



# RESILIENT TRANSPORT SYSTEM (POST-COVID)



**FOCUS ON CHENNAI**

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# OUTLINE

- 1. System Performance**
- 2. Impact of Events (COVID/Floods)**
- 3. Vulnerabilities**
- 4. Integration (Institutions, Services, Finance)**
- 5. Sustainable Service Delivery**
- 6. Conclusions**

# 1. SYSTEM PERFORMANCE



## ACCESSIBILITY

Sustainable Access to Jobs/POIs

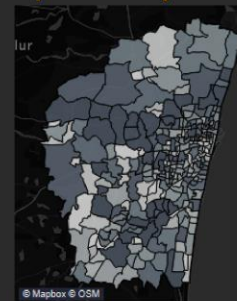
**Average of 30% of all jobs can be reached per population.**

## Access to opportunities per TAZ

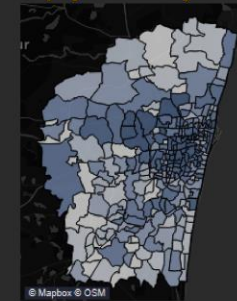
Intermodal transport accessibility performance across Chennai's administrative zones



**Population Density**



**Employment Density**



The map shows the total number of jobs that can be reached within 60 minutes (with a 50% level of confidence)

TAZ: Traffic Analysis Zone per CMP2019

Map based on Longitude (generated) and Latitude (generated). Color shows Quantile Color. The marks are labeled by sum of TAZ. Details are shown for TAZ. The view is filtered on sum of TAZ and Quantile Color. The sum of TAZ filter includes everything. The Quantile Color filter keeps all values.



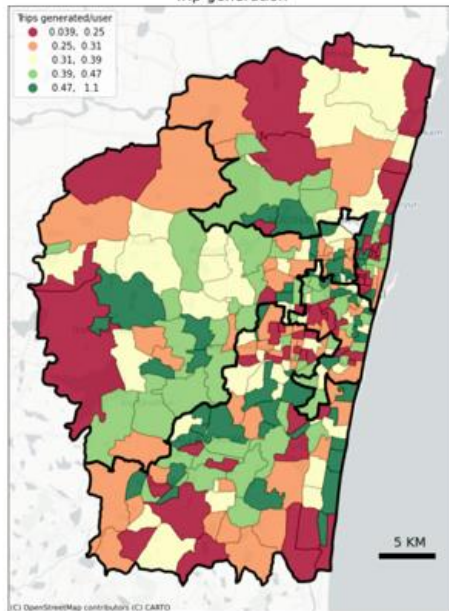
# Transportation analysis

Complementary trip characteristics are observed for morning and evening peak hours.

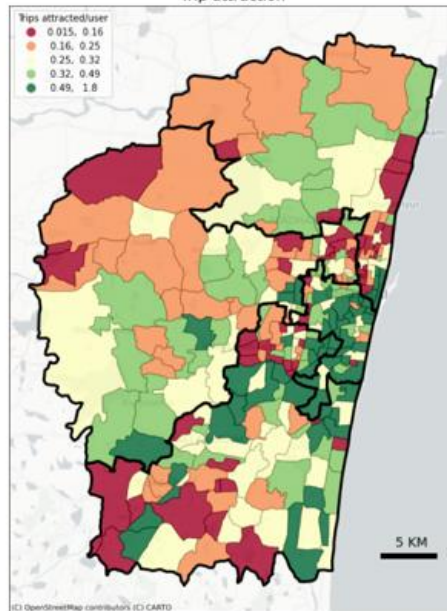
*Trips extracted using mobile phone data*

Morning Peak (7-10 AM)

Trip generation

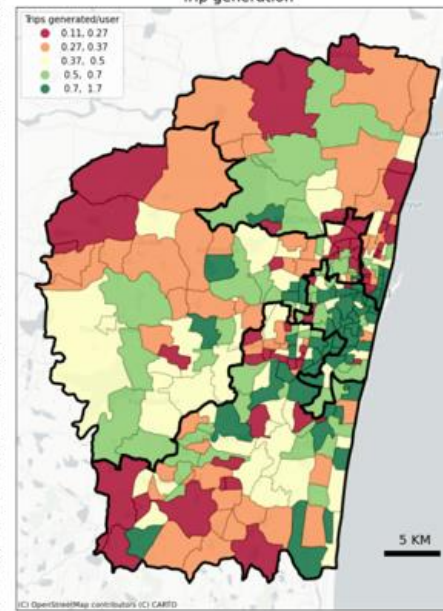


Trip attraction

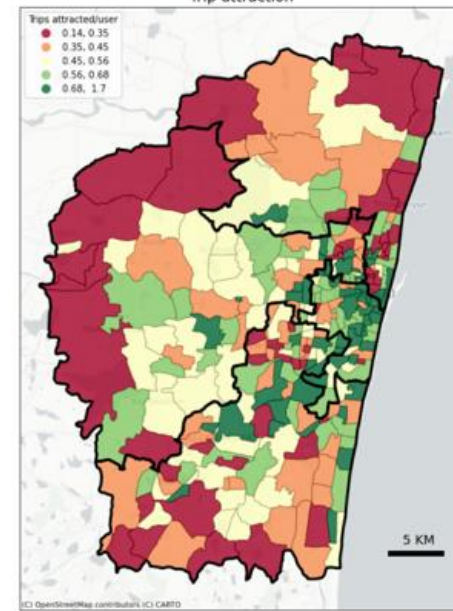


Evening Peak (5-8 PM)

Trip generation



Trip attraction



“Towards” Eastern regions

“Away from” Eastern

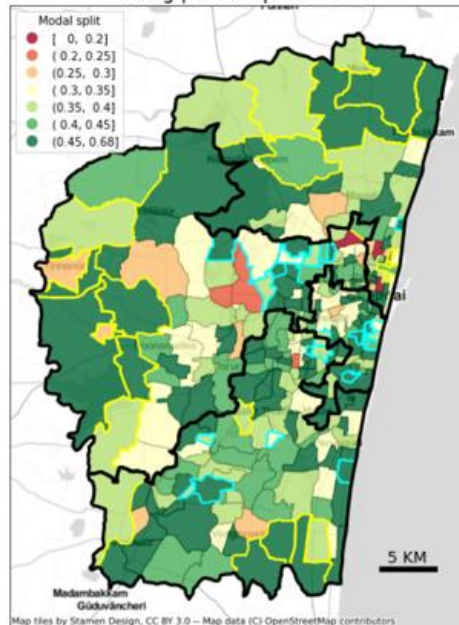
[Work-Home Trips] regions

# Transportation analysis

About 27% of inter-ward trips are conducted via walking

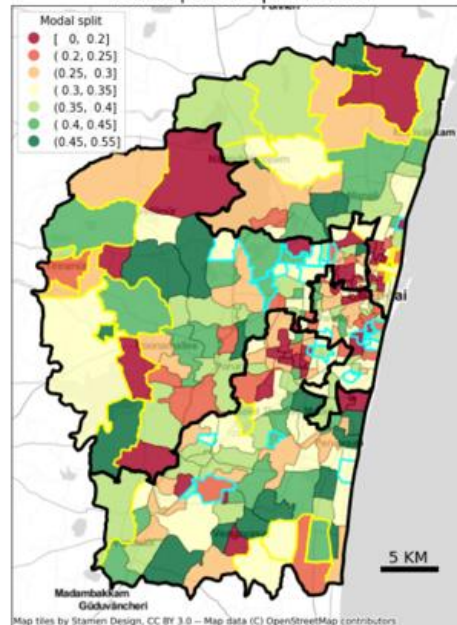
*Mode inference performed using mobile phone data*

Driving | Mobile phone data



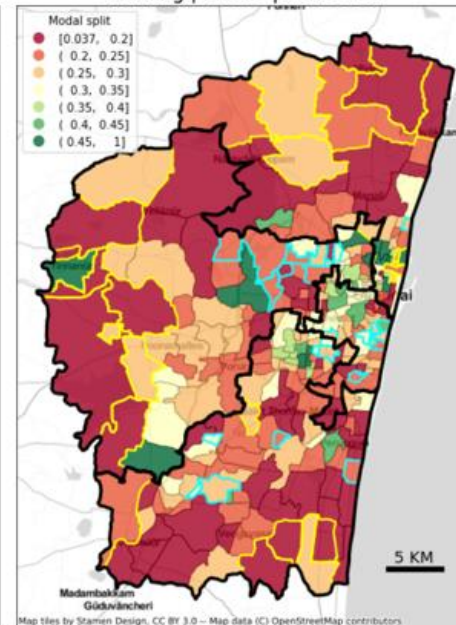
Mean proportion: 0.42

Transit | Mobile phone data



Mean proportion: 0.31

Walking | Mobile phone data



Mean proportion: 0.27

## Validation

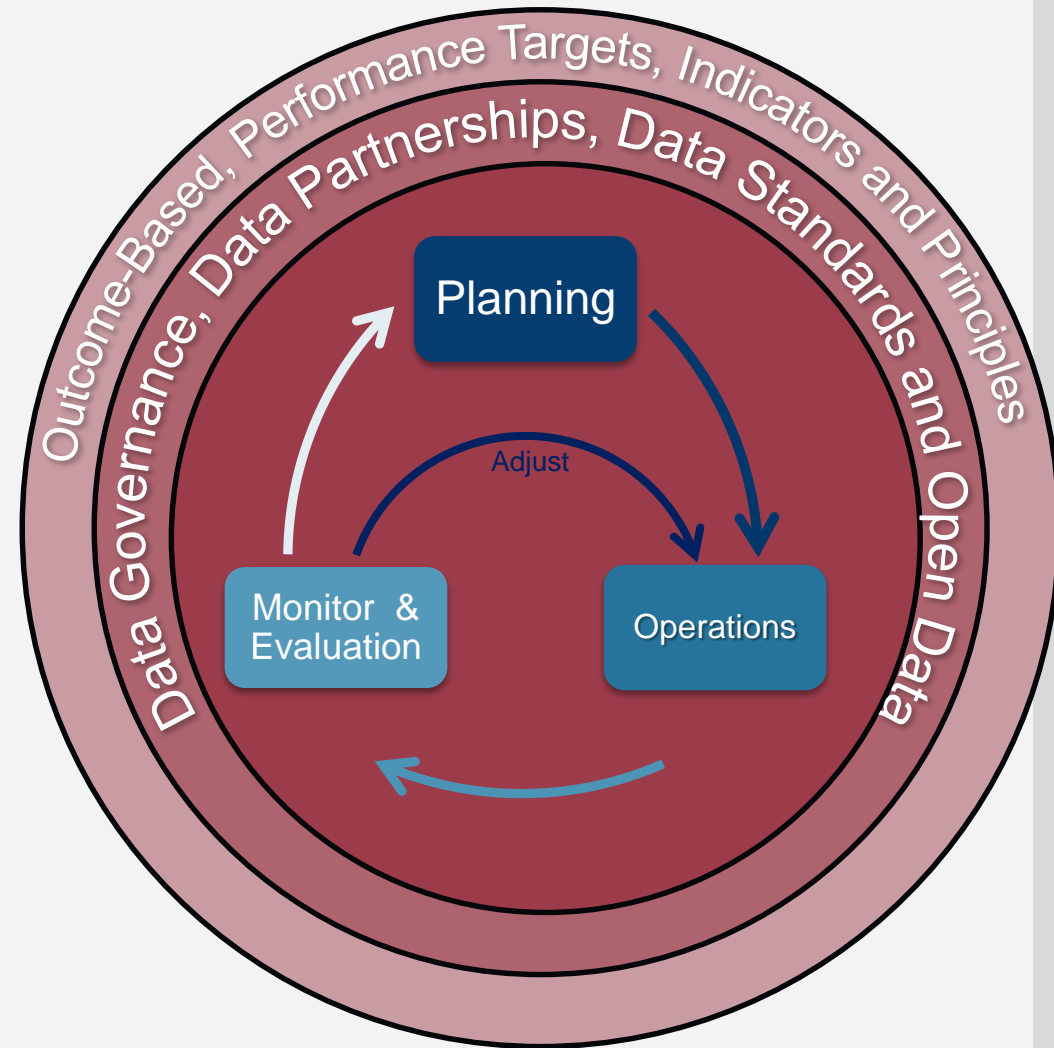
Average proportion of trips	Mobile phone data	CMP OD data
Driving	0.42	0.42
Transit	0.31	0.35
Walking	0.27	0.22

- Driving is most preferred mode of travel.
- The proportion of walking trips is high in central parts of Chennai.



# Principles

- Data is a key in all stages of service delivery: **planning, operations & M&E**
- Leveraging international best practices regarding **data governance, partnerships, standards and open data** can unlock a digital innovation ecosystem
- Digital data should always support a larger **strategy focused on improving service delivery**



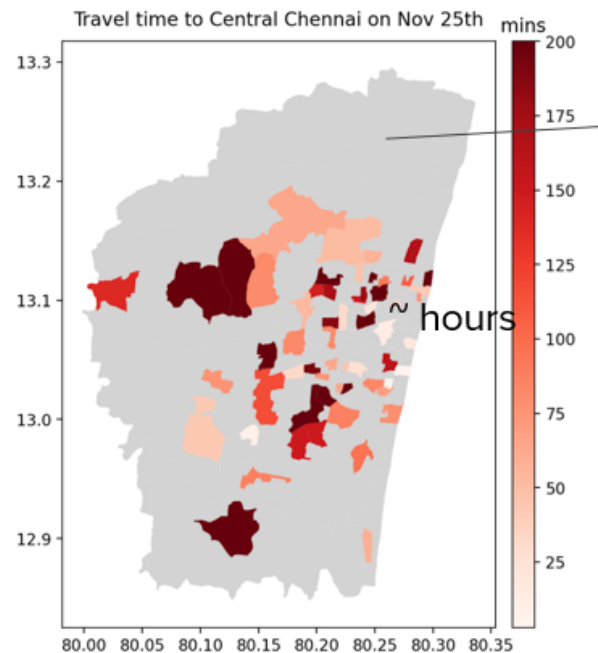
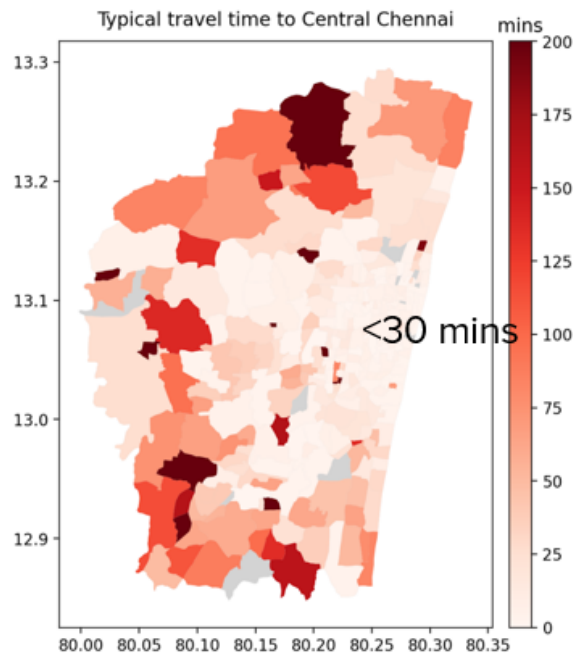
## 2. IMPACT OF EVENTS

- Cyclone Nivar (Nov 2020) Over 1 lakh evacuated
  - Impacts on travel patterns
  - Impacts on businesses and public services
  - Disproportionate effects to the poor
- Impact of COVID



# Cyclone Nivar

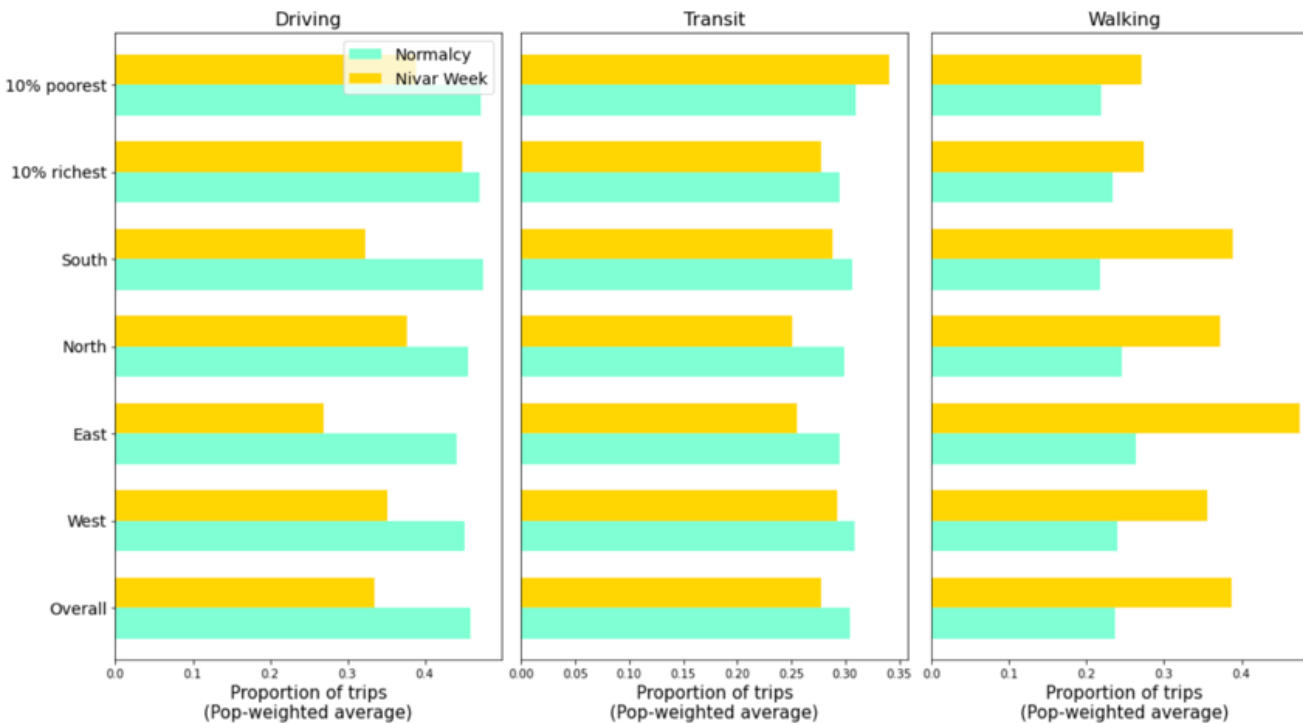
People came from closer areas, but took longer to reach



- Travel time from metro areas typically take 30 minutes → several hours on Nov 25th, and substantial number of trip cancellations

# Cyclone Nivar

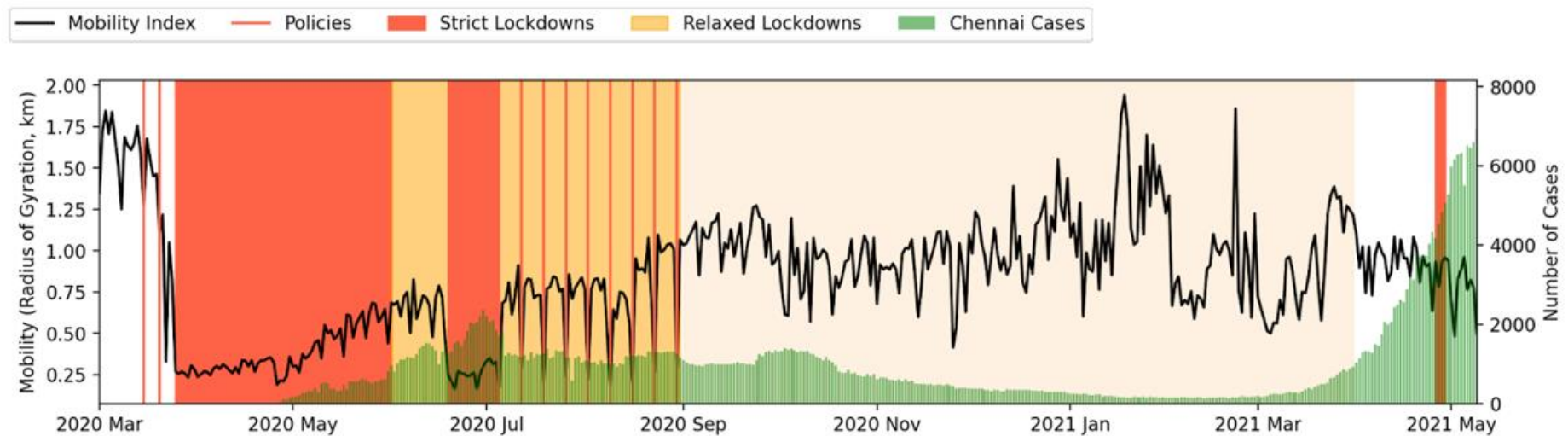
## Proportion of walking trips increased during Nivar



- Higher proportion of walking trips observed.
- In poorer neighborhoods, the proportion of transit trips increases and that of driving trips decreases.

# COVID-19

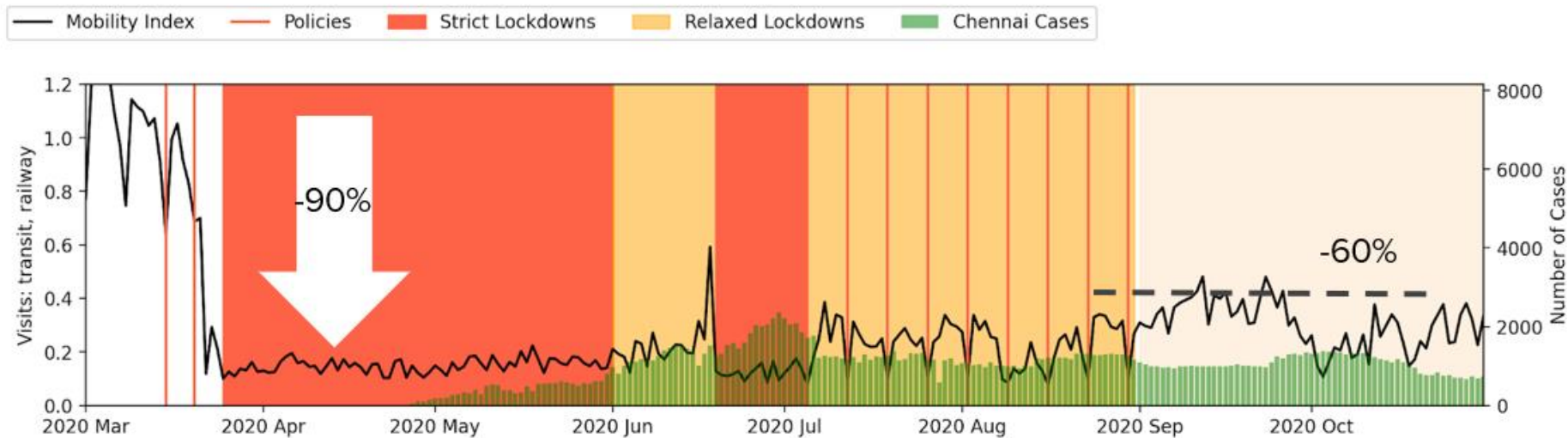
## Mobility significantly reduced during early lockdowns



- 1st, 2nd, and Sunday strict lockdowns in 2020 were extremely effective
- Reduced people's movement radius by 86% on average

# COVID-19

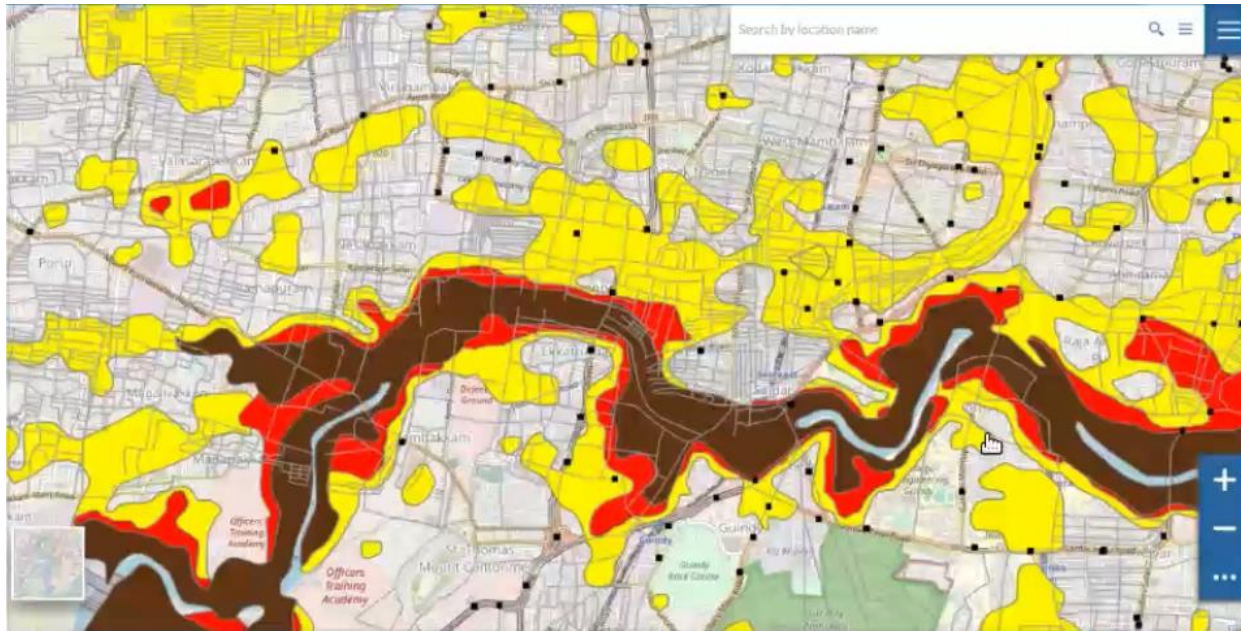
## Significant and persistent drop in foot traffic to bus stops



- 90% reduction of visits to railway stations during 1st lockdown, persistent throughout all of lockdown period with gradual recovery
- By Sep 2020, recovered to 60% of pre-COVID level



# 3. VULNERABILITIES

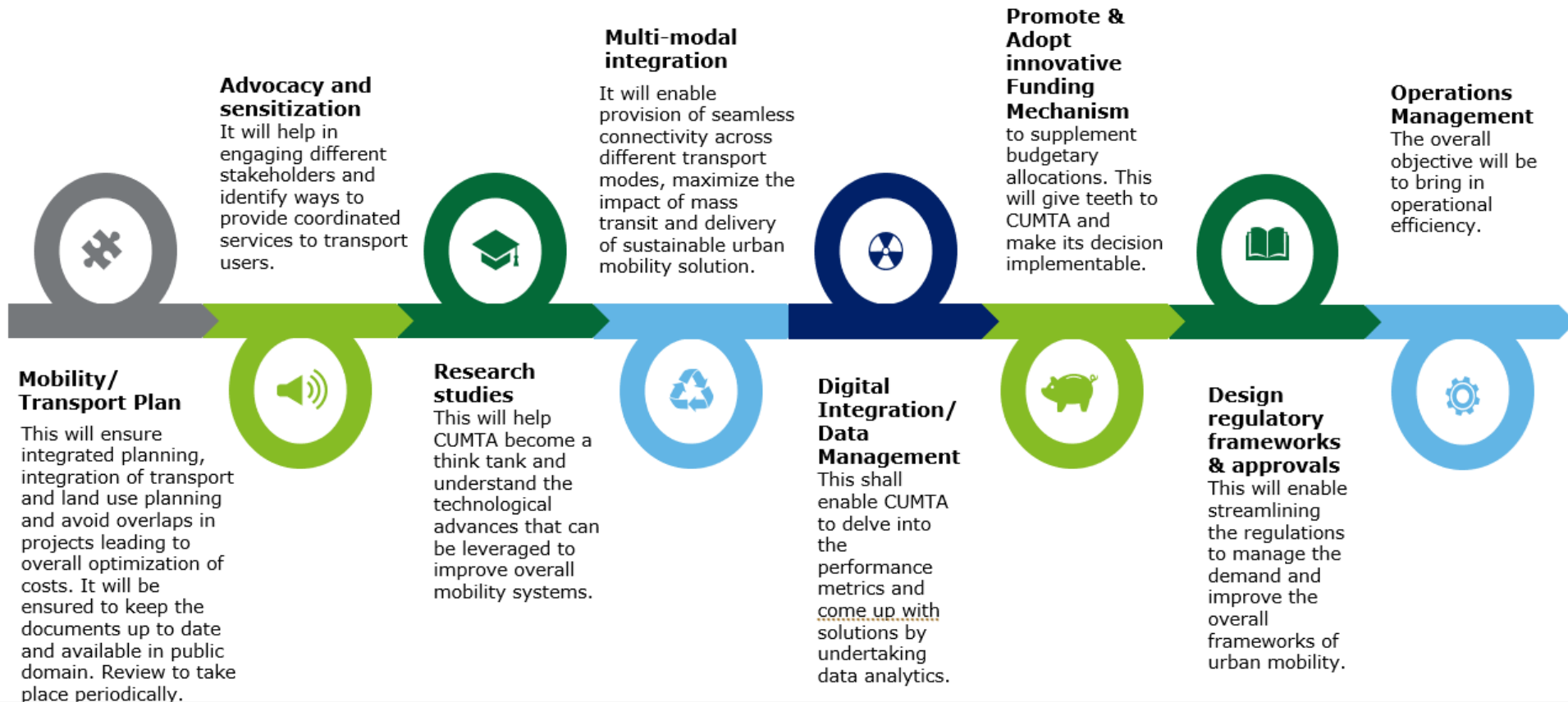


Mapping of flooding and transport network to understand **vulnerabilities**:

- Physical
- Systemic (critical lifeline)
- Socio-economic

And **exposure**

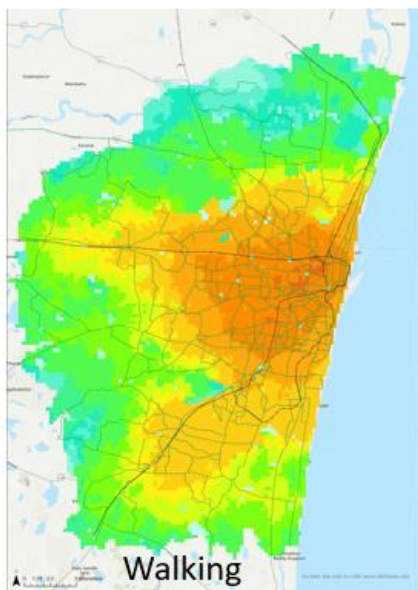
# 4. INTEGRATION: UMTA



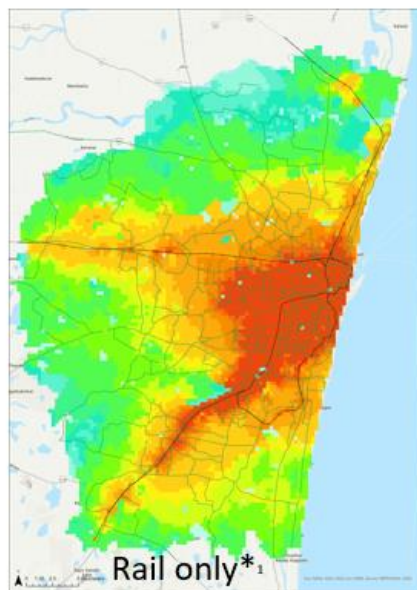
# 4. INTEGRATION: SERVICE/INFRA

- ❖ Design for robustness
- ❖ Promote redundancy
- ❖ Encourage resourcefulness
- ❖ Instill rapid response

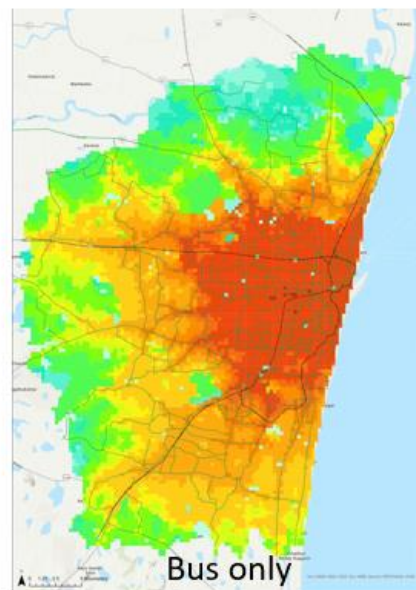
**Walkable space plays a key role in all cases**



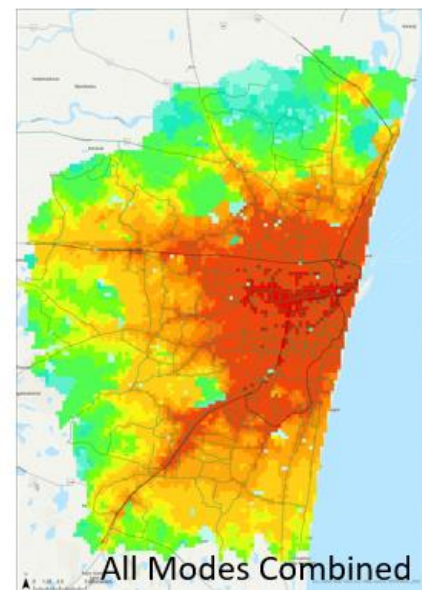
8%



17%



25%

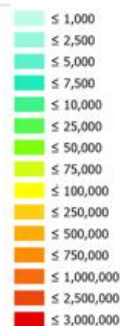


30%

## Accessibility by Mode

Total number of jobs

Total jobs accessible in 60 minutes\*<sup>2</sup>



Accessibility to jobs through a multimodal strategy is **76%** higher than one that relied solely on rail, and **17%** higher than only looking into the bus network.

\*<sup>1</sup>Suburban & Metro

\*<sup>2</sup>For better comparability the scales for all maps showing the same indicator are the same.



# 4. INTEGRATION: FINANCE

- ❖ Balancing needs across modes
- ❖ Multi-year budgetary exercise based on CMP
- ❖ Stability and certainty of revenue streams to replace ad-hoc grant support
- ❖ Link grant support with service delivery and performance
- ❖ Diversifying source of funding for mobility

# 5. SUSTAINABLE SERVICES E-BUSES

## Contracting

**Reduce Viability Gap Funding** through efficiency gains

- 1 Sound contracting:** Enhance procurement/MCA: Costs - 10%
- 2 Scale:** Purchase at scale/unbundled models: Costs - 10%
- 3 Good planning:** better use Revenues + 10%

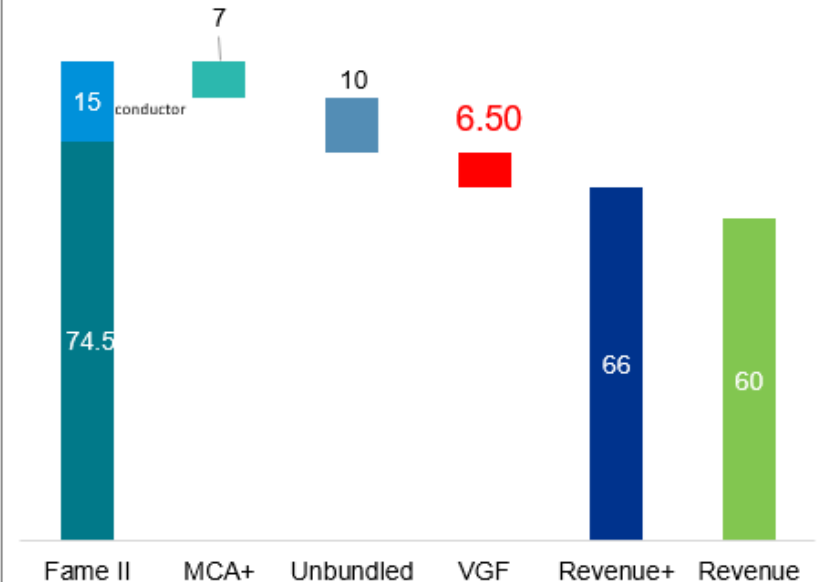
## Financing

**Lower Risk to banks** to reduce capex financing cost (2%)  
(e.g. World Bank Group instruments)

- 1 Payment Security:** Guaranteed payments (who pays? mechanism)
- 2 First Loss Facility:** In case of loss on loans for buses under FAME II contracting with CESL, coverage of [20%] of Loss

**Leverage the detailed work by World Bank Group/WRI and others to address those in lighthouse cities at scale prior to replication**

**Lowering VGF (including fuel costs) from 29 to 6.5 INR/Kms**



Key Assumptions: [to be tailored for each city]

Average daily distance travelled is assumed to be 200 km per day (347 days per year)

For EVs, no road registration fee is assumed for computation of EVs

FAME-II incentive of INR 20,000 per kWh of battery capacity is taken into consideration

State Govt incentive of upto INR 10,000 per kWh of battery capacity is taken into consideration

Debt to equity ratio of 80:20 is assumed with post tax ROE of 14% and interest rate of 10%

MCA+ and Unbundled, Revenue+ based on World Bank (2021)

# 6. CONCLUSIONS

- ❖ COVID impact and climate considerations offer an opportunity for holistic urban mobility rethink
- ❖ Resilience: a core part of any mobility vision
- ❖ Foundations: user-centric approach with effective institutional, funding and financing mechanisms and efficient service delivery
- ❖ Data is central to understanding resilience gaps

# THANKS

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