



# SUSTAINABLE URBAN FREIGHT



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## 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.

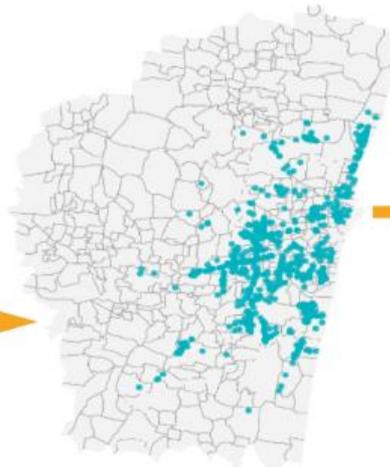


## Data

### 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





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# *Implementation Roadmap for Sustainable Urban Freight Mobility in Chennai*





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# *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*

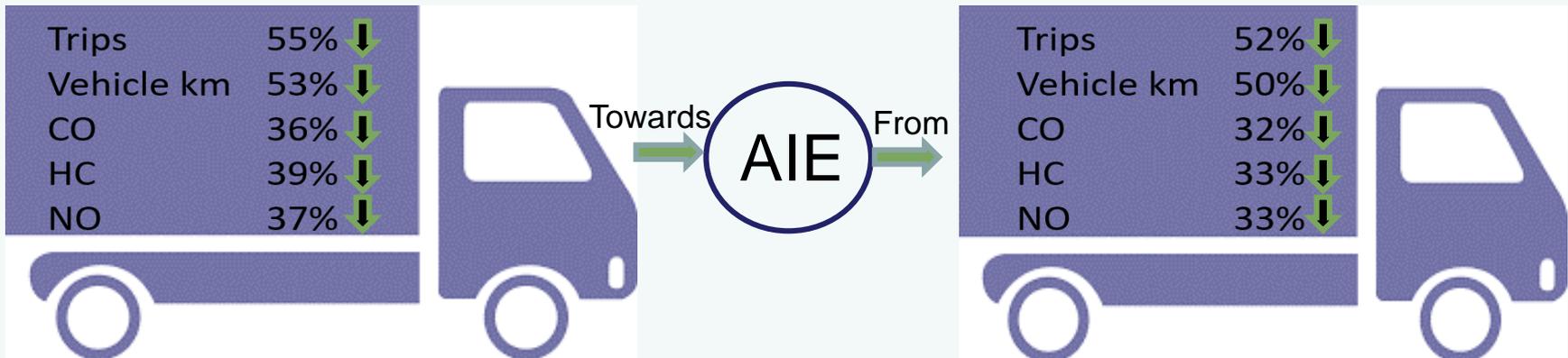
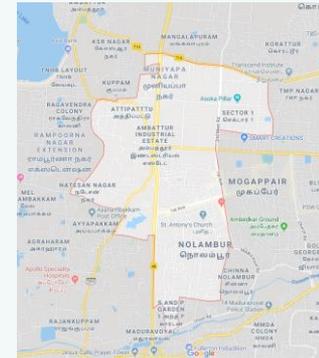
Development of roadmap for electrification of freight vehicle.

- *EV Policy and Infrastructure*



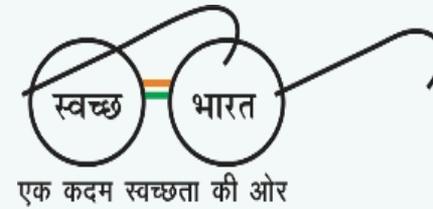
# SCENARIO ANALYSIS: BENEFITS OF CONSOLIDATION

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





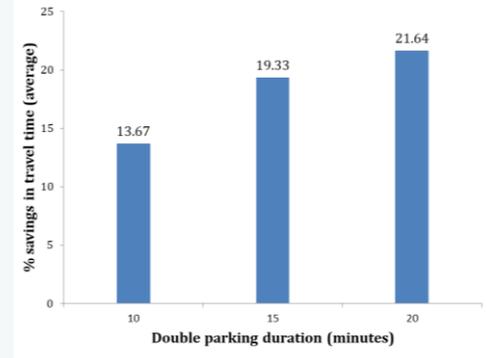
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# TRUCK PARKING SIMULATION STUDY



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



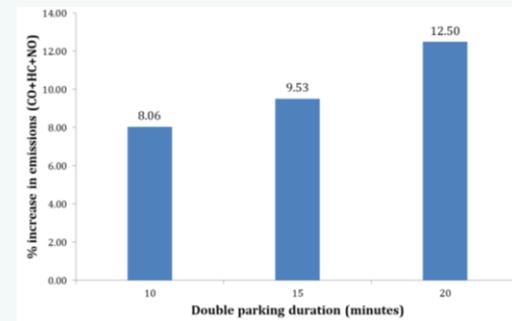
**Scenario 1:**  
Base/ existing

- 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!

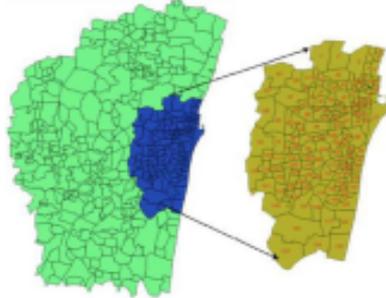


## Cradle to Grave Emissions - Estimated from freight data collected from AIE

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

Chennai city



Establishment-Based Freight Survey (EBFS)  
+  
Real-world emission factors



Emission savings

## Policy analysis

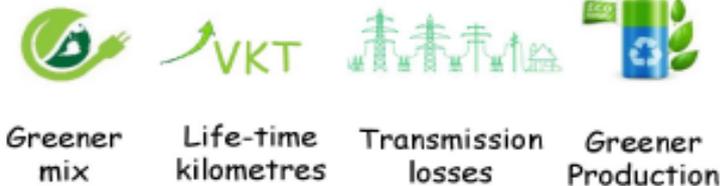
### Conventional fuel vehicles



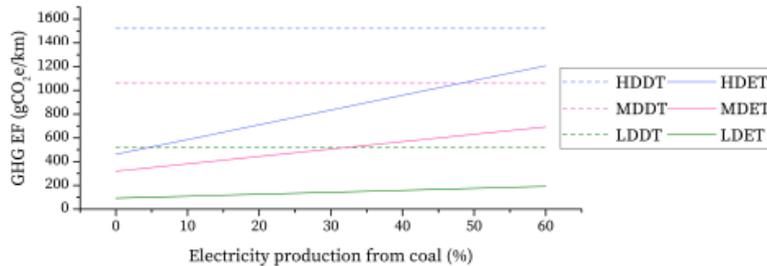
### Battery electric vehicles



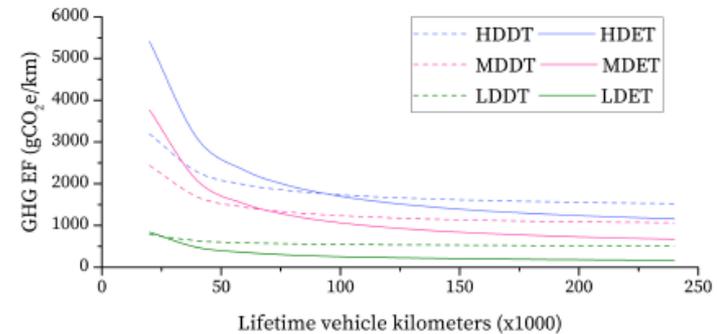
### Sensitivity analysis based on



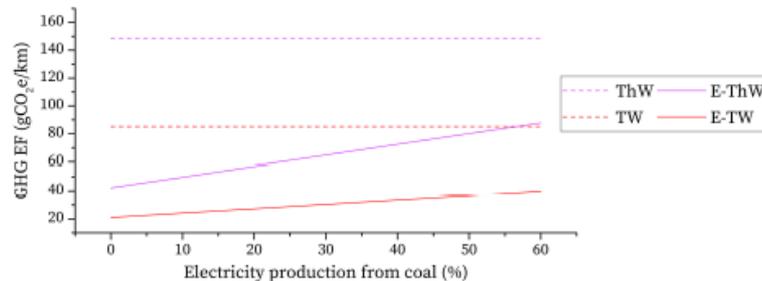
# BEV Scenarios I & II: % coal & lifetime VKT



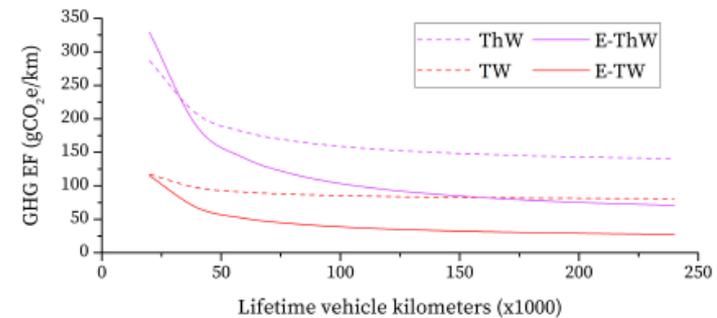
(a) Trucks (Light, Medium, and Heavy-duty)



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(b) TWs and ThWs



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