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Emissions Inventory from Transport Sector

- Ongoing ECMA Project

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Objective

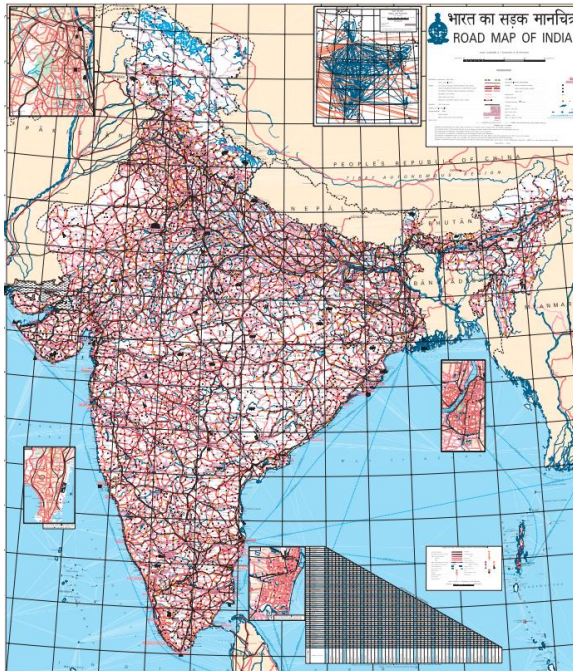
Calculate the emissions of greenhouse gas and criteria pollutants from the on-road transport sector in India at the national and Delhi NCR region, to identify major pollutant contributors & inform policies

Vehicle Type		Applications			Dominant fuel
2-Wheelers	Mopeds		Bikes		Petrol
3-Wheelers	Passenger		Goods vehicle		Petrol, CNG, Diesel
4-wheelers	Passenger, Taxis		Light goods vehicle		Petrol, Diesel, CNG
Buses	Urban, School-bus		Inter-city		Diesel, CNG
Heavy-duty	Pickup / Delivery trucks		Heavy goods vehicle		Diesel

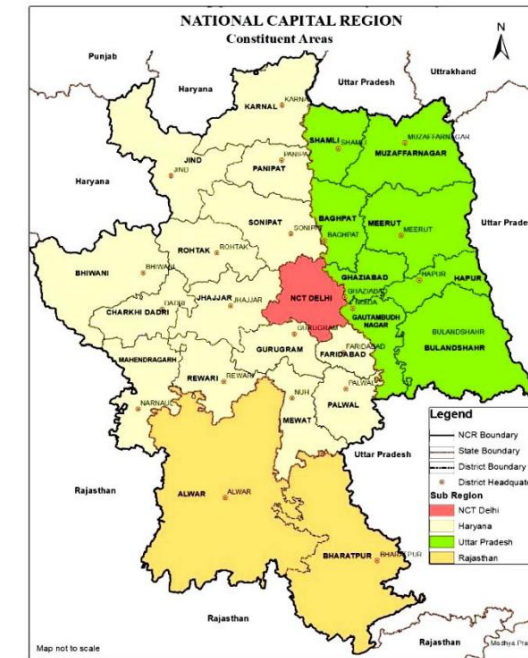
Scope of this study: National and Delhi NCR



National



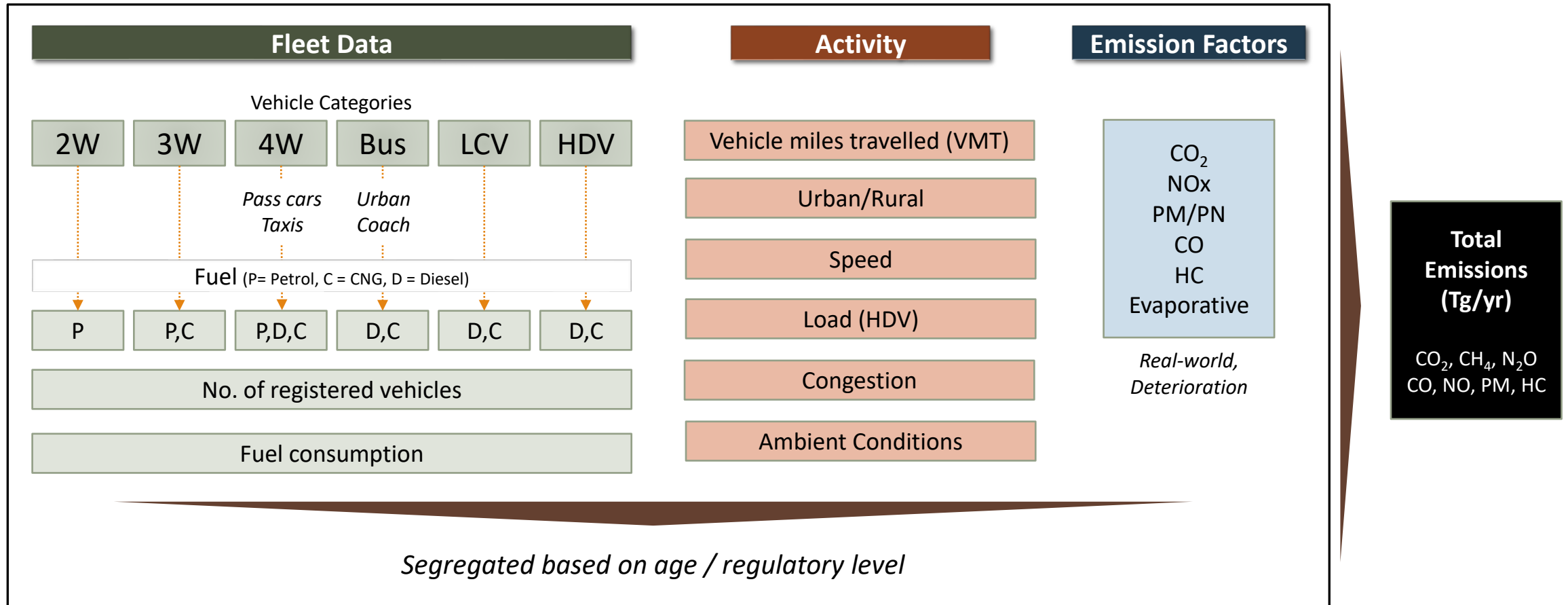
DELHI NCR



- + More data available
- More complexity from regional variability

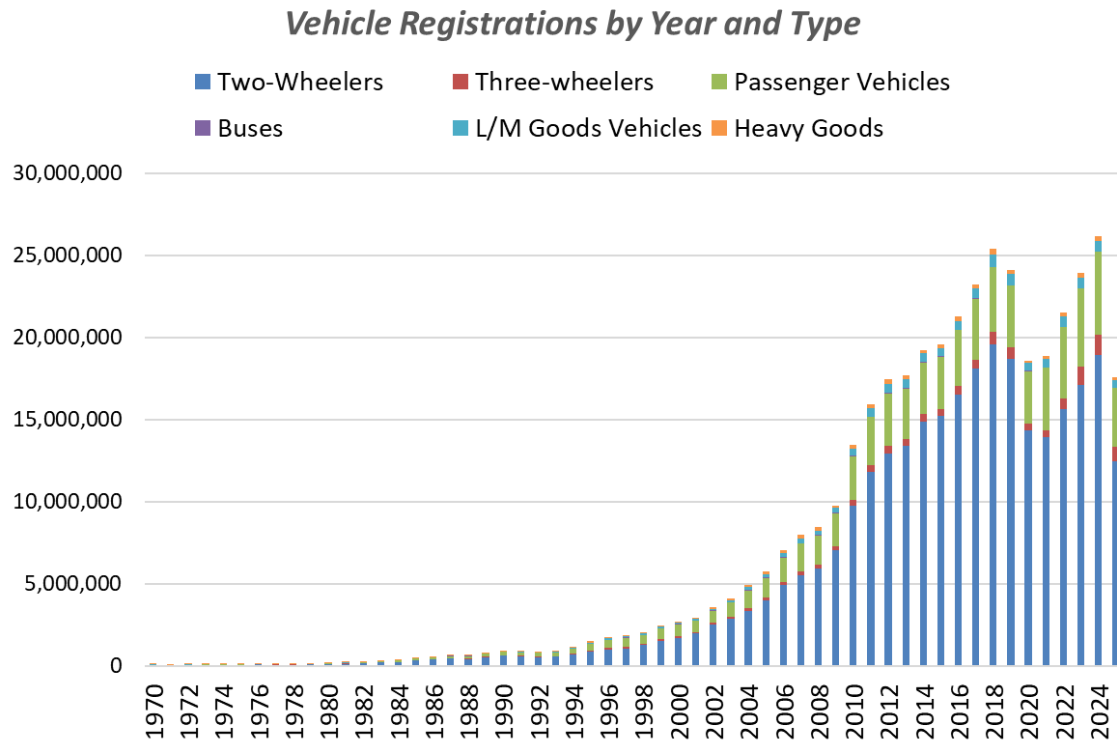
- Less data available
- Early norm introductions, region-specific policies (e.g. scrappage)
- Need to account for cross-border traffic

Emissions Inventory Modeling Framework



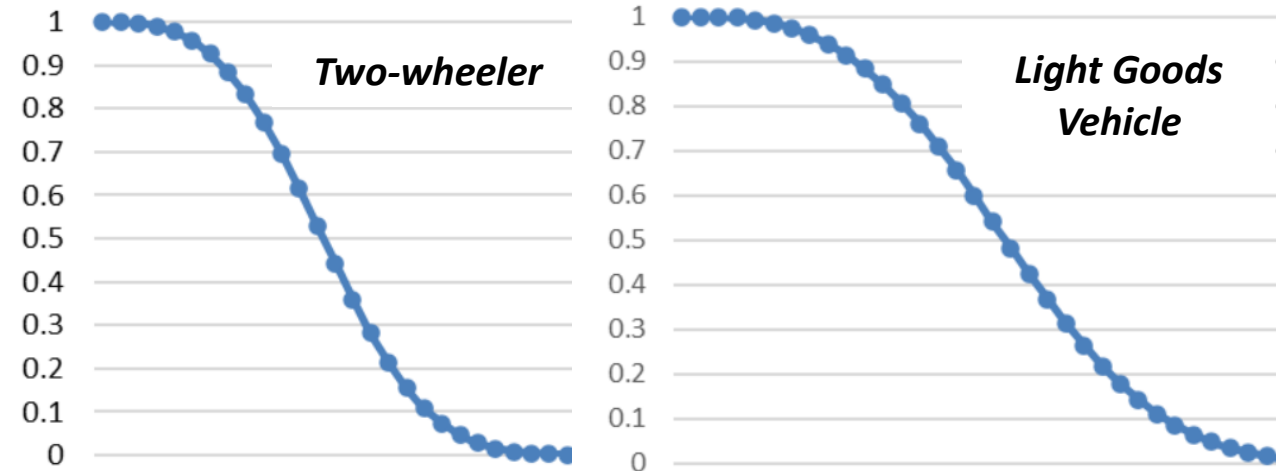
Vehicle stock analysis

Registration data combined with survival functions to calculate current fleet



Source: Vahan Database

Survival functions (phase-out of vehicles due to age)



Note: For Delhi NCR, we will also consider scrappage & other policies

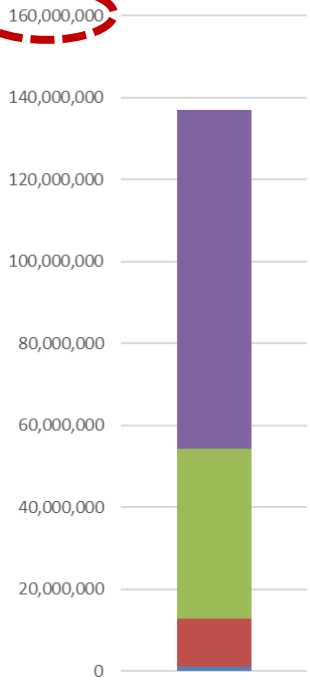
On-road fleet (2025)

Various vehicle types, certs. (BS II – BS VI), fuels & powertrain types

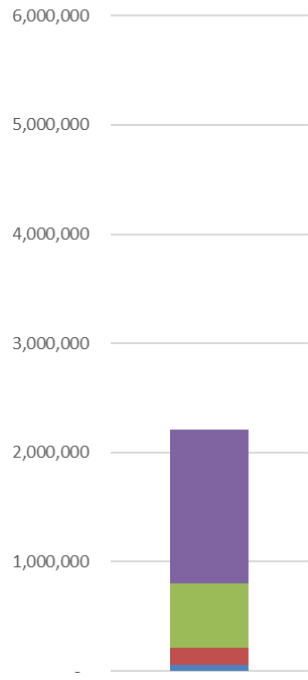
BS VI BS IV BS III BS II



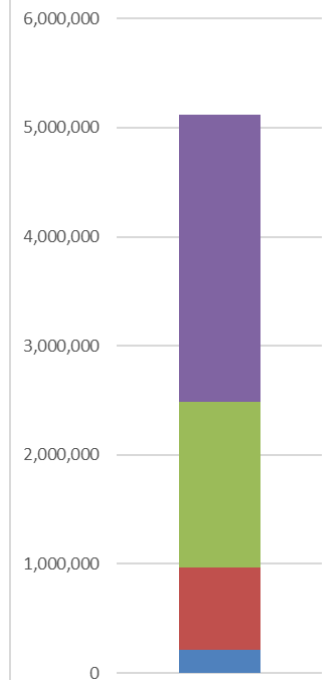
Two-Wheeler



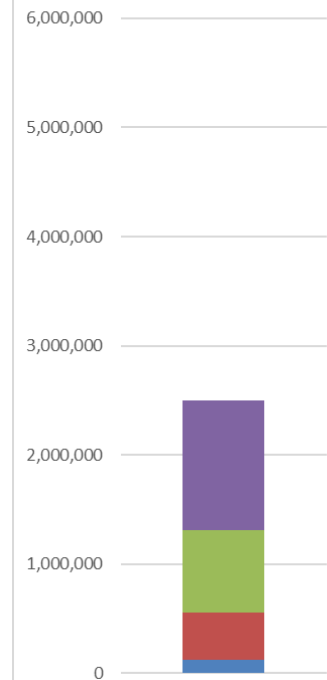
Three-Wheeler



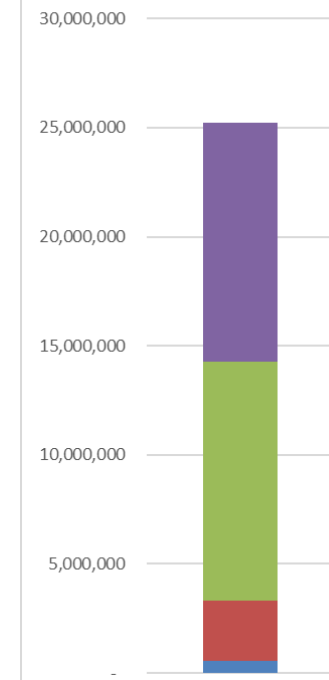
Light/Medium Goods



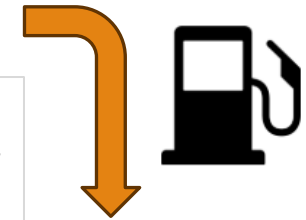
Heavy Goods



Four-Wheeler

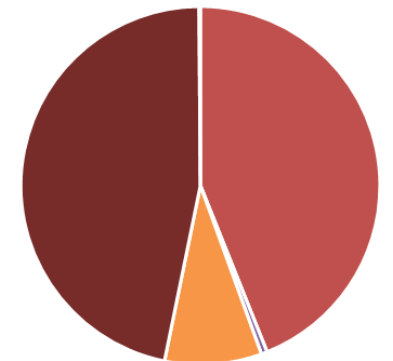


And a mixture of fuel / powertrain types

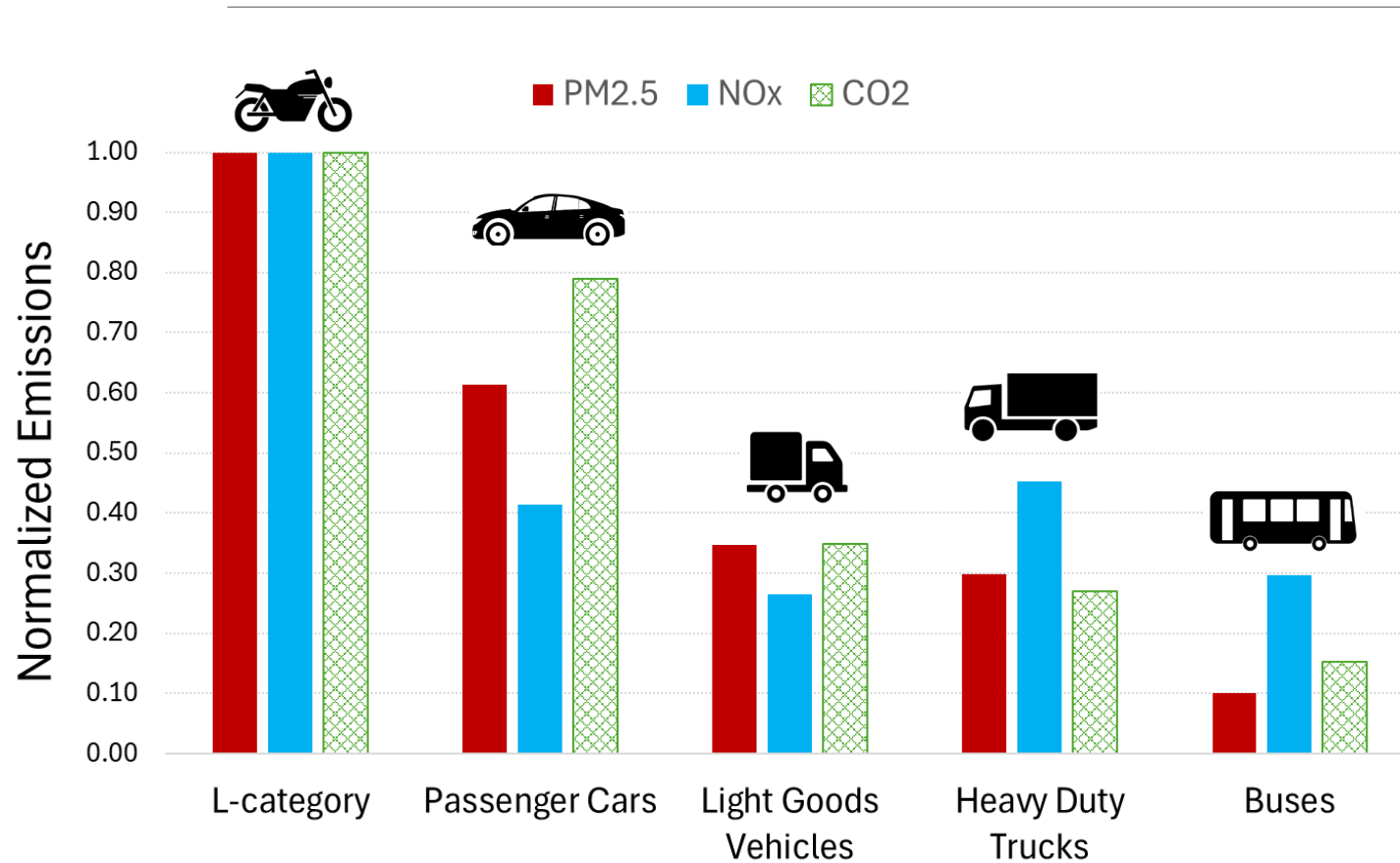


Four-wheeler fleet by fuel type

Petrol Petrol Hybrid
Petrol + CNG/LPG Diesel
CNG



Preliminary calculations ...



- ❖ Emissions dominated by 2-wheelers due to sheer number and relatively poor emission controls
- ❖ Particulates and CO₂ emissions (or fuel consumption) from passenger cars need further reduction
- ❖ NOx emissions from HD vehicles are higher than passenger cars – low NOx standards and technologies
- ❖ Electrification of buses will help in urban areas but overall not expected to reduce air pollution inventory

Note: These are preliminary calculations with Indian vehicle numbers and European vehicle / driving / ambient conditions

Next – Update with Indian driving speeds, urban/rural split, ambient temperatures, etc. and emission factors, deterioration

What next ?

❑ India specific temperatures & sensitivity to test boundary conditions

- High temperatures > Evaporative emissions
- Low temperatures > Cold-start PN emissions

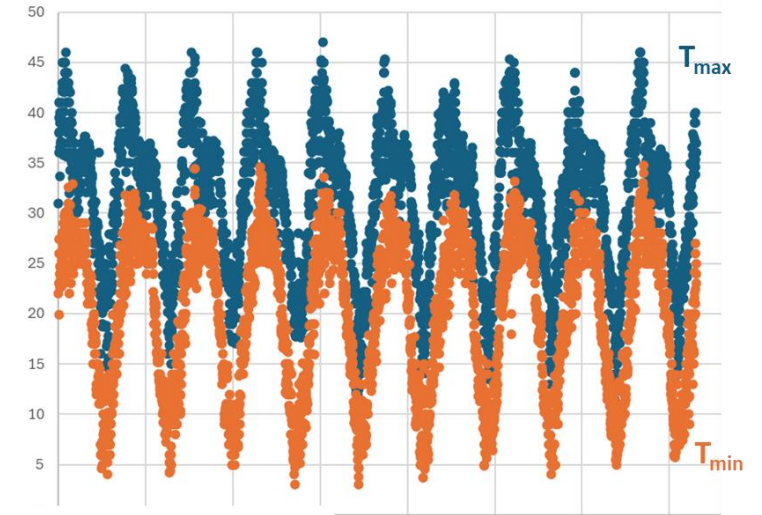
❑ India specific driving conditions

- Urban/Rural split
- Congestion
- Speeds
- Loads (heavy-duty)

❑ India specific emission factors

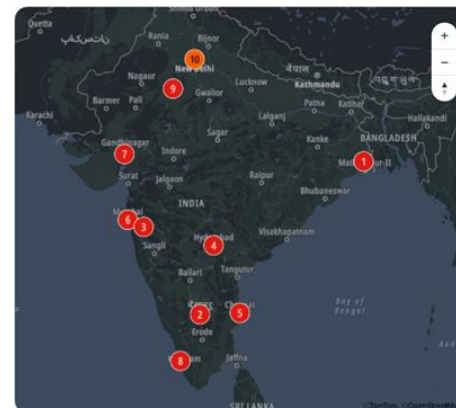
❑ All of above for Delhi + specific policies impacting NCR

Example: Temperatures in Delhi



India Traffic (10 cities)

Avg. time for 6 mi = 23 – 33 min for the 10 cities



Cities (10)

Country rank	World rank	City	Average travel time per 6 mi	Change from 2023	Time in rush hour per year
1	2	Kolkata	33 min	+ 9 s	106 hours
2	3	Bengaluru	33 min	+ 48 s	113 hours
3	4	Pune	32 min	- 57 s	104 hours
4	6	Hyderabad	30 min	no change	82 hours
5	31	Chennai	29 min	+ 9 s	91 hours
6	37	Mumbai	28 min	- 19 s	99 hours
7	43	Ahmedabad	28 min	- 28 s	71 hours
8	90	Ernakulam	28 min	+ 57 s	85 hours
9	82	Jaipur	27 min	+ 19 s	80 hours

Acknowledgments



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Questions ?



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