EMPLOYER TRAVEL DEMAND MANAGEMENT STRATEGIES:
& ITS IMPACT ON EMPLOYEE'S TRAVEL PATTERN:
A CASE OF BANGALORE CITY

Noelene Marisa Yesudas and Shalini Sinha

PRESENTATION STRUCTURE

1 **INTRODUCTION**

Need for the study
Objectives
Research Limitations

2 **LITERATURE REVIEW**

Various ETMD strategies and its impressions on managing the traffic demand

3 **RESEARCH METHODOLOGY**

3 Phases
- Literature review
- Data collection
- Data analysis

4 **OVERVIEW OF STUDY AREA**

- Demographic and Travel characteristics

5 **DATA COLLECTION**

- Survey methodology

6 **DATA ANALYSIS**

- Detail analysis of Staggered work hours
- Overall analysis

7 **CONCLUSIONS**

- Larger society level
- Individual level

1 INTRODUCTION

INTRODUCTION

1 **NEED FOR THE STUDY**

Traffic related issues

Bangalore (IT Hub)

Traditionally: **'Predict and Supply'**

Globally, alternate measures
- **Transport system management**
Traffic Signal Optimization, Incident Management, Speed Limit Reduction and Enforcement, etc.
- **Travel demand management**
Road & Congestion pricing, Parking management & pricing, Land use management & urban design

NUTP also focuses on;

- Growth of **cities** integrated with **sustainable mobility** with **modal mix**

Employer travel demand management strategies Lesser studied in the Indian context

Employee's travel pattern

Employers/ Organizations measures

Why?

When?

How?

INTRODUCTION

2 **OBJECTIVES**

- To identify different employer travel demand management (ETDM)strategies in the Indian context

- To assess the **impacts** of alternate employer travel demand management(ETDM) strategies on the **travel pattern** of employees..

3 **RESEARCH LIMITATIONS**

- The impacts of each ETDM may vary from city to city based on the base context and predominant sectors.

- Captures employees perception towards ETDM strategies

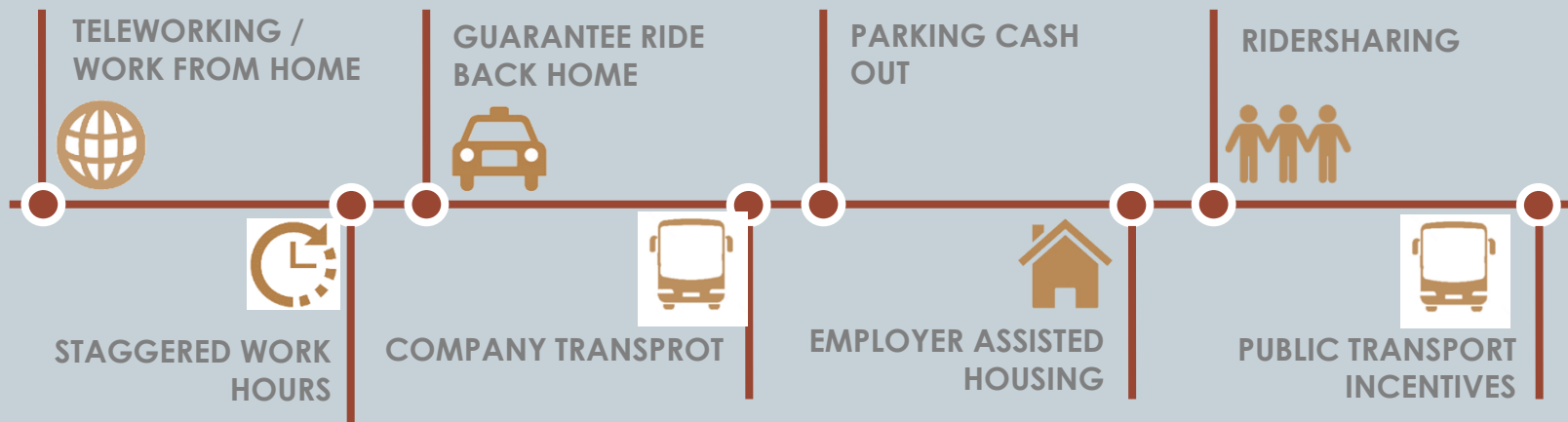# 2 LITERATURE REVIEW

LITERATURE REVIEW

1 **UNDERSTANDING ETDM STRATEGIES**

"

Prof. Simmons

defines, the application of strategies and policies to **alter travel demand**, specifically that of **single occupancy private vehicle,** or to **redistribute** this **demand** in space or time.''

GLOBALLY PRACTISED ETDM STRATEGIES

TELEWORKING / WORK FROM HOME

GUARANTEE RIDE BACK HOME

PARKING CASH OUT

RIDERSHARING

STAGGERED WORK HOURS

COMPANY TRANSPROT

EMPLOYER ASSISTED HOUSING

PUBLIC TRANSPORT INCENTIVES
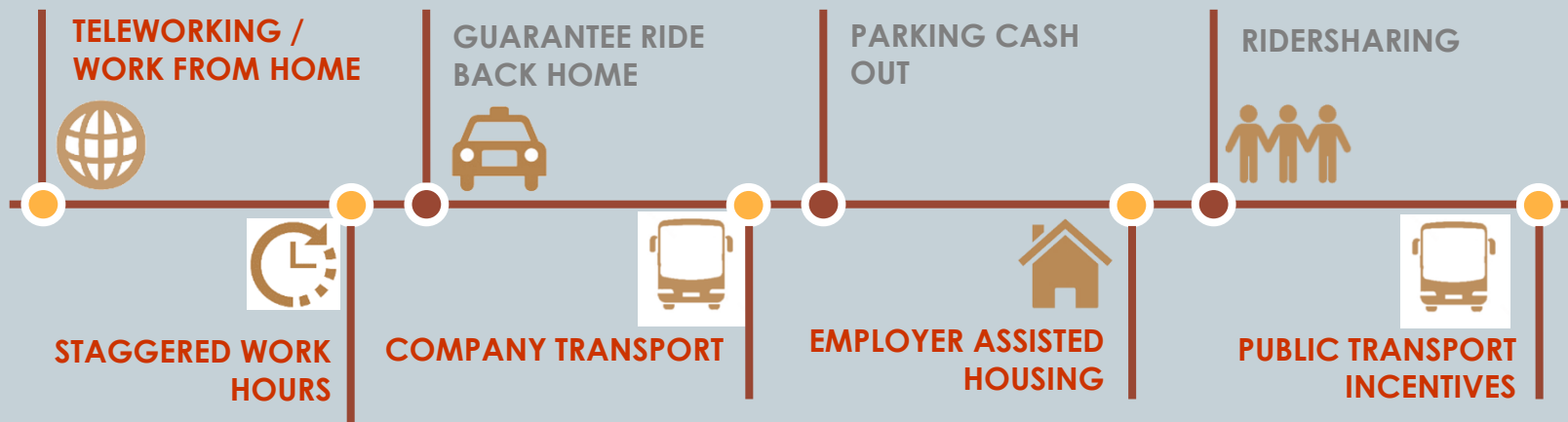
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LITERATURE REVIEW

2 **STATE OF THE ART DISCUSSION**

Work from Home (WFH) or Teleworking

(Mokhtarian and Nilles, 1996)… 'flexible work arrangements due to advance in technology, that alter work centers, thus eliminating or reducing the need to travel…also impacting the spatial distribution of residential locations (origins), which is a subsequent of its link to commute distance to work centers.'

Eliminates or reduces work trips
Leads to sprawled development

Employer assisted Housing (EAH)

(M.Wallas,2010) … ' this strategy of employer assisted housing is a win-win situation, as employees receive financial or subsidized assistance that help them move closer to work and thus decreases theirtravel time to work…flattening peak hour travel.'

Reduces travel distance for work trips
Flattens Peak hour work commute

LITERATURE REVIEW

2 ## STATE OF THE ART DISCUSSION

Staggered work hours (SWH)

(Tannir, 1977)… ' staggering of work hours results in temporal traffic demand such that the peak hour traffic volumes is spread over a longer period of time and is redistributes. The net effect of this change in travel demand can help alleviate and improve traffic flow conditions especially during peak hours.'

Results in temporal traffic demand
Redistributes traffic volumes

Company Transport (CT) and Public Transit Incentives (PT)

(Richard Kuzmyak, 2010)… 'employer's choose to adopt such measures, either because the work site is poorly located in relation to public transit access or in the suburbs or, the employer feels the need or desire to become actively a part of the worker's commute to work ,leading to preference for a particular type of mode or service.'
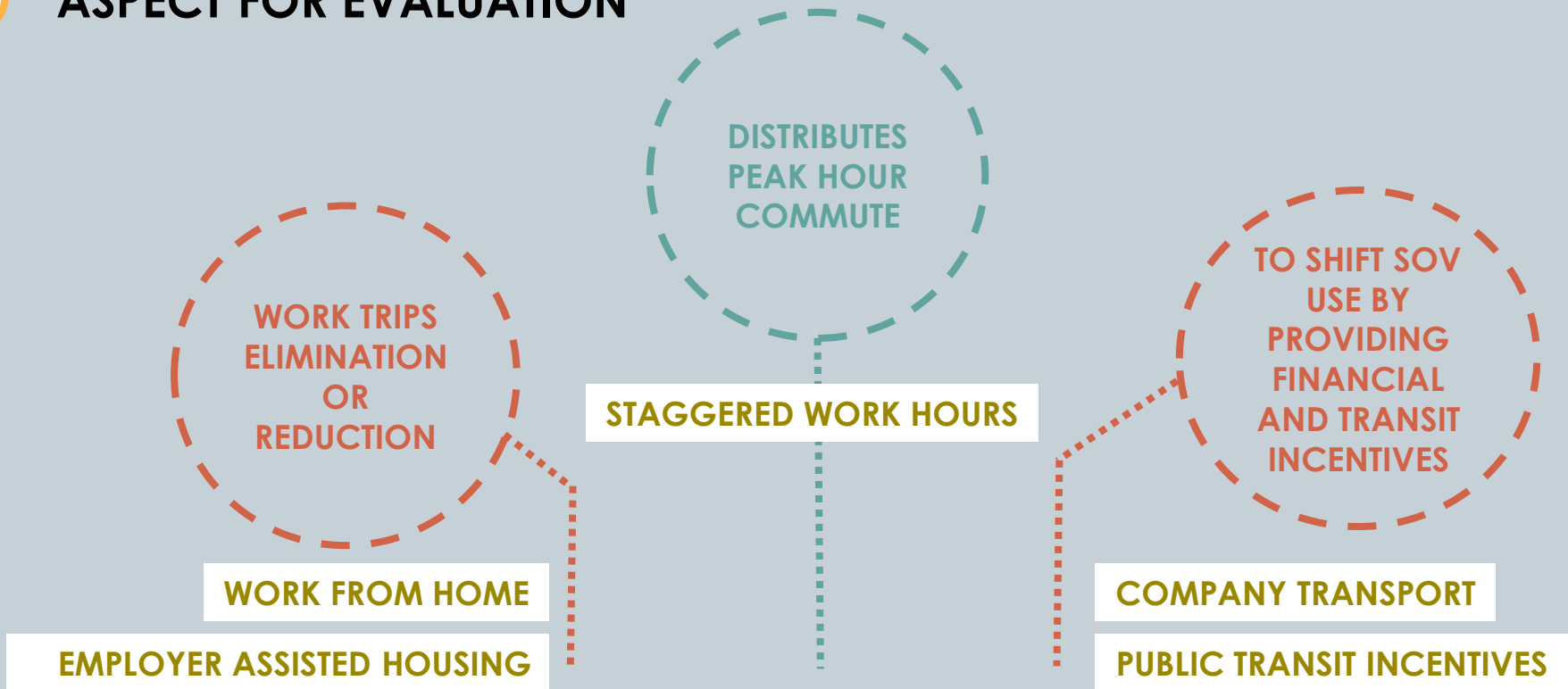
(Gomes N, 2012) consider public transit incentives so as to be designed to shift mode use for work commute, backed by social motivation or financial cross subsidies purchasing power, amplifying the effect of monetary reward to enhance the existing transport system network.

Mode shift from single occupant vehicle
Enhances efficiency of the existing transport system

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3 ## ASPECT FOR EVALUATION

DISTRIBUTES PEAK HOUR COMMUTE

WORK TRIPS ELIMINATION OR REDUCTION

TO SHIFT SOV USE BY PROVIDING FINANCIAL AND TRANSIT INCENTIVES

STAGGERED WORK HOURS

WORK FROM HOME

EMPLOYER ASSISTED HOUSING

COMPANY TRANSPORT
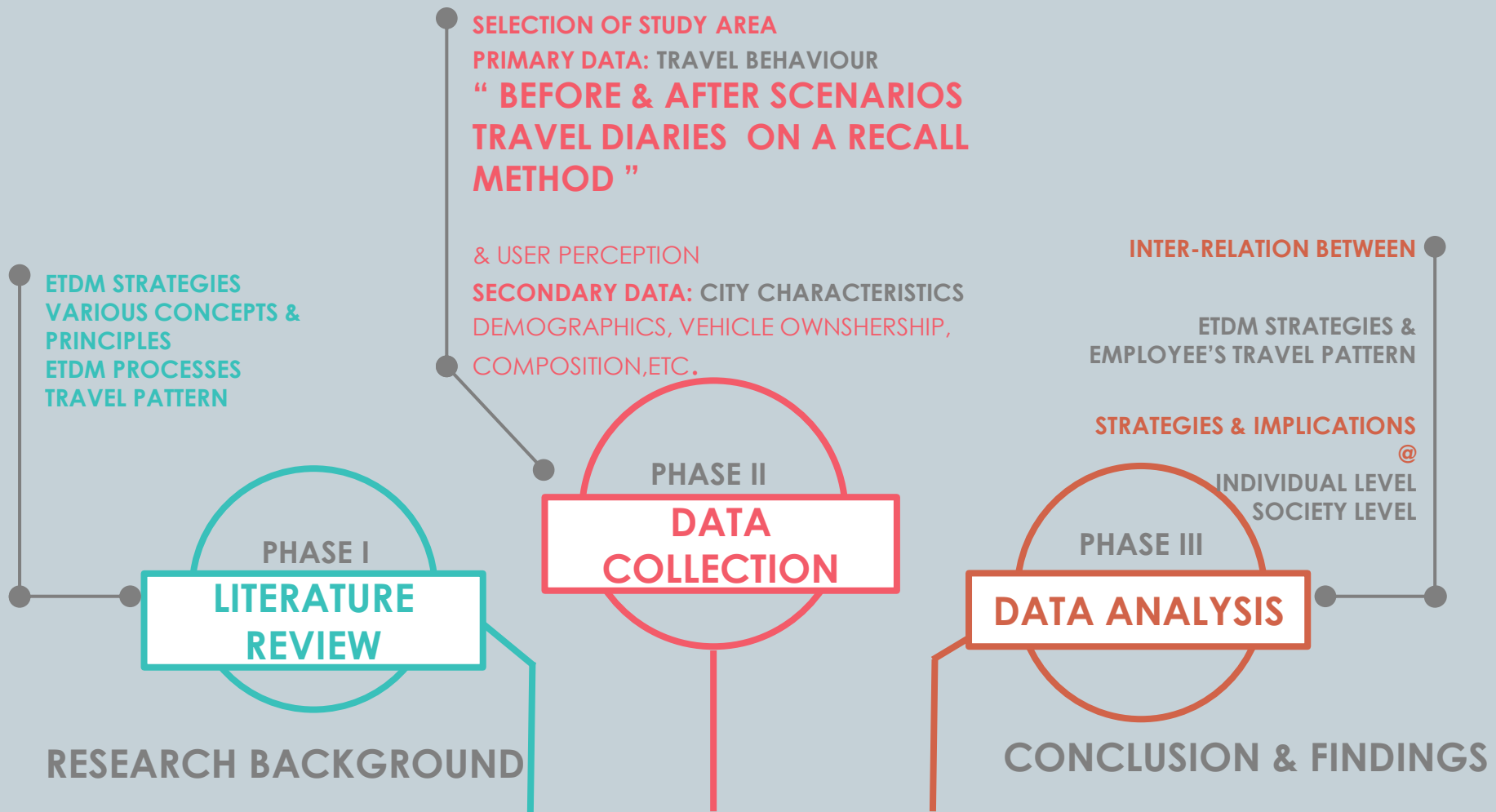
PUBLIC TRANSIT INCENTIVES

ETDM STRATEGIES

TRIP RATE I TRIP PURPOSE I MODE I TRAVEL DISTANCE I TRAVEL TIME I TRAVEL COST I USER PERCEPTION

3 RESEARCH METHODOLOGY

RESEARCH METHODOLOGY

SELECTION OF STUDY AREA
PRIMARY DATA: TRAVEL BEHAVIOUR
" BEFORE & AFTER SCENARIOS TRAVEL DIARIES ON A RECALL METHOD "

& USER PERCEPTION
SECONDARY DATA: CITY CHARACTERISTICS
DEMOGRAPHICS, VEHICLE OWNSHERSHIP,
COMPOSITION,ETC.

ETDM STRATEGIES
VARIOUS CONCEPTS & PRINCIPLES
ETDM PROCESSES
TRAVEL PATTERN

INTER-RELATION BETWEEN

ETDM STRATEGIES &
EMPLOYEE'S TRAVEL PATTERN

STRATEGIES & IMPLICATIONS @
INDIVIDUAL LEVEL
SOCIETY LEVEL

PHASE I
LITERATURE REVIEW

PHASE II
DATA COLLECTION

PHASE III
DATA ANALYSIS

RESEARCH BACKGROUND

CONCLUSION & FINDINGS

RESEARCH METHODOLOGY

4 STUDY AREA: A PRIMER TO BANGALORE

STUDY AREA: A PRIMER TO BANGALORE

① ABOUT THE CITY

Bangalore, apart from the capital city of Karnataka, it is one of the biggest urban agglomerations across the country.
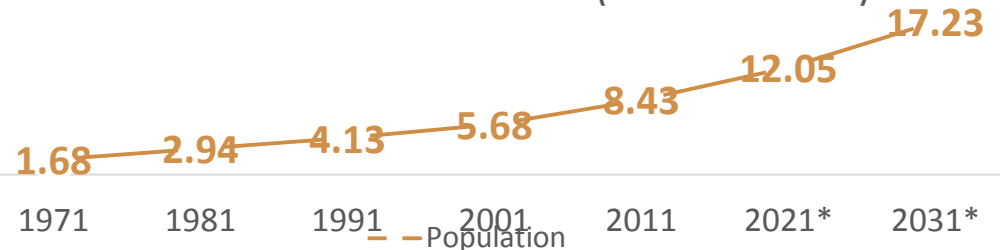
2011 **8.5** MILLION

2016 **11.5** MILLION

POPULATION GROWTH (1971-2031*)

1.68	2.94	4.13	5.68	8.43	12.05	17.23
1971	1981	1991	2001	2011	2021*	2031*

— — Population

Bangalore has been started expanding very promptly leading to horizontal expansion (Sprawl)

2011 **741** Sq.km

2015 **1276** Sq.km

SPATIAL GROWTH (1973-2006)

1973 **1992** **1999** **2001** **2006**

Source: Built up Growth Trends (CU&IIHS, 2012)

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1

Travel characteristics of Bangalore city

Comprehensive Traffic & Transportation Plan for Bengaluru,2011

Trip Purpose

Purpose Home Based	No.	% Share
Work	1839819	29.27
Education	738799	11.75
Others		10.34
Non-home based	92347	1.47
Employer Business	11747	0.19
Return	2953229	46.98
Total	**6285678**	**100.00**

29 % Work

Trip Mode

Trip Length (Km.)	Bus	Car	Two Wheeler	Three Wheeler	Cycle	Walk	Total
0–2	197		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					0	2097026
15–20	612694	65318	135503	82399	2811	0	898725
20–35	329555	3779			0	0	396636
>35	10639				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

PT-14%
Pvt Veh-10%
NMT-2.5%

Trip Length

| Trip Length (Km)	Home Based Work	Home Based Education	Home Based Other	Non Home Based	Employer Business	Return	Total
0–2	327907	137356	28133	4852	1681	223144	723074
2–5	278904	78626	120412	17595	1712	458116	955365
5–10	433673	712	87537	6870	137	579279	1202342
10–15		318	223	1646	375		1797451
15–20	281664	156917	148359	14431	2506	594424	1198301
20–35	95176	55422	41802	2939	675	200621	396636
>35	0	1490	954	4013	43	6011	12511
Total	1839819	738800	649737	92346	11747	2953230	6285680
Avg. Trip Length	9.26	10.88	11.52	10.98	10.72	11.08	10.57

Avg Trip Length 10 Km

STUDY AREA: A PRIMER TO BANGALORE

2

MODAL SPLIT

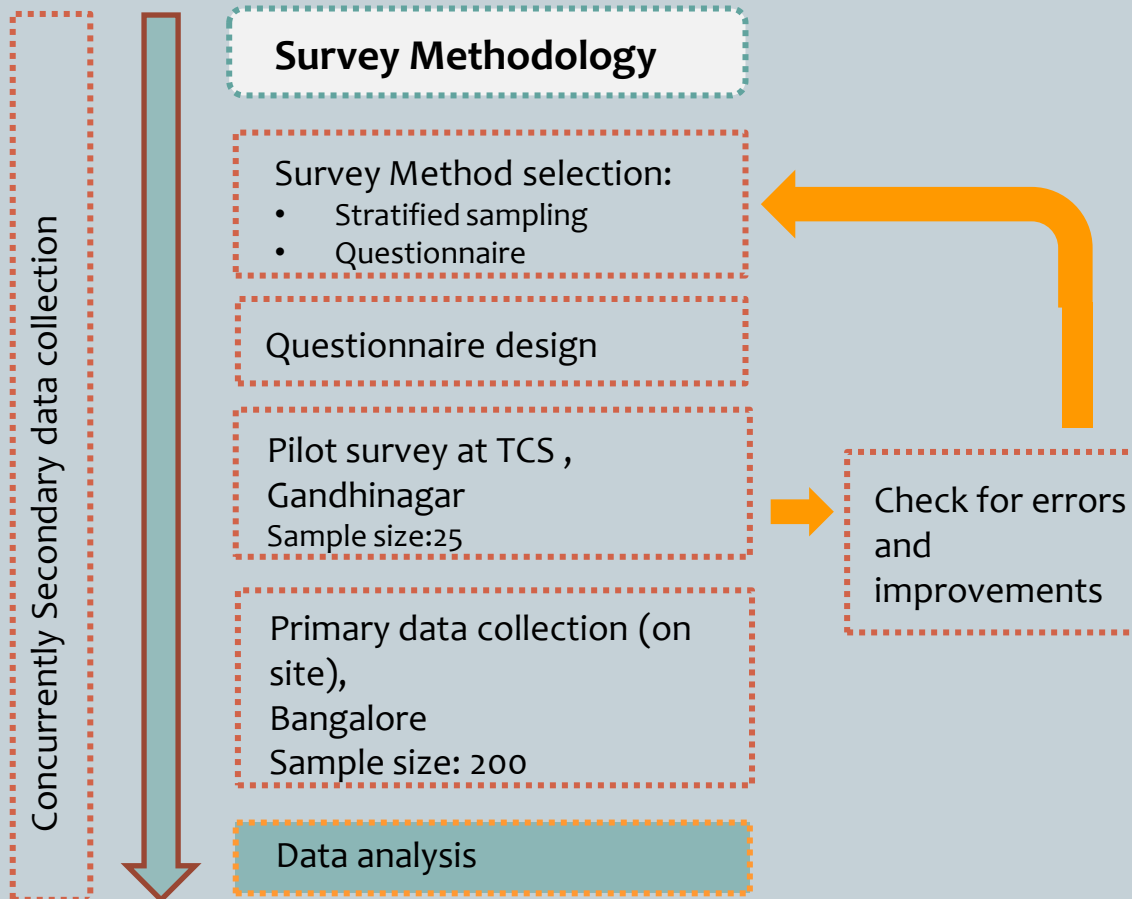### Mode Wise Travel Trips (% of Total) and Avg. Trip Lengths (Km.)
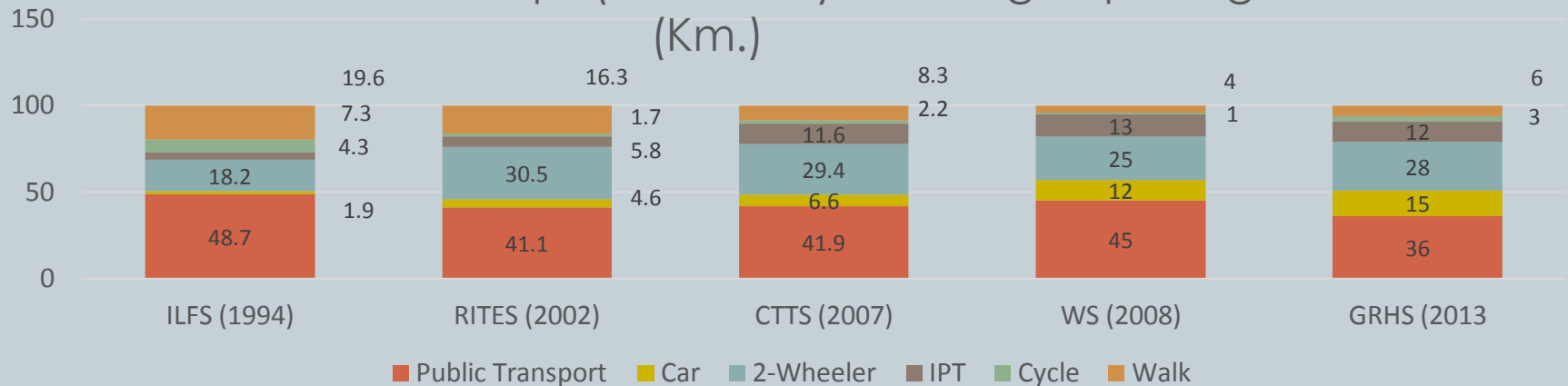
- **Vehicle ownership** has grown from **58 to 503 per 1000 population** from 1981 to 2013

- **Majority** of the trips **(36%)** are performed by **PT**. The share of **motorized trips** has been increased from **20% in 1994** to **43% in 2013**

- Major roads have **V/C ratios > 1.0** indicating high congestion, low speeds and high delays**.**

- **Majority** of the **road network** is **underdeveloped** in terms of size, structure, continuity and connectivity.

- City is **over burdened** with **traffic** and **congestion**

5 **DATA COLLECTION**

DATA COLLECTION & ANALYSIS

1

SURVEY METHODOLOGY

Concurrently Secondary data collection

Survey Methodology

Survey Method selection:
- Stratified sampling
- Questionnaire

Questionnaire design

Pilot survey at TCS , Gandhinagar
Sample size:25

Primary data collection (on site),
Bangalore
Sample size: 200

Data analysis

Check for errors and improvements

DATA REQUIREMENT

- **Personal information**
  - Residential location
  - Age & sex
  - Monthly income
  - Vehicle owned

- **ETDM strategy applicable and period of availment**

- **Travel characteristics**
  - Origin-Destination
  - Trip rate and frequency
  - Trip purpose
  - Travel distance, time and cost
  - Mode

- **User perception**

DATA COLLECTION & ANALYSIS
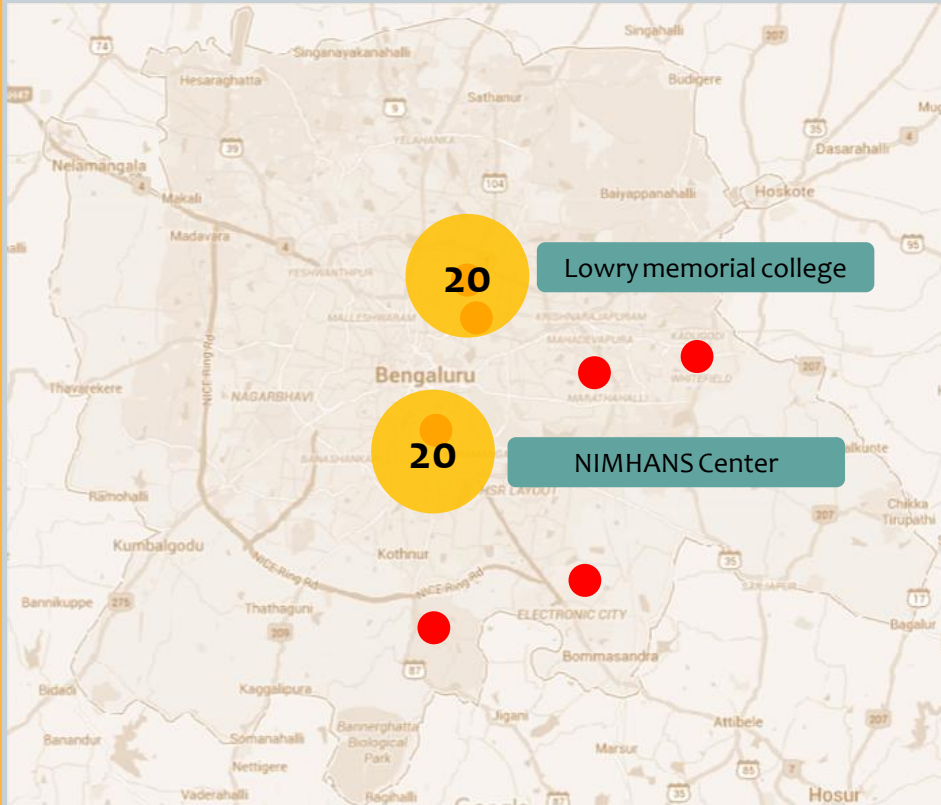
2 **STUDY AREA**

40 **Work from Home**

40 **Employer assisted housing**
On site survey at two employer housing locations

Stratified sampling : **200 samples**

I UNIT :No. of trips per week (WEEKLY)

The survey was conducted from 8:00am to 4:00pm on working days of a week (Monday-Friday)

DATA COLLECTION & ANALYSIS
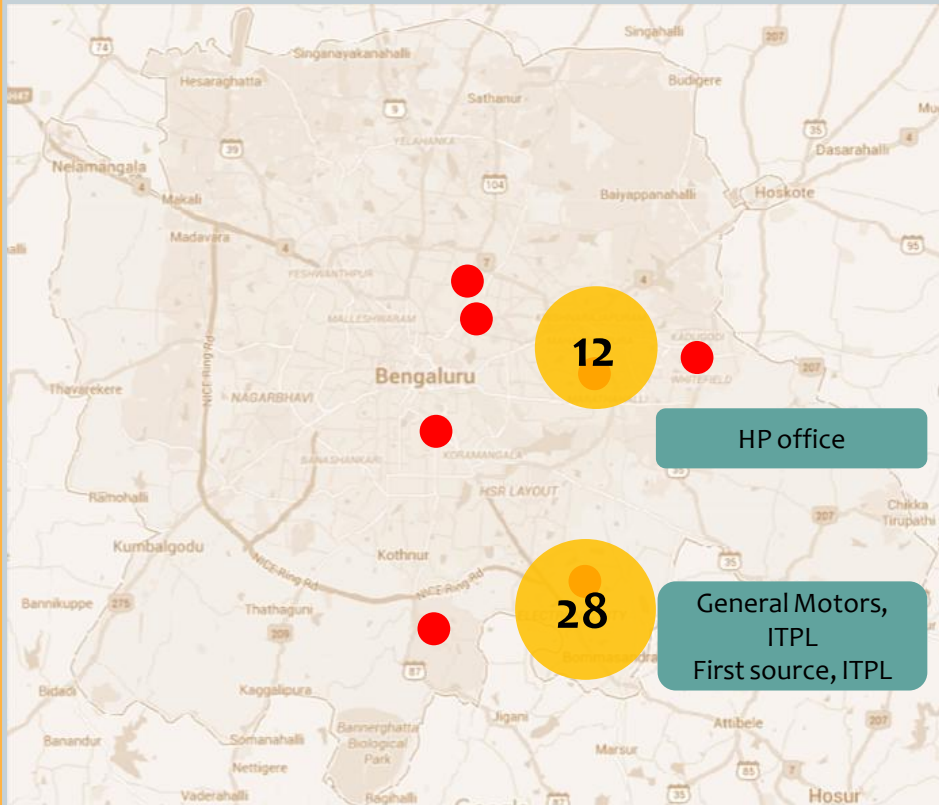
② **STUDY AREA**

40 — **Work from Home**

40 — **Employer assisted housing**
On site survey at two employer housing locations

40 — **Staggered work hours**
3 offices, 2 locations, as per employee access availability

80 — **Company transport and Public transit incentives**
2 Tech parks (ITPL and Manyata Tech park)
As per access

Map labels:
- **12**
- HP office
- **28** — General Motors, ITPL / First source, ITPL

Stratified sampling : 200 samples

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6 **DATA ANALYSIS**

DATA ANALYSIS

EMPLOYER ASSISTED HOUSING

WORK FROM HOME

STAGGERED WORK HOURS

COMPANY TRANSIT

PUBLIC TRANSIT INCENTIVES

DATA ANALYSIS

EMPLOYER ASSISTED HOUSING

WORK FROM HOME

STAGGERED WORK HOURS

COMPANY TRANSIT

PUBLIC TRANSIT INCENTIVES

DATA ANALYSIS (No. of Trips per week)

TRIP RATE BEFORE

WORK TRIPS **10**
OTHER TRIPS **3**

TRIP RATE AFTER

WORK TRIPS **10**
OTHER TRIPS **7.6**
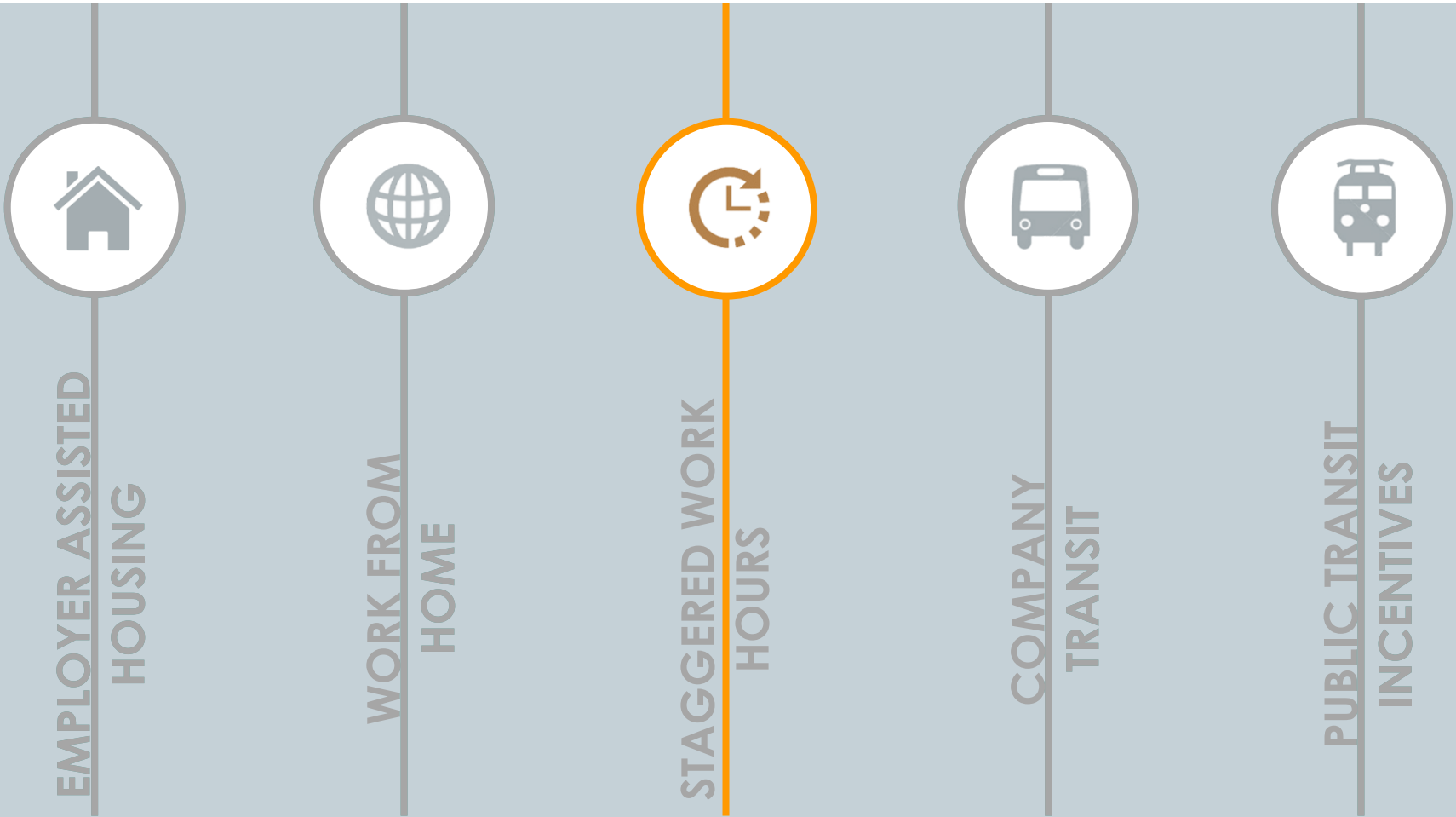
Total Before	**13**
Total After	**17.6**

FREQUENCY OF TRIPS

	Before	After
Work trips	400	400
Other triips	120	305

Trip rate increase is attributed to **increase** engagement in non –work trips
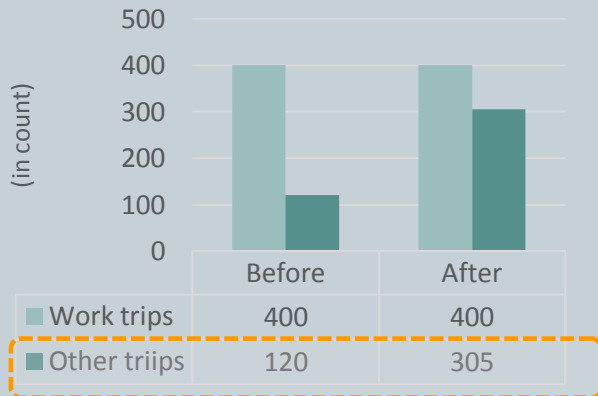
FREQUENCY OF TRIPS v/s PURPOSE

	Work	Shop/market	Recreation/lesiure	Social	Religious	Escort trip	School/education
Before	400	12	45	18	24	15	6
After	405	58	112	37	17	60	21

Trip rate increase is attributed to **increase** in **Recreational**, **Shopping** and **Escort trips**

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2 **STAGGERED WORK HOURS**

TRIP RATE and FREQUENCY | TRIP PURPOSE | MODE CHOICE | TRAVEL DISTANCE | TRAVEL TIME | TRAVEL COST
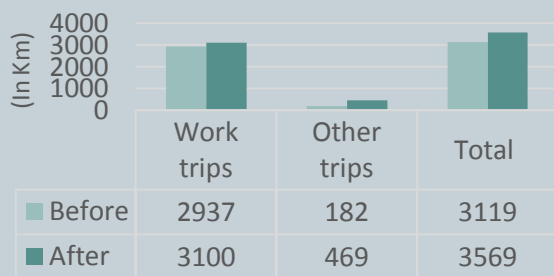
TRIP PURPOSE v/s MODE

	Work Trips	NMT	Private Vehicle	IPT	CT/PT	Other Trips	NMT	Private Vehicle	IPT
■ Series1		10	290	20	80		48	51	21
■ Series2		15	260	30	100		64	222	19

Work trip mode
Pvt   -10 %
CT/PT   + 25%

Other trip mode
Pvt   3.35 times increase
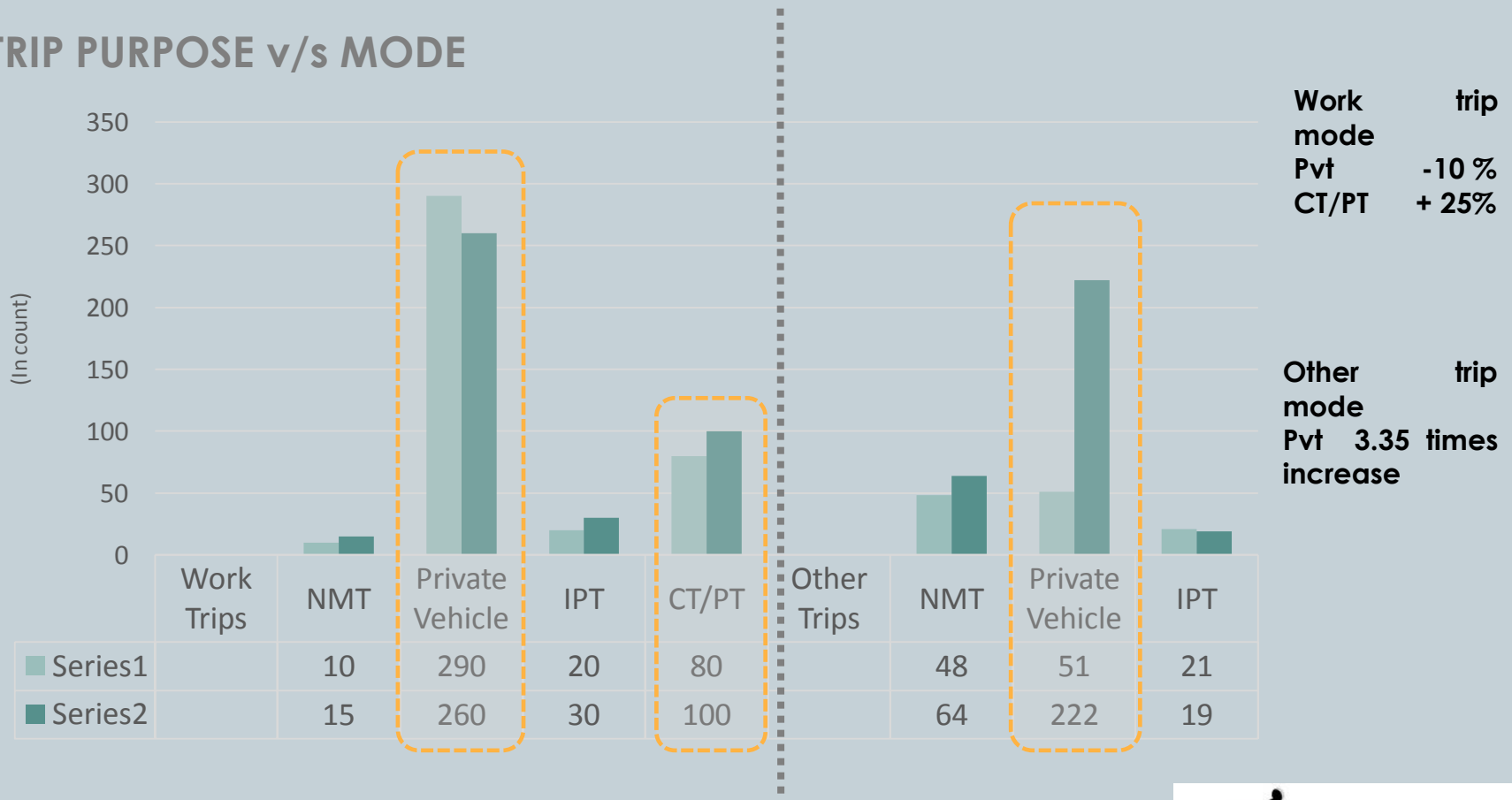
DATA ANALYSIS (No. of Trips per week)

3 STAGGERED WORK HOURS

TRIP RATE and FREQUENCY | TRIP PURPOSE | MODE CHOICE | **TRAVEL DISTANCE** | **TRAVEL TIME** | **TRAVEL COST**

Sum of Vehicle travel distance

(In Km)

	Work trips	Other trips	Total
■ Before	2937	182	3119
■ After	3100	469	3569

Average Travel time

(Mins per trip)

	Work trips	Other trips	Total
■ Before	29	34	63
■ After	33	17	50

Average Travel Cost

(Rs.per trip)

	Work trips	Other trips	Total
■ Before	21	10	31
■ After	17	8	25

Even though **SWH** has **doesn't effect the frequency** of **work trips** the **overall vehicle travel distance increases** by 6% for work trips and cumulatively 14%
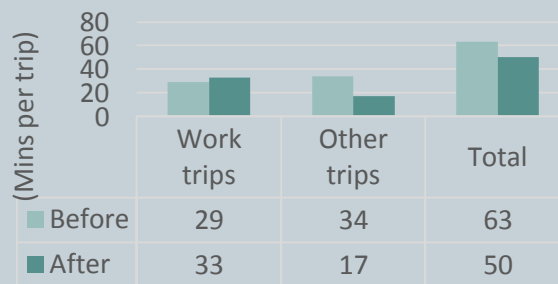
Avg. Travel time for **work trips** has **increased by 14%** and for **non work trips decreased by- 50%**
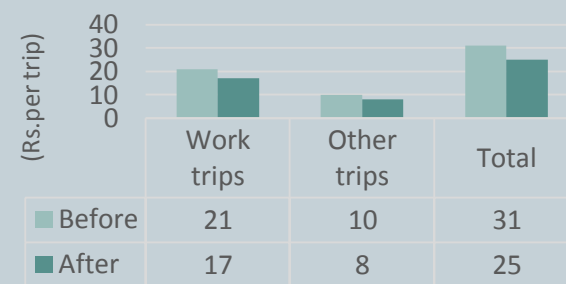
Avg. Travel cost for **work trips cross subsidizes the increase in the avg. travel time by 19%** and for **non work trips** there is **decrease of 20%**

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4

STAGGERED WORK HOURS

Peak hour : Work trips distribution

■ Before ■ After
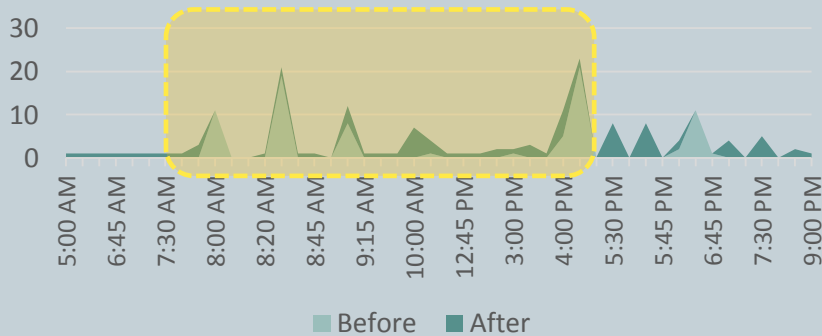
Temporal distribution of **work trips** between 7:30 am to 7:30 pm.

Peak hour :Other trips distribution

■ Before ■ After
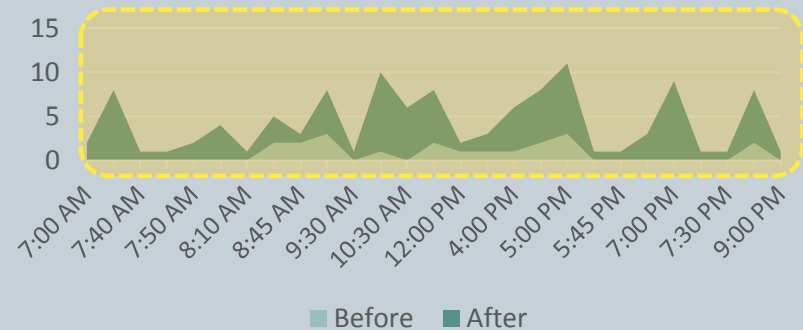
Temporal distribution of **Other trips** between 7:00 am to 5:30 pm,6:30 pm to 9:00 pm

DATA ANALYSIS (No. of Trips per week)

5 ## STAGGERED WORK HOURS

MATRIX

SWH	Trip rate			Change in Work Trips (%)	Change in Other Trips (%)	SOV Change for Work trips (%)	Change in sum of Travel distance (%)		Change in Travel time (%)		Change in Travel cost (%)	
	Before	After	Change (%)				Work Trips	Other Trips	Work Trips	Other Trips	Work Trips	Other Trips
	13	17.6	37%	Nill	54%	-10%	6%	58%	14%	-50%	-19%	-20%

INFERENCE

Minimal **Work trips** change, with **-10%** decrease in **SOV** (Pvt Veh) use as employees shift to alternate modes such as Company transport use.

Other Trips +1.5 times ,therefore the **overall vehicle travel distance 0.14 times.**

SWH distribute the peak hour work traffic, and can act as a lower cost solution to higher cost problems

7 CONCLUSION AND FINDINGS

WORK FROM HOME

Trip rate

	Before	After	
TOTAL	12	13.2	
WORK TRIPS	9.8	6.1	
OTHER TRIPS	2.2	7.1	

Before   After
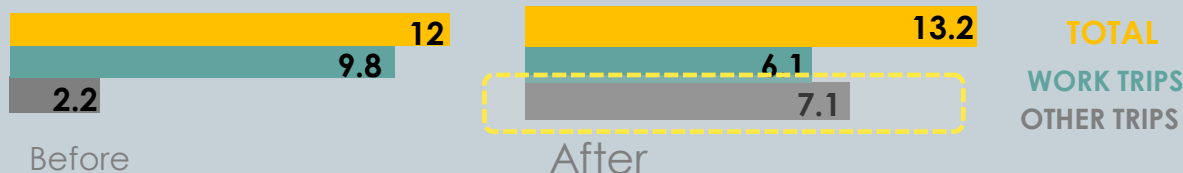
Trip purpose
Escort 4.6 times, Shopping 2.2 times and Recreational 1.8 times

Trip Mode

Work Trips

Pvt Veh 2.5 times increase

CT/PT   0.8 decrease

Other Trips

Pvt Veh 20 times increase

Vehicle distance travelled ,Travel time and Travel cost

Sum of Vehicle distance travelled	WT	- 0.75 times	3.5 times
	OT	+ 4.30 times	
Avg Travel time (per trip)	WT	-0.46 times	-36%
	OT	+0.63 times	
Avg Travel cost (per trip)	WT	+0.50 times	+73 %
	OT	+1.0 times	

EMPLOYER ASSISTED HOUSING

Trip rate

Before
- 12.9 TOTAL
- 10 WORK TRIPS
- 2.9 OTHER TRIPS

After
- 23.7 TOTAL
- 16.3 WORK TRIPS
- 7.3 OTHER TRIPS

Trip purpose

Recreational 3.6 times, Escort trips 3.2 times and Social trips 2.9times

Trip Mode

Work Trips

NMT 5.7 times increase

Pvt Veh 0.2 times increase

Other Trips

NMT 7.0 times increase

Pvt Veh 1.0 times increase

Vehicle distance travelled ,Travel time and Travel cost

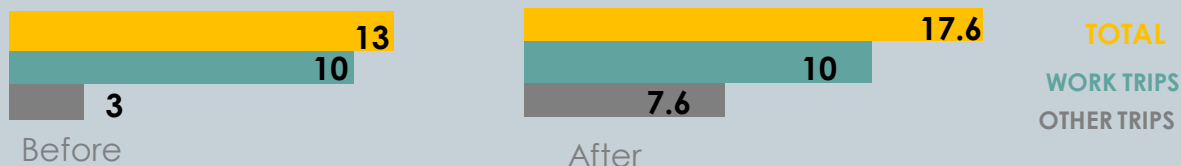|			
Sum of Vehicle distance travelled	WT	- 0.66 times	-45 %
	OT	+ 1.19 times	
Avg Travel time (per trip)	WT	-0.71 times	-38 %
	OT	+0.13 times	
Avg Travel cost (per trip)	WT	-0.68 times	-51 %
	OT	-0.27 times	

Observations

- Work Trips increase by +0.6 times, with an **increase of other trips by +1.5 times.** There is a **far-reaching saving in Travel time for work purpose,** due to Job-House proximity, leading to increase in frequency of work trips

- Change in trips lengths ,reduces the vehicle travel distance for work trips by -0.66 times, and the **overall work and other trips indicates** a **decrease** of -45% in **veh. Travel distance**

- EAH strategy benefits employees at individual level, as it provides for **additional time for non-work activities , reduces commute stress time and cost** by 38% and-51%

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STAGGERED WORK HOURS

Trip rate

	Before	After
TOTAL	13	17.6
WORK TRIPS	10	10
OTHER TRIPS	3	7.6

Trip purpose
Shopping 3.8 times, Escort trips 3 times and Recreational trips 1.4 times

Trip Mode

Work Trips

CT/PT 0.25 times increase

Pvt Veh 0.10 times decrease

Other Trips

Pvt Veh 3.3 times increase

NMT 0.3 times increase
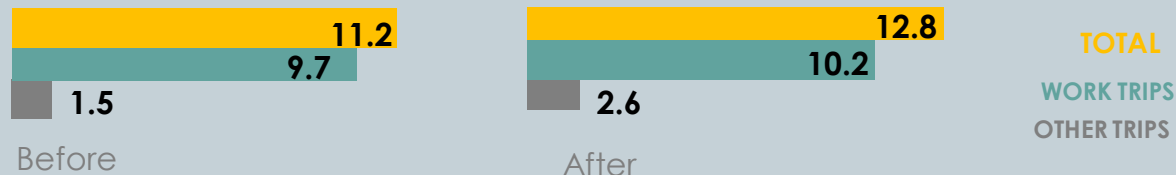
Vehicle distance travelled ,Travel time and Travel cost

Sum of Vehicle distance travelled	WT	+ 0.60 times	+14 %
	OT	+ 1.58 times	
Avg Travel time (per trip)	WT	+0.14 times	-21%
	OT	-0.50 times	
Avg Travel cost (per trip)	WT	-0.19 times	-19 %
	OT	- 0.20 times	

Observations

- No increase in Work trips, simultaneous increase of +1.58 times %for other trips.
- SWH plays an important role at a **larger society level**, as it **facilitates travelling at off peak hours**.

- SWH from the data analyzed show a reduction in the Use of **SOV by -0.1times** where employees choose to **shift to CT due to different work timings.**

- **Avg Travel time to work increases +0.14 times, but is endowed by reduction in travel cost by -0.19 times.**

- SWH strategy benefits employees at individual level, as it provides for **flexible time for non-work activities**

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COMPANY TRANSPORT

Trip rate

Before
- 11.2
- 9.7
- 1.5

After
- 12.8
- 10.2
- 2.6

TOTAL
WORK TRIPS
OTHER TRIPS

Trip purpose
Escort 3.0 times, Shopping trips 2 times and Recreational trips 1.2 times

Trip Mode

Work Trips

CT 100% increase

Other Trips

Pvt Veh 0.76 times increase

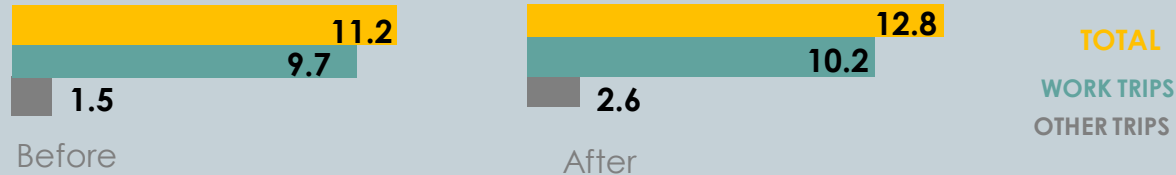## Vehicle distance travelled ,Travel time and Travel cost

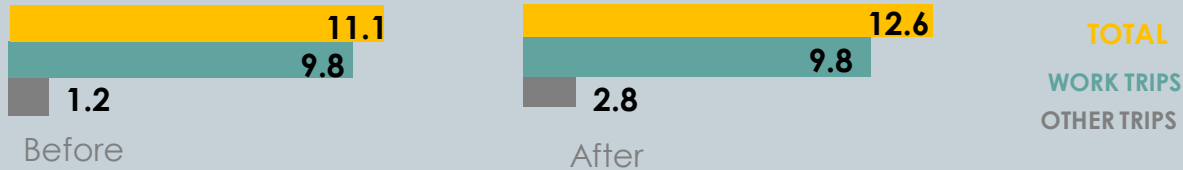| Sum of Vehicle distance travelled	WT	+ 0.12 times	+17 %
	OT	+ 1.04 times	
Avg Travel time (per trip)	WT	+0. 15 times	-8%
	OT	-0.35 times	
Avg Travel cost (per trip)	WT	-0.26 times	-6 %
	OT	+ 0.15 times	

Observations

- Increase in Work trips by 0.05 times, simultaneous increase of 0.7 times %for other trips.

- CT plays an important role at a **larger society level**, as it facilitates **more sustainable mode use for work commute**

- CT show a **reduction in the use of SOV by 100 %.**

- Avg **Travel time** to work **increases** +0.15 times, but is endowed by **reduction in travel cost** by -0.26 times.

- CT strategy benefits employees at individual level, as it provides for **reduction in work commute stress ,and increase mass transit ridership**

COMPANY TRANSPORT

Trip rate

	Before	After	
	11.2	**12.8**	**TOTAL**
	9.7	**10.2**	**WORK TRIPS**
	1.5	**2.6**	**OTHER TRIPS**

Before | After

Trip purpose
Escort 3.0 times, Shopping trips 2 times and Recreational trips 1.2 times

Trip Mode

Work Trips

CT 100% increase

Other Trips

Pvt Veh 0.76 times increase

Vehicle distance travelled ,Travel time and Travel cost

Sum of Vehicle distance travelled	WT	+ 0.12 times	+17 %
	OT	+ 1.04 times	
Avg Travel time (per trip)	WT	+0. 15 times	-8%
	OT	-0.35 times	
Avg Travel cost (per trip)	WT	-0.26 times	-6 %
	OT	+ 0.15 times	

PUBLIC TRANSIT INCENTIVES

Trip rate

11.1 — TOTAL
9.8 — WORK TRIPS
1.2
Before

12.6
9.8 — OTHER TRIPS
2.8
After

Trip purpose
Recreational 5.6 times and Escort trips 1.5 times

Trip Mode

Work Trips
PT 97 % increase (3% attributed to Escort or NMT)
Pvt Veh 0.98 times decrease

Other Trips
NMT 1.7 times increase
Pvt Veh 4 times increase
PT 1.0 times increase

Vehicle distance travelled ,Travel time and Travel cost

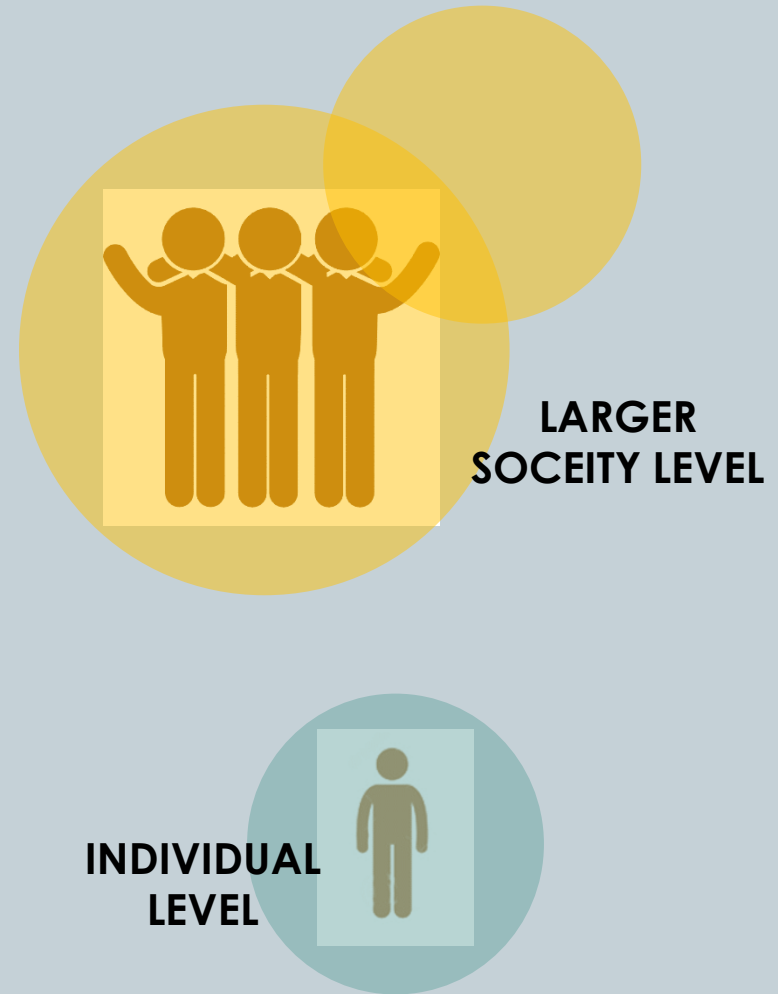| Sum of Vehicle distance travelled	WT	+ 0.26 times	+33 %
	OT	+ 1.41 times	
Avg Travel time (per trip)	WT	+0. 14 times	-11 %
	OT	-0.25 times	
Avg Travel cost (per trip)	WT	-0.29 times	-21 %
	OT	+ 0.08 times	

- **No increase in Work trips**, simultaneous increase of +1.29 times %for other trips.

- PTI from the data analyzed show a **reduction** in the use of **Pvt Veh** by -0.98 .For **other trips** the use of **Pvt Veh increases 4 times**

- **Avg Travel time to work increases** +0.26 times, but is endowed by **reduction in travel cost by** -0.29 times.

- PTI strategy benefits employees at individual level, as it **reduces driving stress,** and **saves on Travel cost.**

- PTI also help **increase the efficiency of the existing transport system by increasing mass ridership**

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5 ETDM'S FINDINGS

1 **SUMMARY**

- To identify different employer travel demand management strategies.

- To assess **impacts** of alternate Employer travel demand management strategies **(ETDM's)** on the **travel pattern of employees**
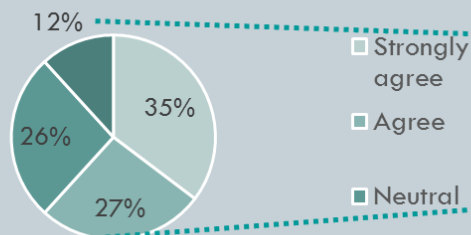
LARGER SOCEITY LEVEL
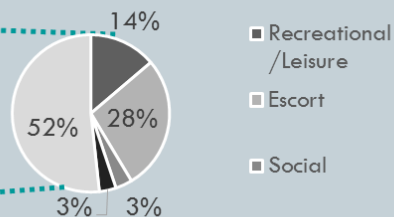
INDIVIDUAL LEVEL

SUMMARY: INDIVIDUAL LEVEL

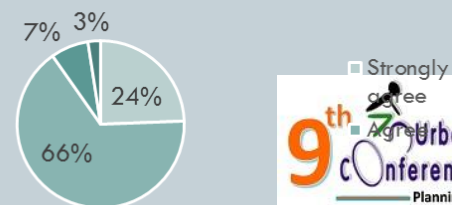| ETDM	Attributes	Benefit	Result
Company Transport & Public Transport	Longer travel distance and time	Reduction in travel cost	**Cumulative saving/benefit** • Lesser commute stress • Increased Job performance • Safety
Work from Home & Employer assisted Housing	Increased work trip frequency	Reduction/ Increase in work commute stress	**Cumulative saving/benefit** • Lesser commute stress • Increased Job performance • Safety
Staggered Work Hours	No change in frequency of trips	Flexible/modified work timings	**Additional time** For other activities

ETDM Strategies provide 'additional time' for non-work activities ?

12%
35%
26%
27%
☐ Strongly agree
☐ Agree
☐ Neutral

'Additional time' is spent on

14%
52%
28%
3% 3%
■ Recreational /Leisure
☐ Escort
☐ Social

ETDM Strategies increases Job performance and is convinent ?

7% 3%
24%
66%
☐ Strongly agree
☐ Agree

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2

SUMMARY: LARGER SOCEITY LEVEL

ETDM	Attributes		Result
Company Transport & Public Transport	Minimal change in the work trips	**Reduce the use of Private vehicles** by 98%.	This shift **increase the Personal distance travelled , but the sum of Vehicle distance travelled moderately increases** and is **attributed by more sustainable modes** for work commute.
Work from Home & Employer assisted Housing	Reduce and increase work trip frequency respectively,	**Increases private vehicle use**	**Overall vehicle travel distance** in **Work From Home increase** 3.5 times due to higher frequency of other purpose trips, and relocation of residences to further locations. A **decrease** of 45% for **Employer Assisted Housing,** due to proximity of work and Home locations
Staggered Work Hours	No change in frequency of trips	Flexible/modified work timings **reduce private vehicle use**	**Re-distribute the peak hour work traffic.**

THANK YOU