

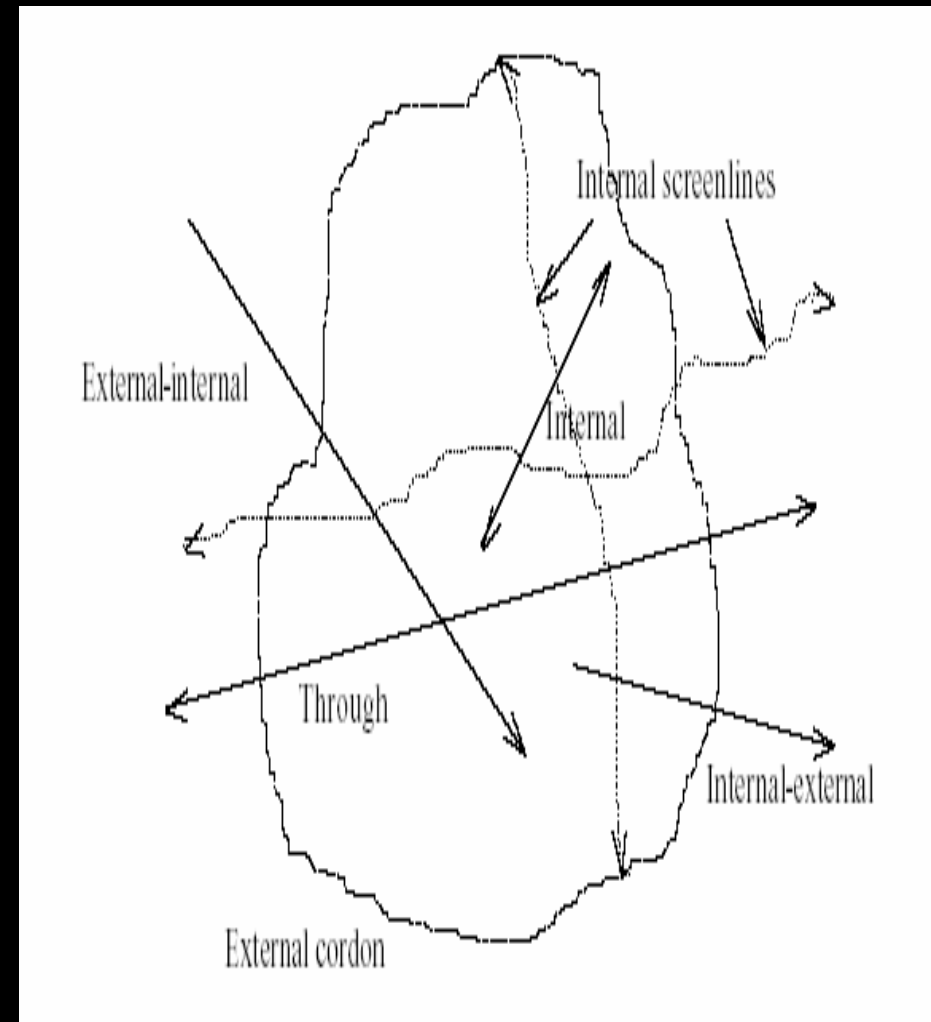
Base Year Travel Pattern

- It is mainly explained by the exchange of trips between Traffic Analysis Zones for various purposes and by various modes.
- The travel pattern is normally represented by O-D Matrix
- The O-D matrices or trip matrices are prepared purpose wise, mode wise etc.

EXTERNAL AND INTERNAL TRIPS

The travel pattern in a study area is a result of four types of movements

- External-Internal movements (EI)
- Internal-External movement(IE)
- Internal - Internal movements(II)
- External – External Movements (EE)



Origin – Destination Matrix

		j									
i			T_{ij}								O_i
	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	
	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	
			D_j								

Data Sources for O-D Matrix

- Home Interview Survey
- Road Side O-D Survey
- O-D Surveys at terminals
- Public Transport In Vehicle Surveys
- Passenger surveys at terminals

Internal to Internal Trips(II)	Home Interview Surveys
External to External Trips (EE) and Internal to External Trips (IE)	Road Side Interview Surveys, Terminal Surveys and Home Interview Surveys
External to External Trips (EE)	Purely Road Side Surveys

In Vehicle Surveys are required for getting their Origin and Destinations

HOME INTERVIEW SURVEY

- In a home interview survey three broad items are collected.
 - **Household Information:**
It includes household size, dwelling unit type, vehicle ownership, family income, etc.
 - **Person Information:**
It consists of relation to head of household, age, sex, occupation, income, possession of driving license, etc.
 - **Trip Information:**
The residents are generally asked to describe their movements on the previous day (A typical working day).

SAMPLING METHODS

- **Random sampling method:**

The method requires that all the households are allocated a number and that the sample is drawn from the population at random

- **Stratified sampling:**

In this method, based on the prior information, the population/households are divided into homogeneous groups or strata

- **Choice Based Sampling:**

This method is used when data is needed about options with a low probability of choice in the population

Sampling Errors

- Two Types of errors occur when taking a sample, they are
- The first is simply due to the fact that we are dealing with the sample and not the total population i.e it always be present due to random effects.
- The second one is sampling bias which is caused by wrong selection of sampling method, data collection method or any other part of process.

SAMPLE SIZE

- The size of the sample (i.e. the number of households to be interviewed) depends on the size of the total population and the accuracy that is required for the study.

Population	Sample Size %	
	Minimum	Recommended
50,000	10	20
50,000-1,50,000	5	12.5
1,50,000-3,00,000	3	10
3,00,000-5,00,000	2	6.67
5,00,000-10,00,000	1.5	5
10,00,000	1	4

Sample Size

$$n = \frac{CV^2 Z_{\alpha}^2}{E^2}$$

CV = Coefficient of Variation

E = The level of accuracy

Z_{α} = The value of the standard normal variate for the confidence level required

SURVEY DATA CODING, CORRECTION

- **Coding:**

The survey data have to be transformed to the form suitable for electronic data processing. This takes the form of assigning each piece of information a numeric code or alphanumeric code.

- **Correction:**

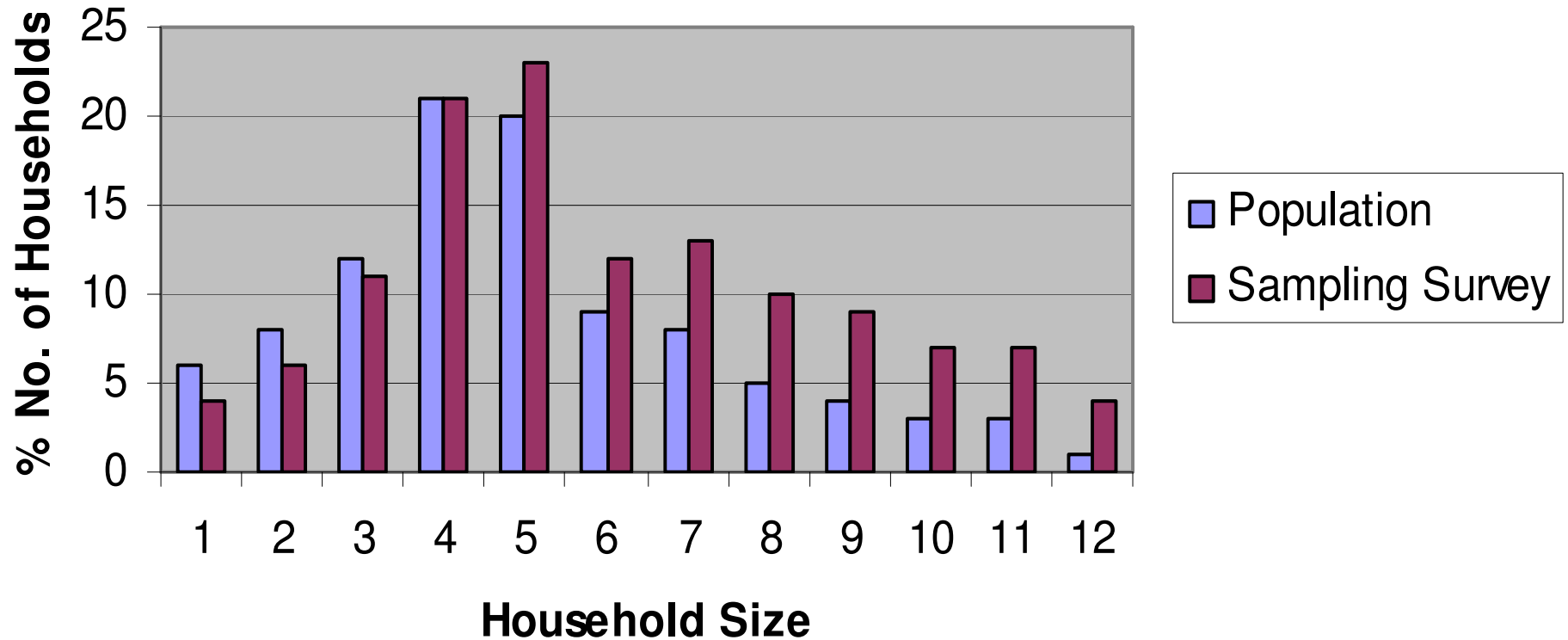
Home interview data should not vary by more than 15% of adjusted census data . Correction for bias could be applied by comparing the sample proportions with those observed in the census data and suitably working out the weightages.

Sampling Theory

- It States that “ For a perfectly Random Sample the sample proportion should exactly match with the Population Proportion” .
- This is explained by an example in the next slide.

Elimination of Sampling Bias Example

Sampling Bias



Elimination of Bias

HH Size	Weightage Factor
1	1.5254
2	1.3225
3	1.1467
4	0.9942
5	0.8620
6	0.7474
7	0.6480
8	0.5618
9	0.4871
10	0.4224
11	0.3662
12	0.3175

Comparison between Sample and Census Data

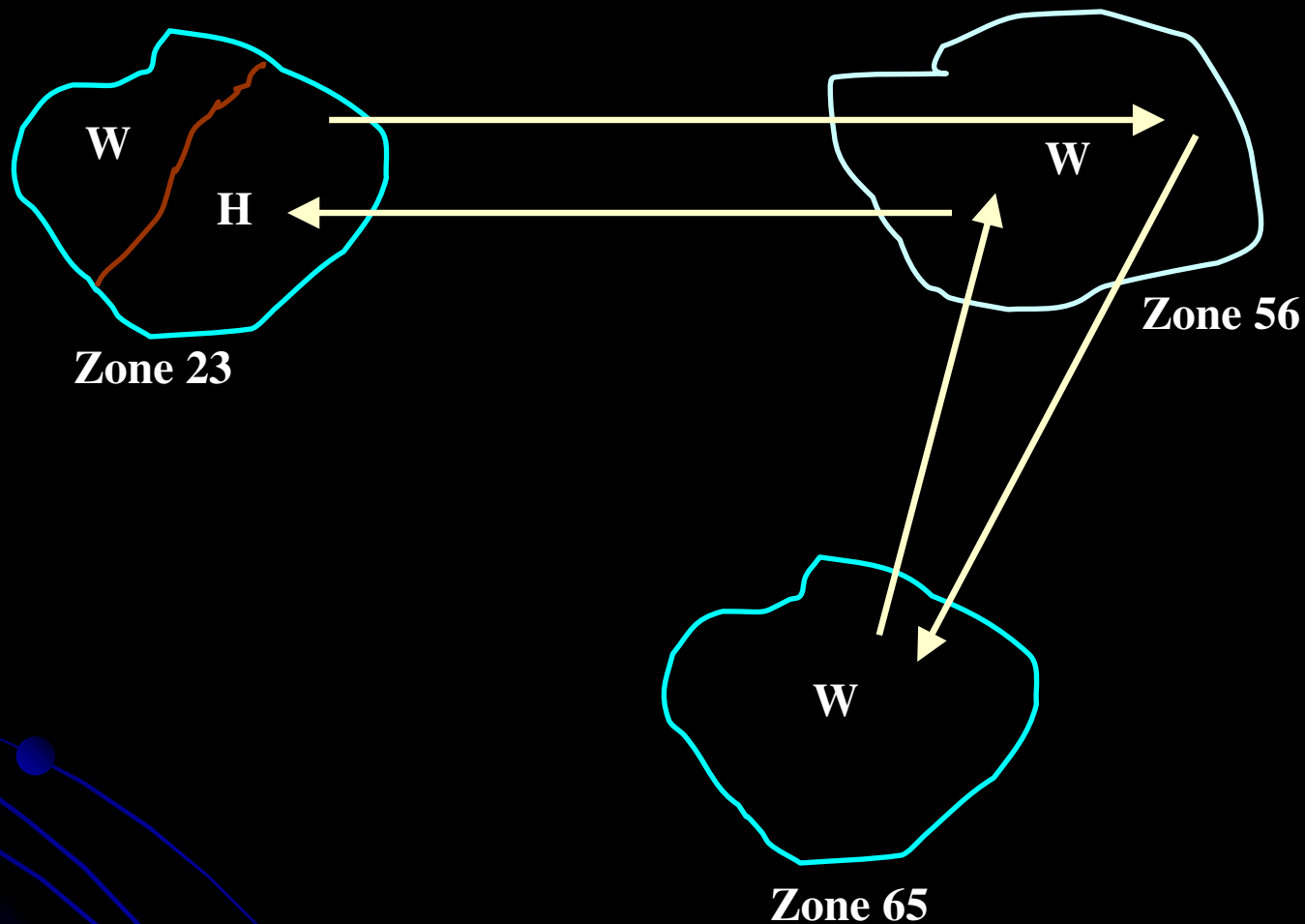
Parameter	HIS Sample Population*	1991 Census Population*
Household Size	3.734	3.749
Workforce Ratio	36.30	37.17
Male-Female Ratio	1.198	1.170

Other Data to be collected

- The Parameters required for estimating the travel demand generated at Zonal level are
 - Population
 - Employment (Category-wise) in work places
 - Vehicle Ownership

Zonal Expansion Factors

- To transform the sample data to the zonal population and to obtain the aggregate demographic, socio-economic and travel characteristics, expansion factors are to be obtained using the corrected household sample data.
- If the no of households in the base year are not readily available from any source then the data can be estimated by extrapolating the available zonal population figures to the base year and dividing it by the observed zonal average household size of existing Census.



All the above trips are to be expanded based on the expansion factor of Zone 23

Expansion and Validation

- Expansion:

Ideally the data collected from the sample can be expanded using the ratio of population/sample. The results of the interviews can therefore be expanded using the following formula:

$$F = (A - (A * C / B)) / (B - C - D)$$

Where,

F = the expansion factor.

A = the number of addresses.

B = the number of addresses selected as the original sample.

C = the number of addresses that were not eligible for interviews.

D = the number of eligible addresses at which an interview could not be conducted.

Validation:

The data is then compared with that actually counted and suitably transformed by means of occupancy rates at cordon lines and screen lines during roadside O-D surveys.

Presentation of Home Interview Survey Data

- Depending on the requirements of the traffic planner various summaries can be produced from the home interview survey data.
- One important and basic summary that is always obtained from the analysis is the travel pattern of the study area documented in the form of a Origin – Destination (O-D) matrix.
- Matrices can be prepared based on mode used, trip purpose, time-of-day of travel, etc., for further use in planning.

Home Interview Survey Questionnaire Format

Name of Interviewee :	Date :
Name of Interviewer :	Time :

Part I - Household Information

1.1 Ward No. 1.2 Electoral Part No. 1.3 S No in Voters List

1.4 Name and Address of Respondent _____
(including Pin Code) _____

Telephone No. _____

1.5 House Ownership - Tick ()

<input style="width: 40px; height: 20px;" type="checkbox"/>	<input style="width: 40px; height: 20px;" type="checkbox"/>	<input style="width: 40px; height: 20px;" type="checkbox"/>	<input style="width: 40px; height: 20px;" type="checkbox"/>
Own	Rented	Govt. Quarters	Company House

1.6 Built-Up Area - Tick ()

<input style="width: 40px; height: 20px;" type="checkbox"/>	<input style="width: 40px; height: 20px;" type="checkbox"/>	<input style="width: 40px; height: 20px;" type="checkbox"/>	<input style="width: 40px; height: 20px;" type="checkbox"/>	<input style="width: 40px; height: 20px;" type="checkbox"/>
<250 sq. ft	250-500 sq. ft	501-750 sq. ft	751-1000 sq. ft	> 1000 sq. ft

1.7 No. of persons in the family
(5 Years and above)

<input style="width: 40px; height: 20px;" type="text"/>	<input style="width: 40px; height: 20px;" type="text"/>	<input style="width: 40px; height: 20px;" type="text"/>
No of Males	No. of Females	Total Persons

1.8 No. of Vehicles Owned by Household

<input style="width: 40px; height: 20px;" type="text"/>	<input style="width: 40px; height: 20px;" type="text"/>	<input style="width: 40px; height: 20px;" type="text"/>	<input style="width: 40px; height: 20px;" type="text"/>	<input style="width: 40px; height: 20px;" type="text"/>
2 Wheeler/ moped	Car/ Jeep	Auto	Taxi	Cycle

Part II - Personal Level Information

2.1 Details of Each Member of Household (5 Years & above)

Person No.	Relation with Head of Family	Age	Sex	Education Level	Occupation	Place of Work/ Study	Income per month (Rs)	Vehicle Ownership	Driving License Holder	Pass Holder	Cost of Pass	Avg. Monthly Exp. on Travel
1	2	3	4	5	6	7	8	9	10	11	12	13
1												
2												
3												
4												
5												
6												
7												
8												
9												

Codes

Col. 2	Relation with Head of Family	Head =1	Wife/ Husband = 2	Son/ Daughter =3	Father/ Mother = 4	Others = 5
Col. 4	Sex	Male =1	Female = 2			
Col. 5	Education	Illiterate = 1	Upto SSC = 2	Upto HSC =3	Graduation & above = 4	
Col. 6	Occupation	Service =1	Farmer/ = 2 Labourer	Business/ = 3 Profession	Student = 4	Housewife = 5 Retired/ = 6 Unemployed
Col. 8	Income	Upto 2000 = 1	2001 - 5000 = 2	5001 - 10,000 = 3	10,001 - 15,000 = 4	15,001 - 20,000 = 5 20001 - 30,000 = 6 30,001 - 40,000 = 7 > 40,000 = 8
Col. 9	Vehicle Ownership	Car/ Jeep/ Van =1	Two Wheeler = 2	Auto = 3	Taxi = 4	Cycle = 5
Col.10	Driving License	No License = 0	Two Wheeler = 1	Car = 2		
Col. 11	Pass Holder	No Pass Holder = 0	1st Monthly Rly = 1	1st Quarterly Rly = 2	2nd Monthly Rly = 3	2nd Quarterly Rly = 4 Rail Concession = 5 Bus Pass = 6

HIS Formats

- Household Information
- Person Information
- Trip Information

**DELHI METRO RAIL CORPORATION (DMRC)
MASTER PLANNING FOR PUNE METRO - HOME INTERVIEW SURVEY**

PART I: Household Data Sheet

Page no. 1

Household Serial Number			
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Map References

HOUSEHOLD LOCATION

Assembly/ Ward No.	<input type="text"/>	<input type="text"/>	<input type="text"/>	Electoral Ward No.	<input type="text"/>	<input type="text"/>	<input type="text"/>
Building Name /Number	<input type="text"/>						
Street Name	<input type="text"/>						
Locality	<input type="text"/>						
Area Name	<input type="text"/>						
Landmark1	<input type="text"/>						
Landmark2	<input type="text"/>						
Landmark3	<input type="text"/>						
PIN Code	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Name of Head of Household	<input type="text"/>						
Contact Tel. No.	<input type="text"/>						

Interview No.	<input type="text"/>	<input type="text"/>	<input type="text"/>	Day	<input type="text"/>	Month	<input type="text"/>
	Date of Interview			<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Interviewer	<input type="text"/>						
Supervisor	<input type="text"/>						
Interview Status	Refused	Partial	Full				
Household Data Sheet	<input type="text"/>	<input type="text"/>	<input type="text"/>				
Personal Data	<input type="text"/>	<input type="text"/>	<input type="text"/>				
Trip Information	<input type="text"/>	<input type="text"/>	<input type="text"/>				

Type of Residence		Ownership			Total no. of Rooms
		Owned	Rented	Employer Provided	
Apartment/Flat	1				
Independent House	2				
Common Gallery	3				
Slum	4				

No. vehicle per household for personal use	Owned by household	Owned by others
Cars		
2-Wheelers		
Bicycles		
Others		
Parking Available at household	Private Spaces	Park on Street
Cars		
2-Wheelers		
Others		

Total no persons living in household

Persons in household of age less than 5 years

Part II - Person Information

Details of Each Member of Household (5 Years & above)

Page No. 2

Person No.	Relation with Head of Family	Age	Sex	Education Level	Occupation	Type of work place	Income per month (Rs in thousands)	Driving License	Type of travel pass	Cost of Pass (Rs)
1	2	3	4	5	6	7	8	9	10	11
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Codes											
Col. 2	Relation with Head of Family	Head = 1			Wife/ Husband = 2		Son/ Daughter = 3		Father/ Mother = 4		Others = 5
Col. 4	Sex	M / F									
Col. 5	Education	Illiterate = 1		Below SSC = 2		Upto HSC = 3			Graduation & above = 4		
Col. 6	Occupation	Employed (Full time) = 1		Employed (Part time) = 2		Self employed = 3		Student = 4		Daily wage = 5	Others = 6
Col. 7	Type of work place	Residential = 1	Industry/ Warehouse/ Factory = 2		Office/ IT /Bank = 3	Shop=4	Educational Institute = 5	Hotel/ Restaurant = 6	Entertainment/ Tourism = 7	Others = 8	
Col. 9	Driving License	Y / N									
Col. 10	Type of Travel Pass	No Pass = 0		Bus weekly pass = 1		Bus monthly pass = 2		Rail monthly pass = 3			

Part III - Trip Information

Most recent working day for which travel is being reported:

(Exclude Saturday & Sunday)

Person No.	Trip No.	Origin	Type of Origin	Destination	Type of Destination	Start time of Journey (24 hr clock)	Mode of Travel	Waiting Time (min)	Travel Time (min)	Travel Cost (Rs)	Parking Cost (Rs)
1	2	3	4	5	6	7	8	9	10	11	12
		Area		Area							
		Locality		Locality							
		Landmark		Landmark							
		Area		Area							
		Locality		Locality							
		Landmark		Landmark							
		Area		Area							
		Locality		Locality							
		Landmark		Landmark							
		Area		Area							
		Locality		Locality							
		Landmark		Landmark							
		Area		Area							
		Locality		Locality							
		Landmark		Landmark							
		Area		Area							
		Locality		Locality							
		Landmark		Landmark							
		Area		Area							
		Locality		Locality							
		Landmark		Landmark							

Codes													
Col. 4&6:	<i>Type of Origin/ Destination</i>	Residence = 1	Work = 2	Education = 3	Shopping = 4	Social/ Recreational = 5	Business = 6	Change of Mode = 7	Other purposes = 8				
Col. 8:	<i>Mode of Travel</i>	Walk = 1	Cycle = 2	Two wheeler = 3	Car = 4	Autorickshaw = 5	Six Seater = 6	Chartered/ Contract Bus = 7	PMT/ PCMT = 8	ST Bus = 9	Rail = 10	Govt/ Company car = 11	Car pool = 12

Conventional Method

- Electoral list
- Generate Random Houses
- Interview Randomly Generated Houses

Drawbacks

- Spatial Distribution
- Economic Strata
- Location of Identified House
- Rejection at Identified House

Index Map



INDEX MAP OF PUNE - PUNE METRO HOME INTERVIEW SURVEY



lat 18.495274° lon 73.864338° S.T. Colony

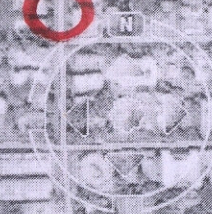
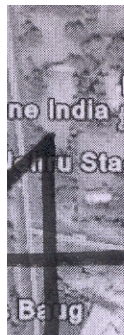
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Streaming 100% Zambre Palace

Google

Eye alt





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Goog

Salient Features

Pune Metro Rail – Salient Features

- Up to 50% reduction in travel times
- Cost of Travel will be comparable to bus Fare
- Trains will run at a convenient frequency of 3 min during peak hours.
- Comfortable Sitting in A/C environment



Metro Rail on the Tracks

- All stations will be equipped with emergency stop buttons and keeping in mind the Indian milieu along with facilities for physically challenged
- State-of-art computerized ticketing system that saves time and facilitates uninterrupted flow of traffic



Automatic Ticketing Counters

- Fully Air-conditioned coaches for hassle free trips everyday
- Passenger Information Display & Public address system at all stations and inside trains



Metro Rail Coach

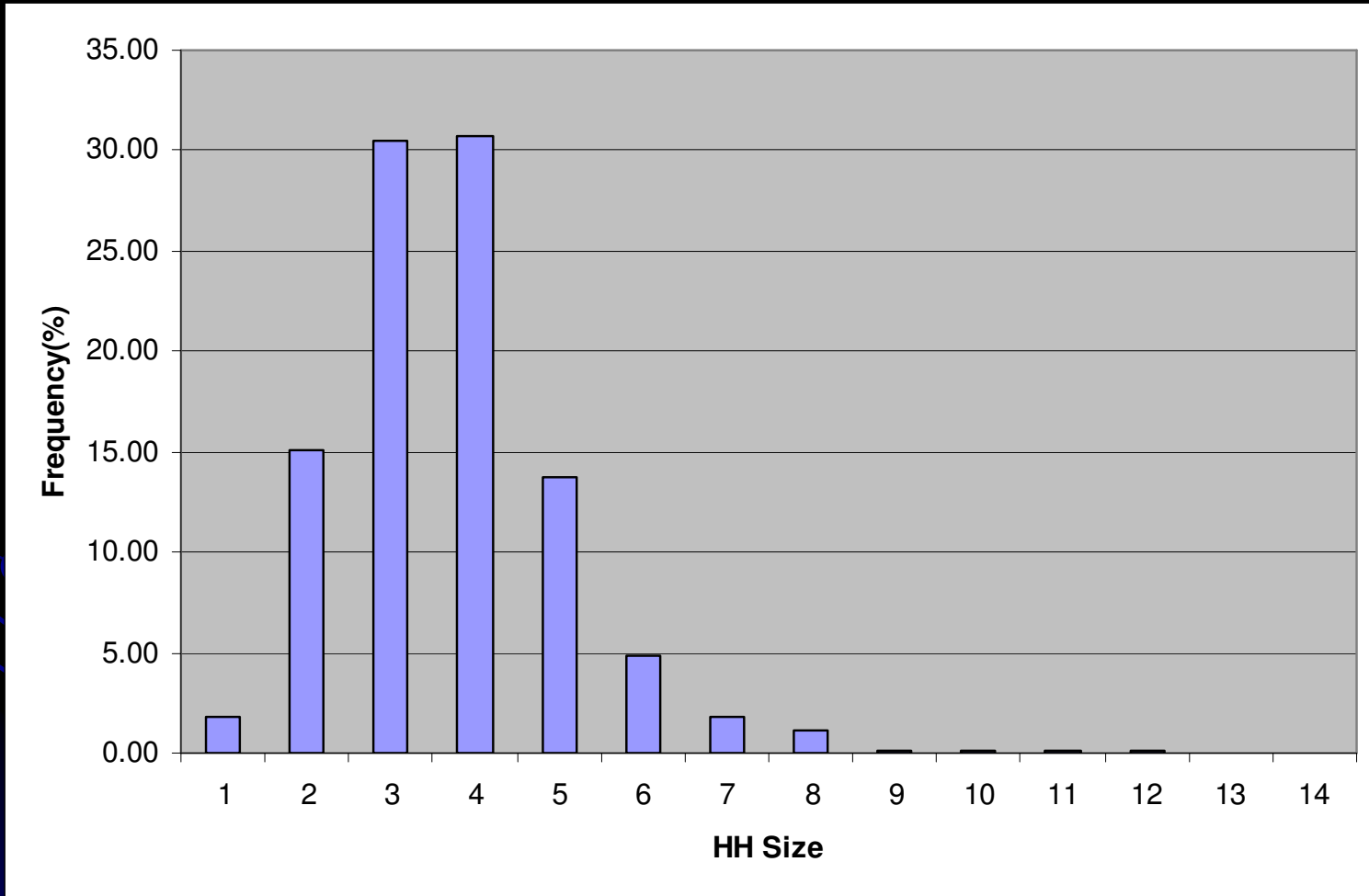
State-of-the-art Safety Features

- a) Automatic door closing with safety features
- b) precaution Power Back-up Facility
- c) Fire-resistant Coaches
- d) Emergency Wireless passenger and driver communication system



Your whole hearted participation in this home interview survey will help in deciding the best routes for this proposed metro rail system

Summary



□ Household size obtained from the sample: 3.70

Elimination of Bias from HIS Sample

HH Size	Weightage Factor
1	1.00
2	0.43
3	0.50
4	1.00
5	2.32
6	2.00
7 & above	1.00

- ❑ Household size obtained from the sample: 3.70
- ❑ Household size as per census 2001: 4.54
- ❑ Household size after applying the weightage factors: 4.31