

STUDY AND FORCASTING OF URBAN TRANSPORTATION OF BARWANI CITY FOR FUTURE DEVELOPMENT

¹Prashant Vyas , ²Vinay Deulkar

¹Research Scholar, ²Assistant Professor, JIT Borawan (M.P)

ABSTRACT

The urban population of India is engaging in a variety of economic activities in rapidly expanding cities, which are, therefore, encountering fast escalations in urban travel demand. The increased travel demand has resulted in rapid growth in the number of motor vehicles in the cities. Urban transport planning is a very complex and specialized subject. As Barwani is not a developed city and hence has some Issues regarding Traffic and Transportation. Four different routes were selected in city with one to two kilometre length. The terms subjected to study are Average Daily Traffic, Traffic / Vehicle type, Peak Hour Traffic, Passenger trip Purpose, Trip Generation, and Trip distribution. Study is conducted to trace OD behaviour of selected four routes, to find daily average traffic, correlation Regression Analysis for Trips (Purpose Wise), trip distribution, assignment model and traffic forecasting for year 2025.

Keywords: Traffic study, urban transport, OD survey, Daily traffic, trip distribution, trip assignment, traffic forecasting.

1. INTRODUCTION

A variety of transport modes, such as, walking, cycling, two-wheelers, para-transit, public transport, cars, etc. are used to meet these travel needs. Travel demand is determined by a number of factors, the primary one being the size of the population. Other determinants include: average number of journeys performed by a resident each day (per capita trips) and the average length of each such journey (trip length). Travel demand has, thus, grown faster than the population because it is a function of both the rising number of trips undertaken by the incremental population as well as increased trip lengths necessitated by expanded city size. Further, it has been found that residents, on an average, tend to perform more trips per day as per capita income levels go up. A study carried out for the Ministry of Urban Development, covering 21 cities in the country, suggests that more than 75 per cent of the trips in a city are on account of either employment or education.

2. Literature Survey

Kartikey Tiwari, 2013, the present paper details the systemic, functional, operational planning and design to implement the intelligent transportation solutions in the city of Indore. The paper documents the recommended technological improvements to improve operational performance of the pilot (A-B Road) BRTS corridor. The paper scope is limited to implementation of field and centralized equipment and software to the A-B Road corridor.

Shanghai Manual, 2000, Cities should respect nature, consider the urban ecological environment as an asset, integrate environmental issues into urban planning and administration, and accelerate the transition to sustainable development. They should promote the use of renewable energy sources and build low-carbon eco-cities. They should strongly advocate for conservation of resources and promote environment-friendly manufacturing. Cities and their citizens should join together to create sustainable lifestyles and an ecological civilization in which people and environment co-exist in harmony.

Dorina Pojani, and Dominic Stead, 2015, There is increasing recognition that combinations (or packages) of measures are necessary. Certain combinations of policies can work together and give rise to synergies, leading to impacts greater than the sum of their individual parts. The identification of policy packages is a crucial issue for promoting more sustainable urban transport: packages should maximize potential synergies. It is crucial to consider local factors such as costs, feasibility, and barriers. Finally, caution is advised both in terms of the appropriateness and effectiveness of policy solutions being transferred to smaller and medium-sized cities in developing countries from larger cities and/or from more developed countries.

S.I. ONI, 2010, In the next decade or so the population in the cities of Nigeria will double creating more than 11 cities with more than a million people. This will increase demand for public transport not only in the provision of services but also in the provision of facilities. The increase in the population and economic development will place a services

constraint on the local government enough to force them to look seriously into the issue of public transport. Three issues at stake are financial resources and availability of appropriate manpower and maintenance. With economic recession in the country local government will face a serious problem in sourcing funds to provide transport services and facilities. Second, the quality of manpower at local level will pose a challenge to local governments to be able to plan, manage and coordinate public transport. The third issue is maintenance; Nigeria depends entirely on importation of vehicle components and parts. The assembly plants are unable to meet the demand for buses even at this stage. The need to work inward is now more vital than ever before.

Anuj Jaiswal and Ashutosh Sharma, 2012, This study is concerned of assessment of public transport demand for Bhopal and identifies the major factors for poor ridership with estimation of the probable shift of personal vehicle users to bus due to the increase in its level of service also identifies ways to account for qualitative factors in the public transport project evaluation by adjusting travel time values to reflect comfort and convenience. This can help to find innovative solutions to the current problems such as increasing traffic congestion, energy-consumption etc. and can increase the efficiencies as well as support for alternative modes of public transport, making them more acceptable by the people & achieving their equity objectives and increased economic efficiency both also a new approach is required to estimate the actual public transport demand so that most feasible and suitable system can be selected to optimise the public transport demand.

3. Problem Identification

Route Selection

Barwani city is studied in literature and routes are selected which are traffic congested in city.

The routes selected are:

From Bus stand to Olympic Square. (2.7 Km)

From Jhanda Chowk to Karanja (MG Road) (1.2 Km)

From Hospital Square to Pati Naka (1.1 Km)

From Kalka mata to Anjad Naka (2 Km)

Need to study Barwani Urban Traffic

Barwani city development master plan is already drafted for year 2035. As Barwani city is subjected to traffic growth with increasing percentage in near future years, the need of traffic study for number of critical routes is the need statement for Barwani city transport.

4. Methodology

Manual Survey

The survey is to be conducted in morning and evening peak hours, it is conducted to record vehicle flow volume with purpose of travel's

A Traffic Surveys & Inventories

The traffic survey is conducted to collect data as mentioned in Problem statement. Traffic flow with vehicle types is to be conducted for various routes.

Origin-Destination (OD) Survey

Origin - destination surveys is conducted with the help of physical traffic survey method for 2 hours morning and evening peak hrs.

Terminal Area Survey

Data and information is collected for movement of traffic for selected four terminals inward and outward. Design of a public transport system also requires a prior decision with regard to the type of city. Geographical features like the availability of land, in turn, often determine city type. Highly dense cities, that have severe land availability constraints, would have only one or a few city centres and would require high capacity public transport systems. However, in medium density cities less expensive bus-based systems would be adequate.

5. Data Collection

Table 1: O-D Survey for All Four Routes

Surveyor	Location	Approach Arm	Purpose Type	Morning Peak Hours		Evening Peak Hours	
				Inflow	Out Flow	Inflow	Out Flow
1	Bus Stand	Olympic Square	Education	227	218	159	146
			Business	143	117	297	287
			Work	79	84	89	77
			Other	313	297	402	389
2	MG Square	Karanja Square	Education	49	55	64	47
			Business	264	287	316	346
			Work	199	224	178	149
			Other	203	187	204	273
3	Hospital Chouraha	PatiNaka	Education	124	146	149	178
			Business	76	86	97	95
			Work	67	67	98	89
			Other	132	138	146	141
4	Kalka Mata	Anjad Naka	Education	107	143	109	127
			Business	213	207	247	278
			Work	176	190	121	187
			Other	187	274	194	141

Same O-D Survey is conducted for continuously seven days, it helps to prepare Route and Purpose Wise Average Daily Traffic

Route and Purpose Wise Average Daily Traffic

Table 2: Business Purpose Trips Summary Table

Day Number	Route	Morning Peak Hours		Evening Peak Hours	
		Inflow	Out Flow	Inflow	Out Flow
Day 1	Route 1	143	117	297	287
	Route 2	264	287	316	346
	Route 3	76	86	97	95
	Route 4	213	207	247	278
Day 2	Route 1	139	121	291	279
	Route 2	278	281	304	328
	Route 3	84	81	92	94
	Route 4	221	213	232	256
Day 3	Route 1	126	133	297	271
	Route 2	252	309	310	318
	Route 3	76	89	94	91
	Route 4	201	234	237	248
Day 4	Route 1	146	132	282	307
	Route 2	292	306	295	361
	Route 3	88	88	89	103
	Route 4	232	232	225	282
Day 5	Route 1	149	120	311	265
	Route 2	297	278	325	312
	Route 3	90	80	98	89
	Route 4	236	211	248	243
Day 6	Route 1	133	128	271	287
	Route 2	267	298	283	338
	Route 3	81	86	86	97
	Route 4	212	226	216	264
Day 7	Route 1	145	122	297	273
	Route 2	289	284	310	321
	Route 3	87	82	94	92
	Route 4	230	215	237	251
		Total			
		5047	5046	6481	6776
		10093		13257	
Average Daily Traffic	Business Purpose	1441.857143		1893.857143	

Table 3: Educational Purpose Trips Summary Table

Day Number	Route	Morning Peak Hours		Evening Peak Hours	
		Inflow	Out Flow	Inflow	Out Flow
Day 1	Route 1	227	218	159	146
	Route 2	49	55	64	47
	Route 3	124	146	149	178
	Route 4	107	143	109	127
Day 2	Route 1	217	226	144	154
	Route 2	52	51	61	52
	Route 3	84	81	92	94
	Route 4	99	126	115	119
Day 3	Route 1	197	249	147	149
	Route 2	47	56	62	50
	Route 3	114	153	144	164
	Route 4	90	139	117	115
Day 4	Route 1	228	246	140	169
	Route 2	55	56	59	57
	Route 3	132	152	137	186
	Route 4	104	137	112	131
Day 5	Route 1	232	224	154	146
	Route 2	56	50	65	49
	Route 3	135	138	151	161
	Route 4	106	125	123	113
Day 6	Route 1	208	240	134	159
	Route 2	50	54	57	54
	Route 3	121	147	131	174
	Route 4	95	134	107	123
Day 7	Route 1	226	228	147	151
	Route 2	54	52	62	51
	Route 3	131	140	144	166
	Route 4	103	127	117	117
		Total			
		3443	3893	3203	3402
		7336		6608	
Average DailyTraffic	Education Purpose	1048		944	

Table 4: Work Purpose Trips Summary Table

Day Number	Route	Morning Peak Hours		Evening Peak Hours	
		Inflow	Out Flow	Inflow	Out Flow
Day 1	Route 1	79	84	89	77
	Route 2	199	224	178	149
	Route 3	67	67	98	89
	Route 4	176	190	121	187
Day 2	Route 1	71	86	83	71
	Route 2	211	226	197	199
	Route 3	71	67	93	99
	Route 4	179	187	126	185
Day 3	Route 1	65	95	85	69
	Route 2	192	249	201	193
	Route 3	65	74	95	96
	Route 4	162	206	129	179
Day 4	Route 1	75	94	81	78
	Route 2	222	246	191	219
	Route 3	75	73	90	109
	Route 4	188	204	122	204
Day 5	Route 1	76	85	89	67
	Route 2	226	224	211	189
	Route 3	76	66	100	94
	Route 4	192	185	135	176
Day 6	Route 1	68	91	77	73
	Route 2	203	240	183	205
	Route 3	68	71	86	102
	Route 4	172	198	117	191

Day 7	Route 1	74	87	85	70
	Route 2	219	228	201	195
	Route 3	74	68	95	97
	Route 4	186	189	129	181
	Total				
		3731	4104	3487	3843
		7835		7330	
Average Daily Traffic	Work Purpose	1119.285714		1047.142857	

Table 5: Other Purpose Trips Summary Table

Day Number	Route	Morning Peak Hours		Evening Peak Hours	
		Inflow	Out Flow	Inflow	Out Flow
Day 1	Route 1	313	297	402	389
	Route 2	203	187	204	273
	Route 3	132	138	146	141
	Route 4	187	274	194	141
Day 2	Route 1	326	284	414	394
	Route 2	223	207	199	233
	Route 3	129	141	151	148
	Route 4	178	201	186	157
Day 3	Route 1	296	312	422	382
	Route 2	202	228	203	226
	Route 3	117	155	154	144
	Route 4	161	221	190	152
Day 4	Route 1	342	310	402	433
	Route 2	234	226	193	256
	Route 3	135	154	146	163
	Route 4	187	219	180	173
Day 5	Route 1	349	281	443	374
	Route 2	239	205	213	221
	Route 3	138	140	162	141
	Route 4	190	199	199	149
Day 6	Route 1	313	301	385	406
	Route 2	214	219	185	240
	Route 3	124	149	140	152
	Route 4	171	213	173	162
Day 7	Route 1	339	287	422	386
	Route 2	232	209	203	228
	Route 3	134	142	154	145
	Route 4	185	203	190	154
	Total				
		5993	6102	6655	6563
		12095		13218	
Average Daily Traffic	Other Purpose	1727.857143		1888.285714	

6. Data Analysis

Correlation Regression Analysis for Trips (Purpose Wise)

Business Purpose

Table 6: Income growth vs business trip generation

Year	Y Trip	X Income growth	x	x2	xY
2008	1584	1057	-818	669124	-1295712
2009	1616	1220	-655	429025	-1058480
2010	1648	1408	-467	218089	-769616
2011	1681	1625	-250	62500	-420250
2012	1715	1875	0	0	0
2013	1749	2164	289	83521	505461
2014	1784	2498	623	388129	1111432
2015	1820	2883	1008	1016064	1834560
2016	1856	3272	1397	1951609	2592832
2017	1894	3840	1965	3861225	3721710
Sum	17347	21842	3092	8679286	6221937
a=	1734.7				

b=	0.716871987			Y = a + bx	3143.353
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Table 7: Population vs business trip generation

Year	Y Trip	X Population growth	x	x2	xY
2008	1584	51132	-4171	17397241	-6606864
2009	1616	52144	-3159	9979281	-5104944
2010	1648	53177	-2126	4519876	-3503648
2011	1681	54230	-1073	1151329	-1803713
2012	1715	55303	0	0	0
2013	1749	56398	1095	1199025	1915155
2014	1784	57515	2212	4892944	3946208
2015	1820	58654	3351	11229201	6098820
2016	1856	59815	4512	20358144	8374272
2017	1894	61000	5697	32455809	10790118
Sum	17347	559368	6338	1.03E+08	14105404
a=	1734.7				
b=	0.136702989			Y = a + bx	2513.497

Table 8: Vehicle growth vs business trip generation evening

Year	Y Trip	X Vehical growth	X	x2	xY
2008	1584	7931	-3659	13388281	-5795856
2009	1616	8720	-2870	8236900	-4637920
2010	1648	9588	-2002	4008004	-3299296
2011	1681	10542	-1048	1098304	-1761688
2012	1715	11590	0	0	0
2013	1749	12744	1154	1331716	2018346
2014	1784	14012	2422	5866084	4320848
2015	1820	15406	3816	14561856	6945120
2016	1856	16940	5350	28622500	9929600
2017	1894	18625	7035	49491225	13324290
Sum	17347	126098	10198	1.27E+08	21043444
a=	1734.7			Y = a + bx	2904.01227
b=	0.166213543				

Similarly income growth, population growth and vehicle growth were tabulated against Education Purpose, Work Purpose and Other Purpose respectively.

Trip Assignment Models

With the help of regression analysis the trip assign with the Models. The equation “Y” is the basic equation to calculate the Number of trips For N number of years. With the help of these equation Trip assignment Models has been Prepared. The purpose of the trips are Business, Industrial, Education and Others. The trips mainly depend upon these for purpose with that region we have decided the trip to be generated.

$$Y = a + b_1X_i + b_2X_p + b_3X_v$$

Where,

Y = Number of Trips

X_i = income growth

X_p = population growth

X_v = vehicle growth

$$a = \sum Y/n$$

$$b = \sum XY / \sum x^2$$

n = Number of years

Trip Equations

For Business Purpose

$$Y_B = 1734.70 + 0.71987X_i + 0.13670 X_p + 0.16621 X_v$$

For Education Purpose

$$Y_E = 902.60 + 0.34714X_i + 0.06325X_p + 0.07956X_v$$

For Work Purpose

$$Y_I = 938.3 + 0.38665X_i + 0.07281X_p + 0.08936X_v$$

For Other Purpose

$$Y_O = 1807.645 + 0.69454X_i + 0.12648X_p + 0.15916X_v$$

This Equation is generated with the help of regression analysis and used for find out the number of trips in N number of years in the Different Purposes like industrial, Education, Business, others.

7. TRIP DISTRIBUTION MODELS

Trip Distribution Models Helps in the Separating the Number of Trips in Region or Zone wise Distribution of Total Number of Trips in Particular Region or Purpose. For a Zone the total Number of Trips Is generated by Trip generation Models but the percentage of Number of Trips in Different Purposes will identified with the trip Distribution Models. In General there are two technique First One is Growth factor Method and second is Synthetic Methods. Trip distribution models will give the details of Percentage of Number of Trips in Particular purpose.

Growth Factor Method are based on the assumption that the present travel pattern can be projected to the Design year in the future by using certain expansion factors. This can be represented by Formula:

$$T_{i-j} = t_{i-j} \times E$$

Where,

T_{i-j} = Design year , Number of Trips From Zone i To Zone j.

t_{i-j} = Observed Base year , Number of Trips From Zone i To Zone j.

E = Growth Factor.

8. Results

Trip Distribution Purpose Wise

Table 9: Business Trip Distribution

		Route 1	Route 2	Route 3	Route 4	
		1	2	3	4	t
Route 1	1	4	216	119	221	560
Route 2	2	227	8	171	225	631
Route 3	3	68	78	7	62	215
Route 4	4	218	128	133	9	488
						1894
E=	10.90975692					

Table 10: Business Trip Distribution for Year 2025

		Route 1	Route 2	Route 3	Route 4	
		1	2	3	4	T
Route 1	1	44	2357	1298	2411	6109
Route 2	2	2477	87	1866	2455	6884
Route 3	3	742	851	76	676	2346
Route 4	4	2378	1396	1451	98	5324
						20663

Table 11: Work Trip Distribution

		Route 1	Route 2	Route 3	Route 4	
		1	2	3	4	T
Route 1	1	3	49	54	53	159
Route 2	2	144	1	127	124	396
Route 3	3	62	79	2	58	201
Route 4	4	85	106	97	3	291
						1047
E=	10.56734613					

Table 12: Work Trip Distribution for Year 2025

		Route 1	Route 2	Route 3	Route 4	
		1	2	3	4	T
Route 1	1	32	518	571	560	1680
Route 2	2	11	11	1342	1310	4185
Route 3	3	21	835	21	613	2124
Route 4	4	32	1120	1025	32	3075
						11064

Table 13: Education Trip Distribution

		Route 1	Route 2	Route 3	Route 4	
		1	2	3	4	t
Route 1	1	2	94	114	107	317
Route 2	2	34	3	48	27	112
Route 3	3	89	108	1	113	311
Route 4	4	62	67	71	4	204
						944
E=	10.40724449					

Table 14: Education Trip Distribution for Year 2025

		Route 1	Route 2	Route 3	Route 4	
		1	2	3	4	T
Route 1	1	21	978	1186	1114	3299
Route 2	2	354	31	500	281	1166
Route 3	3	926	1124	10	1176	3237
Route 4	4	645	697	739	42	2123
						9824

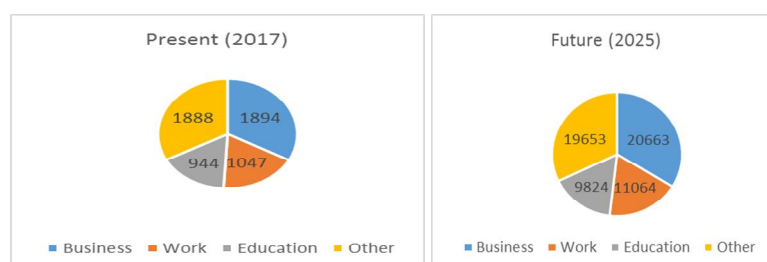
Table 15: Other Trip Distribution

		Route 1	Route 2	Route 3	Route 4	
		1	2	3	4	t
Route 1	1	2	226	338	226	792
Route 2	2	138	3	201	104	446
Route 3	3	103	79	1	126	309
Route 4	4	118	108	113	2	341
						1888
E=	10.40925625					

Table 16: Other Trip Distribution for Year 2025

		Route 1	Route 2	Route 3	Route 4	
		1	2	3	4	T
Route 1	1	21	2352	3518	2352	8244
Route 2	2	1436	31	2092	1083	4643
Route 3	3	1072	822	10	1312	3216
Route 4	4	1228	1124	1176	21	3550
						19653

Percentage Contribution of Purpose for Present and Future Year



Existing Development State

- The existing average condition of road is found in bad condition. The road side areas are acquired by market and it decreases the usable area of the road. It is found that throughout the city and especially in markets there are improper traffic junctions.
- Parking facility in market are not available in city. Private buses deals in interstate and regional traffic are not allotted with proper parking facility and are parked on main road side always causes congestion of traffic. Even there are no pay and park facility available in city.
- Barwani city has the potential to be a future tourism place. As Bawan Gaja Jain Temple can make city a tourist destination. Bawan Gaja Temple and Riverfront on Narmada is not that much developed as required can be developed with plan to improve tourism in Barwani city.
- Barwani is industrially backward city which causes lake of employment in the city. Most development is on Bandhan Road, Anjad Road, Choti Kasrawad Road and Vaisnodevi Temple. Offices are situated at Anjad Road and there is organized shopping area and retail shops besides road are creating parking problems.

Proposed Strategy

- New road network construction and repairing of existing roads in required to achieve free flow traffic in city. Junctions and traffic signals are due to develop in city which is important factor to manage traffic and urban development. Parking management is need to survey and establish in city which is major responsible issue to congestion and slow traffic. Stands are required to construct for buses and trucks to move them out from main road side.
- Industries and small process units must be attracted to generate employment in city. Trade and commerce, transportation, industry, storage and construction sector are required to develop for economic growth of city. Employment and skill development training must be provided to local youth to generate chances to employment and industries.
- Bawan Gaja Jain Temple and Narmada riverfront can be developed with plan to improve tourism in Barwani city. Public transport is need to improve from city to tourist spots. Infrastructure facilities and tourist accommodation with affordable cost must be planned for future urban development. Railway network is required to connect with city to motivate tourism and transportation in and from the city.
- Market and marketing must be motivated in the city. Commercial shopping malls are need to develop to attract tourists and local shoppers. Dairy and agriculture industry must me motivated at small and medium scale level. Sheds must be financed and provided to such setups to motivate youth and business in city.
- Infrastructures including roads, water supply, solid waste management and drainage are required to develop as a first step towards urban development of city. Residential areas and new colonies must be plan legally and in planned manner for future urban development. Townships must be motivated so that private colonizers may motivated for small townships in city

9. Conclusions and Suggestions

It is concluded from the study that:

1. For the route Bus stand - Olympic square, Olympic square to Karanja section is old state highway and is having sufficient width as per traffic load. Karanja to bus stand section is double line road and is also having well enough width against traffic load. The route is under heavy traffic of bus, car, trucks, three wheelers and two wheelers. The route is subjected traffic due to educational collages and commercial offices.
2. Route Jhanda chaowk – Karanja is observed as one of the oldest road and is single narrow width road. The route is subjected to two wheelers and moderated number of cars during peak hours.
3. For the route Kalka mata – Anjad naka, kalka mata to moti mata section is low width road and is observing heavy traffic in peak hours. Second section, Moti mata to Anjad naka is broader section and is having moderated traffic zone. This route is also under traffic load only due to two wheelers and passenger cars.
4. Hospital square - Pati naka route is observed convenient to travel and having moderated traffic. The route is under traffic of bus, car, trucks, three wheelers and two wheelers mostly.

Suggestions proposed with reference to outcomes are:

1. New bus stand location is proposed and suggested near the Indore road and khandwa-baroda bypass intersection, behind Sawariya mandir. The area for bus stand is suggested around between 4 to 5 acres.
2. Parking facility is suggested to be develop near Jhanda chaowk as it is most congested area with all vehicle type domestic and commercial traffic.
3. Several signals are proposed to be install and maintain at Olympic square, Karanja chowk, Hospital Square, Jhanda Chowk. Pala bazar square and Reva square. All these proposed signal points will help in smooth movement of traffic in the city.

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AUTHOR



Prashant Vyas, student of "**Master of Engineering**" in "**Transportation Engineering**" discipline (CE), 2015-2017, hereby declare that the work presented in this dissertation entitled "**STUDY AND FORECASTING OF URBAN TRANSPORTATION OF BARWANI CITY FOR FUTURE DEVELOPMENT**" is the outcome of my own work, is bonfire and correct to the best of my knowledge and this work has been carried out taking care of Engineering Ethics. my respected guide **Mr. Vinay Deulkar**, Assistant Professor & Head of Civil Engineering Department for his valuable guidance, complete technical assistance, critical interruptions and offering many innovative ideas and helpful suggestions, which

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