all preparatory works may start now.

It has been considered that the system will be operational by 2021 and the ridership projections have been done upto 2041. A total of 25 (including 11 new) stations are proposed along the Corridor. Additional stations are proposed to be developed in view of the large development potential and resultant accessibility need for future population along the Corridor. The estimated total ridership as a result of the modal shift and induced due to increased catchment and service frequency has been redistributed amongst the 25 stations in relation to their respective locations, landuse and potential for development.

Based on the afore-mentioned considerations and available figures of expected population growth and passenger trends, the following compounded annual growth rates (CAGR) are taken for estimating the traffic on the proposed Suburban Corridor in various horizon years. It is important to consider that the base figures are low and therefore, the expected growth rate will be higher in the initial years, which taper down in the later years.

Years	2012-2021	2021-2031	2031 -2041
CAGR	10.00%	8.00%	6.00%

Table 2. 12 Projected Peak Hour Peak Direction Passenger Section Loads on the Panvel - Virar Suburban Corridor

CORRIDOR/ SECTION		Year	PHPDT *			
			2012	2021	2031	2041
Virar	Nalasopara		3200	7400	16000	28700
Nalasopara	Vasai Road		3800	8900	19300	34600
Vasai Road	Juchandra		4500	10600	22900	41000
Juchandra	Kaman Road		4400	10400	22500	40400
Kaman Road	Paye Gaon		4400	10300	22300	39900
Paye Gaon	Kharbao		4400	10400	22500	40200
Kharbao	Dunge		4500	10700	23000	41300
Dunge	Kalwar		4600	10900	23600	42300
Kalwar	Bhiwandi Road		4900	11600	25100	44900
Bhiwandi Road	Pimplas		5700	13500	29100	52000
Pimplas	New Dombivli		6100	14300	30900	55300
New Dombivli	Kopar		5600	13300	28700	51500
Kopar	Nandavali		4500	10600	23000	41100
Nandavali	Nilaje		4100	9700	20900	37500
Nilaje	Narivali		4000	9400	20200	36200
Narivali	Nighu		4000	9400	20400	36500
Nighu	Dhansar/Pisarve		4000	9500	20500	36600
Dhansar/Pisarve	Taloje Panchanand		4000	9500	20600	36800
Taloje Panchanand	Pindhar		3900	9100	19700	35300
Pindhar	Navade Road		3900	9100	19600	35200
Navade Road	Kalamboli		3800	8900	19200	34400
Kalamboli	Tembode		3400	7900	17100	30700
Tembode	New Panvel		3300	7700	16700	30000
New Panvel	Panvel		2500	5900	12600	22600

* Peak hour peak direction trips



The average passenger trip length on the proposed Suburban Rail Corridor is estimated at about 27 Km in the base year. The development along the Corridor will pick up with the announcement/ operation of the project. This will also affect the increase in average trip length along the proposed suburban Corridor. The average trip length on the corridor in the year 2021 is estimated to be about 30 km and 33 Km in 2031. Trip length is expected to stabilize at this level in subsequent years.

The Corridor is expected to have a daily ridership of about 4.59 lakh in the first year of operation, i.e. 2021. The daily ridership projections, Peak Hour Station Loads and Daily Station Loads for the proposed Corridor for different horizon years are as presented in Tables 2.13 to 2.15.

Table 2. 13 Projected Daily Ridership on the Panvel - Virar Suburban Corridor

CORRIDOR	Avg. Daily Passengers (In Lakh)			
	2012	2021	2031	2041
Virar - Panvel	1.95	4.59	9.92	17.76

Table 2. 14 Projected Peak Hour Station Loads on the Virar - Panvel Fast Suburban Corridor

Station	Year	2012	2021	2031	2041
		B + A	B + A	B + A	B + A
Virar		5400	12800	27600	49500
Nalasopara		2600	6200	13400	24000
Vasai Road		2800	6700	14500	25900
Juchandra		800	1900	4100	7400
Kaman Road		400	900	1900	3400
Paye Gaon		300	700	1400	2600
Kharbao		800	1900	4100	7300
Dunge		600	1400	3000	5400
Kalwar		1000	2300	5100	9100
Bhiwandi Road		2400	5600	12000	21500
Pimplas		1200	2900	6300	11200
New Dombivli		1600	3900	8400	15000
Kopar		3300	7900	17000	30500
Nandavali		1500	3500	7600	13600
Nilaje		400	1000	2200	4000
Narivali		300	700	1400	2500
Nighu		600	1300	2800	5100
Dhansar/Pisarve		500	1200	2700	4800
Taloje Panchanand		1700	4000	8600	15400
Pindhar		600	1400	3100	5500
Navade Road		1700	4000	8600	15400
Kalamboli		900	2100	4600	8200
Tembode		300	600	1400	2400
New Panvel		1800	4300	9300	16700
Panvel		4500	10500	22700	40700
Total		39000	91900	198300	355100

Table 2. 15 Projected Daily Station Loads on the Panvel - Virar Fast Suburban Corridor

Year	2012	2021	2031	2041
Station	B + A	B + A	B + A	B + A
Virar	54300	127900	276200	494700
Nalasopara	26300	62100	134000	239900
Vasai Road	28400	67000	144700	259100
Juchandra	8100	19200	41400	74100
Kaman Road	3700	8700	18700	33500
Paye Gaon	2800	6600	14300	25600
Kharbao	8000	18800	40600	72700
Dunge	5900	14000	30200	54100
Kalwar	10000	23500	50700	90700
Bhiwandi Road	23600	55600	120100	215000
Pimplas	12300	29000	62700	112200
New Dombivli	16400	38700	83600	149700
Kopar	33400	78800	170100	304700
Nandavali	14900	35100	75700	135600
Nilaje	4400	10300	22200	39800
Narivali	2800	6600	14200	25400
Nighu	5600	13200	28400	50900
Dhansar/Pisarve	5300	12500	26900	48200
Taloje Panchanand	16900	39800	86000	154000
Pindhar	6300	14800	31900	57100
Navade Road	16900	39900	86100	154100
Kalamboli	9000	21300	46100	82500
Tembode	2500	6000	12900	23000
New Panvel	18300	43200	93300	167100
Panvel	44700	105300	227400	407300
Total	389500	918500	1983000	3551300

2. 7 SUMMARISATION OF RIDERSHIP

2.7. 1 RESULTS OF MMRDA

It is seen that the passenger catchment area around the Corridor has not so far developed at the pace as envisaged by the CTS model - which evidently assumes much of the development and the resultant traffic demand to come up by 2021, with comparatively lower growth between 2021-2031. The catchment of all stations are expected to develop significantly by 2031 — and hence the ‘nil’ boarding/ alighting at several stations indicated in the CTS model results need to be ignored.

Based on the current scenario, it is concluded that development in the passenger catchment area is likely to pick up beyond 2021 at a faster pace. Therefore, the passenger ridership forecast for 2031 appear reasonable,



although the passenger ridership may be much lower in 2021 as compared to the forecasted values by the CTS model (due to lower pace of development). Most of the planned development may come up after the proposed rail Corridor is available.

2.7.2 RIDERSHIP FROM AVAILABLE/ COLLECTED DATA

It is summarized that the ridership (PHPDT) on the proposed suburban rail Corridor would be upto 14,300 for Virar - Vasai Road – Diva/ Kopar section and upto 10,600 for Diva/ Kopar - Panvel section in the first year of operation i.e. 2021. The corresponding figures by the year 2041 will be upto 55,300 and 41,100 respectively. The average Daily ridership is expected to increase from 4.59 lakh in 2021 to about 17.76 lakh by 2041.

2.7.3 RECOMMENDATION

Considering the available information and logical assumption made in the assessment of ridership, the figures worked out from the data available/ collected look reasonable. The figures are also somewhat comparable with MMRDA's figures available figures for the longer term (2031). Near-term figures will depend on the pace of development in the area, which has been slow. It is therefore proposed to go ahead with the preparation of technical feasibility report based on the figures presented in **Tables 2.12** and **2.13**.

The ridership (PHPDT) on the proposed suburban rail Corridor would be upto 14,300 in the first year of operation i.e. 2021, which is expected to increase upto 55,300 by the year 2041. The average Daily ridership is expected to increase from 4.59 lakh in 2021 to about 17.76 lakh by 2041.

It is extremely important to develop this Suburban Corridor so as to provide impetus to the development of this vast area, which is important future growth axis in MMR. Apart from its own development, the emergence of this area shall help in decentralising the Mumbai city area (ensuring more uniform development at MMR level). Therefore, its implementation must not be purely linked to the expected ridership and we may provide some minimum service level (frequency) to ensure urban mobility. Ridership figures will be important once we have reached a minimum level of demand and start growing beyond that.