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Study on Travelers' Preferences for Shifting to Metro Rail in Surat, India

Presented by

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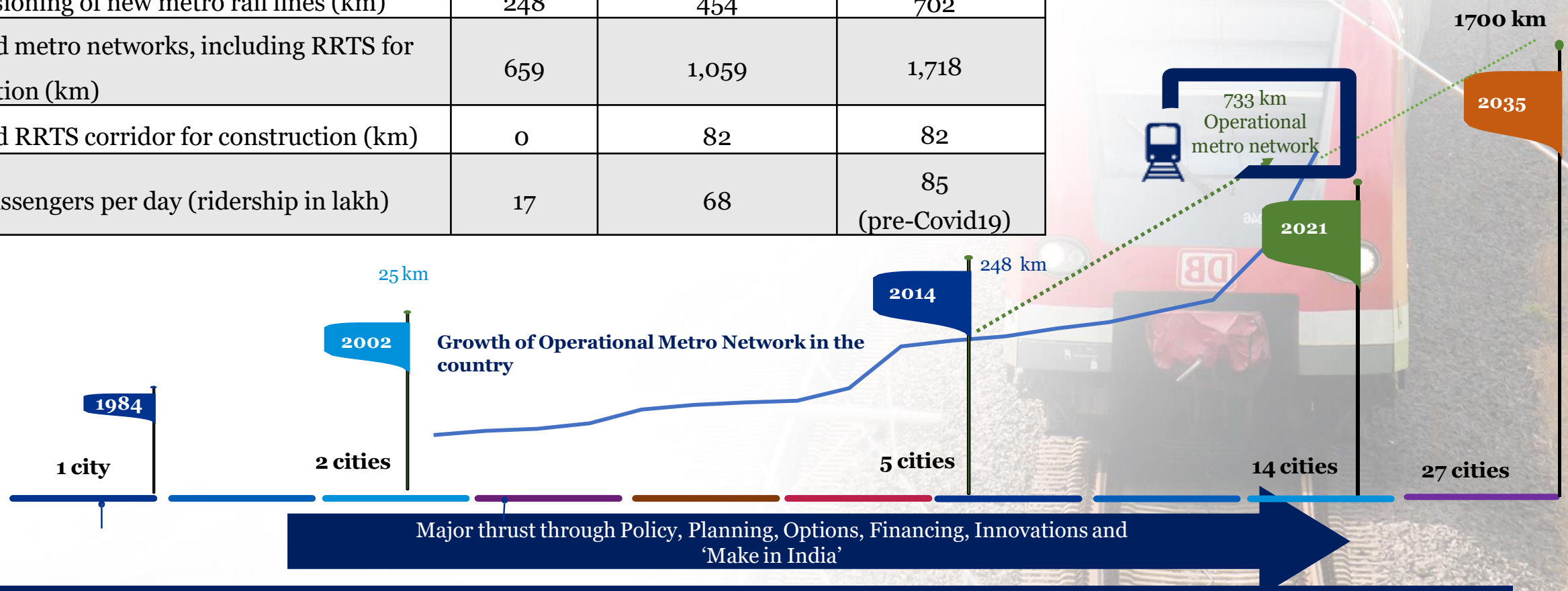
Growth of Metro Rail in India

Item	Before 2014	Addition after 2014	Current Status
No. of cities with operational Metro Network	5	13	14
Commissioning of new metro rail lines (km)	248	454	702
Approved metro networks, including RRTS for construction (km)	659	1,059	1,718
Approved RRTS corridor for construction (km)	0	82	82
Metro passengers per day (ridership in lakh)	17	68	85 (pre-Covid19)



Prior to 2014, about 248 km metro network was operational in 5 cities. 484 km operational metro network added during 2014 to 2021 in 14 cities

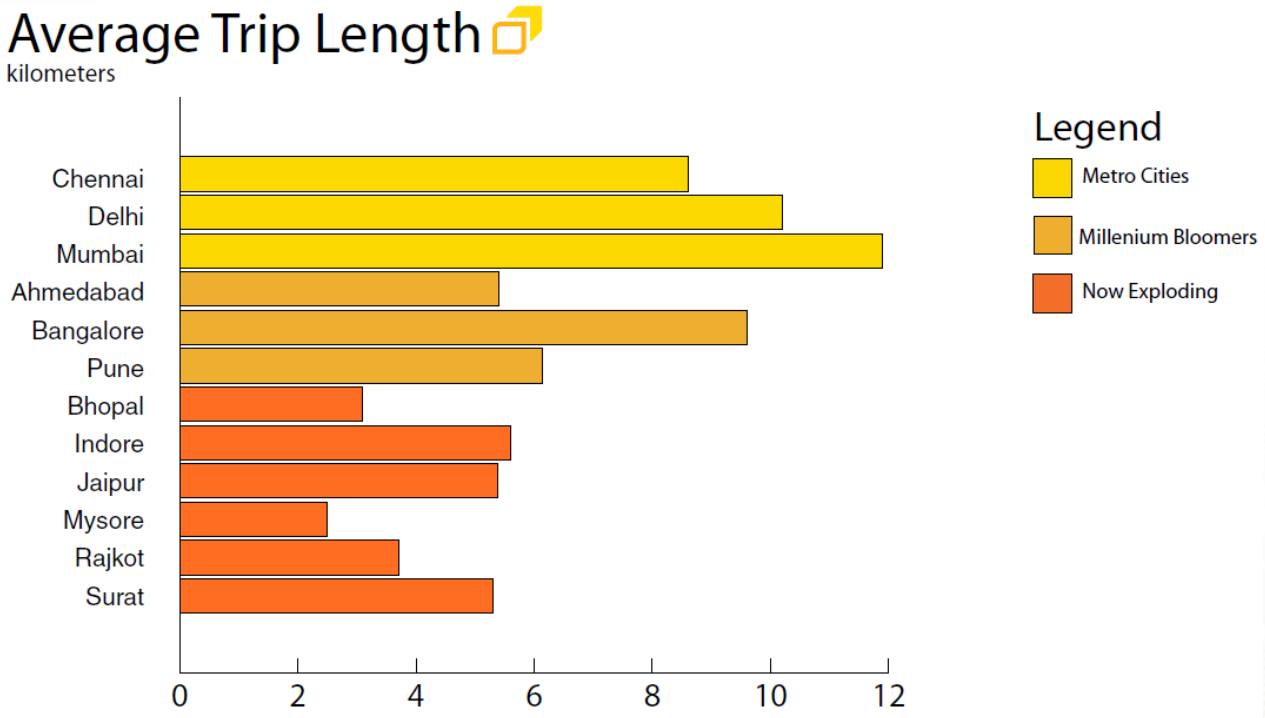
(Source: MoHUA, 2022)

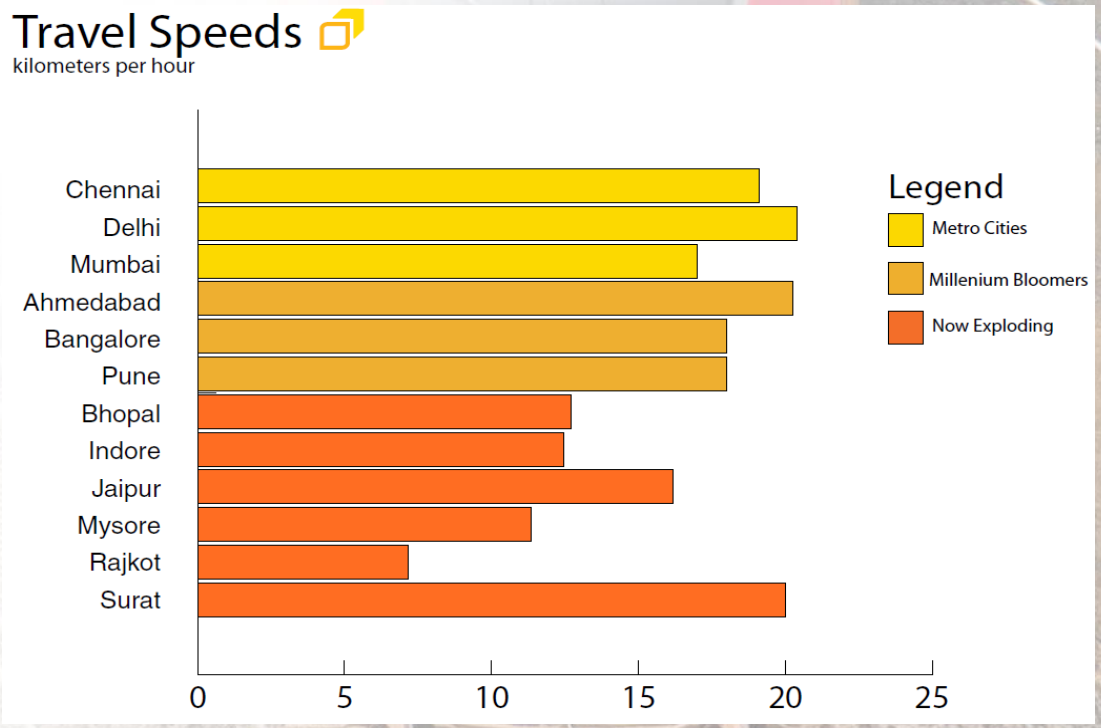
Growth of Metro Rail in India

Mode Shares of Indian cities (Pre Covid)

Population	Bus	Auto-Rickshaw	Rail/ Metro	Car	2W	Cycle	Walk	Total
> 10 million	20	3	**14**	6	9	5	43	100
1 - 10 million	13	11	**2**	3	23	13	35	100
< 1 million	4	13	**0**	2	27	6	48	100

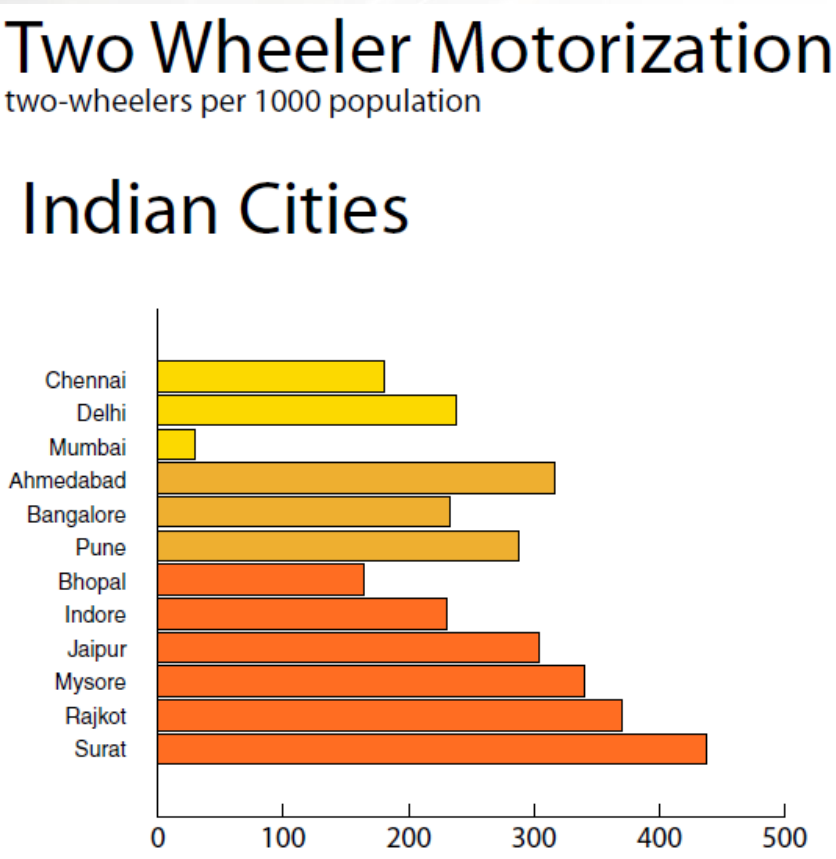
(Source: Complied from Comprehensive Mobility Plans of 27 cities)

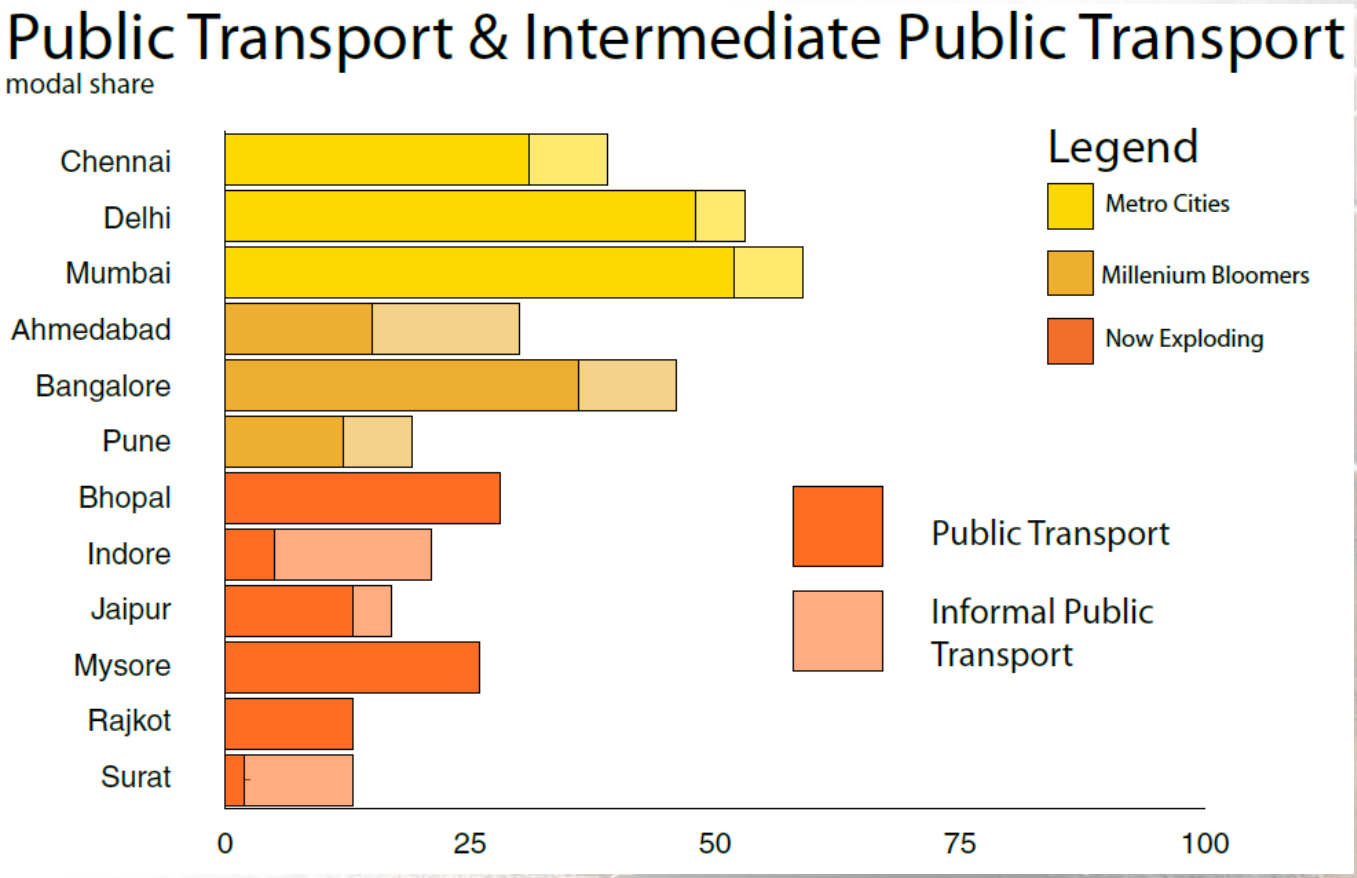




(Source: Transport in cities – India indicators, 2022)

Growth of Metro Rail in India





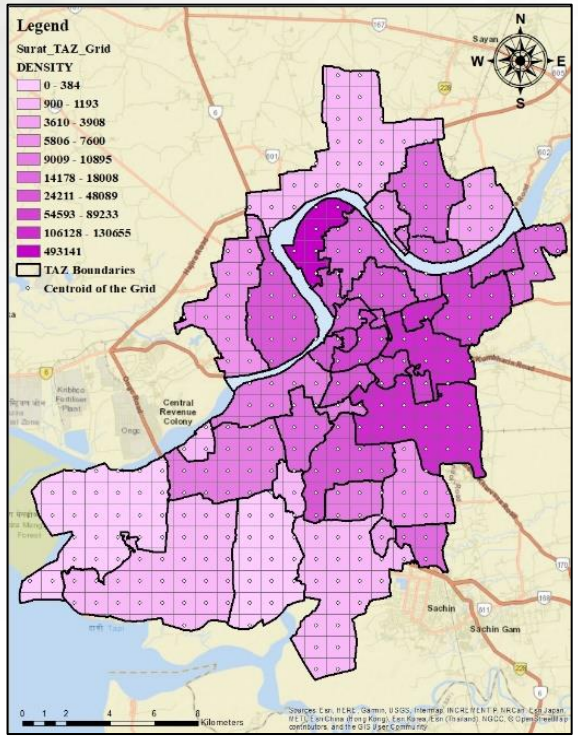
(Source: Transport in cities – India indicators, 2022)

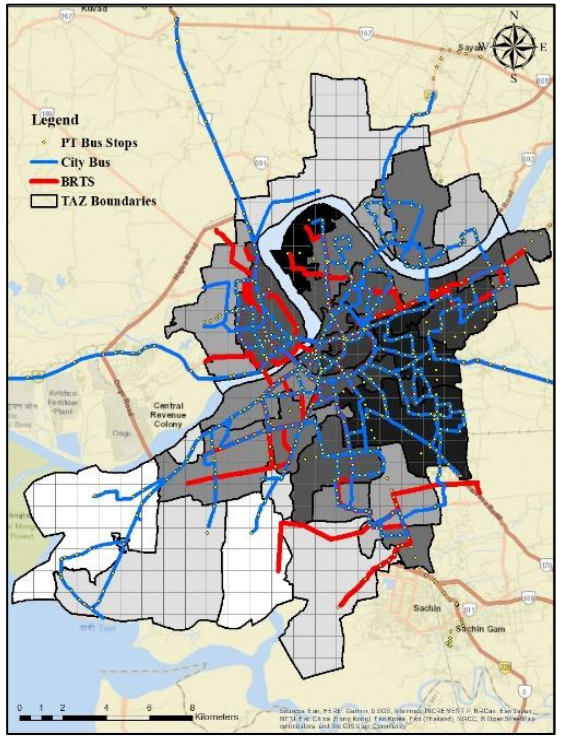
Temporal
Spatial
Capacity
Information

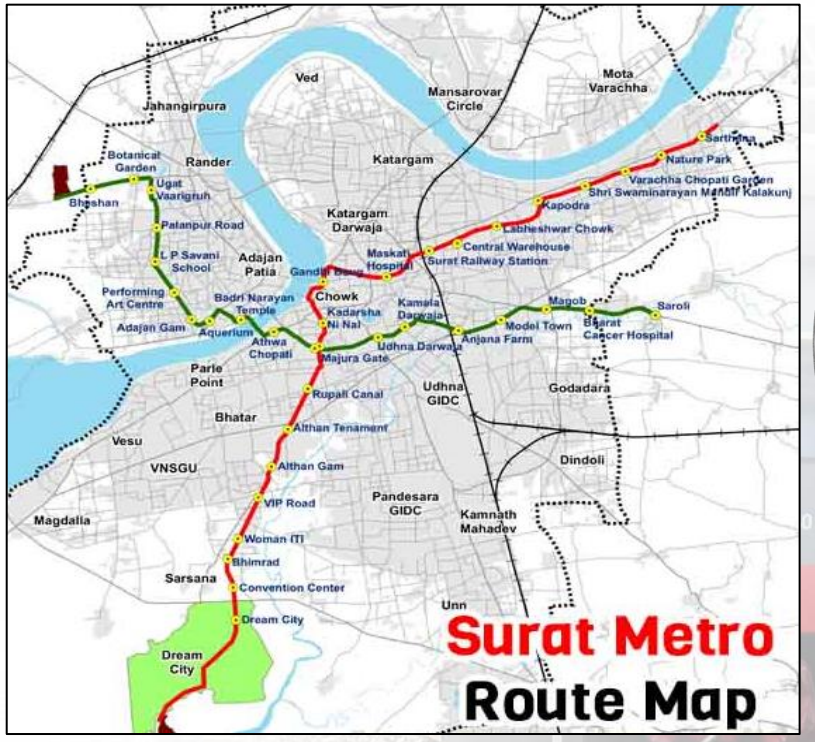
→ **Availability** → Mode come under the choice set of travelers → Comfort and Convenient → **Tread off between modes** → Mode choice

(Source: TCQSM, 3rd edition, 2013)

Surat City Public Transport Operations







❑ Bus Public Transport

- 12 Bus Rapid Transit System (BRTS) routes and 46 City Bus routes
- 500 km bus transit network
- 0.275 million avg. daily ridership
- 2.5% public transport mode share

(Source: Surat Municipal Corporation, Surat Sitilink Limited 2024)

❑ Surat Metro (under construction)

- No. of routes = 2
- Total length = 40
- No. of stations = 40
- Development of 500m buffer influence area of each metro station with the integrated approach of Surat Municipal Corporation and Gujarat Metro Rail Corporation

(Source: Gujarat Metro Rail Corporation, 2024)

Development of Questionnaire

Trip Characteristics	Socio-economic and Demographic
• **Travel Pattern** *(Origin and Destination)*	• **Gender**
• **Mode of Travel** *(Bike, Car, Auto, Bus)*	• **Age**
• **Trip Purpose** *(Work, Education, Social, Recreational, Shopping)*	• **Household Size**
• **Travel Cost**	• **Earning Members in HH**
• **Travel Time**	• **Monthly Household Income (Rs.)**
• **Travel Distance**	• **Vehicle Ownership**
• **Availability of Metro Station** *(near to origin and destination)*	• **Occupation**

RANKING OF TRANSIT SUPPORTIVE STRATEGIES

In order to use metro as your travel mode of transport, which are the THREE most important strategies improvements that you feel are required.

Strategy	Description	Example	Rank
Accessibility	It is first and last Mile Connectivity. To reaching to		

RESPONSE TO TRANSIT SUPPORTIVE STRATEGIES:

(Kindly tick mark the appropriate option)

1) According to you, what is the maximum distance (in meters) you are willing to travel by different other modes (Feeder mode) to use the metro as your main mode of transport?

Less than 500 m	
500– 750 m	
750 – 1000 m	
1000 – 1500 m	

2) What could be the preferred feeder mode?

Public Bike Sharing/ Bicycle	
Park and Ride	
Rickshaw/ Taxi	
Bus	
Walk	

3) At what headway of metro service, you would choose metro as your mode of transport?

Headway = 6 min.	
Headway = 8 min.	
Headway = 10 min	
Headway = 15 min.	

4) How much of your monthly income would you be willing to spend as a maximum expense to use the metro system?

5%	
10%	
15%	
20%	

	services, fare integration, and other real-time traffic data.	
Affordable	It means that people, including those with lower incomes, have enough money to assess basic services.	

Development of Questionnaire

RESPONSE TO TRANSIT-SUPPORTIVE POLICIES: POLICY IV

Strategies			Strategies		
Accessibility & Feeder Services	**Metro**		**Parking Charges**	**2W/4W**	
❖ Less than 500m distance to the metro station. ❖ Exclusive Walkway to metro station.	Very Dissatisfied	1	❖ Parking slots far from the destinations and 2 times parking charge. ❖ Cost of 2W/4W= 2 x present cost. ❖ OVTT = 2 x present time.	Very Less	1
	Dissatisfied	2		Less	2
 	Neutral	3	 	Medium	3
	Satisfied	4		High	4
	Very Satisfied	5		Very High	5
Affordability & Information Availability	**Metro**		**Frequency & waiting time**	**Metro**	
❖ Travel Expense: 5 % of Monthly Income ❖ Prior QR-Based ticketing before entering the station area. ❖ Crowding level: > 3 Pax	Very Poor	1	❖ Interval between arrival of metro service (Headway) = 15 min ❖ Waiting time at Metro station = more than 10	Very Dissatisfied	1
	Poor	2		Dissatisfied	2
	Medium	3	 	Neutral	3
	Good	4		Satisfied	4
	Very Good	5		Very Satisfied	5

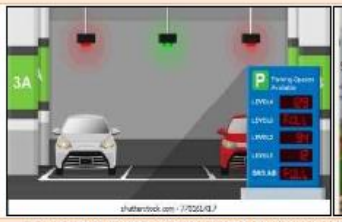
How likely are you to shift to the metro?

Definitely Not	Probably Not	Unsure	Probably Yes	Definitely Yes
				

Development of Questionnaire

3) According to your perception, please rank the following information availability service at the metro system. *(Rank the given options from 1 to 4; where 1:Highest 4:Lowest)*

Arrival and Departure timings of Transit units



Display information about feeder services with parking availability, Park& ride facility

Information about fare structure discounts & other concessions

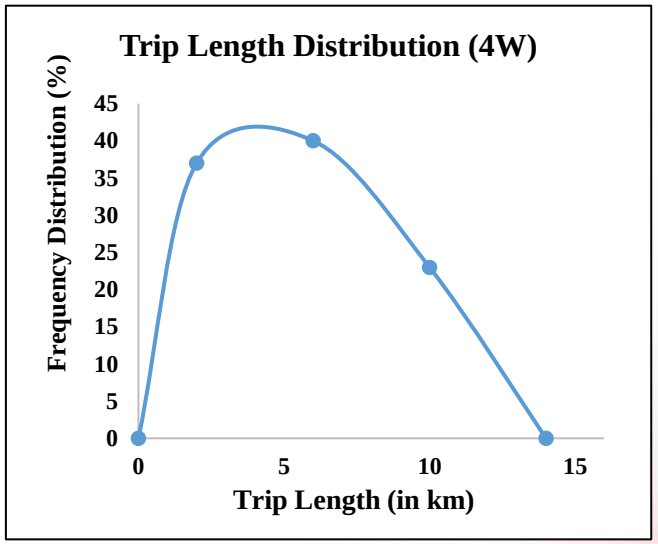
Real-time traffic information (delays, closures, webcast) of major intersections and roads

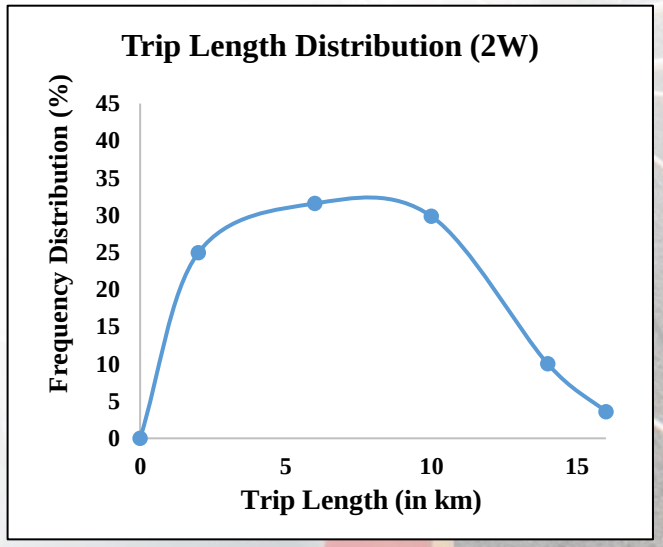
4) Following are the different crowding level of metro, up to which maximum tolerance level you can travel in the metro?

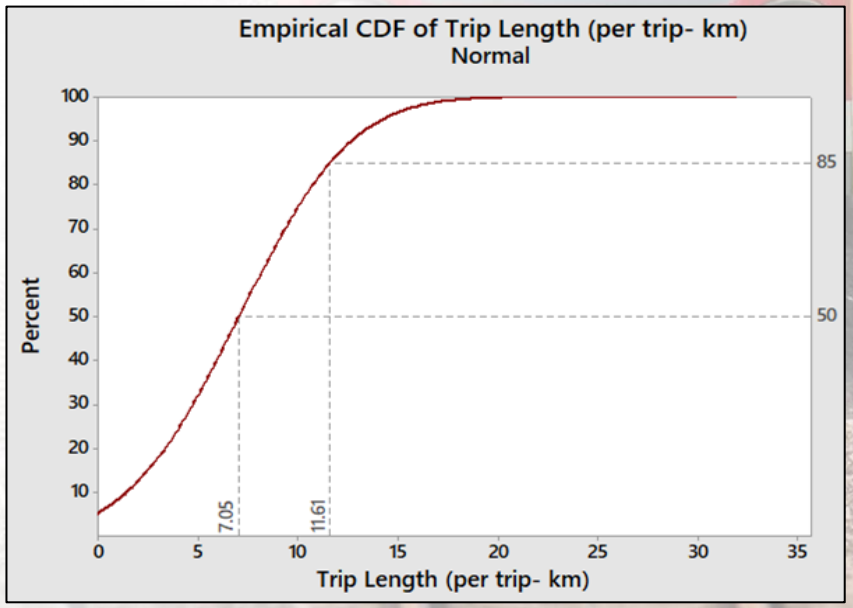
Descriptive Statistics of Collected Samples

Total Sample	543
Gender (%)	
Male	74
Female	26
Age Group (%)	
<18	4
18-30	44
30-40	29
40-50	15
50-60	7
>60	1
Monthly HH Income (%)	
< 20000	11
20000- 40000	28
40000- 60000	22
60000-80000	14
80000-100000	10
100000-125000	7
>125000	8
HH Size (%)	
1	1
2	2
3	13
4	36
5	29
>5	19

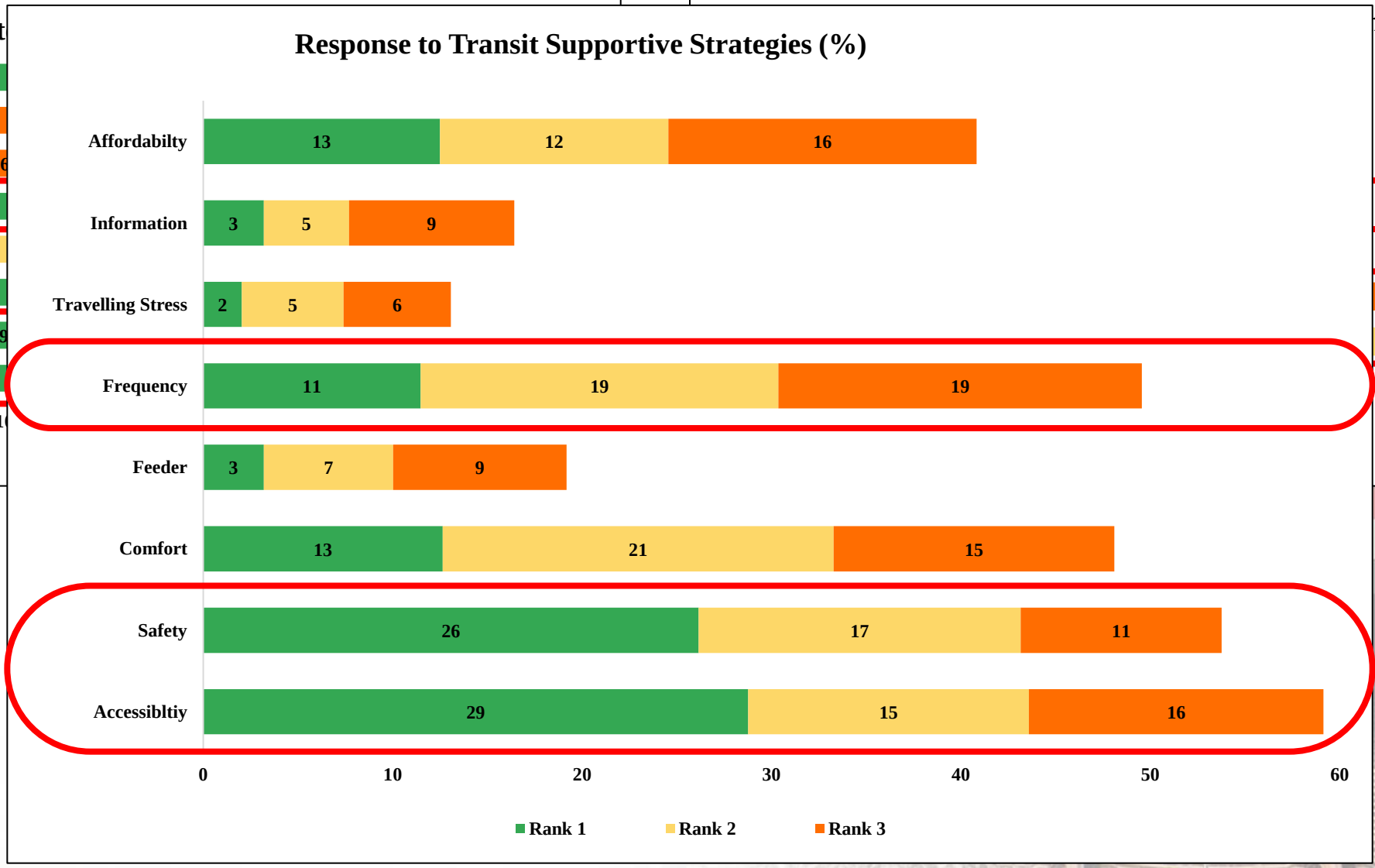
Occupation (%)	
Education	15
Government	3
Private Business	46
Private Services	27
Retired	1
Semi Government	2
No Job	6
Vehicle Ownership (%)	
Bicycle	11
2W	62
Car	26
Other	0
Non	1
Trip Purpose (%)	
Work	75
Education	14
Other	3
Shopping	8
Current Mode of Transport (%)	
2W	77
Bus	11
3W	4
4W	1
Car	4
Cycle	1
Walk	2







Prioritizing Transit Supportive Strategies and their Levels



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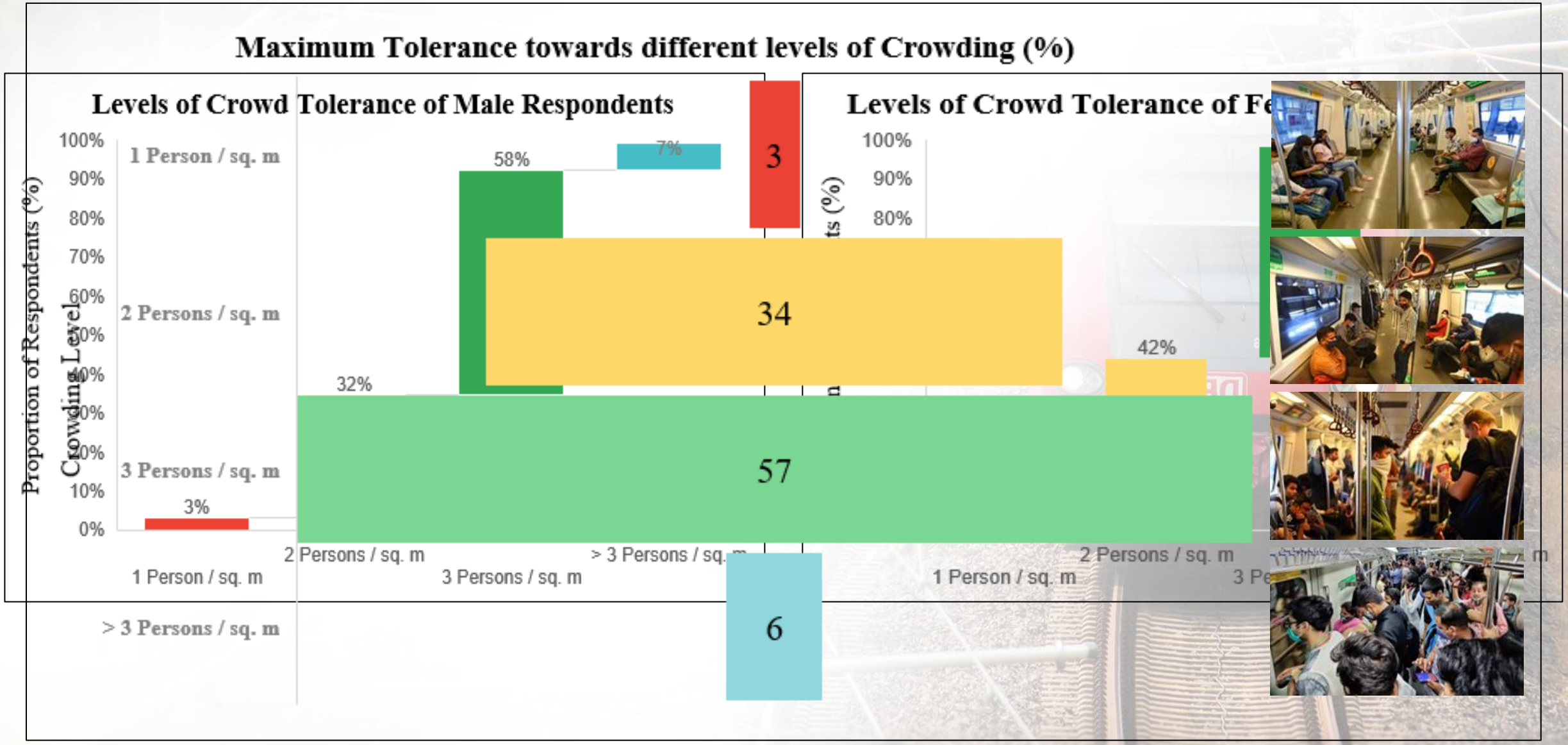

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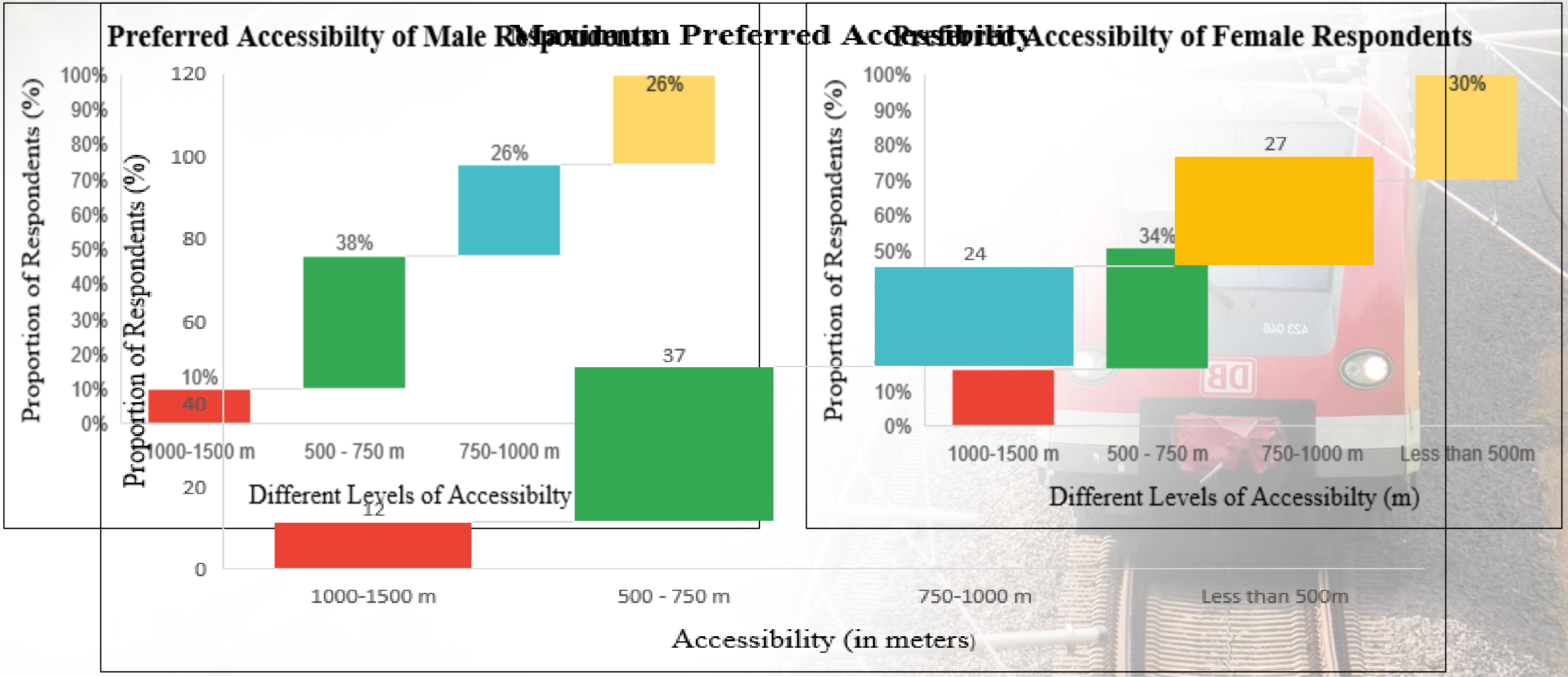

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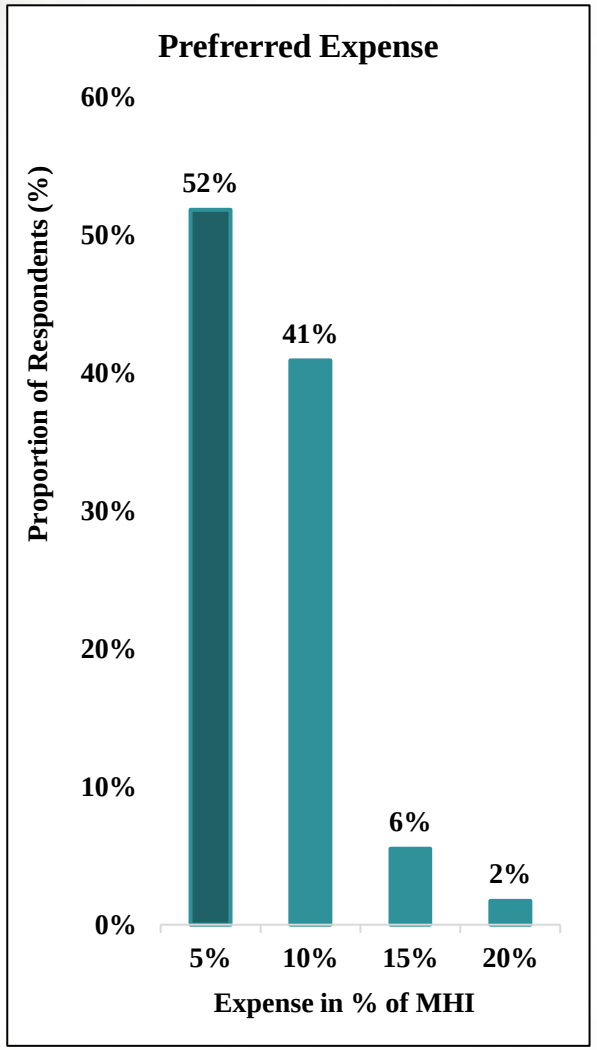
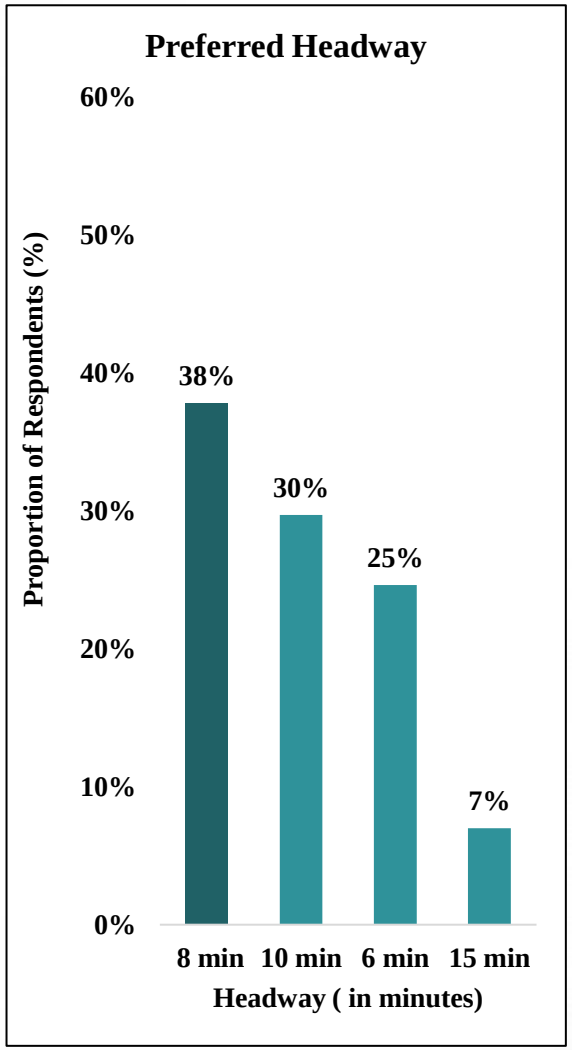
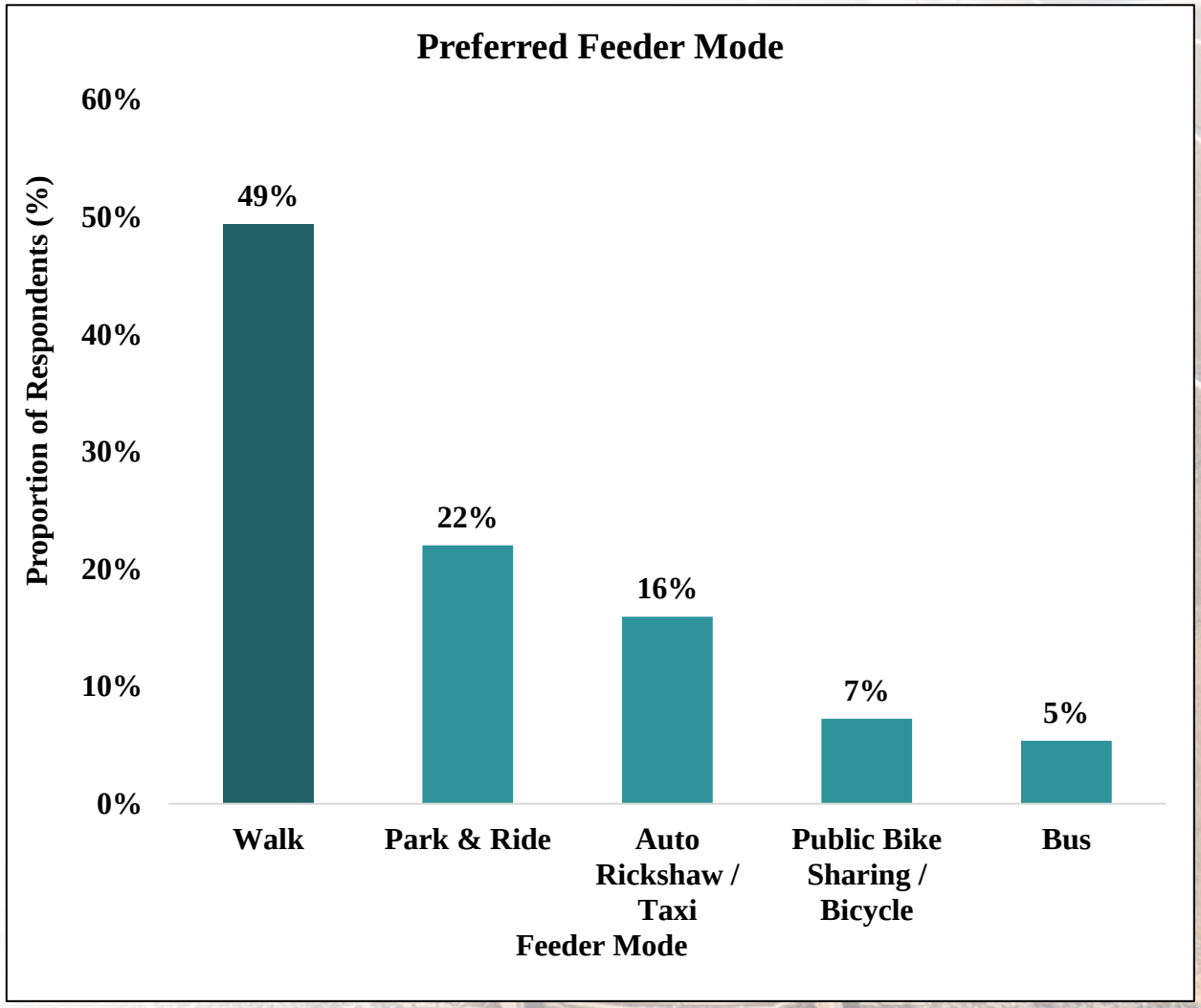
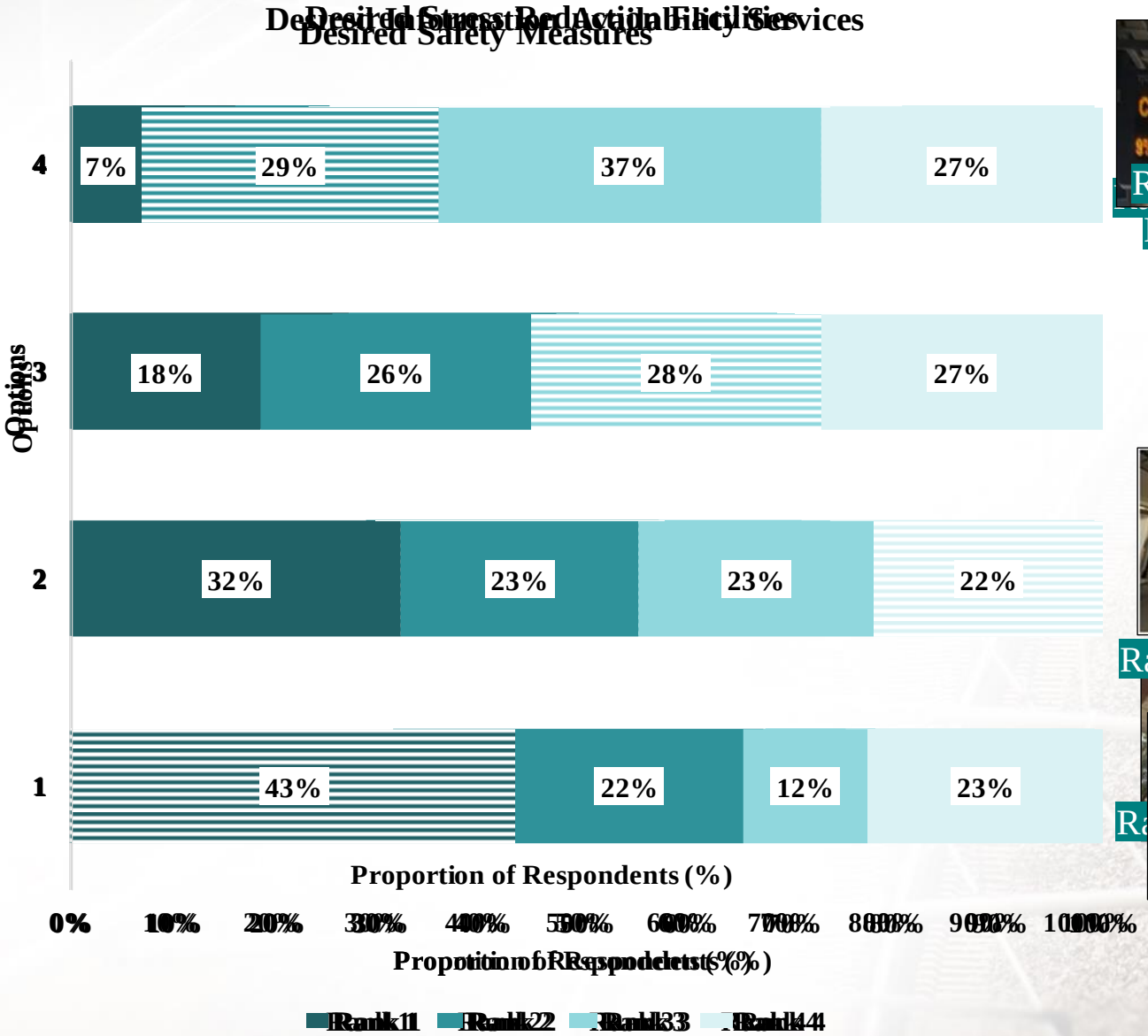






Ranking of Facilities



Rank 3: C Point,

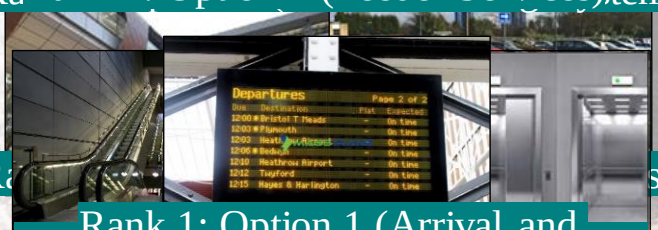
Rank 2: Option 4 (Real Time Traffic)

Rank awkers)

Rank 3: Option 3 (Fare Structure)

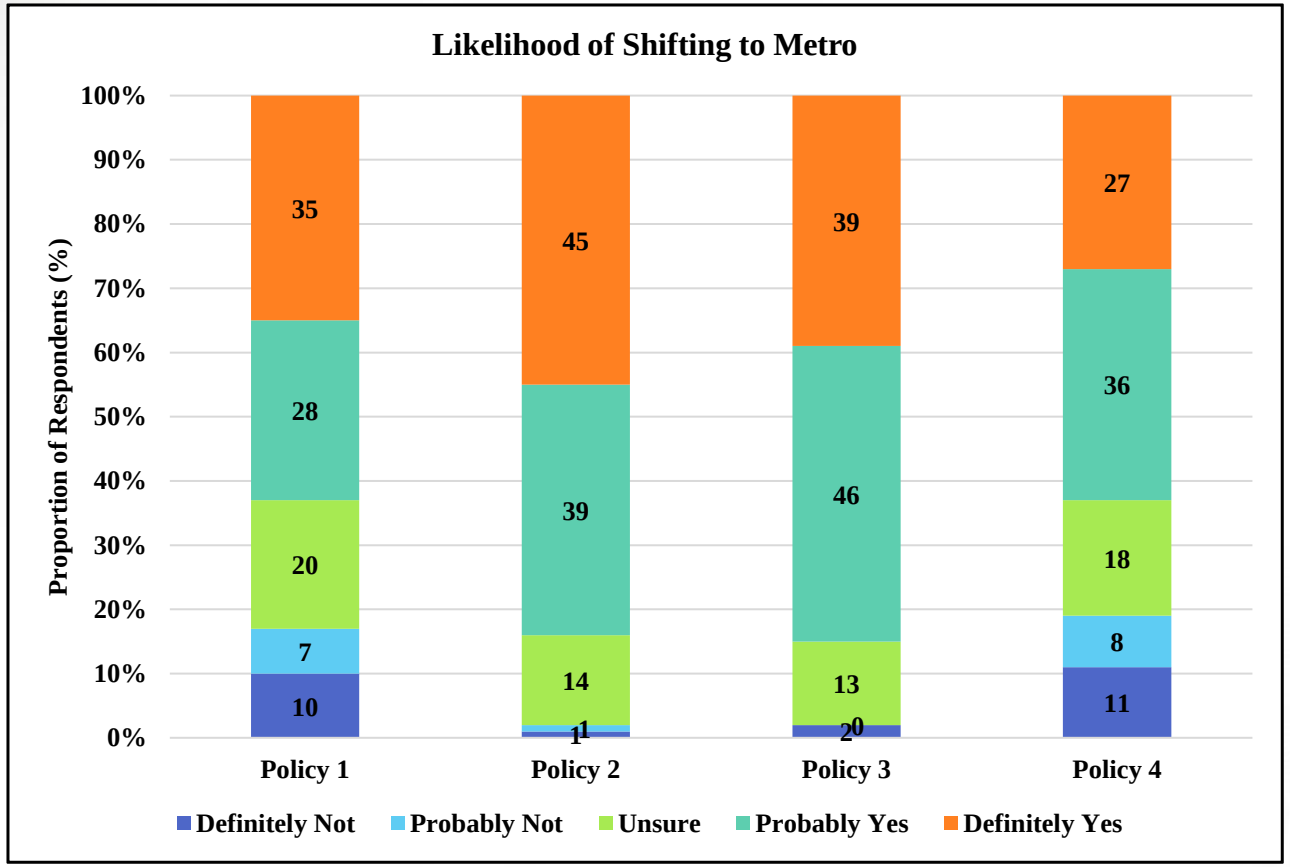
Rank 1 nd QRT)

Rank 4: Option 2 (Feeder Services)



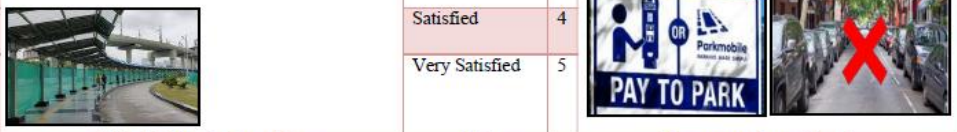
Rank 1: Option 1 (Arrival and Departure Timings)

Policy Ranking



RESPONSE TO TRANSIT-SUPPORTIVE POLICIES: POLICY II

Strategies			Strategies	
Accessibility & Feeder Services	**Metro**		**Parking Charges**	**2W/4W**
❖ 750-1000m distance to the metro station. ❖ E-Rickshaw / auto /taxi services ❖ Information about fare structure discounts & other concessions ❖ Park & Ride	Very Dissatisfied	1	❖ Parking slots far from destinations and 2 times parking charge ❖ Cost of 2W/4W= 2 x present cost. ❖ OVTT = 2 x present time.	Very Less 1
	Dissatisfied	2		Less 2
	Neutral	3		Medium 3
	Satisfied	4		High 4
	Very Satisfied	5		Very High 5
Affordability & Crowding	**Metro**		**Frequency & waiting time**	**Metro**
❖ Travel Expenses: 15 % of Monthly Income ❖ Crowding Level: 2 Pax ❖ Structured Fare System for IPT	Very Poor	1	❖ Interval between the arrival of metro service (Headway) = 8 min ❖ Waiting time at Metro station = 3-5 mins	Very Dissatisfied 1
	Poor	2		Dissatisfied 2
	Medium	3		Neutral 3
	Good	4		Satisfied 4
	Very Good	5		Very Satisfied 5



RESPONSE TO TRANSIT-SUPPORTIVE POLICIES: POLICY III

Strategies			Strategies	
Accessibility & Feeder Services	**Metro**		**Parking Charges**	**2W/4W**
❖ 500-750m distance to a metro station. ❖ Exclusive lane for Bicycle. ❖ PBS docks with smart card payment ❖ Park & Ride	Very Dissatisfied	1	❖ Pay and park system instead of on-street park for private vehicles. ❖ Cost of 2W/4W= 1.5 x present cost. ❖ OVTT = 1.5 x present time.	Very Less 1
	Dissatisfied	2		Less 2
	Neutral	3		Medium 3
	Satisfied	4		High 4
	Very Satisfied	5		Very High 5
Affordability & Crowding	**Metro**		**Frequency & waiting time**	**Metro**
❖ Travel Expenses: 10 % of Monthly Income ❖ Crowding Level: 3 Pax ❖ Incentives in metro Fare	Very Poor	1	❖ Interval between arrival of metro service (Headway) = 10 min. ❖ Waiting time at Metro station = 5 to 10 mins.	Very Dissatisfied 1
	Poor	2		Dissatisfied 2
	Medium	3		Neutral 3
	Good	4		Satisfied 4
	Very Good	5		Very Satisfied 5

How likely are you to shift to the metro?

Definitely Not	Probably Not	Unsure	Probably Yes	Definitely Yes
☹	😕	😐	☺	😄

Mode Shift Analysis

Data Preparation for Mode Shift Analysis

Data for Present Mode				
Mode	**Choice**	**Travel Distance (km)**	**Travel Time (Minutes)**	**Travel Cost (Rs)**
2W	1	6	15	30
4W	0	6	20	90
3W	0	6	20	60
BUS	0	6	35	25
Data Where the Shift Choice is in Range of 1, 2 and 3				
2W	1	6	15	30
3W	0	6	20	90
4W	0	6	20	60
BUS	0	6	35	25
METRO	0	6	10	60
Data Where the Shift Choice is in Range of 4 and 5				
2W	0	6	15	30
3W	0	6	20	90
4W	0	6	20	60
BUS	0	6	35	25
METRO	1	6	10	60

Mode Shift Analysis

Base Scenario	
$U_{2W} = -0.312 * TT - 2.421 * TC$	(1)
$U_{3W} = -1.610 * TT - 3.861 * TC$	(2)
$U_{4W} = -2.076 * TT - 6.456 * TC$	(3)
$U_{BUS} = -19.113 * TT$	(4)

With Metro Operation Scenario	
$U_{2W} = -0.495 * TT - 0.0414 * TC$	(5)
$U_{3W} = -35.580 * TT - 1.671 * TC$	(6)
$U_{4W} = -2.307 * TT - 0.346 * TC$	(7)
$U_{BUS} = -43.153 * TT - 11.047 * TC$	(8)
$U_{METRO} = -0.067 * TT$	(9)

Mode Share (%)

Mode Type	Base Scenario	With Metro Operation Scenario
2W	55	52
3W	16	12
4W	25	19
BUS	4	11
METRO	-	6

- Comparative larger coverage by bus transit
- Higher accessibility
- Lower overall travel time and cost

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Thank you!