

# A Detailed Study on Parking Studies At Nellore And Improvements For The Effective Parking And Traffic Operation

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**Abstract-** *The economy status of a country depends upon how deftly the country is served by its roads, air ports, railways, ports, shipping and pipelines. The economic growth rate of a country is very closely associates to the rate at which the transport sector grows. As road transportation provides the personal mobility to persons, the ownership of the vehicles has been rapidly increasing around the world. Because of expansion in car ownership, the parking problem is begun to be more and more acute by every day. A lot of problems such as traffic congestion, accidents, unwanted delays, reduce of effective road width and due to vehicles that are parked on the kerb side. The parking has a great influence transport development.*

*The main object of the study was to examine the present condition of parking, collect the behaviour response from the commuters and finally Level of Service (LOS). In this analysis data will be collected from various parking places in the city of Nellore. Particularly we have chosen the busiest roads with large traffic volume and major central business areas. Parking creates huge problems in urban areas and it requires an efficient and goal-oriented parking policy. A detailed study about the parking problem is very important in consideration of implementing a policy. To study about the on street parking an easy methodology was espouse, some of the primary survey were carried out such as traffic volume count, duration of the parking, demand survey and accumulation. In the early stages we worked out the variation of PCU with a certain time. In other part we find out the “Temporal distribution” of traffic on main road and its variation of Passenger Car Units (PCU) with time. These variables have been analogized to work out a long-lasting solution and finally, the best parking method is suggested to each street.*

**Keywords-** Parking demand, Traffic volume, Passenger Car Units, Parking Supply.

## I. INTRODUCTION

Economic and population growth have led to the rapid urbanisation and development of Metropolitan cities. As a consequence of the intensive level of development, the demand for local utilities such as on-street parking for developments adjoining to transport corridors has been increased. However, the activity of the community utilising on-street parking can reduces the capacity of road in addition to the attainable driving speeds for the roads adjacent to developments. Correspondingly, traffic delays are being common experience in majority of the urban transport corridors because of the complexity with interaction between traffic flow and land use.

## II. BACKGROUND

Traffic congestion in urban transport networks was been a great issue for traffic engineers and transport planners during the recent times. The idea of this project is to evaluate, to the degree possibility, the impact that on-street parking has on transportation, development, and land-use, to identify and review comprehensively” on-street” parking strategies and management exercises in local cities; and to suggest best practice plans for on-street parking in large cities.

## III. NEEDS AND ADVANTAGES

This study is cramped to the city of Nellore. In order to understand the parking behaviour and modal split of vehiculars with respect to shopping as well as work trips and non work trips in the city of Nellore, survey has been conducted at Six major road Stretches including three busy traffic intersection points and three very popular shopping arcade at Nellore. In Nellore, it has been selected one busy market point which is nearby VRC followed by CMR. Other locations that have been selected and these, Kanakamahal Street, Trunk road and other Road stretch from Bose statue to CMR.

However, traffic volume was studied on six slots from morning to evening for every one hour. Parking criteria was observed for two days on one hour interval based during Weekend and on Weekday for the same slots and also Peak parking demand from these days was taken. Based on the obtained data and geometry of the road supply of parking was calculated and it is compared with parking accumulation.

#### IV. LITERATURE REVIEW

**Hill and Holland (2010)** were collected accident data of adult pedestrians which reveals that the risk being severely injured and kills differ with gender and age. Variety choices of factors affecting road crossing are 218 numbers of adults aged in between 17 to 90 were investigated in a stimulatory study using filmed real traffic. With increasing age, women were appeared to be more unsafe while making crossing decisions, to become destitute at guessing their walking speed. However, the age effects on all of these were improved by driving experience. Men differ from women in that age and were not a considerable factor in guessing unsafe crossing decisions.

**Wu and Zhuang (2011)** were examined that pedestrian crossing out of crosswalks (roadway that are unmarked) causing more number of traffic accidents, but present pedestrian studies mainly concentrate on crosswalk crossings of developed countries especially. Field observations on 254 numbers of pedestrians at un-marked roadway in China exhibit that 65.7% of them hasn't looked for vehicles after approaching at the kerb. Those who looked and paid attention to the moving traffic did so for duration of time that follows an exponential distribution. Pedestrians wish to cross actively in unsure ways rather waiting patiently. The waiting time of the pedestrians at the median, at the kerb and at the roadway follows an exponential distribution. At the time of crossing, all the pedestrians looking at the coming vehicles. While dealing with these vehicles, 31.9% of pedestrians ran and 11.4% moved backwards. Running pedestrians actually started running at the borderlines rather than staying in the lanes.

**Tiwari ,Khatoon and Chatterjee (2013)** were observed that the pedestrians in Delhi roads were often involved in high risks. It's because of the basic requirements of pedestrians were not provides as a part of the urban transport infrastructure development projects in Delhi. A rapid growth of motorized two-wheelers and cars encouraging to build more numbers of grade separators/flyovers to enable signal free movements for motorized vehicle, endangering pedestrians to higher risks. This paper expounds the demographic analysis of pedestrian risk-acceptance behaviour whilst crossing the roads, after and before the building a grade

separator at an intersection in Delhi. An appreciable number of pedestrians are ready to accept risks in both after and before situations. The results reveal that due to the lack and non-existence of signals makes pedestrians to behave in individualistic manner and thereby increasing to variability in their risk-accepting behaviour. After the implementation of grade separators change in the speeds of all sort of vehicles has increased. Once the construction of the grade separator is over, pedestrians waiting time at the beginning point of crossing has been increased and the connection between gaps acceptance and waiting times of pedestrians indicates that after definite time of waiting, pedestrians has become agitated and accepts little gap size for crossing the road. A regression model was developed by considering that the possibility of road crossing by pedestrian dependent on the gap size between conflicting vehicles and pedestrian, age, sex, type of pedestrians and conflicting vehicles type. The results from Logistic regression explains that before the existence of this grade separator , probability of a pedestrian crossing the road depends on solely the gap size; however, after the existence of the grade separator, remaining parameters has become epoch-making in determining the pedestrian risk-acceptance behaviour.

#### V. METHODOLOGY

**The First Phase:** In this phase of the study a preliminary attempt to collect variety of information and secondary data in registered vehicular population from various sources. The data covered location, Traffic volume, vehicular population, geometry of the roads, and parking space information, parking rate, purpose of parking at different parking space, passenger car unit and variation of PCU with time, in the city of Nellore. The information has been collected from the manually by conducting surveys.

**The intermediate phase:** Once collection of data was done and same will be used to calculate parking accumulation, parking congestion scenario, parking supply, and outputs were tabulated for analysis.

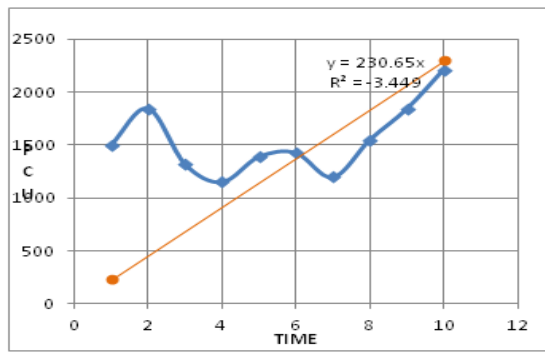
**The final phase:** After collecting the primary and secondary data, calculation, tabulation and analysis for the collected data has been done. In the final phase, data was been used for preparing relevant graphs and optimal methods were suggested to keep up on street parking.

#### VI. TRAFFIC VOLUME STUDIES

Traffic Volume count was carried out in the important road Stretches of Nellore. They are Bose Statue to CMR, CMR to Gandhi Statue, Gandhi Statue to VRC, Gandhi

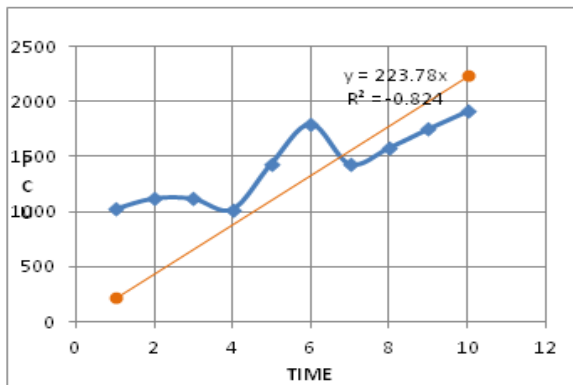
statue to Archana (Trunk road), Kanakamahhal RR Street. In these major road Stretches four of them are two-way divided carriage way with four lanes and the remaining one is One-way road with 3 lanes. Data was collected from 8.00 A.M in the morning to 6.00 P.M in the evening on one hour interval for one day using field data sheets and carried out by the trained persons.

**BOSE STATUE TO CMR**



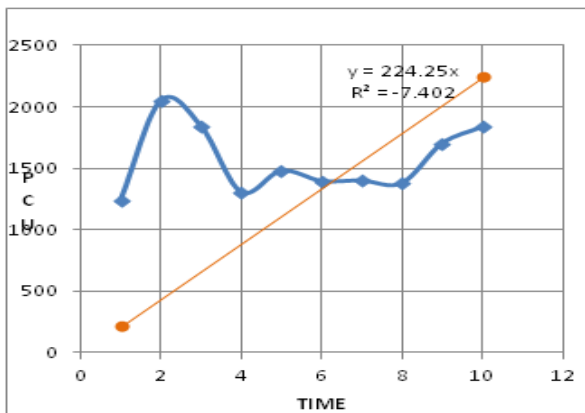
**Graph no.1 Variation of Traffic Volume with Time**

**CMR TO GANDHI STATUE**



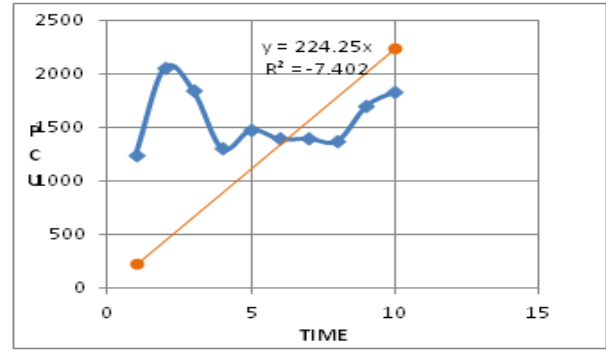
**Graph no.2. Variation of Traffic Volume with Time**

**GANDHI STATUE TO VRC**



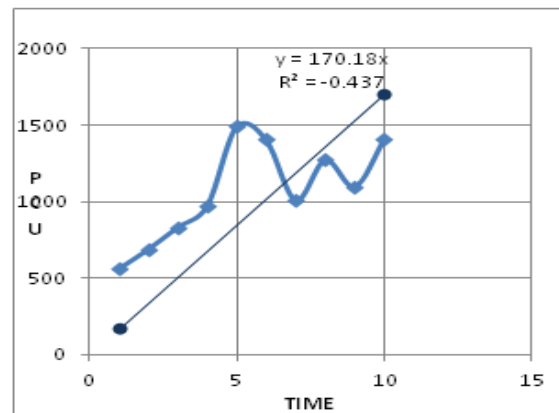
**Graph no.3 Variation of Traffic Volume with Time**

**GANDHI STATUE TO ARCHANA (TRUNK) ROAD**



**Graph no.4 Variation of Traffic Volume with Time**

**KANAKAMAHAL RR STREET**



**Graph no.5 Variation of Traffic Volume with Time**

**PARKING STUDIES**

Two days Ten hours parking studies were carried out in the important road Stretches of Nellore. They are Bose Statue to CMR, CMR to Gandhi Statue, Gandhi Statue to VRC, and Gandhi statue to Archana (Trunk road), Kanakamahhal RR Street. In these major road Stretches four of them are two-way divided carriage way with four lanes and the remaining one is One-way road with 3 lanes. Data was collected using field data sheets and carried out by the trained persons.

Parking criteria was observed for two days on one hour interval based during Weekend and in Weekday for the same slots and also Peak parking demand from these days were taken. Parking studies were carried with ten slots all through the day. Later various characteristics of the parking were calculated and tabulated for the further use.

PEAK PARKING DEMAND OF BOSE STATUE TO CMR										
PCU_P	45.2	55.9	64.3	82.7	87.4	86.7	98.1	97.5	108.3	128.7

PEAK PARKING DEMAND OF CMR TO BABU ICE CREAMS										
PCU_P	23	33.4	46.3	57.4	70.3	75.7	64.7	67.4	75.3	90.9

PEAK PARKING DEMAND OF BABU ICE CREAMS TO GANDHI STATUE										
PCU_P	27.4	40	51.5	63.5	84.3	84.4	109.6	115.8	101.5	106.1

PEAK PARKING DEMAND OF GANDHI STATUE TO VRC										
PCU_P	59.9	85.5	113.9	156.4	168.1	154.8	152.5	155.8	166.6	174.6

PEAK PARKING DEMAND OF GANDHI STATUE TO ARCHANA										
PCU_P	35.4	54.4	78.1	100.4	94.7	86.8	81.3	92.9	97.7	111.7

PEAK PARKING DEMAND KANAKAMAHAL RR STREET										
PCU_P	47	75.9	100.9	150.9	142.6	133.4	133.7	145.8	144.5	159

Number of Car parking spaces available  
= 729/5.9

= 124

**30°PARKING**

Number of Car parking spaces available  
= (729-1.25)/5 = 146

**45°PARKING**

Number of Car parking spaces available  
= (729-1.77)/3.54 =205

**60°PARKING**

Number of Car parking spaces available  
= (729-2.16)/2.89 =252

**90°PARKING**

Number of Car parking spaces available  
= (729)/2.5= 292

**CALCULATION OF PARKING SUPPLY FOR CMR TO BABU ICE CREAMS GT ROAD:**

Total Length of the road usable for parking =  
392-83=309m

For parallel parking Number of Car parking spaces available=  
309/5.9=52

For 30° parking-no. of spaces available:  
62

For 45° parking-no. of spaces available:  
87

For 60° parking-no. of spaces available:  
106

6.For Perpendicular parking-no. of spaces available:  
123

**CALCULATION OF PARKING SUPPLY FOR BABU ICE CREAMS TO GANDHI STATUE GT ROAD:**

Total Length of the road usable for parking =  
326-37= 289 m

For parallel parking-no. Of spaces available: 49  
For 30° parking-no. of spaces available:

58

For 45° parking-no. of spaces available:  
81

For 60° parking-no. of spaces available:  
99

For Perpendicular parking no. Of spaces available:  
116

**PARKING SUPPLY SURVEY**

The supply of parking spaces for six locations under study are computed by using the following formulae taking the reference of Traffic Engineering and Transport planning text book by L. R. Kadiyali.

1. For Parallel Parking:  $N = L/5.9$
2. For 30°Parking:  $N = (L-1.25)/5$
3. For 45°Parking:  $N = (L-1.77)/3.54$
4. For 60°Parking:  $N = (L-2.16)/2.89$
5. For 90°Parking:  $N = L/2.5$

Where L=length of kerb in meters

N=Number of Parking Bays

**CALCULATION OF PARKING SUPPLY FOR BOSE STATUE TO CMR GT ROAD:**

**PARALLEL PARKING:** No. of car parking spaces, N  
=  $L/5.9$   
Total Length of the road stretch under study  
= 856 m  
Total Length of the road usable for parking  
= 856-127=729  
(127m is being subtracted from 856m to account for road intersections and length of road stretches not suitable for parking)  
= 729

**CALCULATION OF PARKING SUPPLY FOR BABU ICE CREAMS TO GANDHI STATUE GT ROAD:**

Total Length of the road usable for parking = 1048-198=850m  
 For parallel parking Number of Car parking spaces available =  $850/5.9$   
 = 144

For 30° parking-no of spaces available: 170  
 For 45° parking-no. of spaces available: 240  
 For 60° parking-no. of spaces available: 293  
 For Perpendicular parking-no. of spaces available:340

**CALCULATION OF PARKING SUPPLY FOR GANDHI STATUE TO VRC GT ROAD:**

Total Length of the road usable for parking = 1048-198=850m  
 (198m is being subtracted from1048 m to account for road intersections and length of road stretches not suitable for parking)

For parallel parking Number of Car parking spaces available =  $850/5.9=144$   
 For 30° parking-no of spaces available: 170  
 For 45° parking-no. of spaces available: 240  
 For 60° parking-no. of spaces available: 293  
 For Perpendicular parking-no. of spaces available:340

**CALCULATION OF PARKING SUPPLY FOR GANDHI STATUE TO ARCHANA:**

Total Length of the road usable for parking = 658-135=523m  
 (135m is being subtracted from658m to account for road intersections and length of road stretches not suitable for parking)

For parallel parking Number of Car parking spaces available =  $523/5.9=89$   
 For 30° parking-no. of spaces available: 104  
 For 45° parking-no. of spaces available: 147  
 For 60° parking-no. of spaces available: 180  
 For Perpendicular parking-no. of spaces available: 20

**Table No.1 Supply and accumulation analysis results**

S. N. o.	Parking Lot (Area)	Supply of Spaces	Morning			Evening		
			Morning Occupied	Surplus & Short fall of spaces	Accumulation /Supply	Evening Occupied	Surplus Short fall	Accumulation /Supply
1	BOSE STATUE STATUE-CMR weekend	124	87	+37	0.702	111	+13	0.895
2	BOSE STATUE STATUE-CMR week	124	84	+40	0.677	128	-4	1.032
3	CMR-BABU ICE CREAMS weekend	52	70	-18	1.346	91	-39	1.769
4	CMR-BABU ICE CREAMS week	52	70	-18	1.346	83	-31	1.596
5	BABU ICE CREAMS-GANDHI STATUE weekend	49	84	-35	1.714	116	-67	2.367
6	BABU ICE CREAMS -GANDHI STATUE week	49	75	-26	1.531	110	-61	2.245
7	GANDHI STATUE-VRC weekend	144	168	-24	1.167	175	-31	1.215
8	GANDHI STATUE-VRC week	144	109	+35	0.757	157	-13	1.090
9	GANDHI STATUE-ARCHANA weekend	89	100	-11	1.124	112	-23	1.258
10	GANDHI STATUE-ARCHANA week	89	79	+10	0.888	99	-10	1.112
11	KANAKAM AHAL weekend	183	151	+32	0.825	159	+24	0.869
12	KANAKAM AHAL WEEK	183	143	+40	0.781	149	+34	0.814

**Table 2: Parking Supply of various locations**

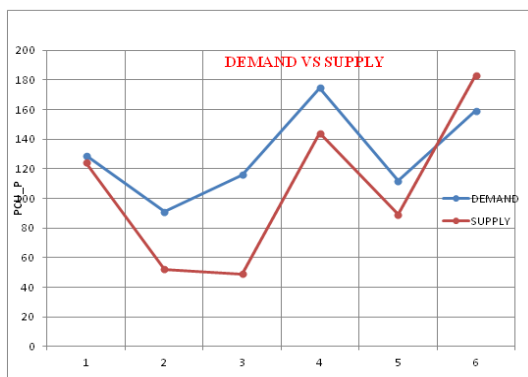
S.No	Parking Angles	BOSE STATUE -CMR	CMR-BABU ICE CREAMS	BABU ICE CREAMS-GANDHI STATUE	GANDHI STATUE-VRC	GANDHI STATUE-ARCHANA	Kanakamahal
1	Parallel	124	52	49	144	89	183
2	30°	146	62	38	170	104	216
3	45°	205	87	81	240	147	303
4	60°	232	108	99	293	180	374
5	90°	292	123	116	340	209	433

**Table 3:Percentage Utilization of Existing Supply**

S.No	Parking Areas	Maximum Demand (PCU_P)	Parking Supply (PCU_P)	Percentage utilization of existing supply (in %) weekend	Maximum Demand (PCU_P)	Parking Supply (PCU_P)	Percentage utilization of existing supply (in %) week
1	BOSE STATUE TO CMR GT ROAD	128.7	124	103.79	110.6	124	89.19
2	CMR TO BABU ICE CREAMS GT ROAD	90.9	52	177.50	83.3	52	160.19
3	BABU ICE CREAMS TO GANDHI STATUE GT ROAD	115.8	49	236.33	109.6	49	223.67
4	GANDHI STATUE TO VRC GT ROAD	174.6	144	121.25	157	144	109.03
5	GANDHI STATUE TO ARCHANA ROAD	111.7	89	125.51	99	89	111.24
6	KANAKAMAHAL RR STREET	159	183	86.89	149	183	81.42

**Table No 4:Percentage Utilization Of Existing Supply (Peak Demand)**

S.No	Parking Areas	Maximum Demand (PCU_P)	Parking Supply (PCU_P)	Percentage utilization of existing supply (in %) weekend
1	BOSE STATUE TO CMR GT ROAD	128.7	124	103.79
2	CMR TO BABU ICE CREAMS GT ROAD	90.9	52	177.50
3	BABUICE CREAMS TO GANDHI STATUE GT ROAD	115.8	49	236.33
4	GANDHI STATUE TO VRC GT ROAD	174.6	144	121.25
5	GANDHI STATUE TO ARCHANA ROAD	111.7	89	125.51
6	KANAKAMAHAL TO SIRI RR STREET	159	183	86.89



**Graph no.6 Graph showing the DEMAND VS SUPPLY (Peak)**

**Table No 5: Parking turn-over rate**

S.No	Parking Lot (Area)	Supply	Number of different vehicle utilizing parking space in a period of 10 hours	Parking Turn-Over
1	BOSE STATUE TO CMR GT ROAD	124	854.8	6.89
2	CMR TO BABU ICE CREAMS GT ROAD	52	604.4	11.62
3	BABU ICE CREAMS TO GANDHI STATUE GT ROAD	49	784.1	16.00
4	GANDHI STATUE TO VRC GT ROAD	144	1388.1	9.639
5	GANDHI STATUE TO ARCHANAROAD	89	833.4	9.36
6	KANAKAMAHAL RR STREET	183	1233.7	6.74

**VII. CONCLUSIONS**

In this project the travel patterns of on-street parking area in six major streets of Nellore, Andhra Pradesh, India. The various facts and finding of the study can be listed as under:

1. Among six parking sub-areas ,four locations are fully packed to their capacity and are in-fact over loaded in many cases with 3\4 wheelers group
2. The parking turnover rate varies from **6.74 to 16.00** percent of all the six streets during the 10 hours of duration.
3. At present the demand is excess as the ratio of parking supply to maximum demand is more than **1** in case of five roads considering two, three and four-wheeler parking. The other street is having parking demand is less than **1** for two, three and four-wheeler parking
4. The peak accumulation in all the six parking sub-areas for two days parking study during morning slots is about **12.07** percent of the total accumulation and is **14.55** during eveninging slots.
5. The heavy accumulation is in the time period of **04:00 pm to 6:00 pm** and the peak hour is generally **5:00pm -6:00 pm** in all the cases.
6. Parking congestion is observed to be **37 to 50** percent. Highest space occupied was about **70%** in some streets allowing restriction to traffic flow.

**VIII. RECOMMENDATIONS**

Based on the analysis and conclusions some of the recommendations which are mentioned below:

- A Detailed Parking Audit at Nellore should be conducted of existing buildings and land uses by a team especially constituted for the same, to determine

the actual parking demand for the type of building / land use.

- The NELLORE URBAN DEVELOPMENT AUTHORITY (NUDA) Rules need to be amended accordingly. Any new development should be mandated to submit an Impact Statement, clearly setting out the impact it will have on all urban infrastructure, especially the transport infrastructure.
- During the parking surveys it was observed that some of the vehicles are coming in opposite direction to the one way streets which were intended only for moving vehicle in one direction and are causing traffic congestion and making difficulty for parking the vehicle on the other side of the road. Restricting them by collecting fines if they come in wrong route will help to reduce the traffic congestion.
- It was also observed that nearby VRC intersection the traffic signal was not in use, due to it there occurring traffic congestion and unwanted delays to the vehiculars. The effective usage of the traffic signal will definitely provide better traffic operation.
- On-street parking should be minimized, especially on Local and Collector streets to avoid traffic congestion.
- Parking restrictions are to be enforced forcefully, and traffic police will need to be empowered to do.

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