



Impacts of Transit-Oriented Compact-Growth on Air Pollutant Concentrations and Exposures in the Tampa Region

Sashikanth Gurram

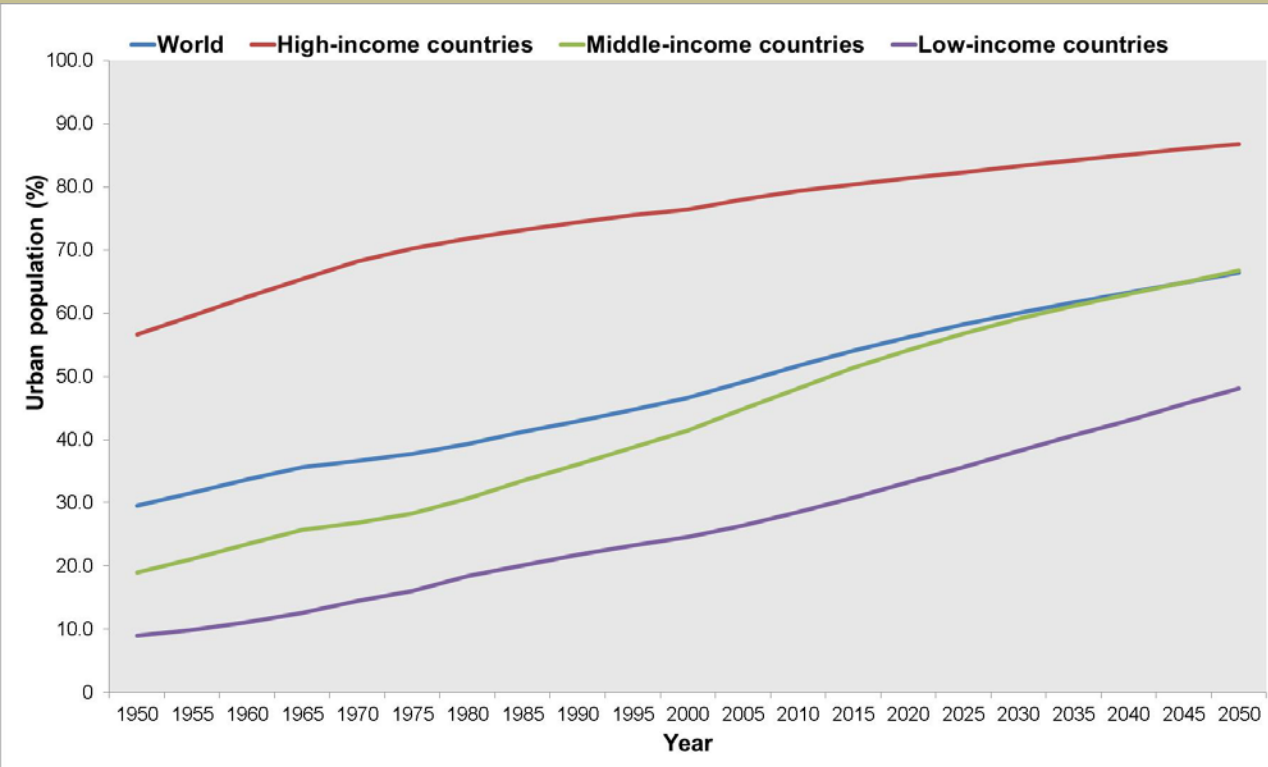
Amy L. Stuart

Abdul R. Pinjari

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URBANIZATION AND AIR POLLUTION



- Economic growth
- Poverty reduction
- Access to facilities and infrastructure
- Environment and climate (Burak et al., 2004; Seto et al., 2010; Kalnay & Cai, 2003)
- Urban air pollution
 - Traffic-related air pollution

Source: United Nations, Department of Economic and Social Affairs, Population Division (2014). World Urbanization Prospects: The 2014 Revision, CD-ROM Edition.

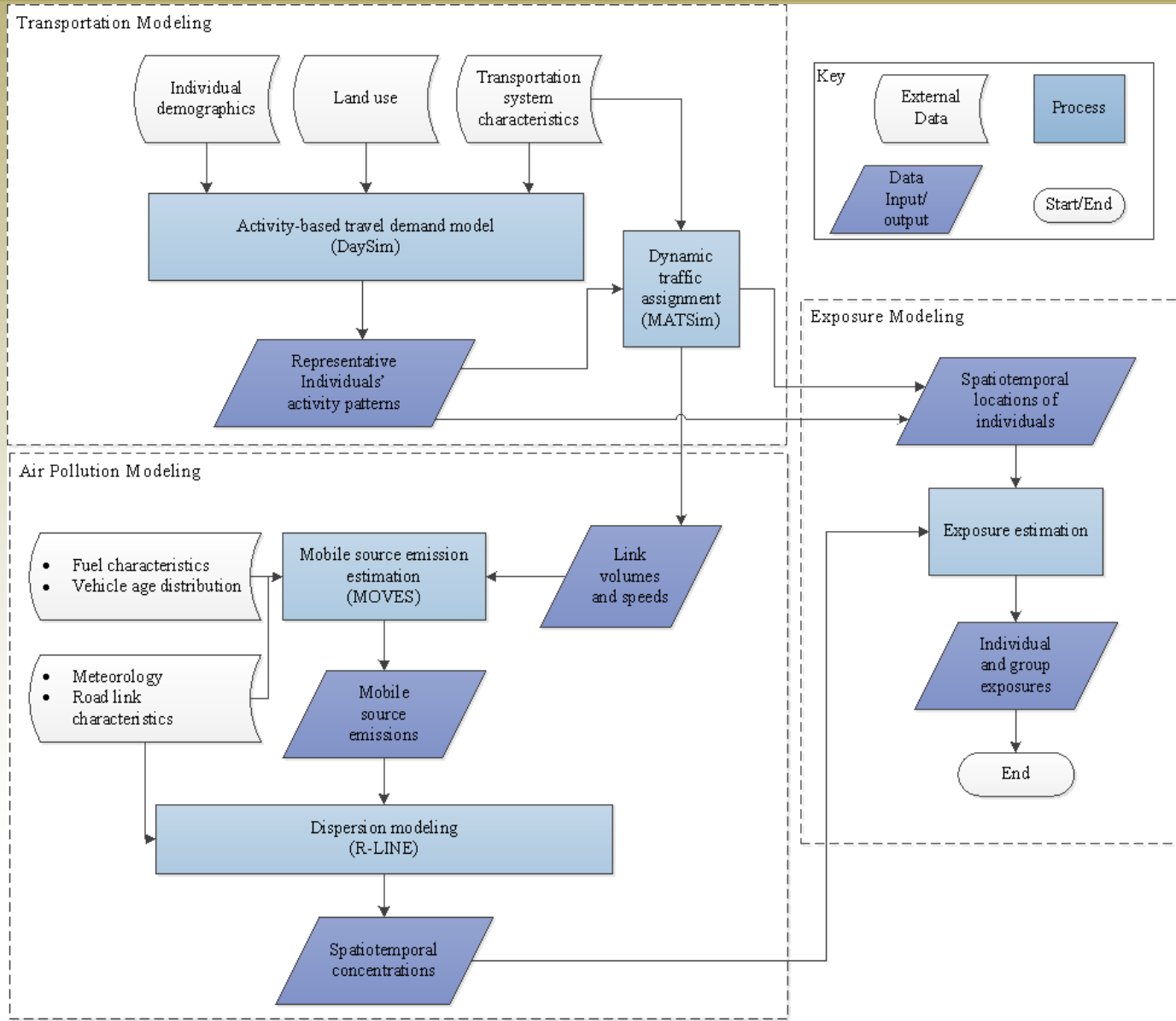


SCOPE

- Study area: Hillsborough County, Florida
 - Diverse mix of air pollutant emission sources
 - Few transportation modes apart from automobile
 - Diverse socioeconomic makeup
 - Underwent significant amount of sprawl
- Pollutant focus
 - NO_x
 - Linked to transportation emissions
 - Surrogate for traffic-related air pollution (HEI 2010)
 - NO_2 is a criteria pollutant with known health effects



METHODOLOGY





NOVELTY OF WORK



- Daily activities (DaySim)
 - 100% population
 - Spatial resolution of parcels
- Agent-based dynamic traffic assignment (MATSim)
 - 100% population
- Mobile emissions (EPA MOVES)
 - Link-level emissions
- Concentrations (RLINE)
 - Receptors every 500 meters (13,806 receptors)
 - Entire winter season (3,131 hours of meteorology)
- Exposures
 - Spatial resolution of parcels and updated locations every 5 seconds along roadways



TRANSPORTATION AND LAND-USE SCENARIOS

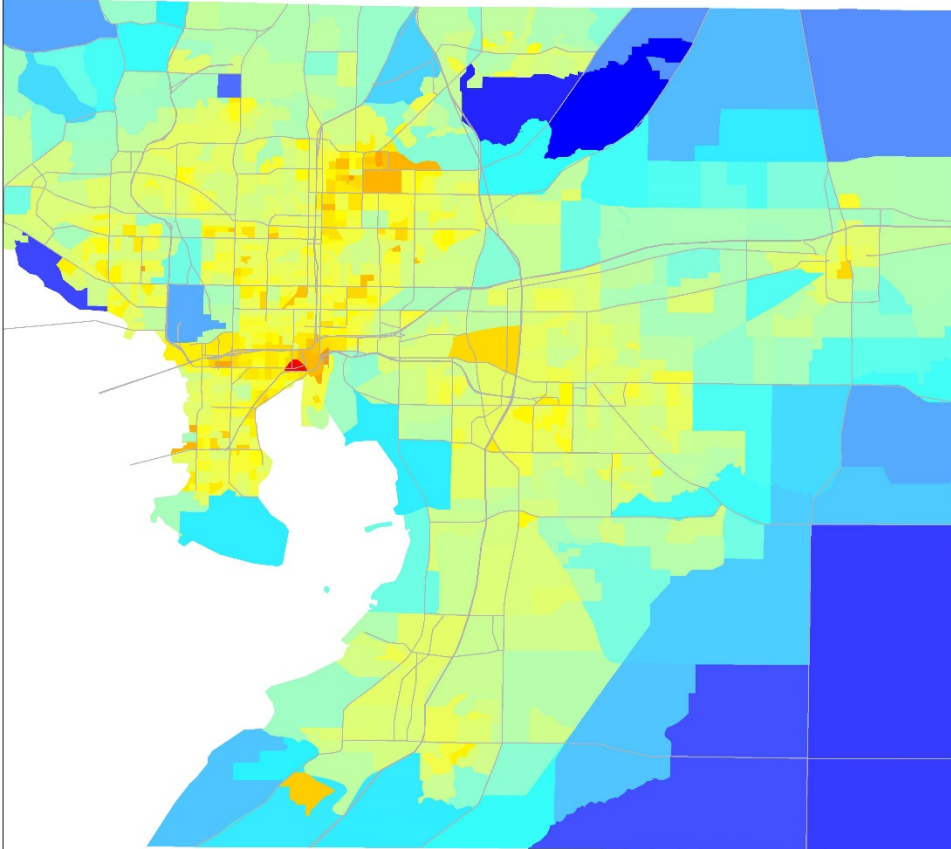


urban form and transportation characteristics	Scenario		
	<i>low-transit</i>	<i>enhanced-transit</i>	<i>compact growth</i>
urban form	2040 base population distribution		reallocated base population
	lower residential density		higher residential density
transportation	2040 highway		
	2010 diesel-bus service	2040 diesel-bus service	

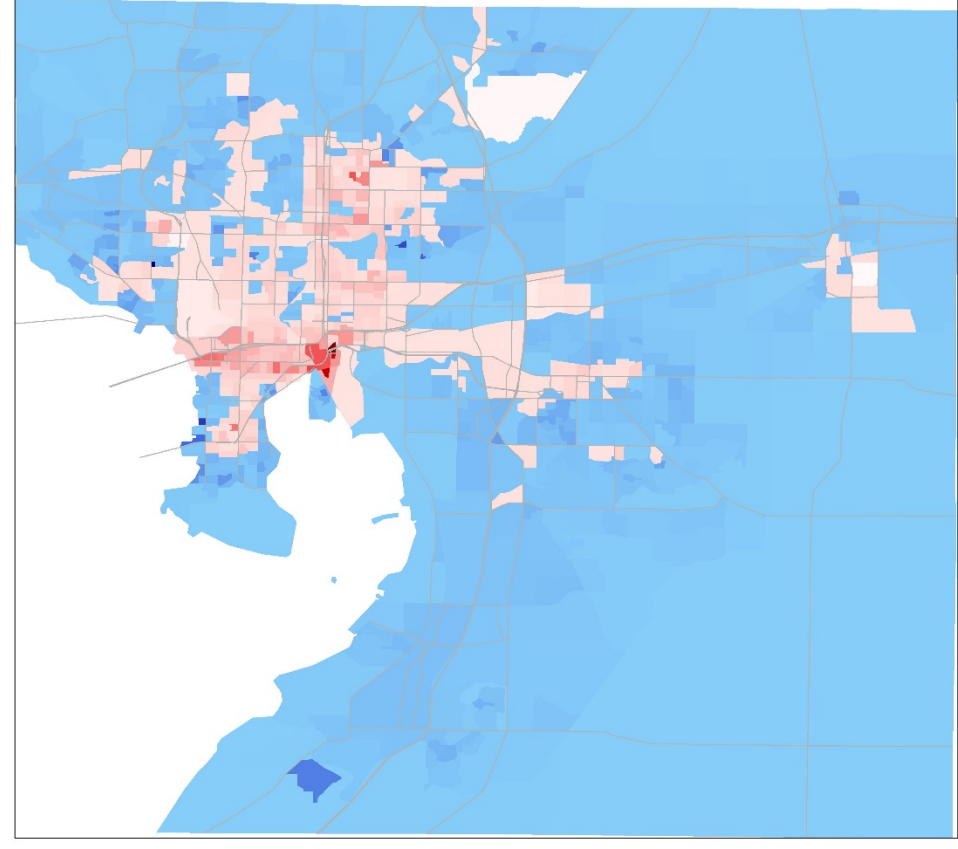
RESIDENTIAL DENSITY (YEAR 2040)



a) base residential density



b) difference in residential density (compact-base)

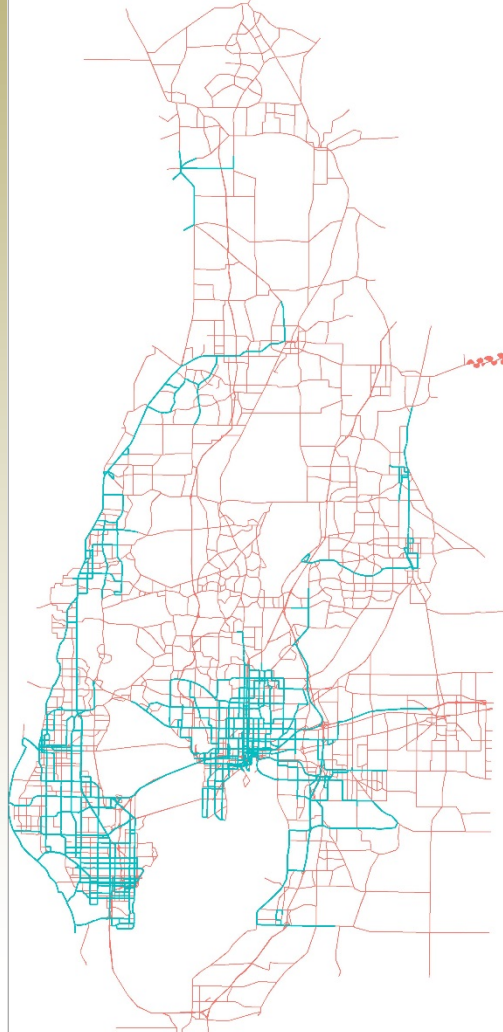


$$AI_i = \frac{t_i}{\log D_{t_i}} \sum_{k=1}^n \frac{r_k}{\log D_{r_k}}$$

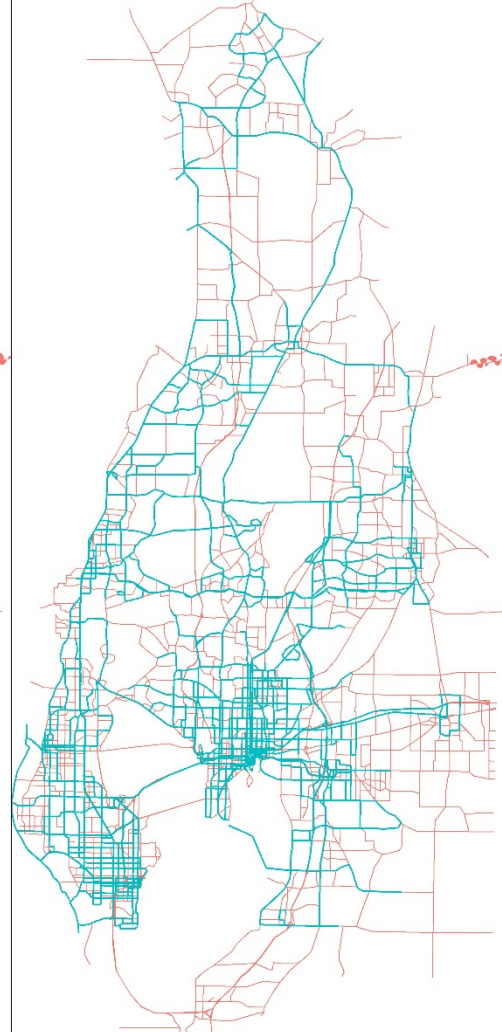


TRANSPORTATION INFRASTRUCTURE

a) low-bus service



b) enhanced-bus service



roadway type
— highway only
— highway and transit

low-bus

- 2010 transit with diesel
- 6284 bus stops
- 94 routes
- 2811 km of bus-serviced roadways

enhanced-bus

- 2040 transit with diesel
- 8754 bus stops
- 195 routes
- 5413 km of bus-serviced roadways



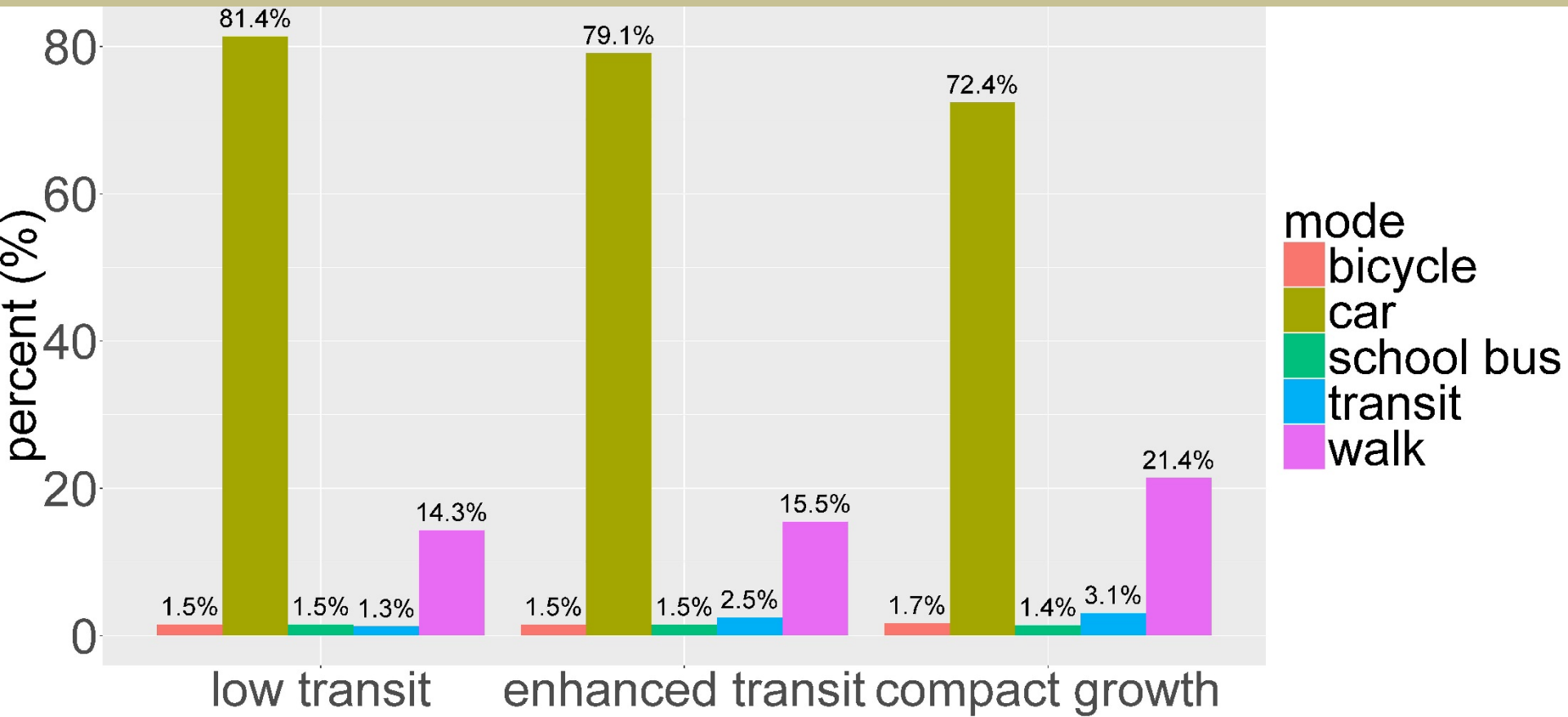
TRANSPORTATION AND LAND-USE SCENARIOS



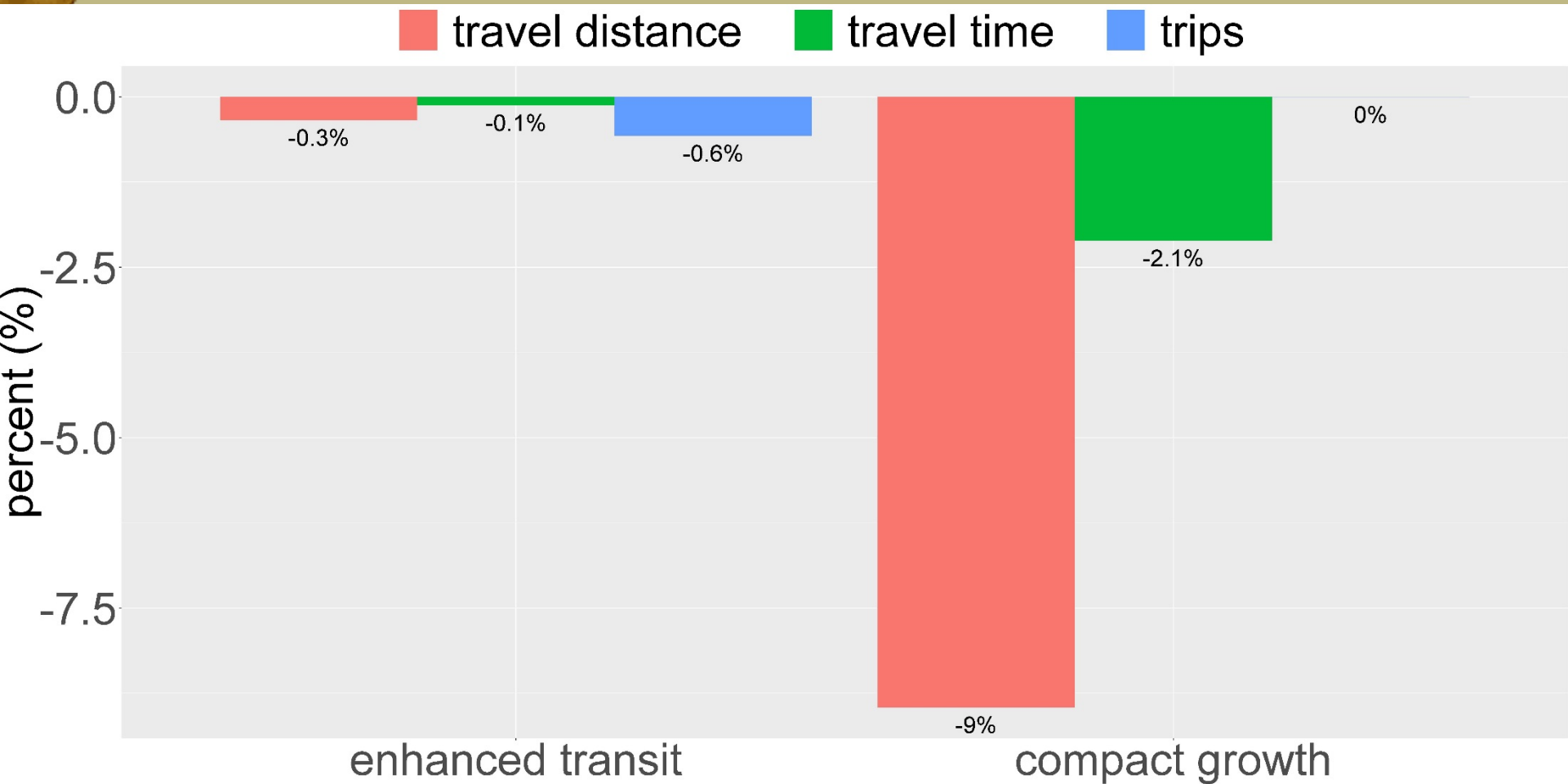
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TRAVEL MODE SHARES

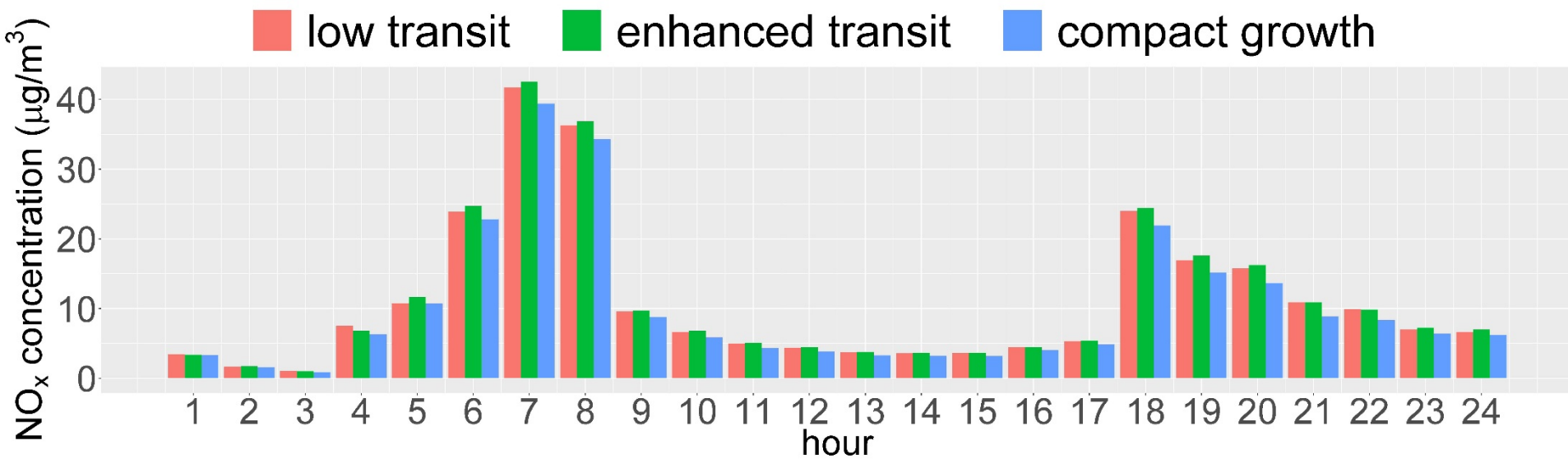
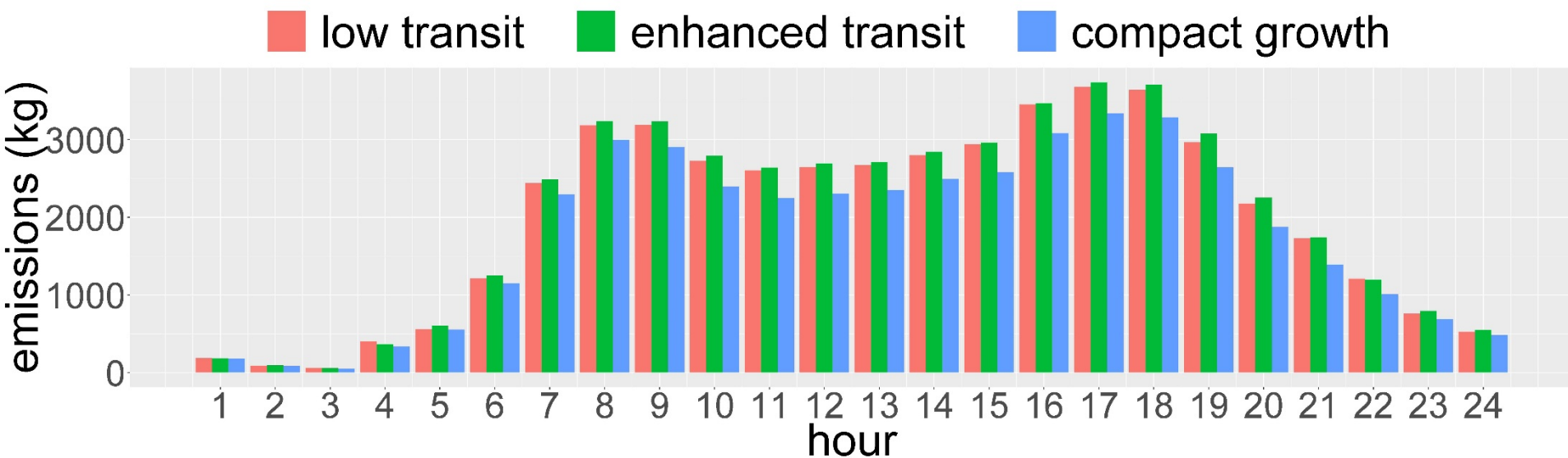


TRAVEL CHARACTERISTICS COMPARED WITH THE LOW-TRANSIT SCENARIO

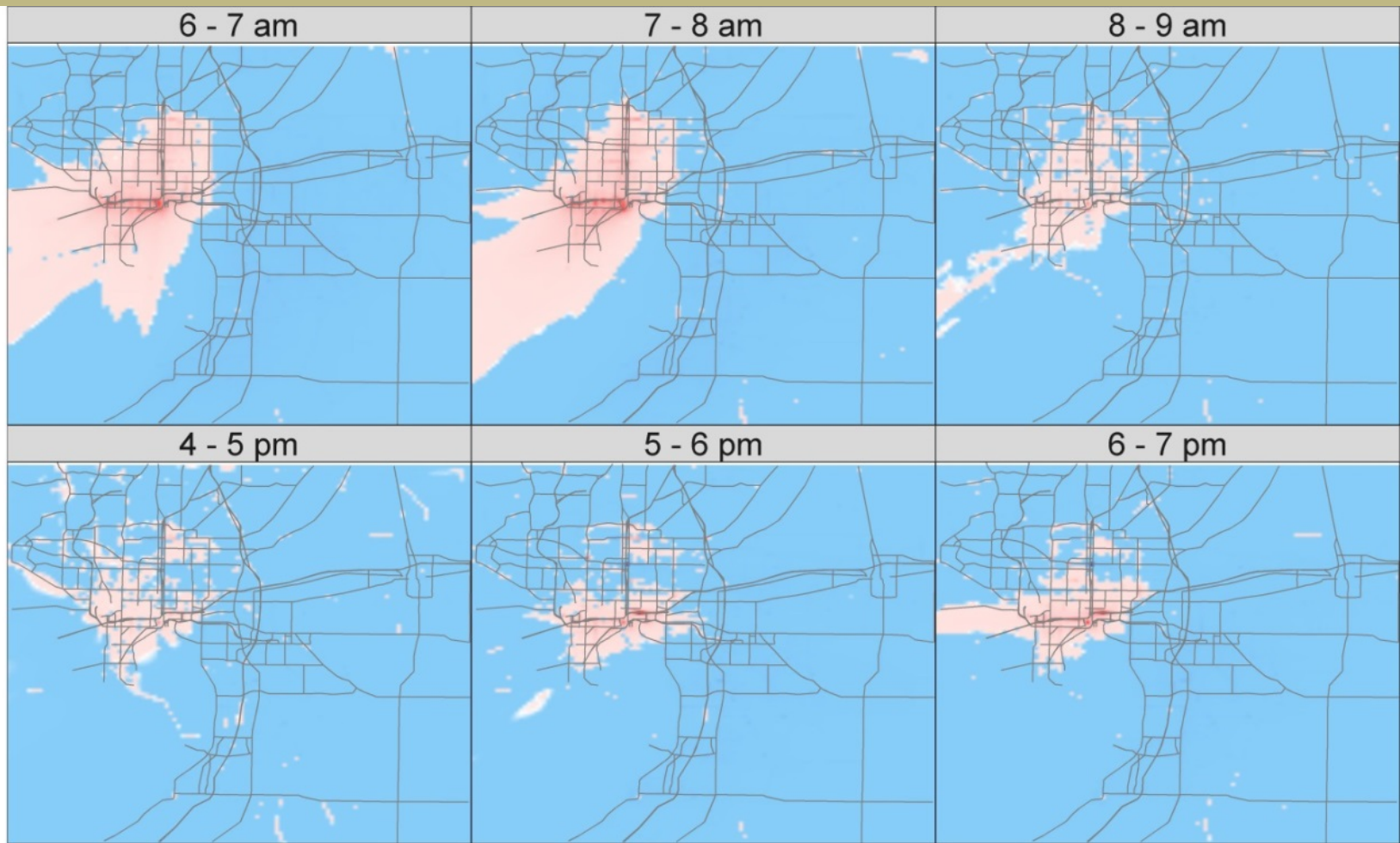




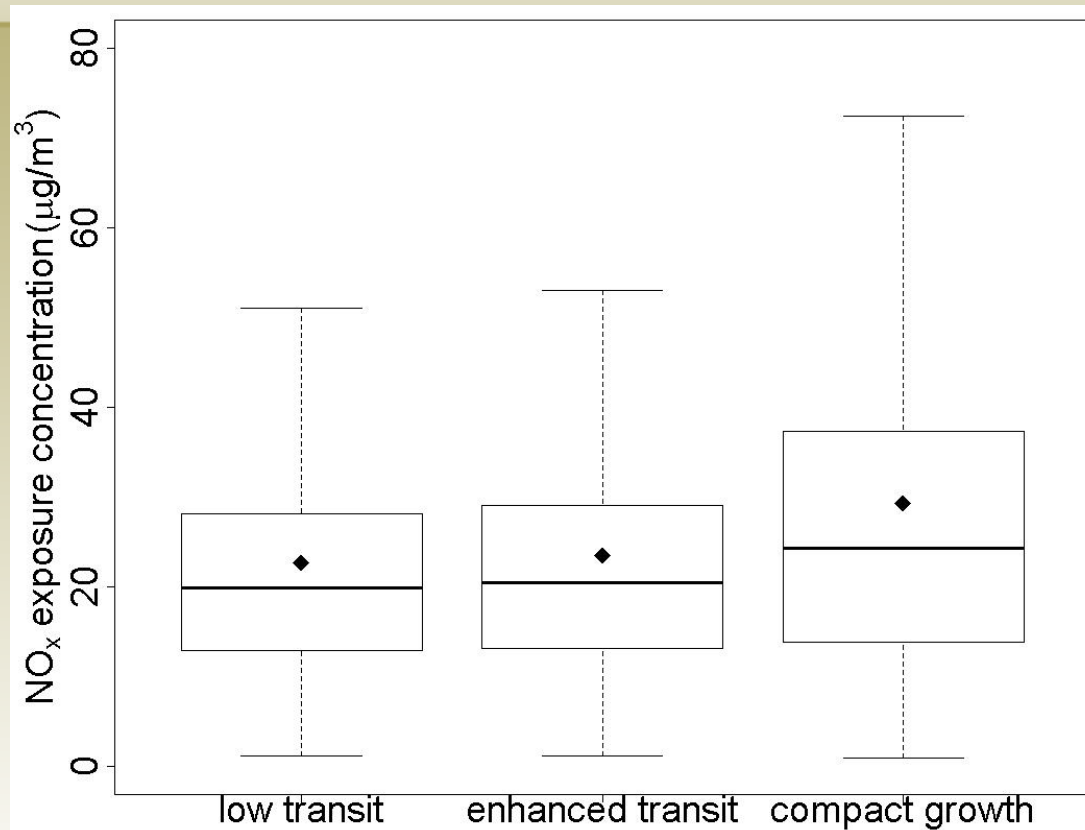
DIURNAL NO_x EMISSIONS AND CONCENTRATIONS



SPATIAL DIFFERENCES IN NO_x LEVELS BETWEEN THE COMPACT GROWTH AND LOW-TRANSIT SCENARIOS



DISTRIBUTION OF POPULATION EXPOSURES



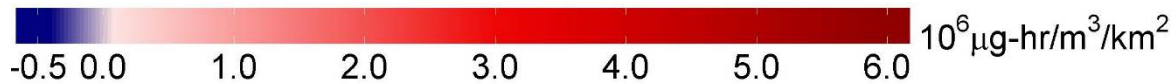
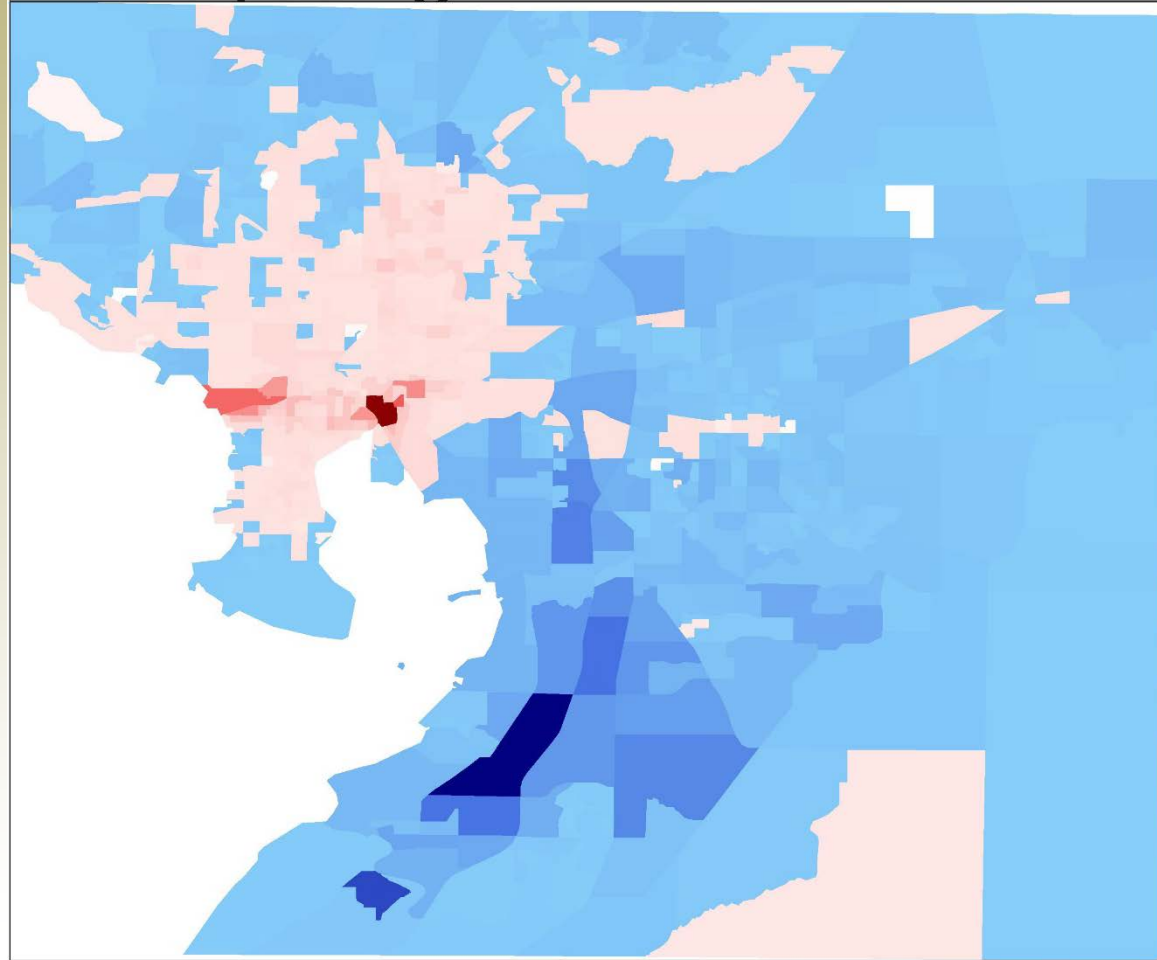
minimum	1.1	1.2	0.9
median	19.9	20.4	24.3
mean	22.7	23.4	29.3
maximum	168.9	180.2	186.1



EXPOSURE DENSITY (NORMALIZED BY THE BLOCKGROUP AREA)



compact growth - low transit





CONCLUSIONS AND FUTURE WORK

- Conclusions
 - Increased diesel-bus services increased emissions and concentrations – not enough mode shift from cars to offset
 - Compact scenario lowered travel distances and increased active modes, including walk and transit (by a small amount)
 - Access to transit at the origin location had only a marginal effect on travel characteristics and mode shares
 - Compact growth improved air quality overall, but increased population exposure (due to reallocation of population to higher pollution zones)
- Future Work
 - Investigation of CNG fuel for transit services



Thank You

Contact:

sgurram@airsage.com