

# VARIATION IN PEDESTRIAN FLOW DURING RELIGIOUS EVENT

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**Abstract :** India as a county of multiple religion having too many religious events celebrated throughout a year. On every religious event pedestrian devotees crowd gathered at respective religious places. So, to understand the variation in pedestrian devotees flow and composition of pedestrian devotees flow during specific religious event the present study conducted at Swaminarayan Temple Bharuch. The data has been collected on Diwali by using video recording of 3 hours. Total 2497 no of pedestrian has been observed on the event day. The peak hour has been identified as 6:00 pm to 7:00 pm with an flow of 1017 pedestrians per hour. The pedestrians flow has been categorized gender wise in four different categories namely Children 5-18years, Youngster 18-35 years, Mid-Age 35-60 years and Senior Citizen 60 years and above. The data analysis enables that youngster and mid age pedestrians are dominating the pedestrian flow having 41% share of total flow. Also the study enables that the share of senior citizens is also considerable with due concerns safety.

**Index Terms -** Pedestrian, Devotees, Religious Event, Pedestrian Flow

## I. INTRODUCTION

Pedestrians are an important element of transportation system since every person's trip begins and end in walking. However in spite of its importance, pedestrian needs are often not considered effectively in the design and planning of transportation system particularly in developing economies like India. India is the second largest populated country in the glob with more than 125 million population. In India, for different religious reasons, people walk to certain places for worship. On few specific events, this gathering used to be very large and needs special attention with respect to pedestrians' facilities on road for walking safely and comfortably. However, pedestrians behavior in public locations in a usual situation and in crowd for the period of religious festivals are considerably different. Figure 1.1 and 1.2 below shows the difference in pedestrian walking behavior in public locations and in a usual situations.



Figure 1.1 Pedestrian Walking Behavior in Religious Mass Gathering (Source: Google Image)



Figure 1.2 Pedestrian Walking Behavior in public locations and in a usual situations (Source: Google Image)

From all the temples around India, "BAPS Shri Swaminarayan Mandir, Bharuch" is one of the busiest temple when it comes to devotees visit. So for the present study "Variation in Pedestrian Flow During Religious Event" the "BAPS Shri Swaminarayan Mandir, Bharuch" is selected as study area. At BAPS Shri Swaminarayan Mandir, Bharuch there are more than 10 major festivals celebrated where large no of pedestrian devotees visits. At BAPS Shri Swaminarayan Mandir, Bharuch to control the devotees flood on specific events is kind of a headache. so it is evident that scientifically designed pedestrian walking facilities are essential for devotees.

## II. AIM OF STUDY

Investigate the variation in pedestrian flow during specific event and identify the dominating pedestrian category from mixture of different category pedestrian flow.

## III. OBJECTIVES OF STUDY

- Identify the present facilities for pedestrian devotees.
- Identify the peak hour for pedestrian flow during specific religious event.
- Scrutinize pedestrian flow composition.
- Investigate the dominating pedestrian category from mixture of different pedestrian category.

## IV. LITERATURE REVIEW

Pedestrian behavior study is quite different as compared to the vehicular traffic. Pedestrian behavior and its characteristics like speed, flow, space, density and their relationships are studied by different researchers for various locations and specific conditions. The detailed compiled literature is presented in table 4.1 below.

Table 4.1 Review of Pedestrian Researches

Sr. No.	Paper Title	Author	Journal and Publication Year	Remarks
1	The effect of events on pedestrian behavior and its compression with normal walking behavior in CBD area in Indian Context.	Hardik Sukhadia Sanjay Dave Jiten Shah	Elsevier - 2014	<ul style="list-style-type: none"> <li>• Conducted at CBD area of Vadodara</li> <li>• Data collected on Durgashtami, Dushera and One normal working day</li> <li>• Decrease in walking speed on event day by 20% than working day.</li> <li>• LOS Decreases on event day than normal day</li> </ul>
2	Measurement of Pedestrian Flow Parameters – A Case Study of Dakor.	Chhaya Brahmhatt L. B. Zala Mukti Advani	IRJET - 2014	<ul style="list-style-type: none"> <li>• Conducted at Dakor temple</li> <li>• Data collected on Outside street on normal working day.</li> <li>• Pedestrian flow parameters speed, space, density, flow rate determined.</li> <li>• Determined LOS as per HCM 2000 &amp; from Thesis of Rima Sahani.</li> </ul>
3	Pedestrian characteristics & behavior on surrounding temple area Madurai	Bharathy G. & Karthigaipriya T.	IJMETMR - 2017	<ul style="list-style-type: none"> <li>• Conducted at CBD area of Madurai Temple</li> <li>• 7 wards 350 pedestrian samples</li> <li>• Crossing speed found for               <ul style="list-style-type: none"> <li>• - old age – 0.95 m/s</li> <li>• - Adults – 1.12 m/s</li> </ul> </li> </ul>
4	A Review of studies on understanding crowd dynamics in the context of crowd safety in mass gatherings	Gayathri H. P M Aparna Ashish Verma	Elsevier – 2017	<ul style="list-style-type: none"> <li>• Kumbh Mela Ujjain - 2016</li> <li>• Dr. Ashish Verma &amp; Team</li> <li>• Indo-Dutch Collaboration</li> <li>• Ongoing project.</li> </ul>

## V. METHODOLOGY

Initially the problem will be identified such as difficulty in managing pedestrian devotees mass on any religious event at respective religious places, then objectives would be set as per the requirement that minimize the problems and lastly data will be collected on event day "Diwali" and then it will be analyzed. Lastly on the basis of data analysis and its results the suggestions will be concluded to minimize the impact of the problem. The figure 5.1 below shows the flow chart of methodology that has been followed for the present study.

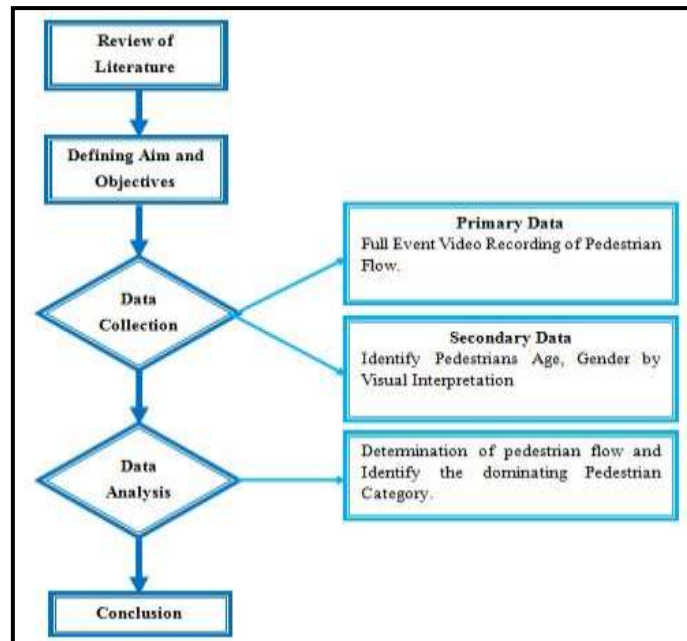


Figure 5.1 Study Methodology

## VI. STUDY AREA

For the present study "Variation in Pedestrian Flow During Religious Event" BAPS Shri Swaminarayan Temple, Zadeshwar, Bharuch has been selected as study area. The Fig. 5.1 below shows the location of temple.

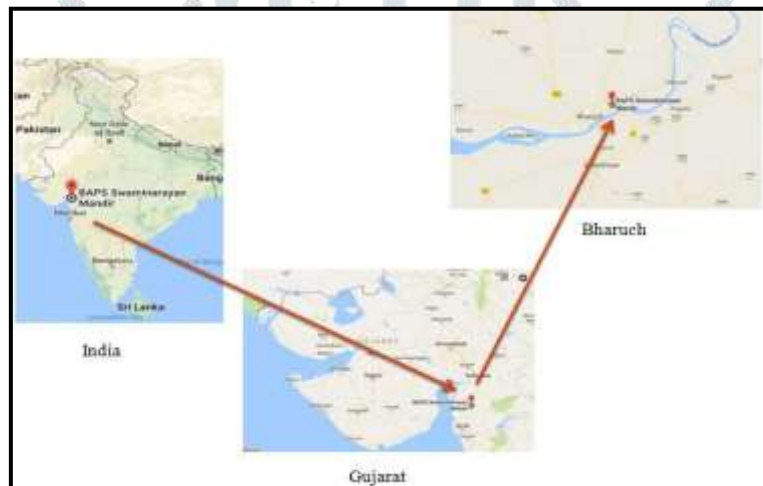


Figure 6.1 Study Area Location

## VII. DATA COLLECTION

The pedestrian flow data has been observed on event day of Diwali to be celebrated at study location with maximum number of visits by pedestrian devotees. Pedestrian flow has been observed at the entry gate of temple inside the temple premises on 30 feet long (10m) walk way. The trap length to be considered is 5m. The observation location is clearly shown in fig. 7.1.



Figure 7.1 Observation Location

## VIII. RESULTS AND DISCUSSION

The pedestrian volume count has been done per one minute basis. Firstly the Pedestrians are categorized in children, Adult Youngsters, Adult Mid-Age and Senior Citizens. The number of pedestrians passing the trap entry and exit point counted as per the motioned category. The entire volume count converted into pedestrian half hour flow to identify the peak hour. Table 8.1 shows the pedestrian flow per half hour according to gender and different categories.

Table 8.1 Pedestrian Volume Count

Time	Male				Female				Total
	Children	Youngster	Mid-Age	Senior Citizen	Children	Youngster	Mid-Age	Senior Citizen	
04:00 to 04:30	21	37	68	43	18	42	72	37	338
04:30 to 05:00	17	46	84	31	26	57	46	38	345
05:00 to 05:30	29	53	74	21	18	64	86	42	387
05:30 to 06:00	37	63	93	34	23	73	56	31	410
06:00 to 06:30	48	58	104	14	36	107	78	44	489
06:30 to 07:00	39	87	94	27	41	114	93	33	528
Total	191	344	517	170	162	457	431	225	2497

The graphical representation of above mentioned half hourly pedestrian volume change is as shown below figure 8.2. From graph peak hour identified as 06:00 pm to 07:00 pm with volume of 1017 pedestrian per hour which is very high.

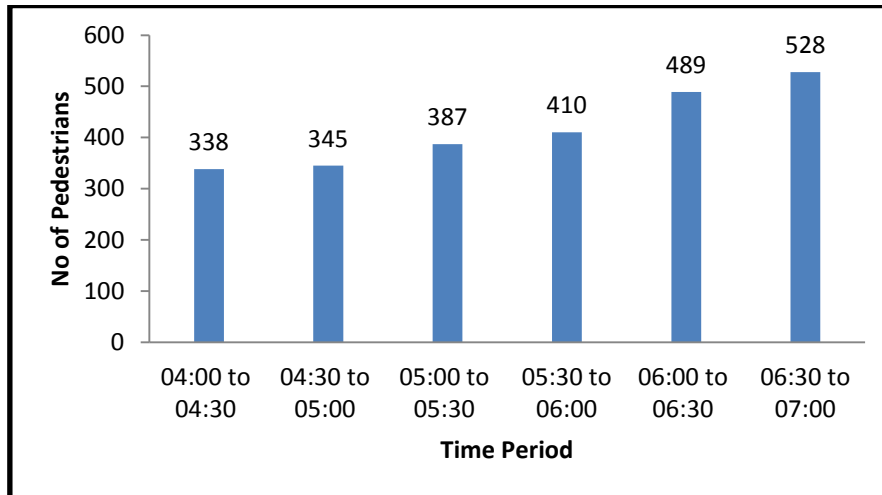


Figure 8.2 Half Hourly Variation in Pedestrian Flow

The pedestrian composition gender wise described in figure 8.3 below. From the figure 8.3 shown below it is quite clear that 48% male pedestrians and 52% female pedestrians visited on event day.

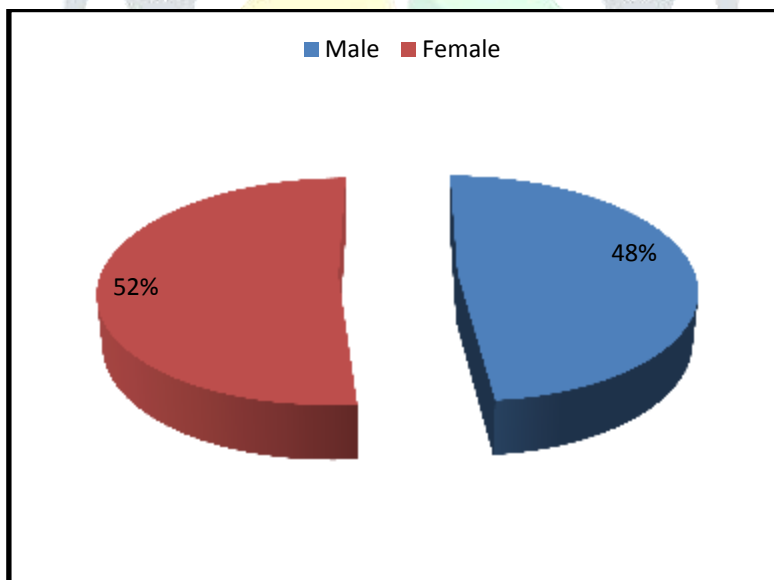


Figure 8.3 Half Hourly Variation in Pedestrian Flow

The pedestrian composition as per different category described in figure 8.4 below. From the figure 8.4 shown below it is quite clear that youngsters and mid age pedestrian category is dominating having maximum share in total flow.

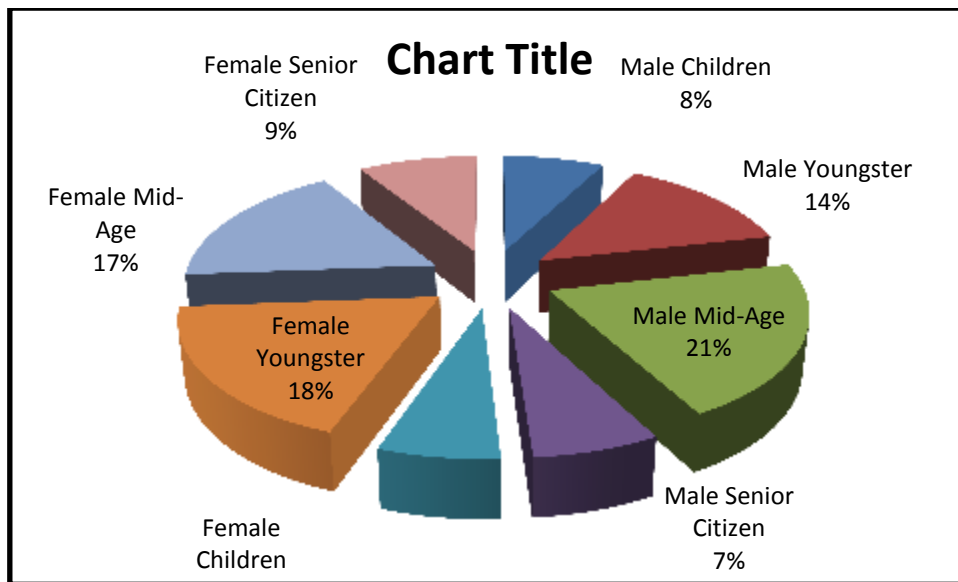


Figure 8.4 Pedestrian Flow Composition According to Different Category

## IX. CONCLUSION

The pedestrian flow may be very high on religious event day Diwali at study location. The peak hour identified as 06:00 pm to 07:00 pm having pedestrian flow of 1017 pedestrians per hour. The share of male and female pedestrian in total volume is almost equal having 48% male pedestrians and 52% female pedestrians. The main dominating pedestrian category identified as youngsters and mid-age pedestrians due considering 41% share of total flow.

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