ACTIVITY AND TRAVEL PATTERN OF THE RESIDENTS OF THE CITY IN A DEVELOPING COUNTRY

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Abstract

The increasing concern in many urban and suburban areas about the level of traffic congestion coupled with the conceptual deficiencies of the conventional trip-based travel demand modeling approach has led to the emergence of an activity-based model to study the travel behavior. Notwithstanding the existence of various models of activity scheduling behaviour, lack of efforts to develop models in the Indian cities signifies the scope for investigation and development of such models. This study has attempted to determine the activity and time-use patterns in a developing city like Thane in Maharashtra. Two-day diary data of every individual, above five years, was collected through a household personal interview and their activity, travel and time use information were analysed to identify differences in activity engagements across different sample groups. The impact of socio-economic variables on the activity pattern is also analysed. a new time-space diary is designed and is effectively applied in the study area and found to have a good performance. The most suitable method of data collection for activity based analysis in the Indian contest is found. The results indicate a need for greater consideration of attitudinal dynamics in transportation planning and policy analysis.

Keywords: Activity pattern; Time- space diary; Tour; Activity travel pattern
Topic Area: D3 Integrated Supply / Demand Modeling

1. Introduction

The shift in emphasis from evaluating capital improvement strategies to understanding travel behavior responses to congestion management policies has prompted the development of an activity-based approach. While this approach offers considerable potential, the data collection and analysis that it has inspired has largely focused on revealed activity-travel outcomes. It is only recently that travel behavior researchers have begun to emphasize the need for in-depth research into the activity scheduling decision processes that underlies observed activity-travel patterns.

Significant socioeconomic changes have taken place in the past few decades with far-reaching implications for travel behavior. The overall increase in the number of workers has meant higher per capita income and greater geographic mobility, but less disposable time, more travel, and more traffic congestion. Inevitably, to get the most out of every day, individuals try to substitute money for time. Facilitated by advances in technology and the emergence of new services and various labor saving devices, this substitution of money for time has implied complex adjustment patterns among travel and activities. The study of these patterns of human activity has engaged researchers across disciplines.

Recent studies by transportation engineers and modelers includes the introduction of trip chaining, activity sequencing, and combined time-of-day and route choice into demand forecasting procedures (Clarke et al., 1981; Kitamura, 1998; Recker et. al., 1986). However, there has been less empirical work analyzing the long term stability of activity patterns and their placement in a broader economic context. Transportation researchers have noted that, over time, non-work trips have been increasing to over one-half the total number of trips by adults (Gordon et.al., 1988; Pisarski, 1992). Pioneering work quantifying the use of time has been conducted by (Szalai, 1972) internationally, (Robinson, 1977) in the United States. Meanwhile, sociologists have examined the impact of rising female participation in the labor force on the quality of life and changing roles of time at work and leisure (de Grazia, 1962; Schor, 1991); planners have studied the allocation of time by activity and by location, for demographic and socioeconomic classes (Chapin, Hightower, 1965), (Chapin, 1968, 1974); and economists have developed a theory of the allocation of time proposing that individuals or households combine time and market goods to produce "commodities" (Becker, 1965). However little effort was given for the pattern analysis for the cities in the developing countries.

This study of activity patterns analyzed household travel surveys from the Mumbai, Thane region. The purpose of the research is to learn more about trends in activity patterns of the cities in the developing countries, in order to improve the theoretical basis of travel forecasts. In addition, better understanding of behavior as related to work status will give insight into the changes in travel patterns if any associated with the rise in at-home work. Possible design of survey instrument and method of data collection most suited for the cities in the developing countries.

Travel pattern reinforces the finding of increase in trip chaining, where workers combine work and non-working activities on their commute home to accommodate various needs. The article examines the connections among demographic and socioeconomic characteristics, the allocation of time, and the results for travel demand. The next section discusses about the study area and the design of instrument for data collection.

2. Study area

The study area selected for the work is Thane municipal corporation (TMC), a major urban center of Mumbai Metropolitan Region (MMR), India (Figure.1). In the past, the development of various industrial estates and also the supporting residential and service employment has created the city more dynamic in nature. The city has developed in a circular fashion, expanding outwards from the initial CBD adjacent to the main railway station. Buses run by various transport undertakings are the present modes of public transport in Thane. The closeness of Thane to Greater Mumbai, the commercial capital of India, has resulted in a rapid growth both in population and employment. Thane municipal corporation area extends over 128.23 sq km and is divided into 11 sectors and 38 wards. However, some wards in the periphery of the TMC are quite large and have sparse population. Therefore, it is decided to conduct the study in the most activity oriented area of Thane Municipal Corporation. For that it was decided to collect data from the 31 wards out of the 38 wards available in TMC. These areas are expected to accommodate most of the developments within the TMC area.

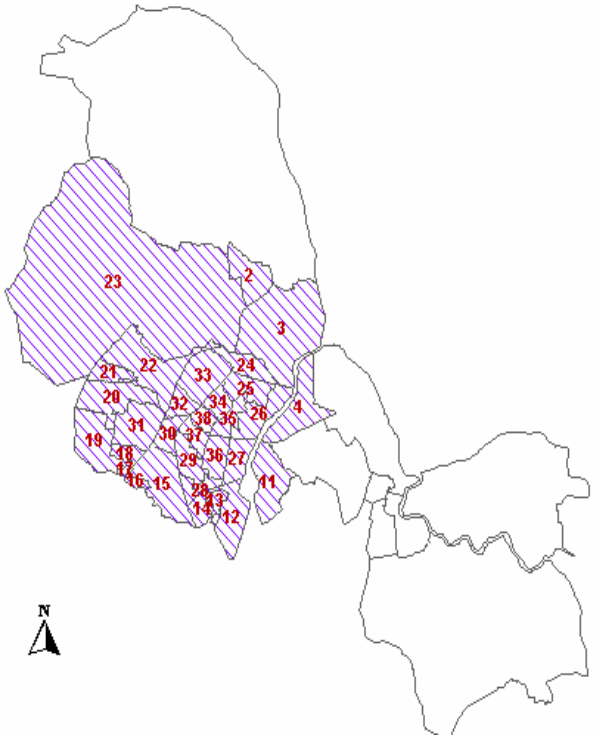

Figure 1 Selected Case Study Area

3. Survey instrument design

A new time- space diary format was designed for data collection, which integrates the features of the travel diary as well as time use diary. The design of this instrument was motivated by several observations. First, travel diary does not allow the respondents to report multiple activities conducted successively at the same location if the location is not the home. Second, reporting travel activities and other activities in a separate booklet does not encourage a consistent reporting of time of sequence across all activities, which may cause overlapping or gaps in reported times of successive activities. Third, the time- diary uses the same guiding principles for reporting activities and trips. In contrast to the activities, trips are best viewed as a connection between activity locations and have specific features, such as transport mode, stages and network characters. Probably the travel diary provides a more structured and natural format for encoding trips than does the time-use diary. Fourth as the number of sheets increase, the response rate of the people decreases and so number of sheets should be limited as far as possible.

The combined format collects detailed travel information and information about the activities. As with the travel diary format, extended information about all stages and stops of trips are asked. To synchronize the trips with the other activities, all activity related information is retrieved in the same booklet thus it was thought prudent that most efficient way to retrieve activity related information in the use of time- use diary format. In addition to the time space diary the household, personal details and details of travel of the private vehicle users were also asked for the pilot survey. Household details includes total members in the family, household ownership details, type of accommodation, family size, vehicle ownership,

income, and number of members having driving license in the family. Personal detail of the trip maker includes age, sex, monthly income, driving license details, education, occupation, travel pass details etc. Along with this, some addition details were also collected for the private vehicle users, they are average mileage of the vehicle per litre of petrol/ disel, amount getting from the employer for travel, distance of parking lot, type of parking lot used, ownership of the vehicle used for the travel, the seating position of the trip maker in the vehicle etc. These private mode features were not included in the diary since 89 per cent of the passengers are depending on the public transport system for their travel compared to the developed countries where they mostly depend on private vehicles.

4 Pilot survey

Based on the experiences of various researchers and giving due consideration to the different socioeconomic characteristics of the study area as compared to cities in developed countries, it was decided to conduct a pilot survey with the previously discussed objectives. The objective of the pilot-testing phase was to evaluate the performance of the time-space diary against the travel diary, which is commonly adopted for data collection in Indian condition. The diaries were tested by using a sample, consisting of people living in different residential locations in Thane. The sampling process ensured that sufficient variation was present in the sample regarding location and socio-demographic variables. The size of sample for pilot survey is decided using the thumb rule that 5 to 10 percent of the total survey budget can be spent on the pilot survey (Richardson et al., 1995a; Richardson, Wolf 2000). Accordingly a sample containing information on 50 to 100 households is supposed to be collected.

The pilot survey is carried out using two survey methods: face-to-face (FTF) interview method and drop and pick up (DAP) method. Out of the 258 households contacted FTF interview could be conducted in 96 households and DAP method in 162 households. Two day diary information is collected. One is for a holiday and other is for a working day. Stratified random sampling technique is adopted for the data collection. The information was collected from the eligible members of the randomly selected households, as per the survey population definition. The survey population has been defined as consisting members of the household, above five years of age.

4.1 Socioeconomic characteristics of sample for pilot survey

The data collected for the pilot survey was analysed and the salient features are presented here. Out of the total responses, 56% are males and 46% are females. The details by household demographics and economics show that the working force is 34%, 80% of households have four to five members , the average household size is 4.53 persons per household whereas it is 4.84 persons per household as per 1991 census., and 49% of households and individuals lie in the income range of 5,000 rupees to Rs15,000 . Around 22% of households have no vehicle and 3% have car, 29% have two-wheeler, 20% have bicycle and the rest 48% have combination of these vehicles. The type of accommodation can provide the economic status of the responding household. 41% of respondent have 1 bed room hall kitchen. The households possessing four or more rooms belong to the high income group, households possessing three rooms belong to the high to medium income group, the households possessing two rooms belong to the medium income group, and households possessing a single room belong to the low income group. The majority of respondents, 62%, belong to the 18–45 year age category. Forty-six percent are graduates or postgraduates, 23% possess professional degrees, and 28%

have an education up to the senior secondary level. About 82% of the respondents have their own house.

(Pas, 1982), places all out-of-home activities in the three broad categories of *subsistence, maintenance and leisure*. The same categorisation is taken for this work also. All work, work related and school is considered as subsistence and shopping and personal business as maintenance and leisure as optional activities engaged in for enjoyment. Subsistence tour for the day 1 is 76% whereas that for the day 2 only 10%. Maintenance tours are 14 and 62 per cent for the day 1 and day 2 respectively. Leisure tours come around 10% for day 1 with an increase of 18% in day 2. 41 per cent respondents were belonging in the middle income group. Average activities per person are found to be 7.87. Number of tours per day per person is at the rate of 1.5. Average trips per person per day come around 3.11 and that for tour is 2.11. stages per trip is 1.67 and average trips reported for home based work trip is 2.13 and that for home based non work trip is 2.34. Trips for the non home based trip are reported as 2.00.

The information has been analyzed for the identification of a satisfactory data collection technique and instrument format based on non-responses and missing data. These are discussed in the successive paragraphs.

A non-response analysis has been conducted to identify the most problematic parameters relating to different characteristics. In the case of household characteristics, the most problematic parameter to obtain is household income followed by household size and dwelling unit. Non-responses are more abundant in DAP. The non-response analysis has been discussed in the following contexts of different survey methods: First, the probable reasons of non-responses are examined and are given in Table 1. The hurdles were due to lack of eligible candidates at home while conducting the survey and non-availability of eligible candidates. Instances were also seen in eligible candidates at home unwilling to respond to the questionnaire survey. The responses to different parts of the survey instrument are presented in Table 2. It is noted that respondents are more comfortable in providing the revealed preference information where the responses are over 90 percent. In case of diary characteristics if the non-responses related to the travel distance and wait time are ignored then the response here also increases to above 90 per cent.

Table 1 Percent Non-Responses by Reason for Different Survey Methods

Description	**Face to Face Interview**	**Drop and Pick up Method**
Successfully Collected	69	8
Showed Un-Willingness	4	22
Eligible Person out	15	6
Lack of Eligible Person	12	2
Form Lost by Respondent	-	30
Requested to contact next week	-	32

Table 2: Percent Responses by Survey Methods to Different Characteristics

Section	Completely Filled		Partially Filled	
	FTF	DAP	FTF	DAP
Household Characteristics	95.3	80	4.7	20
Person Characteristics	95.84	94.29	04.16	5.71
Activity Diary Day1	94.5	84	6.5	16
Activity Diary Day 2	92	18	8	82

FTF: Face to Face; DAP: Drop and Pick up:

Average cost of FTF method is found to be Rs 14.00 and that for DAP method is Rs 83.50 as per the pilot interview.

The basic format of the instrument is found satisfactory. However for differentiating the housewife and non-earning member of the household, a category of no worker is introduced in the household size information. The problem with the writing of codes is eliminated by asking the respondent to tick the appropriate category. The experiences from the pilot surveys have clearly highlighted that instead of the DAP method, which gives best net response rate in west, FTF gives best response rate in developing countries. The face-to-face interview method is found better for collecting RP information. FTF method is selected for final survey from the economic point of view and the quality of work.

5 Main survey

The main survey used the same protocol. Back ground data was collected about the household and its members, and each member of the household completed a two day diary listing all on tour activities and travel. The survey contains 1500 household, giving more than 6500 persons and 13000 person-days travel and activities, more than 90 percentage of the sample is found to be useful. In addition to the survey conducted the following details were also collected. The development plan sheets (1981-2000) showing all the existing and some of the proposed land use features are procured from the zonal offices of Thane Municipal Corporation (TMC). The information about the planning variables has been taken from the CES (2001) report. Route map of the Thane -city and the suburbs is procured from TMT office. The distances between stations and the train schedules for finding the travel times between different pair of stations, travel distances and cost of travel by train are found from the time-table booklets available in the market.

5.1 Socio-economic characteristics

The descriptive statistics of the household in the final sample are provided on Table 3. Average ratio of the dependent members to the workers is 1.8 and the average household size is 4.63. It is observed from the analysis of vehicle occupancy that around 55% of households have no vehicle and 40 % of households have exactly one vehicle at home. The other 5% of households have two or three vehicles per household. Workers constitute one fourth and students constitute half of the total population. Each worker is supporting, on average, 2.7 members per household termed as the dependency factor. 90 percentage of the respondent participated in the survey residing in their own house and 54% of households lie in the income range of Rs 5,000 to Rs15,000. The details by household demographics and economics shows that the working force is 36% and 65% of households have four to five members. The study of

relationships among members of household who have responded shows that 28 percent respondents are household head. It is required to define household head here. Household Head is the main earning member of the household, preferably a male member. A retired person in such a case is not taken as a household head. About 54 percent respondents are belonging to the children category.

Table 3 Descriptive Sample Statistics

Variable	Mean	S.D
Household Socio-Demographics		
Household Size	4.54	1.18
Male	2.48	0.9
female	2.06	0.9
Number of Children less than 5 yrs	0.05	0.23
Number of children between 5 and 17	1.72	0.93
Number of individual between 18 and 25	1.62	0.68
Number of individual between 26 and 35	0.14	0.41
Number of individual between 36and 45	1	0.76
Passenger Car	0.11	0.31
Motorised Two wheeler	0.5	0.6
Bi-cycle	0.25	0.42
Number of Driving license	0.73	0.87

The survey population distribution by the gender has been 63 percent males and 37 percent females. According to the distribution by age group, around 36 percent persons in of age range between 25and 45 years. The respondents in the age group of 17 and 25 years are 21 percent and of age 45 to 60 years are 8 percent. The license holding respondents are 52 percent in the study area, in which 2 percent people have car licence,13 percent people have two wheeler license, 39 percent have both the car and two-wheeler license and the rest 48 percent people do not have any license. Distribution of respondent by education level, it is found that 25 percent respondents are graduate or more. Professional comes around 5 percentage in the sample. It can be noted that around 13 percent respondents are in government service and 20 percentage respondents are in private sector. Around 10 percent is working in business sector whereas only 1.5 percentage is comes in public sector employment. Student's category is predominating by 48 percentages.

5.2 Diary characteristics

Two day diary details have collected for the final survey. For the respondents who do not have any out home activity during the holiday is asked to fill for the diary for another working day, so that 2 samples will get from one respondent. 54 percentages says that they have out home activity during the holiday. Rest 46 percentage respondents say that they will be at home through out the holiday. The analysis of these two days is done separately. Table 4 presents the sample pattern distribution by primary activity for the day 1 and day2 respectively. In Table 2 possible changes in choice of the activity type based on the classification of out-home activities into three categories is considered. The decreased frequency of subsistence activities

in day 2 on one hand and increased frequency of leisure activities on other is striking. There is a substantial increase in maintenance activities for day 2 from 8 to 27 percentages.

Table 4 Sample Pattern Distribution by Primary Activity for the Day 1 and Day2

Activity Type	Day 1	Day 2
Subsistence on tour	**87**	**23**
no extra stops	85	93.5
stop after	12	4.5
stop before	1.2	1
stop between	1	0.5
stop before and after	0.8	0.5
Maintenance on tour	**8**	**27**
no extra stops	93	89
stop after	4	7
stop before	1	1
stop between	1	0
stop before and after	1	4
Leisure on tour	**5**	**50**
no extra stops	90	83.35
stop after	5	9
stop before	5	3.5
stop between	0	3
stop before and after	0	0.15

Day 1- working Day Day 2- Holiday

The trip chaining considered here as a facet of an out home activity. The option considered are defined on the basis of the locations of preceding and succeeding activities: a trip is classified as a no stop if both preceding and succeeding activities are home based, an after stop is only if the preceding activities is out of home, a before stop if only the succeeding activity is out of home, and a between stop if both the activities are out of home. Compared to the other stop chaining after stop chaining found to have higher percentage this may be due to the fact that the maintenance activity and leisure activity are carried out on the way back home rather than going out after reaching home. The total home based work trip for day 1 is 87 percent whereas that for day2 is 24 percent. Home based non work trip comes 12 percent for day 1 and that of 76 percent for day2. Non home based work trip have very low value of 1 per cent on day 1 and 0.15 percent for day2. . Table 5 presents the sample pattern distribution by number & purpose of secondary tours for the day 1 and day2 respectively. Around 87 percentage of activity pattern have only 0 secondary tours for day1 as well as for day2. Single secondary tour is found to be higher both for day 1 and day 2.

Table 6 represents sample pattern distribution by mode for primary tour. The result shows an increase in use of the car mode on holidays. This gives a clear indication of family outing on holiday. Similarly the percentage use of the mode auto is higher for leisure and maintenance tours. The percentage uses of walking trip for maintenance and leisure tours are high for the working day due to respondent's preference to nearby areas for such activities, whereas the survey witnessed a fall of 30 per cent from 70 per cent on a working day.

Table 5 Sample Pattern Distribution by Number & Purpose Of Secondary Tours

Pattern Description	Day1	Day2
0 Tour	87.6	88.85
1 secondary subsistence tour	3.4	1
1 secondary maintenance tour	2.7	2
1 secondary leisure tour	4.9	7
2+ secondary subsistence tours	0.5	1.30
2+ secondary leisure tours	-	5.8
1+ secondary subsistence and 1+ secondary leisure tours	0.5	2.9
1+ secondary maintenance and 1+ secondary leisure tours	0.4	-

Table 6 Sample Pattern Distribution by Mode for Primary Tour

Mode of travel	Day 1			Day 2		
	S	M	L	S	M	L
Auto with Walk Access	11	20	9	3	22	17
Bus with Walk Access	58	5	5	24	24	23
Car	4	3	0	1.5	1	6
Cycle	1	1	3	5.5	2	4
Two-wheeler	6	1	5	13	7	8
Walk	20	70	78	53	44	42

Five time periods were considered for the analysis. In the early time period, time before 7AM is considered. Time between 7AM and 9.30 AM is considered as AM., 9.30 AM to 4PM to consider as Mid. 4PM to 7PM is considered as PM and 7PM to 2AM is considered as Late. Table 7 reports the percentage of travel activity by start time taking all activities for day 1 and day 2 respectively. From the result it was found that no subsistence trip originated at late time. The maintenance and leisure activity for day 1 was mainly carried out at the PM time.

Table 7 Sample Pattern Distribution by Starting Time for Activity Type Choice

Starting Time (leaving time from home)	Day 1			Day 2		
	S	M	L	S	M	L
Early	21	1.5	3	9	2	1
AM	50	9	6	45	10	28
Mid	26	10.5	6	24	37	25
PM	3	76	67	21	50	45
Late	0	3	18	1	1	1

Table 8 shows the percentage of activity by end time taking all activities for day 1 and day 2 respectively. From the results it was found that for the subsistence activity, with the ending time at PM period, have the highest percentage compared to other timings similarly for maintenance & leisure activities, it is at late time. Day 2 for maintenance and leisure

activities, the maximum percentage was found for the late period and that for subsistence activity at mid time.

Table 8 Sample Pattern Distribution by Starting Time for Activity Type Choice

Ending Time	Day 1			Day 2		
	S	M	L	S	M	L
Early	0.1	0	0	1	0	0
AM	0.1	0	3	4	0	3
Mid	38	15	6	49	43	15
PM	47	27	24	30	14	43
Late	14.8	58	67	16	43	39

In Table 9 sample pattern distribution of tour time for activity type choice **(**combinations of the time period for starting and ending time of tours) is given. For the subsistence tour the combination of AM-PM is found to be highest. AM-Mid and Mid- PM combination also have a value of around 25 percent. Majority of maintenance and leisure activity was taking place during the time PM-Late for day1 and day 2, where as subsistence activity dominates the time period AM-Mid period.

Table 9 Sample pattern distribution of Tour Time for Activity Type Choice

Time combination for the tour	Day 1			Day 2		
	S	M	L	S	M	L
AM-AM	0.16			2.56		1.93
AM-Late	9.41			1.25		1
AM-Mid	**23.86**	7.46	6.06	**23**	9.36	5.9
AM-PM	**29**	1.5		12	0.85	19.32
e-AM			3.03	.64		1
e-Late	0.81					
e-Mid				6.4	1.7	
e-PM	4.00	1.5		.64		
Late-Late		4.5	18.18	13.5	0.85	1
Mid-Mid		7.5		14.1	3.23	9
Mid-Late	2.43				0.85	1.5
Mid-PM	**25.81**	3	6.06	7.05	3.4	14
Pm-e	.16			.64		
PM-Late	2.75	**53.7**	**48.48**	11.5	**40.85**	**35**
PM-PM	1.3	20.9	18.18	6.41	9.78	10.14

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Table 10 represents results in terms of number of indicators for day 1 and day2 respectively. Activity travel pattern indicator is found to be approximately same for both day 1 and day 2 respectively, except for average activity took place in a day.

Table 10 Indicators of Activity Travel Pattern.

Sl.No	Indicators	Day1	Day2
(1)	(2)	(3)	(4)
	Category 1: # Activities and Trips		
1.	Activities (per person per day)	7.3	5.15
2.	Number of Tour (per person per Day)	1.375	1.45
3.	Trips (per person per day)	3.00	3.02
4.	Trips (per tour)	2.19	2.17
	Category 2: Trip Rate		
1.	HBW Trips	2.19	2.27
2.	HBNW Trips	2.05	2.045
3.	NHB Trips	2.0	2.0

6. Discussion and results

Pilot survey was conducted to evaluate the performance of the newly designed time-space diary and to select the most suitable data collection method out of the drop and pick up method and face-to-face personal interview. Direct interview is found to be the most suitable method of data collection in Indian conditions with an added advantage of saving money and improvement in quality of data.

The comparison of response rates recorded by the two data collection techniques in consideration shows that face to face (FTF) personal interview method is far superior to drop and pick up (DAP) method. The response rate in DAP method was found very low at around 8 per cent, while the FTF recorded as high as 69 per cent.

The analysis of the responses during data collection in the study area is based on two days -----on a working day and a holiday----of the respondent's diary information. More than 90 per cent of the data collected from 1,500 households was found to be resourceful. It is found that 90 per cent of people were living in their own house, 52 per cent lived in a 1 bed room-hall kitchen accommodation. The average household size was found to be 4.54 persons per household and vehicle ownership per household at 0.81. On an overall basis the average household income ranges between Rs 10,000 and 15000 per household. The dependency factor, an indicator of affluence, is 2.8 per worker. More respondents are found to be belonging to the age group between 5-- 25 years.

The subsistence activity is found to be 57 per cent for day one and 23 per cent for day two. Leisure activity comes around 50 per cent for the day2 offering a clear indication to family outings on day 2. The percentage uses of walking trip for maintenance and leisure tours are high on a working day due to respondent's preference to nearby areas for such activities, whereas the survey witnessed a fall of 30 per cent from 70 per cent on a working day.

The total home-based work trip for day 1 is 87 per cent whereas it is found to be 24 per cent for day 2. Home based non-work trip comes 12 per cent for day 1 and 76 per cent for day2. Non home based work trip was a meager 1 per cent on day 1 and 0.15 per cent for day2.

Around 87 percentage of activity pattern have only 0 secondary tours for day1 as well as for day2. Single secondary tour is found to be higher both for day 1 and day 2.

Around 87 per cent of activity by trip chaining has only 1 stop for both all activities and subsistence activities. After stop chaining is found to be higher in both day 1 and day2.

From the result it was found that no subsistence trip originated late time. The maintenance and leisure activity for day 1 was mainly carried out at the PM time.

From the results it was found that for the subsistence activity, with an ending time at PM period, have the highest percentage compared to other timings. Similarly it is late time for maintenance & leisure activities.

Day 2 for maintenance and leisure activities, the maximum percentage was found for the late period and that for subsistence activity at mid time. For the Subsistence tour the combination of AM-PM is found to be highest. AM-Mid and Mid- PM combination also have a value of around 25 per cent. Majority of maintenance and leisure activity was taking place during the time PM-Late for day1 and day 2, where as subsistence activity dominates the time period AM-Mid period.

Activity travel pattern indicator is found to be approximately same for both day 1 and day 2 respectively, except for average activity took place in a day

The above discussion clearly highlights that the socio-economic characteristics of the person and the household have pronounced effect on the responses and the activity behaviour. In the light of above, the following contributions have been made from this study.

A clear effect of the socio-economic characteristics has been found on the overall response rates, the cost of survey, the time taken for individual response and the effective contacts made by a survey enumerator. It is ascertained that 80 to 90 per cent positive responses can be collected by convincing the respondents about the significance of the survey.

7. Conclusion

A detailed analysis has been presented in the previous paragraphs spanning on revealed information analysis covering household characteristics, personal characteristics and diary details. It has become very clear from the analysis that the socio-economic characteristics of the person and the household have a pronounced impact on the responses given by the respondents of an area. Activity, travel, time-use information derived from surveys conducted in Thane City has been analysed to identify differences in activity engagement patterns across different sample groups. In addition to that the impact of socio- economic variable such as income, sex, age etc on activity pattern is also taken into consideration. These events were considered important in defining the temporal constraints under which the people exercise activity and travel choices.

The main contribution of the works are ---- 1) A new activity diary has been designed in the context of developing city, which combines the advantage of both travel and time use diary format and it is effectively applied in the study area. 2) A small scale pattern analysis has been carried out in the context of developing country. 3) The most suitable method of data collection both from the economic and quality point is identified for the Indian context.

The data collected for analyzing pattern is useful in formulating models like mode and destination choice models, tour and day-activity models, which will be useful for travel demand forecasting and determining the effect of different policy analysis on travel pattern.

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