



SUSTAINABLE URBAN FREIGHT



GITAKRISHNAN RAMADURAI

PROFESSOR

DEPARTMENT OF CIVIL ENGINEERING



Freight Trip Generation - Demand Model

- Transport planners and policy makers require demand estimates for facility planning and management



- Sanchez-Diaz (2017) - Freight system has seen limited efforts
- Urban freight transport in India is heterogeneous
 - Two-wheelers, three-wheelers, pickups, and trucks



Middela, M.S. and Ramadurai, G., 2021.
Incorporating spatial interactions in zero-inflated
negative binomial models for freight trip generation.
Transportation, 48(5), pp.2335-2356.

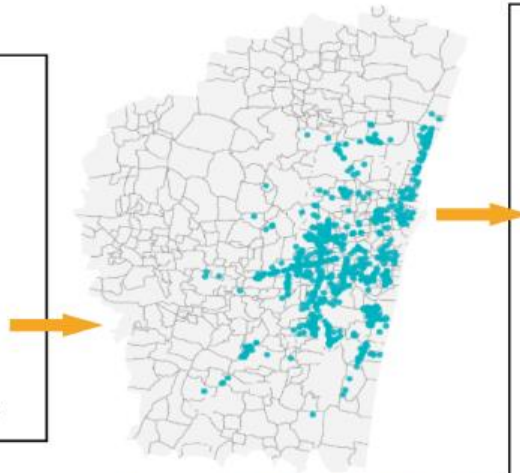


Data

Establishment-Based Freight Survey 2016

Random sampling

- Data sources are economic census and Google API
- Additional data sources are from commercial tax department and Chennai corporation



- FTP and FTA by vehicle types at 1100 establishments
- Establishment type and floor area
- Number of full-time and part-time employees
- Parking area
- Presence of loading docks
- Work shifts
- Home deliveries
- Pickup/Take away
- Distance to the warehouse

Mean est. area is 163 sq. m. Generate higher FTG and lower FG compared to earlier studies.

Towards Developing a Comprehensive Planning Framework for Urban Freight in Chennai.

(COE-UT, IIT Madras project sponsored by Shakti Sustainable Energy Foundation)



Daily and weekly FTG models by vehicle type

Freight Trip Production



Freight Trip Attraction





Implementation Roadmap for Sustainable Urban Freight Mobility in Chennai





Implementation Roadmap for Sustainable Urban Freight Mobility in Chennai

Development and evaluation of freight consolidation strategies

- *Consolidation strategy*
- *Consolidation app*

Development of freight parking management plan.

- *Freight parking strategy*

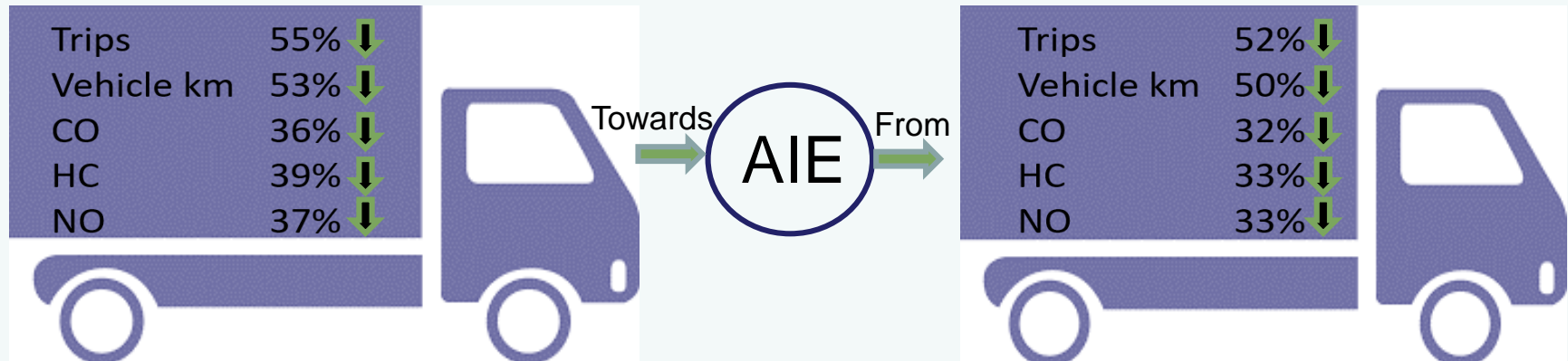
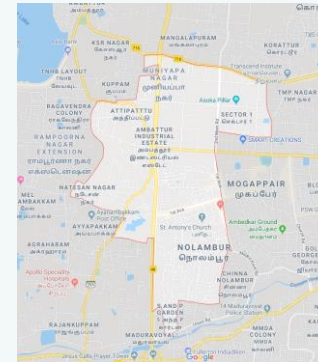
Development of roadmap for electrification of freight vehicle.

- *EV Policy and Infrastructure*



SCENARIO ANALYSIS: BENEFITS OF CONSOLIDATION

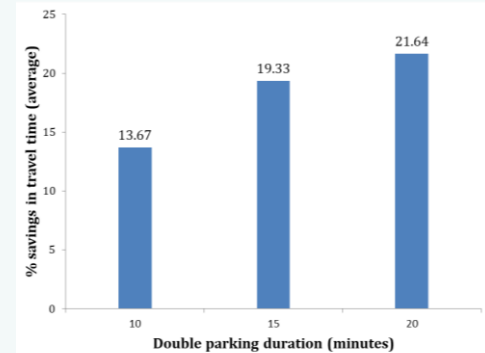
Ambattur Industrial Estate (AIE)-Started in the year 1963
Biggest small-scale industrial estate in South Asia
1500 enterprises registered with Ambattur Industrial Estate Members Association (AIEMA)
Face to Face interview-159 samples collected



TRUCK PARKING SIMULATION STUDY



14 - 22%
savings in
travel time due
to dedicated
freight parking



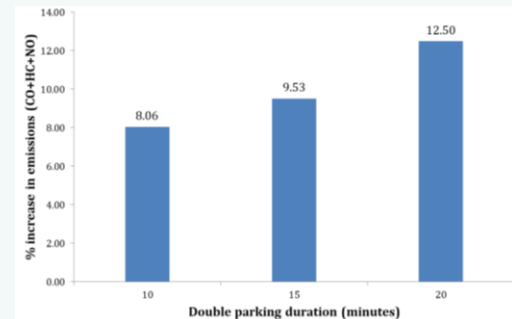
Scenario 1:
Base/ existing

- Common parking lots for both passenger and freight
- Varying double parking duration: 10, 15, and 20 minutes

Scenario 2:
Dedicated
freight vehicle

- Exclusive parking lots for freight vehicles

Double
parking results
in 8-12%
higher
emissions!



Cradle to Grave Emissions - Estimated from freight data collected from AIE

Freight trips generated	Vehicle type	Total Distance (km)	ICE		EV	
			Emission factor (g/ km)	Emissions CO2 eq. (kg)	Emission factor (g/ km)	Emissions CO2 eq. (kg)
Freight trips produced	LDDT/ LDET	46209	1447	66864	199	9196
	MDDT/ MDET	8543	1423	12157	717	6125
	HDDT/ HDET	7297	1876	13689	1257	9172
Freight trips attracted	LDDT/ LDET	18002	1447	26049	199	3582
	MDDT/ MDET	7212	1423	10263	717	5171
	HDDT/ HDET	661	1876	1240	1257	831
Total			130262		34077	

Emissions from Urban Freight

Policy analysis

Conventional fuel vehicles

20.3% CO
74.5% HC+ NO_x
BS-VI Vehicles

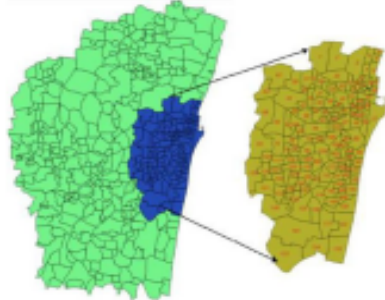
Battery electric vehicles

50.3 % GHG

Sensitivity analysis based on

Greener mix Life-time kilometres Transmission losses Greener Production

Chennai city



Establishment-Based Freight Survey (EBFS)

+
Real-world emission factors



Base case
emissions by
vehicle type



Emission savings

BEV Scenarios I & II: % coal & lifetime VKT

