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CORRIDOR MANAGEMENT OF AN URBAN ROAD

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ABSTRACT

Traffic plays a vital role in the field of highway. It has been growing at a tremendous rate due to the combined effect of population growth, increase in vehicle ownership and individual mobility. Improper design of junctions, inadequate carriageway width and irregular parking on the carriageway reduces the flow rate on the corridors. In order to alleviate all these problems, corridor management is necessary. The aim of any corridor management study is to improve the mobility of the corridor within the available facilities using the corridor management strategies. In the present study, an effort has been made to understand and evaluate the performance of the study corridor and suggest the management measures by causality analysis. Present corridor is of length 6.3Km, with four signalized intersections and four mid blocks included. Performance evaluation include peak hour identification at mid-blocks and intersections, Delay and LOS of all the intersections, Capacity and LOS of all the mid blocks, average journey time, running time, journey speed, running speed of each and every segment individually, Identification of bottlenecks by plotting speed contours for both peak and off peak, speed profile, time profile. Management measures have been suggested keeping in mind that those have to be of low cost solutions and easily executable.

Keywords: Bottlenecks, Corridor, Delays,Journey Time,Peak Hour.

I. INTORDUCTION

The study corridor starts from JNTUH and ends at HI-TECH CITY Junction, the total length of the corridor was 6.3 Km, passing through main shopping centers in thecity such asJNTUHuniversity, Manjeera Majestic mall, Rain Tree park, IT park, Surya enclave etc.… and the major junctions such as JNTUH, Malaysian Township, 4thphase,Hi-Tech-city.

1.1JNTUH to Malaysian Township Mid-Block

The total length of this segment is 2Km, which passes through the major shopping malls in the city such as cinepolis, manjeera majestic and many eating places etc.… the entire segment was divided with widened mouths at intersection. The road width was not getting utilized completely because of the encroachments, since the whole segment was activated on both sides with the shopping centers and chat bandars and private travel agencies.

1.2Malaysian township to IVth phase mid-block

This is the shortest segment of the entire corridor which is just 1.2 Km in length, the segment was four lanes divided but at the junction i.e.; diversion of traffic from JNTUH towards residential areas, towards local MMTS

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railway station, towards Hi-Tech-City it was widened up to a single lane on each side and made six lanes divided with shoulders provided on each side.

1.3 IV th phase to Hi-Tech-City mid-block

This is also a shortest segment whose length was 2.1Km. the segment was eight lanes divided for 200m from Malaysian township intersection. The bus stop which was located at the starting of narrowed three lane road causes severe inconvenience to the through traffic, since the buses are also running frequently in this corridor, since it was the major arterial of Hyderabad.

1.4 Hi-Tech-City – Surya enclave Hi-Tech city mid-block

The length of this segment was 1.0 Km, which was a six-lane divided with three lanes on each side. The major complaint in this segment was illegal median openings and encroachments which is reducing the capacity by almost to half. The encroachments are because of the fruit market which occupied almost one complete lane, because of which the capacity was getting reduced. Apart from that the illegal median openings which is allowing the through traffic on both the sides to make a U-turn in the mid segment, which is causing inconvenience to the other vehicles.

II. DATA COLLECTION

2.1Pavement and Shoulder Widths

The width of pavement and shoulder (on both sides) are measured at each segment of thecorridor, at least three readings within a segment were taken.

Table: physical inventory (width of pavement and shoulder)

Segment Name & No.	Width of the Pavement (m)	Shoulder Width (m)	Distance B/W intersections (m)
JNTUH to Malaysian Township	10.5	1.5	2000
Malaysian Township to IV th Phase	14	2.0	1200
IV th Phase toHi-Tech-City	15.5	1.0	2100
Hi-Tech-City – Surya Enclave	11.9	1.0	1000

2.2 Peak Hour Volume Factor Measurement

The traffic volume data was collected at every intersection and at every mid-block for 3 hours either in the morning peak or in the evening peak hours with its PHF's were found out.

PHF = peak hour volume / 4* Highest 15-minute volume in peak hour.

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Table: Peak hour volume factors

JUNCTION NAME	PHF
JNTUH Junction	0.9616
Malaysian Township Junction	0.924
IV thPhase Junction	0.82
Hi-Tech-City Junction	0.936
JNTUH To Malaysian Township	0.937
Malaysian Township toIV th Phase	0.913
IV th Phase toHi-Tech-City	0.953
Hi-Tech-City- Surya Enclave	0.951

2.3Measuring Delays

Table: Delays at various segments

SEGMENT NAME	LENGTH (m)	STOPPED DELAY (Sec)	JOURNEY TIME (Sec)
Delays in The Peak Hour JNTUH-HI-TECH-CITY			
JNTUH to Malaysian township	2000	11	122
Malaysian township to IV th phase	1200	8	71
IV th phase to Hi-Tech-city	2100	10	96
Hi-Tech-City- Surya enclave	1000	9	96
Delays in The Off-Peak Hour JNTUH-HI-TECH-CITY			
JNTUH to Malaysian township	2000	4	131
Malaysian township to IV th phase	1200	5	61
IV th phase to Hi-Tech-City Surya enclave	2100	3	76
Surya Enclave- Hi-Tech-City	1000	7	88
Delays in The Peak Hour HI-TECH-CITY-JNTUH			
Hi-Tech-City-Surya Enclave	1000	25	298
Surya Enclave - IV th Phase	2100	6	131
IV th Phase - Malaysian Township	1200	2	79
Malaysian Township - JNTUH	2000	5	78
Delays in The Off-Peak Hour HI-TECH-CITY-JNTUH			
Hi-Tech-City-Surya Enclave	1000	4	131
Surya Enclave - IV th Phase	2100	5	61
IV th Phase - Malaysian Township	1200	3	76
Malaysian Township - JNTUH	2000	7	88

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For conducting this survey, stop watches to accuracy of 1/10 of a second are used to note the delays and travel time. All the observers, equipped with stop watches, data sheets etc., Traveled by a car. The speedometer of the vehicle was used to read off the distance covered at each end of the section. 2 trails have been taken in the peak hour and in the off – peak hour and the average of the two trails was presented.

III. DATA ANALYSIS& RESULTS

3.1 Level of Service at Intersections

Levels of service of all the intersections are given based on HCM 2000.

Table: Level of service of all the intersections

Intersection Title	Controlled Delay (Sec/Vehicle)	LOS
JntuJunction.	28.1	D
Malaysian Township Junction.	40	E
IV thphase junction.	26	C
Hi-Tech-City Junction.	67	E

The level of service of all the four intersections with in the corridor were presented above in the Table, it reveals that four out of four intersections performance was satisfactory and one intersection, Hi-Tech-City junction is performing below the satisfactory level, and one intersection IV th Phase junction. is performing good.

3.2 Sample Calculation of Speed Flow Curves Technique

The speed flow curves technique has been adopted for those segments in the corridor which are having more than 2 lanes on each side, the traffic volume data has been taken in the half peak times in order to obtain the free flow speed and in the peak hours for the congested flow.

Table: Capacity and LOS for mid blocks

Segment Name	Capacity(C)	Existing Volume(V)	V/C Ratio	LOS
JNTUH- Malaysian Township	4200	3218	0.766	C
Malaysian Township - IV th Phase	4465	3730	0.835	D
IV th Phase – Hi-Tech City	6246	3772	0.763	C
Hi-Tech-City-Surya Enclave	4560	3754	0.827	D

3.3 Floating Car Method

Floating car method was used to find the Average running speed and Average journey speed and Average Running time and Average Journey time of the corridor. A number of test runs are made along the study stretch and a group of observers record the various details.

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Table: Summary of peak flow of the corridors

PARAMETERS	PEAK TIME{sec}	OFF PEAK TIME{sec}
Peak Flow of The Corridor, JNTUH-HI-TECH-CITY Segment		
Avg. Journey Time (Min)	13.08	8.15
Avg. Running Time (Min)	12.35	7.76
Avg. Journey Speed (Kmph)	27.15	44.73
Avg. Running speed (Kmph)	29.07	47.67
Avg. Delay (Sec)	44	23
Peak Flow of The Corridor, HI-TECH-CITY-JNTUH Segment		
Avg. Journey Time (Min)	15.33	9.76
Avg. Running Time (Min)	14.35	9.43
Avg. Journey Speed (Kmph)	24.96	41.53
Avg. Running speed (Kmph)	26.32	44.19
Avg. Delay (Sec)	59	20

The peak travel times are greater than the off-peak travel times and the delays are greater in peak as compared to off peak and the delays are more in Hi-Tech-City-JNTUH side in peak times, whereas the delays are more in JNTUH to Hi-Tech-City side during the off-peak times. When all the segments are considered individually Delays are more for Hi-Tech-city to MTS segment when flowing from Hi-Tech-City to JNTUH and in JNTUH to MTS while flowing from JNTUH to Hi-Tech-City, during the peak times and the delays during the off-peak times were very less as compared to peak times in both the directions.

3.4 Bottleneck Analysis

A bottleneck is a localized section of an urban road or a highway that experiences reduced speeds and inherent delays due to recurring operational influence or a nonrecurring impact event. The bottlenecks impede the capacity of the roads and cause substantial commuter delays. These bottlenecks cause a lot of delays and a are a source of great inconvenience to the commuters.

The bottleneck analysis has been carried out for each and every segment individually by plotting the speed contour maps, by taking Time on X-Axis, Distance on Y-Axis and Speed on Z-Axis by using MINITAB 15 Software. The observations of Bottleneck Analysis are presented in the following Table

Table: Observations from the bottleneck analysis during the peak time

Element	JNTUH – Hi-Tech-City		Hi-Tech-City-JNTUH	
Least Journey Speed (Kmph)	JNTUH-MTS	14	MTS-IV th phase	12
Highest Journey Speed (Kmph)	MTS- Ivth Phase	72	Ivth Phase-Hi-Tech-City	64
Bottlenecks Identified	JNTUH-Hi-Tech-City	1	MTS-JNTUH	1

Table reveals that the least Journey speed in the peak hour happened in JNTUH-MTSmid-block and MTS-IV thPHASE segments in the peak times. Highest speeds were recorded in MTS- IV th PHASE and IV th PHASE-HI-TECH-CITY segments.Total 2 bottlenecks were identified in the total corridor in segments, 1 on each side of the corridor. The bottlenecks were identified in JNTUH-HI-TECH-CITY and MTS-JNTUH segments in the

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peak times, out of which Hi-Tech-city – MTS Segment was identified as the Largest bottleneck with 400m of length

3.5Speed 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.

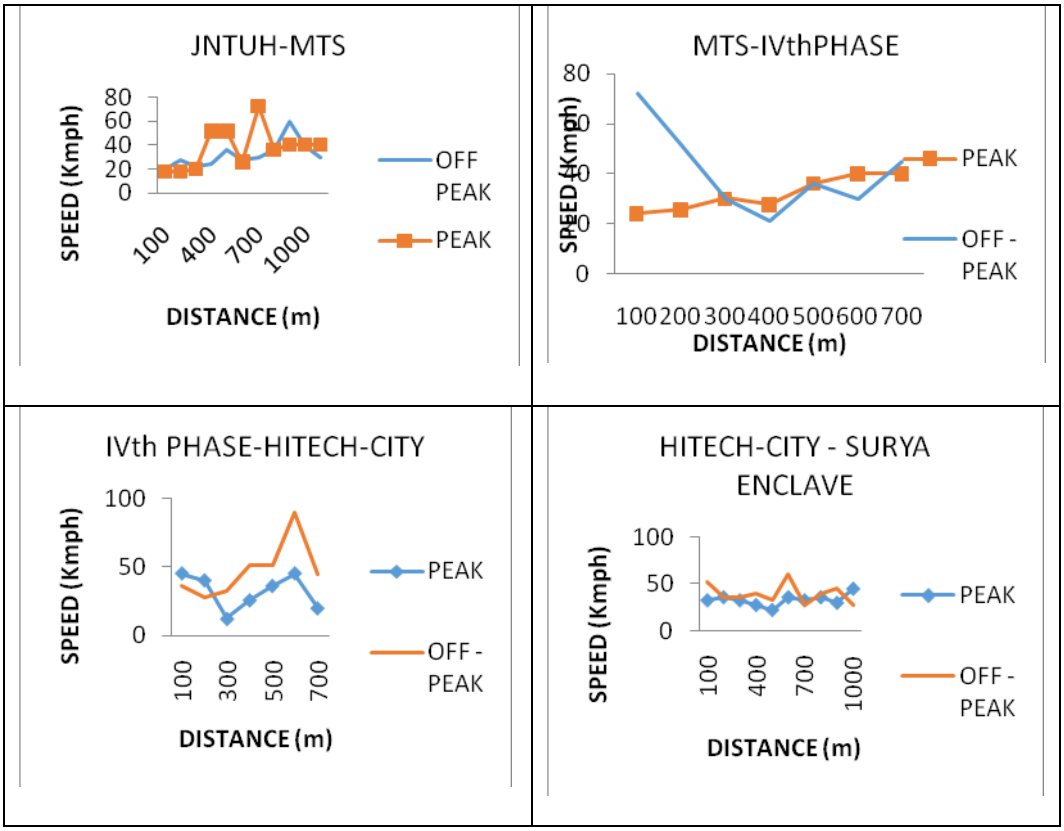

Fig 3.1: speed profile at various section in the corridor

1. JNTUH- MTS Shows that there is a noticeable change in the peak & off – peak speeds particularly in the mid of the segment I. peak time speed is more than off – peak speed at 3 sections.
2. MTS-IV thPHASE shows that there is a huge variation in the speed at start of the Segment and not much later which was because of the MTS bus stop.
3. IV thPHASE-HI-TECH-CITY reveals that there is a good variation between the peak and off peak travel speeds in the third segment. This might be due to the variation in the traffic volume.
4. Hi-Tech city -Surya enclave, that there is a continuous variation between the peak and off peak travel speeds which was due to encroachments.

3.6Travel Time Profile

The travel time profile within the corridor was done by plotting the graphs by taking both peak and off – peak travel times into consideration, which was collected during the floating car method.

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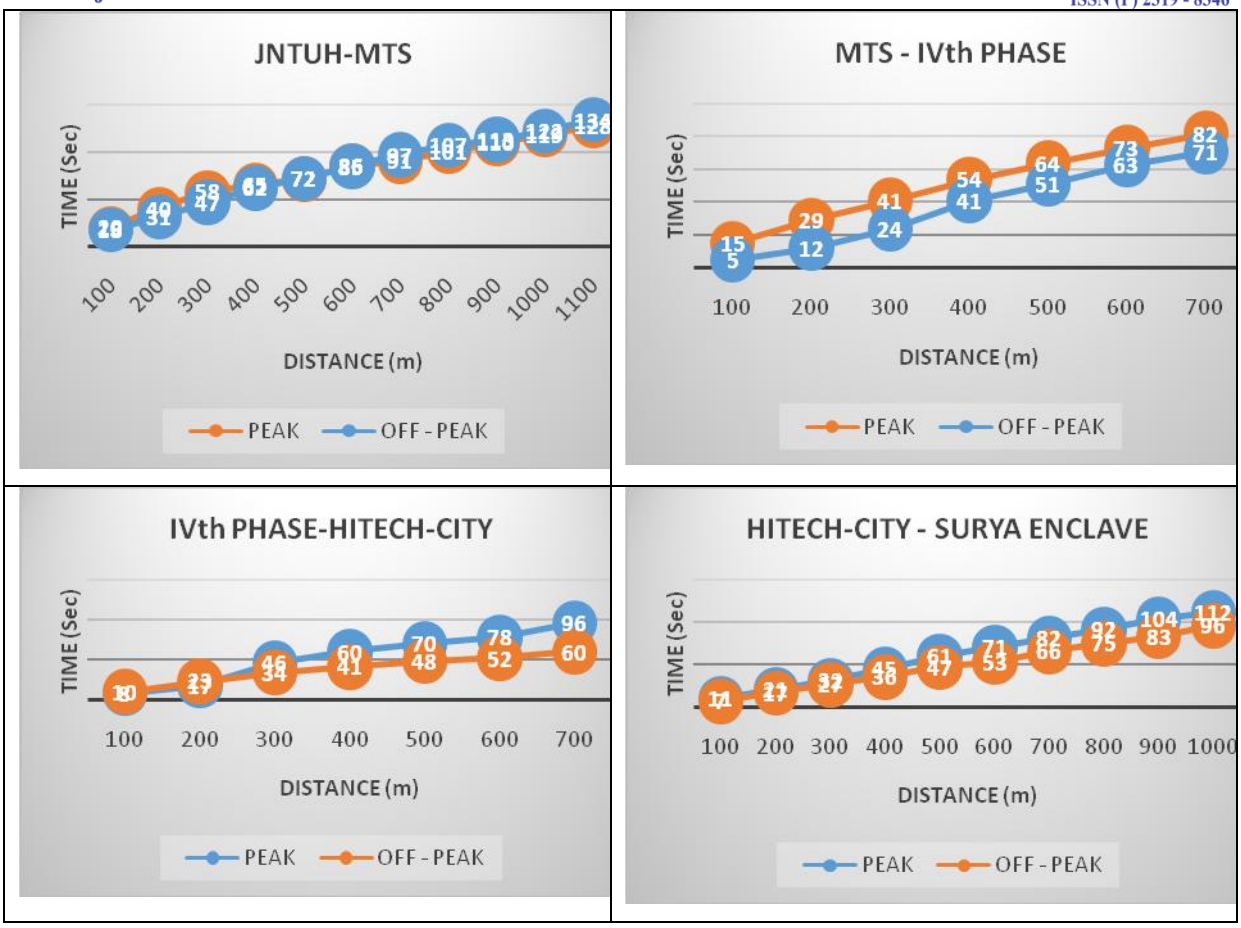

Fig 3.2: travel time profile at various section in the corridor

1. JNTUH-MTSIt can be clearly observed that the peak and off – peak travel times doesn't differ much when the segment was taken as a whole, but the difference in the first half of the segment can be observed.
2. MTS- IV thPHASE It's clearly noticeable that there is no interference between the peak and off – peak times in this segment, at every part of the segment the travel times were high in the peak time.
3. IV th PHASE-HI-TECH-CITY, reveals that there is a remarkable difference in the travel times between peak and off – peak times as the segment is getting ended, it's increasing as the segment is approaching HI-TECH-CITY, which is due to the Encroachments.
4. HI-TECH-CITY - SURYA ENCLAVE,it's clearly noticeable that there is a continuous increase in the travel times as the segment is approaching towards Surya enclave, and the first quarter of the segment is absorbing less time of travel, in both peaks and off – peaks.

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3.7 Peak Hour Variations in The Corridor

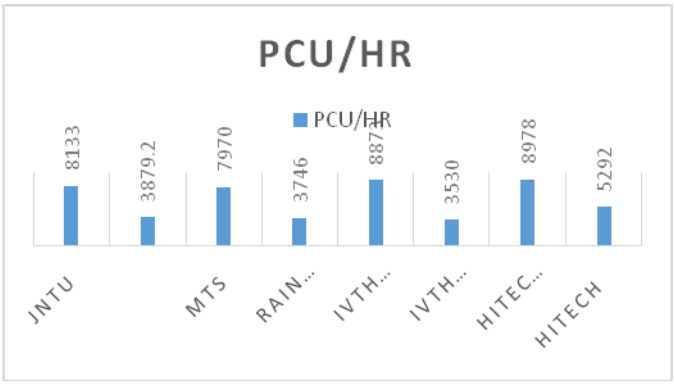

Fig 3.3: peak hour variations in the corridor

The variations of peak hour volumes along the corridor starting from the JNTUH at the end. It is observable that Hi-Tech-city intersection is having the highest peak hour volume as compared to all other intersections in the corridor and when the Segments are considered Hi-Tech-city-Surya enclave segment is recorded the highest peak hour volume.

3.8 Causality Analysis

Causality analysis aims to discover the exact reasons why a problem exists at certain location, based on which informed decisions can be made on development of improvement alternatives.

Table: Causality analysis for various Segments

Location	Problem Identified	Management Measures
Causality analysis for JNTUH-MTS Segment		
JUNCTIONTU Bus Stop	Slow traffic movement because of the reduced capacity by one lane which was occupied by the bus stop.	Bus stop location has to be changed
HI-TECH-CITY.	More delay for minor leg and also blocking the way for the free left.	The green time for HI-TECH-CITY -JNTUH leg has to be reduced to 84 Sec and the green time for the minor leg has to be made 46 Sec, since the queue was getting cleared prior to the green time in this major leg.
Causality analysis for MTS-IV th PHASE Segment		
MTSBus stop	High speeds of the vehicles, hence causing delay for the pedestrians and also interference for the through traffic some times.	Install speed breakers or Cushions or a Speed Hump just before the bus stop such that the speeds come down and hence pedestrians could find time to cross the road. Install a foot over bridge if it full fill the norms.
IV th PHASE Junction.	Signal Jumping at JNTUH-HI-TECH-CITY leg which is interfering the minor leg traffic.	Tyre flattening, if not possible at this Junction, the bike number has to be noted. Since there are no access roads in between these two junctions. Tyre

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		flattening can be done by the non – uniformed police.
Causality analysis for IV th Phase to Hi-Tech-City Segment		
IV th phase Bus Stop	Slowing down of speeds because it was located very next to the narrowed road	Must be relocated after 300m from the existing bus stop which would also be accessible to the alighting passengers.
Hi-Tech-city Junction.	Signal Jumping from the two wheelers.	Tyre Flattening.
Causality analysis for Hi-Tech-city to Surya enclave Segment		
Minor deviation to shilparamam	Reduction in the road capacity because of the encroachments and side friction.	Encroachments need to be strictly cleared as the road width will be sufficient then.
shilparamam	Illegal Median Opening, which was causing U Turns, from the opposite direction which results in the interference to the through traffic and hence slowing down the speeds, especially because of the two wheelers,	Illegal Median opening has to be closed.

IV. CONCLUSIONS

1. This approach is in contrast to solving traffic problems in an isolated manner as per the corridor type ofanalysis, gives a better insight to understand traffic problems by correlating the bottle neck situations by measuring various types of traffic parameters.
2. Capacity and Level of Service of all the mid blocks were found out followed by the Delay and Level of Service of Intersections. Delays at mid-blocks were also found out by floating car survey, followed by the identification of Bottlenecks in all the segments and Travel time comparisons and speed profiles were also done for all the segments individually.
3. Total two bottlenecks were identified in the entire corridor out of all the segments. They are Surya enclave to Hi-Tech-city and JNTUH to MTS and the largest Bottleneck was identified in JNTUH to MTS segment.
4. When the overall corridor's performance is considered, it can be improved when the pedestrian crossings are made easier for which the management measures have already been suggested.
5. The encroachments are another severe problem, which is to be taken very seriously due to their adverse impact on Capacity.

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