



5th Triennial world symposium on **Transport and Land Use Research**

Paper # 095

How do we move in Latin American cities today?

Modal share versus PKT as sustainable urban mobility demand indicators:
a comparison of Bogotá and Lima

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Introduction

Mobility demand indicators taking mode use and trip patterns into account.

Unified, comparable, replicable methods in different Latin-American cities.

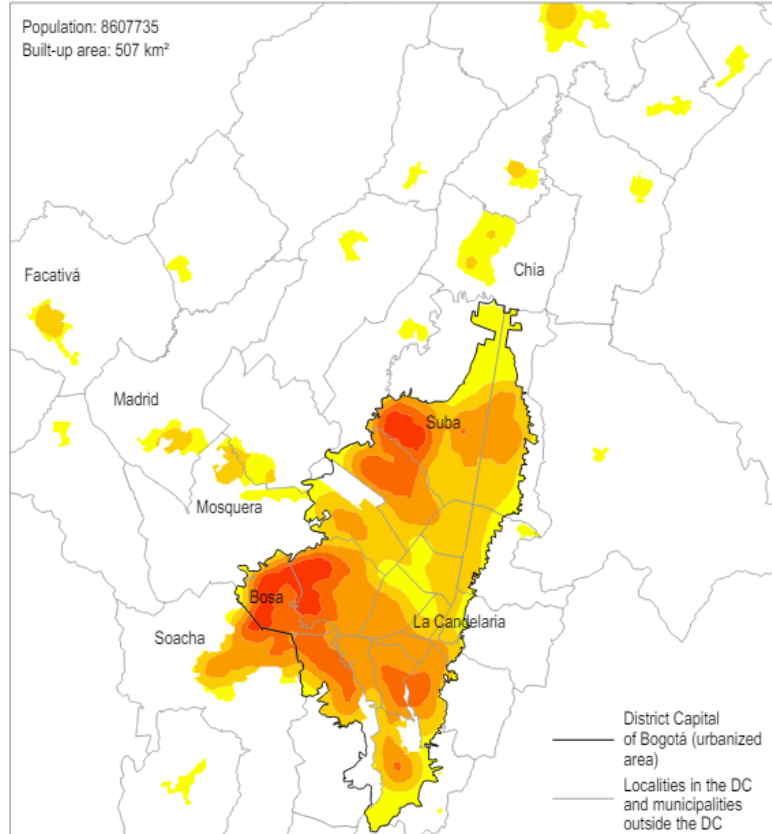
Based on mobility survey individual microdata.

Open-science approach.

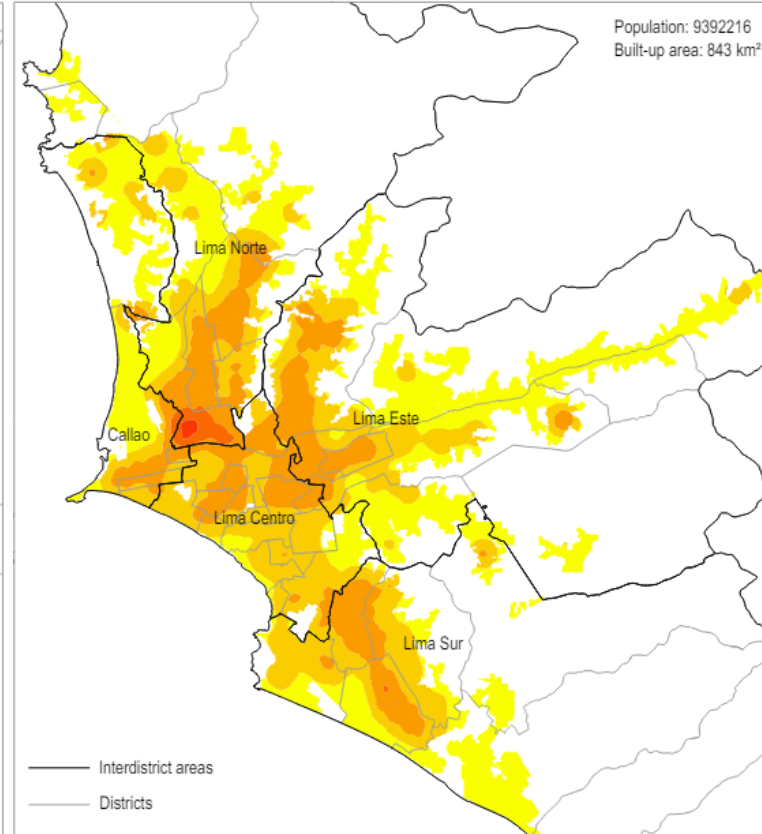


Different population location and density patterns

Metropolitan Area of Bogotá



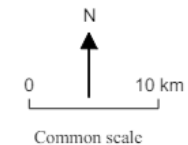
Metropolitan Area of Lima



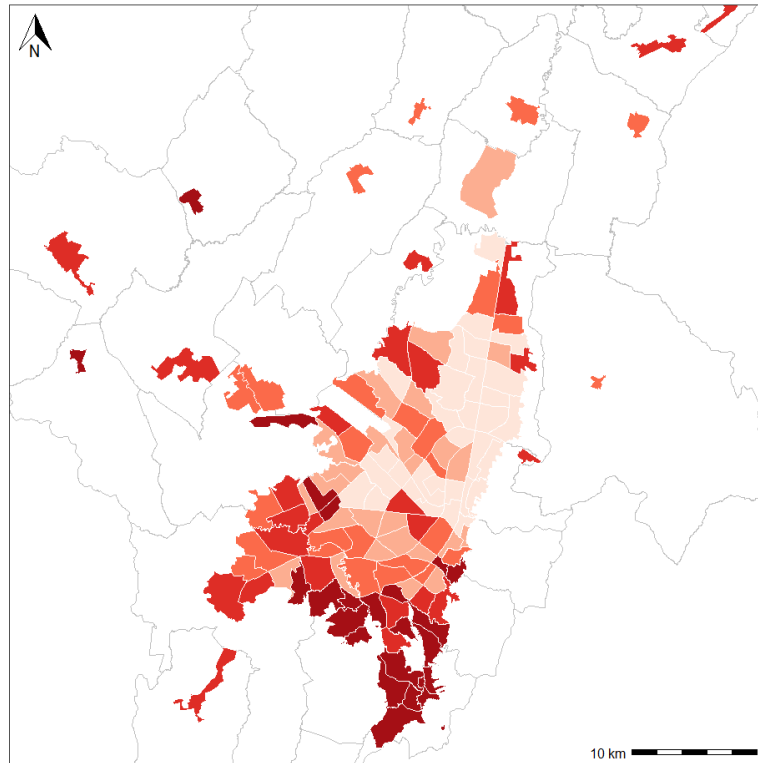
Number of inhabitants
(in a 2km-bandwidth)

- less than 33430
- [33430 ; 66860[
- [66860 ; 100300[
- [100300 ; 133710[
- [133710 ; 167140]

Equal-interval-binning-method

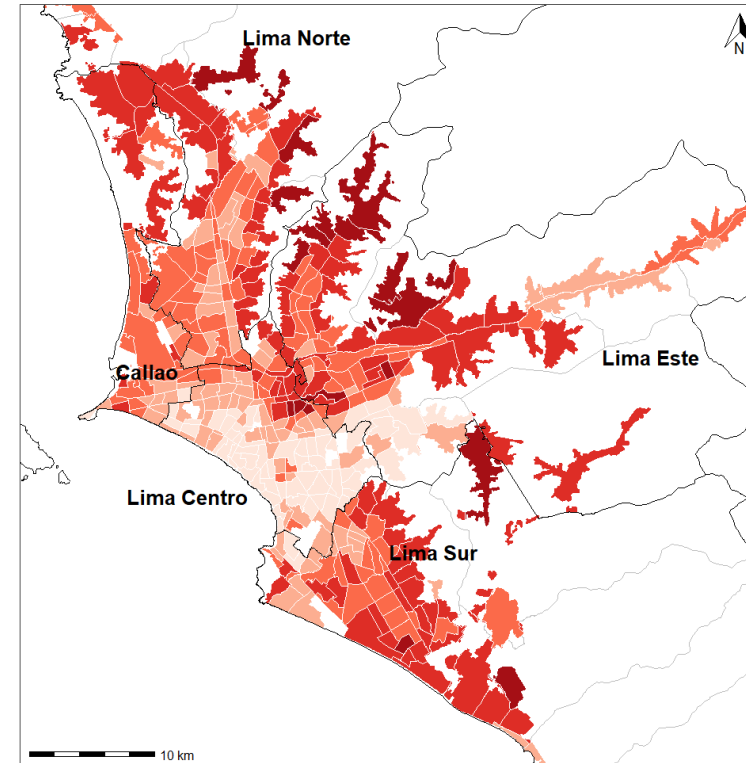


Lima and Bogotá: two segregated cities



% households
ICS 1 and 2

- (1,6,10]
- (10,20]
- (20,30]
- (30,40]
- (40,57.8]

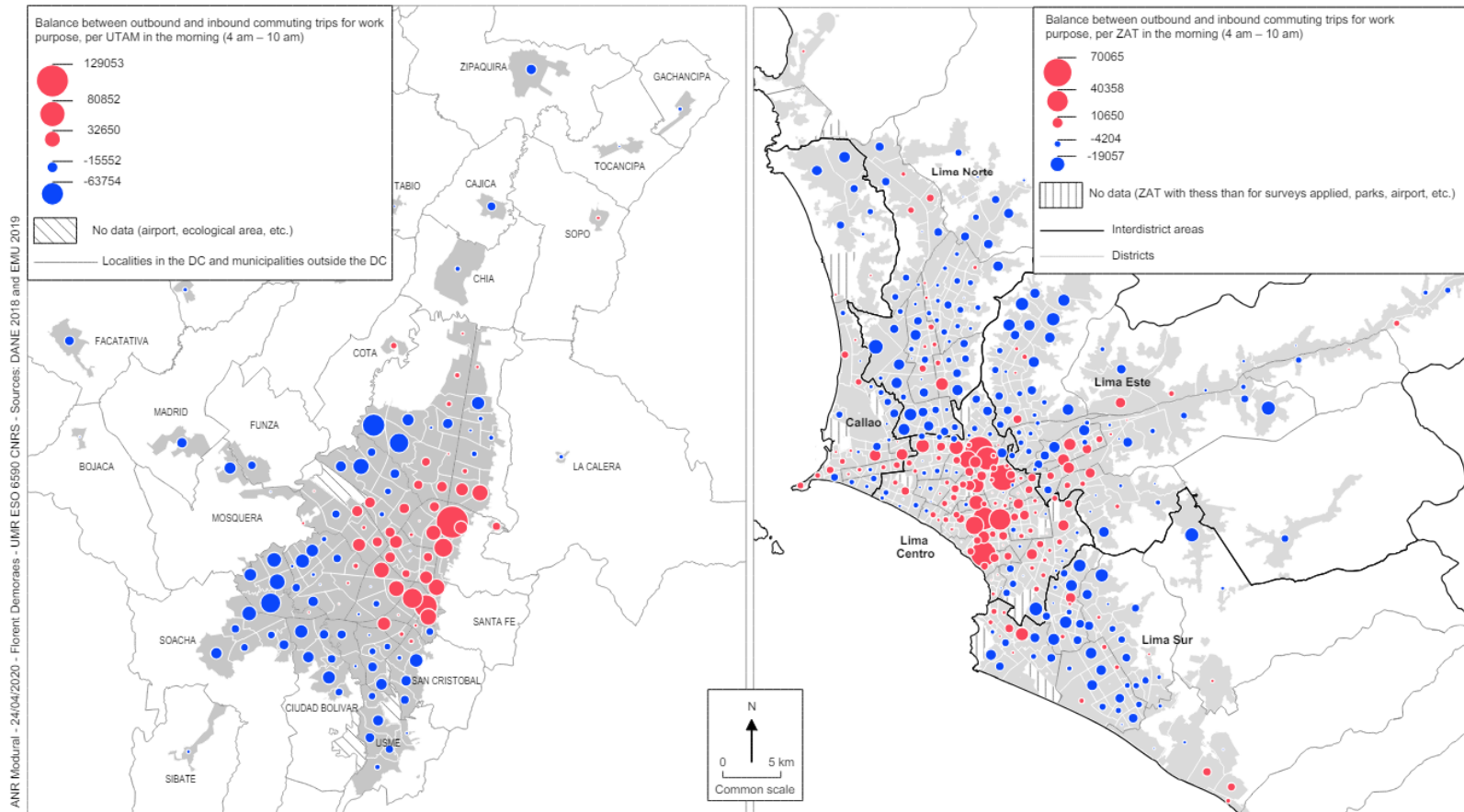


% households
ICS 1 and 2

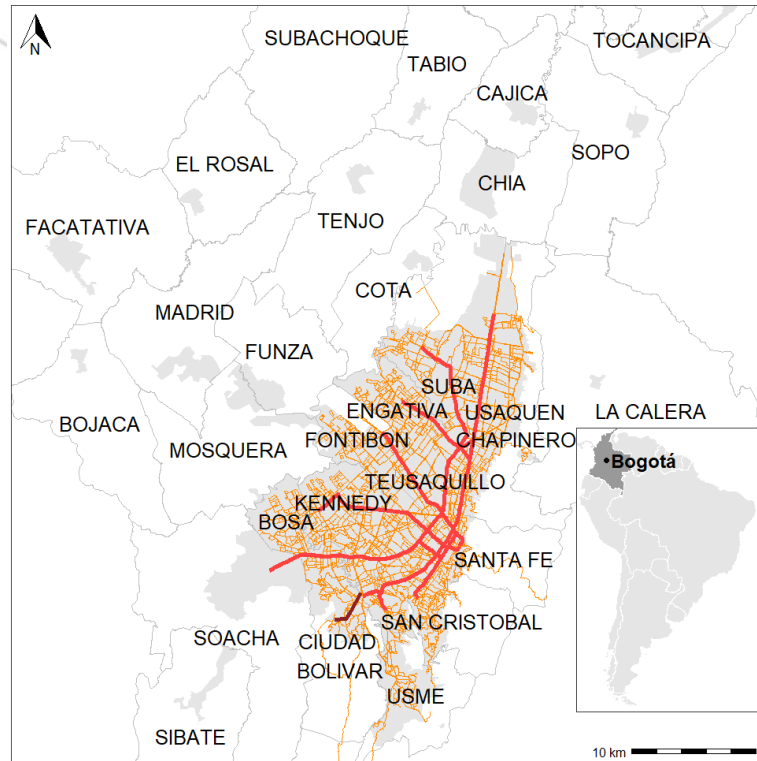
- (0,149,5]
- (5,20]
- (20,30]
- (30,40]
- (40,60]

Maps by authors, census data from DANE, 2018 (Bogotá) and INEI, 2017 (Lima)

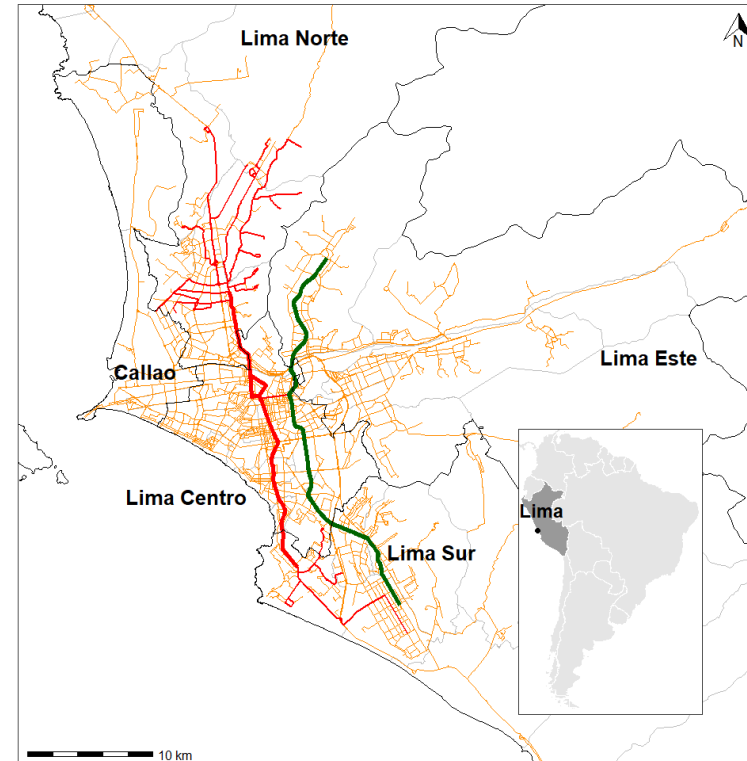
Unbalanced job and population location



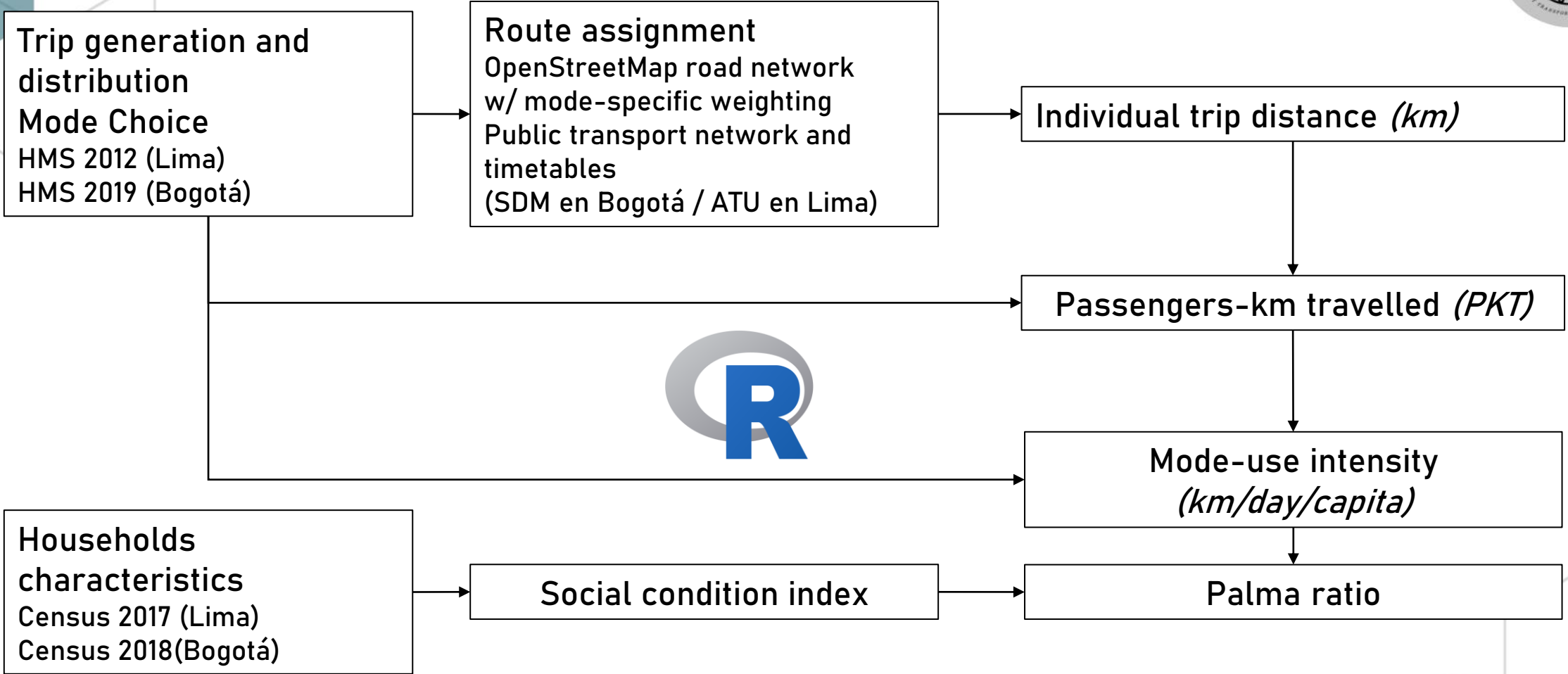
Distinct public transport supply... and policies



Network
- BRT
- Cable car
- Local bus routes



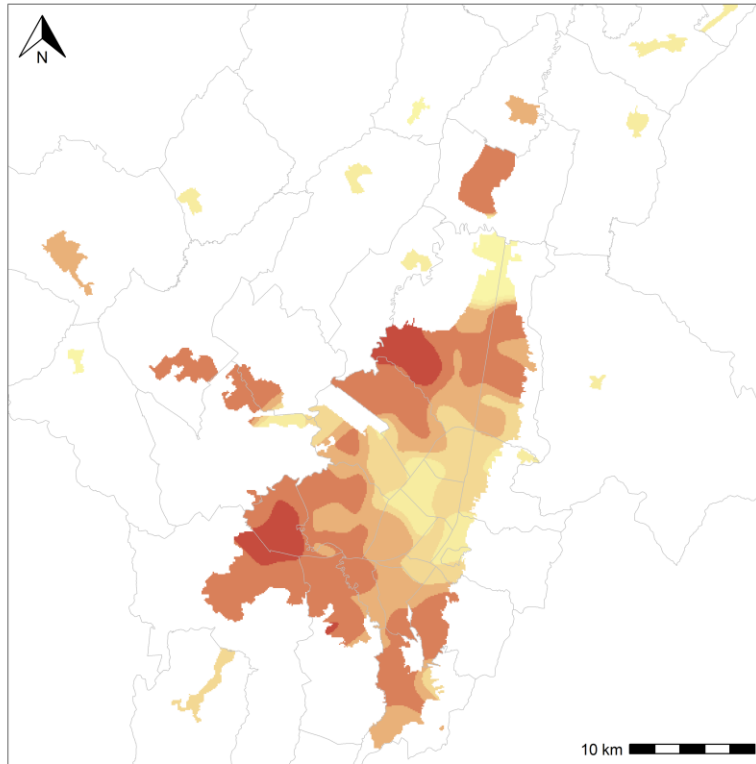
Network
- Rapid transit
- BRT
- Feeder bus
- Regular bus routes



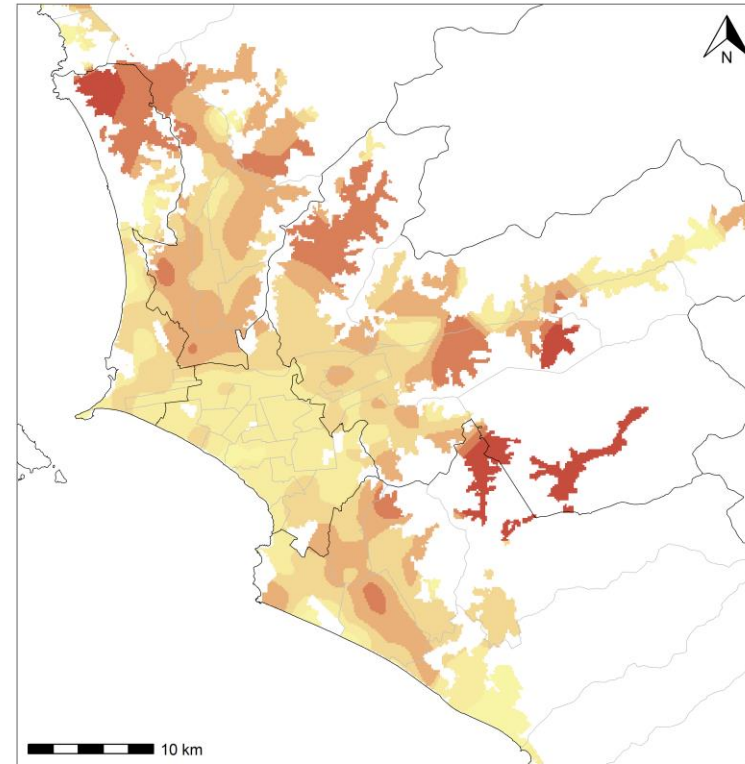
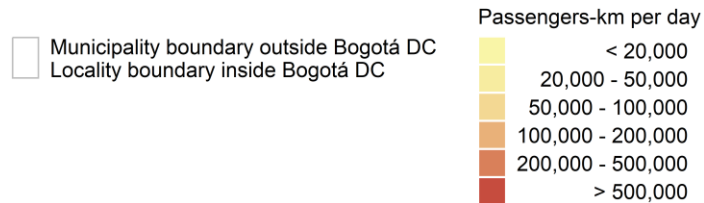
	Bogotá	Lima	Bogotá	Lima	Bogotá	Lima
Main mode	Mode share		Million daily PKT		PKT share (% total PKT)	
	(% N. trips)					
BRT	13.3	2.1	30.1	5.8	27.7	4.4
Bicycle	6.0	0.4	5.3	0.1	4.9	0.1
Motorcycle	4.5	0.3	8.0	0.3	7.4	0.2
Otro	0.9	2.1	1.4	2.4	1.3	1.8
Paratransit	3.5	8.6	4.7	4.3	4.3	3.3
Private car	11.6	8.5	16.0	10.9	14.7	8.3
Rapid transit	-	0.4	-	0.8	0.0	0.6
Regular bus	16.3	58.9	27.3	98.9	25.1	75.7
School bus	2.3	-	2.5	-	2.3	0.0
Taxi	3.6	3.8	4.0	4.2	3.7	3.2
Walking	38.1	15.0	9.5	3.0	8.7	2.3
TOTAL	100	100	108.7	130.7	100	100

Table by authors based
on HMS 2019 and HMS
2012

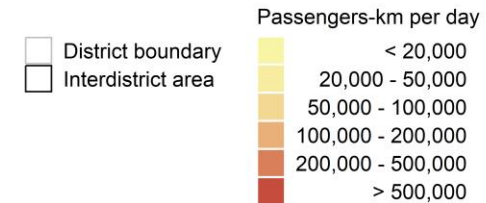
PKT to work
according to
the place of
residence



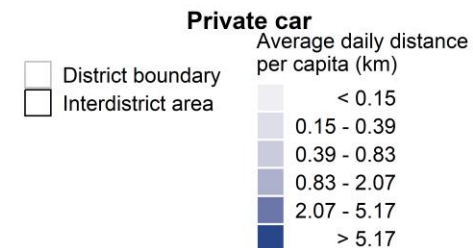
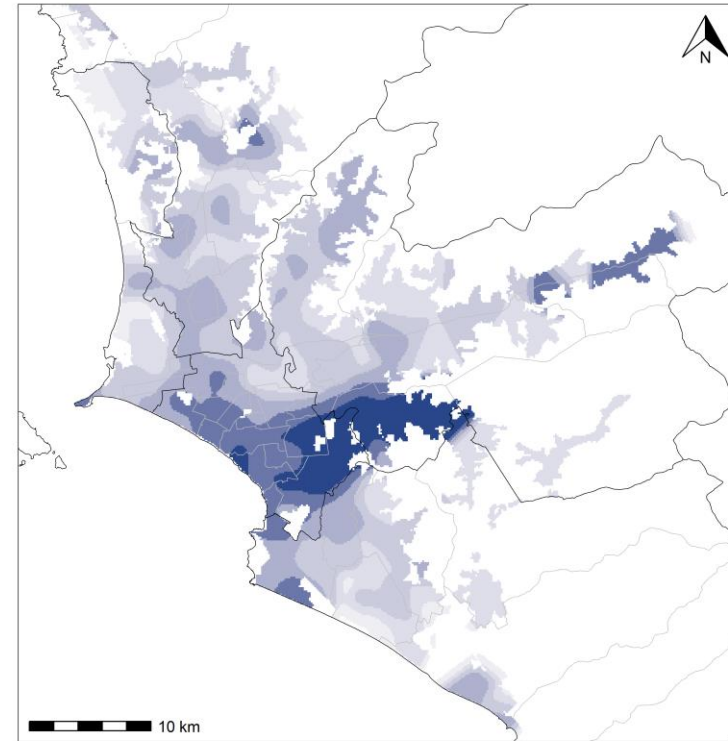
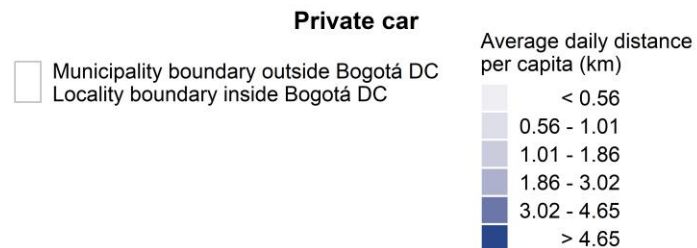
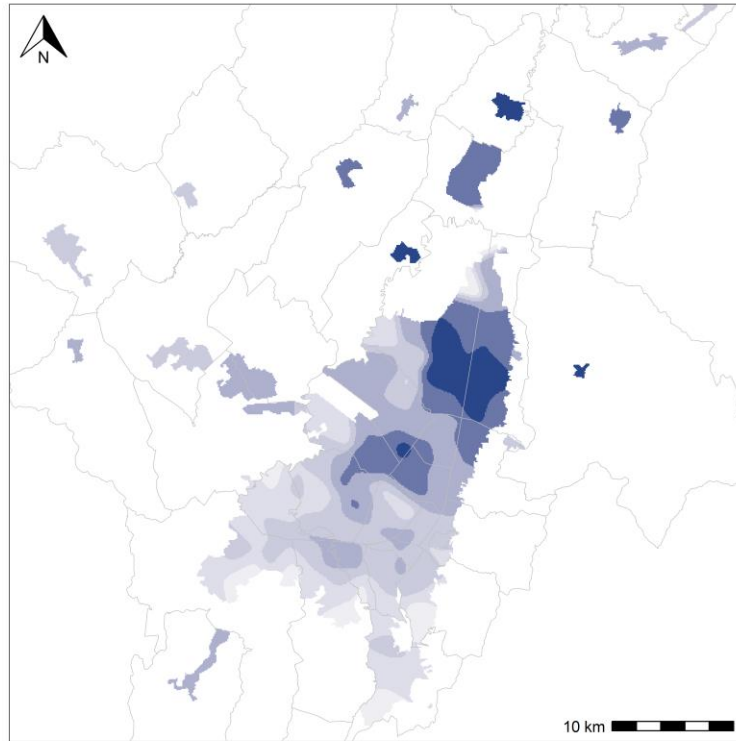
Commuting to work



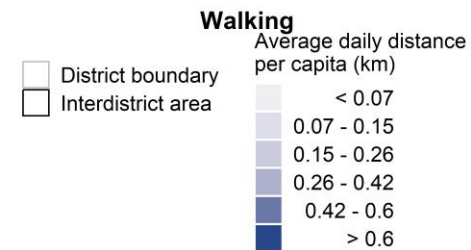
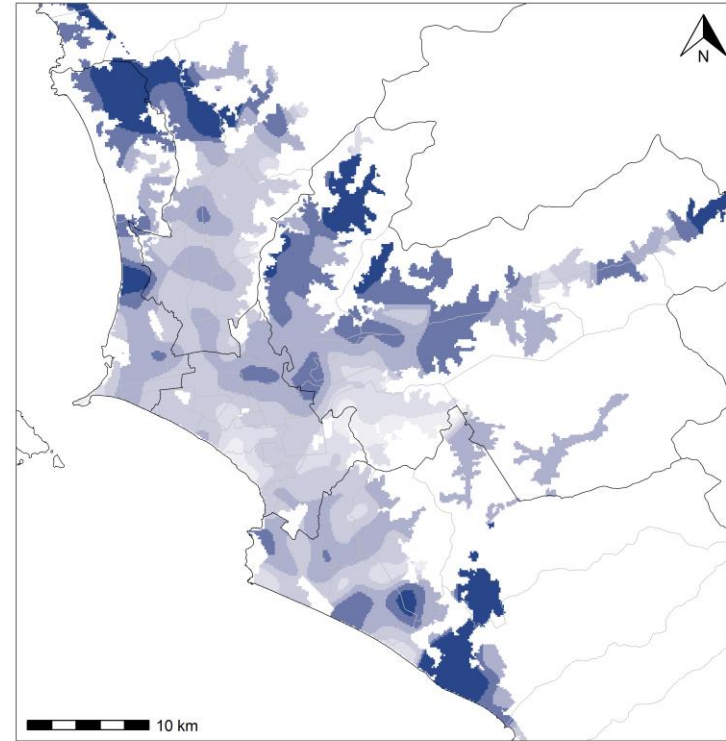
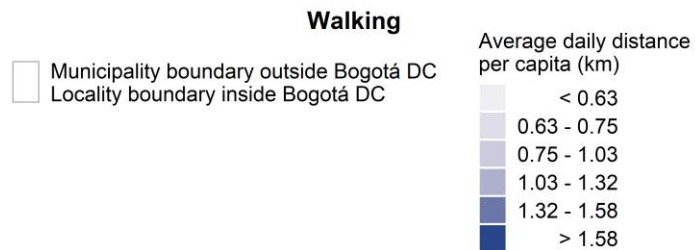
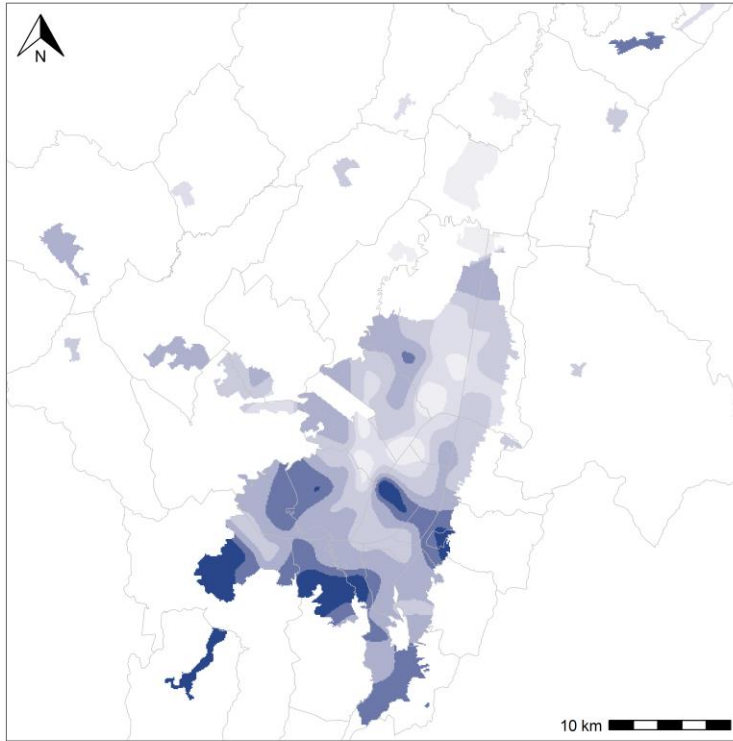
Commuting to work



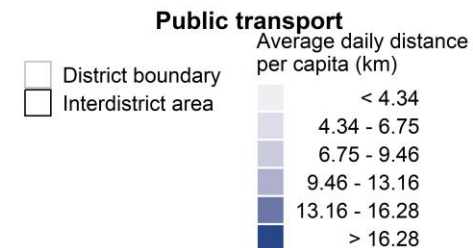
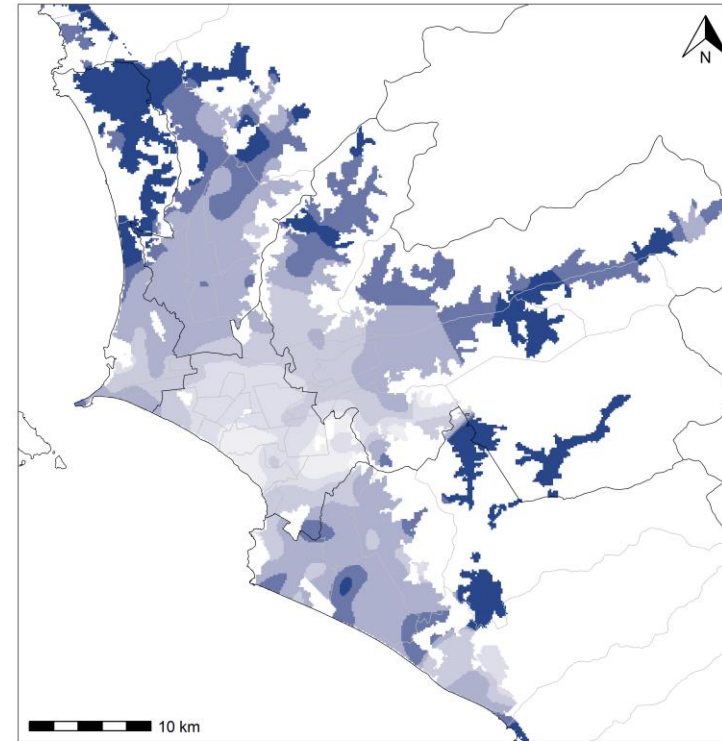
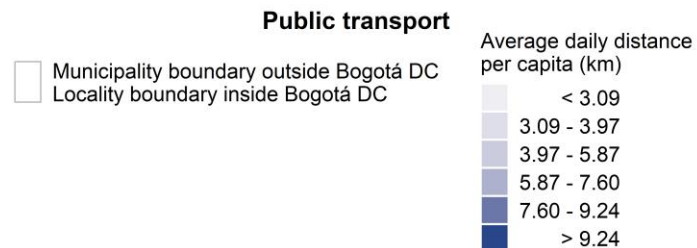
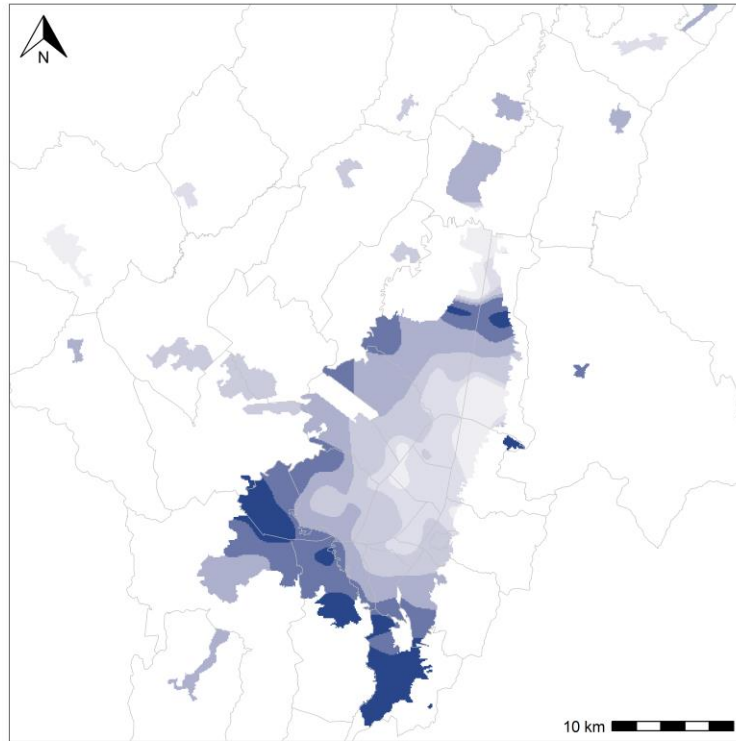
Car-use
intensity
according to
the place of
residence



Walking intensity according to the place of residence



Public transport-
use intensity
according to
the place of
residence



Palma ratios on mode-use intensities

$$\text{Palma Ratio (PKT per capita)} = \frac{(\sum_{\text{wealthiest 10\%}} \text{PKT per capita} \cdot \text{Pop}) \cdot (\sum_{\text{poorest 40\%}} \text{Pop})}{(\sum_{\text{wealthiest 10\%}} \text{Pop}) \cdot (\sum_{\text{poorest 40\%}} \text{PKT per capita} \cdot \text{Pop})}$$

Bogotá

Lima

	Average (PKT/capita)	Palma ratio	Average (PKT/capita)	Palma ratio
Car-use intensity	1.8	9.64	1.2	3.34
Walking intensity	1.1	0.65	0.3	0.42
Public transport-use intensity	6.3	0.37	10.1	0.44

Limitations of the study

Routing using shortest path

Main mode assignment for intermodal trips

Mobility survey availability and oldness

Conclusions

Different modes attend different people with different needs.

The private car is the most socially-selective mode.

Modal share must be used together with mode-use intensities to understand individual mobility patterns.



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Thank you for your attention

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Paper # **095**

Annex

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Social condition index

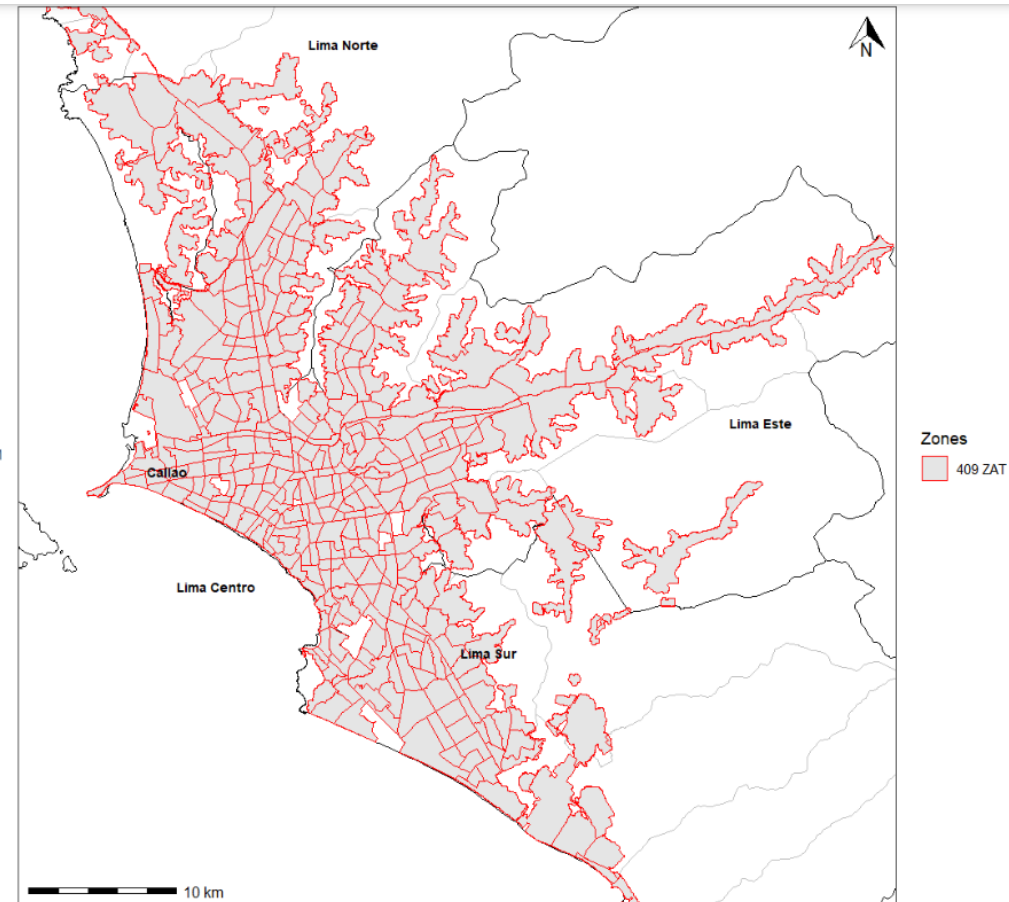
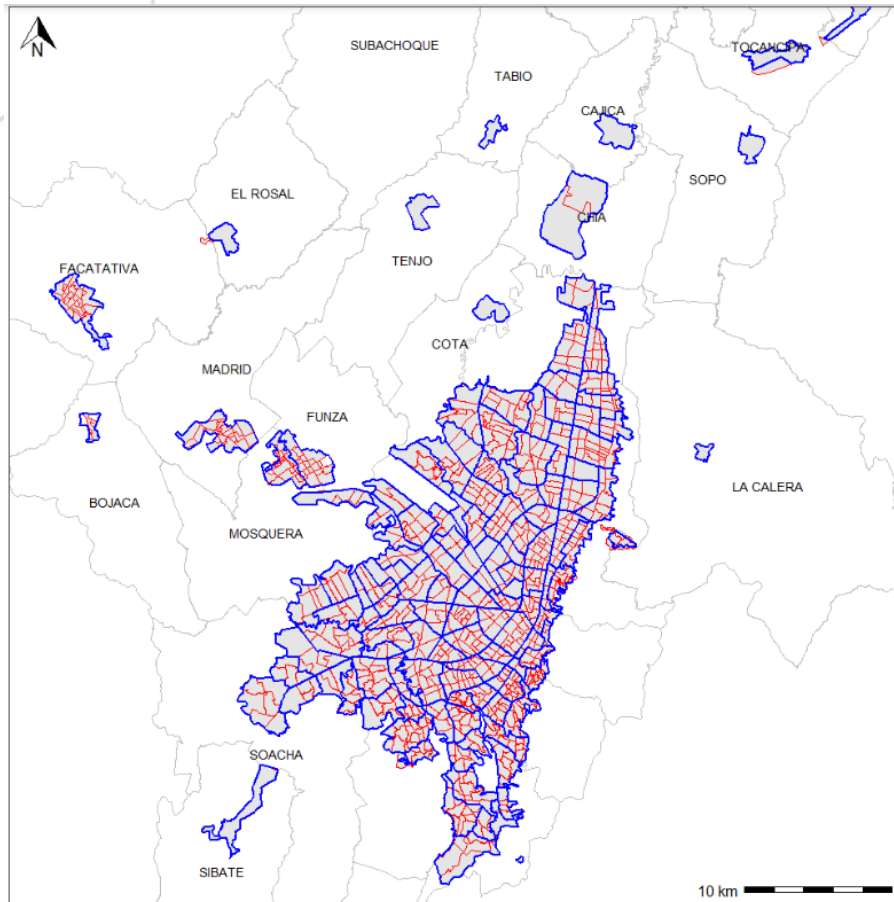
To compare the socioeconomic strata between both cities, a Social Condition Index (ICS) was calculated for each household using the census microdata and binned into 6 categories reflecting the social hierarchy.

The unique ICS formula is, therefore, the following:

$$\text{ICS} = \frac{\text{Educational climate (average years of education of people aged 15 and over in the household)} \times \text{Number of rooms in the dwelling}}{\text{Number of members in the household}}$$

Each household is assigned an ICS category based on its ICS score. The 10% households with lowest ICS were assigned ICS 1, and the following 15%, 25%, 25%, 15% and 10% respectively ICS 2 to ICS 6.

Zoning for origins and destinations

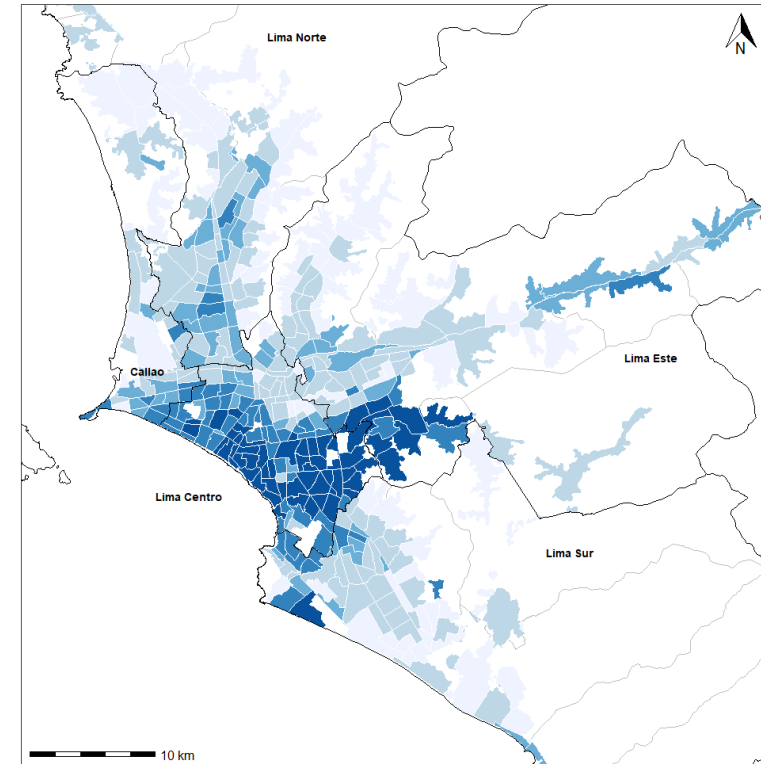
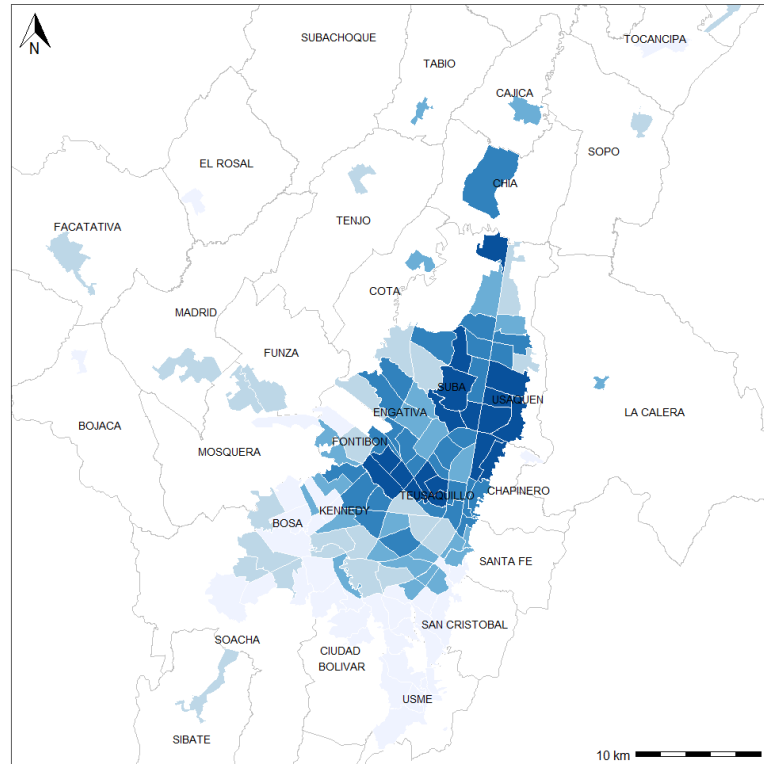


Average trip distances

Table 4 - Average network-based distance per trip per mode. Table by authors based on HMS 2019 and HMS 2012.

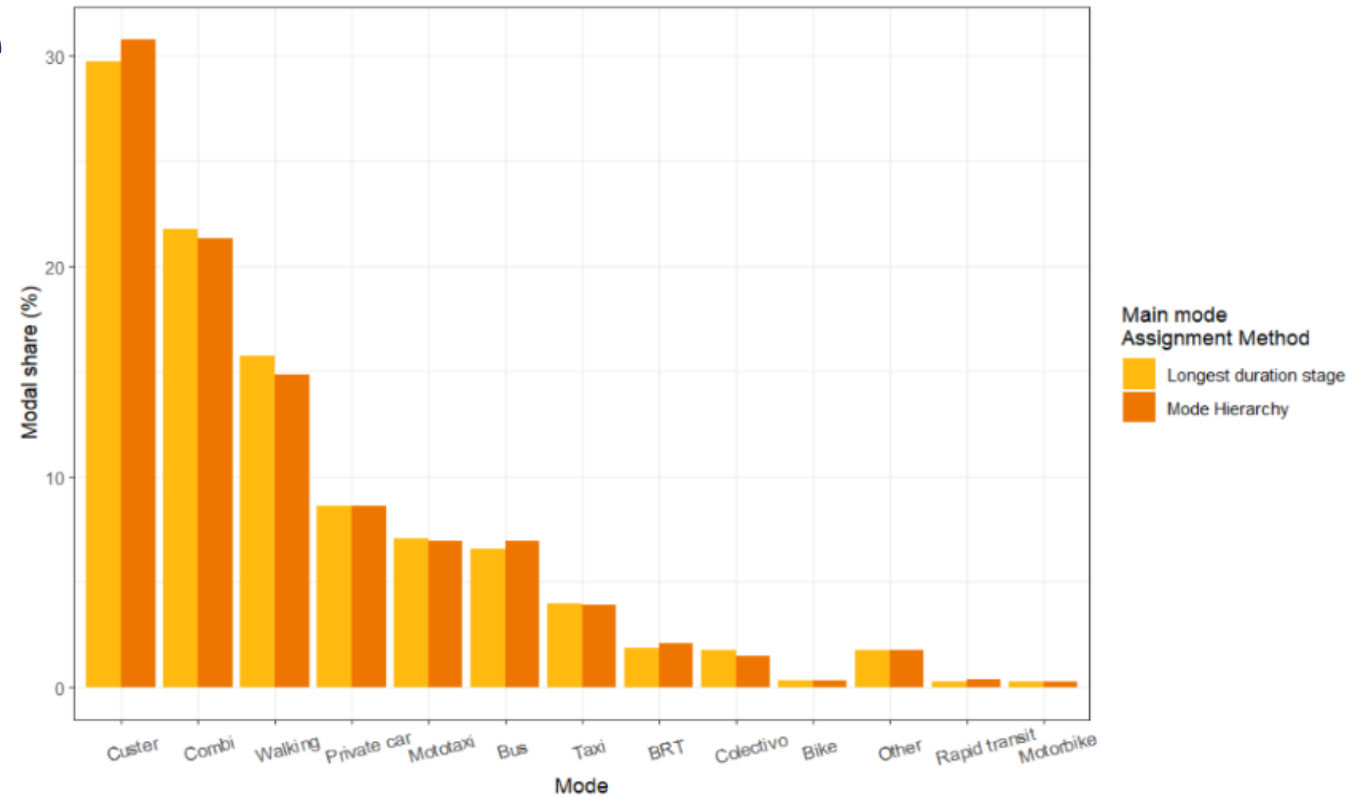
	Bogotá	Lima
Main mode	Average distance per trip (km)	
BRT	13.4	17.0
Bike	5.2	2.3
Motorbike	10.5	6.4
Other	9.3	6.9
Paratransit	7.8	3.0
Private car	8.2	7.8
Rapid transit	-	12.9
Regular bus	9.9	10.2
School bus	6.6	-
Taxi	6.5	6.6
Walking	1.5	1.2
AVERAGE	6.4	7.9

Lima and Bogotá: two segregated cities



Maps by authors, census data from DANE, 2018 (Bogotá) and INEI, 2017 (Lima)

Main mode



Hierarchy: Rapid transit > Bus rapid transit > Regular bus > Taxi > Private car > Moto > Bike > Walking

Figure A5. Two ways of assigning the main mode in Lima mobility survey. Chart by authors based on HMS 2012.