Data analysis in Trip distribution

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Four-stage Travel demand forecasting method:

1. Trip Generation
2. Trip Distribution
3. Mode Choice
4. Trip Assignment

What is Trip Distribution?

Trips generated from each zone are distributed to all other zones as per choice of destination.

Two methods are used in the trip distribution stage:

1. ***Growth factor methods***, which are:

a. Constant factor method.

b. Average factor method.

c. Detroit factor method.

d. Fratar method.

e. Furness method.

2. ***Synthetic methods using gravity-type models or opportunity models.***

In this talk, we will discuss two classical trip distribution models:

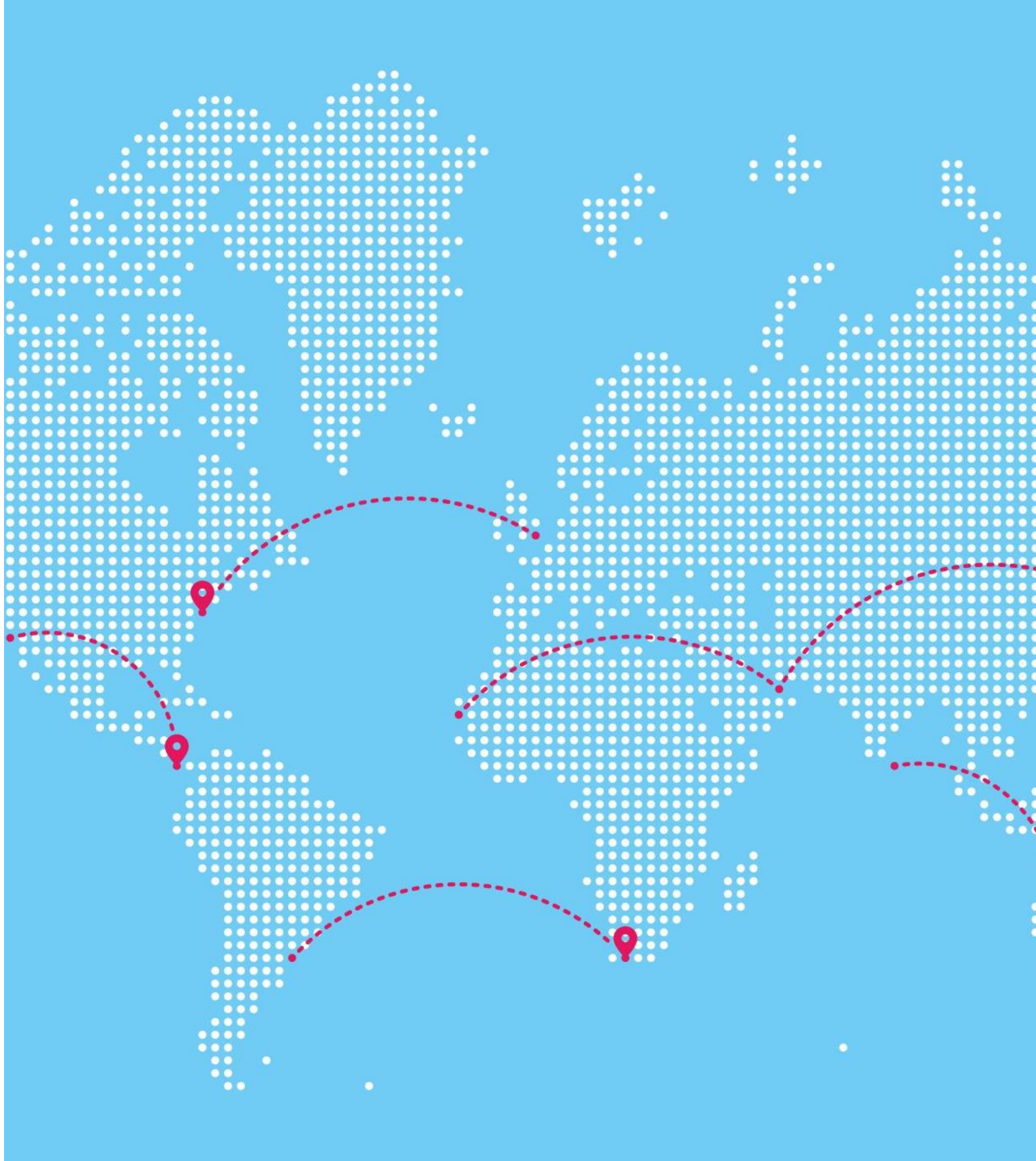
Gravity Model:

Internal trips

Growth Factor Model:

External Trips (limited information on travel impedance).

- ❑Trip distribution using these classical models is undertaken separately for different trip purposes.



Origin-Destination Matrix :

An O-D matrix shows the trip pattern distribution of an area.

Zones	1	2	...	j	...	n	O_i
1	T_{11}	T_{12}	...	T_1j	...	T_1n	O_1
2	T_{21}	T_{22}	...	T_2j	...	T_2n	O_2
...	...	...	...	...	...	...	...
	T_{i1}	T_{i2}	...	T_ij	...	T_in	O_i
...	...	...	...	...	...	...	...
n	Tn_i	Tn_2	...	Tnj		Tnn	On
Dj	D_1	D_2	...	Dj	...	Dn	T

Skim Table (Based on base year and target year inter zonal impedance).

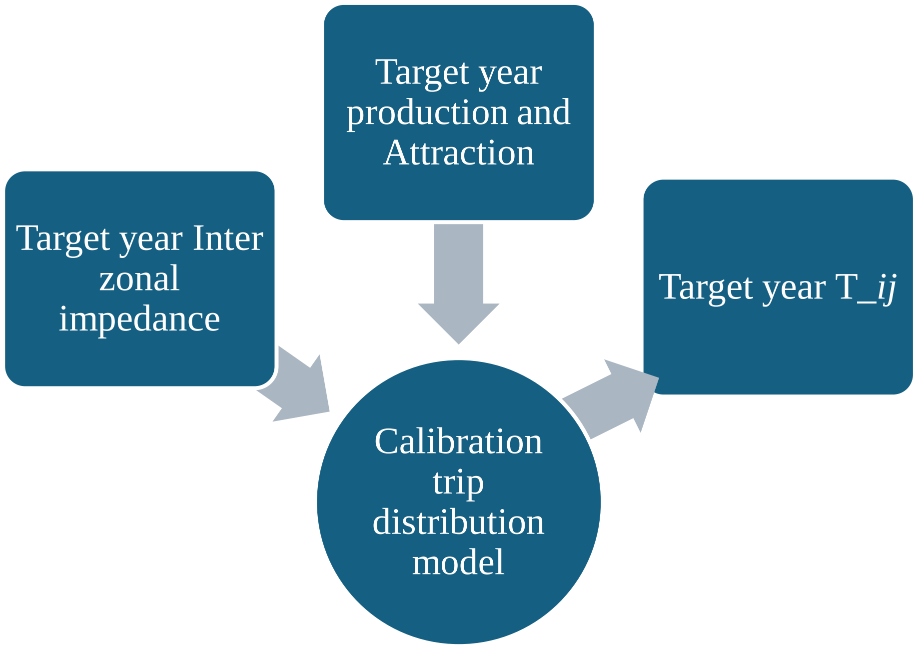
Inter zonal impedance is obtained from existing and proposed networks and mode availability data.

Constraints:

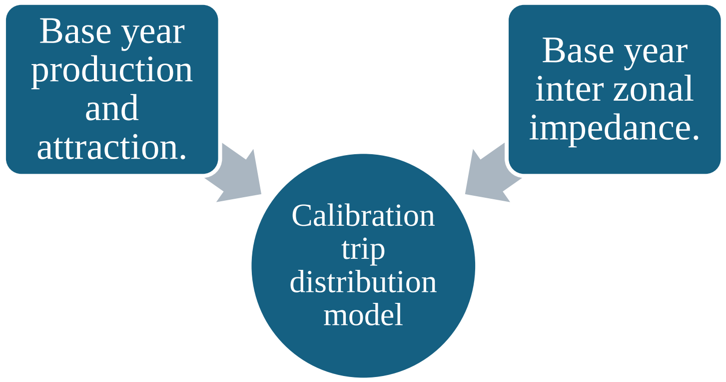
- ❑ Doubly Constrained.
- ❑ Singly Constrained.

Zones	1	2	...	*j*	...	*n*
1	t_{11}	t_{12}	...	t_1j	...	t_1n
2	t_{21}	t_{22}	...	t_2j	...	t_2n
...	...	...	...	...	...	...
	t_{i1}	t_{i2}	...	t_ij	...	t_in
...	...	...	...	...	...	...
n	tn_i	tn_2	...	tnj		tnn

Trip Distribution Input and Output:



Parameters and model factors are estimated using base year data.



Gravity Model Equations :

Based on Newton's law of Gravitation:

$$T_{ij} = k.\frac{O_i.D_i}{W_{ij}^c}$$

- T_ij is known as the interchange volume.
- k and c are model parameters that are estimated by the process of calibration using base year data.

We also know,

$$O_i = \sum_x^n T_{ix}$$

$$O_i = k.O_i \sum_x^n \frac{D_x}{W_{ix}^c}$$

$$k = \left[\sum_x^n \frac{D_x}{W_{ix}^c}\right]^{-1}$$

Classical Form of Gravity Model:

$$T_{ij} = O_i.\left[\frac{D_j/W_{ij}^c}{\sum_x^n D_x/W_{ix}^c}\right]$$

- Proportion of trip originating (produced) at zone i and destined (attracted) to zone J considering attraction of all other zones.

Thus, we do not require absolute attraction values just relative attractiveness.

Gravity Model:

Gravity model can also be written as:

$$T_{ij} = O_i.\left[\frac{D_j F_{ij}}{\sum_x^n D_x F_{ix}}\right];\ \text{Where } F_{ij} = \frac{1}{W_{ij}^c}$$

Even after calibration of the friction factor, discrepancies remain which can be taken care of by the K factor also known as inter-zonal socio-economic adjustment factors.

$$T_{ij} = O_i.\left[\frac{D_j F_{ij} K_{ij}}{\sum_x^n D_x F_{ix} K_{ix}}\right] = O_i.P_{ij}$$

- Pij is the probability of a trip originating from zone i that will be attracted/destined to zone j.

Gravity Model Example:

B. Skim Table (inter-zonal impedances)	Destination/ Attraction				
Origin/ Production: Zones	1	2	3	4	5
1	5	10	15	20	25
2	10	5	10	10000	20
3	15	10	5	15	10
4	20	10000	15	5	15
5	5	25	20	10	5

A. Zones	Productions	Attractions
1	2000	0
2	0	4
3	2500	0
4	0	2
5	1000	3
Total	5500	

C. Skim Table (Friction factor; c=2)	Destination/ Attraction				
Origin/ Production: Zones	1	2	3	4	5
1	0.04	0.01	0.0044	0.0025	0.0016
2	0.01	0.04	0.01	0.00000001	0.0025
3	0.0044	0.01	0.04	0.0044	0.01
4	0.0025	0.00000001	0.0044	0.04	0.0044
5	0.0016	0.0025	0.01	0.0044	0.04

Gravity Model Example:

O_i	J	D_j	F_{ij}	$D_j*F_{ij}*K_{ij}$	p_{ij}	T_{ij}
2000	1	0	0.04	0	0	0
2000	2	4	0.01	0.04	0.803213	1606
2000	3	0	0.004444444	0	0	0
2000	4	2	0.0025	0.005	0.100402	201
2000	5	3	0.0016	0.0048	0.096386	193
				0.0498	1	2000
2500	1	0	0.004444444	0	0	0
2500	2	4	0.01	0.04	0.507042	1268
2500	3	0	0.04	0	0	0
2500	4	2	0.004444444	0.008888889	0.112676	282
2500	5	3	0.01	0.03	0.380282	951
				0.078888889	1	2501
1000	1	0	0.0016	0	0	0
1000	2	4	0.0025	0.01	0.072	72
1000	3	0	0.01	0	0	0
1000	4	2	0.004444444	0.008888889	0.064	64
1000	5	3	0.04	0.12	0.864	864
				0.138888889	1	1000

Origin Destination matrix(Inter-zonal trip table)

		Destination/Attraction j					
Origin /Production i	Zone(i,j)	1	2	3	4	5	Total
	1	0	1606	0	201	193	2000
	2	0	0	0	0	0	0
	3	0	1267	0	282	951	2500
	4	0	0	0	0	0	0
	5	0	72	0	64	864	1000
	Total	0	2945	0	547	2008	5500

Growth Factor Model:

❑***Uniform Growth Method:***

A uniform growth rate is assumed for each inter-zonal trip.

$$T_{ij} = f.t_{ij.}$$

f = Uniform growth factor

t_{ij} = Inter – zonal trip volume of base year

❑***Furness Method:***

Uses iterative proportional fitting method.

$$T_{ij} = a_i . b_j . t_{ij.}$$

a_i = Origin growth factor

b_j = Destination growth factor

t_{ij} = Inter – zonal trip volume of base year

$$Error\ (e) = \sum |O_i - O_{i\ iteration\ P}| + \sum |D_j - D_{j\ iteration\ P}|$$

O_i = Target year trip production from zone i

$O_{i\ iteration\ P}$ = Estimated trip production from zone i in P^{th} iteration

D_j = Target year trip production from zone j

$D_{j\ iteration\ P}$ = Estimated trip production from zone j in P^{th} iteration

Furness Model Example:

Zone(i,j)	1	2	3	4	5	Base year Origin i	Target year Origin i	ai	Oi iteration 1
1	255.1282	2.564103	19.23077	2.564103	20.51282	234	300	1.282051	300
2	50.65789	36.18421	17.36842	4.342105	1.447368	76	110	1.447368	110
3	195.3488	465.1163	103.6545	25.24917	10.63123	602	800	1.328904	800
4	382.8306	104.4084	4.640371	5.800464	2.320186	431	500	1.160093	500
5	406.5254	99.15254	7.711864	5.508475	1.101695	472	520	1.101695	520

Zone(i,j)	1	2	3	4	5	Base year Origin i	Target year Origin i
1	199	2	15	2	16	234	300
2	35	25	12	3	1	76	110
3	147	350	78	19	8	602	800
4	330	90	4	5	2	431	500
5	369	90	7	5	1	472	520
Base year Destination j	1080	557	116	34	28	1815	2230
Target year Destination j	1200	557	200	200	73	2230	Total

Base year Destination j	1080	557	116	34	28
Target year Destination j	1200	557	200	200	73
bj	1	1		1	1
Dj iteration 1	1290.491	707.4255	152.6059	43.46432	36.0133

Furness Model Example:

Zone(i,j)	1	2	3	4	5	Base year Origin i	Target year Origin i	ai	Oi iteration 1
1	237.2383	2.018877	25.20318	11.79866	41.58008	300	300	1	317.8390597
2	47.10569	28.49008	22.76245	19.98009	2.933858	110	110	1	121.2721681
3	181.6507	366.2149	135.846	116.1834	21.54981	800	800	1	821.4448461
4	355.986	82.20718	6.081509	26.6907	4.703083	500	500	1	475.6684862
5	378.0193	78.06895	10.1069	25.34711	2.233168	520	520	1	493.77544

Base year Destination j	1290.491	707.4255	152.6059	43.46432	36.0133
Target year Destination j	1200	557	200	200	73
bj	0.929879	0.787362	1.310565	4.601476	2.027029
Dj iteration 1	1201	559	203	204	78

- Furness method is more appropriate for estimating trip distribution for external trips for an urban area where impedances are not known.

Case Study of Hyderabad (ORR):

Origin & Destination Distance Matrix

S No	Name of IC	Kokapet	Neopolis	Edula nagulapa lly	Patanche ru	Sultanpu r	Mallamp et	Dindigal/ Saragude m	Medchal	Shamirpe t	Keesara	Ghatkes ar	Tarampti pet	Pedda Amberpe t	Bongulur u	Raviryal	Tukkugu da	Pedda Golcond a	Shamsha bad	Rajendra Nagar	TSPA	Narsingi	Nanakra mguda
1	Kokapet	0.00	1.70	11.90	20.50	29.00	35.00	40.70	50.20	59.10	71.00	74.11	65.86	58.96	46.71	39.61	34.11	25.86	19.51	11.26	7.96	3.61	7.25
1A	Neopolis	1.70	0.00	10.20	18.80	27.30	33.30	39.00	48.50	57.40	69.30	75.76	67.56	60.66	48.41	41.31	35.81	27.56	21.21	12.96	9.66	5.31	8.95
2	Edula	11.90	10.20	0.00	8.60	17.10	23.10	28.80	38.30	47.20	59.10	67.65	75.85	70.86	58.61	51.51	46.01	37.76	31.41	23.16	19.86	15.51	19.15
3	Patancheru	20.50	18.80	8.60	0.00	8.50	14.50	20.20	29.70	38.60	50.50	59.05	67.25	74.15	67.21	60.11	54.61	46.36	40.01	31.76	28.46	24.11	27.75
4	Sultanpur	29.00	27.30	17.10	8.50	0.00	6.00	11.70	21.20	30.10	42.00	50.55	58.75	65.65	75.71	68.61	63.11	54.86	48.51	40.26	36.96	32.61	36.25
4A	Mallampet	35.00	33.30	23.10	14.50	6.00	0.00	5.70	15.20	24.10	36.00	44.55	52.75	59.65	71.90	74.61	69.11	60.86	54.51	46.26	42.96	38.61	42.25
5	Dindigal/	40.70	39.00	28.80	20.20	11.70	5.70	0.00	9.50	18.40	30.30	38.85	47.05	53.95	66.20	73.30	74.81	66.56	60.21	51.96	48.66	44.31	47.95
6	Medchal	50.20	48.50	38.30	29.70	21.20	15.20	9.50	0.00	8.90	20.80	29.35	37.55	44.45	56.70	63.80	69.30	76.06	69.71	61.46	58.16	53.81	57.45
7	Shamirpet	59.10	57.40	47.20	38.60	30.10	24.10	18.40	8.90	0.00	11.90	20.45	28.65	35.55	47.80	54.90	60.40	68.65	75.00	70.36	67.06	62.71	66.35
8	Keesara	71.00	69.30	59.10	50.50	42.00	36.00	30.30	20.80	11.90	0.00	8.55	16.75	23.65	35.90	43.00	48.50	56.75	63.10	71.35	74.65	74.61	78.25
9	Ghatkesar	74.11	75.76	67.65	59.05	50.55	44.55	38.85	29.35	20.45	8.55	0.00	8.20	15.10	27.35	34.45	39.95	48.20	54.55	62.80	66.10	70.45	76.61
10	Taramptipet	65.86	67.56	75.85	67.25	58.75	52.75	47.05	37.55	28.65	16.75	8.20	0.00	6.90	19.15	26.25	31.75	40.00	46.35	54.60	57.90	62.25	68.41
11	Pedda	58.96	60.66	70.86	74.15	65.65	59.65	53.95	44.45	35.55	23.65	15.10	6.90	0.00	12.25	19.35	24.85	33.10	39.45	47.70	51.00	55.35	61.51
12	Bonguluru	46.71	48.41	58.61	67.21	75.71	71.90	66.20	56.70	47.80	35.90	27.35	19.15	12.25	0.00	7.10	12.60	20.85	27.20	35.45	38.75	43.10	49.26
13	Raviryal	39.61	41.31	51.51	60.11	68.61	74.61	73.30	63.80	54.90	43.00	34.45	26.25	19.35	7.10	0.00	5.50	13.75	20.10	28.35	31.65	36.00	42.16
14	Tukkuguda	34.11	35.81	46.01	54.61	63.11	69.11	74.81	69.30	60.40	48.50	39.95	31.75	24.85	12.60	5.50	0.00	8.25	14.60	22.85	26.15	30.50	36.66
15	Pedda	25.86	27.56	37.76	46.36	54.86	60.86	66.56	76.06	68.65	56.75	48.20	40.00	33.10	20.85	13.75	8.25	0.00	6.35	14.60	17.90	22.25	28.41
16	Shamshaba	19.51	21.21	31.41	40.01	48.51	54.51	60.21	69.71	75.00	63.10	54.55	46.35	39.45	27.20	20.10	14.60	6.35	0.00	8.25	11.55	15.90	22.06
17	Rajendra	11.26	12.96	23.16	31.76	40.26	46.26	51.96	61.46	70.36	71.35	62.80	54.60	47.70	35.45	28.35	22.85	14.60	8.25	0.00	3.30	7.65	13.81
18	TSPA	7.96	9.66	19.86	28.46	36.96	42.96	48.66	58.16	67.06	74.65	66.10	57.90	51.00	38.75	31.65	26.15	17.90	11.55	3.30	0.00	4.35	10.51
18A	Narsingi	3.61	5.31	15.51	24.11	32.61	38.61	44.31	53.81	62.71	74.61	70.45	62.25	55.35	43.10	36.00	30.50	22.25	15.90	7.65	4.35	0.00	6.16
19	Nanakramg	7.25	8.95	19.15	27.75	36.25	42.25	47.95	57.45	66.35	78.25	76.61	68.41	61.51	49.26	42.16	36.66	28.41	22.06	13.81	10.51	6.16	0.00

Case Study of Hyderabad (ORR):

O/D Daily Pass (2023-24)		Car/Jeep/Van/LMV																				
		1	1A	2	3	4	4A	5	6	7	8	9	10	11	12	13	14	15	16	17	18	18A	19
S No	Name of IC	Kokapet	Neopolise	Edula nagulapally	Patancheru	Sultanpur	Mallampet	Dindigal/ Saragudem	Medchal	Shamirpet	Keesara	Ghatkesar	Taramptipet	Pedda Amberpet	Bonguluru	Raviryal	Tukkuguda	Pedda Golconda	Shamshabad	Rajendra Nagar	TSPA	Narsingi	Nanakramgu da
1	Kokapet	0	15	45	75	105	120	135	165	195	240	255	225	195	165	135	120	90	60	45	30	15	30
1A	Neopolis	15	0	30	60	90	105	135	165	195	240	255	225	210	165	135	120	90	75	45	30	15	30
2	Edula nagulapally	45	30	0	30	60	75	90	135	165	195	225	255	240	195	180	150	120	105	75	60	45	60
3	Patancheru	75	60	30	0	30	45	75	105	135	165	195	225	255	225	210	180	150	135	105	90	75	90
4	Sultanpur	105	90	60	30	0	15	45	75	105	135	165	195	225	255	225	210	180	165	135	120	105	120
4A	Mallampet	120	105	75	45	15	0	15	45	75	120	150	180	195	240	255	240	210	180	150	150	135	150
5	Dindigal/ Saragudem	135	135	90	75	45	15	0	30	60	105	135	165	180	225	240	255	225	210	180	165	150	165
6	Medchal	165	165	135	105	75	45	30	0	30	75	105	120	150	195	210	240	255	240	210	195	180	195
7	Shamirpet	195	195	165	135	105	75	60	30	0	45	75	90	120	165	180	210	225	255	240	225	210	225
8	Keesara	240	240	195	165	135	120	105	75	45	0	30	60	75	120	150	165	195	210	240	255	255	270
9	Ghatkesar	255	255	225	195	165	150	135	105	75	30	0	30	45	90	120	135	165	180	210	225	240	255
10	Taramptipet	225	225	255	225	195	180	165	120	90	60	30	0	30	60	90	105	135	150	180	195	210	225
11	Pedda Amberpet	195	210	240	255	225	195	180	150	120	75	45	30	0	45	60	90	105	135	165	165	180	210
12	Bonguluru	165	165	195	225	255	240	225	195	165	120	90	60	45	0	30	45	75	90	120	135	150	165
13	Raviryal	135	135	180	210	225	255	240	210	180	150	120	90	60	30	0	15	45	75	90	105	120	135
14	Tukkuguda	120	120	150	180	210	240	255	240	210	165	135	105	90	45	15	0	30	45	75	90	105	120
15	Pedda Golconda	90	90	120	150	180	210	225	255	225	195	165	135	105	75	45	30	0	15	45	60	75	90
16	Shamshabad	60	75	105	135	165	180	210	240	255	210	180	150	135	90	75	45	15	0	30	45	60	75
17	Rajendra Nagar	45	45	75	105	135	150	180	210	240	240	210	180	165	120	90	75	45	30	0	15	30	45
18	TSPA	30	30	60	90	120	150	165	195	225	255	225	195	165	135	105	90	60	45	15	0	15	30
18A	Narsingi	15	15	45	75	105	135	150	180	210	255	240	210	180	150	120	105	75	60	30	15	0	15
19	Nanakramguda	30	30	60	90	120	150	165	195	225	270	255	225	210	165	135	120	90	75	45	30	15	0

Development of P-A Matrix:

- In order to find the total production of a zone sum up all the trips that originated at a given zone.

- In order to find the total attraction of a zone sum up all the trips that are destined at a given zone.

Number of trips produced and attracted.

Zones:	Kokapet	Neopolis e	Edula nagulapa lly	Patanche ru	Sultanpu r	Mallamp et	Dindigal/ Saragude m	Medchal	Shamirp et	Keesara	Ghatkes ar	Tarampti pet	Pedda Amberpe t	Bongulur u	Raviryal	Tukkugu da	Pedda Golconda	Shamsha bad	Rajendra Nagar	TSPA	Narsingi	Nanakra mgu da
Production(gi)	2460	2430	2535	2655	2760	2850	2985	3120	3225	3345	3285	3150	3075	2955	2805	2745	2580	2535	2430	2400	2385	2700
Attraction(ai)	2460	2430	2535	2655	2760	2850	2985	3120	3225	3345	3285	3150	3075	2955	2805	2745	2580	2535	2430	2400	2385	2700

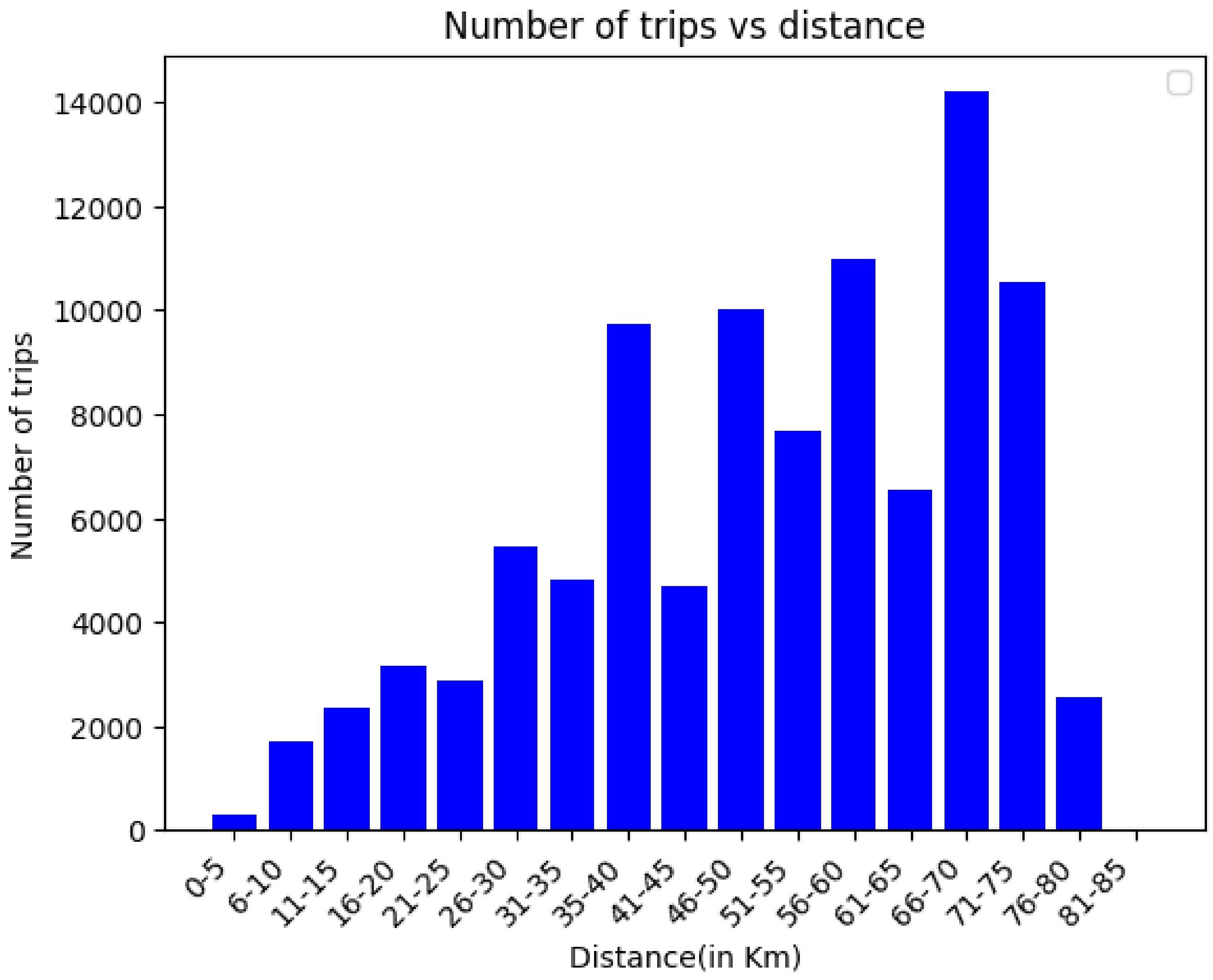
Determination of friction factor:

Steps involved in developing distance frequency distribution:

1. From the Distance matrix, for a given place we must identify all the places and the distance between them.
2. From the OD matrix, for a given place record the number of trips corresponding to a particular distance.
3. The same procedure was done for the rest of the zones and distance was divided in a set of intervals.
4. Summing all the trips for the given intervals and plotting them in a bar graph.

Distance frequency Distribution graph:

- It is not following the **gamma distribution.**
- This may be due to an anomaly in the data provided.
- But most of the trips are in the middle zone.

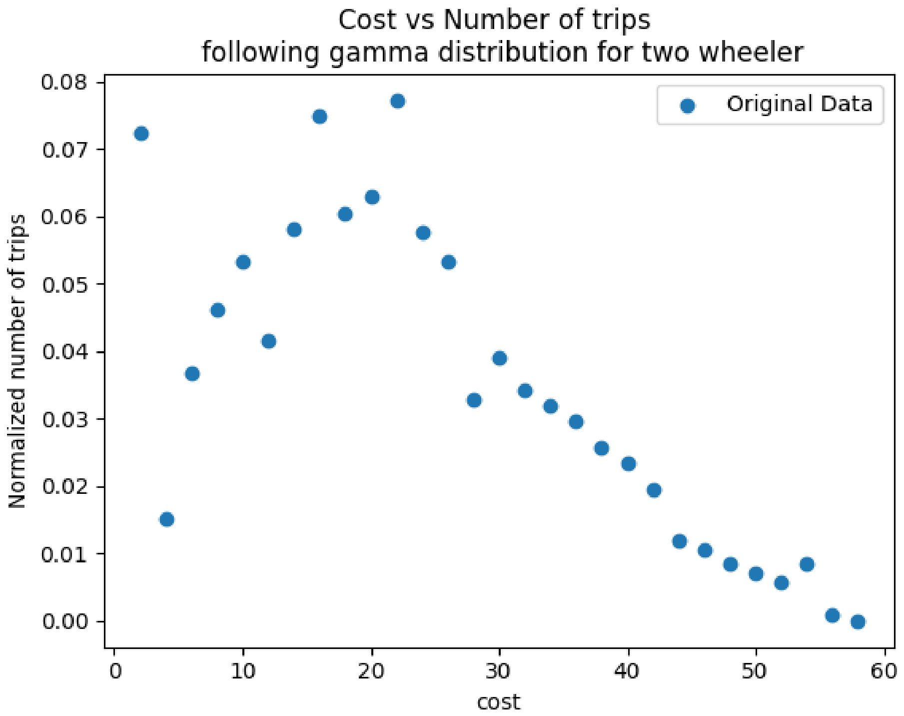


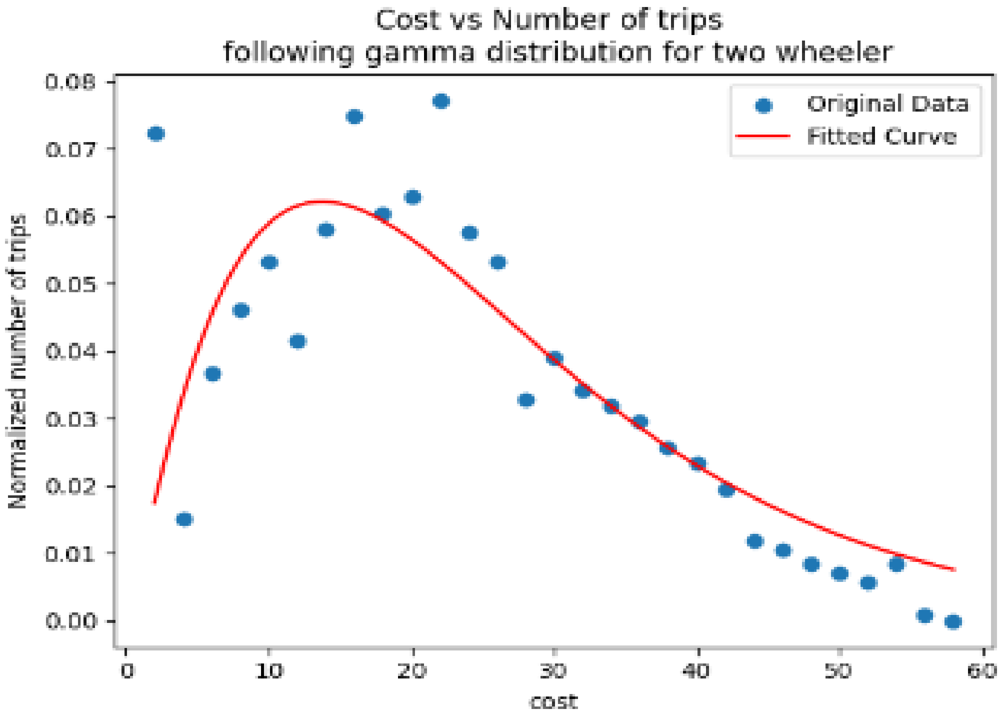
Determination friction factor of Bengaluru(calculations) :

Table 3.9 Distribution of Trips by Mode & Trip Length

Trip Length (Km.)	Bus	Car	Two Wheeler	Three Wheeler	Cycle	Walk	Total
0-2	197	46	142633	0	59137	521061	723074
2-5	117434	27809	482306	279891	45390	2536	955365
5-10	134333	151603	725082	165814	25509	0	1202342
10-15	1429620	152409	316173	192265	6560	0	2097026
15-20	612694	65318	135503	82399	2811	0	898725
20-35	329555	17627	43779	5675	0	0	396636
>35	10639	1492	0	381	0	0	12511
Total	2634471	416304	1845476	726425	139407	523597	6285680
Average Trip Length	**14.99**	**11.59**	**8.02**	**8.59**	**3.88**	**1.01**	**10.57**

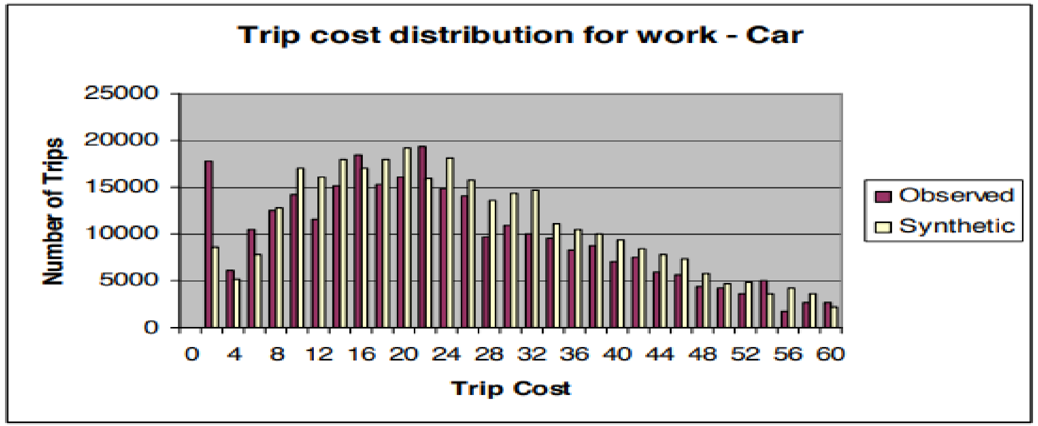
Travel cost frequency distribution graph:

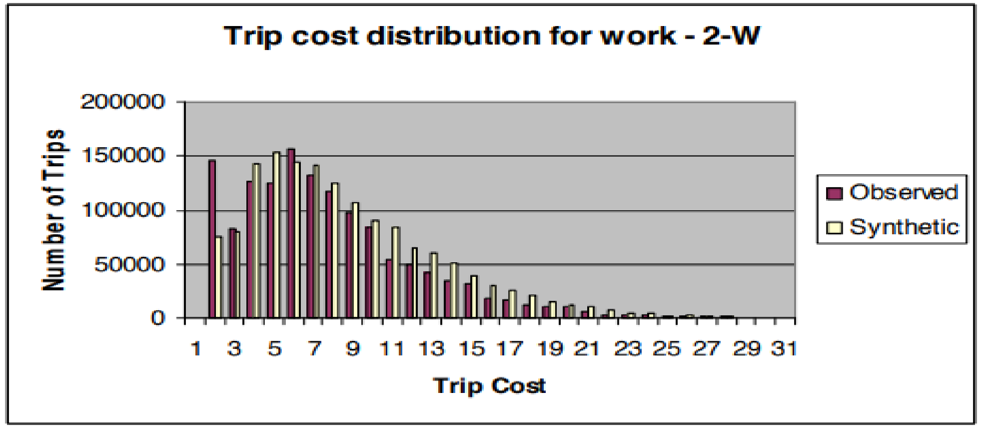


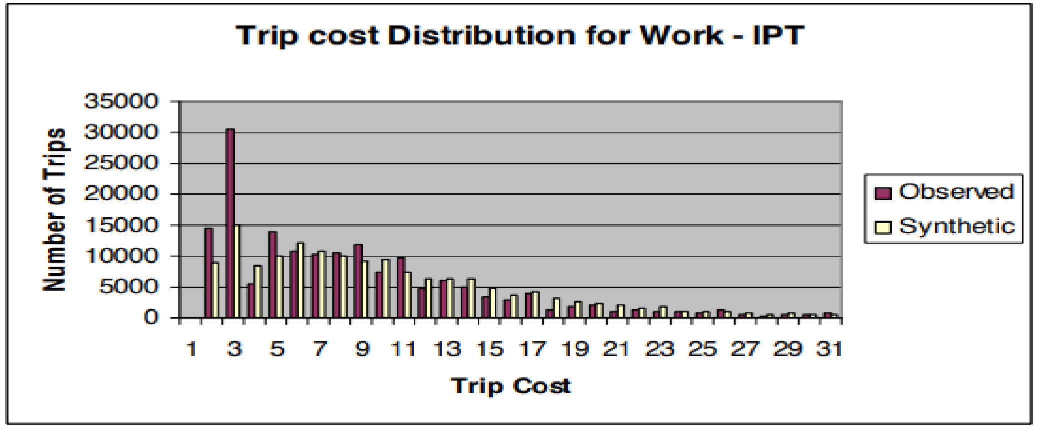


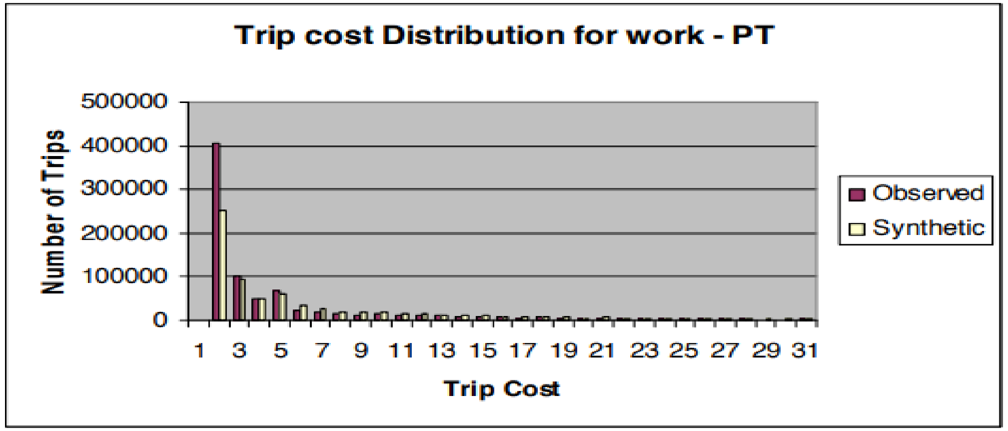
$$Fitted\ Gama\ Equation : f(x) = 0.01 * \ {d_{ij}}^{1.18} * \ e^{-0.1*d_{ij}}$$

Other Traffic Pattern Observed:









Designing a Direct Gravity Trip Distribution Model based on Air Passenger Demand

- The direct gravity trip distribution model is more useful because there is no need for modal split and traffic assignment.
- The direct gravity trip distribution model can be used either for Air Transport and sea transport.

Model Development

1. It follows Newton's universal law of gravitation.

$$F_{ij} = g \times \frac{m_i m_j}{d_{ij}^2}$$

2. Basic Gravity formula must be modified into an expression containing: attraction coefficient, attraction mass, and impedance.

$$Z_{ij} = K \times M_i^a \times M_j^b \times I_{ij}^c$$

3. Attraction Mass is defined as Population and Economic Mass ; Impedance is defined as Distance and Ticket Tariff.

$$T_{i,j} = K \times P_i^a \times P_j^b \times E_i^c \times E_j^d \times D_{i,j}^e \times Ta_{i,j}^f$$

Modelling:

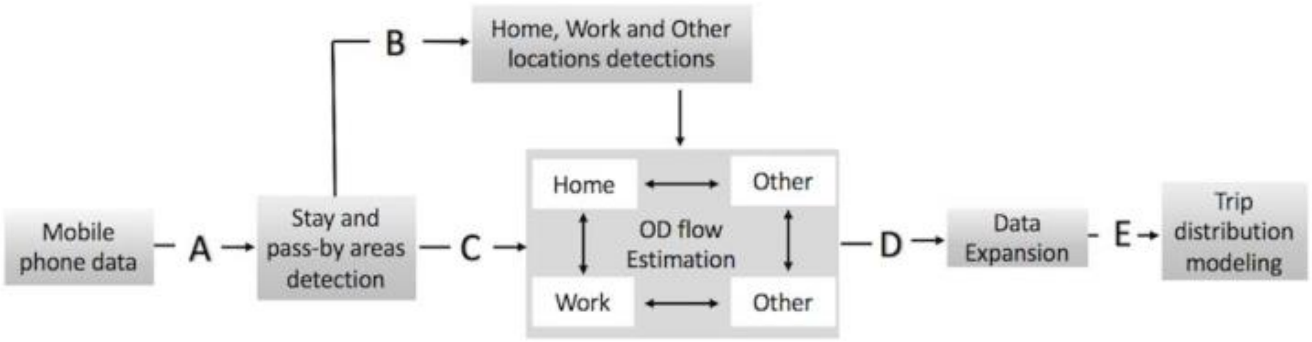
- It involves finding several coefficient values.
- For each calculation, the objective is finding the coefficient value to minimize the Sum of Square Error (SSE).
- The iterations must be repeated until a solution can be gotten
- For each step of the iteration, each constant is optimized separately while keeping the other constant unchanged.
- Afterward, the accuracy of the model is measured by the percentage of absolute error of calculated Tij. Error is the difference between the real Tij value to the modeled Tij value.

Data needed for this modelling are all secondary data

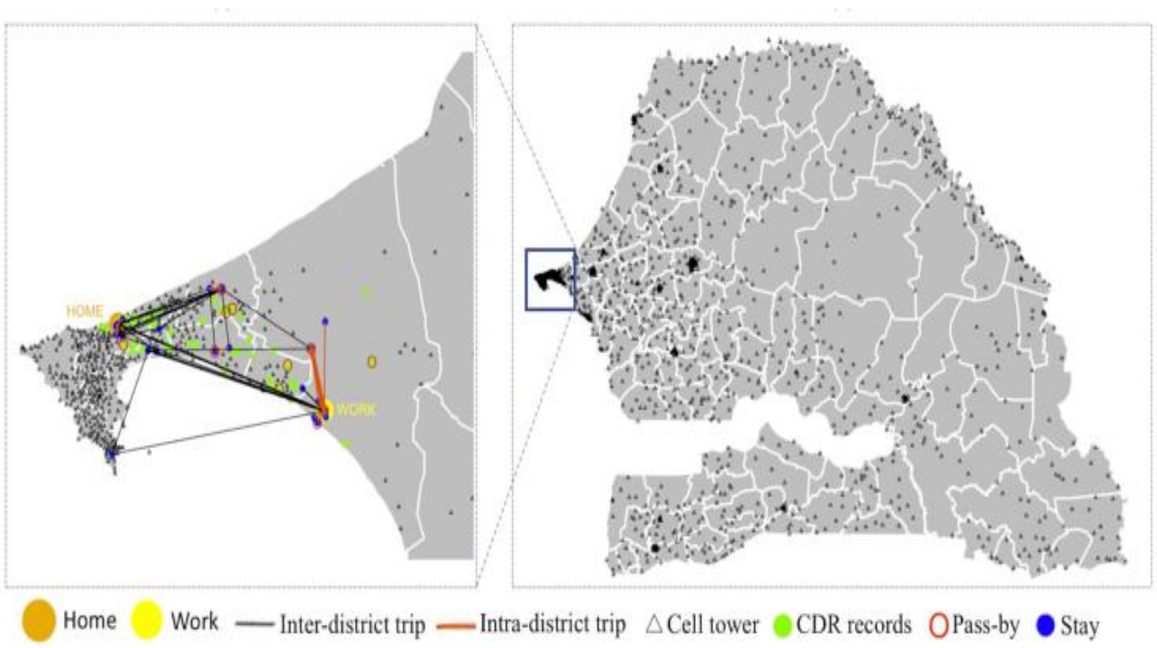
1. Flight related data.
2. Attraction force related data.

Methodology for Data Collection for trip distribution

- Trip distribution modeling using cell phone data for intrazonal trips.
- intra-zonal trips carry a significant proportion of non-motorized trips
- Explore the use of CDRs(**Call Detail Records**) data to derive more realistic OD trips.
- **Senegal** is used as a case-study region to illustrate the analysis carried out in this study**.**



- Home Location-the number of times each cell tower is contacted during the nighttime (10pm to 7am) is measured. Then, the cell tower with the highest number of interactions is identified as the home location.
- Work Location-Similarly, from 8 am to 7 pm filtering out calls on weekends gives us work location.



- Trip-types: Home-based work, Home-based other, Non-home based

- The average intra-zonal trip distance measured as a function of the area of the zone produced relatively larger trip distances

- The modeling approach can complement regional transportation travel demand models by integrating the mobility information from the under-surveyed locations of a region

- Provide bases to use mobile phone data as means urban, which
are usually expensive

MODELING TRIP-LENGTH DISTRIBUTION OF SHOPPING CENTER TRIPS FROM GPS DATA

There are two methods to calculate trip-length data, travel surveys and GPS technology.

Mobile GPS loggers are used to collect and analyse "trip length data".

We classified shopping centres based on size, as larger centres tend to attract more trips and trip lengths. Small convenience centres are densely scattered within neighbourhoods and attract short trips whereas larger centres attract longer trip-lengths.

Each respondent kept the GPS logger in their vehicles for three days of normal driving activity, including weekdays and weekends.

Identifying Trip Ends

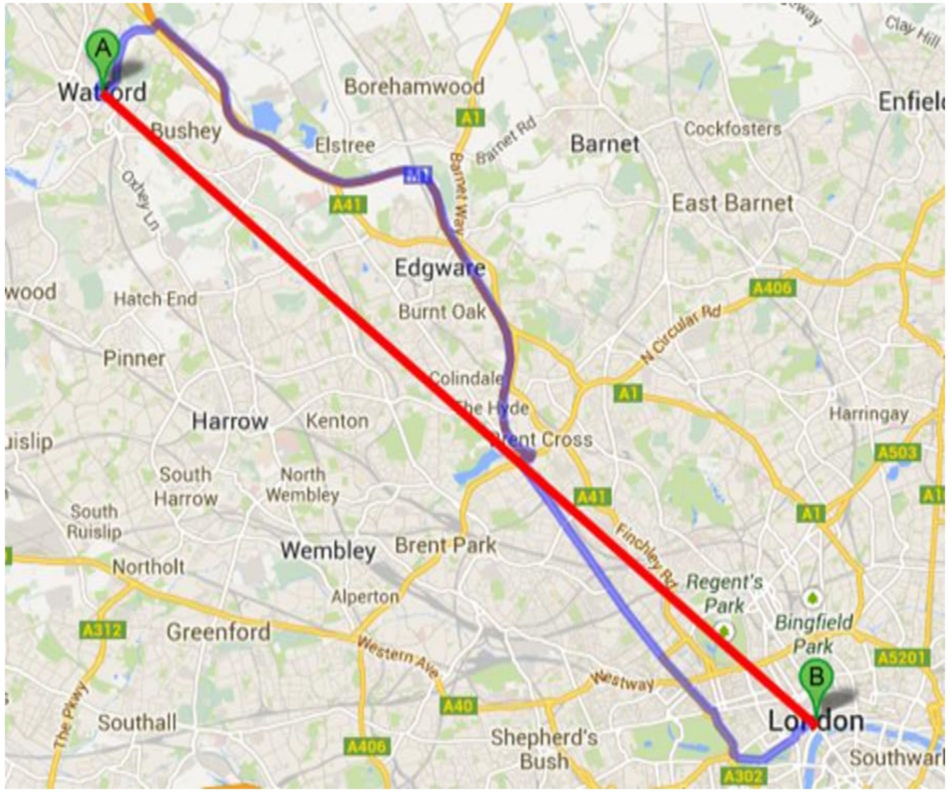
For GPS devices, the primary variable used to identify possible trip ends is the time gap when the device was stationary, also referred to as the stopped time or dwell time. Repeated use of road links in shopping centres can help identify trip ends by calculating the distance between points.

Data cleaning includes excluding abnormal trips from the trip data set include extremely short trips, zero travel time, impractical high-speed trips, trips with origin or destination outside the study area, and trips where the vehicle left and returned.

Methods to determine trip lengths

After identifying trip ends, two main methods are used for determining trip lengths from GPS data, these are:

- The point-to-point method—sum of distances between points over the entire trip (PP).
- The link-to-link method—sum of link lengths over the entire trip after matching the GPS points to road network links (LL). Depending upon the condition the appropriate method is used.



Calculating Trip Lengths for Shopping Center Trips

- For each trip log, a cumulative distance was calculated using the point-to-point method by adding the distances between the points recorded every second. trip length to a shopping center was calculated by subtracting the shopping center trip end’s cumulative distance from the previous trip end’s cumulative distance value.
- Difference in trip length calculated from travel surveys and GPS method can be attributed to pass-by-trips (trips made as intermediate stops on the way from an origin to a primary trip destination). GPS surveys tend to include more pass-by-trips, would tend to increase trip distances associated with single shopping centres.
- But we certainly can’t say the difference is due to the pass-by-trips only, maybe due to land use and behavioural factors. Therefore, GPS method are not yet enough mature to replace conventional survey methods.

A comprehensive study on travel distribution modeling for effective transportation planning in Vadodara

Challenges and context

- Parking demand, noise, and air pollution.
- Traffic congestion, delays, and accidents.
- Vadodara with population of 16.66 lacs (as per 2011 census), exhibits three types of trips: internal, interzonal, intrazonal trips.

•Data collection and analysis

Data collection involves surveys on travel patterns, transport facilities and land use .The household survey is reliable method, collecting 4000 samples from 18,836. This survey captures household members travel patterns and household characteristics influencing trip making.

Population data for each zone is projected for future years. Data from the household information survey is inputted Microsoft Excel and imported into TransCAD for analysis.

Key findings and Implications

Key findings

- Distinct travel patterns
- Traffic hotspots
- Mode preferences

Implications

- Optimizing infrastructure
- Sustainable Mobility
- Future planinng.

Survey on the mobility changes before, after and during the pandemic.

1) These surveys were mainly done in google form in tier A and B cities.

2) Before covid, PT ridership take metro and buses more but after corona people often purchase PMV / MTW motorized two-wheeler or used IPT like auto rikshaw, bike which are less crowded.

3) People were willing to pay extra for safety during traveling and the chance of getting infected. Most of the people were ready to use the PRT (personal rapid transit) during emergency time.

4) during primary activities were nearly zero in every sector and secondary activities were getting higher, walking was the preferable mode of transportation.

The effect of Pandemic on the trip distribution model

- Due to corona the model trip of the emergency vehicles was modified especially ambulance during.
- The pandemic caused a significant shift in trip purposes. Many non-essential trips, such as leisure and recreational travel, were postponed or canceled altogether. Trips for work, education, and medical purposes remained essential but decreased in frequency due to remote work, online education, and telemedicine options.
- During the pandemic, the people change their working, work from home was very popular. because of this there was decrease of trip distribution model.
- Trip distribution models were changed, adapted to anticipate long term effects by scenario planning, analysis, and forecasting of the post pandemic world
- After post covid, there were huge changes in the traffic class. People avoid public transport, thus leading to a surplus of small or isolated vehicles like car. Because of this changes, the trip distribution models were drastically change.

- Passenger density was positively correlated with the variation in PM concentrations during the trip.
- In-cabin PM concentrations in taxi transit were negatively associated with urban precipitation and wind speed.
- Urban background particle concentrations were mostly positively correlated with variations in in-cabin particle concentrations during bus and subway transits between cities.
- out-cabin PM concentrations measured during idling periods have a negative effect on the PM concentrations inside bus and metro cabins.
- Travel duration of the route segments show a negative effect on PM concentrations inside bus cabins.
- This implies that frequently opened doors have a negative impact on the PM concentrations inside the cabin, possibly owing to the air exchange between the indoors and outdoors and passenger movements (boarding and alighting). This suggests that optimizing the distribution of bus stops can mitigate the in-cabin exposure levels in transit.

Summarizing key Findings:

This trip distribution modeling exercise has provided valuable insights into the patterns and dynamics of travel within our region. Through rigorous analysis and interpretation of data, I have uncovered several key findings;

- Understanding Peak Travel Times
- Validation of Existing Models
- Impact of Socioeconomic Factors

References:
https://drive.google.com/drive/folders/1AYJ56jY6NcoVrlY9RfwuLvSgfRid1Irx?usp=drive_link


Thank you!