



Traffic Assignment on Urban Road Network - a Case Study of Anand Agglomeration

* Nirajkumar P.Mandowara, ** Dr. L. B. Zala.

* Manohar nagar society, Outside ahmedabadi gate, Nadiad-387001

** Head, Civil Engg. Dept, B.V.M. Engineering. College, Vallabh Vidhyanagar

ABSTRACT

Trip assignment is the fourth and the final phase of the four stage modelling. Travelers will choose the route which will take minimum travel time, minimum travel distance dependent on the traffic volume on the road. The following are commonly used traffic assignment models. There are different types of traffic assignment models, All-or-nothing, User-equilibrium, and System-optimum assignment models are the commonly used models. The analysis is done using TransCAD software and excel, whichever is best suited and the optimum solution is suggested at the end in future.

Keywords : Traffic Assignment, All or Nothing Assignment, TransCAD, Anand Agglomeration,

1. INTRODUCTION:

Traffic assignment models are used to estimate the flow of traffic on a network. These models take a certain demand for travel (usually expressed as a matrix identifying the number of trips between all possible origins and destinations [O-D pairs]) and then loads or 'assigns' these trips to the network itself. Generally, trips are assigned to the fastest possible route from the origin to destination. The end result is a table containing the number and characteristics of flows observed on each link in the network. These results are a key element in the urban travel demand forecasting process and used in a variety of applications including benefits estimation, air quality impact analysis, modal choice analysis and traffic safety models. As per "transportation planning key issues" by department of transportation, U.S. government, transportation planning plays a fundamental role in the state, region and community's vision for future. It includes a comprehensive consideration of possible strategies; an evaluation process that encompasses diverse viewpoints; the collaborative participation of relevant transportation related agencies and organization. It includes number of steps

- Monitoring existing conditions
- Forecasting future population and employment growth, including assessing projected land uses in the region and identifying major growth corridors.
- Identifying current and projected future transportation problems and need and analyzing through detailed planning studies, various transportation improvement strategies to address those needs.
- Developing long range plans and short range programs of alternative capital improvement and operational strategies for moving people and goods.

According to Arun Chatterjee and Mohan M. Venigalla, "Travel Demand Forecasting For Urban Transportation Planning", The basic purpose of transportation planning and management is to match transportation supply with travel demand, which represents 'need'. A thorough understanding of existing travel pattern is necessary for identifying and analyzing existing traffic related problems. Detailed data on current travel pattern and traffic volumes are needed also for developing travel forecasting or prediction models. The prediction of future travel demand is an essential task of the long-range transportation planning process for determining strategies for accommodating future needs. These strategies may include land use policies, pricing programs, and expansion of

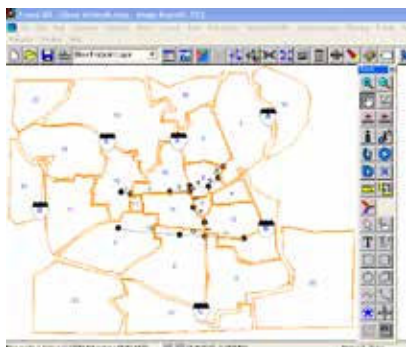
transportation supply – highways and transit service. As said by Srikanth Shastri (August 2012), "Spatial assessment of transit oriented development in Ahmedabad", India Urbanization is an integral part of economic development. In India especially, rapid economic growth and urbanization have led to formation of slums, deterioration in environment, congestion etc. A sustainable strategy is thus required to maintain the economic growth and alleviate the problems arising due to the growth. Transit oriented development which is an integrated approach to land use and transport planning is one such strategy. As said by Michael patrikkson, Linkoping Institute of Technology, Linkoping, Sweden, A significant amount of the activity in urban area concerns the movement of people and goods between different locations in the transportation infrastructure, and a smooth and efficient transportation system is essential for the economical health and the quality of life within the urban region. When analyzing the present infrastructure for future investments and operating policies, a careful study of transportation system is therefore among the most important components of the planning process. For only a few people is transport an end in itself. Most need to travel to be able to perform a certain activity, e.g. work, education or shopping. Since activities are carried out at different locations, people tend to make trips between these locations. This results in mobility and has its effect on daily society life (Peter Kant, "Route choice modelling in dynamic traffic assignment Master thesis", July 2008). Transportation is the backbone to the development of urban areas. It enables functioning of urban areas efficiently by providing access and mobility. Passenger transport has an overriding influence on the functioning of the city. Transportation planning and development of infrastructure for the system is one of the most crucial factors particularly for urban areas, where in high level and rapid urbanization is taking place.

2. OBJECTIVES

The main objectives of the study is to provide measures for a well distributed traffic on a route network with better level of service, safety and speed using different methods of route assignment.

1. Digitization of zones and road network
2. Collection of road network attributes.
3. Vehicle volume and trip data.
4. Traffic assignment scenario.

5. Suggestion for improving capacity or enhancing network.



3. STUDY AREA:

Anand is the administrative centre of Anand district in the state of Gujarat, India. It is administrated by Anand municipality. It is also known as the milk capital of India. It is located at latitude 22.57° North and longitude 72.93° East. The mean altitude of the city is 127 feet or 39 meters. City has an area of 22.7 sq. km. Anand is located near the Gulf of Cambay in the southern part of Gujarat. Proximity with Ahmedabad, Vadodara, Bharuch and Gandhinagar has made the district an important industrial center. Focus industry sectors include, Food & Agriculture, Engineering & Autoparts, Chemicals, Port & Ship Building, Minerals, Cement. National Highway (NH)8 passes nearby Anand city. The Anand city is well connected with Godhra, Ahmedabad, Kheda, Khambhat, Vasad and Mumbai through a broad gauge rail line of 147 km. Nearest airports are in Ahmedabad and Vadodara. Nearest ports are Dahej port and Hazira port. The study area plan with study stretch along with cordon points and zoning of study area is shown in the figure 1

Figure 1. Study Area Zoning and Road Network

Anand agglomeration is divided into 24 different zones based on the zoning of Anand municipality. The study stretch consists of major urban streets of Anand agglomeration, and they are mainly

1. Anand Vidhyanagar road (link 1-2-3)
2. Anand Grid to Borsad Chowkdi (link 4-5-6-7)
3. Anand Grid to Shamarkha Intersection link (7-8-9-10)
4. Ganesh Chowkdi to Janta Chowkdi (link 11-12-13)

There are mainly six cordon points for Anand city, and they are namely

1. Samarkha Chowkdi (denoted as "A")
2. Chikodhara Chowkdi (denoted as "B")
3. Borsad Chowkdi (denoted as "C")
4. Janta Chowkdi (denoted as "D")
5. Bakrol Gate (denoted as "E")
6. S. K. T-junction (denoted as "F")

4. STUDY METHODOLOGY



Steps For Analysing Traffic Assignment Using TransCAD Software:

1. After starting TransCAD, click Open a Map or Workspace from the quick start menu. If the quick start menu does

- not pop up automatically, select File → Open.
2. Select 'Matrix' from the Files of Type drop down list. Navigate to and open the matrix file containing the O-D demand matrix.
3. Select Matrix→Indices. Under Current Indices, select 'Zone to Node' in both the Rows and Columns drop down lists. This re-labels the rows and columns so that they match the node ID's in the network file we are about to open.
4. Select File → Open again and this time select 'Geographic File' from the Files of Type drop down list. Navigate to the folder containing the line layer representing the street network.
5. You should now have two windows open in TransCAD, one showing the road network and another the O-D matrix. While looking at the road network map, select Plannig → Traffic Assignment.
6. Since we have not loaded a network file into TransCAD yet, a window will pop asking for one. Navigate to the network file or you may use the 'tutorial_network' network file you created in chapter 5. Click OPEN. (Note: If you are still working in the same workspace as when you created the network file earlier, you won't have to perform this step).
7. The Traffic Assignment dialog box will now appear asking you to set the parameters of the traffic assignment.
8. From the Method drop down list, select the algorithm type you wish to use for your traffic assignment.
9. Each of the default settings should be correct but verify that your dialog box looks the same as the image above.
10. Click on Options and check the Create Themes box. Click OK. Selecting this option will add a visual representation of volume and congestion to your street network line layer once the traffic assignment is complete.
11. Click OK to display the Save As dialog box. You are being asked to name the table that will contain the results of the traffic assignment including link flows, congestion, travel time, etc. Give the file a meaningful name and click SAVE.
12. The traffic assignment will execute. When completed, a dialog box appears allowing you to review the results and any errors experienced during the assignment. Click Close.
13. The traffic assignment is now complete. TransCAD automatically joins the results table to the attribute table of your street network file and shows this as a new dataview on screen for use in later analysis. You can always join these tables again manually using the join tools in TransCAD. Your road network will also now be coloured to show flow volumes and congestion.

5. DATA COLLECTION:

5.1 HOUSEHOLD INTERVIEW SURVEY:

This is the best survey carried out for preparing O-D matrix. The data collected from this surveys are Origin of trip, Destination of trip, time required, number of vehicle ownership, route selected for trip, type of mode selected. Around 1070 number of forms are collected from throughout the Anand city to prepare a O-D matrix. The O-D matrix prepared is shown in the table below. This provides data regarding the internal trips of anand population

Table 1: O-D Matrix Prepared With Household And Cor-don Road Side Interview

[illegible]

The data for the O-D matrix formation is taken by random household survey technique for internal trips and cordon road side interview survey for external-external, external-internal, and external-external trips of the study stretch.

5.2 CORDON SURVEY:

These provide trips not registered in a household survey, especially external-internal trips. This involves asking questions to a sample of drivers and passengers of vehicles crossing a particular location. Unlike household survey, the respondent will be asked with few questions like origin, destination, and trip purpose. The objective of the survey is primarily to collect the origin and destination zones and for this many suitable methods can be adopted. It could be either recording the license plate number at all the external cordon points or by post-card method. There are six cordon points in Anand city and the above surveys are carried out at each cordon point. The data are shown in the table 1 above.

5.3 VOLUME COUNT SURVEY:

This is the survey carried out to find the volume on each link of a study stretch to find whether the links are accommodating over traffic or under traffic. This survey is carried out on each link as well as each cordon point. The technique used for volume counts are manual as well as video recording technique whichever is best suited at the location.

Table 2. Road attributes and volume count data on selected links

LINK	LEFT SIDE					RIGHT SIDE				
	SHOULDER	R.O.W.	VOLUME	CAPACITY	V/C RATIO	SHOULDER	R.O.W.	VOLUME	CAPACITY	V/C RATIO
1	0.00	7.50	1252.00	1500	0.835	0.00	6.10	857.00	1500	0.571
2	1.60	7.70	1535.00	1500	1.023	1.75	7.50	1893.00	1500	1.262
3	1.60	7.50	1814.50	1500	1.210	1.65	7.50	1664.50	1500	1.110
4	1.00	6.00	1895.50	1500	1.264	1.00	6.80	1955.00	1500	1.303
5	0.00	6.50	1488.50	1500	0.992	0.00	6.80	1360.00	1500	0.907
6	0.00	5.00	1622.00	1500	1.081	0.00	6.80	1778.00	1500	1.185
7	0.00	6.10	1488.50	1500	0.992	0.00	7.00	1360.00	1500	0.907
8	1.50	7.50	1937.00	1500	1.291	1.50	7.50	1721.50	1500	1.148
9	1.00	7.50	1865.50	1500	1.244	1.00	7.50	1838.00	1500	1.225
10	1.20	7.50	1765.50	1500	1.177	1.00	7.50	1665.50	1500	1.110
11	1.20	7.20	1852.50	1500	1.235	1.20	7.20	2386.00	1500	1.591
12	0.00	6.20	1777.00	1500	1.185	0.00	6.20	1886.00	1500	1.257
13	0.00	6.00	1081.00	1500	0.721	0.00	6.00	1483.00	1500	0.989

6. ANALYSIS OF THE COLLECTED DATA USING TransCAD SOFTWARE:



Figure 2: Traffic Assignment on Anand Agglomeration Using TransCAD Software

The above Figure 2 shows the Traffic Assignment analysis on the selected links of Anand Agglomeration. The assignment is done using the O-D matrix data with the zoning and networks. The result shows the flow with the varying thickness on the link of major urban roads of Anand city. Figure 3 and table 3 shows the traffic flow data on the different link after the traffic assignment. This shows the maximum as well as minimum flow links.

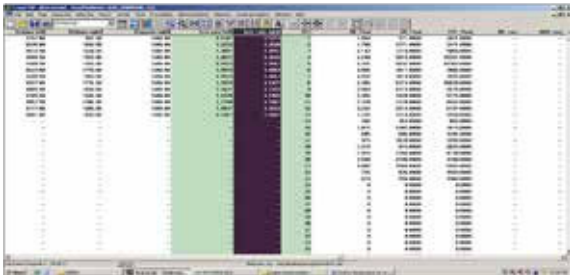


Figure. 3 Traffic assignment results in TransCAD window

Table 3 Link volume result of traffic assignment

LINK	VOLUME LEFT	FLOW LEFT	VOLUME RIGHT	FLOW RIGHT
1	1252	1050	857	971
2	1535	1700	1893	1771
3	1815	3142	1665	2718
4	1896	5248	1955	5073
5	1489	5331	1360	5032
6	1622	3895	1778	3911
7	1489	3837	1360	3818
8	1937	5305	1722	5315
9	1866	3503	1838	4173
10	1766	2355	1666	3420
11	1853	2324	2386	2128
12	1777	3242	1886	2915
13	1081	1232	1483	1318

7. CONCLUSION :

- There is maximum traffic flow on the link 4-5-6-7(Anand Grid to Borsad Chowkdi) among all the other links. Capacity of this link is 1500 pcu/hr. Flow is 1489 pcu/hr to 1896 pcu/hr, i.e., link is congested.
- Link 7-8-9-10(Anand Grid to Samarkha Intersection) having capacity 1500 pcu/hr has volume ranging 1789 pcu/hr to 1937 pcu/hr i.e., link is congested.
- Link 1-2-3 (Anand to Vidhyanagar Road) has a capacity of 1500 pcu/hr with a range of flow 1252 pcu/hr to 1815 pcu/hr, hence link is congested
- All the three road network requires widening of roads.

REFERENCES

• Murtaza Haider & Brian Gregoul(July 2009), "traffic assignment models (Draft) Travel Demand Models" | • "Transportation Planning Key Issues", Department of Transportation Planning, U.S. Government | • Arun Chatterjee and Mohan M. Venigalla, "Travel Demand Forecasting For Urban Transportation Planning" | Howard, S., Jonathan B., Andres R., (2006) Caliper Corporation, "An Empirical Comparison of Alternative User Equilibrium Trip Assignment Methods", AETC | Srikanth Shastri, "Spatial assessment of transit oriented development in Ahmedabad", (August 2012) | Michael patriksson (June 1994), Linkoping Institute of Technology, Linkoping, Sweden, "The Traffic Assignment Models" | Peter Kant, "Route choice modelling in dynamic traffic assignment Master thesis", (July 2008) | Mathew, T. V. and Krishna Roa, K.V. "Introduction to Transportation Engineering – Travel Demand Modeling", NPTEL, May 2007 | Mathew, T. V. and Krishna Roa, K.V. "Introduction to Transportation Engineering – Trip Assignment", NPTEL, May 2007 | "Gujarat State and Anand City Map"; (www.mapsofindia.com) | "Census Data Of India and Gujarat 2011"; (www.census2011.co.in) | Knorr, J. H.; "Basic Human Decision Making: An Analysis Of Route Choice Decisionsby Long-Haul Truckers", Princeton University, 2003 | Michael, B., "Problems of Transport Planning Methodology", (www.michael-baker.com) | Kadiyali, L. R., "Traffic Engineering and Transport Planning", Khanna Publisher, 2011 | Anand City, (www.anandcity.wikipedia.com) |