LANE CAPACITY OF HIGHWAY

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Abstract - *Capacity of a transport facility means the maximum number of vehicles, passengers, per unit time which can be accommodated under given conditions with a reasonable expected rate. The Highway Capacity Manual (2010) defines the capacity as the maximum rate at which persons or vehicles can be reasonably expected to traverse a point or a uniform segment of a lane or roadway during a given time period, under predominant roadway, traffic and control conditions.*

Key Words: Traffic volume, level of service, growth rate, planning, traffic composition, widening, future growth, projected traffic, PCU, PHF, etc.

1. INTRODUCTION

Capacity analysis is fundamental to the planning, design and operation of roads, and provides, among other things, the basis for determining the carriageway width to be provided at any point in a road network with respect to the volume and composition of traffic. Moreover, it is a valuable tool for evaluation of the investments needed for future road construction and improvements, and for working out priorities between the competing projects.

1.1 Aim

To determine lanes of highways to accommodate heterogeneous traffic with safe & smooth flow.

1.2 Objectives

The objective of thesis was to investigate various methods that can be used to estimate Lane capacity of project road. Following tasks were performed to desired results for Lane capacity Analysis:

- Collecting data required for Lane capacity estimation from project site & analyzing data.
- To list out factors affecting lane capacity Analysis of Highway.
- Finding out the methods of estimation of capacity of highway
- Identify the simplest method for highway capacity analysis, which we can use for further new project.
- To evaluate design Service Volume & Level of Service.
- Different methods of estimating capacity values are compared with each other, as with HCM value

2. PROPOSED WORK

Project location – The Entire project road (NKT Road, SH-141) having length Approx.140 km. In accordance with administrative boundaries, the project road is divided into four packages, however our thesis study only two packages are considered. The studied packages are following in Ahmednagar District. The location of project corridor is shown in below figure.

Package-I start at Ahmednagar (Chandani Chowk) Ch. 0+000 & ends at Taluka Boundary of Shreegonda-Karjat (38+775). It follows 38.775 Km length of overall length of project. From entire length of project 27.75% length is situated in this package. The entire road follows two lane paved shoulder. The average rainfall is 345 mm.

Package-II Start from Taluka boundary of Shreegonda-Karjat (Km 38+775) to Ahmednagar-Solapur District boundary (Km 80+390). This Package located in Ahmednagar. The total length of package is 41.615 Km. From whole length of project 29.79% length follows Package-II.

2.1 PCU FACTORS ADOPTED FOR THE STUDY

The PCUs adopted for the analyses are as per IRC-64 "Capacity of Rural Roads". The PCU factors for different vehicle types are presented in Table.

Table-1: PCU Factors for Different Modes

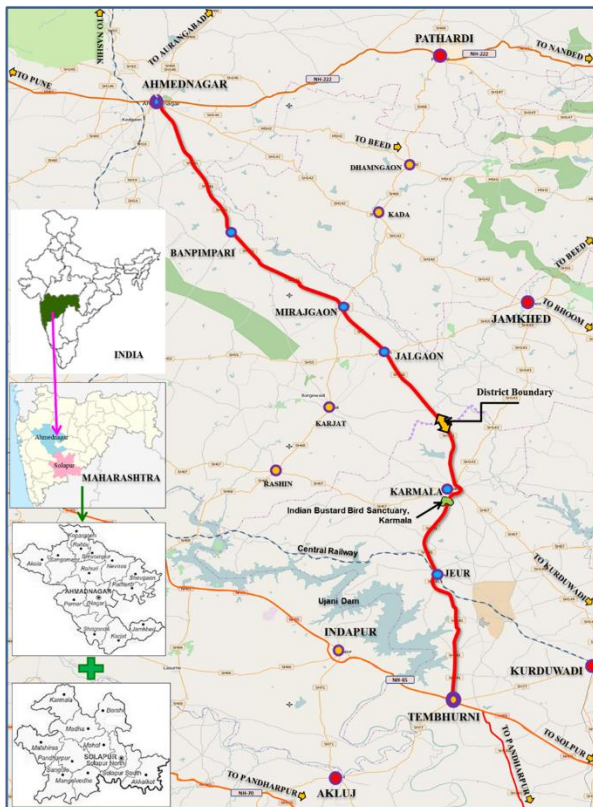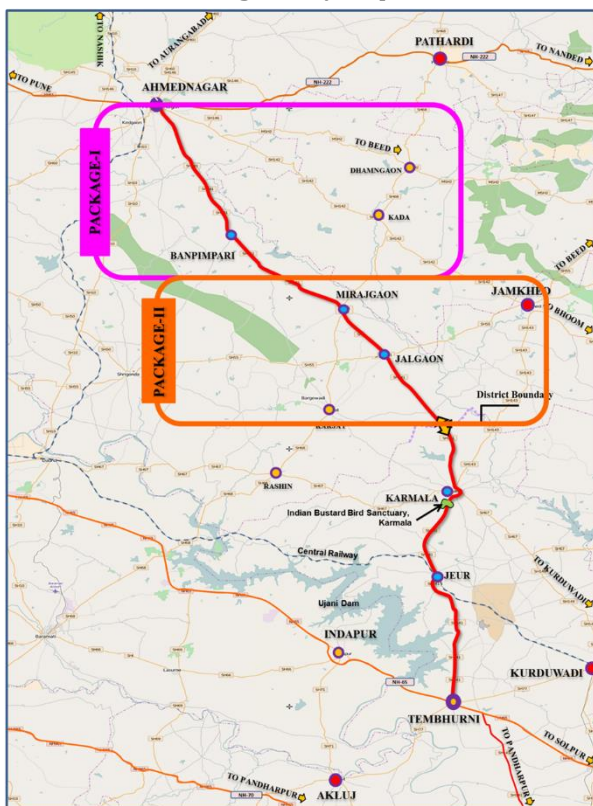| Type of Vehicle	PCU Equivalent
Two-wheeler/Bicycle	0.5
Car/Jeep/Auto rickshaw	1.0
LCV/Minibus/Tractor without trailer	1.5
Bus/Truck (excluding multi- axle truck)	3.0
Multi axle truck/Tractor with trailer	4.5
Animal Drawn Vehicles	6.0
Hand Cart	3.0
Bullock Cart	8.0

Fig -1: Key Map

Fig -2: Location Map

2.2 PCU FACTORS ADOPTED FOR THE STUDY

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2.3 DATA COLLECTION

Primary traffic surveys are intended to understand the base year travel. These surveys Include following parameter as per IRC: 108-2015:
1. Classified Traffic Volume Count (CTVC) Survey and Turning Movement count (TMC)
2. Origin-Destination Survey
3. Intersection Volume Count

Secondary data may consist of the following:

- Population
- Fuel-sales data along the project highway
- Agricultural and/or industrial output in the influence area of project highway
- Socio-economic data of the PIA, including economic parameters (Net District Domestic Product/Net State Domestic Product, Per capita Income) in the PIA.
- Past traffic data on proposed project corridor and/or surrounding road network
- Vehicle registration data (mode-wise/vehicle category wise)
- Land-use development plans viz. upcoming township, industrial unit/ SEZ etc.
- Transport network/link development/improvement plan with the PIA

Table -3: Average Daily Traffic (ADT) in terms of vehicles

Traffic Data Vehicle Type	TMC -1 (Ch. 10+000)	MB-I (Ch. 19+000)	MB-II (Ch. 55+000)
2 W	4162	5473	2820
3 W	70	134	228
LMV	2324	2866	2423
G. Bus	272	479	540
Pvt. Bus	36	63	91

Traffic Data / Vehicle Type	TMC -1 (Ch. 10+000)	MB-I (Ch. 19+000)	MB-II (Ch. 55+000)
Mini Bus	47	55	66
LCV	977	1089	1278
2A	886	604	774
3A	1887	1116	1200
4-6 A	3657	2029	1935
7A/ HCM	14	14	17
Tractor Without Trolley	12	16	54
Tractor with Trolley	19	24	236
Cycle	13	23	84
B cart other	0	15	56
Total	**14376**	**14000**	**11802**

Table -4: Average Daily Traffic (ADT) in terms of PCU

Traffic Data / Vehicle Type	TMC -1 (Ch. 10+000)	MB-I (Ch. 19+000)	MB-II (Ch. 55+000)
2 W	2081	2737	1411
3 W	70	134	229
LMV	2324	2867	2423
G. Bus	816	1437	1621
Pvt. Bus	108	189	273
Mini Bus	71	83	99
LCV	1466	1632	1917
2A	2658	1811	2322
3A	5661	3349	3600
4-6 A	16457	9132	8709
7A/ HCM	63	64	76
Tractor Without Trolley	18	25	82
Tractor with Trolley	86	109	1063
Cycle	7	12	42
B cart other	0	83	394
Total	**31884**	**23657**	**24254**

2.4 SEASONAL CORRECTION FACTOR (SCF)

Seasonal Correction factors is calculated from the fuel consumption on project highway petrol pump. The data collected from petrol pump & calculated SCF which is different for petrol & diesel vehicles given below.

For Passenger vehicles
0.88 for Passenger vehicles.

For Freight vehicles
0.90 for Freight vehicles.

Table -5: Annual Average Daily Traffic (AADT) in terms of vehicles

Traffic Data / Vehicle Type	TMC -1 (Ch. 10+000)	MB-I (Ch. 19+000)	MB-II (Ch. 55+000)
2 W	3663	4816	2482
3 W	62	118	201
LMV	2045	2522	2132
G. Bus	245	431	486
Pvt. Bus	32	57	82
Mini Bus	42	57	59
LCV	879	979	1150
2A	797	543	697
3A	1698	1004	1080
4-6 A	3291	1826	1742
7A/ HCM	13	13	15
Tractor Without Trolley	11	14	49
Tractor with Trolley	17	22	212
Cycle	13	23	84
B cart other	0	14	54
Total	**12808**	**12432**	**10525**

Table -6: Annual Average Daily Traffic (AADT) in terms of PCU

Traffic Data / Vehicle Type	TMC -1 (Ch. 10+000)	MB-I (Ch. 19+000)	MB-II (Ch. 55+000)
2 W	1832	2408	1241
3 W	62	118	201
LMV	2045	2522	2132
G. Bus	735	1293	1458
Pvt. Bus	96	171	246
Mini Bus	63	75	89
LCV	1319	1469	1725
2A	2391	1629	2091
3A	5094	3012	3240
4-6 A	14810	8217	7839
7A/ HCM	59	59	68
Tractor Without Trolley	17	21	74
Tractor with Trolley	77	99	954
Cycle	7	12	42
B cart other	0	77	383
Total	**28607**	**21182**	**21783**

3. CAPACITY ESTIMATION OF PROJECT ROAD NH 516 A

We proposed four lane for project road in accordance with MoRTH circular No. RW/NH-33044/37/2015/S&R(R) Dated 26/05/2016. The traffic in terms of AADT already crosses 10,000 PCU therefore Four lane is mandatory as per MoRTH policy. However, capacity of said road under four lane configurations is need to verify for its further Augmentation. The capacity estimation of project road NH 516 A is prepared on the basis of AADT and peak hour share. The section wise AADT and its peak hour share is presented below.

Table -7: AADT & Peak Hour Share

Description	Section –I 0+000 to 38+775	Section –II 38+775 to 80+390
AADT (PCU)	21182	21783
Peak Hour Traffic (PCU)	1644	1505
Peak Hour Share (%)	7.76%	6.91%

Therefore, Section wise DSV for respective peak hour share and for LOS B becomes

Table -8: Design Service Volume

Description	Section –I 0+000 to 38+775	Section –II 38+775 to 80+390
As per IRC-64-1990 and for 10% peak hour share	40000	40000
Peak Hour Share (%)	7.76%	6.91%
DSV for LOS B	**51,546**	**57,887**

Therefore, Section wise DSV for respective peak hour share and for every LOS @ project road becomes

Table -9: Proposed Level of Service

Criteria	Level of Service				
LOS	A	B	C	D	E
Max V/C Ratio	0.35	0.50	0.70	0.85	1.00
DSV (SECT- I)	36082	51546	72165	87629	**103093**
DSV (SECT- II)	40521	57887	81042	98408	**115774**

3.1 Q-MAX OF PROJECT HIGHWAY

Maximum volume that can be accommodating on the road Q MAX is considered road capacity. The maximum capacity of project segments is determined through IRC-64-1990 and

Highway Capacity Manual -2000 published by TRB (Transport research board, America). The computed capacity of existing facility is presented in following Table.

Table -10: Computed Maximum traffic volume

Section	Existing Two lane (PCU per Day)	Four lane (PCU per Day)	Four lane + Paved shoulders (PCU per Day)
Sect –I	38660	90206	98522
Sect –II	43415	101302	115774

3.2 LANE CAPACITY ANALYSIS

As the project road is divided into Two segments, (Ahmednagar District) From Ch. 0+000 to 80+390. The following table of Capacity analysis indicates present and upcoming Scenario of Level of service of road till ultimate capacity (Break down stage) for both segments.
By considering 5% growth rate the year wise analysis for every section and for every LOS is as below.

Table -11: Calculated Level of Service

Criteria	End of Level of Service in year				
	A	B	C	D	E
Section –I (0+000 to 38+775)	2024	2034	**2041**	2045	**2048**
Section –II (38+775 to 80+390)	2025	2036	**2043**	2047	**2050**

4. CONCLUSIONS

In this synopsis we are taking traffic count on selected locations, Calculate Peak hour flow, Calculate Q-max, Calculate Lana capacity of road.
After completion of study we are following conclusion made
1. Existing road need upgradation as traffic increases yearly by 5%.
2. Existing Two-lane width insufficient after 2024.
3. As per the study Four Lane Capacity for Section-I is 103093 PCU, for Section-II is 115774 PCU.

4.1 RECOMMENDATION

The project road (NH 516 A) becomes operational ------------
Under LOS A ------ free flow condition till 2022.
Under LOS B ---- Steady flow condition till 2033.
Under LOS C ---- Steady flow with slight conflict condition till 2040.
Hence, the upgradation of this road for four-lane width.

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