



# **iJRASET**

International Journal For Research in  
Applied Science and Engineering Technology



---

# **INTERNATIONAL JOURNAL FOR RESEARCH**

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

---

**Volume: 5**

**Issue: V**

**Month of publication: May 2017**

**DOI:**

**[www.ijraset.com](http://www.ijraset.com)**

**Call:  08813907089**

**E-mail ID: [ijraset@gmail.com](mailto:ijraset@gmail.com)**

# Study and Determination of Pedestrian Level of Service & Pedestrian Flow Parameters for a Busy Street in Anand City

Sagar S. Talpada<sup>1</sup>, N. F. Umrigar<sup>2</sup>

<sup>1</sup>M.Tech. Student, <sup>2</sup>Professor, Department of Civil Engineering  
BVM Engineering College, V.V.Nagar, Anand, India.

**Abstract:** There are many modes of transport starting from walking to the multi-axle vehicles. But, from the modal split study carried out by various authors, it is said that, amongst all the various modes, the traffic load share by the pedestrian varies from 22% to 34% in the urban areas. While pedestrians are faced with poor linkages with footpaths, congestion, and difficulty in free movement of the persons at the various parts of the Anand City. For ensuring the mobility and transportation as the key component, it warrants for critical study in the Anand Commercial Centre. The study involves defining the pedestrian flow parameters for a selected stretch area of the Anand City's one of the busiest streets, and determining the pedestrian level of service according to that. For this purpose, a marked area was taken into consideration for the videography survey on two different points, and the analysis is done on the videography.

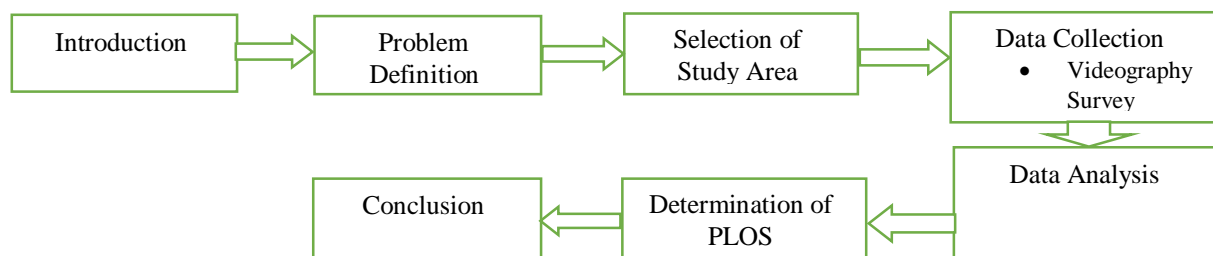
**Keywords:** Pedestrian, Flow parameters, PLOS, Level of service, Pedestrian Space, Pedestrian Walking Speed, Pedestrian Density.

## I. INTRODUCTION

The demand of transportation rises when there's a need of people to move from one location to another location and their urge of belongings. Out of all the different modes available, the mode which is more convenient, comfortable, economical, feasible, and beneficial in saving of time and money is selected by the users. And walking is the mostly used mode of transport around the world. And for the effective implementation of the walkable environment, planners, designers, and decision makers have to define and evaluate the elements which support the built environment in order to strengthen the walking facilities. One of the effective measuring quality of the pedestrian's environment is the approach to the Level of Service (LOS). There are several factors which affect the pedestrian LOS and the pedestrian LOS does vary from person to person. For defining the PLOS, the pedestrian flow parameters are required. The design features like road type, width of carriageway, intersection and weaving section are required to define the capacity. Suitability of the roadway network can be evaluated by comparing the present traffic volume with the capacity of the road. The service provided by the road network in terms of space, speed, density, and flow is the Level of Service of the road network.

## II. METHODOLOGY

The study methodology consists of two basic steps, first is to collect the data and, second is to analyse the data. The data collection has been done on the two spots on a selected street of the Anand city. The data collection has been done by adopting the method of videography survey. By analysing the collected data, the pedestrian flow parameters, Pedestrian Space, Density, and Speed were then found out. After deriving the parameters, the PLOS is then defined by comparing the frequency distribution with the available standard code provisions which are, HCM 2000, IRC:103-2010, and M.Parida et al. (2015).



## International Journal for Research in Applied Science & Engineering Technology (IJRASET)

### III. STUDY AREA PROFILE

Anand City is a city located in the State of Gujarat in India. Anand is also known as the Milk Capital of India. It is very well known for the Amul Dairy and its milk revolution. the city hosts the National Dairy Development Board (NDDDB), Anand Agricultural University (AAU) and Sardar Patel University (SPU). Vallabh Vidyanagar and Karamsad, an Educational suburb of Anand is located within the Anand Urban agglomeration. Anand is located between the Ahmedabad and Vadodara, The Western Railway, The National Highway and National Express Highway passes through Anand.

Anand is having an area of 2940.31sq.km with the population of 1856712 according to the census data 2001, out of which 156050 of the populations is of the Anand City having an area of 38.58sq.km.

Our study area is located at nearby the CBD area of the Anand city. Study area is starts from the Railway station and ends at the Nimbuwala complex, at and where in between the streets are very busy and congested throughout the day and specially during the Peak hours.

The highlighted portion in the following figure shows the study area,

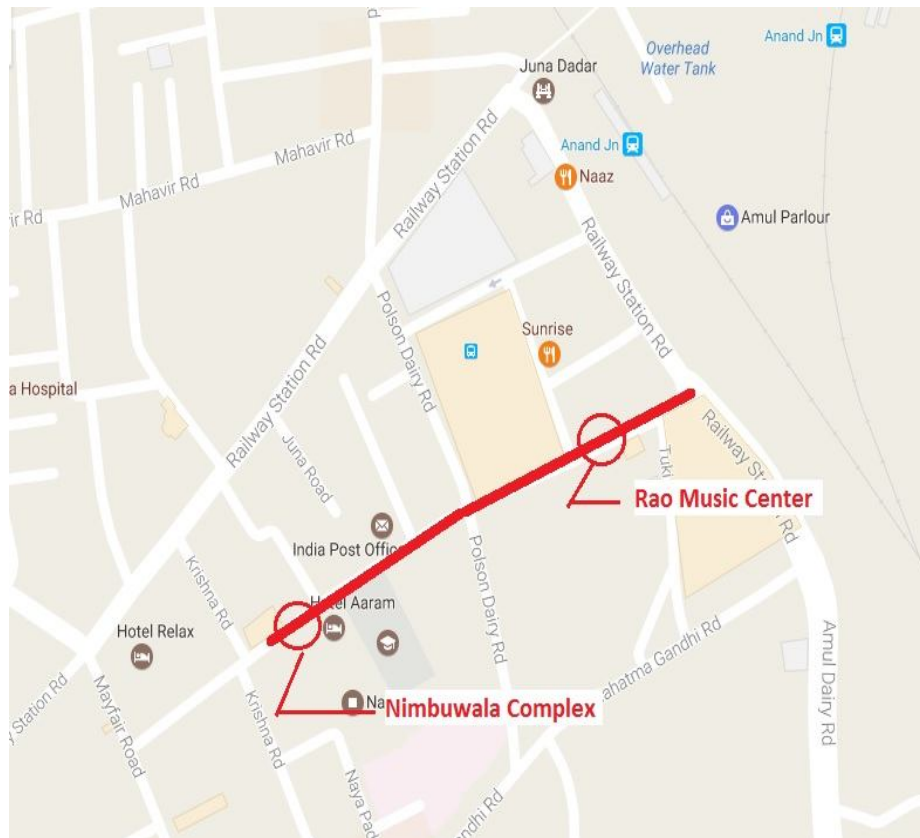


Figure 1 Study Location

### IV. DATA COLLECTION

After identifying the location to be surveyed, the next step is to collect the data related to the study. For this purpose, the road measurements like carriage way width footpath width and availability on road parking facility were measured, then the road stretch is marked with white lines drawn on the road with use of chalk or chalk powder, in our case the road stretch is of having length of 10 meters. A vantage point is selected having height of at least 10 meters. The data is recorded for about suitable length of time and the hourly variation in pedestrian flow is recorded. The flexibility with video recording technique is that the data can be easily made available, after recording in soft copy, at any time after the data collection work, for the analysis purpose.

At selected locations video-recording have been carried out for 4-4 hours., as 4 hours on morning peak and 4 hours during the evening peak. Video cameras positioned to capture the desirable view of pedestrians. Continuous video shooting was done from 0900hrs to 1300hrs and 1600hrs to 2000hrs at every location on respective days.

# International Journal for Research in Applied Science & Engineering Technology (IJRASET)

## V. DATA ANALYSIS

The performance measures which are derived after the data analysis for a network or a facility or a portion of it, and if it does not meet with the established standards, we can define the problem occurring in the real situations, and by that we are able to provide an suitable solution for it.

To measure the speed, density, space and flow of the pedestrian traffic, the traditional method of marking a road stretch with use of white lines is been adopted. The following methodology has been adopted to calculate the flow parameters which have been mentioned here:

### A. Density

The total number of heads which are in the entrapped area are counted and is been then divided with the total area. The density is then found in the unit of the pedestrian per meter square.

### B. Space

The total number of pedestrian divide by the area bounded by the selected stretch gives the space in the unit of the meter square per pedestrian.

### C. Speed

For the selected stretch of the study area the time taken for a pedestrian to pass it is measured and division of the trap length and time taken is found as the speed in terms of the m/s. a random person is been selected for the analysis and the average of the total number of the pedestrian is found as the average pedestrian speed.

The sample of the data analysed for average speed and other pedestrian flow parameters at two locations is presented in Table 1 to 4 for location of Rao Music Centre and at Nimbuwala Complex. The effective width of the roadway is the portion of the carriageway which is effectively available to the pedestrians for movement. It can be calculated by subtracting the width of side friction. The effective width of all location has been calculated as below.

Location 1: @ Rao Music Centre

$$\begin{aligned} \text{Effective width} &= \text{Road width} - \text{Side friction} \\ \text{Effective width} &= 9.0 - 2(1.2) \\ &= 6.6 \text{ m} \end{aligned}$$

Location 3: @Nimbuwal Complex

$$\begin{aligned} \text{Effective width} &= \text{Road width} - \text{Side friction} \\ &= 10.0 - 2(1.5) \\ &= 7.0 \text{ m} \end{aligned}$$

### D. Calculation of Average Speed

At each minute, 10 persons are observed walking, and the time (sec) taken by them to walk up to a distance of 10 m is noted down, and the speed is found out for all 10. The average of the 10 observations gives average speed of pedestrians at that moment of time. The sample of average speed at both the locations is given in table 1 and 3 respectively.

| Location 1 : @ Rao music centre |   |    |    |    |    |    |    |    |    |     | Pedestrian Speed Data  |      |      |      |      |      |      |      |      |      |                     |
|---------------------------------|---|----|----|----|----|----|----|----|----|-----|------------------------|------|------|------|------|------|------|------|------|------|---------------------|
| Time (hrs)                      | Time taken by Pedestrian to cover the distance of 10 meters (sec) |    |    |    |    |    |    |    |    |     | Pedestrian Speed (m/s) |      |      |      |      |      |      |      |      |      | Average Speed (m/s) |
|                                 | P1  | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P1                     | P2   | P3   | P4   | P5   | P6   | P7   | P8   | P9   | P10  |                     |
| 900                             | 14  | 14 | 14 | 14 | 9  | 11 | 11 | 10 | 15 | 8   | 0.71                   | 0.71 | 0.71 | 0.71 | 1.11 | 0.91 | 0.91 | 1.00 | 0.67 | 1.25 | 0.87                |
| 901                             | 11  | 10 | 9  | 8  | 8  | 12 | 14 | 13 | 14 | 10  | 0.91                   | 1.00 | 1.11 | 1.25 | 1.25 | 0.83 | 0.71 | 0.77 | 0.71 | 1.00 | 0.96                |
| 902                             | 10  | 13 | 12 | 11 | 10 | 9  | 13 | 14 | 14 | 14  | 1.00                   | 0.77 | 0.83 | 0.91 | 1.00 | 1.11 | 0.77 | 0.71 | 0.71 | 0.71 | 0.85                |
| 903                             | 8   | 12 | 14 | 9  | 12 | 11 | 14 | 11 | 12 | 10  | 1.25                   | 0.83 | 0.71 | 1.11 | 0.83 | 0.91 | 0.71 | 0.91 | 0.83 | 1.00 | 0.91                |
| 904                             | 10  | 12 | 11 | 12 | 11 | 14 | 9  | 14 | 12 | 15  | 1.00                   | 0.83 | 0.91 | 0.83 | 0.91 | 0.71 | 1.11 | 0.71 | 0.83 | 0.67 | 0.85                |
| 905                             | 9   | 13 | 11 | 9  | 14 | 9  | 10 | 10 | 12 | 13  | 1.11                   | 0.77 | 0.91 | 1.11 | 0.71 | 1.11 | 1.00 | 1.00 | 0.83 | 0.77 | 0.93                |

## International Journal for Research in Applied Science & Engineering Technology (IJRASET)

|     |    |    |    |    |    |    |    |    |    |    |      |      |      |      |      |      |      |      |      |      |      |
|-----|----|----|----|----|----|----|----|----|----|----|------|------|------|------|------|------|------|------|------|------|------|
| 906 | 14 | 9  | 11 | 10 | 12 | 14 | 11 | 13 | 11 | 13 | 0.71 | 1.11 | 0.91 | 1.00 | 0.83 | 0.71 | 0.91 | 0.77 | 0.91 | 0.77 | 0.86 |
| 907 | 14 | 15 | 13 | 11 | 13 | 11 | 9  | 9  | 9  | 11 | 0.71 | 0.67 | 0.77 | 0.91 | 0.77 | 0.91 | 1.11 | 1.11 | 1.11 | 0.91 | 0.90 |
| 908 | 10 | 15 | 14 | 9  | 9  | 11 | 12 | 13 | 13 | 11 | 1.00 | 0.67 | 0.71 | 1.11 | 1.11 | 0.91 | 0.83 | 0.77 | 0.77 | 0.91 | 0.88 |
| 909 | 10 | 12 | 10 | 13 | 12 | 14 | 11 | 10 | 13 | 12 | 1.00 | 0.83 | 1.00 | 0.77 | 0.83 | 0.71 | 0.91 | 1.00 | 0.77 | 0.83 | 0.87 |
| 910 | 9  | 13 | 10 | 9  | 10 | 14 | 14 | 8  | 15 | 12 | 1.11 | 0.77 | 1.00 | 1.11 | 1.00 | 0.71 | 0.71 | 1.25 | 0.67 | 0.83 | 0.92 |
| 911 | 10 | 13 | 14 | 8  | 10 | 11 | 15 | 8  | 15 | 15 | 1.00 | 0.77 | 0.71 | 1.25 | 1.00 | 0.91 | 0.67 | 1.25 | 0.67 | 0.67 | 0.89 |
| 912 | 12 | 9  | 12 | 13 | 8  | 8  | 15 | 13 | 15 | 15 | 0.83 | 1.11 | 0.83 | 0.77 | 1.25 | 1.25 | 0.67 | 0.77 | 0.67 | 0.67 | 0.88 |
| 913 | 13 | 11 | 12 | 9  | 10 | 10 | 10 | 8  | 10 | 14 | 0.77 | 0.91 | 0.83 | 1.11 | 1.00 | 1.00 | 1.00 | 1.25 | 1.00 | 0.71 | 0.96 |
| 914 | 11 | 12 | 10 | 11 | 12 | 13 | 10 | 11 | 8  | 10 | 0.91 | 0.83 | 1.00 | 0.91 | 0.83 | 0.77 | 1.00 | 0.91 | 1.25 | 1.00 | 0.94 |
| 915 | 11 | 11 | 13 | 10 | 15 | 14 | 10 | 10 | 10 | 10 | 0.91 | 0.91 | 0.77 | 1.00 | 0.67 | 0.71 | 1.00 | 1.00 | 1.00 | 1.00 | 0.90 |
| 916 | 8  | 11 | 13 | 14 | 12 | 13 | 14 | 9  | 10 | 12 | 1.25 | 0.91 | 0.77 | 0.71 | 0.83 | 0.77 | 0.71 | 1.11 | 1.00 | 0.83 | 0.89 |
| 917 | 13 | 14 | 9  | 9  | 13 | 13 | 14 | 12 | 15 | 12 | 0.77 | 0.71 | 1.11 | 1.11 | 0.77 | 0.77 | 0.71 | 0.83 | 0.67 | 0.83 | 0.83 |
| 918 | 11 | 13 | 8  | 13 | 11 | 10 | 12 | 9  | 14 | 12 | 0.91 | 0.77 | 1.25 | 0.77 | 0.91 | 1.00 | 0.83 | 1.11 | 0.71 | 0.83 | 0.91 |
| 919 | 8  | 15 | 15 | 11 | 13 | 9  | 8  | 9  | 11 | 9  | 1.25 | 0.67 | 0.67 | 0.91 | 0.77 | 1.11 | 1.25 | 1.11 | 0.91 | 1.11 | 0.98 |
| 920 | 8  | 8  | 10 | 10 | 8  | 8  | 10 | 9  | 12 | 12 | 1.25 | 1.25 | 1.00 | 1.00 | 1.25 | 1.25 | 1.00 | 1.11 | 0.83 | 0.83 | 1.08 |

Table 1 : Pedestrian Speed Data @ Location 1 : Rao Music Center

| Location 1: Rao Music centre |      |             | Calculation of pedestrian flow parameters |                  |       |         |                 |
|------------------------------|------|-------------|---|------------------|-------|---------|-----------------|
| Time (hrs)                   | Area | Pedestrians | Pedestrian Density                        | Pedestrian Space | Speed |         | Pedestrian Flow |
|                              |      |             |   |                  | (m/s) | (m/min) | (p/min/m)       |
| 900                          | 66   | 27          | 0.41                                      | 2.44             | 0.87  | 52.22   | 21.36           |
| 901                          | 66   | 15          | 0.23                                      | 4.40             | 0.96  | 57.31   | 13.02           |
| 902                          | 66   | 37          | 0.56                                      | 1.78             | 0.85  | 51.21   | 28.71           |
| 903                          | 66   | 20          | 0.30                                      | 3.30             | 0.91  | 54.65   | 16.56           |
| 904                          | 66   | 32          | 0.48                                      | 2.06             | 0.85  | 51.15   | 24.80           |
| 905                          | 66   | 44          | 0.67                                      | 1.50             | 0.93  | 55.97   | 37.31           |
| 906                          | 66   | 45          | 0.68                                      | 1.47             | 0.86  | 51.83   | 35.34           |
| 907                          | 66   | 38          | 0.58                                      | 1.74             | 0.90  | 53.88   | 31.02           |
| 908                          | 66   | 48          | 0.73                                      | 1.38             | 0.88  | 52.76   | 38.37           |
| 909                          | 66   | 48          | 0.73                                      | 1.38             | 0.87  | 51.97   | 37.80           |
| 910                          | 66   | 33          | 0.50                                      | 2.00             | 0.92  | 55.02   | 27.51           |
| 911                          | 66   | 43          | 0.65                                      | 1.53             | 0.89  | 53.36   | 34.76           |
| 912                          | 66   | 39          | 0.59                                      | 1.69             | 0.88  | 52.90   | 31.26           |
| 913                          | 66   | 20          | 0.30                                      | 3.30             | 0.96  | 57.52   | 17.43           |
| 914                          | 66   | 17          | 0.26                                      | 3.88             | 0.94  | 56.48   | 14.55           |
| 915                          | 66   | 15          | 0.23                                      | 4.40             | 0.90  | 53.81   | 12.23           |
| 916                          | 66   | 40          | 0.61                                      | 1.65             | 0.89  | 53.42   | 32.38           |
| 917                          | 66   | 39          | 0.59                                      | 1.69             | 0.83  | 49.75   | 29.40           |
| 918                          | 66   | 46          | 0.70                                      | 1.43             | 0.91  | 54.59   | 38.05           |
| 919                          | 66   | 22          | 0.33                                      | 3.00             | 0.98  | 58.52   | 19.51           |
| 920                          | 66   | 28          | 0.42                                      | 2.36             | 1.08  | 64.67   | 27.43           |

Table 2 : Pedestrian Flow Parameters @ Location 1 : Rao Music Center

## International Journal for Research in Applied Science & Engineering Technology (IJRASET)

| Location 2: Nimbuwala Complex |   |    |    |    |    |    |    |    |    |     | Pedestrian Speed Data  |      |      |      |      |      |      |      |      |      |                     |
|-------------------------------|---|----|----|----|----|----|----|----|----|-----|------------------------|------|------|------|------|------|------|------|------|------|---------------------|
| Time (hrs)                    | Time taken by Pedestrian to cover the distance of 10 meters (sec) |    |    |    |    |    |    |    |    |     | Pedestrian Speed (m/s) |      |      |      |      |      |      |      |      |      | Average Speed (m/s) |
|                               | P1  | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | P10 | P1                     | P2   | P3   | P4   | P5   | P6   | P7   | P8   | P9   | P10  |                     |
| 900                           | 9   | 9  | 12 | 10 | 13 | 8  | 10 | 8  | 12 | 12  | 1.11                   | 1.11 | 0.83 | 1.00 | 0.77 | 1.25 | 1.00 | 1.25 | 0.83 | 0.83 | 0.999               |
| 901                           | 9   | 9  | 9  | 13 | 11 | 11 | 11 | 11 | 10 | 9   | 1.11                   | 1.11 | 1.11 | 0.77 | 0.91 | 0.91 | 0.91 | 0.91 | 1.00 | 1.11 | 0.985               |
| 902                           | 9   | 8  | 9  | 9  | 12 | 9  | 9  | 9  | 10 | 9   | 1.11                   | 1.25 | 1.11 | 1.11 | 0.83 | 1.11 | 1.11 | 1.11 | 1.00 | 1.11 | 1.086               |
| 903                           | 12  | 9  | 9  | 9  | 13 | 8  | 10 | 8  | 8  | 10  | 0.83                   | 1.11 | 1.11 | 1.11 | 0.77 | 1.25 | 1.00 | 1.25 | 1.25 | 1.00 | 1.069               |
| 904                           | 11  | 12 | 12 | 8  | 12 | 13 | 12 | 10 | 11 | 9   | 0.91                   | 0.83 | 0.83 | 1.25 | 0.83 | 0.77 | 0.83 | 1.00 | 0.91 | 1.11 | 0.928               |
| 905                           | 10  | 9  | 10 | 10 | 9  | 9  | 13 | 11 | 10 | 11  | 1.00                   | 1.11 | 1.00 | 1.00 | 1.11 | 1.11 | 0.77 | 0.91 | 1.00 | 0.91 | 0.992               |
| 906                           | 12  | 12 | 12 | 10 | 8  | 11 | 10 | 12 | 10 | 9   | 0.83                   | 0.83 | 0.83 | 1.00 | 1.25 | 0.91 | 1.00 | 0.83 | 1.00 | 1.11 | 0.960               |
| 907                           | 10  | 12 | 9  | 9  | 11 | 11 | 13 | 9  | 9  | 11  | 1.00                   | 0.83 | 1.11 | 1.11 | 0.91 | 0.91 | 0.77 | 1.11 | 1.11 | 0.91 | 0.977               |
| 908                           | 13  | 10 | 8  | 9  | 11 | 10 | 10 | 13 | 10 | 11  | 0.77                   | 1.00 | 1.25 | 1.11 | 0.91 | 1.00 | 1.00 | 0.77 | 1.00 | 0.91 | 0.972               |
| 909                           | 12  | 9  | 9  | 12 | 10 | 10 | 11 | 11 | 9  | 12  | 0.83                   | 1.11 | 1.11 | 0.83 | 1.00 | 1.00 | 0.91 | 0.91 | 1.11 | 0.83 | 0.965               |
| 910                           | 10  | 8  | 12 | 8  | 11 | 13 | 9  | 11 | 10 | 12  | 1.00                   | 1.25 | 0.83 | 1.25 | 0.91 | 0.77 | 1.11 | 0.91 | 1.00 | 0.83 | 0.987               |
| 911                           | 9   | 12 | 9  | 13 | 13 | 13 | 12 | 8  | 10 | 13  | 1.11                   | 0.83 | 1.11 | 0.77 | 0.77 | 0.77 | 0.83 | 1.25 | 1.00 | 0.77 | 0.922               |
| 912                           | 10  | 11 | 10 | 8  | 13 | 13 | 8  | 10 | 11 | 10  | 1.00                   | 0.91 | 1.00 | 1.25 | 0.77 | 0.77 | 1.25 | 1.00 | 0.91 | 1.00 | 0.986               |
| 913                           | 9   | 12 | 8  | 11 | 9  | 13 | 11 | 11 | 11 | 11  | 1.11                   | 0.83 | 1.25 | 0.91 | 1.11 | 0.77 | 0.91 | 0.91 | 0.91 | 0.91 | 0.962               |
| 914                           | 10  | 9  | 10 | 13 | 12 | 11 | 13 | 12 | 13 | 10  | 1.00                   | 1.11 | 1.00 | 0.77 | 0.83 | 0.91 | 0.77 | 0.83 | 0.77 | 1.00 | 0.899               |
| 915                           | 9   | 12 | 12 | 11 | 9  | 12 | 9  | 12 | 11 | 10  | 1.11                   | 0.83 | 0.83 | 0.91 | 1.11 | 0.83 | 1.11 | 0.83 | 0.91 | 1.00 | 0.948               |
| 916                           | 11  | 11 | 9  | 11 | 10 | 10 | 12 | 13 | 8  | 13  | 0.91                   | 0.91 | 1.11 | 0.91 | 1.00 | 1.00 | 0.83 | 0.77 | 1.25 | 0.77 | 0.946               |
| 917                           | 10  | 10 | 12 | 11 | 9  | 9  | 12 | 12 | 11 | 10  | 1.00                   | 1.00 | 0.83 | 0.91 | 1.11 | 1.11 | 0.83 | 0.83 | 0.91 | 1.00 | 0.954               |
| 918                           | 9   | 10 | 9  | 10 | 11 | 9  | 9  | 10 | 12 | 9   | 1.11                   | 1.00 | 1.11 | 1.00 | 0.91 | 1.11 | 1.11 | 1.00 | 0.83 | 1.11 | 1.030               |
| 919                           | 9   | 9  | 12 | 12 | 12 | 12 | 10 | 13 | 9  | 11  | 1.11                   | 1.11 | 0.83 | 0.83 | 0.83 | 0.83 | 1.00 | 0.77 | 1.11 | 0.91 | 0.934               |
| 920                           | 11  | 10 | 10 | 13 | 10 | 13 | 10 | 13 | 10 | 9   | 0.91                   | 1.00 | 1.00 | 0.77 | 1.00 | 0.77 | 1.00 | 0.77 | 1.00 | 1.11 | 0.933               |

Table 3 : Pedestrian Speed Data @ Location 2 : Nimbuwala Complex

| Location 2: Nimbuwala Complex |      |             | Calculation of pedestrian flow parameters |       |       |         |                           |
|-------------------------------|------|-------------|---|-------|-------|---------|---------------------------|
| Time                          | Area | Pedestrians | Pedestrian Density                        | Space | speed |         | Pedestrian Flow (p/min/m) |
|                               |      |             |   |       | (m/s) | (m/min) |                           |
| 900                           | 70   | 26          | 0.3714                                    | 2.692 | 0.999 | 59.94   | 22.26                     |
| 901                           | 70   | 22          | 0.3143                                    | 3.182 | 0.985 | 59.10   | 18.57                     |
| 902                           | 70   | 27          | 0.3857                                    | 2.593 | 1.086 | 65.16   | 25.13                     |
| 903                           | 70   | 20          | 0.2857                                    | 3.500 | 1.069 | 64.11   | 18.31                     |
| 904                           | 70   | 23          | 0.3286                                    | 3.043 | 0.928 | 55.69   | 18.29                     |
| 905                           | 70   | 19          | 0.2714                                    | 3.684 | 0.992 | 59.52   | 16.15                     |

## International Journal for Research in Applied Science & Engineering Technology (IJRASET)

|     |    |    |        |       |       |       |       |
|-----|----|----|--------|-------|-------|-------|-------|
| 906 | 70 | 26 | 0.3714 | 2.692 | 0.960 | 57.62 | 21.40 |
| 907 | 70 | 18 | 0.2571 | 3.889 | 0.977 | 58.64 | 15.08 |
| 908 | 70 | 20 | 0.2857 | 3.500 | 0.972 | 58.30 | 16.65 |
| 909 | 70 | 24 | 0.3429 | 2.917 | 0.965 | 57.90 | 19.85 |
| 910 | 70 | 19 | 0.2714 | 3.684 | 0.987 | 59.19 | 16.06 |
| 911 | 70 | 28 | 0.4000 | 2.500 | 0.922 | 55.29 | 22.11 |
| 912 | 70 | 20 | 0.2857 | 3.500 | 0.986 | 59.13 | 16.89 |
| 913 | 70 | 23 | 0.3286 | 3.043 | 0.962 | 57.72 | 18.96 |
| 914 | 70 | 30 | 0.4286 | 2.333 | 0.899 | 53.96 | 23.12 |
| 915 | 70 | 23 | 0.3286 | 3.043 | 0.948 | 56.90 | 18.69 |
| 916 | 70 | 20 | 0.2857 | 3.500 | 0.946 | 56.76 | 16.21 |
| 917 | 70 | 29 | 0.4143 | 2.414 | 0.954 | 57.24 | 23.71 |
| 918 | 70 | 19 | 0.2714 | 3.684 | 1.030 | 61.78 | 16.77 |
| 919 | 70 | 24 | 0.3429 | 2.917 | 0.934 | 56.06 | 19.22 |
| 920 | 70 | 30 | 0.4286 | 2.333 | 0.933 | 55.96 | 23.98 |

Table 4 : Pedestrian Flow Parameters @ Location 2 : Nimbuwala Complex

### VI. DETERMINATION OF PLOS

The Pedestrian Level of Service at study locations are established in context of (i) IRC103 (2012) for space and flow rate space and flow rate, v/c Ratio (ii) Parida (2014) for space, speed and flow rate and (iii) HCM 2000 for speed, space, flow rate and v/c Ratio and compared in following tables on location 1 and location 2. Table 5 to 10.

| As per HCM 2000 |                           |               | Location 1: Rao Music Centre |            | Time: 9:00AM - 1:00PM  |       |           |
|-----------------|---------------------------|---------------|------------------------------|------------|------------------------|-------|-----------|
| PLOS            | Space (m <sup>2</sup> /p) | Speed (m/sec) | Flow Rate (p/min/m)          | v/c Ratio  | Frequency distribution |       |           |
|                 |                           |               |                              |            | Space                  | Speed | Flow rate |
| A               | >5.6                      | >1.3          | ≤16                          | ≤0.21      | 0                      | 0     | 30        |
| B               | 5.6 - 3.70                | >1.27 - 1.3   | ≤16-23                       | >0.21-0.31 | 17                     | 0     | 64        |
| C               | 3.70 - 2.2                | >1.22 - 1.27  | ≤23-33                       | >0.31-0.44 | 91                     | 0     | 77        |
| D               | 2.2 - 1.40                | >1.14 - 1.22  | ≤33-49                       | >0.44-0.65 | 105                    | 0     | 69        |
| E               | 1.4 - 0.75                | >0.75 - 1.14  | ≤49-75                       | >0.65-1.0  | 27                     | 240   | 0         |
| F               | ≤0.75                     | ≤0.75         | Variable                     | Variable   | 0                      | 0     | 0         |

Table 5 : PLOS as pr HCM 2000 @ Location 1 : Rao Music Centre

| As per IRC 103 - 2012 |                           | Location 1: Rao Music Centre |                        | Time: 9:00AM - 1:00PM |  |
|-----------------------|---------------------------|------------------------------|------------------------|-----------------------|--|
| PLOS                  | Space (m <sup>2</sup> /p) | Flow rate (p/m/min)          | Frequency Distribution |                       |  |
|                       |                           |                              | Space                  | Flow Rate             |  |
| A                     | >4.9                      | ≤12                          | 0                      | 1                     |  |
| B                     | >3.3-4.9                  | >12-15                       | 32                     | 23                    |  |
| C                     | >1.9-3.3                  | >15-21                       | 97                     | 48                    |  |
| D                     | >1.3-1.9                  | >21-27                       | 111                    | 48                    |  |
| E                     | >0.6-1.3                  | >27-45                       | 0                      | 120                   |  |
| F                     | ≤0.6                      | Variable                     | 0                      | 0                     |  |

Table 6 : PLOS as per IRC 103- 2012 @ Location 1 : Rao Music Centre

## International Journal for Research in Applied Science & Engineering Technology (IJRASET)

| As per Parida |                           | Location 1: Rao Music Centre |               | Time: 9:00AM - 1:00PM  |           |       |
|---------------|---------------------------|------------------------------|---------------|------------------------|-----------|-------|
| PLOS          | Space (m <sup>2</sup> /p) | Flow rate (p/m/min)          | Speed (m/min) | Frequency Distribution |           |       |
|               |                           |                              |               | Space                  | Flow rate | Speed |
| A             | >5.45                     | ≤14                          | >77           | 0                      | 11        | 0     |
| B             | 3.55 – 5.45               | 21 – 14                      | 74 – 77       | 23                     | 61        | 0     |
| C             | 2.05 – 3.55               | 34 – 21                      | 69 – 74       | 94                     | 107       | 0     |
| D             | 1.25 – 2.05               | 49 – 34                      | 61 – 69       | 123                    | 61        | 4     |
| E             | 0.6 – 1.25                | 68 – 49                      | 40 – 61       | 0                      | 0         | 236   |
| F             | ≤0.60                     | Variable                     | <40           | 0                      | 0         | 0     |

Table 7 : PLOS as pe Parida @ Location 1 : Rao Music Center

| As per HCM 2000 |                           | Location 2: Nimbuwala Complex |                     |            | Time: 9:00AM - 1:00PM  |       |           |
|-----------------|---------------------------|-------------------------------|---------------------|------------|------------------------|-------|-----------|
| PLOS            | Space (m <sup>2</sup> /p) | Speed (m/sec)                 | Flow Rate (p/min/m) | v/c Ratio  | Frequency distribution |       |           |
|                 |                           |                               |                     |            | Space                  | Speed | Flow rate |
| A               | >5.6                      | >1.3                          | ≤16                 | ≤0.21      | 0                      | 0     | 45        |
| B               | 5.6 - 3.70                | >1.27 - 1.3                   | ≤16-23              | >0.21-0.31 | 29                     | 0     | 146       |
| C               | 3.70 - 2.2                | >1.22 -1.27                   | ≤23-33              | >0.31-0.44 | 203                    | 0     | 47        |
| D               | 2.2 - 1.40                | >1.14 - 1.22                  | ≤33-49              | >0.44-0.65 | 8                      | 0     | 2         |
| E               | 1.4 - 0.75                | >0.75 -1.14                   | ≤49-75              | >0.65-1.0  | 0                      | 240   | 0         |
| F               | ≤ 0.75                    | ≤ 0.75                        | Variable            | Variable   | 0                      | 0     | 0         |

Table 8 : PLOS as per HCM 2000 @ Location 2: Nimbuwala Complex

| As per IRC 103 - 2012 |                           | Location 2: Nimbuwala Complex |                        | Time: 9:00AM - 1:00PM |  |
|-----------------------|---------------------------|-------------------------------|------------------------|-----------------------|--|
| PLOS                  | Space (m <sup>2</sup> /p) | Flow rate (p/m/min)           | Frequency Distribution |                       |  |
|                       |                           |                               | Space                  | Flow Rate             |  |
| A                     | >4.9                      | ≤12                           | 0                      | 0                     |  |
| B                     | >3.3-4.9                  | >12-15                        | 83                     | 20                    |  |
| C                     | >1.9-3.3                  | >15-21                        | 152                    | 128                   |  |
| D                     | >1.3-1.9                  | >21-27                        | 5                      | 84                    |  |
| E                     | >0.6-1.3                  | >27-45                        | 0                      | 8                     |  |
| F                     | ≤0.6                      | Variable                      | 0                      | 0                     |  |

Table 9 : PLOS as per IRC 103 – 2012 @ Location 2: Nimbuwala Complex

| As per Parida |                           | Location 2: Nimbuwala Complex |               | Time : 9:00 AM - 1:00PM |           |       |
|---------------|---------------------------|-------------------------------|---------------|-------------------------|-----------|-------|
| PLOS          | Space (m <sup>2</sup> /p) | Flow rate (p/m/min)           | Speed (m/min) | Frequency Distribution  |           |       |
|               |                           |                               |               | Space                   | Flow rate | Speed |
| A             | >5.45                     | ≤14                           | >77           | 0                       | 3         | 0     |
| B             | 3.55 – 5.45               | 21 – 14                       | 74 – 77       | 50                      | 145       | 0     |
| C             | 2.05 – 3.55               | 34 – 21                       | 69 – 74       | 184                     | 90        | 0     |
| D             | 1.25 – 2.05               | 49 – 34                       | 61 – 69       | 6                       | 2         | 49    |
| E             | 0.6 – 1.25                | 68 – 49                       | 40 – 61       | 0                       | 0         | 191   |
| F             | ≤0.60                     | Variable                      | <40           | 0                       | 0         | 0     |

Table 10 : PLOS as per Parida @ Location 2: Nimbuwala Complex



## International Journal for Research in Applied Science & Engineering Technology (IJRASET)

For, Location 1: Rao Music centre the PLOS for speed is E, for space LoS is D, and for the Flow rate the LoS varies as C as per HCM 2000 & Parida (2014) and D as per IRC 103 – 2012.

For, Location 2: Nimbuwala Complex the PLOS for speed is E, for space it is C, and for the flow rate the LOS varies between B and C under all LOS criteria.

### VII. CONCLUSION

From the Videography survey carried out for the chosen locations, following conclusions are drawn:

- A. The PLOS as per all the standards considered do give us the relatively different output but varies only little.
- B. The Pedestrian Density near the Rao Music centre, a place near to the Railway station have the maximum pedestrian density under the heterogeneous traffic condition.
- C. While, going far from the Railway station the traffic density in context of the pedestrian reduces.
- D. The pedestrian level of service as per seen is gets the highest during the morning period of 10:00AM to 12:00AM, and during the evening period of 5:00PM to 7:00PM.
- E. The pedestrian speed mostly stays at the LOS of E and D, even if the space and density of the pedestrian stays at LOS b and C, under this we can conclude that the pedestrian at nearby the study area do shows the behaviour of walking slow, and get affected by the on-going vehicular traffic.

### REFERENCES

- [1] Parida, M. (2014), "Review Meeting of Indo HCM", CRRI, New Dehli.
- [2] Purnima Parida, Jiten shah & S.Gangopadhyay, Jan.2014, "Feasibility of providing a skywalk for pedestrian in Chandni chowk, Dehli".
- [3] Tanaboriboon, Y., Hwa, S.S. and Chor, C.H. (1986), "Pedestrian Characteristics study in Singapore", Journal of Transportation Engineering, ASCE, 112(3), 229 - 235
- [4] Mitullah W and Makajuma G, (2009), "Analysis of Non-Motorised Travel Conditions on the Jogoo Road Corridor in Nairobi", 4th International Conference on Future Urban Transport: Access and Mobility for the Cities of Tomorrow, Göteborg
- [5] Chhaya Brahmabhatt, Dr.LB.Zala, Dr.Mukti Advani (2015), "Study of Pedestrian Flow Behaviour : A Case Study of Dakor", International Journal of Engineering and Technology, vol. 2.
- [6] Wang, L., Chen, H., and Zhou, J. (2012), "Design Methods Research of Non-Motorized Transport in Intersection", CICTP 2012: pp. 3246-3257.
- [7] Chandra R. Bhat, Jessica Y. Guo, Rupali Sardesai (2010), "NON-MOTORIZED TRAVEL IN THE SAN FRANCISCO BAY AREA"
- [8] Gowri Asaithambi, Manu O. Kuttan, Sarath Chandra (2016), "Pedestrian Road Crossing Behavior Under Mixed Traffic Conditions: A Comparative Study of an Intersection Before and After Implementing Control Measures"
- [9] CHRISTOPHER PORTER, JOHN SUHRBIER, AND WILLIAM L. SCHWARTZ (1999), "Forecasting Bicycle and Pedestrian Travel State of the Practice and Research Needs"
- [10] DRAFT DEVELOPMENT PLAN 2033, (2015), AVKUDA – ANAND VALLABH VIDYANAGAR KARAMSAD URBAN DEVELOPMENT AREA
- [11] Evaluating Non-motorized Transport Techniques for Measuring Walking and Cycling Activity and Conditions, TDM Encyclopaedia
- [12] Pedestrian Design Guidelines, ©UTTIPEC, Delhi Development Authority, New Delhi November 2009
- [13] Street Design Guidelines, ©UTTIPEC, Delhi Development Authority, New Delhi Guidelines Adopted: Nov 2009. Revision 1: Nov 2010
- [14] BICYCLING & WALKING in the United States, BENCHMARKING REPORT, 2016
- [15] Urban Transport in India Challenges and Recommendations, IIHS RF Paper on Urban Transport, 2013
- [16] IRC : 103-1988, Guidelines for pedestrian Facilities
- [17] IRC : 103 – 2012, Guidelines for pedestrian Facilities
- [18] HCM – Highway Capacity Manual, 2000



10.22214/IJRASET



45.98



IMPACT FACTOR:  
7.129



IMPACT FACTOR:  
7.429



# INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24\*7 Support on Whatsapp)