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CORRIDOR MANAGEMENT FOR NELLORE CITY FROM ATMAKURU BUS STOP TO KVR PETROL BUNK

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ABSTRACT

Traffic and transportation problems in Nellore City have not been commensurate with the increasing demands for its usage. The city expanded dynamically without any planning and control due to the rapid socioeconomic changes. Nellore City is the south end of Andhra region in Andhra Pradesh which is 130 kms away from Chennai. There is huge development in terms of setting up of Special Economic Zones (SEZ's) which created more employability to the people either directly or indirectly. In addition this, one of the India's largest port namely Krishnapatnam Port Company Limited is established in 2006 with national importance which is just 20 Kms from the Nellore city. Because of the newly establishment of such a huge port nearer to the Nellore city, so much employability has been generated in and around the Nellore city. It will drastically changes the scenario of Nellore city.

The present transportation infrastructure is inadequate to cater to the increasing traffic. Improper design of junctions, inadequate carriageway width and irregular parking on the carriageway are reducing the flow rate on the corridors. In order to alleviate all these problems corridor management is necessary.

The corridor, from Atmakur Bus stand to KVR Petrol Bunk junction is much need of immediate improvements and hence are taken for the study. Detailed surveys, both physical and traffic are organized all along these links. Level of service analysis with the volume capacity ratios is carried out. Along with this delay analysis is also carried out at junctions.

In this study an attempt has been made to assess the delay and capacity from the developed models. By using v/c ratio level of service is predicted. Depending up on these parameters critical sections are identified, where the problems are acute, so that the restrictive and alternative measures could be suggested to solve at least some of the traffic problems in Nellore city.

INTRODUCTION

Taken in a long historical sense, traffic congestion has been around forever. Periods without significant congestion of some kind have probably been relatively limited. Current congestion levels may be higher than desired, but they may not be all that unusual. When everyone walked, cities were rarely more than a lakhs population; houses were close together and small. As the existing towns grew too large, office and commercial centers developed farther from city centre, the need for travel increased enormously. As houses moved to the suburbs, the commuter trips gone up considerably. The rapid growth in industrialization and commercial hubs, created a steep increase in travel demand there by need for the construction of new facilities. After independence, transportation infrastructure improved in leaps and bounds, but still the congestion problems exist and it is growing continuously.

The growth in population and travel needs will continue and the challenge is for the growth to be handled in ways that don't make travel time considerations an undue burden. While congestion in traffic, transit, or other forms will not be eliminated, there are many improvements that can make congestion easier to deal with. This work deals with some of the ways that are used to reduce congestion and improve the present day travel on a transport corridor.

CORRIDOR DEFINITION

The concept "transport corridor" lacks a precise definition. It has both a physical and functional dimension. In terms of physical components, a corridor includes one or more routes that connect centers of economic activity. These routes will have different alignments but with common transfer points and connected to the same end points. These routes are composed of the links over which the transport services travel and the nodes that interconnect the transport services. The end points are gateways that Allow traffic with sources or destinations outside the corridor and to enter or Exit the corridor, the following factors is likely to attributes for inclusion in the corridor definition.

- Broad geographic area or band, with no predefined size or scale, that follows a general directional flow – essentially a linear transportation service – connecting major sources of trips (e.g., population and employment centers; flow of people, goods and services) at both trip ends.
- Defined by logical, existing, and forecasted travel patterns; includes a particular travel market or markets that are all affected by the same or similar transportation needs and mobility problems.
- Composed of various adjacent modes (e.g., freeway / arterial streets, transit, bicycle, pedestrian pathway, waterway), constituting a pathway for the flow of people and goods, that provide the same function or provide complementary functions.
- Availability of good connector routes between the facilities and modes throughout the corridor, thereby allowing route and mode shifts without severe mileage and/or travel time penalty to the travelers.
- Located within a metropolitan area, with the need to operate as a system.

CORRIDOR PERFORMANCE EVALUATION

The performance of a transport corridor is evaluated based on the capacities and volumes on different links, speeds and delays along the corridor. The volume to capacity ratio is measured to get the level of congestion. The speed flow relationships and intersection delay analysis will be helpful tools to indentify the deficiencies and bottlenecks. These tools will enable to evaluate the performance of a given corridor and subsequently to suggest remedial measures for improvements. Generally Corridor Performance is evaluated based on three perspectives.

- Infrastructure
- Quality of Service
- Movement of goods

Infrastructure

This considers the physical capacity of the links and nodes in a corridor and the utilization of these components. This approach is often used when deciding on requirements for additional capacity but provides little insight into the effect of corridor performance on trade.

Quality of Service

It provided for the goods moving on the various routes. Performance is measured in terms of average time and cost for transport units moving through this corridor. These may be broken down into the time and cost for specific links and nodes.

Movement of Goods

In this perspective again cost and time are measured but this time for each of the principal supply chains. The costs and time can be disaggregated for the transport services on the links and the processing services at the nodes.

NEED FOR THE STUDY

Traffic planners and motorists continually face increased levels of traffic congestion and operational inefficiencies. The major contributors are population growth and increased vehicles use, combined with the inadequate growth (if any) in capacity. Transportation officials are struggling to keep up with the increases in travel demand, but have thus far been unsuccessful. Transportation officials often must overcome political and economical barriers when implementing transportation improvements. Funding for transportation improvements has not historically matched the growing transportation needs. It seems unlikely that this trend will change. Funding is likely to continue to lag behind the growth in demand.

Transportation officials need to make the most efficient use of the infrastructure that is in place and they need to continue to investigate new, low-cost alternatives. They also need to focus on the operations of the transportation system, to modify their perspective from a construction mentality to an operations mentality. In other words, instead of determining the best construction projects in which to invest capital funding, they need to determine how best to allocate their resources to provide an operational system the best determine to allocate their resources to provide an operational system the best meets the needs of the users of the system. Investing in properly designed and operated transportation corridors will help to meet the needs of the travelling public and will help to get the most efficiency out of the existing transportation infrastructure. The can be achieved by applying proper management techniques on the transport corridor. Mainly, the adverse impact of the steadily increasing traffic is felt at road intersections, where delay and vehicle queues keep increasing till handling capacity is augmented. Very often it is seen that the delay at intersections constitutes nearly one third of the total travel time. The resulting economic losses considering the excess fuel consumption, noise, accident etc. are enormous. As more and more junctions are brought under signal control, such economic losses will get compounded. While signalization is essential for ensuring automatic right of way assignment with safety, there is a simultaneous need for finding out ways to minimize the delays. Signalization serves no purpose when drivers held at one signal as it just turns red and watching wasted green at downstream signals.

GOALS OF THE STUDY

The purpose of a corridor management study is to bring local, regional, and state officials together to examine existing and future conditions along this corridor, and to identify ways to maximize capacity, improve safety, and ensures that the public benefit from investment in the highway infrastructure is maintained. A primary goal of the Corridor Management Study is to maximize the potential of the corridor to serve economic development the aim is to develop recommendations for short and long term strategies to prevent or reduce future traffic problems as growth occurs in the area. One focus of this study is to identify any structural improvements that are needed now or that are likely to be needed in the future, before growth along the corridor further limits options. The second is to identify management techniques which can be used by communities along the corridor to reduce conflicts between local and through-traffic. The third is to identify strategies to reduce the growth in the numbers of single occupant vehicles, especially at peak hours, to maintain the level of service of the corridor as commuter shed communities continue to grow.

OBJECTIVES OF THE STUDY

The main objective of the present study is as given below

- To critically review the available literature on corridor management.
- To conduct surveys for the collection of

sufficient data required for the corridor management.

- To find speed and delays along the corridor
- To analyses the data and prepare alternatives for the improvements of corridor.

METHODOLOGY

General

One of the main objectives of the corridor management schemes is to identify the major bottlenecks and problem areas, so that improvements at such places can smoothen out the traffic flow to a considerable extent. A route offering a smoother flow in terms of speed etc. is said to possess a comfortable level of service. On the contrary, if the disturbances confluence to a rough flow, offering a lot of variations in speed, then the route in said to have a low level of service. On great Endeavour of traffic engineer is to give good level of service. Many parameters can be employed to identify the disturbances, of which mentions may be made of the following;

i. Carriage way width
ii. Traffic volumes
iii. Speeds
iv. Delays
v. Level of Service

Physical Inventory Studies:

It is first phase of study synonymous to the preliminary survey, whose study includes the collection of the existing features of the corridor like width of pavement and shoulder, existence of junction, their inter-distances etc. This gives a brief physical layout of the corridor taken up for study.

Road Width

The item studied include;

i. Pavement and shoulders widths.
ii. Intersection, location and spacing.

i) Pavement and Shoulder widths

Measurements: The width of pavement and shoulder (on both sides) are measured at the important sites of the corridor, especially one at least within two major junctions.

They are measured with a tape directly during the early hours of the day when traffic is very low.

PEAK HOUR VOLUME MEASURMENT

The traffic volume and their variations at different links (or intersections) enable us to identify the peak hours on all the links. These peak volumes are taken for design of signals. Peak volumes also give an idea of special traffic control measures at the hours.

Need of the study

The importance of traffic volume studies are listed as follows;

i. Traffic volumes are generally accepted as a true measure of the relative importance of roads and in deciding the priority for improvement.
ii. It is used in planning, traffic operations and control of existing facilities.
iii. The study is used in the analysis of traffic patterns and trends.
iv. Classified volume study is useful in structural design of pavements in geometric design and in computing road capacity.
v. Volume distribution study is used in planning one-way streets and other regulatory measures.
vi. It is essential in the design of signals at intersections.

Description of Method (HOBBS F.D. 2nd edition)

Manual count

It is the simplest form, where the observer records, traffic in each direction on a census sheet. The passage of each vehicle according to its classification is noted separately. The data can be summarized for each hour of the day which can be used for further analysis.

Detectors

The essential element in automatically counting traffic is a detector (sensor) which signals a response to a counter on the passage of vehicles through a selected point. Many practical vehicles detectors have been produced based on a number of principles. Some of them are

i. Pneumatic tube in which air pulses, actuated by wheels, pass along the tube activating a metal diaphragm.

ii. Inductive loop detector, in which the presence of a vehicles' metallic mass alters the inductance of a loop of wire.
iii. Transducer unit detector.
iv. Detectors which work through the distortion of earth magnetic field.

Careful sitting of the detector is necessary so that the count is not intercepted wrongly by the detector. Normally, intersections, accesses, bus stops, parking areas, pedestrian crossing points, queue points etc., must be avoided.

Moving car observes technique

Volume counting, whether manual or automatic has usually to be carried out on a point basis which need not necessarily be the same as the volume at another point on the road. A method which widens the sample at a point to mean volume along a length of the road is the "moving car observes technique". This system, developed by "War drop and Charles worth", provides other useful information like speed, delays etc. (Hobbs F.D.).

It is carried out by observers traveling in a car and the vehicle makes a series of runs over the selected route, which is split into carefully determined sections, generally starting and ending at major intersections.

A full crew for a moving car observer run consists of a journey observer, an opposing counter, a tally counter and a driver.

The journey observer records the time of stopping and starting along the route, the times of passing control points. The opposing counter counts the number of vehicles, in classifications, moving past the test vehicles in the opposite stream for each section. These totals are referred to as "X Counts". The tally counter counts the number of vehicles over taking the test vehicles and those overtaken by the test vehicles is called the "Y Count".

The traffic volume is one direction for each section and for each class is given by

$$q = (X+Y) / (ta + tw)$$

Where,

q = Vehicles per minute in the direction of the stream considered.

X = No. of Vehicles (of the same class) met traveling against the stream.

Y = No. of vehicles (of the same class) overtaking the test vehicles minus the number of overtaken while traveling in the section.

ta = Journey time, in minutes, of the test vehicle traveling against the stream.

tw = Journey time, in minutes, of the test vehicles traveling with the stream.

The average journey time, in minutes, of a particular class of vehicles in the stream is given by:

$$t = tw – (Y/q)$$

This method is also used in speed and delay studies considered later in this chapter.

Procedure

Manual count method has been adopted for getting traffic volume data. Traffic volumes, at selected sites along the corridor (15 in number), are actually recorded on the traffic volume data sheet to an accuracy of 15 minutes interval. The number of vehicles traveling in the same stream is counted in classifications. The data collected are processed in which the sum of each class of vehicles is found out and then the whole total is found out.

TRAFFIC VOLUME

The traffic volume study was carried out during morning (9:00 A.M to 12:00 PM) and evening hours (4:00 PM to 8:00 PM) with manual count method. The traffic volume count for every 15 minutes count interval was conducted to obtain exact peak hour. The data collected was converted into one common unit i.e., Passenger Car Unit commonly known as PCU.

The traffic volume count charts and traffic flow diagrams for intersections are shown in the graphs below.

Based on the study the traffic in the future can be predicted by the following formula and results indicated in tabular form below

$$\mathbf{A = P\,(1+r)^{(n+10)}}$$

Where,

n = Constant period of intersection taken as Zero

r = Rate of Volume increased per year to be 0.1

P = Present volume

A = Projected volume in the year 2018

Table 1: Predicted Traffic Volume

Intersection	Present Traffic Volume in PCU/Hr	Predicted Traffic Volume in PCU/Hr
Atmakur Bus stand	6406	16616
KVR Petrol Bunk	2568	6660

K.V.R.PETROL BUNK JUNCTION

The table reveals that the peak hour is in between 16:45 PM to 17:45 PM with traffic volume 3439 vehicles per hour as shown in graph below.

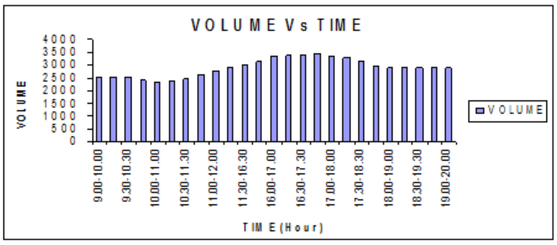

Figure 5.1: Peak hour volumes for KVR Petrol Bunk junction

ATMAKUR BUS STAND JUNCTION

The table reveals that the peak hour is in between 9:30 A.M to 10:30 A.M with traffic volume of 9879 vehicles per hour as shown in graph below.

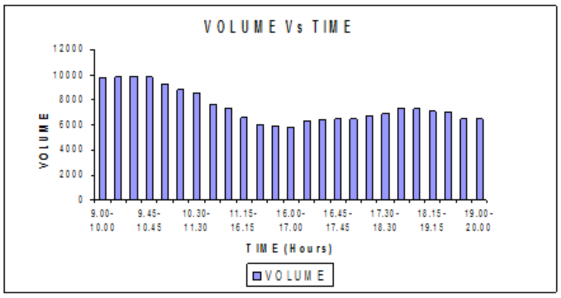

Figure 5.2: Peak hour volumes for Atmakur Bus stand Junction

ATMAKUR BUSSTAND JUNCTION TO K.V.R. PETROL BUNK JUNCTION

The table reveals that the peak hour is in between 17:45 P.M to 18:45 PM with a traffic volume of 2627 vehicles per hour as shown in graph below.

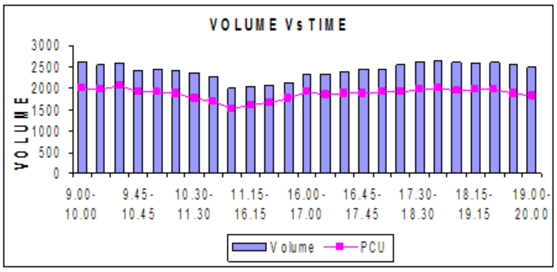

Figure 5.4: Peak hour volumes for Atmakur Bus stand to KVR petrol bunk

The below graph it revels that in peak hours delay is caused due to the presence of heavy vehicles, maximum delay is caused at 5:15 PM to 6:15PM where the percentage of heavy vehicles is also maximum.

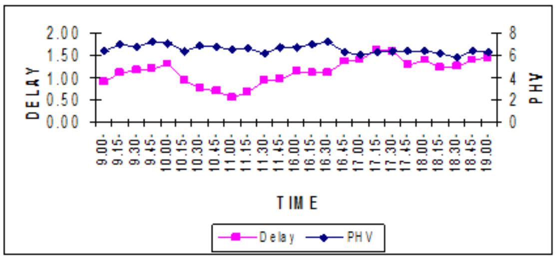

Figure 5.6: Delays vs. PHV

The below graph reveals the relation between Delay – Time – Percentage of cars; the delay is maximum where the percentage of cars are almost maximum.

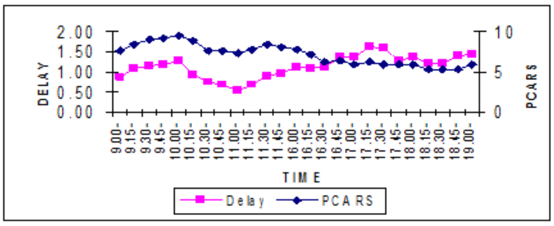

Figure 5.7: Delays vs. PCAR

The below graph reveals the relation between Delay – Time – Percentage of Autos, the delay caused by the autos are very much high in peak hours.

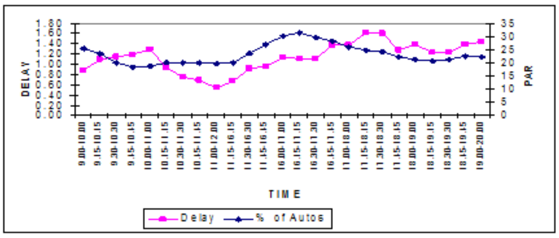

Figure 5.8: Delays vs. PAR

The below graph revels the relation between Delay – Time – Percentage of Right turning vehicles, in peak hours the increase in right turning vehicles results in heavy delay in peak hours.

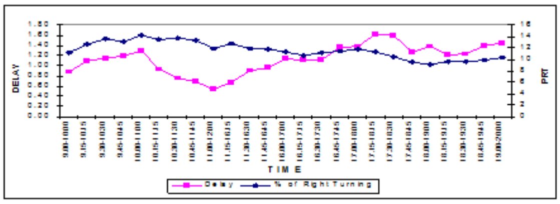

Figure 5.9: Delays vs. PRT

The below graph reveals the relation between Delay – Time – Average Equivalent Traffic, in peak hours delays are more when the AET is also more.

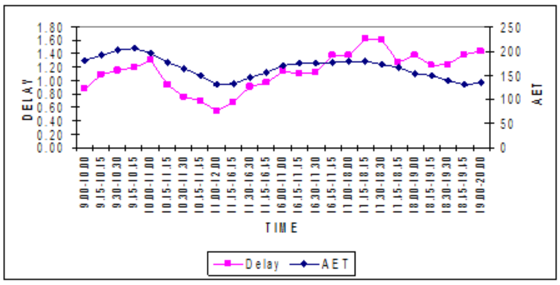

Figure 5.10: Delays vs. AET

Equation Developed

DELAY = 1.73 - 0.043 (PHV) - 0.121 (PCAR) - 0.0104 (PAR) - 0.0625 (PRT) + 0.00910 (AET)

R-Square = 67.4%

The below graph reveals the relation between Delay – Time – Percentage of Heavy vehicles, In peak hours the delays are caused due to the presence of heavy vehicles. So, the delays are maximum when the percentage of heavy vehicles is maximum

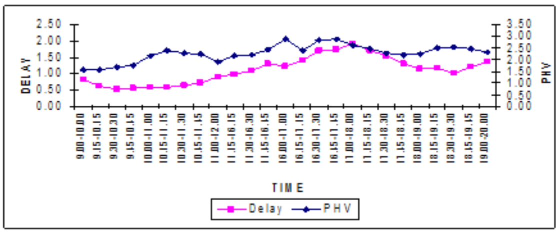

Figure 5.11: Delays vs. PHV

The below graph reveals the relation between Delay – Time – Percentage of Cars, the percentage of cars has not much influence in the delay causing at Atmakur Bus stand junction.

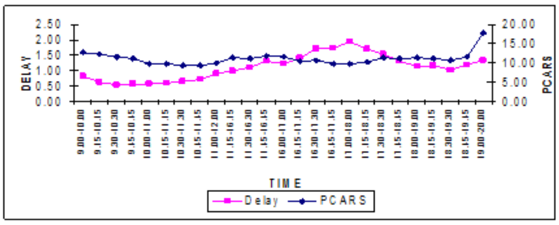

Figure 5.12: Delays vs. PCAR

The below graph reveals the relation between Delay – Time – Percentage of Autos, In morning hours there is not much influence of autos in causing delay where as in evening peak hours much delay is caused due to the presence of autos.

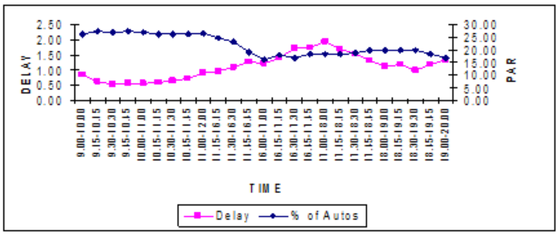

Figure 5.13: Delays vs. PAR

The below graph reveals the relation between Delay – Time – Percentage of Right turning vehicles, The right turning vehicles causes delay in evening peak hours than morning hours.

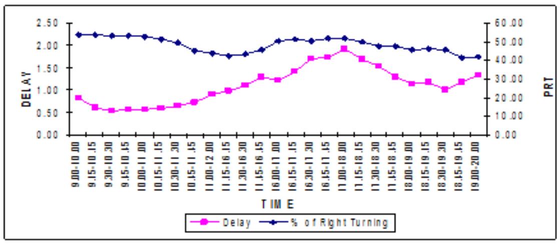

Figure 5.14: Delays vs. PRT

The below graph reveals the relation between Delay – Time – AET, the AET has much influence in evening peak hours.

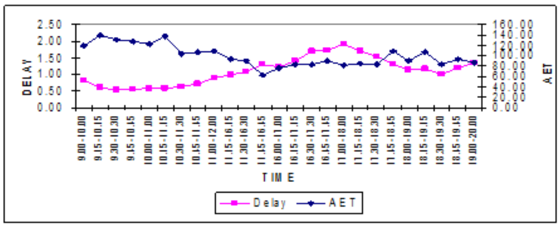

Figure 5.15: Delays vs. AET

Equation Developed

DELAY = 4.39 - 0.264 (PHV) - 0.0568 (PCAR) - 0.0977 (PAR) + 0.0101 (PRT) - 0.00406 (AET)

R-Square value = 81.5%

The below graph reveals the relation between Delay – Time – PHV, the delays are high when the percentage of heavy vehicles are high.

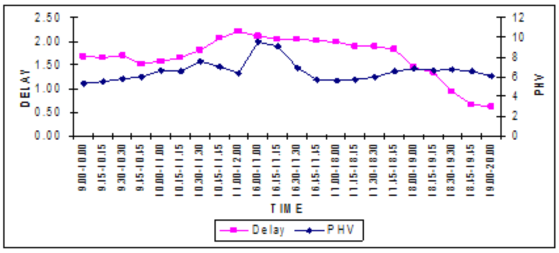

Figure 5.16: Delays vs. PHV

The below graph reveals the relation between Delay – Time – Percentage of Cars, the PCRS has considerable effect in Ayyappagudi junction which causes heavy delay in the junction.

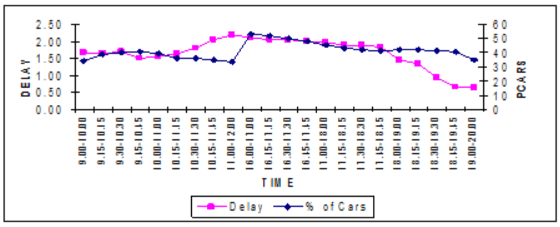

Figure 5.17: Delays vs. PCARS

The below graph reveals the relation between Delay – Time – PAR, the junction is experiencing delays due to the presence of autos though out the day.

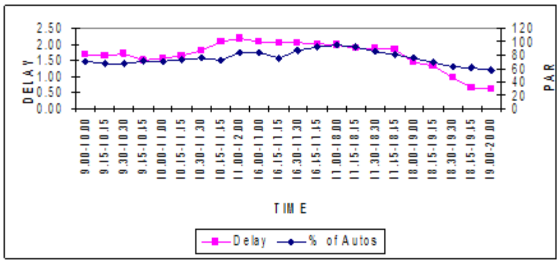

Figure 5.18: Delays vs. PAR

The below graph reveals the relation between Delay – Time – PRT, the percentage of right turning vehicles are causing considerable delay at the intersection throughout the day.

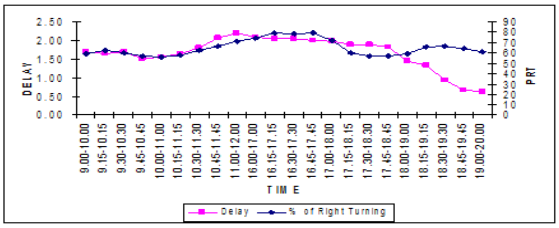

Figure 5.19: Delays vs. PRT

The below graph reveals the relation between Delay – Time – AET, the average equivalent factor has considerable effect on the delay occurring at the intersection.

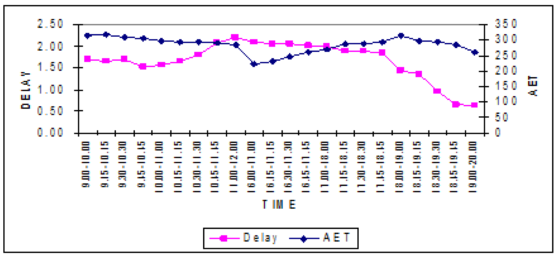

Figure 5.20: Delays vs. AET

Equation Developed

DELAY = - 4.59 + 0.191 (PHV) - 0.0400 (PCAR) + 0.0452 (PAR) + 0.0208 (PRT) + 0.00662 (AET)

R-Square value = 80.8%

SPEED PROFILE METHOD

Speed Profile method is conducted to know the running speed pattern of the test vehicle along the corridor, the test car is run in peak and off peak hours to know the speed profile of the test vehicle.

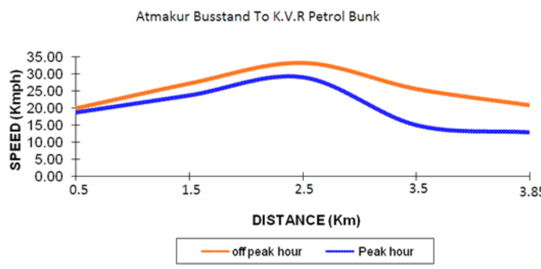

Figure 5.21: Speed Profile for Atmakur Bus stand to KVR Petrol Bunk

CONCLUSIONS

The corridor type of analysis enables the traffic engineer to understand different types of traffic problems in a comprehensive manner such that compatible solutions can be arrived at. This approach is in contrast to solving traffic problems in an isolated manner as per the corridor type of analysis, gives a better inside to understand traffic problems by correlating the bottle neck situations by measuring various types of traffic parameters. Thus comprehensive solution in the form of management measures attempt is made for the first time to stream-line the flow of traffic on the busiest road of the Nellore city. This has registered high growth rates of population and traffic adopting a corridor type of analysis approach.

In future these facilities could be updated following a similar approach in order to reduce delays, accidents and geometric related parameters. This exercise enables implementing agencies to evolve traffic management programs on a time schedule basis.

The following are the measures listed in order of priority:

1. Paving intersection areas and their approaches
2. Pavement markings and traffic sings at intersections
3. Activation of signals at every intersection.
4. Widening of road segments on the corridor, which includes paving of the widened portions and removal of all obstructions such as electric poles, telephone poles.
5. Contractions of Bus Bays.

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