



**Rensselaer**

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# **Estimating Fuel Consumption and Environmental Pollution of Freight Activities From GPS Data**

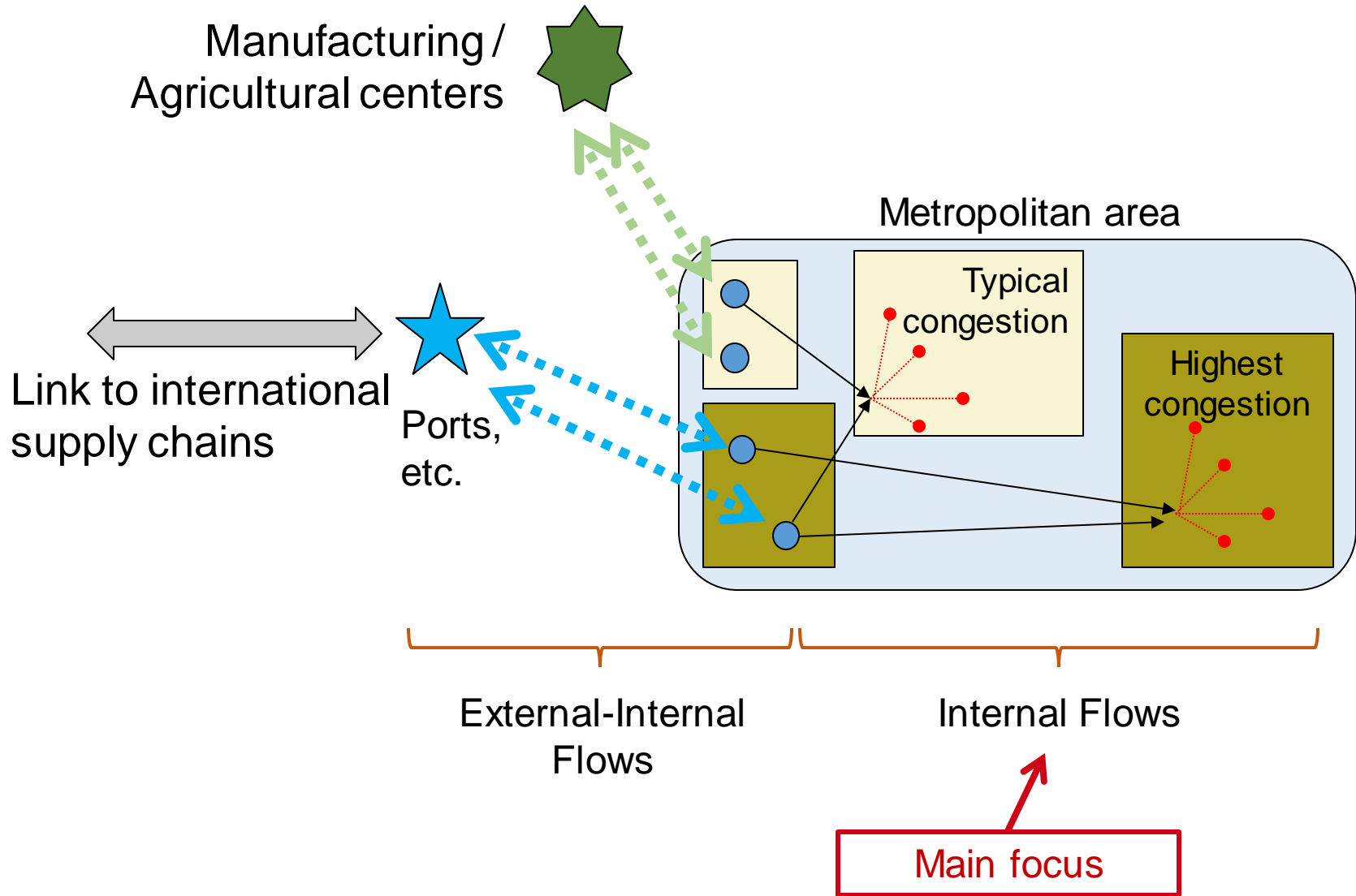
Trilce Encarnación

## Collaborators

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- Carlos Gonzalez-Calderon
- Sofia Kyle
- Xia Yang

# SAMPLE SELECTION



## Recruitment

- Contact the owners/managers of establishments to identify their main vendors and request their assistance in securing the vendor's collaboration
- Contact the vendors and obtain permission to install GPS tracking devices in the trucks that deliver to the supermarkets

## Data Collection

- Install GPS data loggers in the selected trucks for a period of time of 3-4 weeks
  - “Install” means plugging the device into the cigarette lighter
- Monitor the GPS devices

## Equipment



Bad Elf 2200 GPS Pro (Black/silv  
by Bad Elf

**\$146.43** ~~\$479.99~~ Prime  
Get it by **Thursday, Jan 22**

More Buying Choices  
**\$142.99** new (46 offers)  
**\$120.00** used (4 offers)



iTrail GPS Data Logger Spy Car  
by SecurityGearPro

**\$189.00** Prime  
Only 9 left in stock - order soon.

More Buying Choices  
**\$185.00** new (9 offers)  
**\$79.11** used (2 offers)



Canmore GT-730FL-S USB GPS  
Waypoints...

by Canmore

**\$41.99** ~~\$99.99~~  
Only 20 left in stock - order soon.

More Buying Choices  
**\$36.95** new (4 offers)



Columbus V-800+ USB GPS Data  
by Columbus

**\$46.95** ~~\$49.95~~

More Buying Choices  
**\$43.95** new (2 offers)

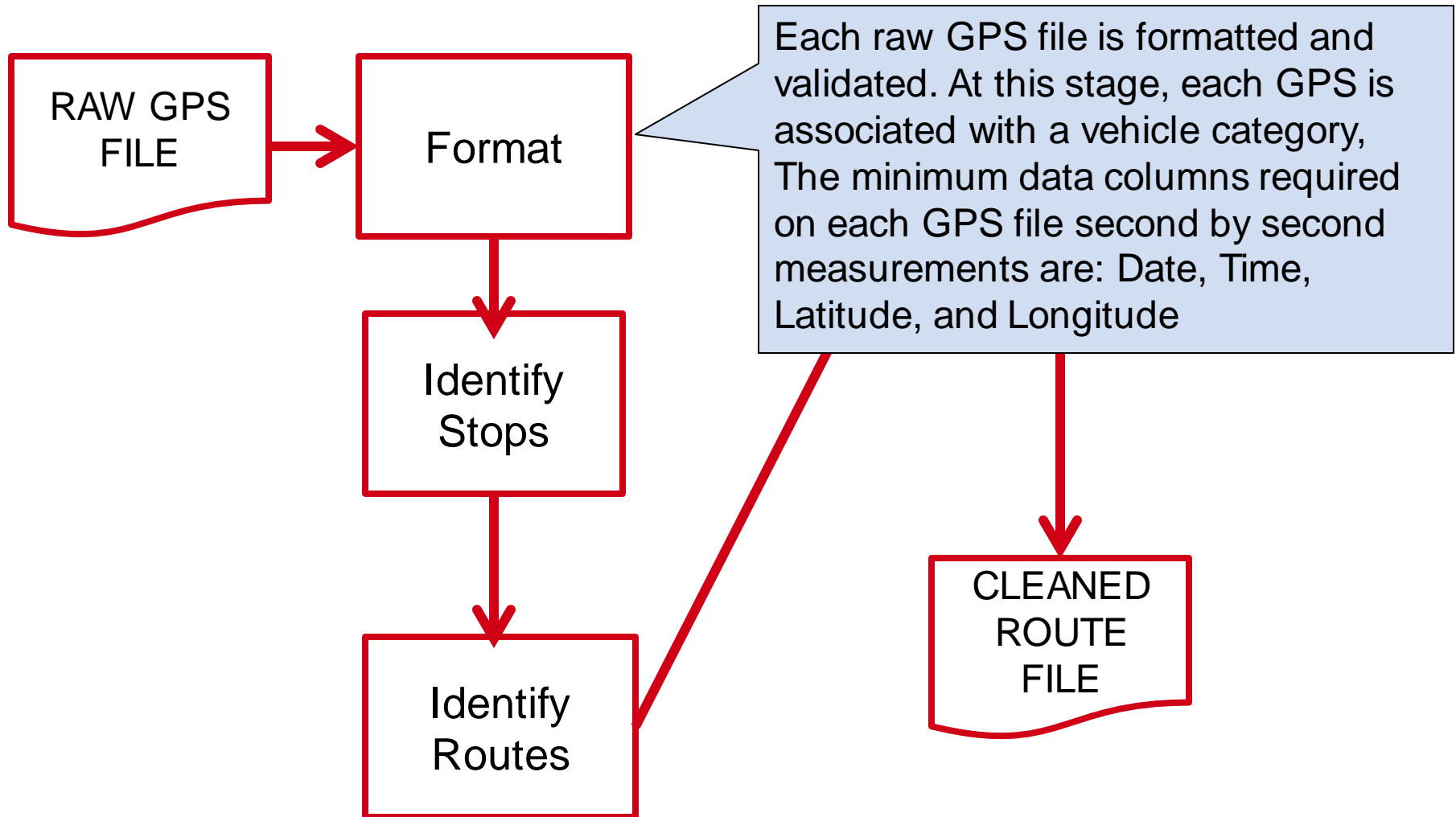
# GPS DATA LOGGER USED

## ■ VISIONTAC VGPS-900

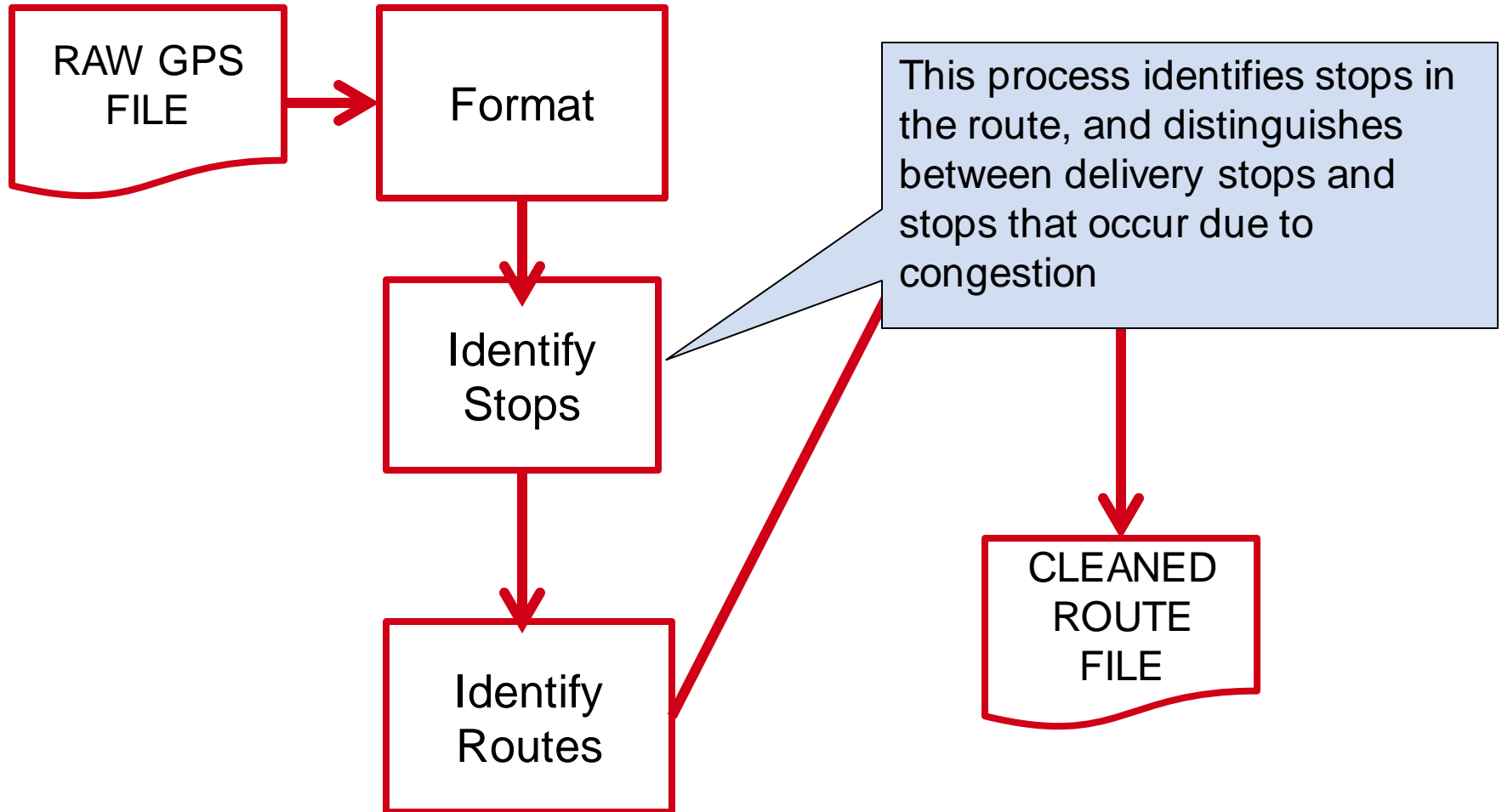
- Small device (credit card size)
- Collect data every three seconds
- Data: a CSV file in MicroSD card
- CSV converted to Google Earth file



## STAGE 1 – FORMAT AND CLEAN GPS FILES



# STAGE 1 – FORMAT AND CLEAN GPS FILES









# IDENTIFYING STOPS

A delivery/pick-up, the truck had problems entering the street

A delivery/pick-up, and bouncing of GPS signals

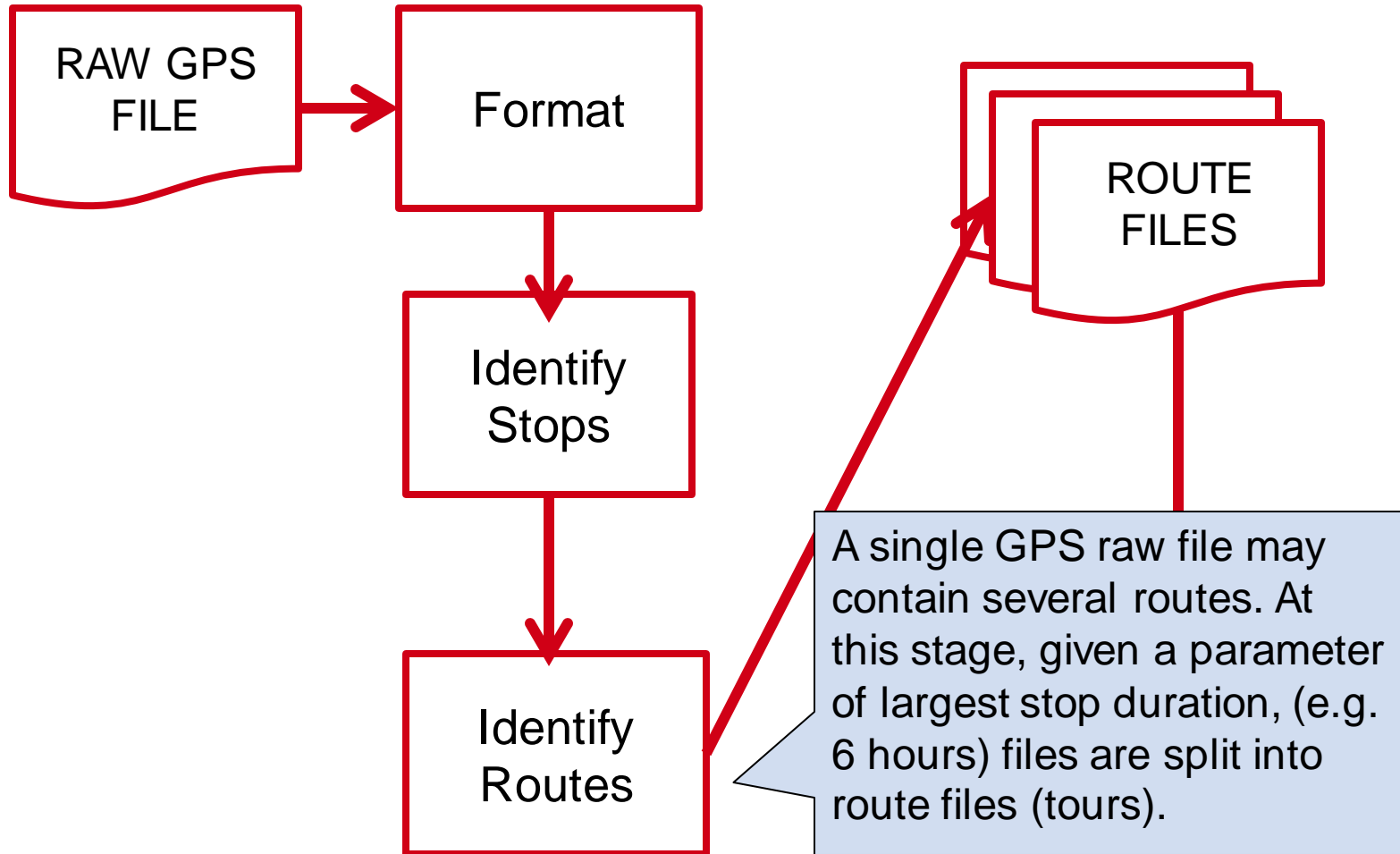
Congestion

No congestion

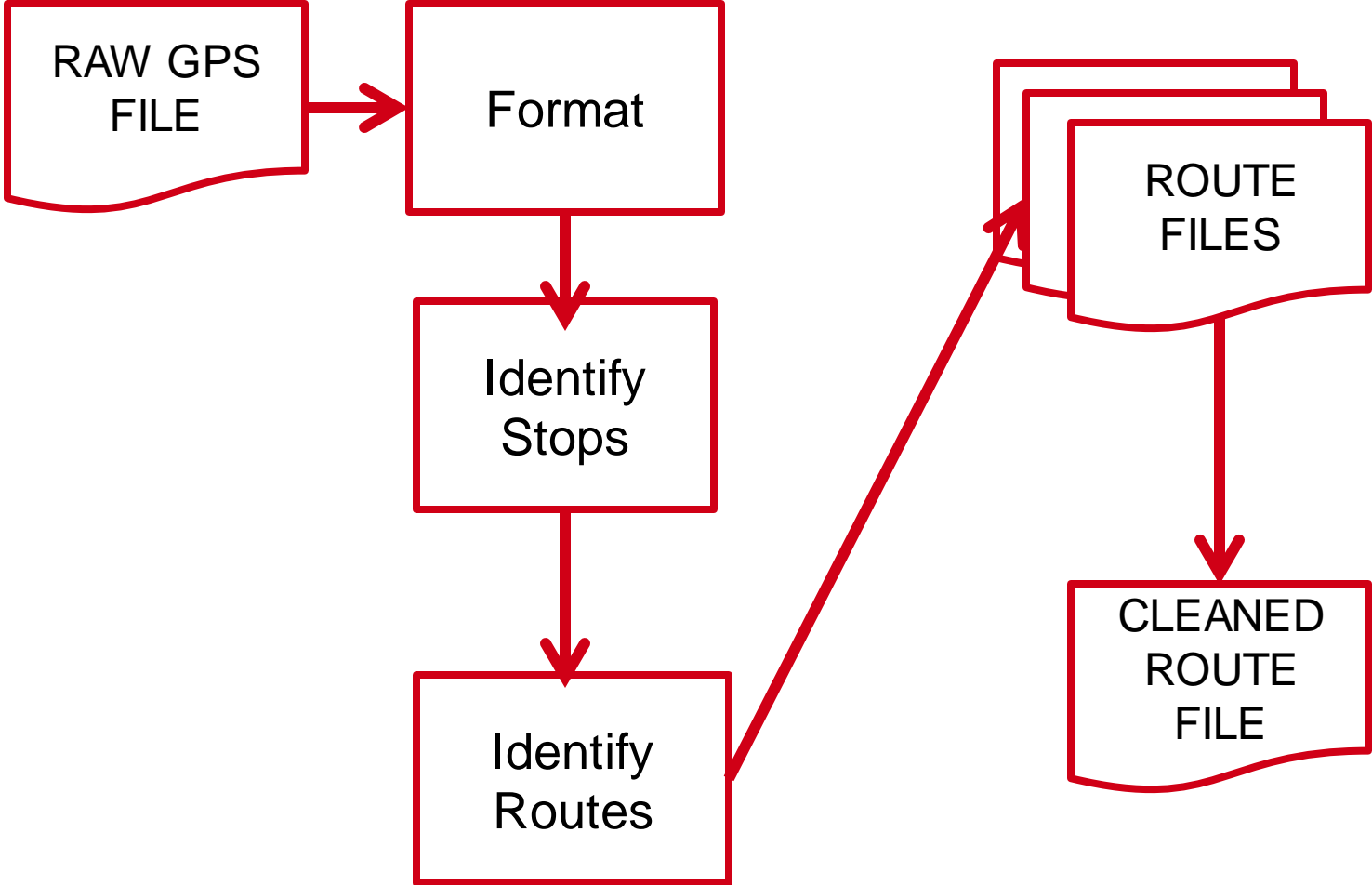




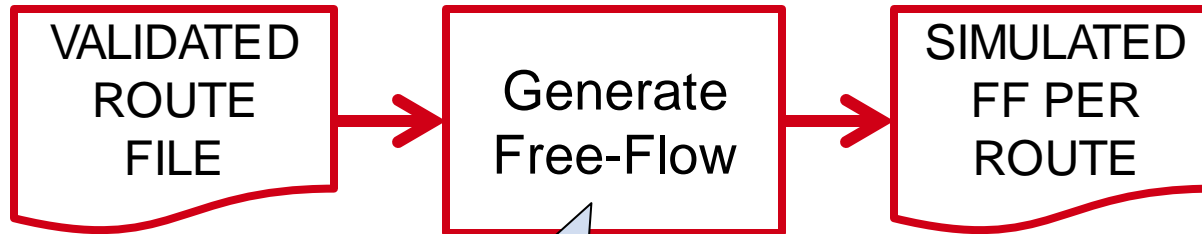
# STAGE 1 – FORMAT AND CLEAN GPS FILES



# STAGE 1 – FORMAT AND CLEAN GPS FILES

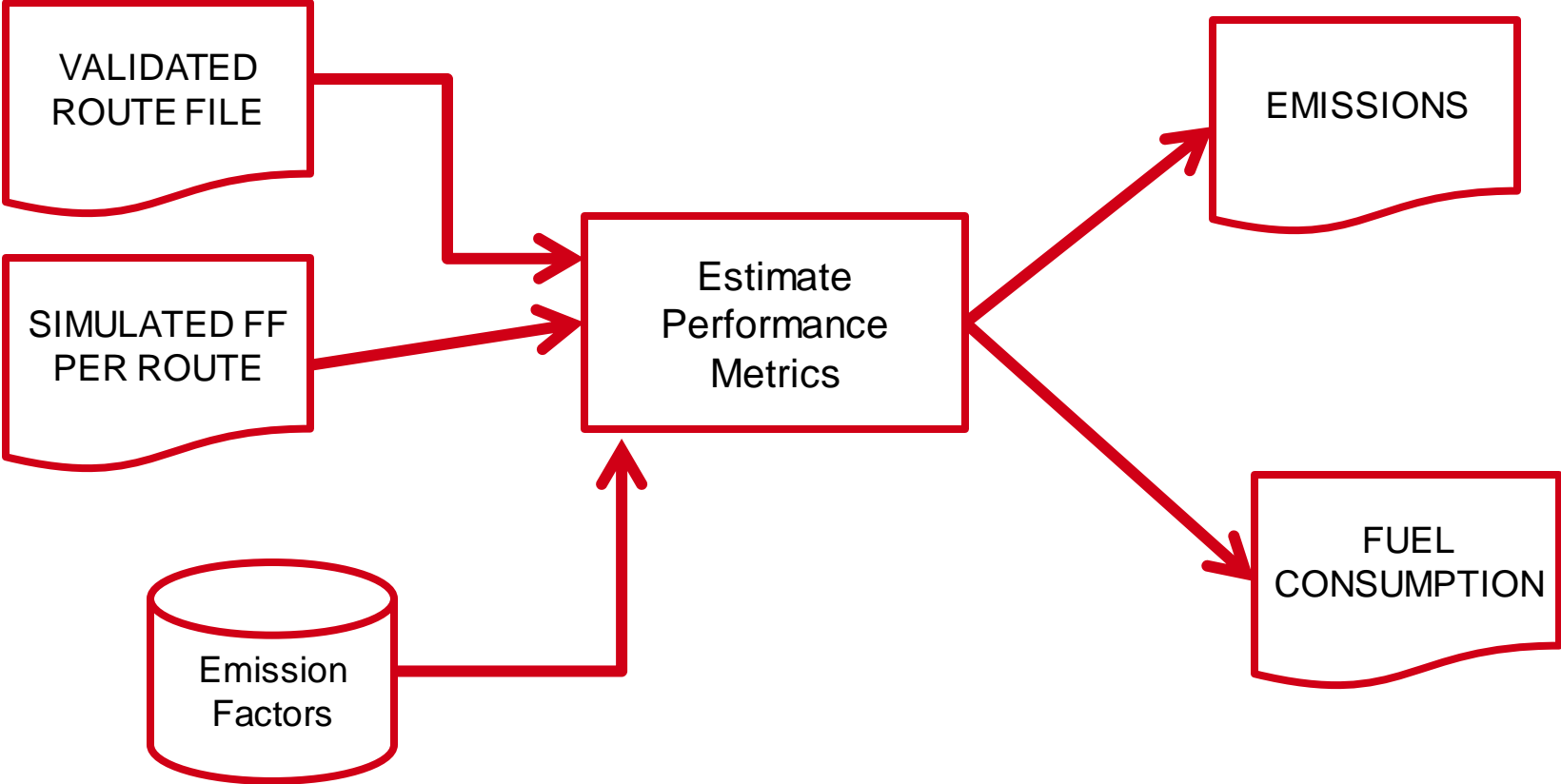


## STAGE 2 – GENERATE FREE FLOW ESTIMATE



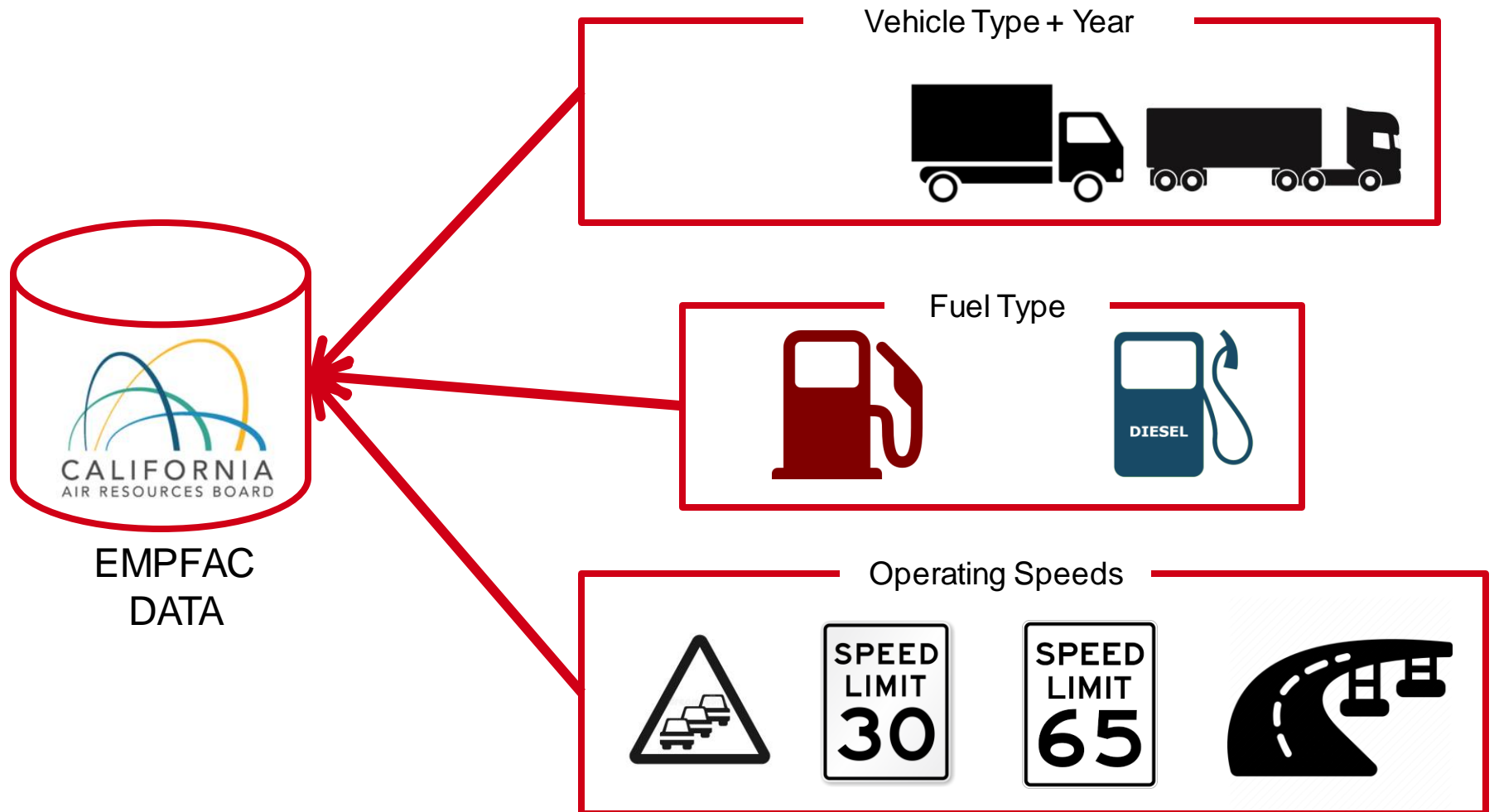
This process simulates trips along the same routes traveling in free flow conditions. These are generated by finding the shortest routes between the multiple stops on the truck routes using the Google Maps API which provides travel time and distance estimates for each segment.

# STAGE 3 – PERFORMANCE METRICS





# Emissions Factors

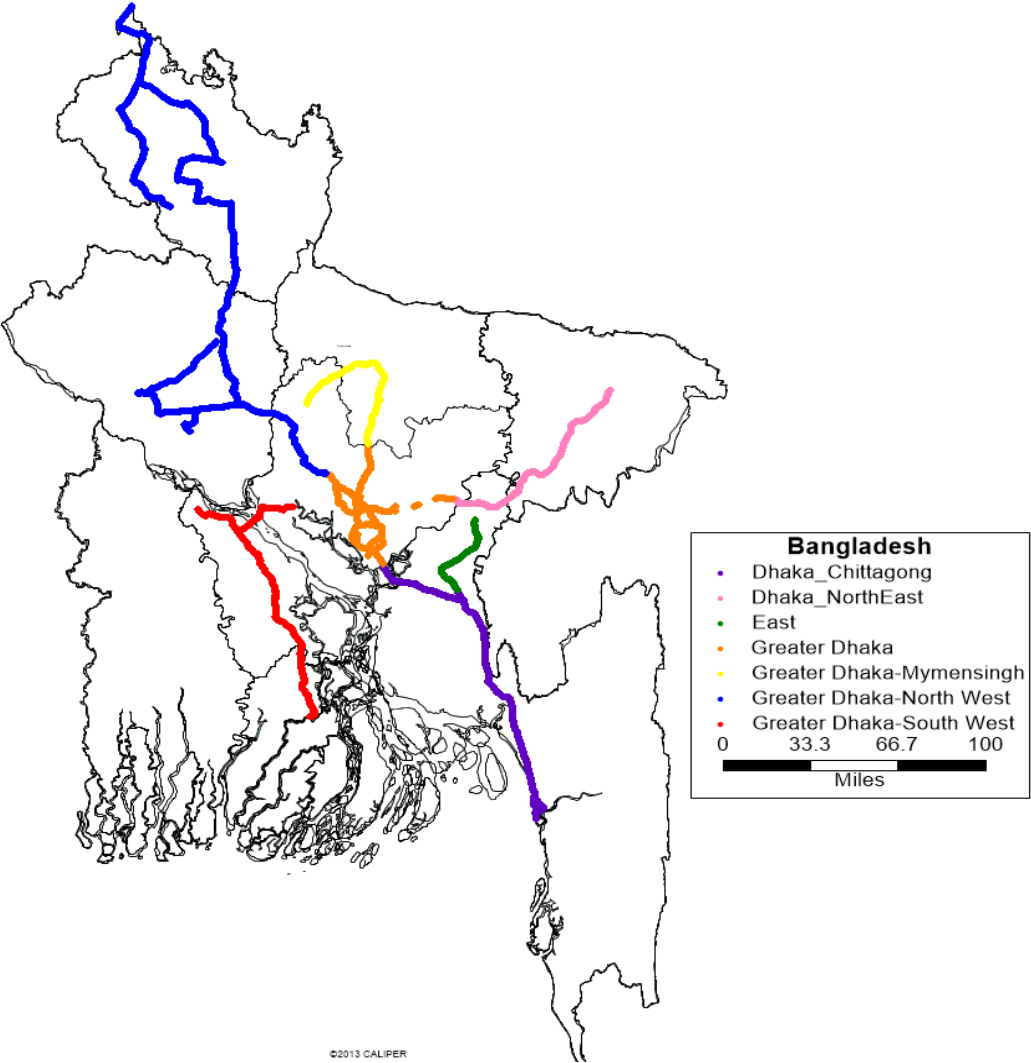


Mobile Source Emission Inventory: <https://www.arb.ca.gov/emfac/2017/>

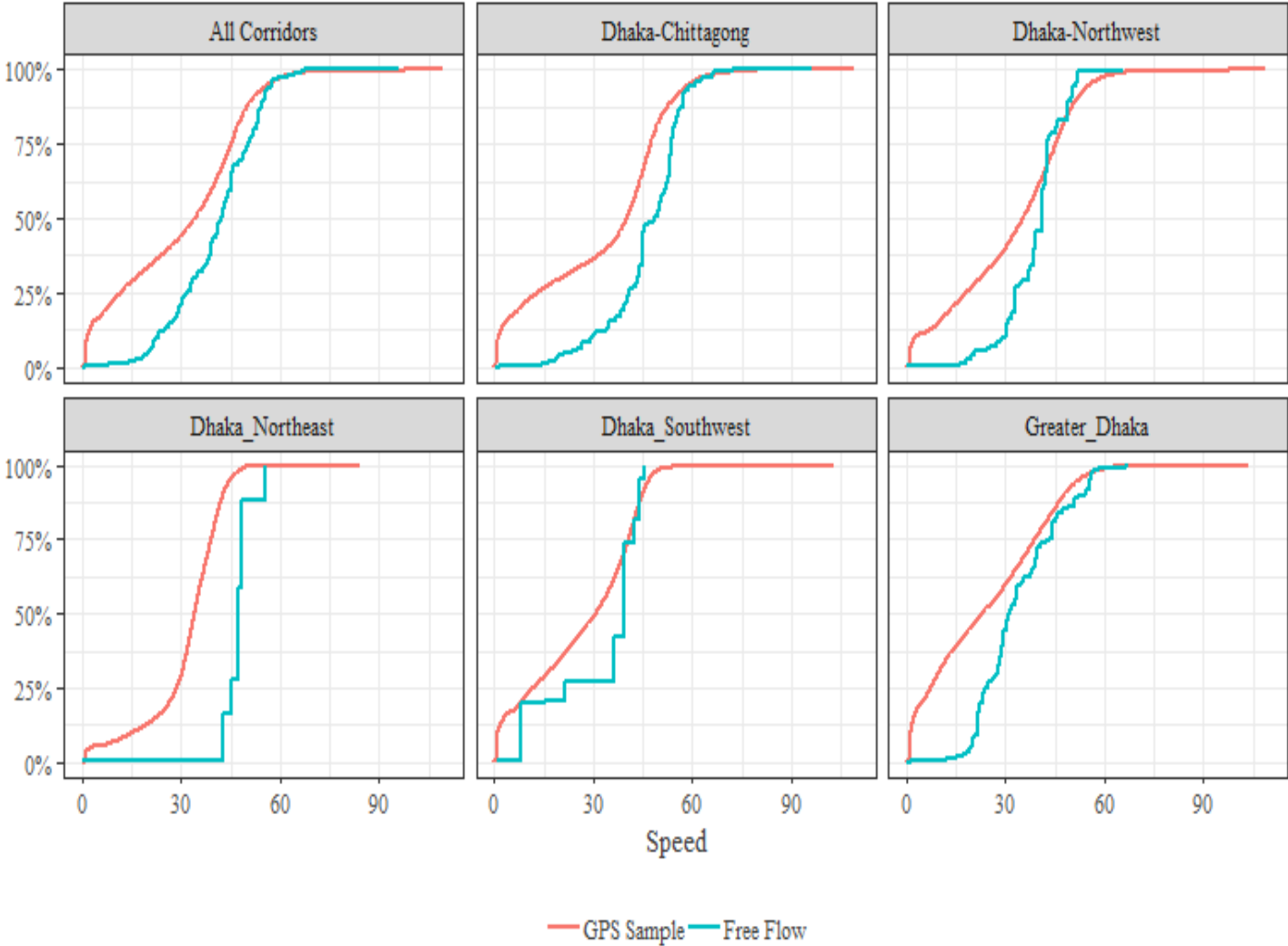
# SAMPLE RESULTS: BANGLADESH



# BANGLADESH ROUTES



# BANGLADESH ROUTES



# BANGLADESH EMISSIONS

Corridor	Emission Rates (g/km)						
	ROG	TOG	NOX	CO	CO2	PM10	PM25
Dhaka-Chittagong	0.017	0.017	0.186	310	0.023	0.005	0.005
Dhaka-Northwest	0.017	0.017	0.19	289	0.023	0.005	0.005
Dhaka_Mymensigh	0.011	0.011	0.163	311	0.024	0.004	0.004
Dhaka_Northeast	0.011	0.011	0.164	301	0.023	0.004	0.003
Dhaka_Southwest	0.02	0.02	0.228	315	0.026	0.006	0.006
East	0.019	0.019	0.262	349	0.031	0.006	0.006
Greater_Dhaka	0.029	0.029	0.312	343	0.031	0.009	0.008
Corridor	Emissions Increment due to Congestion						
	ROG	TOG	NOX	CO	CO2	PM10	PM25
Dhaka-Chittagong	196%	196%	112%	6%	28%	153%	153%
Dhaka-Northwest	132%	132%	65%	13%	25%	105%	105%
Dhaka_Mymensigh	80%	80%	31%	6%	19%	66%	66%
Dhaka_Northeast	107%	107%	154%	8%	33%	93%	93%
Dhaka_Southwest	106%	106%	53%	5%	11%	81%	81%
East	86%	86%	39%	3%	14%	71%	71%
Greater_Dhaka	198%	198%	105%	9%	28%	155%	155%

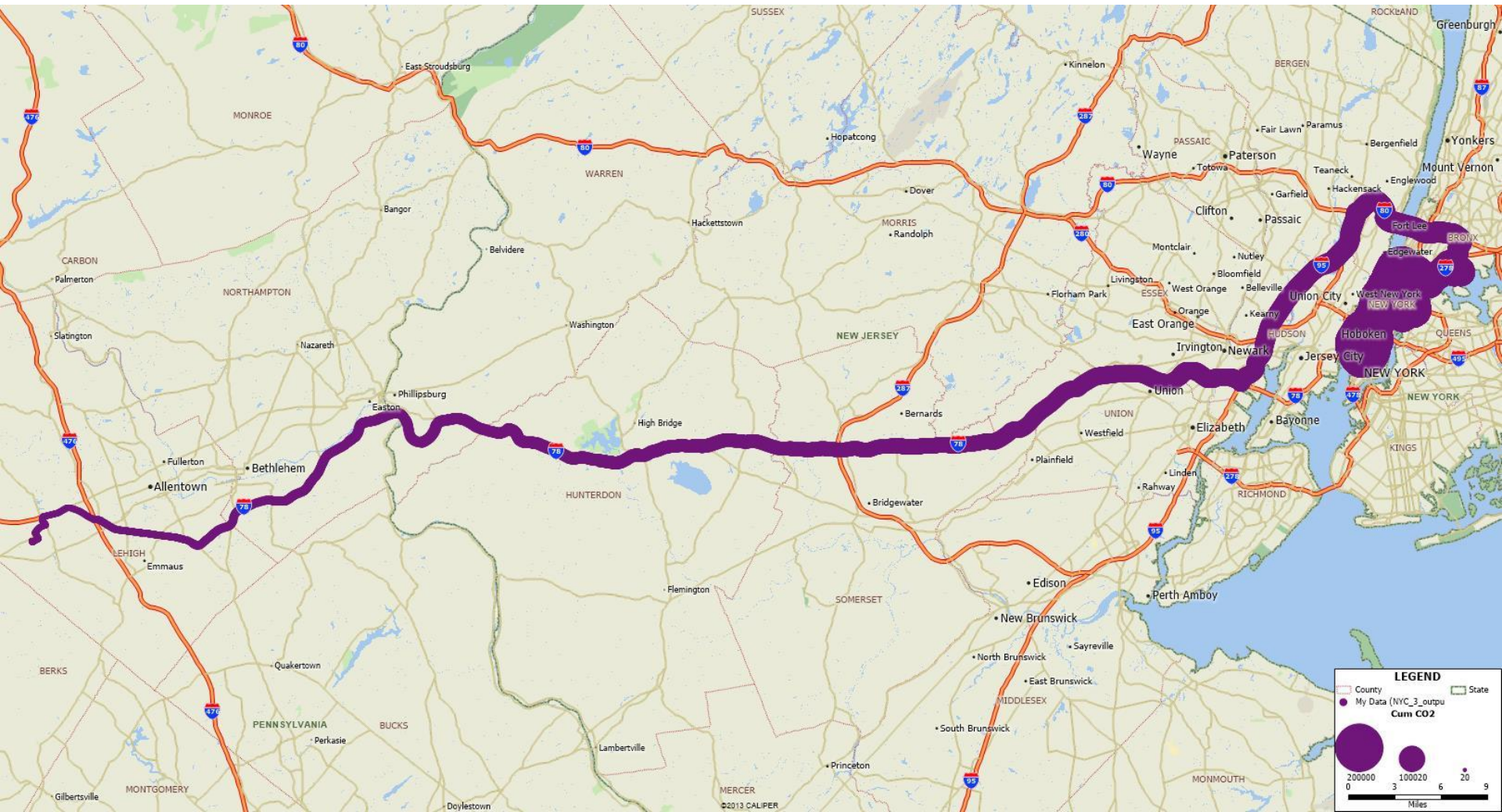


# SAMPLE RESULTS: NEW YORK CITY



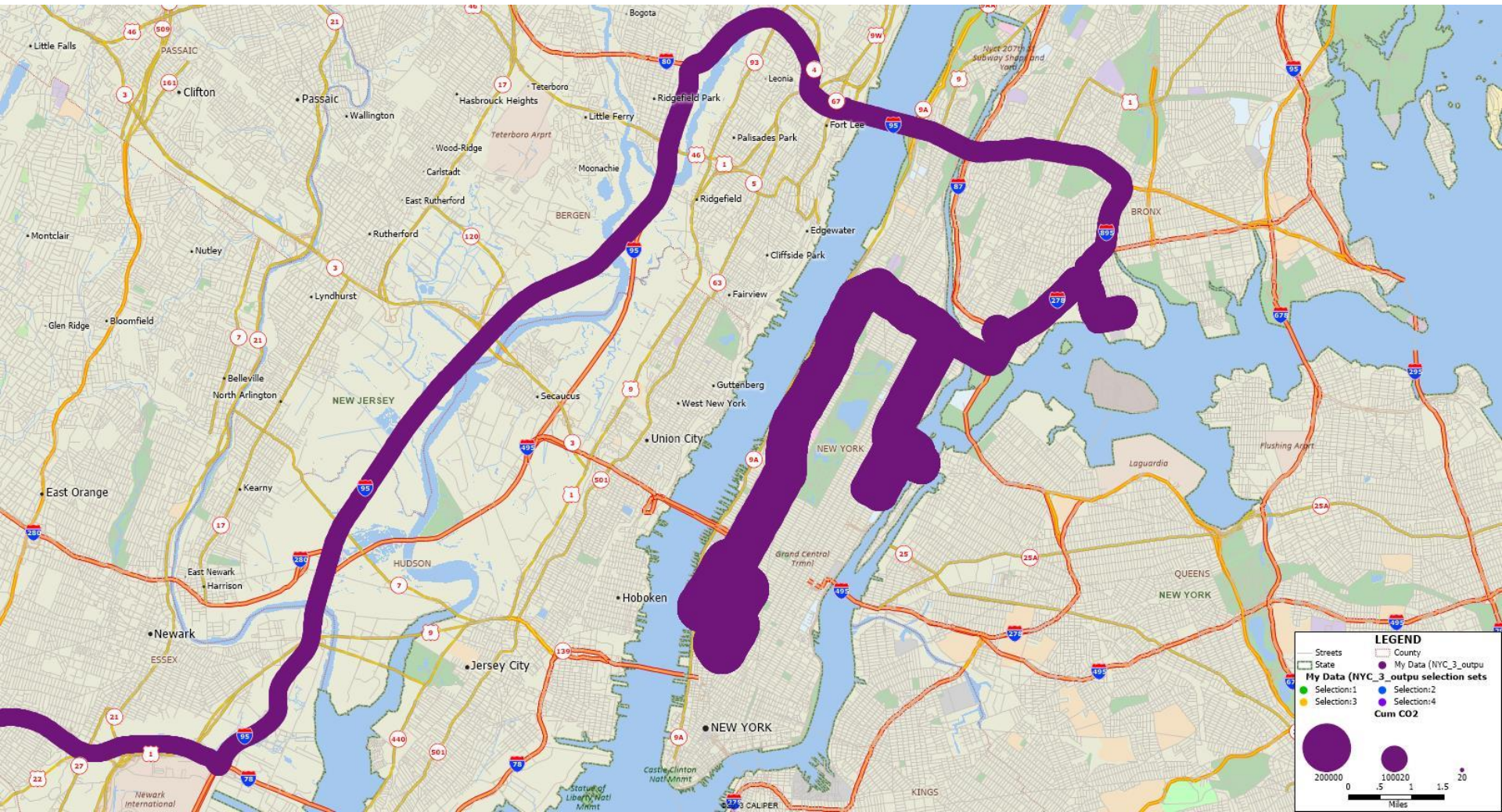
© NYC DOT

# NYC LONG HAUL: CO<sub>2</sub> EMISSIONS

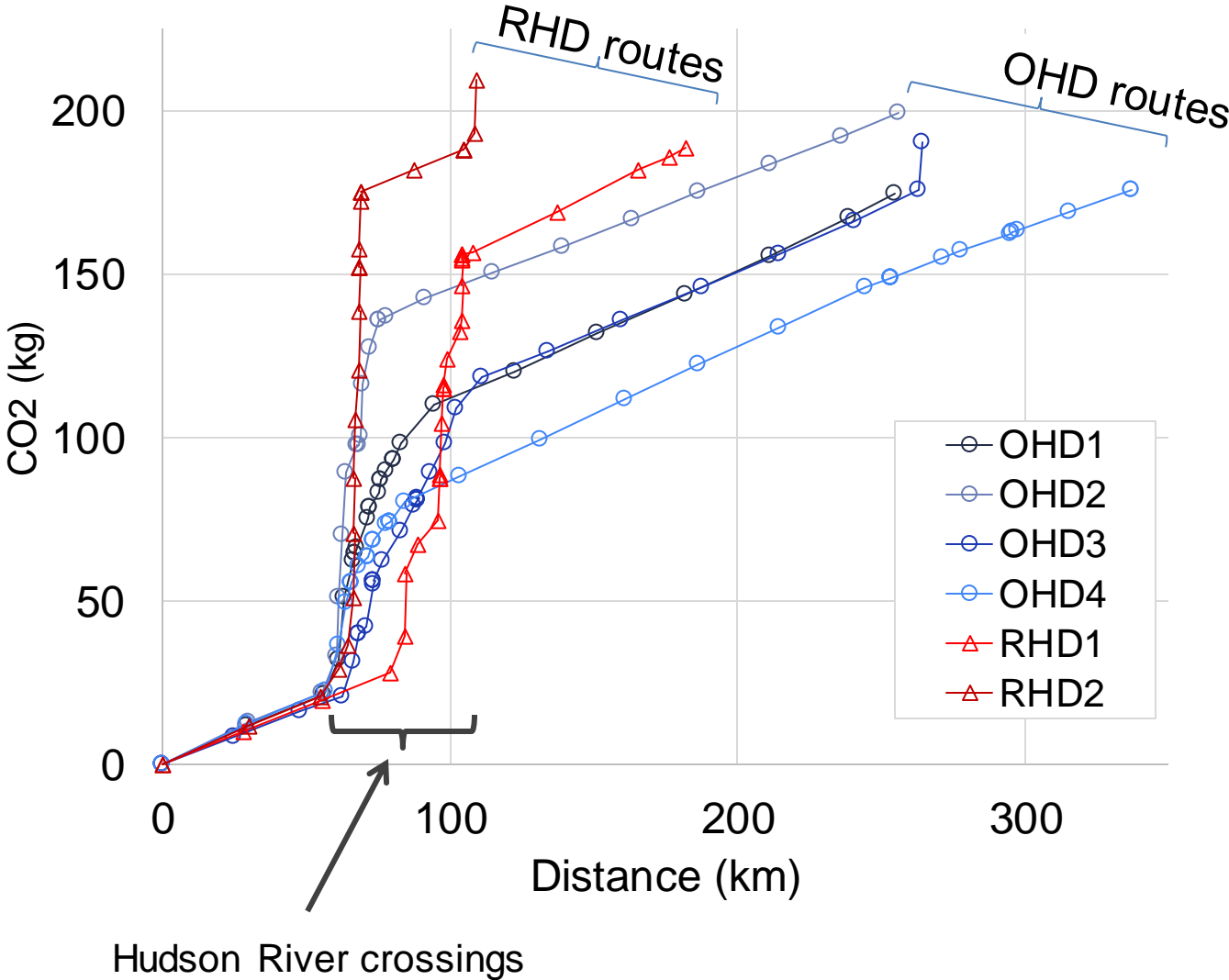




# NYC LONG HAUL: CO<sub>2</sub> EMISSIONS



# NYC: CO<sub>2</sub> EMISSIONS



# Questions?

# Thanks!