Traffic Impact Study At 3 Legged Intersection

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ABSTRACT

Traffic Impact study (TIS) is a valuable tool for analyzing traffic generated by proposed developments with new access or increased use of an existing access. A TIS generally includes a description of the scope and intensity of the proposed project, a summary of the projected impacts and any required mitigation measures, and helps ensure that the highway can safely accommodate a proposed subdivision/ development. The goal of a traffic impact study is to assess the potential impact of traffic generated by a proposed development or re-development and to identify the road way improvements required to ensure that the road network will operate safely and efficiently upon completion of the development. For the traffic impact study, a three legged intersection was chosen at Durga ghat in Vijayawada, Andhra Pradesh and conducted a traffic volume count. In this paper the observations shows that the capacity of dual lane carriageway with both directions (14mts) was exceeds by the volume travels at that junction. Normally the capacity of two-lane both direction carriage way is 3000 pcu's/day (IRC 106:1990), but the study area results says that the peak hour vehicular traffic was 5000pcu's. To measure the traffic volume counts manual method of count was adopted.

Key words: TIS, Capacity, Volume, Vehicular traffic, Peak hour

1. INTRODUCTION

Traffic Impact Study (TIS) is a systematic and scientific study to analyze the impact of the traffic generated by a new development on the surrounding transportation system. A TIS is generally required to support the transportation aspects of a proposed development that has the potential to generate significant amounts of pedestrians, bicycle trips, transit users, and vehicular traffic. A well-prepared traffic impact study helps the developer and permitting agency accomplish the following:

- Forecast the traffic impacts created by proposed development based on accepted practices, not perceptions;
- Determine improvements needed to accommodate the proposed development;
- Allocate funds more efficiently;
- Evaluate the number, location, and design of access points;
- Update traffic data (projections)
- Identify needed roadway improvements; and
- Provide a basis for determining the developer's responsibility for specific off-site improvements.

2.STUDY AREA

Vijayawada, one of the thirty-fifth(35^{th}) metropolitan cities in the country, is the third largest city in the state of Andhra Pradesh after Hyderabad and Visakhapatnam, located on banks of river Krishna.

Vijayawada has considerable historical importance and cultural heritage. It is considered as the agricultural and commercial capital of Andhra Pradesh. The Vijayawada Urban Agglomeration (VUA) has a population of 1.11 million as per 2001 census. Vijayawada Municipal Corporation is more than a century old and has been constituted as a municipality in 1888 with an area of 30 sq.km. It was upgraded as a Municipal Corporation in 1981.

Vijayawada is a major railway junction connecting north and south India. The rail and road trunk route link Madras, Delhi, Calcutta and Hyderabad at Vijayawada, which is one of the largest railway, centers in South India. Vijayawada is a major tourist destination in the state having a number of pilgrimage and historical sites. The most prominent ones being Prakasam Barrage, Kanaka Durga Temple, a 56 feet Stupa on the Gandhi Hill, a Planetarium, Kondapalli killa and the Mogalrajpuram caves which are in the entire south India.

Vijayawada urban agglomeration(VUA) consists of Vijayawada Municipal Corporation (VMC), Mangalagiri Municipality and four panchayats. As per 2001 census it has a population of 1.11 millions. The VMC has a population of 0.85 millions and Mangalagiri Municipality has a population of 0.06 millions and the rest of the population is spread in the panchayats and peri - urban areas. Vijayawada is the biggest city of the Krishna District and the third largest city in the state of Andhra Pradesh, India, after Hyderabad and Visakhapatnam, with an area of 61.88 km^2. The city has a population of 1,048,240 (2011 Census), while the population of the metropolitan area is 1,491,202. The name Vijayawada, meaning "Land of Victory", is derived from the presiding deity, Kanaka Durga, also called Vijaya. The city is also popularly known by its historic name, Bezavada which is used by the Indian Railways in assigning its railway station code "BZA".

Transportation:-

Vijayawada is an important link connecting the three regions of Andhra Pradesh and is a major transit point. Two National Highways, the NH-5 from Chennai to Kolkata and the NH-9 from Machilipatnam to Mumbai, pass through the city connecting it to other parts of the country. National Highway 221 connects the city to Jagdalpur in Madhya Pradesh. It is connected to other areas of the state by state highways and district roads. A BRTS project is under construction as well.

Rail

Vijayawada Junction is the second biggest and second busiest railway junction in India and contributes the highest revenues in the South Central Railway region. Situated along the Chennai – Howrah and Chennai – Delhi rail route, Vijayawada Junction is the largest railway junction on the South Central Railway network.

Road

Vijayawada is well connected to the rest of the country by National Highways: NH-5, NH-9 and NH-221. Transport by road from Vijayawada is available in the form of Andhra Pradesh State Road Transport Corporation (APSRTC) buses. Private bus operators also provide transport services to parts of the country.

Vijayawada Municipal Corporation (VMC) is planning to launch Bus Rapid Transit System (BRTS) with dedicated bus corridors. The initiative, however, is mired in procedural delays and was launched in mid 2010. Motor-driven auto-rickshaws and manual-driven cycle-

rickshaws are the other alternative means of transport within Vijayawada. Private Lorrie, cars and two-wheeled vehicles are common. Vijayawada has the second biggest and busiest bus terminal in the Asia, next to Chennai (CMBT). It was inaugurated on 23 September 1990 and is officially named as Telugu Satavahana Prayana Pranganam with its current name of Pandit Nehru Bus station.

In the present study the city of vijayawada is taken as a case study, where two National Highways (NH-5 & NH-9) are passing through this city. Especially NH-9 is a major arterial cordon point which allows traffic from Hyderabad through the Durga temple where more traffic impact on road due to intra and inter vehicles are utilizing the same carriageway. In order to find out the traffic impact at Durga ghat which is a 3-legged junction, traffic volume count was conducted. It is observed that the capacity of a dual lane carriageway in both directions exceeds the volume of traffic flow on this road, which is a serious condition. This is a quite common problem in various cities like Simhachalam, Amaravathi where the most famous temples are located.

3. REPORT & REVIEW:-

Understanding the demand's placed on the community's transportation network by development is an important dimension of assessing the overall impact's of development. All development generates traffic and it may generate enough traffic to create congestion and to compel the community to invest more capital into the transportation network, weather it is in the form of new roads or traffic signals or turn lanes. Traffic congestion results in a number of problems, including economic costs due to delayed travel times, air pollution and accidents. As one road way becomes congested, drivers may use others not necessarily intended for through traffic. As a result, traffic impact analysis is becoming more common as a planning tool to fore-see demands on the transportation network and to mitigate any negative impacts. Understanding traffic impacts becomes even more important as budgets for public facility and infrastructure improvements become increasingly strained.

A traffic impact analysis is a study which assesses the effects that a particular development's traffic will have on the transportation network in the community. These studies vary in their range of detail and completely depending on the type, size and location of the development. Traffic impact studies should accompany developments which have the potential to impact the transportation network. They are important in assisting public agencies in making land use decisions. These studies can be used to help evaluate whether the development is appropriate for a site and what type of transportation improvements may be necessary.

Traffic impact studies help communities to:

Forecast additional traffic associated with new development, based on accepted practices.

Determine the improvements that are necessary to accommodate the new development.

Assist communities in land use decision making.

Assist in allocating scarce resources to areas which need improvements.

Identify potential problems with the proposed development which may influence the developer's decision to persue it.

Allow the community to assess the impacts that a proposed development may have.

Help to ensure safe and reasonable traffic

conditions on streets after the development is complete.

Reduce the negative impacts created by developments by helping to ensure that the transportation network can accommodate the development.

Provide decision to community decision makers and developers of excepted impacts.

Protect the substantial community investment in the street system.

Traffic impact analysis is focused on the effects of a particular set of developments, but may provide information relevant to these broader plans and decisions. Traffic impact studies should be used as one piece of several kinds of information to judge the suitability of development from a transportation standpoint.

WHEN IS ATRAFFIC IMPACT STUDY NECESSARY?

A traffic impact study is not necessary for every development. Those developments that are unlikely to generate significant traffic generally do not need a traffic impact study. One of the approaches for determining whether a traffic impact analysis should be required for a proposed development is the use of trip generation data. The trip generation of a pro-posed development is essential the number of inbound and outbound vehicle trips that are expected to be generated by the development during an average day or during peak hour traffic. The process outlined in this chapter entails calculating the expected trip generation of the proposed development and comparing it to accepted thresholds to determine whether the comprehensive traffic analysis is needed.. A comprehensive traffic impact analysis procedure is beyond the scope of this workbook however the workbook does describe the impacts that should be included in a full study.

Generally, a comprehensive traffic analysis should be completed whenever a development is excepted to generate 100 or more new inbound or outbound trips during the peak hours (ITE recommended practice). Developments containing about 150 single-family, 220 multi family units, 55,000 square feet of general office space or a15, 000 square foot shopping centre would be expected to generate this level of traffic and hence, require a complete traffic analysis.

4. METHODOLOGY

VOLUME STUDIES

Engineers will often use the number of vehicles passing a point or entering an intersection in the analysis of roadway operations. The two basic methods of collecting data are manual observation and automatic recording. Each has their use and effectiveness depending on the type of information needed for analysis. The traffic data is the basis of all analysis in a traffic impact study and careful consideration should be given to the locations, types of counts and duration of counts.

Manual Counts

A. Requirements

Manual counts typically require trained observers to collect specific information that cannot be efficiently obtained through automated means. Examples might be vehicle occupancy, pedestrians, turning movements and vehicle classifications. As traffic data collection technology continues to advance many of these types of counts may become automated.

B. Equipment

The most common types of equipment used are tally sheets.

The use of a tally sheet involves the observer to make a tick mark for every vehicle in a given classification or movement. The tally sheet is prepared prior to going out into the field allowing space for all information to be marked easily once the

count has begun. These sheets are usually modified for the specific counts being taken. This is used in conjunction with a stopwatch to time the desired interval. Once these counts are collected they are tallied and summarized back in the office.

Mechanical count boards consist of accumulating pushbutton devices with three to five registers. Prior to starting the count, the observer determines the meaning of each of the count board buttons. Like the tally sheets, the use of a stopwatch is necessary to determine the period of each count and to cue the observer. When the end of an interval is reached the observer reads the counter, records the data and resets the counters to zero.

Manual adjustment of the data will be required to account for the lost time during the recording and resetting of the data. This procedure is described in further detail in subsequent sections.

Electronic counter boards are light hand-held and battery operated. They are typically lighter, more compact and easier to handle than the manual count boards. They also contain an internal clock and eliminate the need for separate field forms. They also preclude the need for manual data reduction and summary. Data may be transferred directly into a computer via modem or direct connection with a computer. Many electronic count boards are capable of handling several types of common traffic studies such as turning movement, classification, gap, stop delay, saturation flow rate, stop sign delay, spot speed and travel time studies. For most agencies and consultants the electronic count board is a cost effective and laborsaving tool.

C. Personnel

Manual traffic counting requires trained observers. Breaks should be planned for at least 10 min every 3 hours. One observer can easily count turning movements at a four way low volume signalized intersection as long as special classifications or occupancy are not required. A typical four-way signalized intersection may be counted by two observers. Duties may be divided among observers in a multitude of ways. Approach, lane, vehicle types and pedestrians may be divided by observers. For example one person may collect the northbound and westbound directions while the other would collect information for the southbound and eastbound direction.

D. Count Periods

Typical count periods may depend on the type of nearby land uses. Many nearby land uses may influence peak times of a particular intersection. For example an intersection near a hospital may peak during a mid afternoon shift change rather than the typical pm peak hour. Schools, temples, hospitals or shipping centers may impact peak periods due to their individual peaking characteristics. Care should be given to understand the surrounding land uses before scheduling peak hour counts over a limited time period as shown in table no:1. It is suggested that an investigation of the daily counts be conducted prior to collecting the peak-hour counts to allow a determination of a typical range of peak hour traffic movements on a roadway facility.

For most studies an AM and PM count will be sufficient as shown in *Table No 1*. However, additional traffic counts may be requested if in the opinion of the city traffic engineer that they are warranted. Saturday counts are sometimes needed near high shopping areas. Count periods should avoid special events and adverse weather conditions. A count interval of 15-minutes should be used for most studies.

Typical Peak Flow Traffic hours

LAND USE	TYPICAL PEAK HOURS
Residential	7:00-9:00 am weekday and 4:00-6:00 pm weekday
Regional Shopping center	2:30-3:30 pm Saturday, 5:00-6:00 pm weekday
Office	7:00-9:00 am weekday, 4:00- 6:00 pm weekday

Table No 1: Typical peak hours

5. ANALYSIS AND DISCUSSIONS

For the traffic impact study, a three legged intersection was chosen at Durga ghat in Vijayawada and conducted a traffic volume count as shown in Fig 1. In this paper the observations shows that the capacity of dual lane carriageway with both directions (14mts) was exceeds by the volume travels at that junction. Normally the capacity of two-lane both direction carriage way is 3000 pcu's/day (IRC 106:1990), but the study area results says that the peak hour vehicular traffic was 5000pcu's. To measure the traffic volume counts manual method of count was adopted.

Junction Name: Durga Ghat

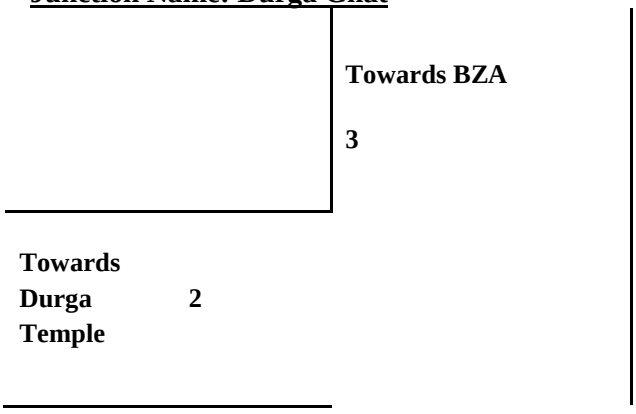

Fig 1: Direction wise traffic flow patterns

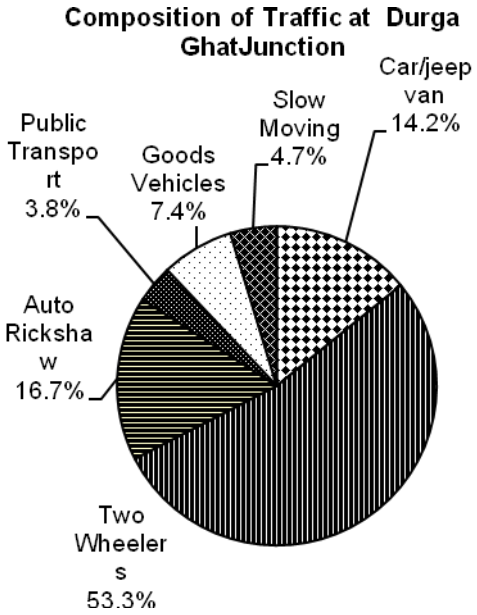

Fig 2: Mode Distribution

The distribution of modes on NH-9 near duga ghat during peak hours was observed as two wheelers – 51.6 %, Auto Rickshaw – 17.2%, Public Transport – 4 %, Goods Vehicles – 7.6 %, Low moving vehicles – 5.1%, Car/Jeep – 14.6% as shown in *Fig 2*. The hourly variation of traffic at durga ghat junction in vijayawada given in the graph.

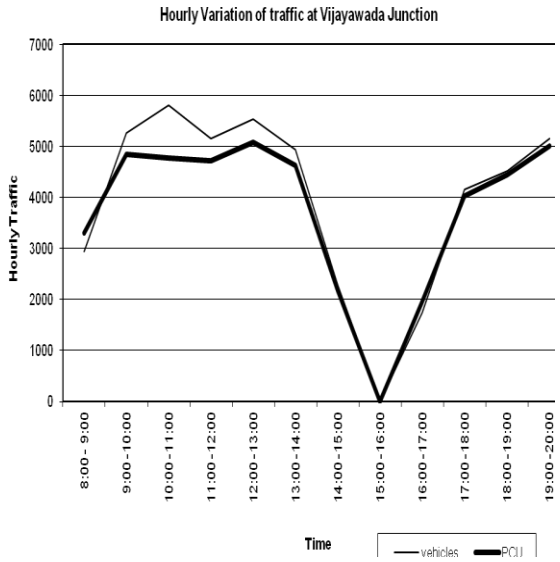

Fig 3: Hourly Peak Traffic

The study shows the hourly variation of traffic at durga ghat junction arises in the morning section at 9:00 – 10:00 AM and in the evening at 19:00-20:00 as shown in Fig 3.

Population Growth in Vijayawada

The city has witnessed a rapid growth over the past five decades with an average decennial growth rate of 39.72 %. During the period 1981-91 the net growth has been about 51.9% attributed to a large influx of the rural population to the city as shown in Table No 2. However, during the past decade 1991-2001, the growth has stabilized with a decadal population growth of 20.4 %.

Year	Population in lakhs	Decadal exponential growth rate (%)
1981	4.61	4.5
1991	7.01	5.2
2001	8.45	2.1
2005	10.01	1.5
2011	11.77	1.3

Table No 3: Growth rate of Population

Vehicular Growth and Composition

The total number of vehicles registered in Vijayawada Regional Transport Office as on 31- 03-2004 was 4, 53,815. Among these, 50808 are Transport Vehicles (Public Carriers) and 3, 95,151 are Non Transport Vehicles (Private). Details of growth of vehicles are shown in Table No 3; and a graph representing cumulative growth of total vehicles against Transport and Non transport vehicles, and cumulative growth of Transport and Non Transport vehicle against individual modes.

Year	Transport	Percentage Increase	Non-Transport	Percentage Increase	Total Percentage	Percentage Increase
1995	27499	--	125765	--	153264	--
1996	30242	9.97	189794	50.91	220036	43.57
1997	34563	14.29	207591	9.38	242154	10.05
1998	36418	5.37	225299	8.53	261717	8.08
1999	37977	4.28	241588	7.23	279565	6.82
2000	42029	10.67	261656	8.31	303685	8.63
2001	43306	3.04	288509	10.26	331815	9.26
2002	48742	12.55	312384	8.28	361126	8.83
2003	49002	0.53	317990	18.76	419992	16.30
2004	50808	3.69	395151	6.51	445959	6.18

Table No 2: Yearly Population Growth

Growth of Vehicles in Vijayawada Region Public Transport System

The predominant Public Transport modes in Vijayawada are City Buses and Auto-Rickshaws. There are three other types of services like Sub-Urban, Moffussil and ordinary services along with City Buses and they are operating from 5 depots. There are 358 buses plying through 119 routes and, serves around 2 lakh passengers per day in and around the city. Auto rickshaws ply on almost on all major routes. Presently, the shared auto services are more in the city to all other surrounding areas of the city except near railway station and Bus Stand areas. The other mode of travel for the city observed as cycle rickshaw in almost all locations, but cycle rickshaw cater to short trips only as shown in Table No 4.

Share of Public Transport

S.No	City Population (in millions)	Desired share of public transport (%)
1	0.5-1	25
2	Above1.0 and up to 2.0	30-40
3	2.0-3.0	50-60
4	3.0-5.0	60-70
5	5.0 plus	70-85

Table No 4: Public Share Percentage

Volume / Capacity Ratio Table

TABLE 2. RECOMMENDED DESIGN SERVICE VOLUMES (PCUs PER HOUR)

S. No.	Type of carriageway	Total Design Service Volumes for Different Categories of Urban Roads		
		Arterial*	Sub-arterial**	Collector***
1.	2-Lane (One-Way)	2400	1900	1400
2.	2-Lane (Two-Way)	1500	1200	900
3.	3-Lane (One-Way)	3600	2900	2200
4.	4-Lane Undivided (Two-Way)	3000	2400	1800
5.	4-Lane Divided (Two-Way)	3600	2900	–
6.	6-Lane Undivided (Two-Way)	4800	3800	–
7.	6-Lane Divided (Two-Way)	5400	4300	–
8.	8-Lane Divided (Two-Way)	7200	–	–

Table No 5: V/C Ratios

The capacity of dual lane road as per IRC shows that 3000 pcu's per day where as in the present study it is observed that 5000 pcu's for 12 hours. In this regard V/C ratio exceeds normal condition.

6. CONCLUSION:-

. The goal of a traffic impact study is to assess the potential impact of traffic generated by a proposed development or re-development and to identify the road way improvements required to ensure that the road network will operate safely and efficiently upon completion of the development. For the traffic impact study, a three legged intersection was chosen at Durga ghat in Vijayawada and conducted a traffic volume count. In this paper the observations shows that the capacity of dual lane carriageway with both directions (14mts) was exceeds by the volume travels at that junction. Normally the capacity of two-lane both direction carriage way is 3000 pcu's/day (IRC 106:1990), but the study area results says that the peak hour vehicular traffic was 5000pcu's. To measure the traffic volume counts manual method of count was adopted. The level of service of the present road condition was reaches LOS "E". The study shows the model distribution, vehicular traffic during peak hours, yearly growth factors, public

share factors, volume capacity tables. Based on this study it is proposed that the additional lane requirement is essential at the study area. The Traffic impact at durga ghat in Vijayawada leads to the problematic condition for the flow of traffic towards Hyderabad and the in and around residential areas.

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