

# A MOBILIDADE E AS CIDADES: DESAFIOS E OPORTUNIDADES PARA QUE SE TORNEM INTELIGENTES



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Aula INPE 2024



centro de estudos da metrópole









Foto: TETO



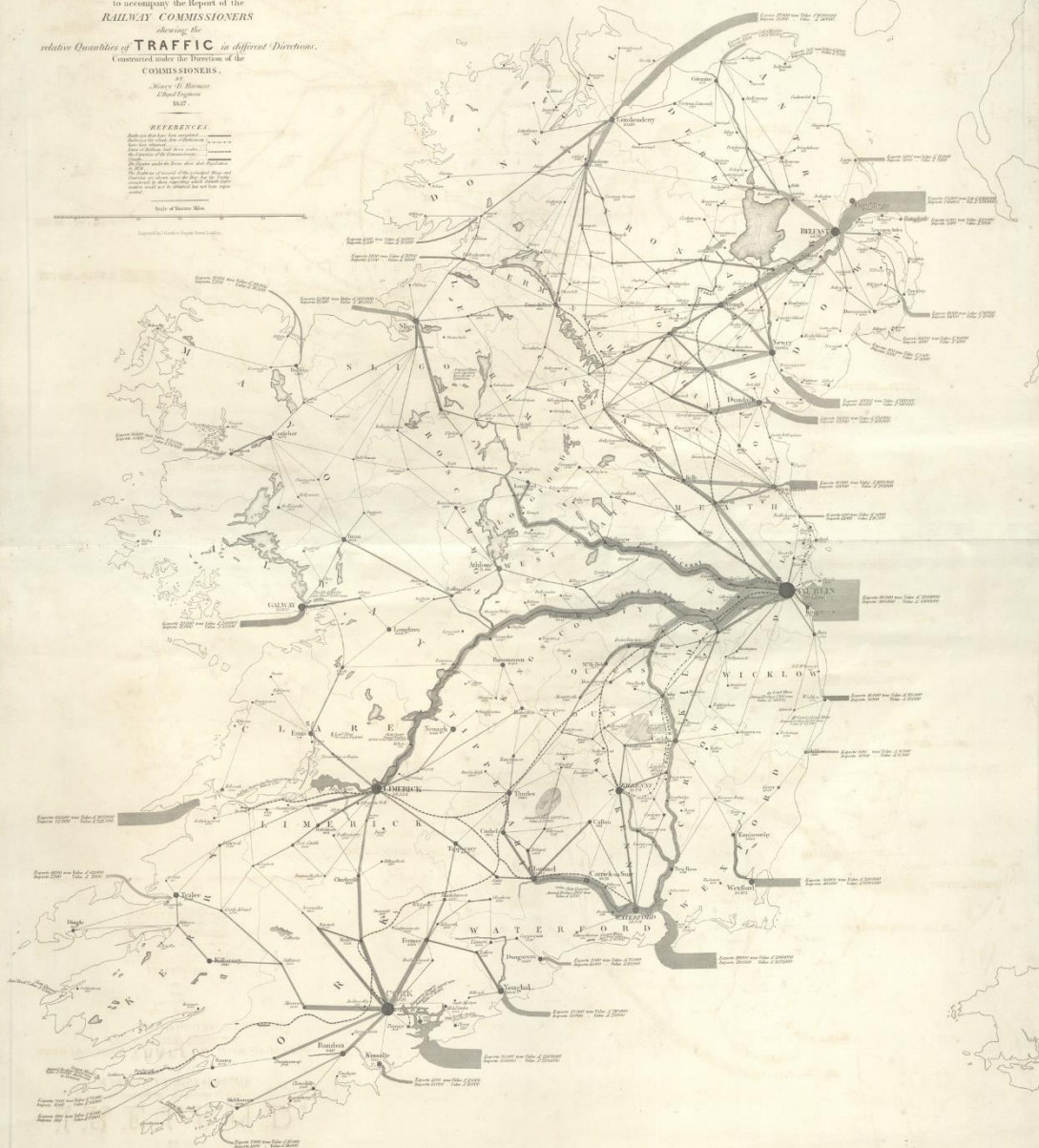
ATLAS  
TO ACCOMPANY 2<sup>d</sup> REPORT  
OF THE  
RAILWAY COMMISSIONERS  
IRELAND  
1858

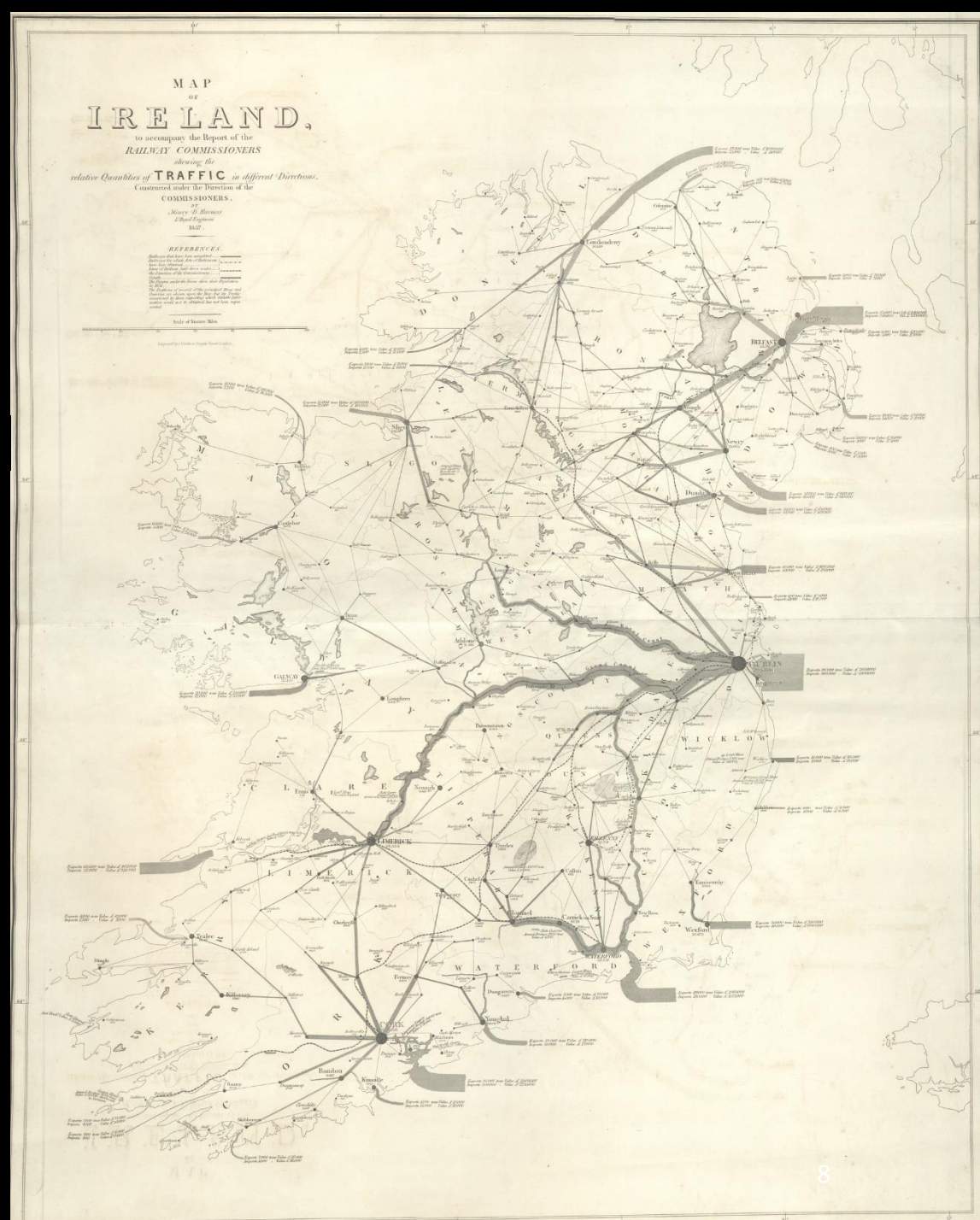
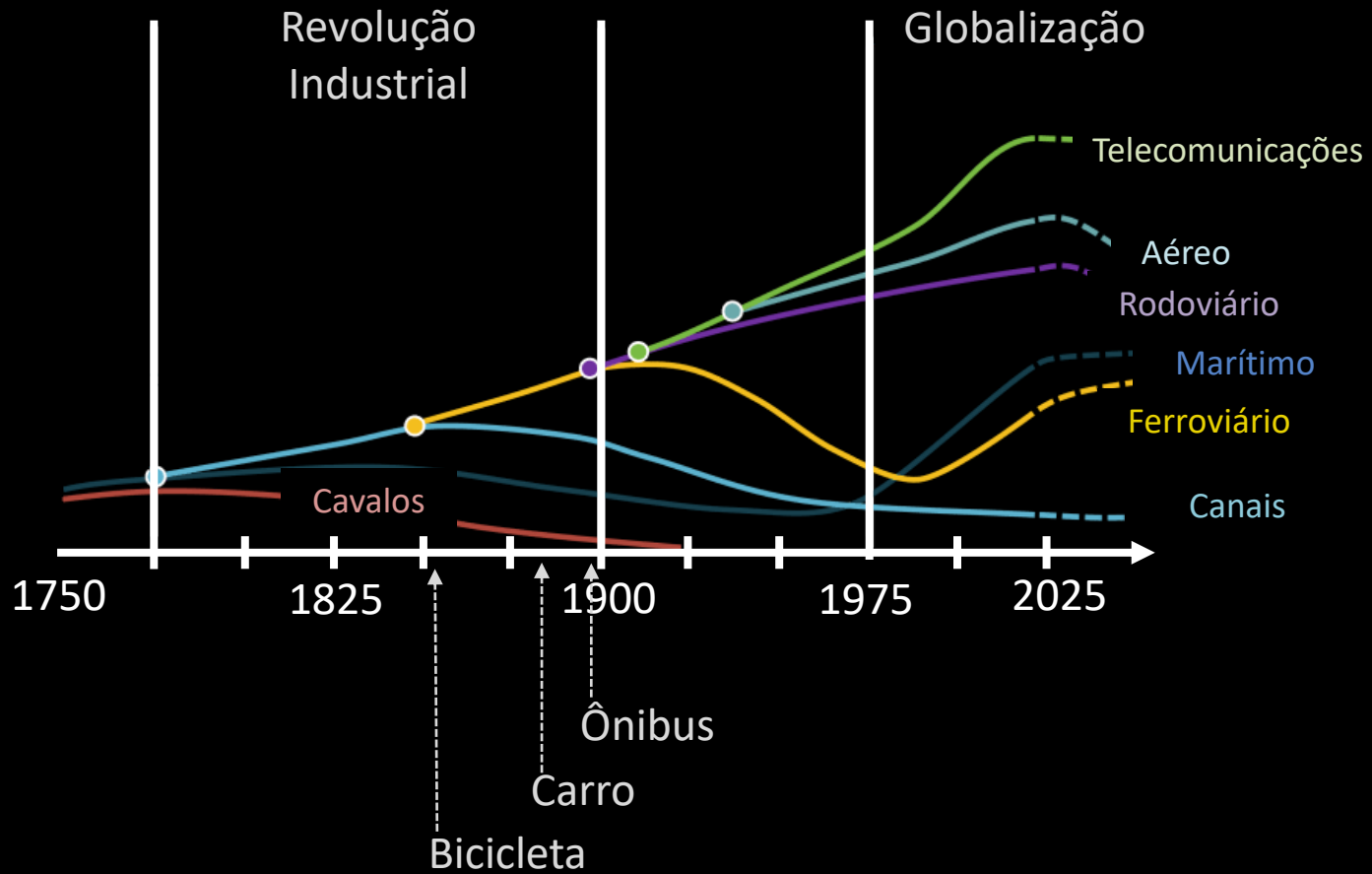
MAP  
OF  
IRELAND,

to accompany the Report of the  
RAILWAY COMMISSIONERS  
showing the  
relative Quantities of TRAFFIC in different Directions,  
Contracted under the Direction of the  
COMMISSIONERS.

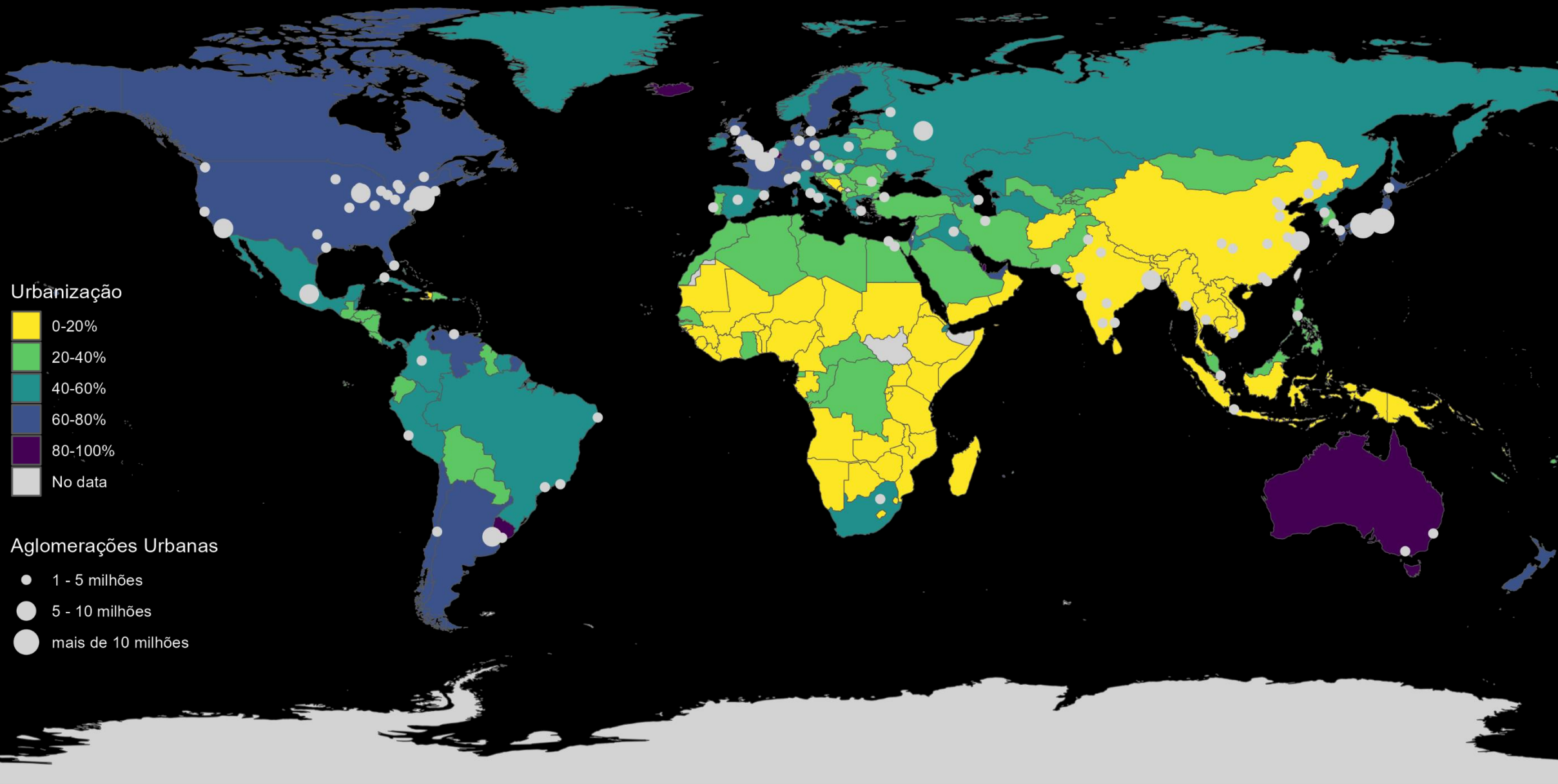
REFERENCES

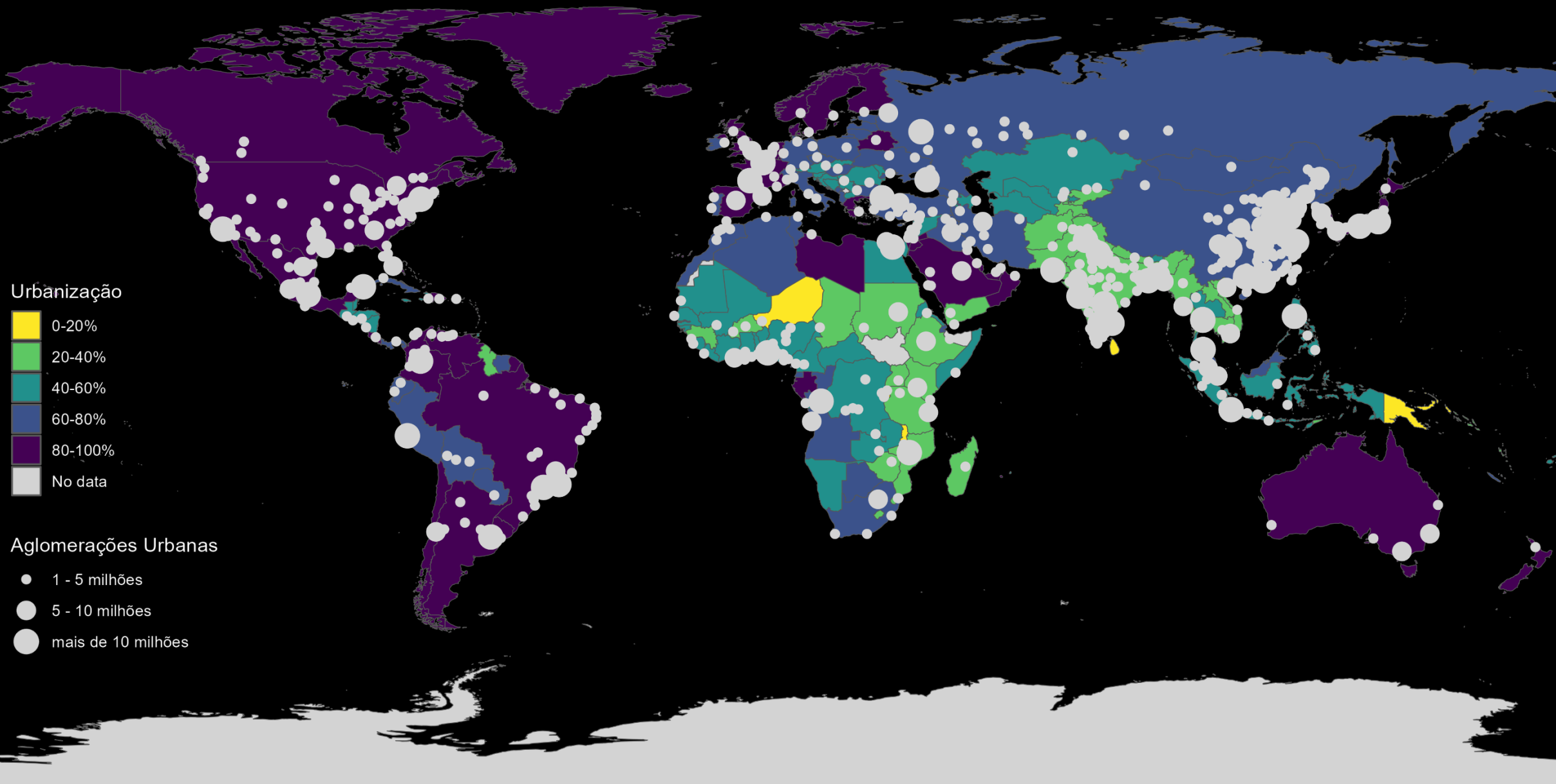
Scale of Statute Miles  
Scale of Railway Miles



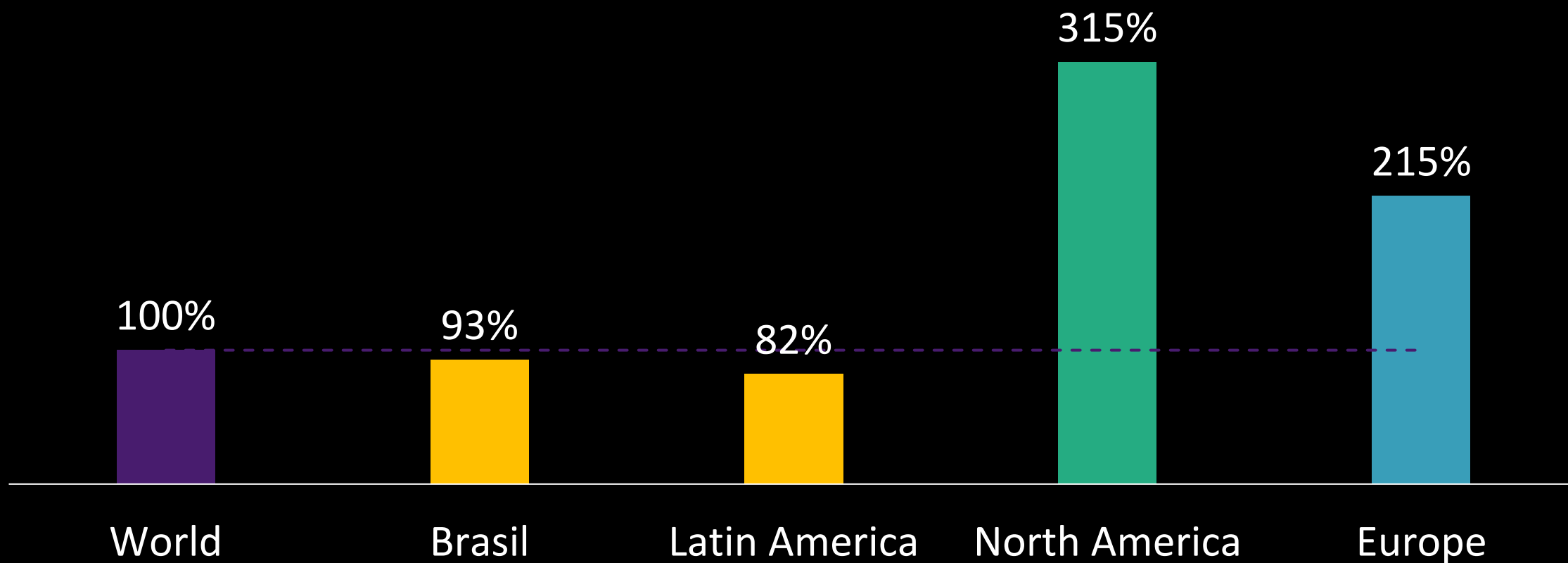




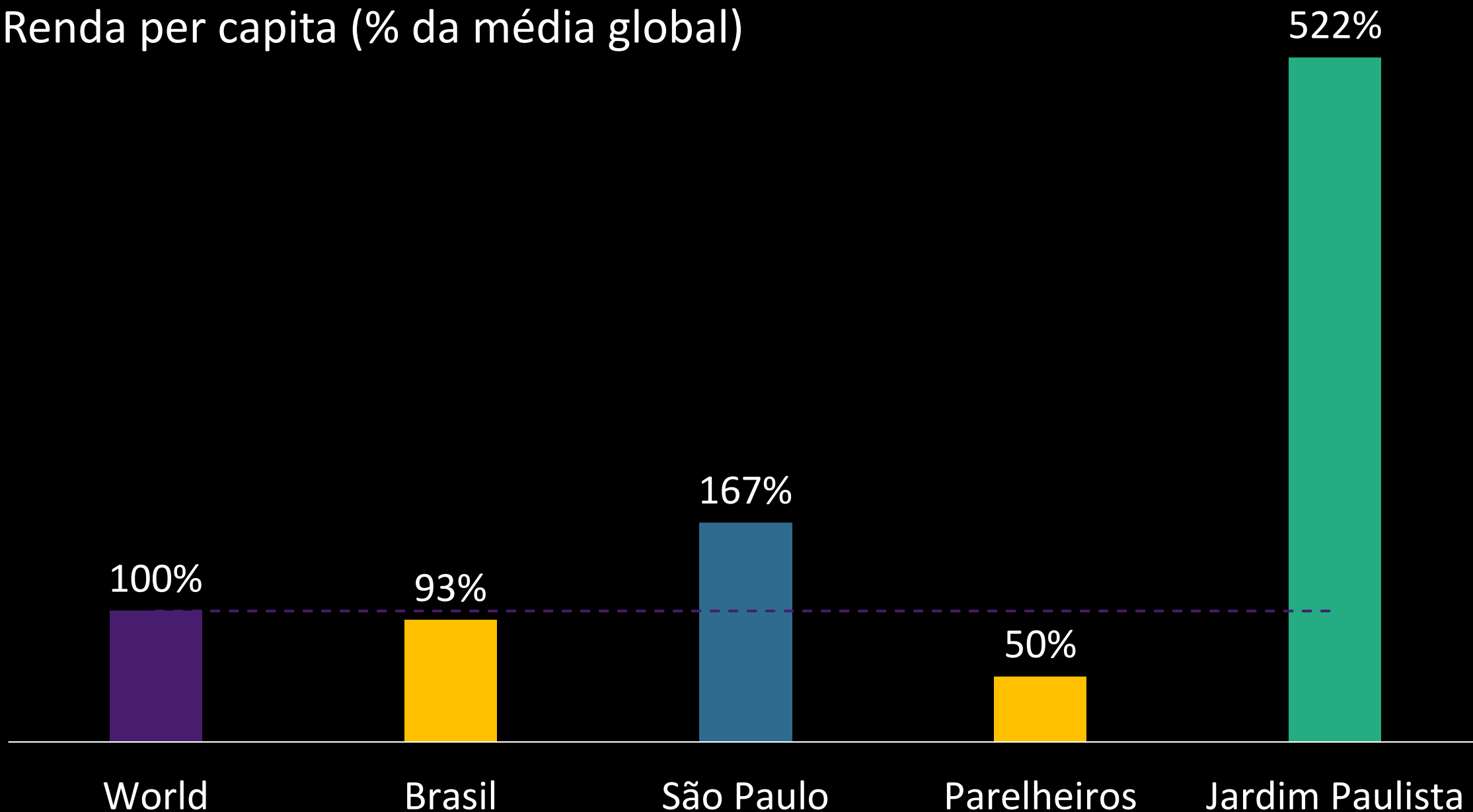




## Renda per capita (% da média global)



# Renda per capita (% da média global)



“A **smart city** is a place where traditional **networks and services** are made **more efficient** with the use of digital and telecommunication **technologies** for the **benefit of its inhabitants** and **business**”

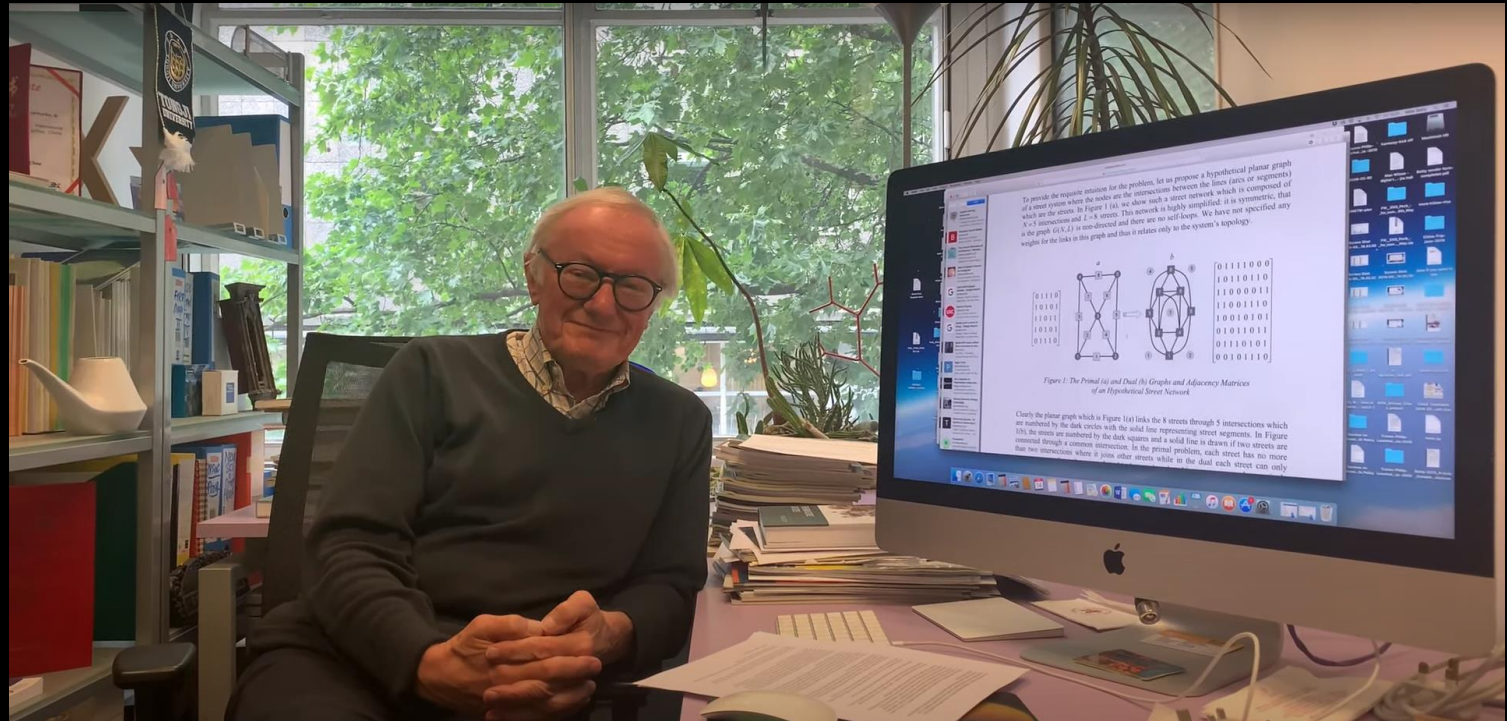
**European Commission**

**“Smart mobility is one of the main pillars** that characterizes **smart cities** and maintains their **sustainability** as a way to deal with continuously growing world urbanization and its expected impacts on public health, congestion and accelerated global climate change”

**IEEE SM**

“The nature of smart cities lies in the very technology that defines it”

Michael Batty (2018)

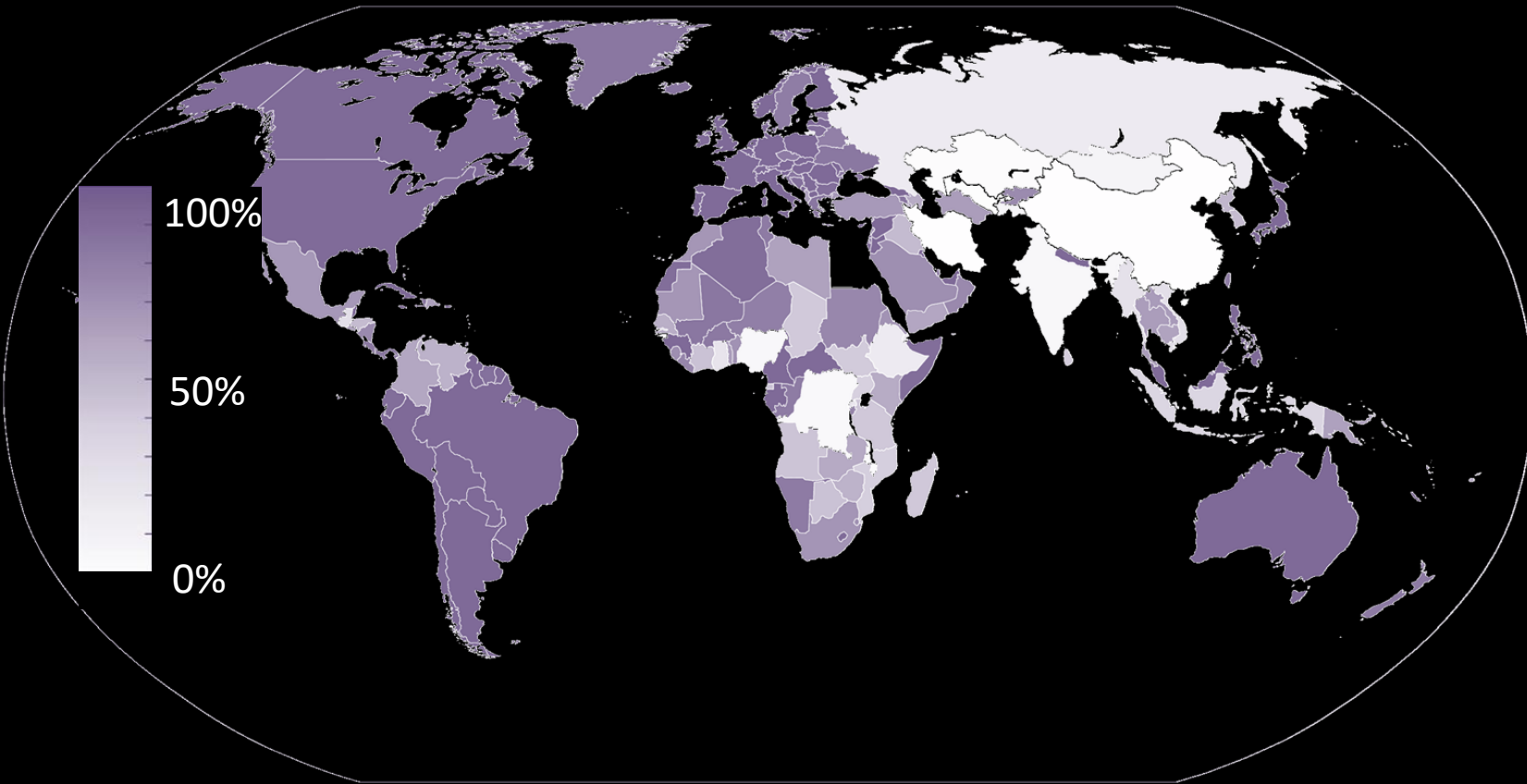


Michael Batty

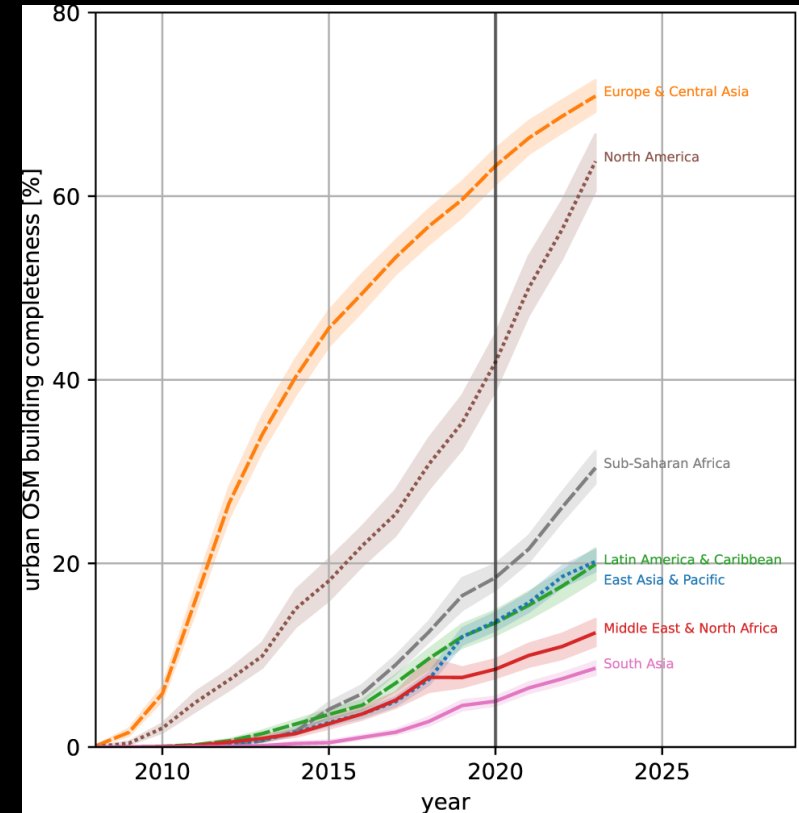
Center for Advanced Spatial Analysis  
University College London



Citações 54586  
Índice h 117  
Índice i10 436



Barrington-Leigh, C., & Millard-Ball, A. (2019). The world's user-generated road map is more than 80% complete. *Plos one*, 14(10), e0224742.



Herfort, B., Lautenbach, S., Porto de Albuquerque, J., Anderson, J., & Zipf, A. (2023). A spatio-temporal analysis investigating completeness and inequalities of global urban building data in OpenStreetMap. *Nature Communications*, 14(1), 3985.





## Mapear a cidade: dados para soluções em engenharia dos problemas urbanos

- ✓ Mobilidade
- ✓ Infraestrutura viária
- ✓ Acesso à cidade

Subsidiar a formulação, o monitoramento e a avaliação de políticas e práticas urbanas

Transporte público (redes metroferroviária e ônibus)

Transporte ativo (redes cicloviária e pedonal)

Habitação de interesse social

Visão estratégica

Pesquisa

Extensão



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- ✓ Transporte ativo (redes cicloviária e pedonal)
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### Visão estratégica

Pesquisa

Ensino

Extensão



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- ✓ Transporte ativo (redes cicloviária e pedonal)
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## Visão estratégica

- ✓ Pesquisa
- ✓ Extensão



## Mapear a cidade: dados para soluções em engenharia dos problemas urbanos

### ✓ Mobilidade

Infraestrutura viária

Acesso a cidade

Subsidiar a formulação, o monitoramento e a avaliação de políticas e práticas urbanas

Transporte público (redes metroferroviária e ônibus)

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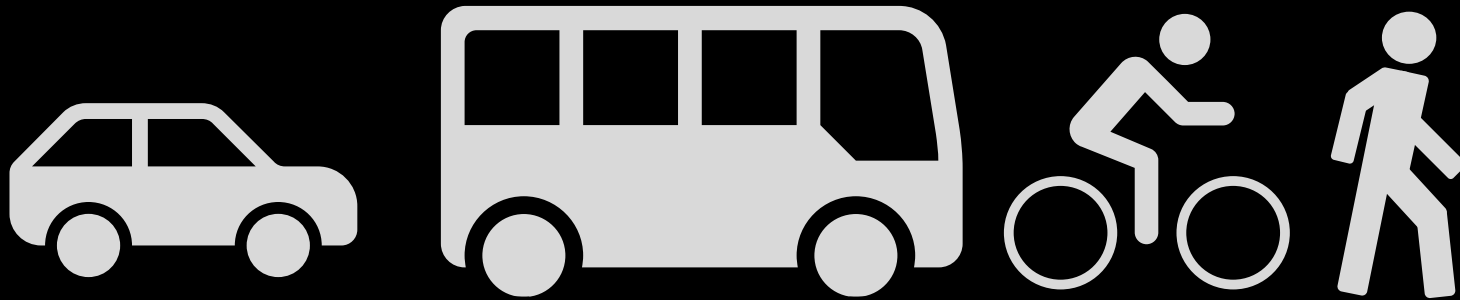
Habitação de interesse social

Visão estratégica

Pesquisa

Extensão

# Mapear a mobilidade urbana



# It starts with a single app

Combining old and new ways of getting around will transform transport—and cities, too



# MOBILE PHONE APP

## PARAISÓPOLIS MOBILITY DIAGNOSIS PROJECT

Providing more equitable and sustainable transport options for vulnerable populations



WORLD BANK GROUP



World Bank

BRAZEEC Project - Component 2: ICT Solutions for Equitable and Sustainable Transport

Journal of Choice Modelling 39 (2021) 100287

Contents lists available at ScienceDirect

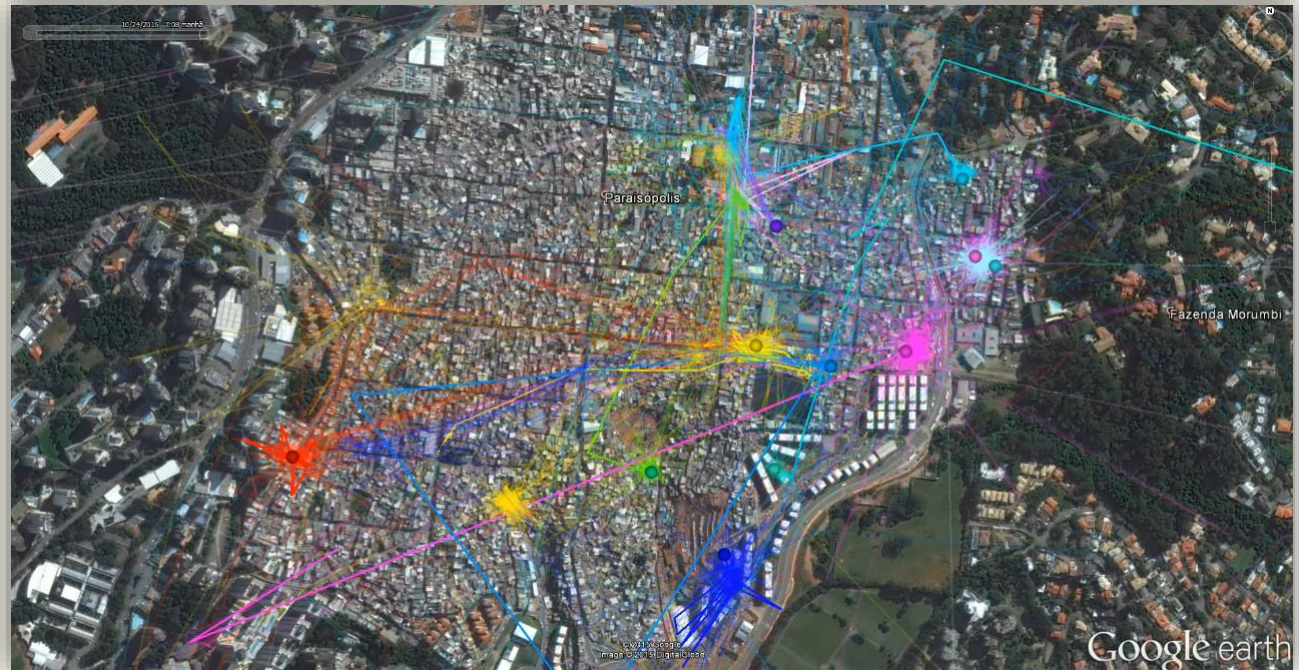
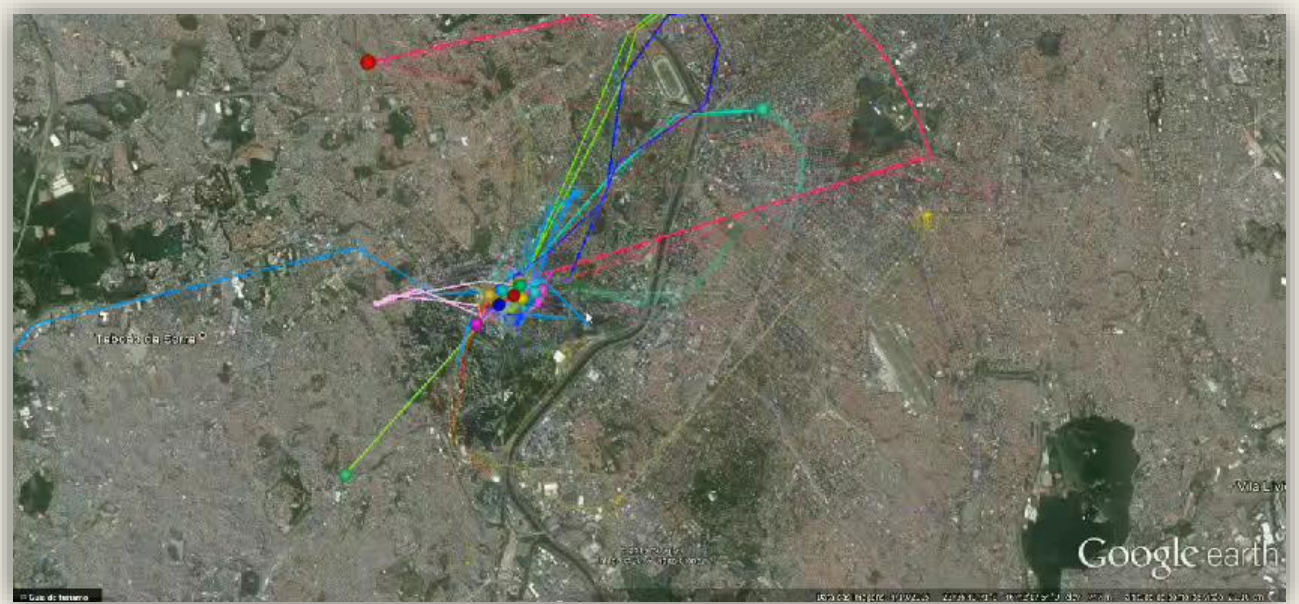
Journal of Choice Modelling

journal homepage: <http://www.elsevier.com/locate/jocm>



Activity behavior of residents of Paraisópolis slum: Analysis of multiday activity patterns using data collected with smartphones

Bruna Pizzol<sup>a,\*</sup>, Orlando Strambi<sup>a</sup>, Mariana Giannotti<sup>a,b</sup>, Renato Oliveira Arbex<sup>a</sup>, Bianca Bianchi Alves<sup>c</sup>



PIZZOL, B., STRAMBI, O , GIANNOTTI, M., ARBEX, R., ALVES, B. Activity behavior of residents of Paraisopolis slum Analysis of multiday. *Choice Modeling.* , 2021.

# BIG DATA SMART CARD

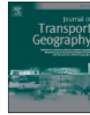
Integração com dados de GPS dos ônibus, enriquecimento semântico, machine learning, 77 dias, 9,5 milhões de cartões, 803 milhões de transações



Contents lists available at ScienceDirect

Journal of Transport Geography

journal homepage: [www.elsevier.com/locate/jtrangeo](http://www.elsevier.com/locate/jtrangeo)



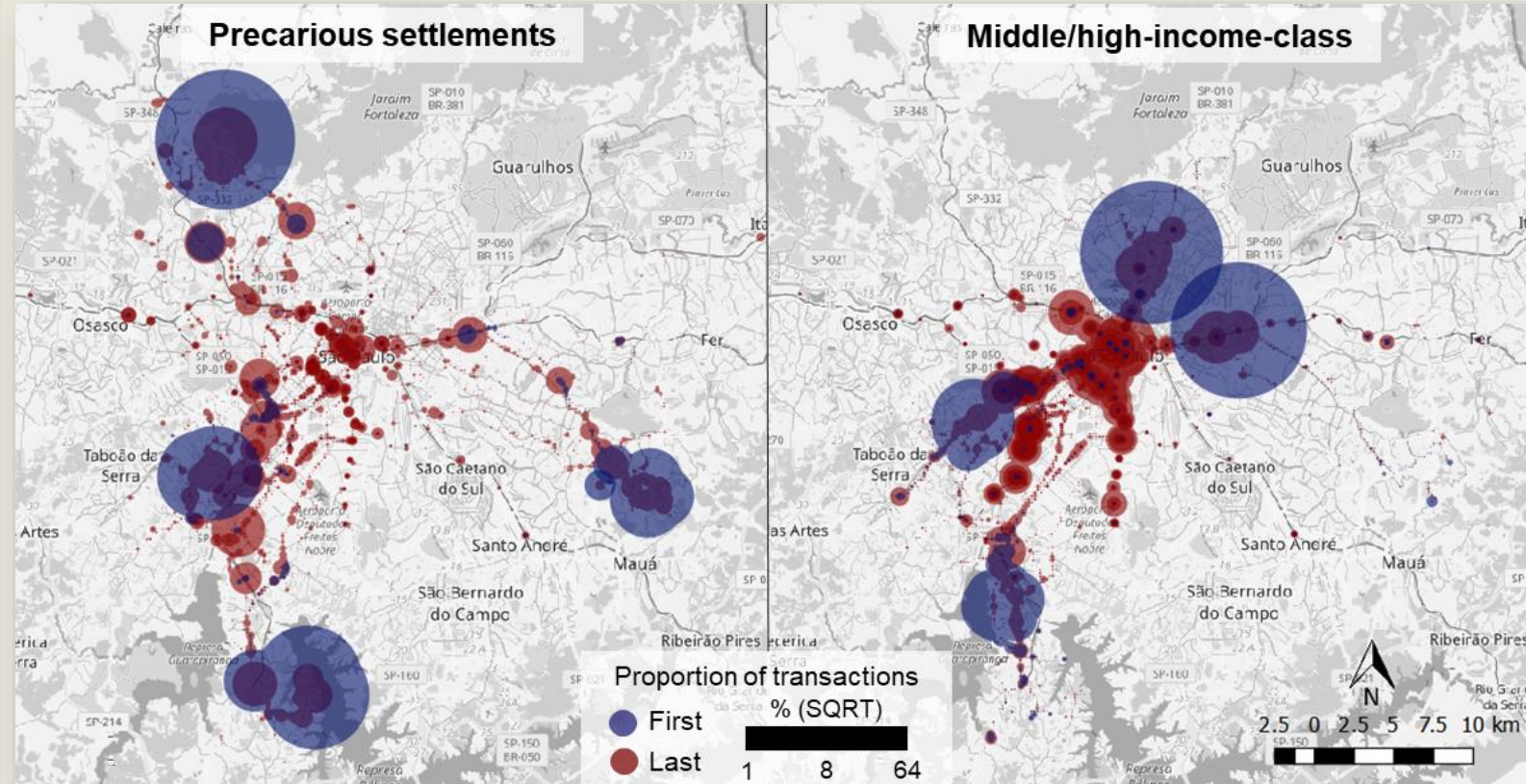
Big data for big issues: Revealing travel patterns of low-income population based on smart card data mining in a global south unequal city

Caio Pieroni<sup>a,\*</sup>, Mariana Giannotti<sup>a,b</sup>, Bianca B. Alves<sup>c</sup>, Renato Arbex<sup>d</sup>

<sup>a</sup> Department of Transport Engineering, Polytechnic School at University of São Paulo, São Paulo 05508-070, SP, Brazil  
<sup>b</sup> Center for Metropolitan Studies and Laboratory for Geospatial Analysis at Polytechnic School at University of São Paulo, São Paulo 05508-070, SP, Brazil

## 5h - 7h

## 7h - 9h



PIERONI, C.; GIANNOTTI, M.; ALVES, B. B.; ARBEX, R. Big data for big issues: Revealing travel patterns of low-income population based on smart card data mining in a global south unequal city. *Journal of Transport Geography*, v.96, p.103203, 2021.





# Smart Card

## Temporal Pattern and Variability



1. Start hour of travel;
2. Start hour of travel dispersion;



3. Weekly travel frequency;
4. Weekly travel frequency dispersion;

## Spatial Pattern and Variability

5. Daily distance;
6. Daily distance dispersion;



## Activity Pattern and Variability



7. Daily activity duration;
8. Daily activity duration dispersion;

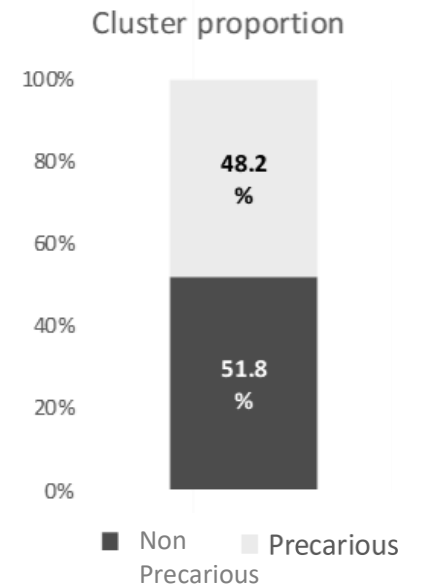
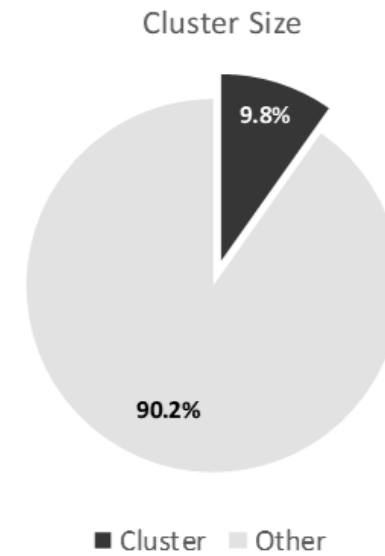
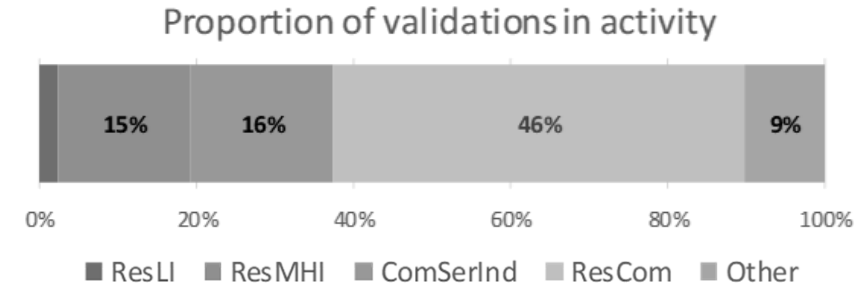
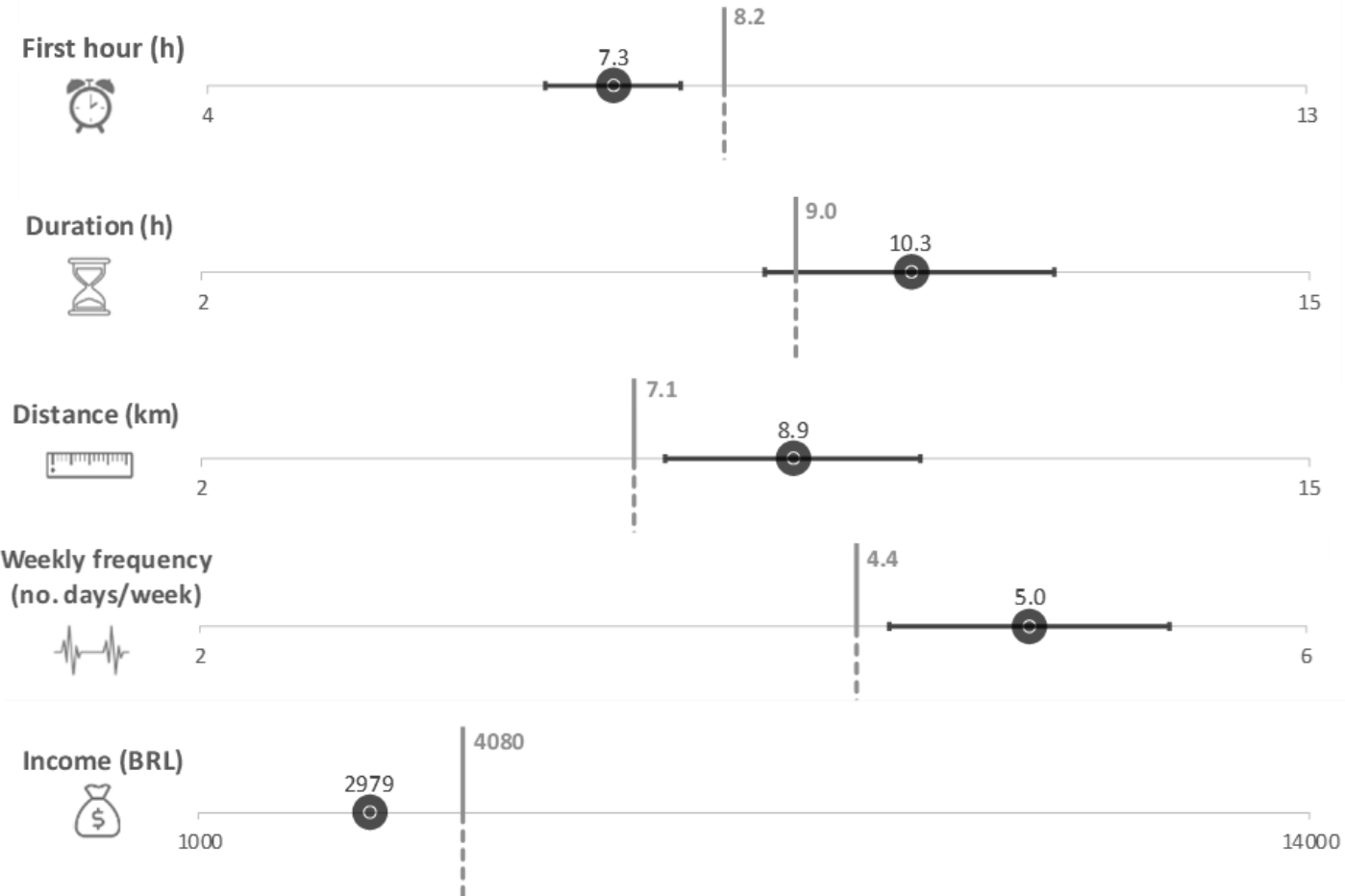
## Socioeconomic Characteristic



9. User's household income;

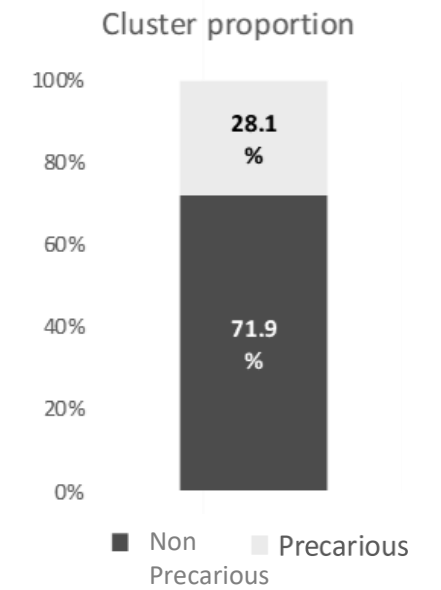
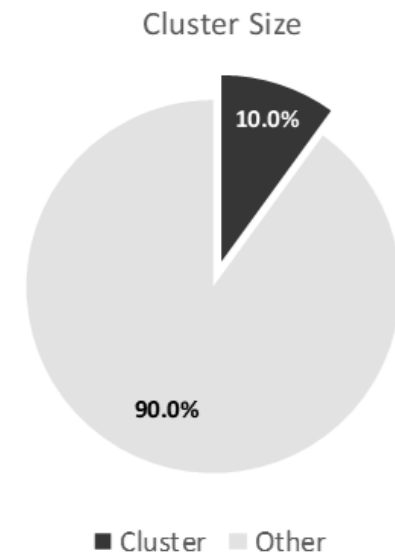
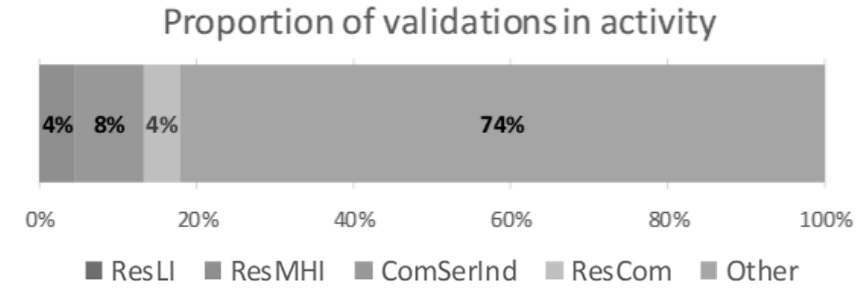
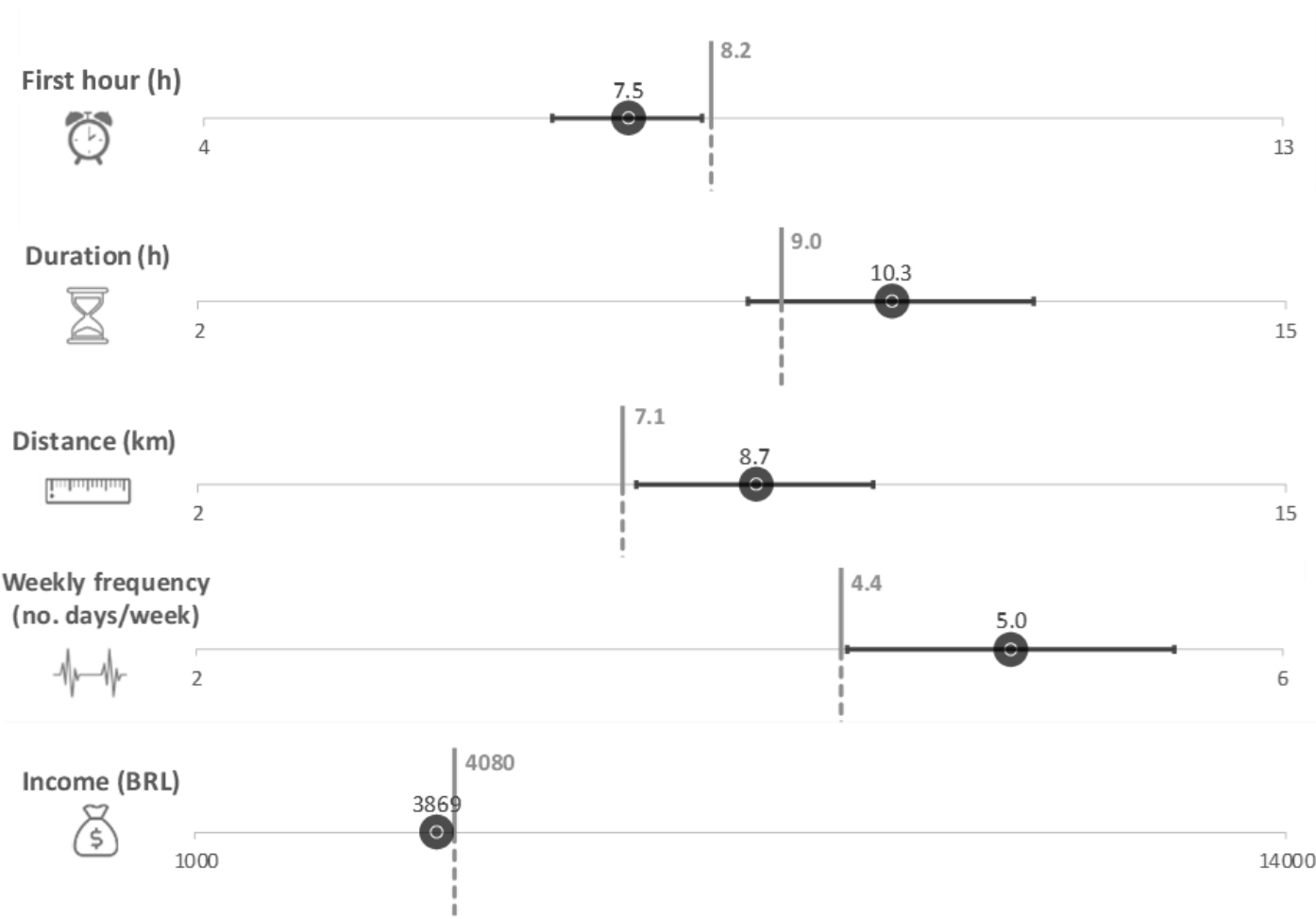


## Cluster 1



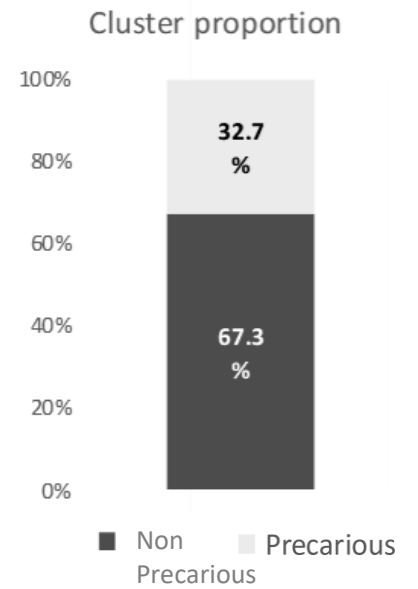
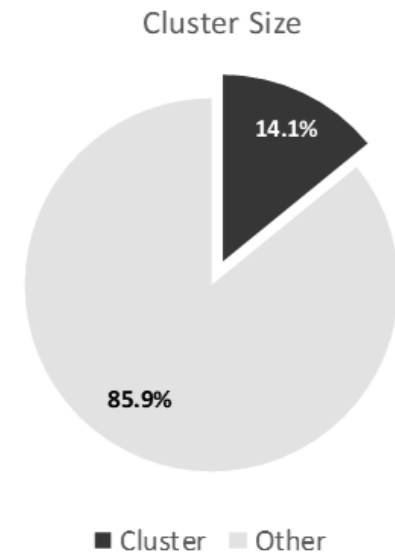
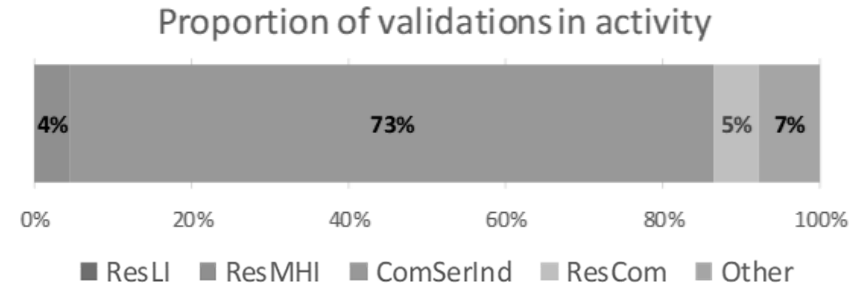
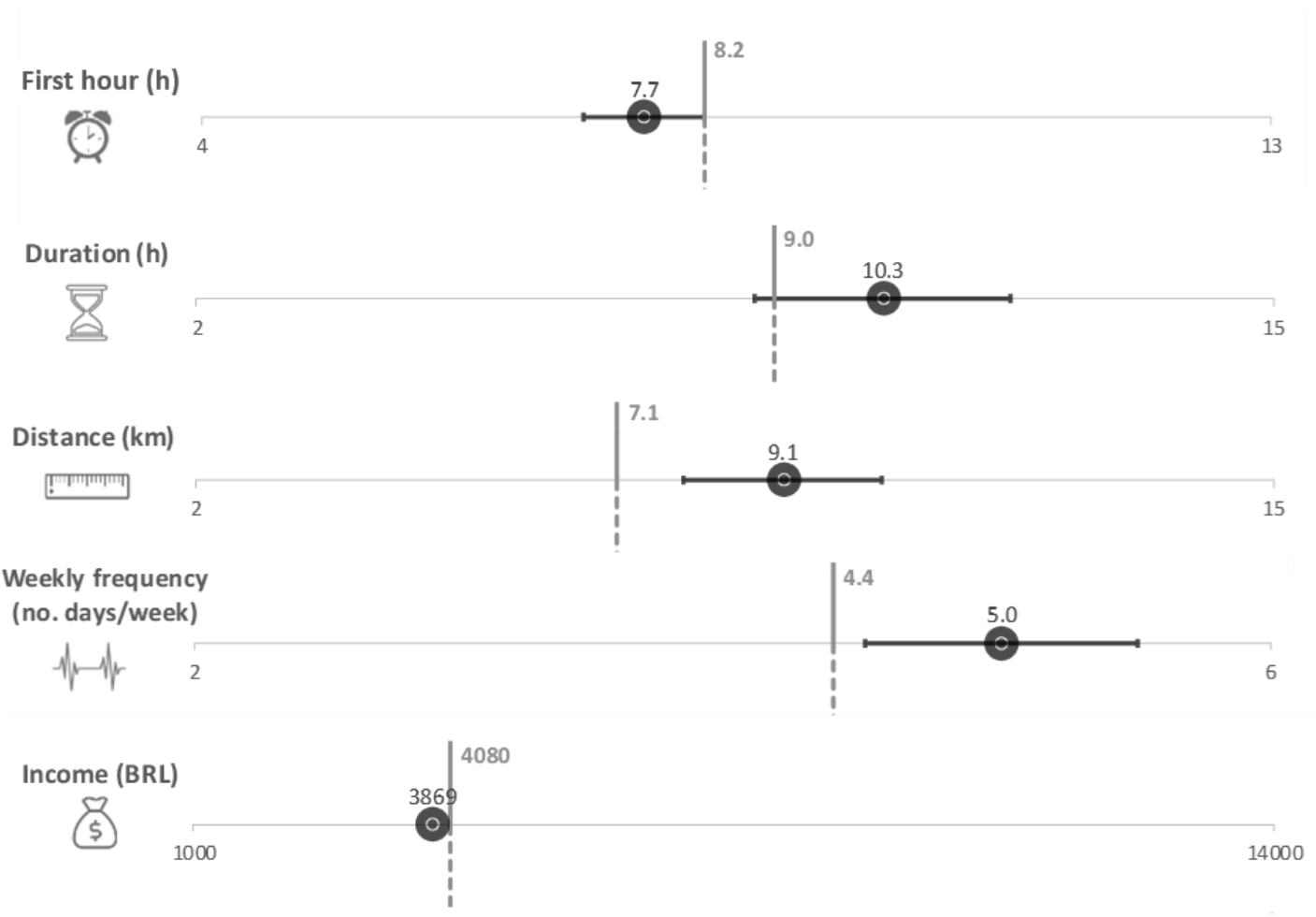


### Cluster 3



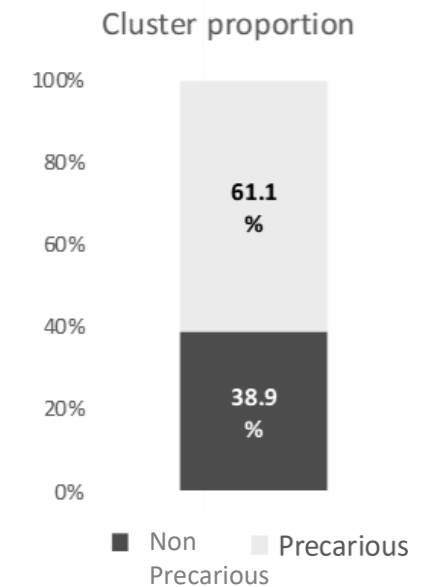
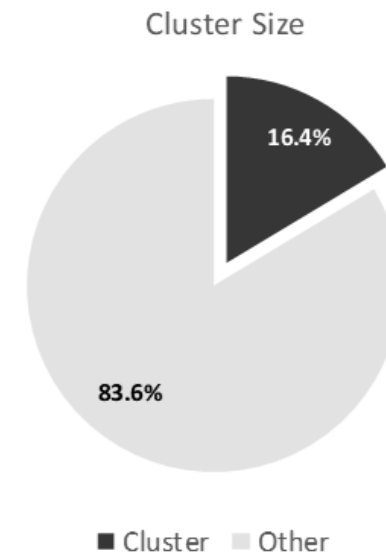
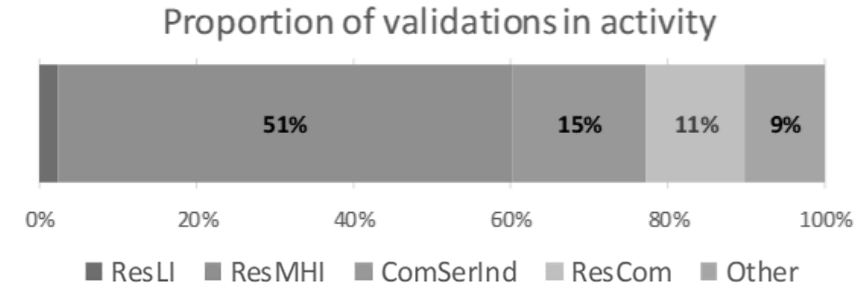
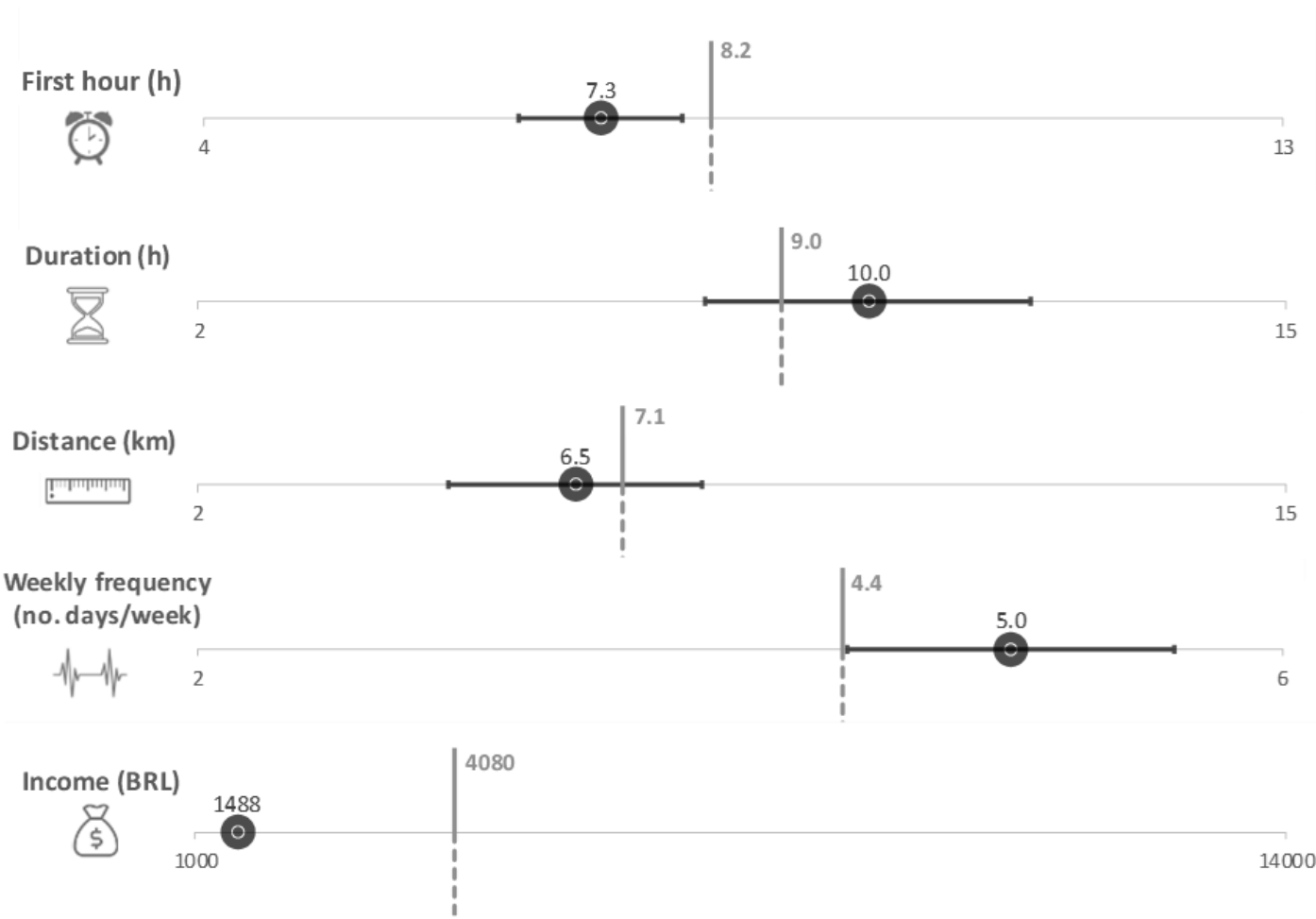


# Cluster 5



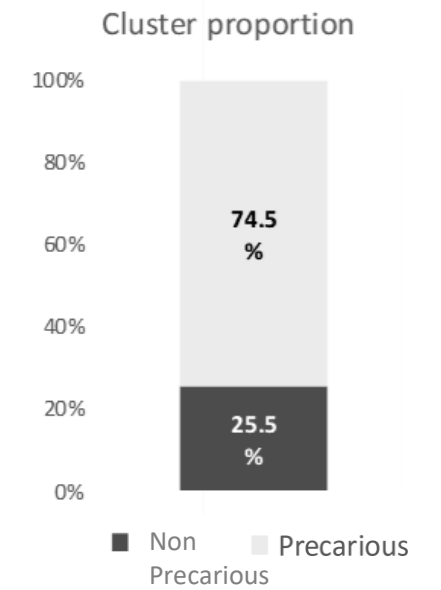
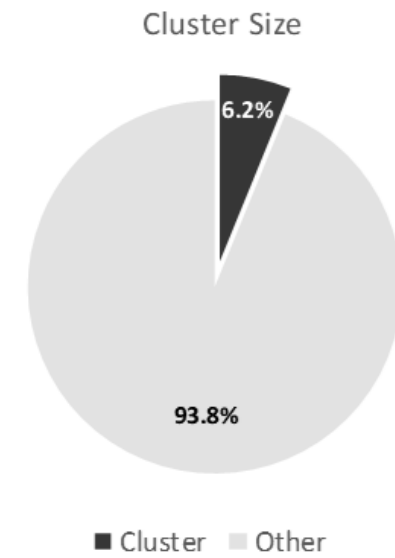
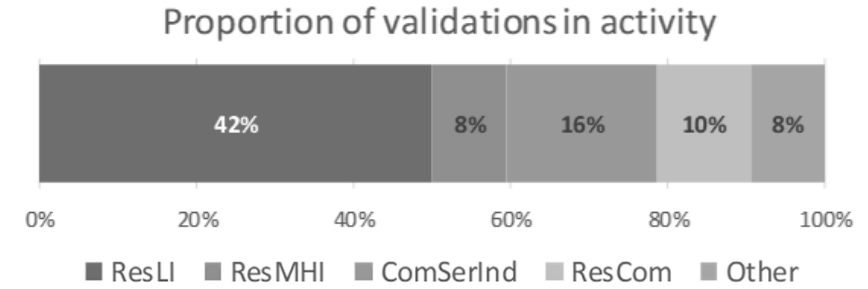
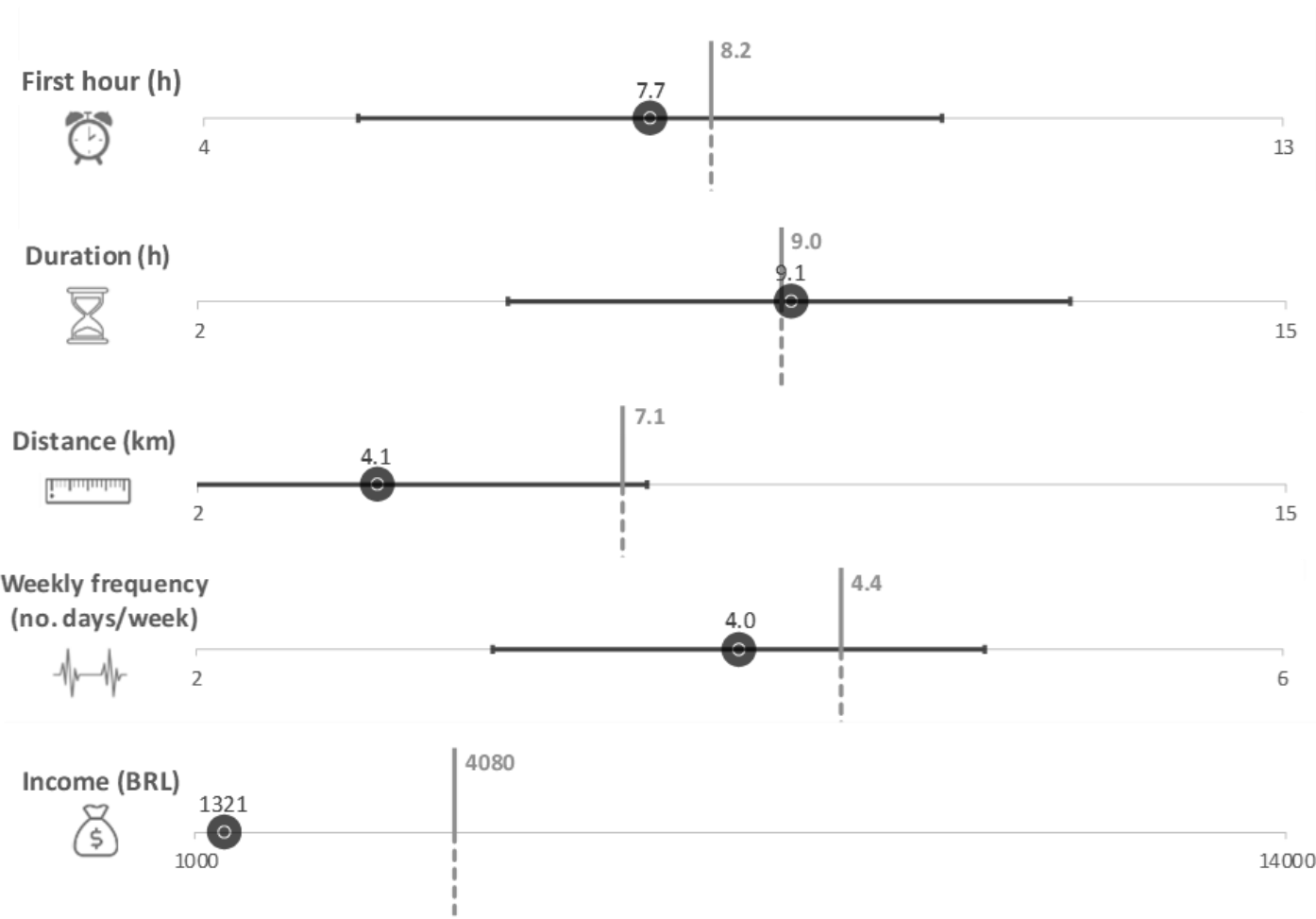


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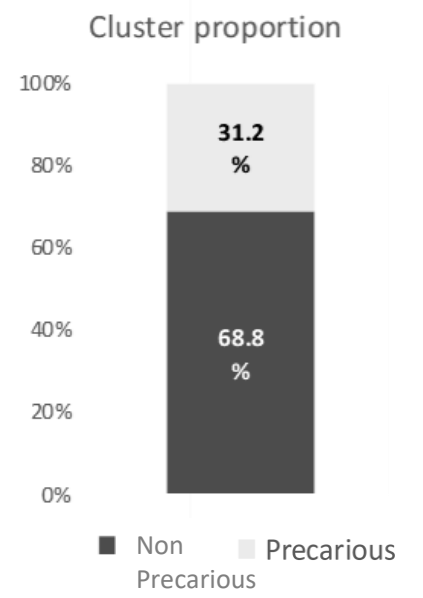
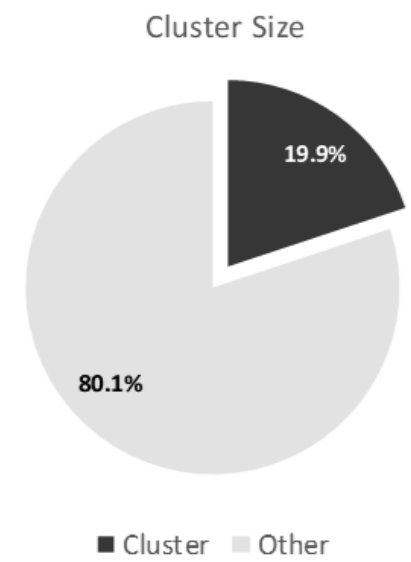
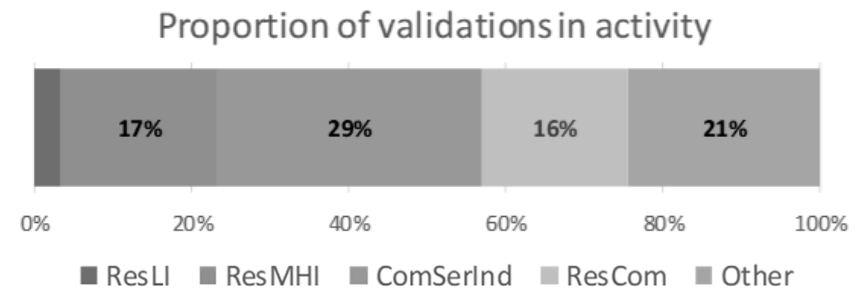
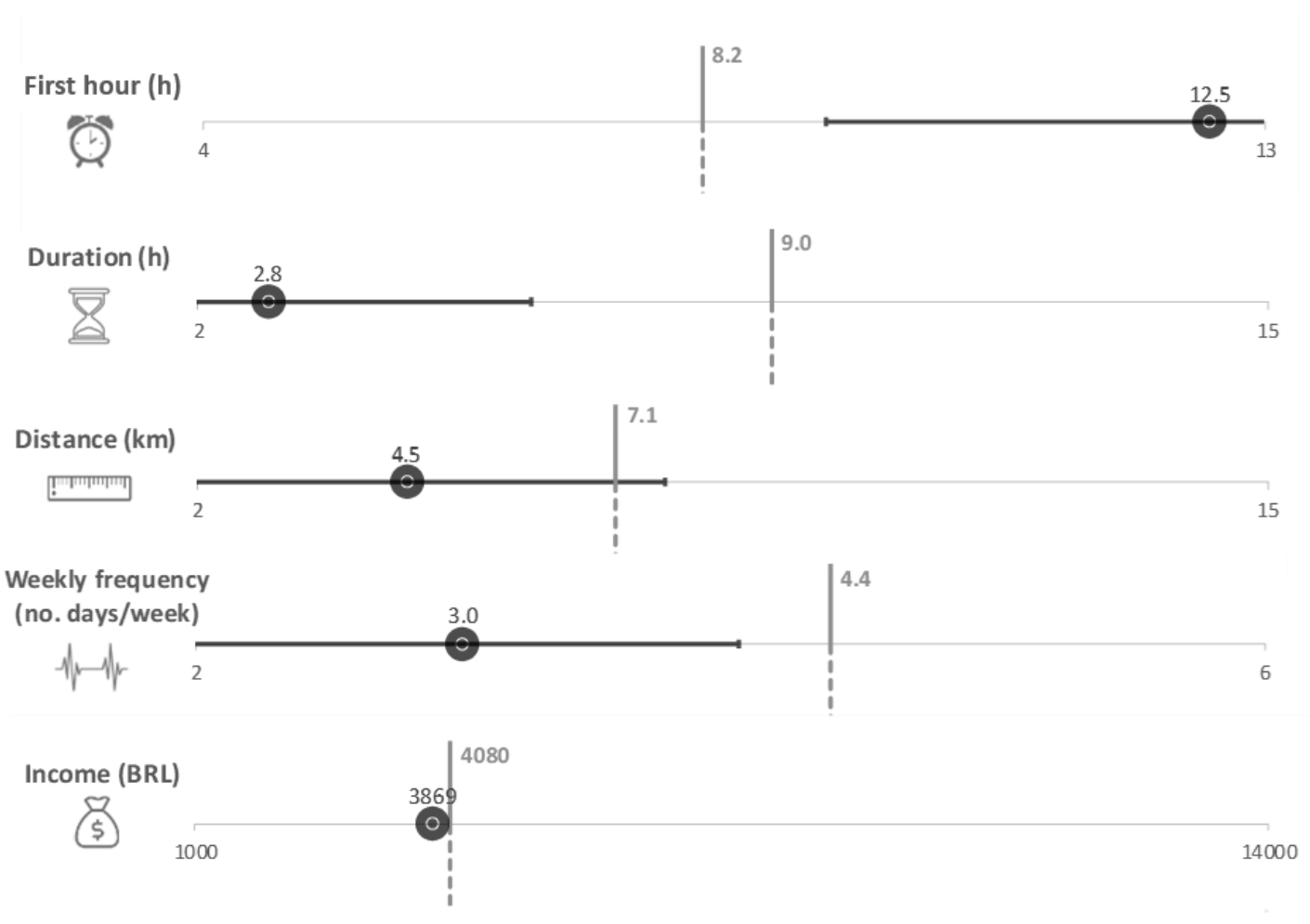


## Cluster 4





## Cluster 6



# BIG DATA TELEFONIA



**10 ERBs** 25/04/2016 a 25/05/2016

~ **250 K** usuários únicos

~ **10 K** usuários frequentes (10 dias)

**10 ERBs** 25/04/2016 a 09/08/2016

~**30 milhões** de registros de **CDR**

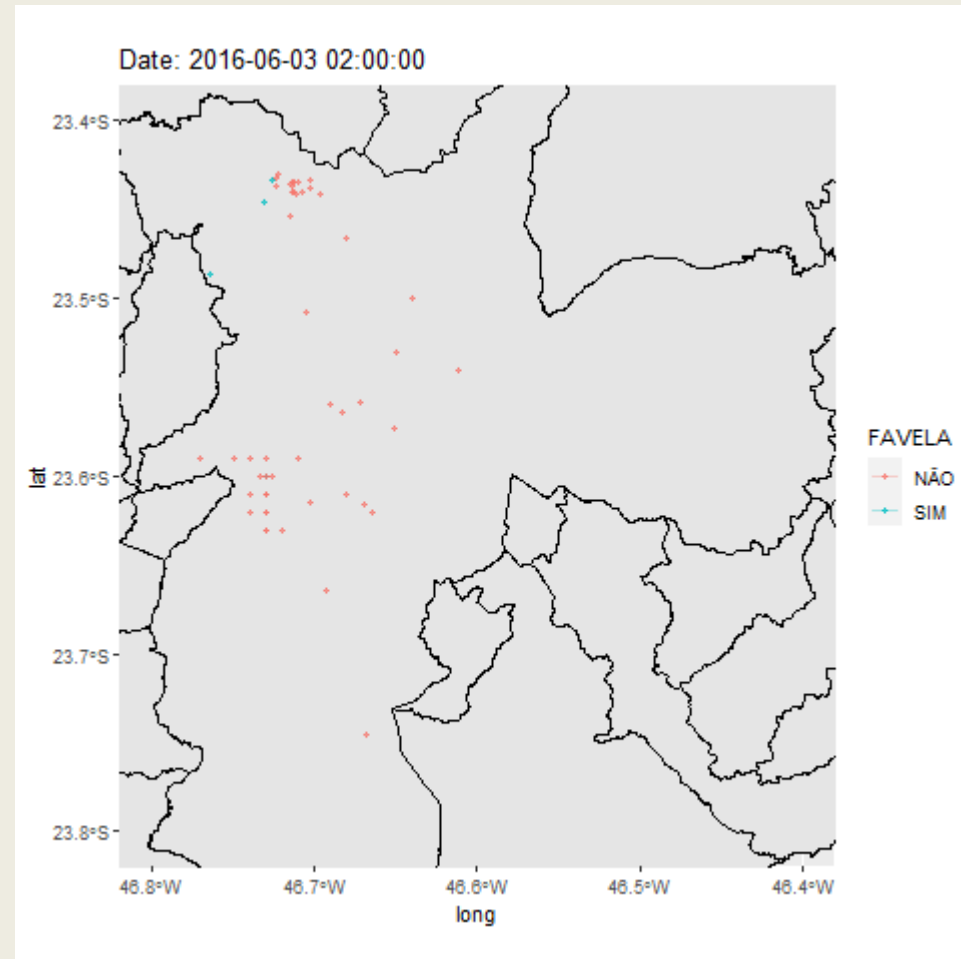
~**3,6 K** usuários únicos com pontos suficientes para a definição dos pontos de estadia





# BIG DATA TELEFONIA

Anonimização, inferência de local de residência e de atividades, análise especial  
10 ERBs, ~30 milhões de registro de CDR, 3.600 usuários únicos



Habitat International 110 (2021) 102346

Contents lists available at ScienceDirect

Habitat International

journal homepage: <http://www.elsevier.com/locate/habitatint>



Measuring mobility inequalities of favela residents based on mobile phone data

André Leite Rodrigues<sup>a,d,\*</sup>, Mariana Giannotti<sup>a,b</sup>, Matheus H.C. Cunha Barboza<sup>a,c</sup>, Bianca Bianchi Alves<sup>c</sup>

<sup>a</sup> Polytechnic School of the University of São Paulo (Poli/USP), São Paulo, Brazil

<sup>b</sup> Center for Metropolitan Studies (CEM), São Paulo, Brazil

<sup>c</sup> World Bank Group, Washington, USA

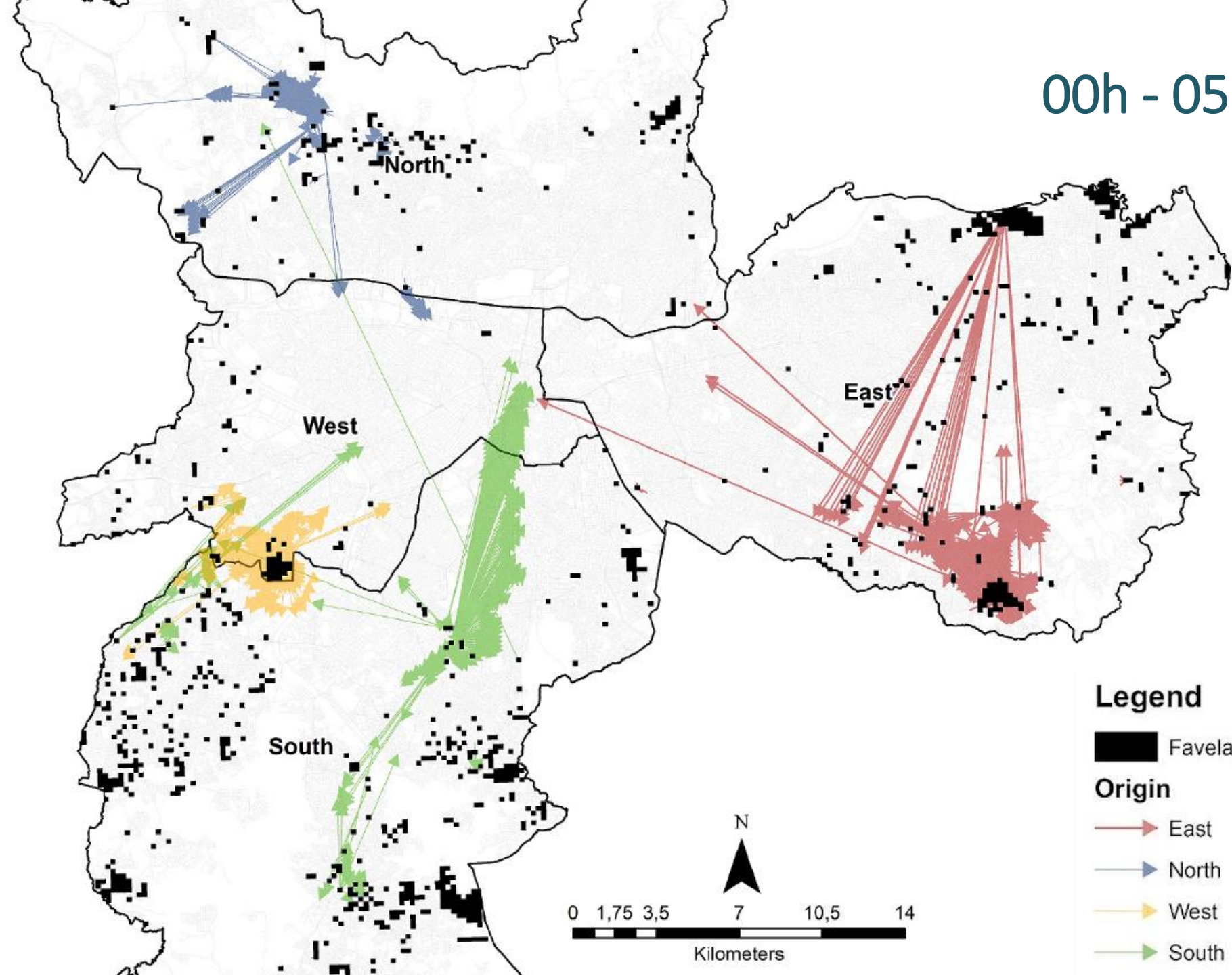
<sup>d</sup> Institute of Geography and Spatial Planning of the University of Lisbon (IGOT/UL), Lisbon, Portugal

\* Center for the Study of the Politics and Economics of the Public Sector, Getúlio Vargas Foundation (CEPESP/PGV), São Paulo, Brazil

RODRIGUES, A. L.; GIANNOTTI, M.; BARBOZA, M. H.C.; ALVES, B. B. Measuring mobility inequalities of favela residents based on mobile phone data. **Habitat International**. , v.110, p.102346 - , 2021.



00h - 05h



**Legend**

■ Favelas

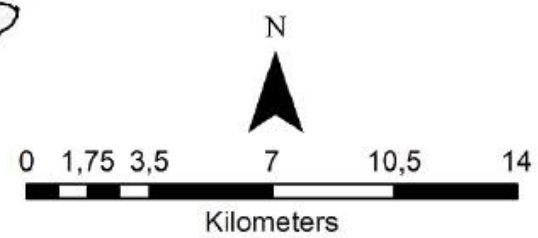
**Origin**

→ East

→ North

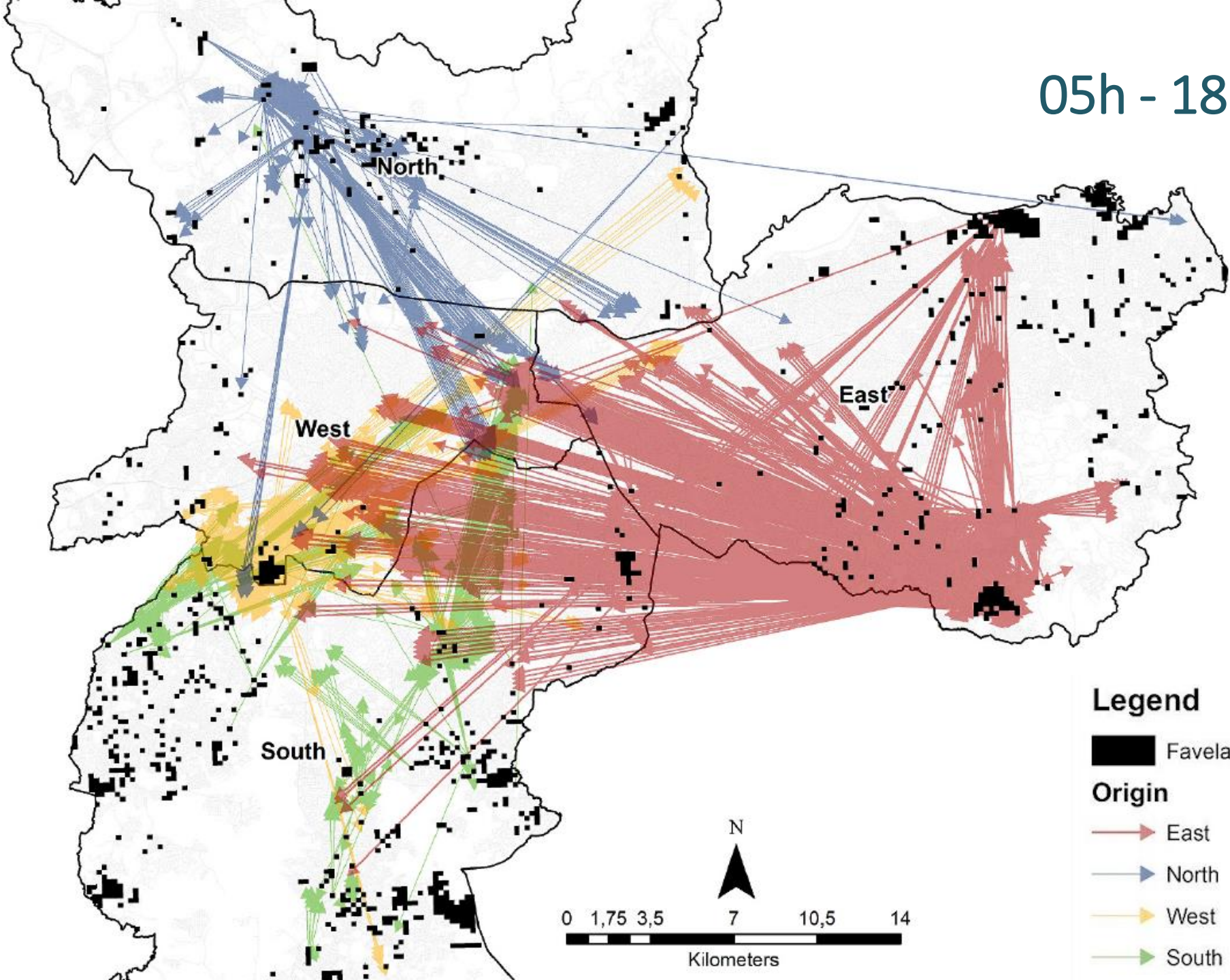
→ West

→ South





05h - 18h



**Legend**

■ Favelas

**Origin**

→ East

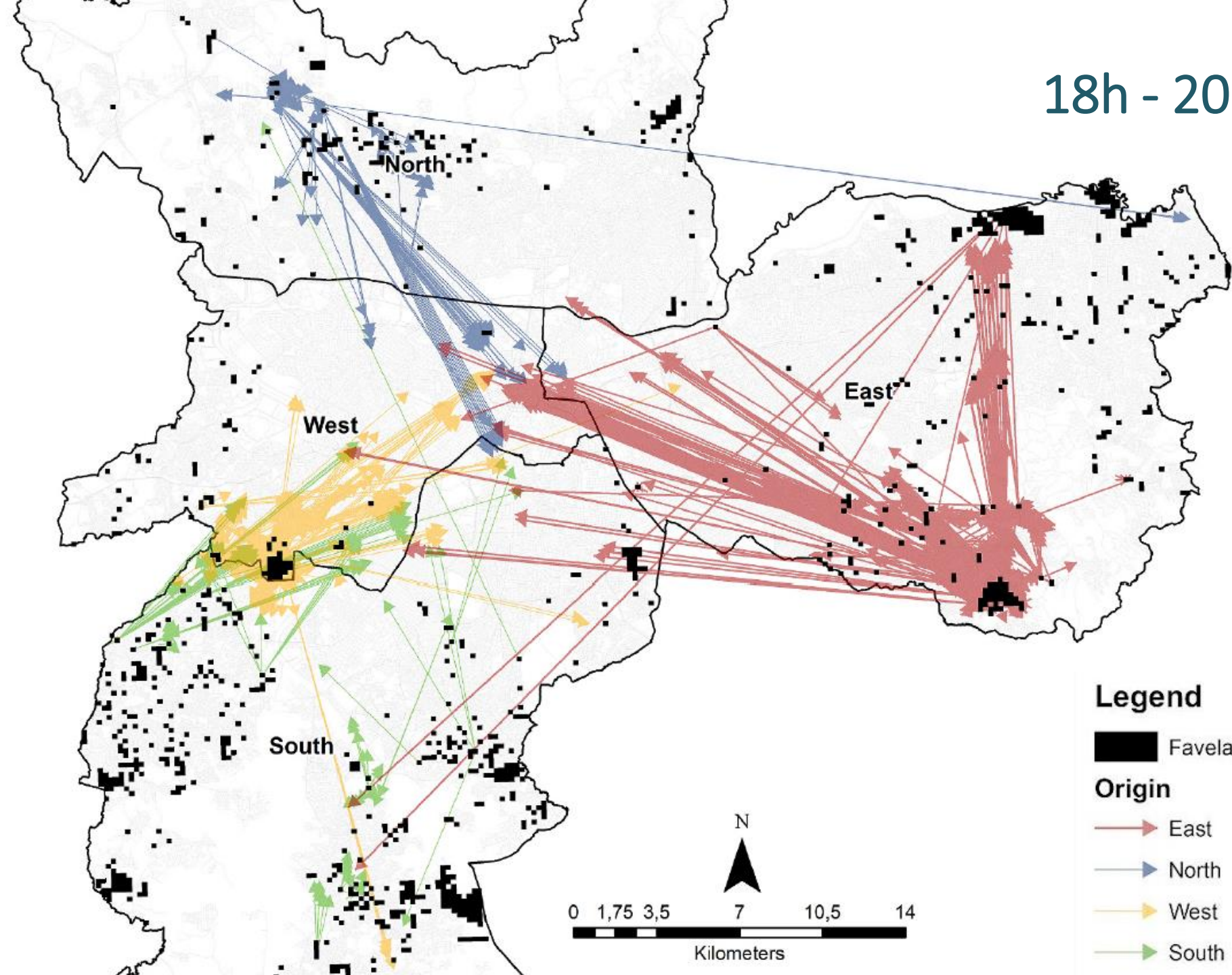
→ North

→ West

→ South

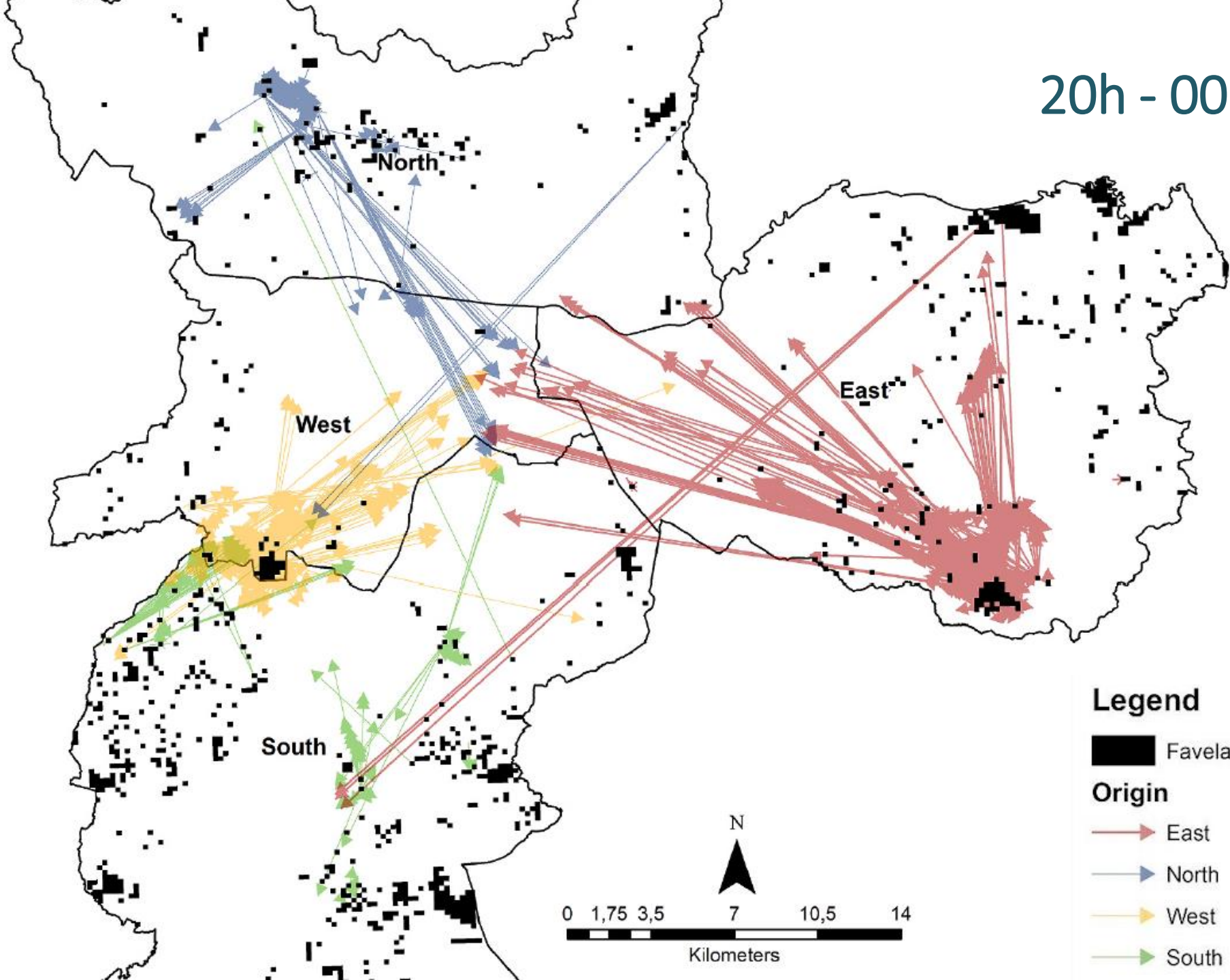


18h - 20h





20h - 00h



**Legend**

■ Favelas

**Origin**

→ East

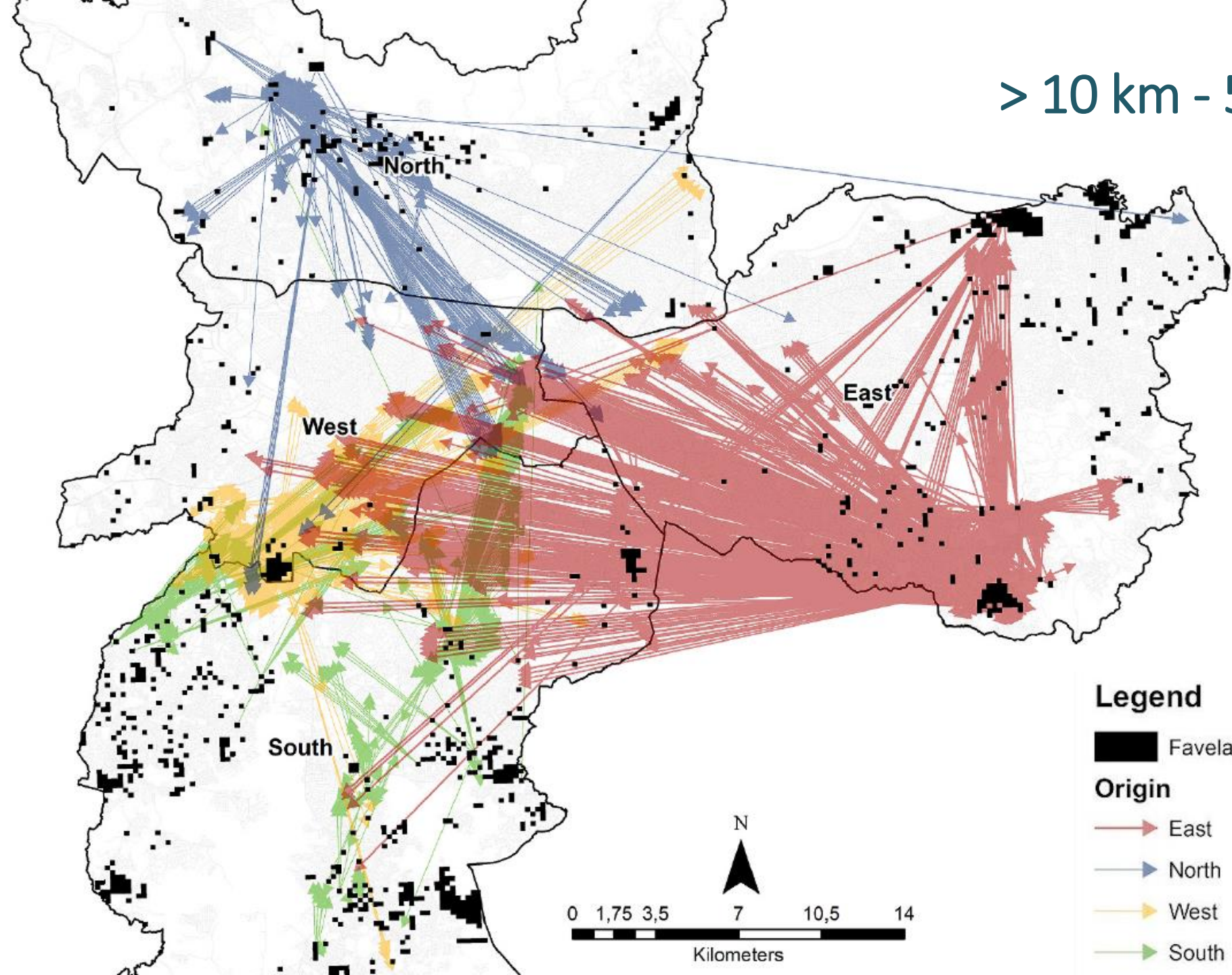
→ North

→ West

→ South



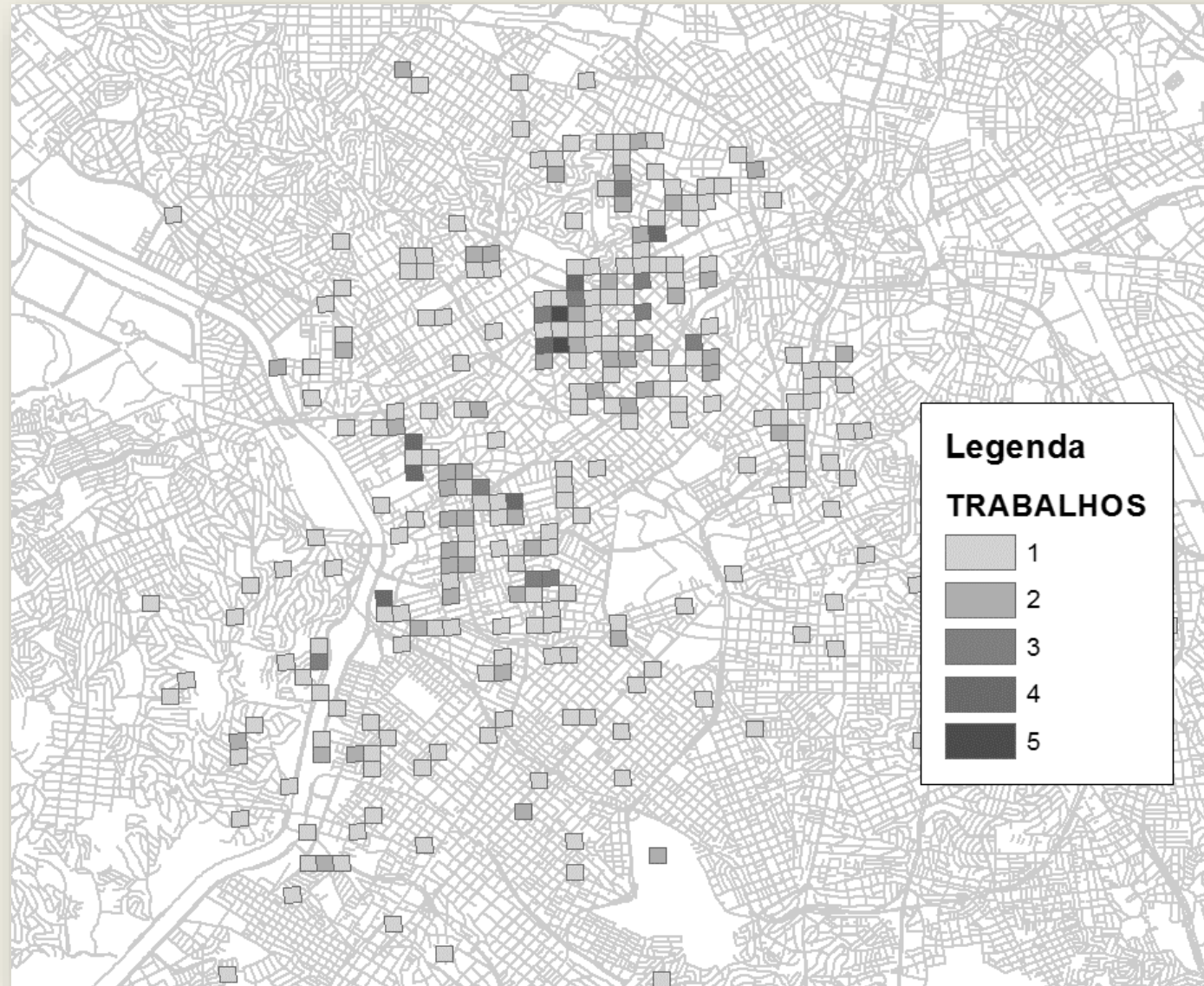
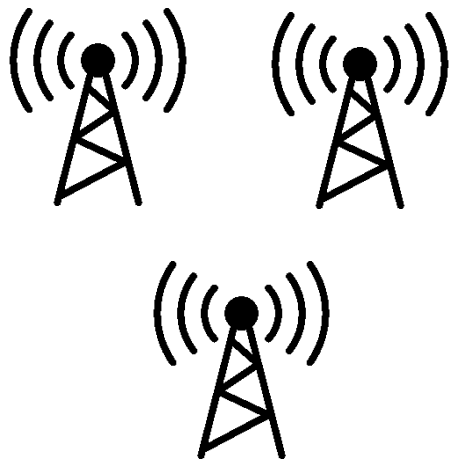
> 10 km - 5h



### Legend

- Favelas
- ➔ East
- ➔ North
- ➔ West
- ➔ South

# TELEFONIA



# SMART CARD







# QUESTIONÁRIOS E ENTREVISTAS

Combinar dados de fontes heterogêneas, que podem orientar o planejamento amostral de coletas em campo mais eficientes





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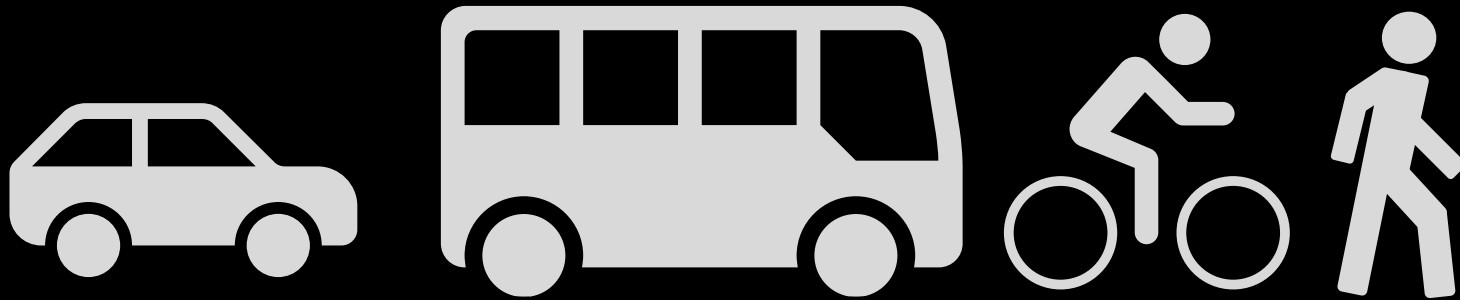
Habitação de interesse social

Visão estratégica

Pesquisa

Extensão

# Mapear a infraestrutura viária





**Jane Jacobs**

**Cities are complex systems whose  
infrastructural,  
economic and social components are  
strongly interrelated  
and therefore, difficult to understand  
in isolation**

Jacobs, J.  
The Death and Life of Great American Cities  
(1961)

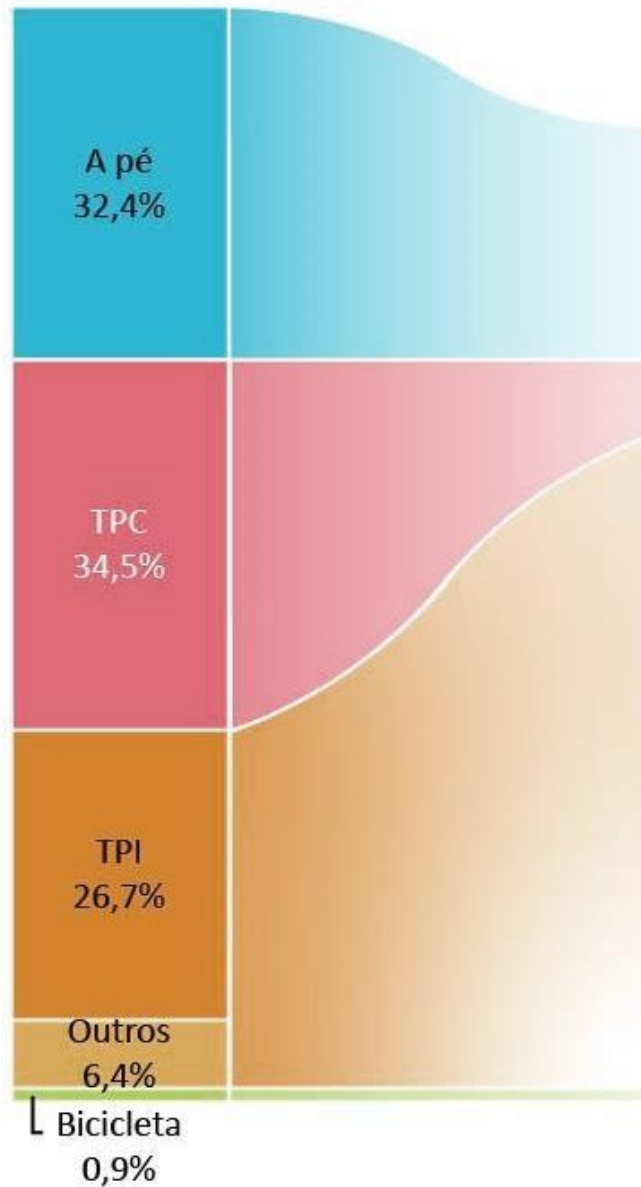
# SHARED STREETS



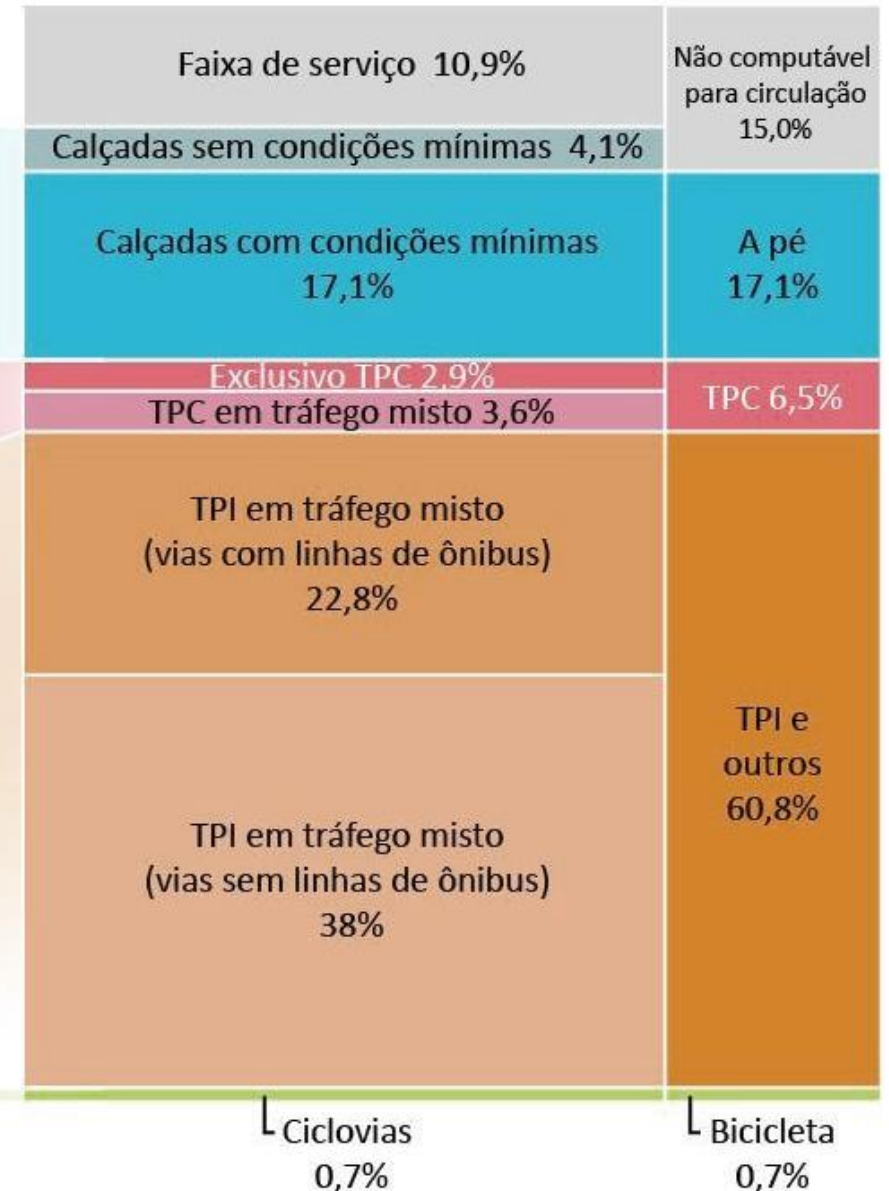
WORLD BANK GROUP



## Demanda de viagens



## Distribuição do espaço viário



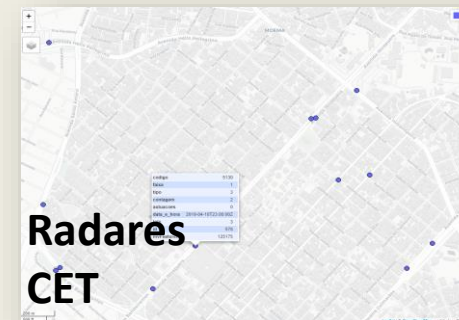
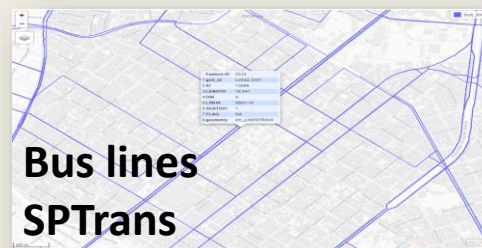
**Walking Infra (m<sup>2</sup>) =  $\sum$  sidewalks (m<sup>2</sup>)**

**Bike Infra (m<sup>2</sup>) =  $\sum$  bikelanes (m<sup>2</sup>) + bike in shared streets (m<sup>2</sup>)**

**PT Infra (m<sup>2</sup>) =  $\sum$  bus corridors (m)\*3,5m +  $\sum$  exclusive lanes (m)\*3,5m**

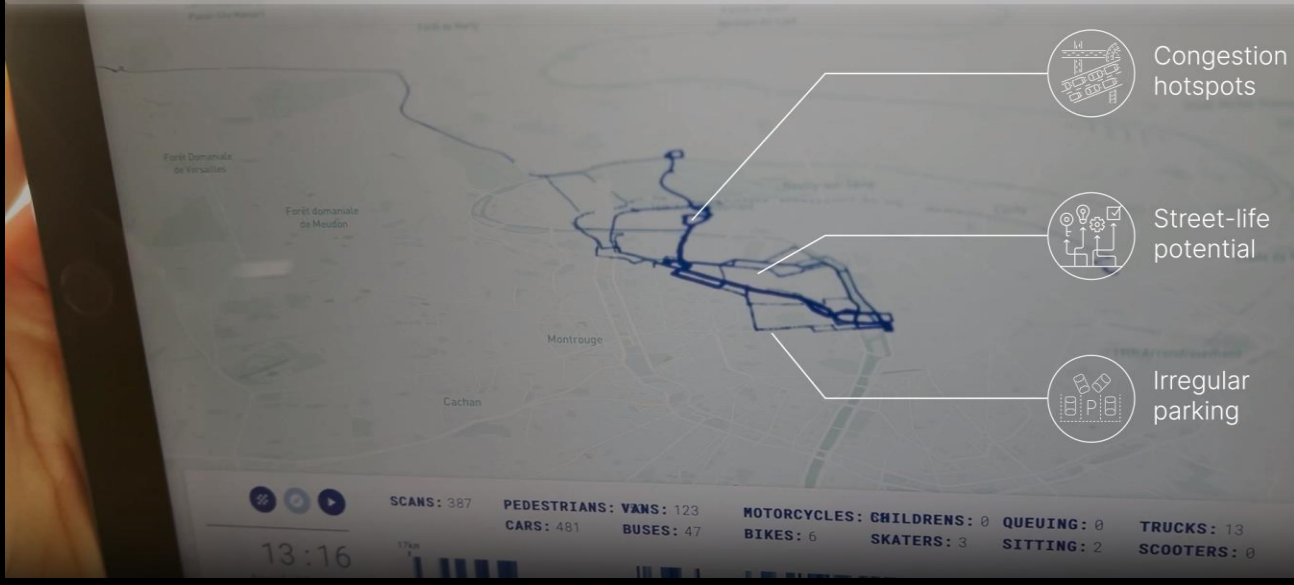
**Mix Infra – PT and IT (m<sup>2</sup>) =  $\sum$  streets with lines PT (m<sup>2</sup>) - PT Infra (m<sup>2</sup>) - bike in shared streets (m<sup>2</sup>)**

**IT Infra (m<sup>2</sup>) =  $\sum$  streets (m<sup>2</sup>) - PT Infra (m<sup>2</sup>) - Mix Infra (m<sup>2</sup>) - bike in shared streets (m<sup>2</sup>)**



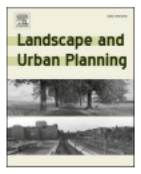


Our computer vision algorithms can distinguish vehicles, vans, and trucks



# Landscape and Urban Planning

journal homepage: [www.elsevier.com/locate/landurbplan](http://www.elsevier.com/locate/landurbplan)



## Research Paper

### Smart curbs: Measuring street activities in real-time using computer vision

Arianna Salazar-Miranda <sup>a</sup>, Fan Zhang <sup>b,\*</sup>, Maoran Sun <sup>a</sup>, Pietro Leoni <sup>a</sup>, Fábio Duarte <sup>a,c</sup>, Carlo Ratti <sup>a</sup>

<sup>a</sup> Senseable City Lab, Department of Urban Studies and Planning, Massachusetts Institute of Technology, Cambridge, MA 02139, United States  
<sup>b</sup> Department of Civil and Environmental Engineering, the Hong Kong University of Science and Technology, Hong Kong, China  
<sup>c</sup> Center for Real Estate, Massachusetts Institute of Technology, Cambridge, MA 02139, United States

## HIGHLIGHTS

- A framework to study street activity using a mobile device and computer vision.
- A deep learning-based model to detect various human mobility types.
- Constructing measures of street use to study their spatio-temporal dynamics.

## ARTICLE INFO

**Keyword:**  
Street activity  
Pedestrians  
Transportation modes  
Image analysis  
Computer vision

## ABSTRACT

Streets are conduits of human activity. Despite their importance, studying street activity has been obscured by a lack of data on how people use them, with most approaches limited to studying a single point in time or small geographic areas. This paper proposes a new framework to measure street activity in real-time. Our framework leverages machine learning and computer vision to classify pedestrian activities and transportation modes using images collected from moving vehicles. We apply our methodology to measure street activity in Paris for five weeks. We produce activity maps for this period showing that streets vary dramatically in their capacity to support pedestrian activity and that these differences are highly persistent. Our proposed framework can be used to measure street activities in other contexts and cities, providing urban researchers with an approach to guide planning interventions, identify infrastructural deficiencies, and inform design policies that foster active streets.



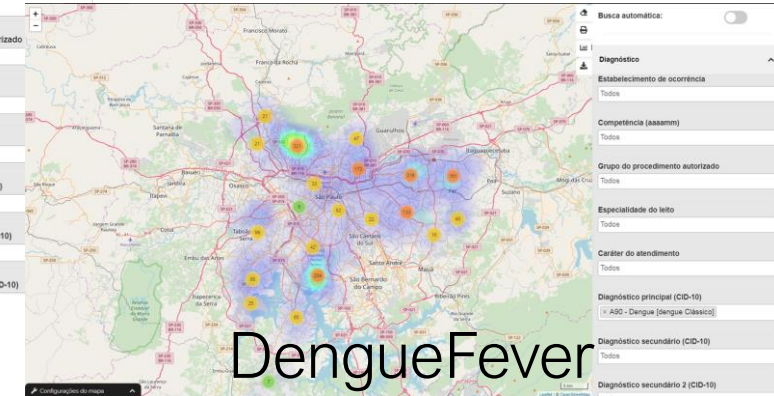
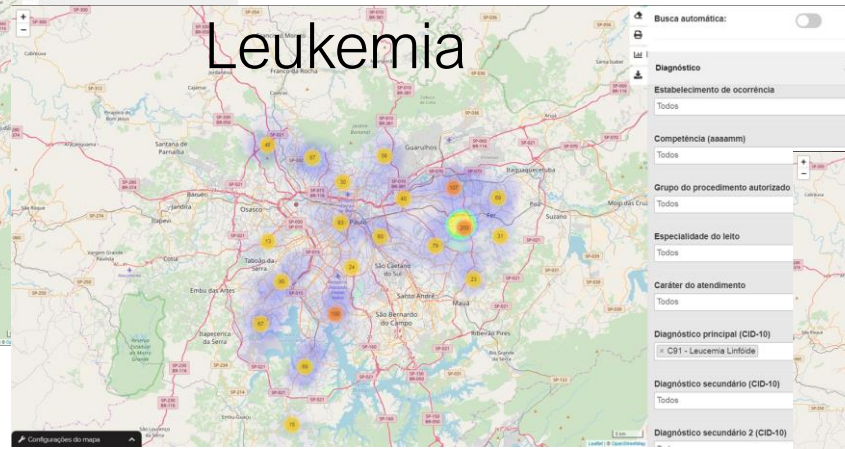
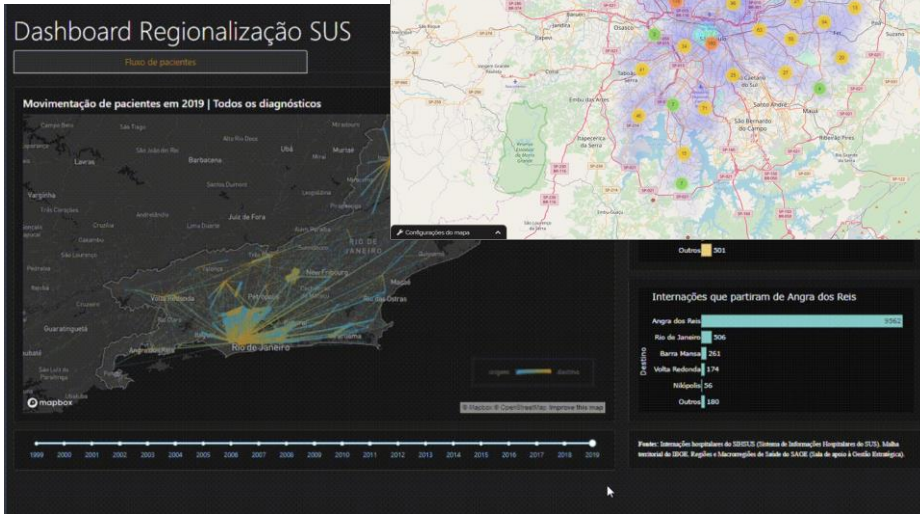
# Health

HIV

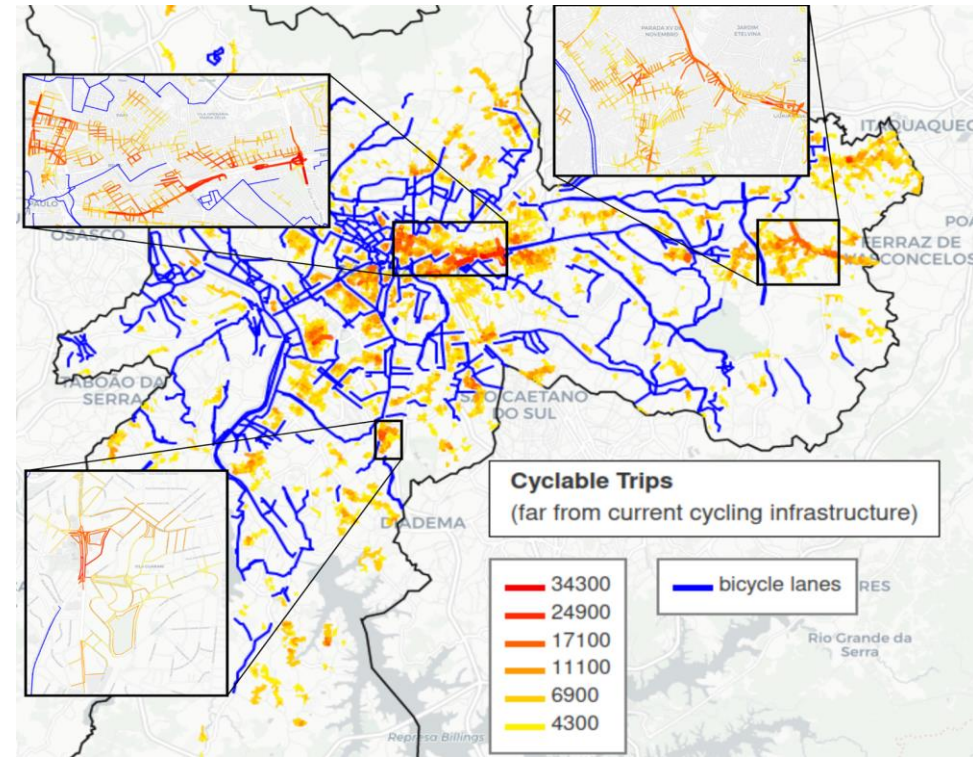
Leukemia



INCT  
InterSCity

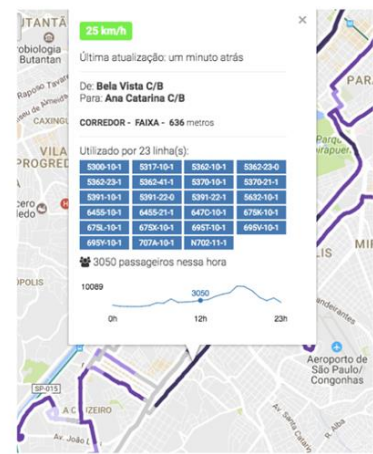
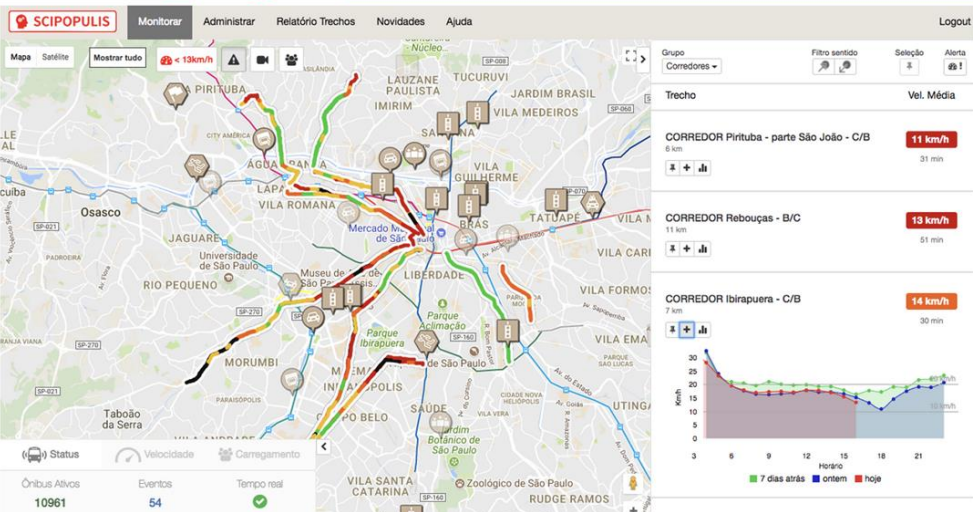


# Mobility



## REAL TIME DASHBOARD for 15K buses

Evidence-based Public Transport Operation and Policymaking





## Mapear a cidade: dados para soluções em engenharia dos problemas urbanos

- ✓ Mobilidade
- ✓ Infraestrutura viária
- ✓ Acesso à cidade

Subsidiar a formulação, o monitoramento e a avaliação de políticas e práticas urbanas

Transporte público (redes metroferroviária e ônibus)

Transporte ativo (redes cicloviária e pedonal)

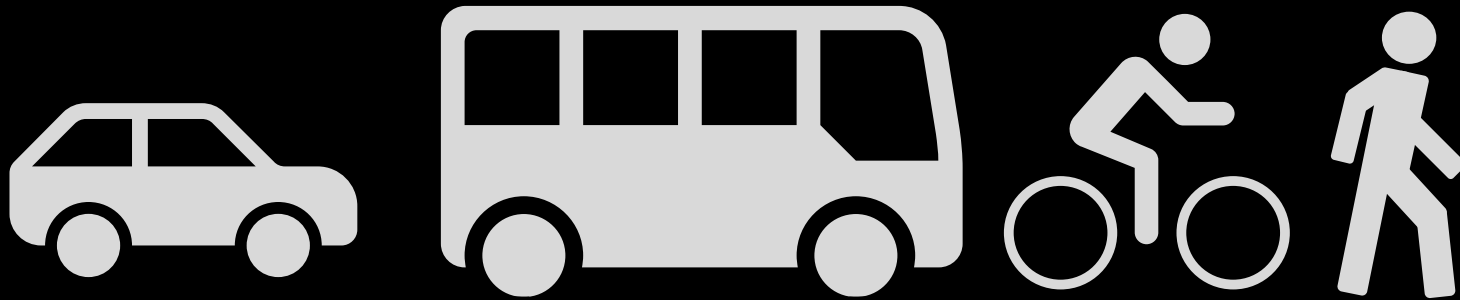
Habitação de interesse social

Visão estratégica

Pesquisa

Extensão

# Mapear o acesso à cidade



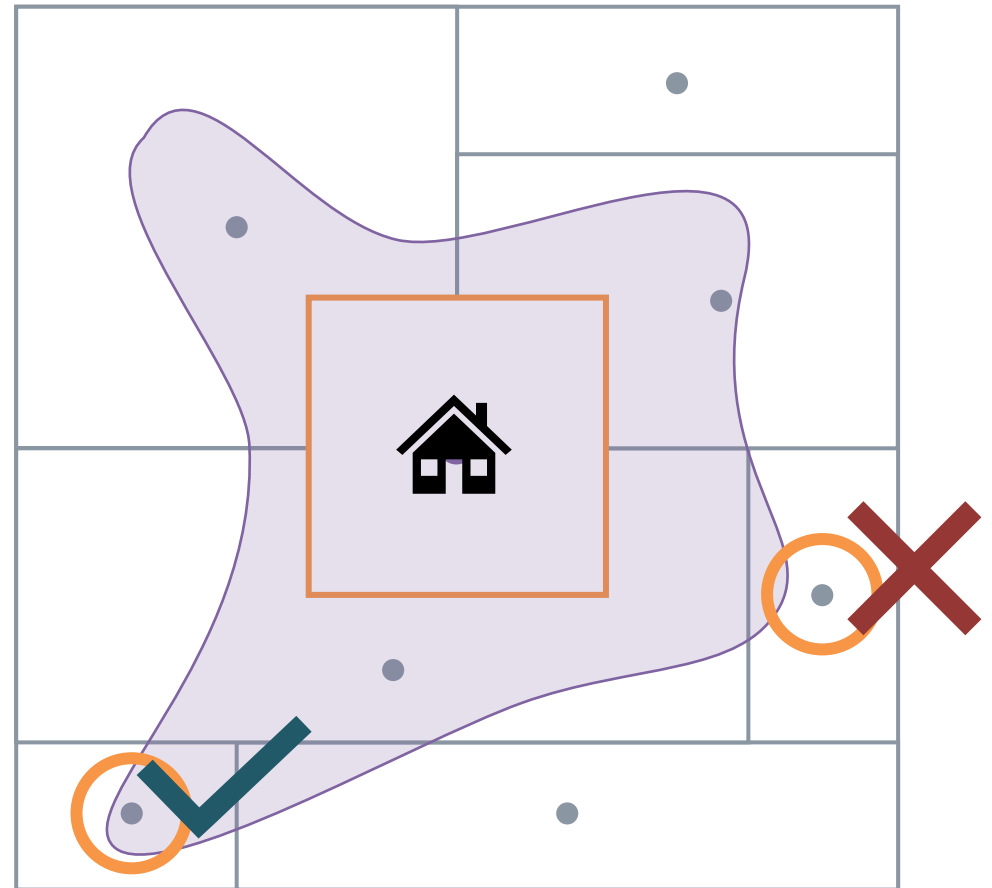
Urban **mobility** enables measuring the revealed patterns and conditions of how people move when interacting with the city (Martens, 2012)

Urban **accessibility** is an estimation of the **potential** for interaction from places to other activities in the city (Hansen, 1959)

$$A_i = \sum_{j=1}^n O_j \text{ if } c_{ij} < c_{max}$$

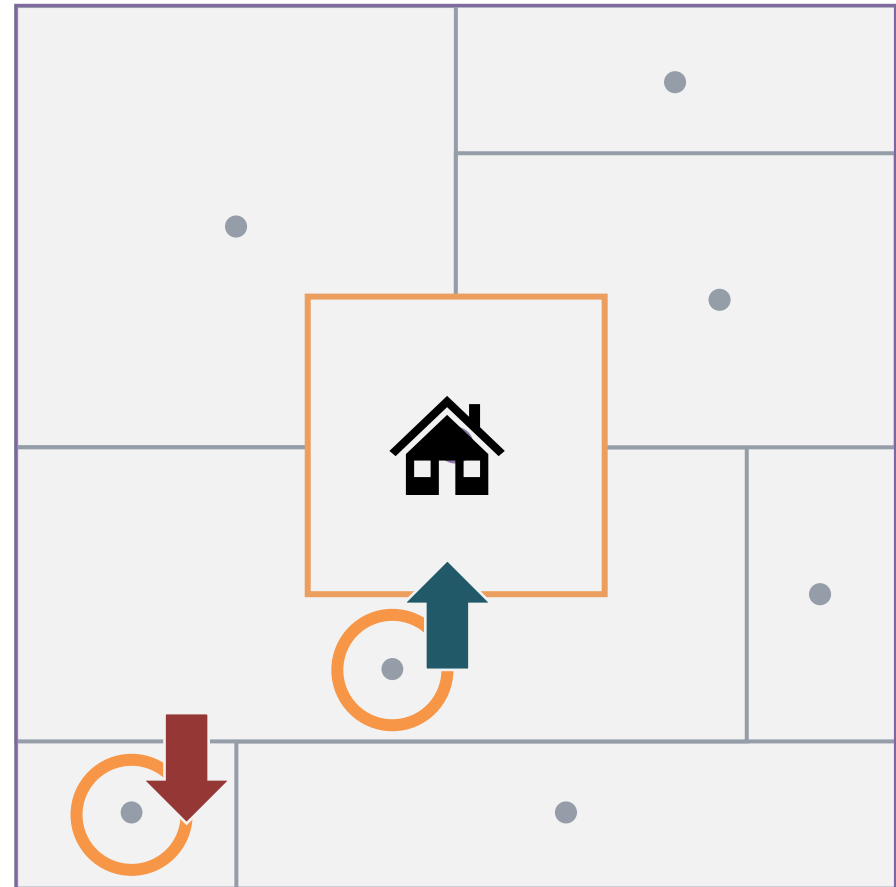
# Acessibilidade cumulativa

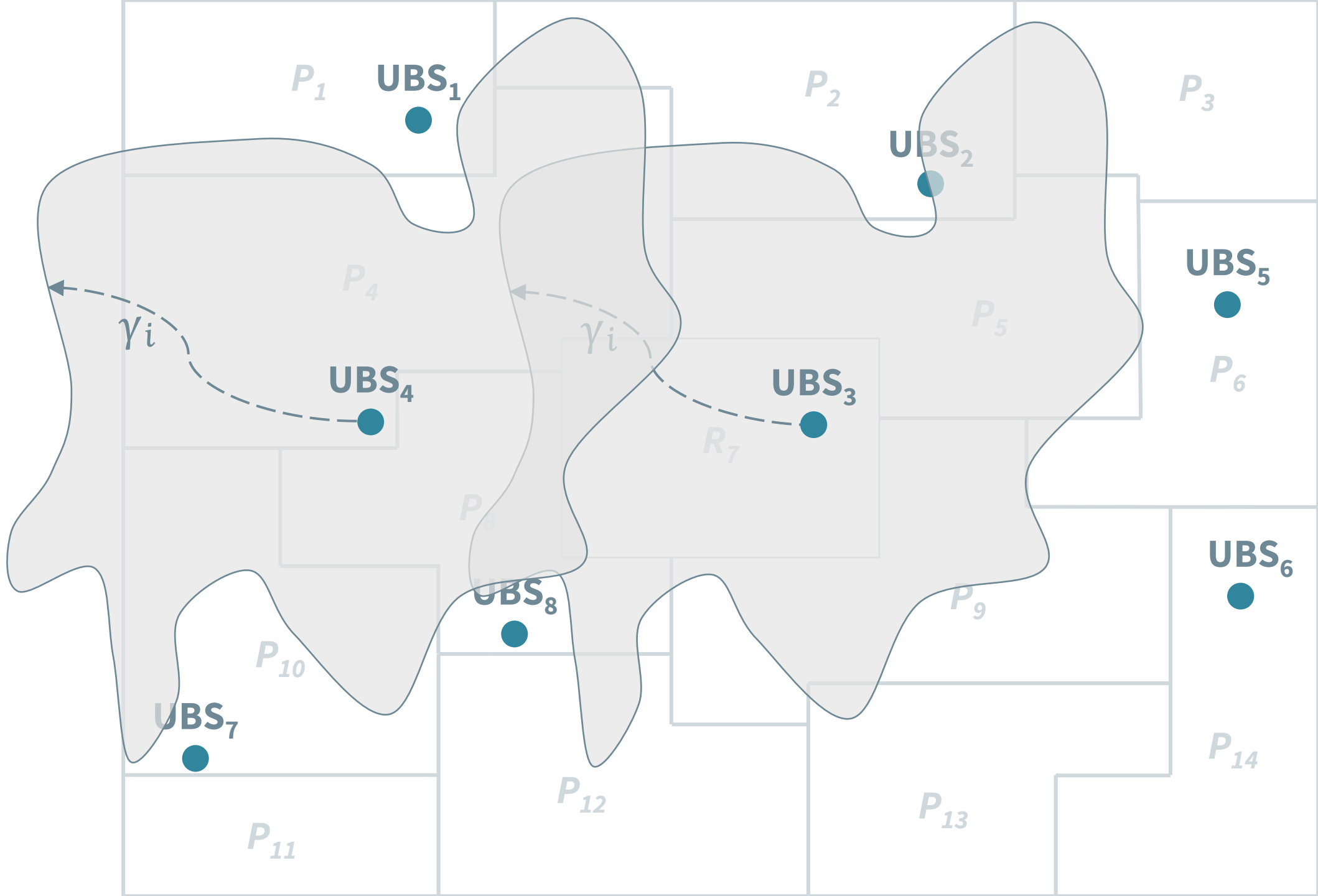
(Wachs & Kumagai, 1973)



$$A_i = \sum_{j=1}^n O_j \cdot f(c_{ij})$$

**Acessibilidade  
gravitacional**  
(Hansen, 1959)





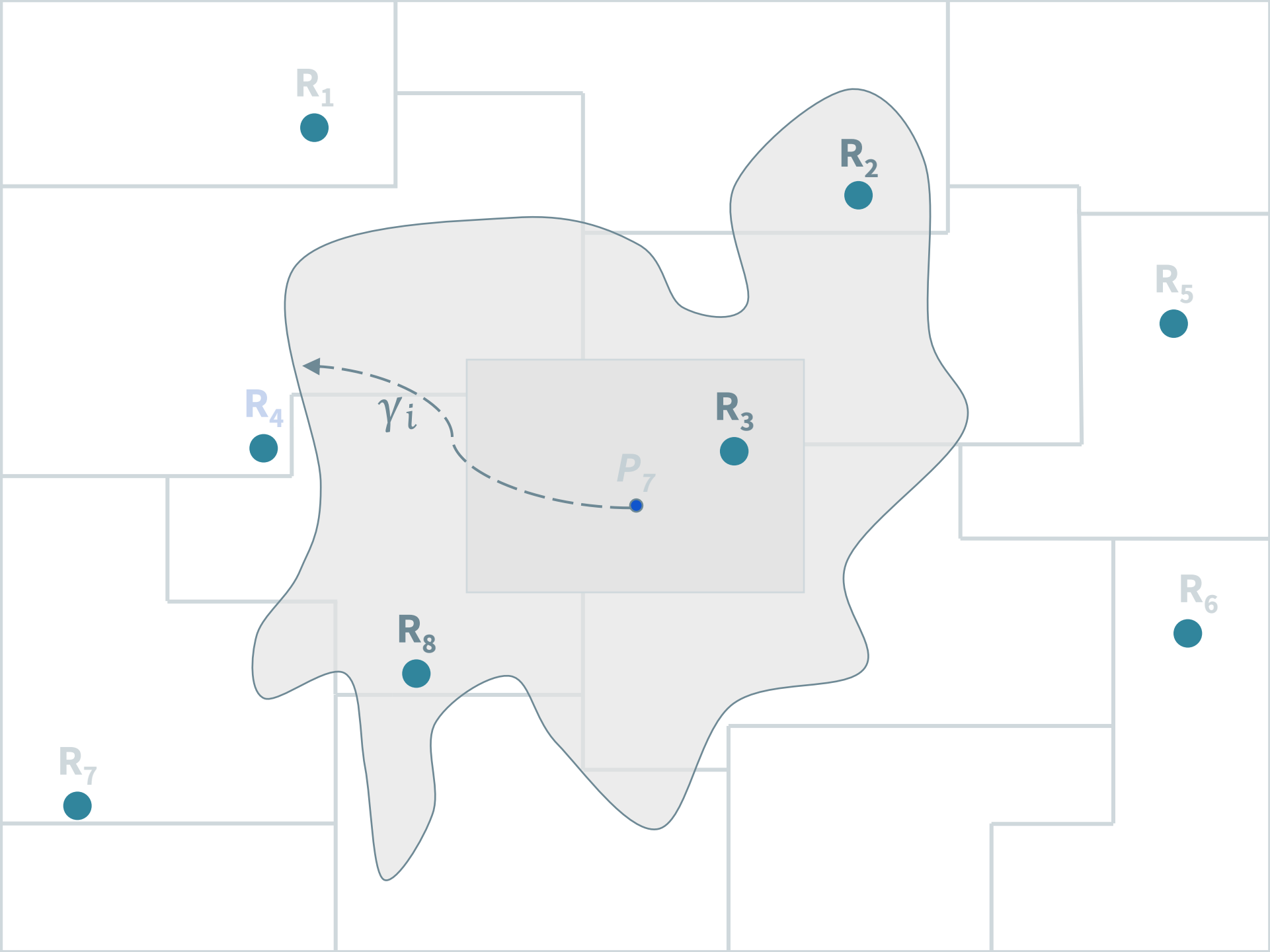
Fonte: Slide adaptado de (Beato, Elias, Rodrigues e Tarifa, 2018)

$$R_j = \frac{O_j}{\sum_{k \in \{c_{kj} \leq c_{max}\}} P_k}$$

## Acessibilidade **2SFCA** (STEP 1)

(Luo & Wang, 2003)





Fonte: Slide adaptado de (Beato, Elias, Rodrigues e Tarifa, 2018)

$$A_i^F = \sum_{j \in \{c_{ij} \leq t_{max}\}} R_j = \sum_{j \in \{c_{ij} \leq c_{max}\}} \frac{O_j}{\sum_{k \in \{t_{kj} \leq c_{max}\}} P_k}$$

## Acessibilidade 2SFCA (STEP 2)

(Luo & Wang, 2003)

# ACESSO A CIDADE? TRABALHO

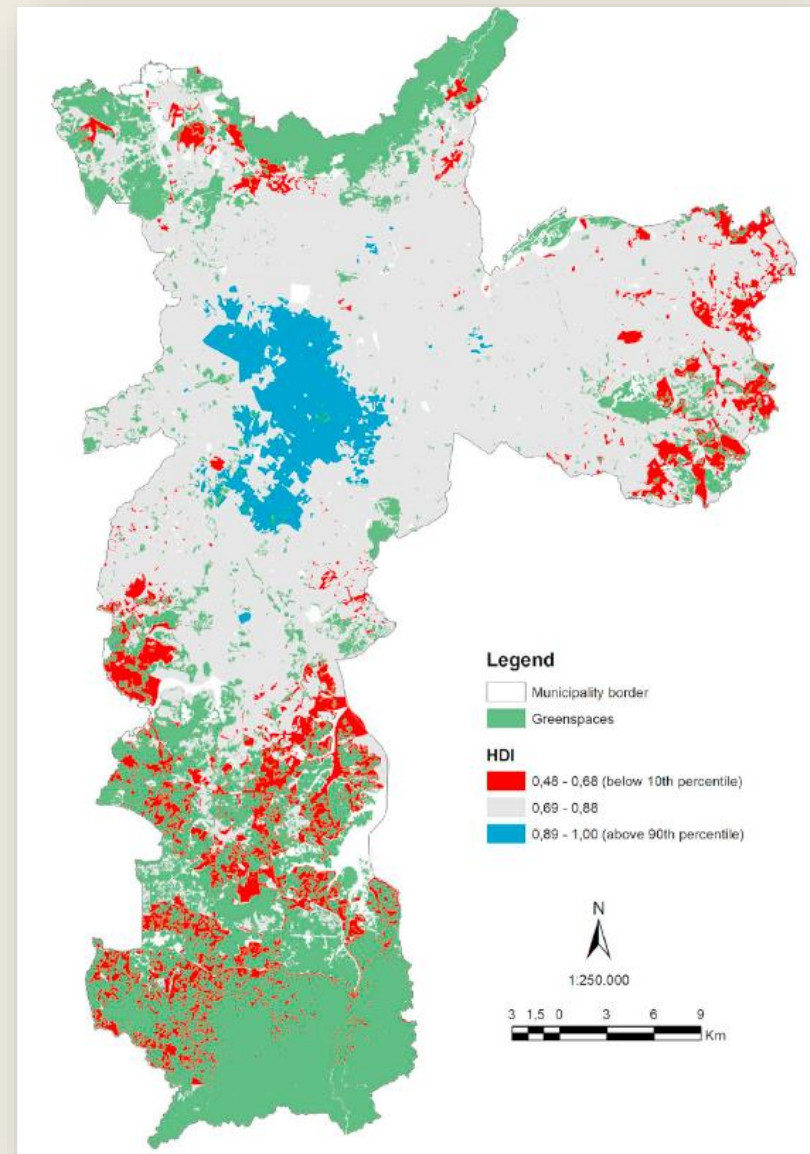
ASTRID PROJECT  
Accessibility, Social Justice and  
Transport Emission Impacts of TOD  
Strategies



UNIVERSITY  
OF TWENTE.



Netherlands Organisation for Scientific Research



SLOVIC, A. D.; TOMASIELLO, D. B.; GIANNOTTI, M.; ANDRADE, M. F.; NARDOCCI, A. C. The long road to achieving equity: Job accessibility restrictions and overlapping inequalities in the city of São Paulo. *Journal of Transport Geography*, v.78, p.181 - 193, 2019.

# ACESSO A CIDADE? LAZER

Dados da Tom Tom, Uber, GTFS,  
redes do OpenStreetMap,  
GeoSampa, CEM



Special Issue: Data Science for Developing Cities

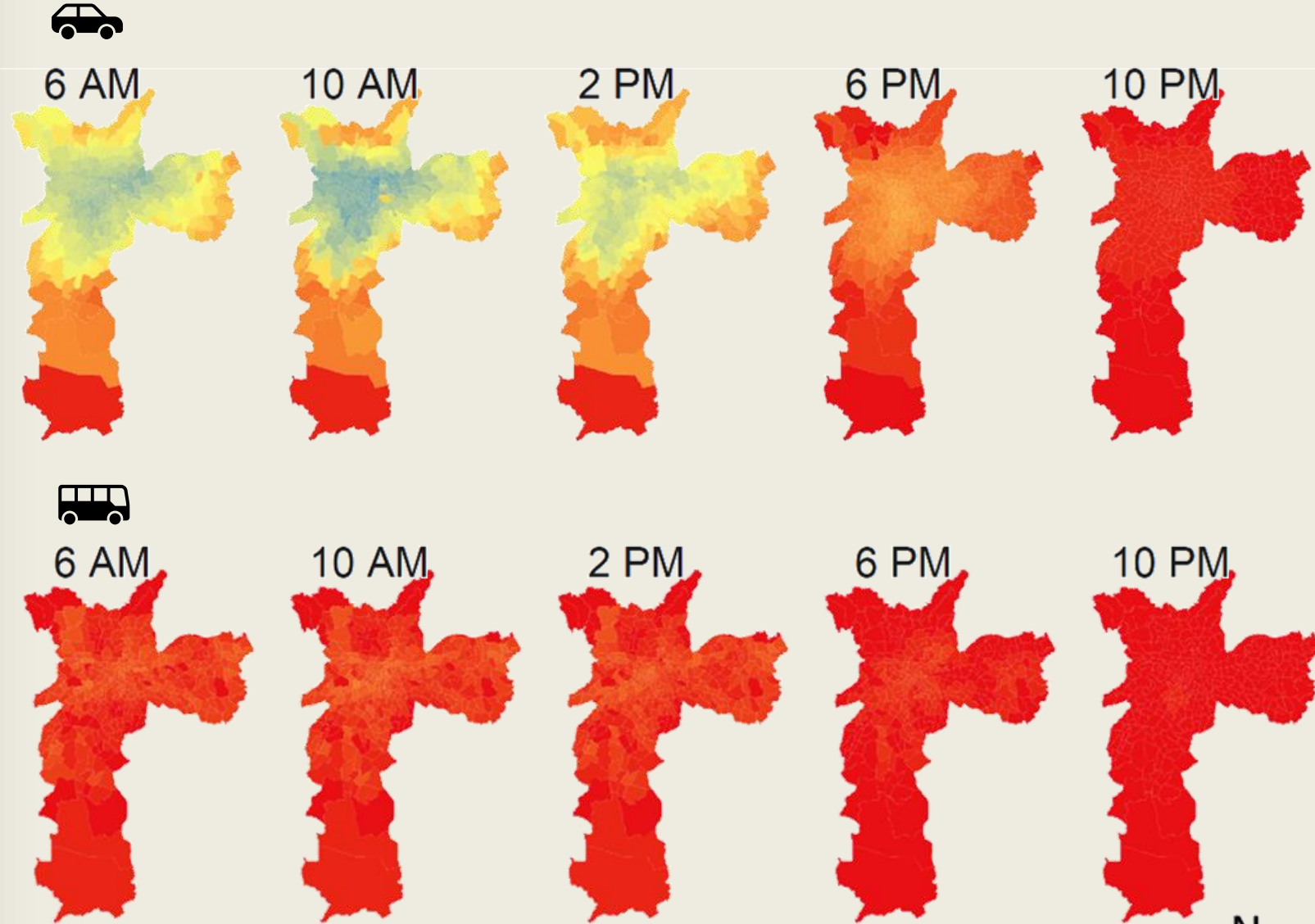
Urban Analytics and  
City Science

## Unfolding time, race and class inequalities to access leisure

EPB: Urban Analytics and City Science  
2022, Vol. 0(0) 1–15  
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DOI: 10.1177/23998083221111405  
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SAGE

Diego Bogado Tomasiello and Mariana Giannotti

Center for Metropolitan Studies and Laboratory for Geospatial Analysis at Polytechnic School, University of São Paulo, São Paulo, SP, Brazil







TOMASIELLO, D. B.; GIANNOTTI, M. Unfolding time, race and class inequalities to access leisure. *Environment and Planning B: Urban Analytics and City Science*. Special Issue: Data Science for Developing Cities., p. 1–15 2022.

# ACESSO A CIDADE? EDUCAÇÃO

Inclusão de parâmetro de qualidade das escolas



Accessibility to public schools  
(LISA Map)

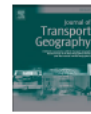
-  Low accessibility
-  High accessibility
-  High/Low
-  Low/High

Journal of Transport Geography 96 (2021) 103199

Contents lists available at ScienceDirect

Journal of Transport Geography

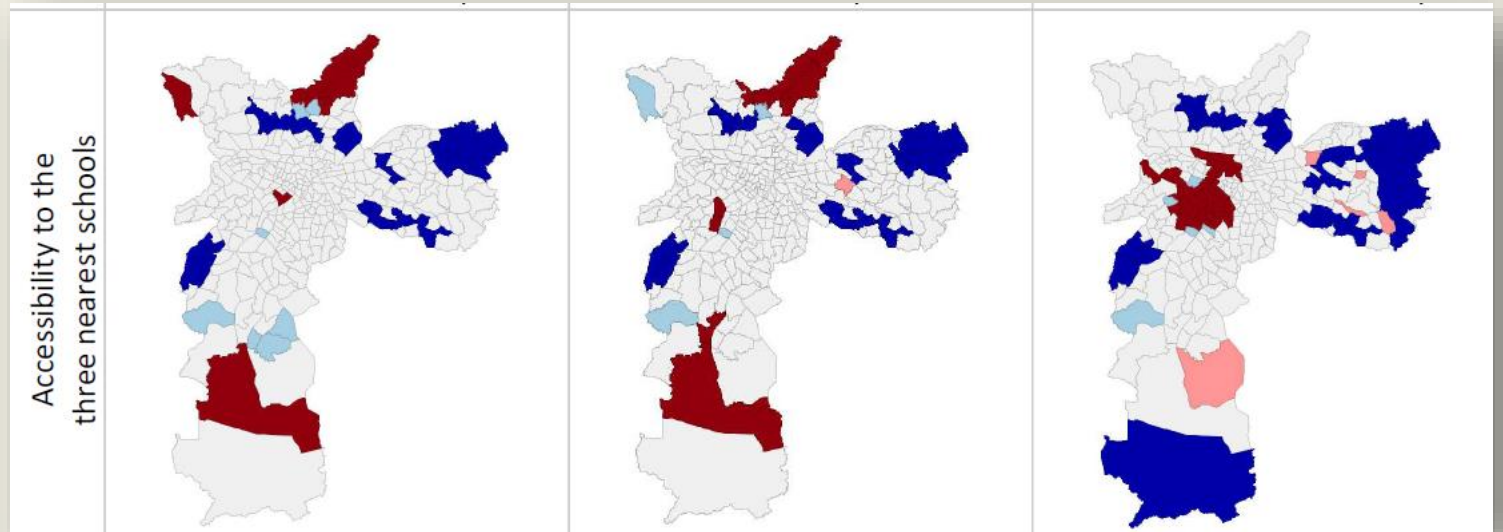
journal homepage: [www.elsevier.com/locate/jtrangeo](http://www.elsevier.com/locate/jtrangeo)



Qualifying accessibility to education to investigate spatial equity

Bruna Pizzol<sup>a,\*</sup>, Mariana Giannotti<sup>b</sup>, Diego Bogado Tomasiello<sup>b</sup>

<sup>a</sup> Department of Transportation Engineering Polytechnic School, University of São Paulo, São Paulo, Brazil  
<sup>b</sup> Center for Metropolitan Studies and Laboratory for Geospatial Analysis at Polytechnic School, University of São Paulo, São Paulo, Brazil







PIZZOL, B.; GIANNOTTI, M.; TOMASIELLO, D. B. Qualifying accessibility to education to investigate spatial equity. *Journal of Transport Geography*, v.96, p.103199, 2021.

# ACESSO A CIDADE? EDUCAÇÃO

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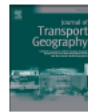
-  Low accessibility
-  High accessibility
-  High/Low
-  Low/High

Journal of Transport Geography 96 (2021) 103199

Contents lists available at ScienceDirect

Journal of Transport Geography

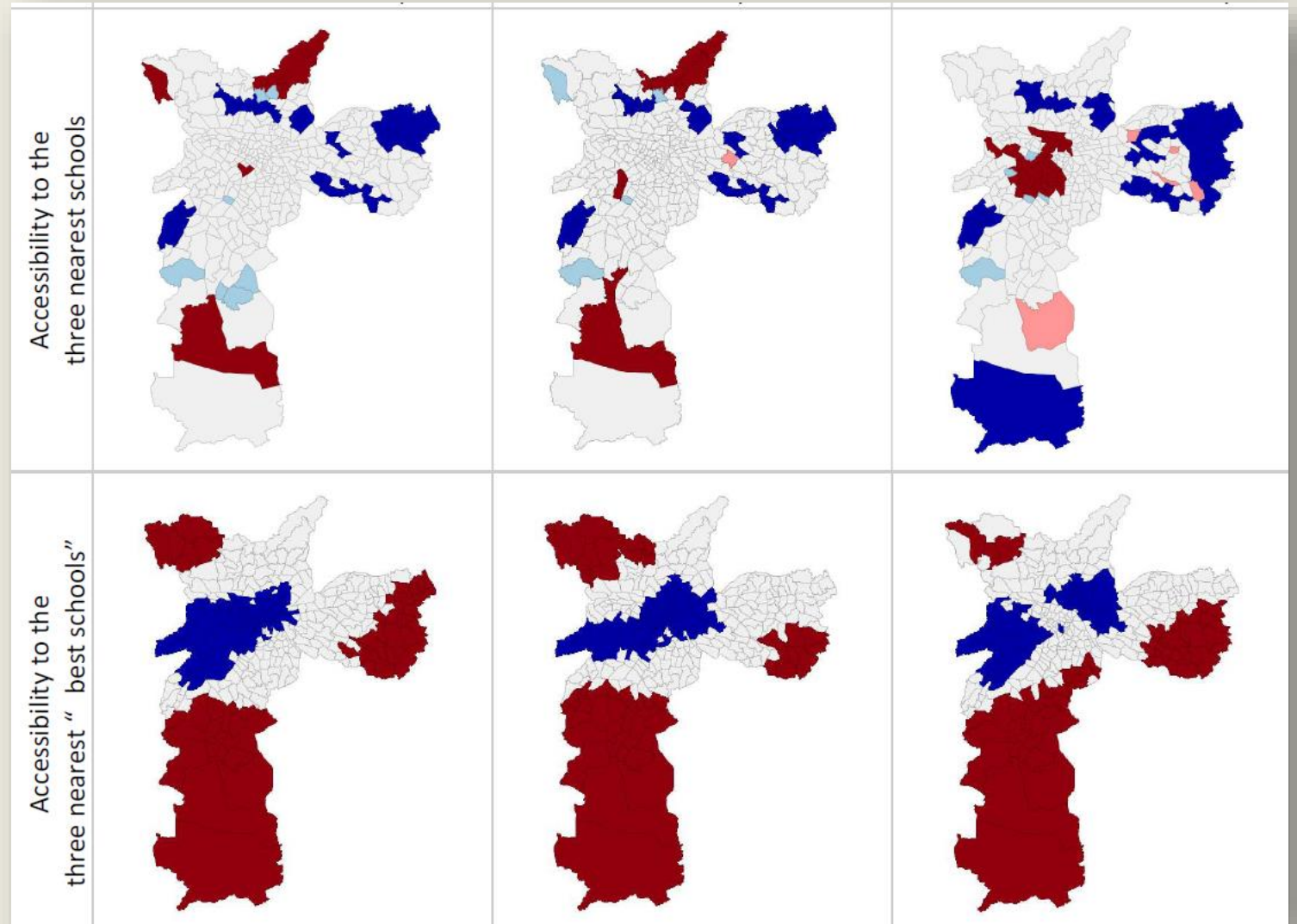
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<sup>a</sup> Department of Transportation Engineering Polytechnic School, University of São Paulo, São Paulo, Brazil  
<sup>b</sup> Center for Metropolitan Studies and Laboratory for Geospatial Analysis at Polytechnic School, University of São Paulo, São Paulo, Brazil



PIZZOL, B.; GIANNOTTI, M.; TOMASIELLO, D. B. Qualifying accessibility to education to investigate spatial equity. *Journal of Transport Geography*, v.96, p.103199, 2021.

**Sem competição**

**Fácil  
interpretação  
&  
Sem  
ponderação**

**Cumulativa**  
(Wachs & Kumagai,  
1973)

**Gravitacional**  
(Hansen, 1959)

**Difícil  
interpretação  
&  
Com  
ponderação**

**2SFCA**  
(Luo & Wang, 2003)

**Shen**  
(Shen, 1998)

**Com competição**

# OPTIMIZATION-BASED ACCESSIBILITY

Considerando restrição de capacidade (efeito de competição), ponderação com distância, facilidade de interpretação, identificação do local da demanda não atendida e quantificação

Transportation Research Part A 177 (2023) 103833

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: [www.elsevier.com/locate/tra](http://www.elsevier.com/locate/tra)



Evaluating the accessibility and availability of public services to reduce inequalities in everyday mobility

Tainá A. Bittencourt\*, Mariana Giannotti

Polytechnic School and Center for Metropolitan Studies, University of São Paulo, Brazil

Minimize the total cost  $c$  spent by individuals ( $x$ ) living in all origin zones ( $i$ ) to reach the services spatially distributed throughout all destination zones ( $j$ ):

$$\min \sum_{i=1}^n \sum_{j=1}^n x_{ij} c_{ij}$$

Service capacity (S): 
$$\sum_{i=1}^n x_{ij} = S_j \text{ for all } j = 1, \dots, n$$

Population (P): 
$$\sum_{j=1}^n x_{ij} \leq P_i \text{ for all } i = 1, \dots, n$$

Accessibility (A): 
$$A_i = \frac{\sum_{j=1}^n x_{ij} c_{ij}}{\sum_{j=1}^n x_{ij}}$$

Unattended (U): 
$$U_i = P_i - \sum_{j=1}^n x_{ij}$$



# ACESSO A CIDADE? SAÚDE

## OPTIMIZATION-BASED ACCESSIBILITY

Mensuração e localização  
da demanda não atendida

Transportation Research Part A 177 (2023) 103833

Contents lists available at ScienceDirect

Transportation Research Part A

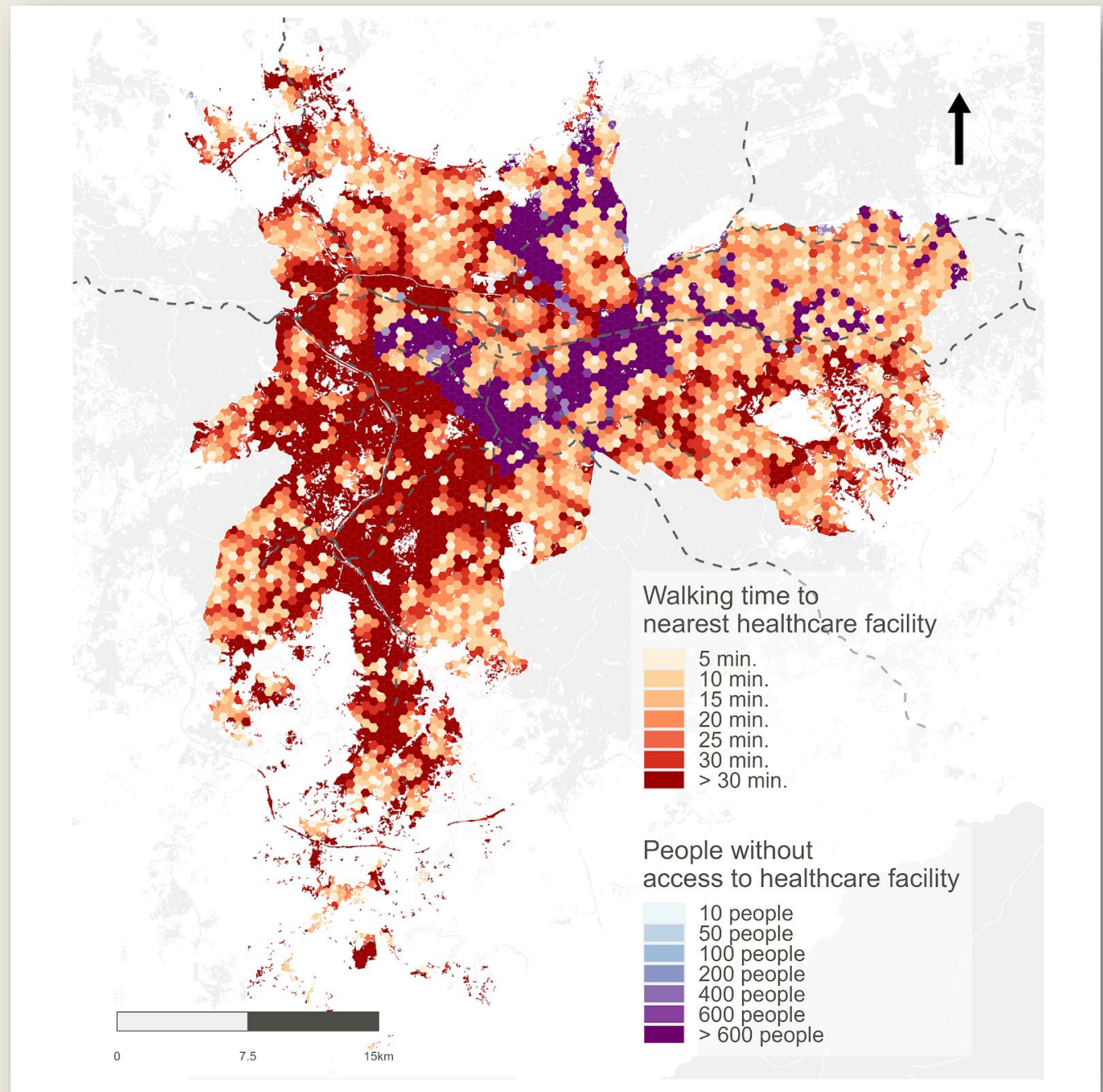
journal homepage: [www.elsevier.com/locate/tra](http://www.elsevier.com/locate/tra)



Evaluating the accessibility and availability of public services to reduce inequalities in everyday mobility

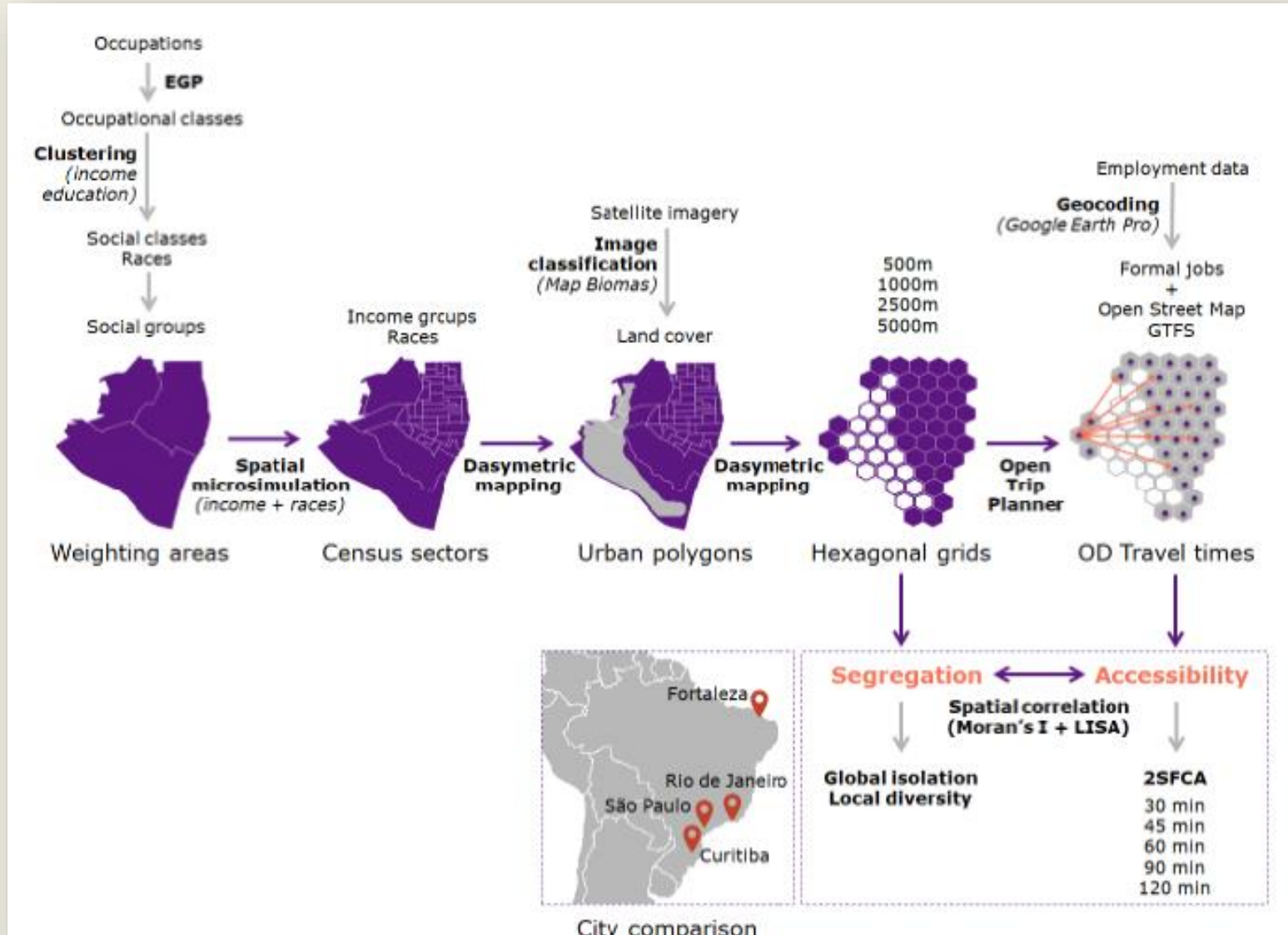
Tainá A. Bittencourt\*, Mariana Giannotti

Polytechnic School and Center for Metropolitan Studies, University of São Paulo, Brazil



# ACESSO EM MÚLTIPLAS CIDADES

Escalonando para várias cidades, de diferentes tamanhos, geografias, sistemas de transporte



Article

Urban Analytics and City Science

## Cumulative (and self-reinforcing) spatial inequalities: Interactions between accessibility and segregation in four Brazilian metropolises

EPB: Urban Analytics and City Science  
2021, Vol. 48(7) 1989–2005  
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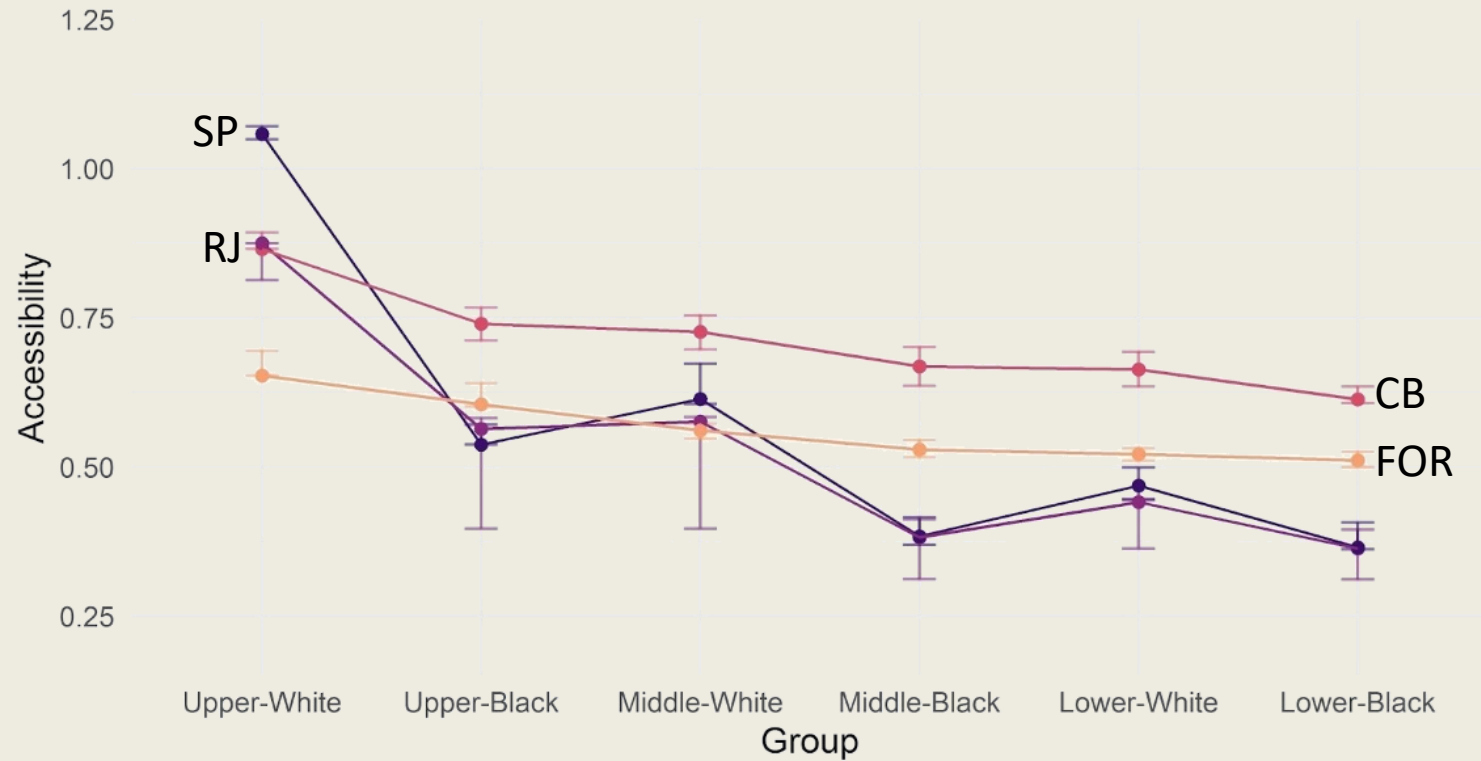


Tainá A Bittencourt , Mariana Giannotti and Eduardo Marques  
University of São Paulo, Brazil

BITTENCOURT, T. A.; GIANNOTTI, M.; MARQUES, E. Cumulative (and self-reinforcing) spatial inequalities: Interactions between accessibility and segregation in four Brazilian metropolises. *Environment and Planning B-Urban Analytics and City Science*, 2021.

# ACESSO EM MÚLTIPLAS CIDADES

Desigualdades de classe e raça



Article

Urban Analytics and City Science

**Cumulative (and self-reinforcing) spatial inequalities: Interactions between accessibility and segregation in four Brazilian metropolises**

EPB: Urban Analytics and City Science  
2021, Vol. 48(7) 1989–2005  
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DOI: 10.1177/2399808320958426  
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Tainá A Bittencourt , Mariana Giannotti and Eduardo Marques  
University of São Paulo, Brazil

BITTENCOURT, T. A.; GIANNOTTI, M.; MARQUES, E. Cumulative (and self-reinforcing) spatial inequalities: Interactions between accessibility and segregation in four Brazilian metropolises. **Environment and Planning B-Urban Analytics and City Science**, 2021.

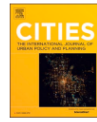
# ACESSO EM MÚLTIPLAS CIDADES RESOLUTION PROJECT REsilient Systems fOr Land Use TransportatION



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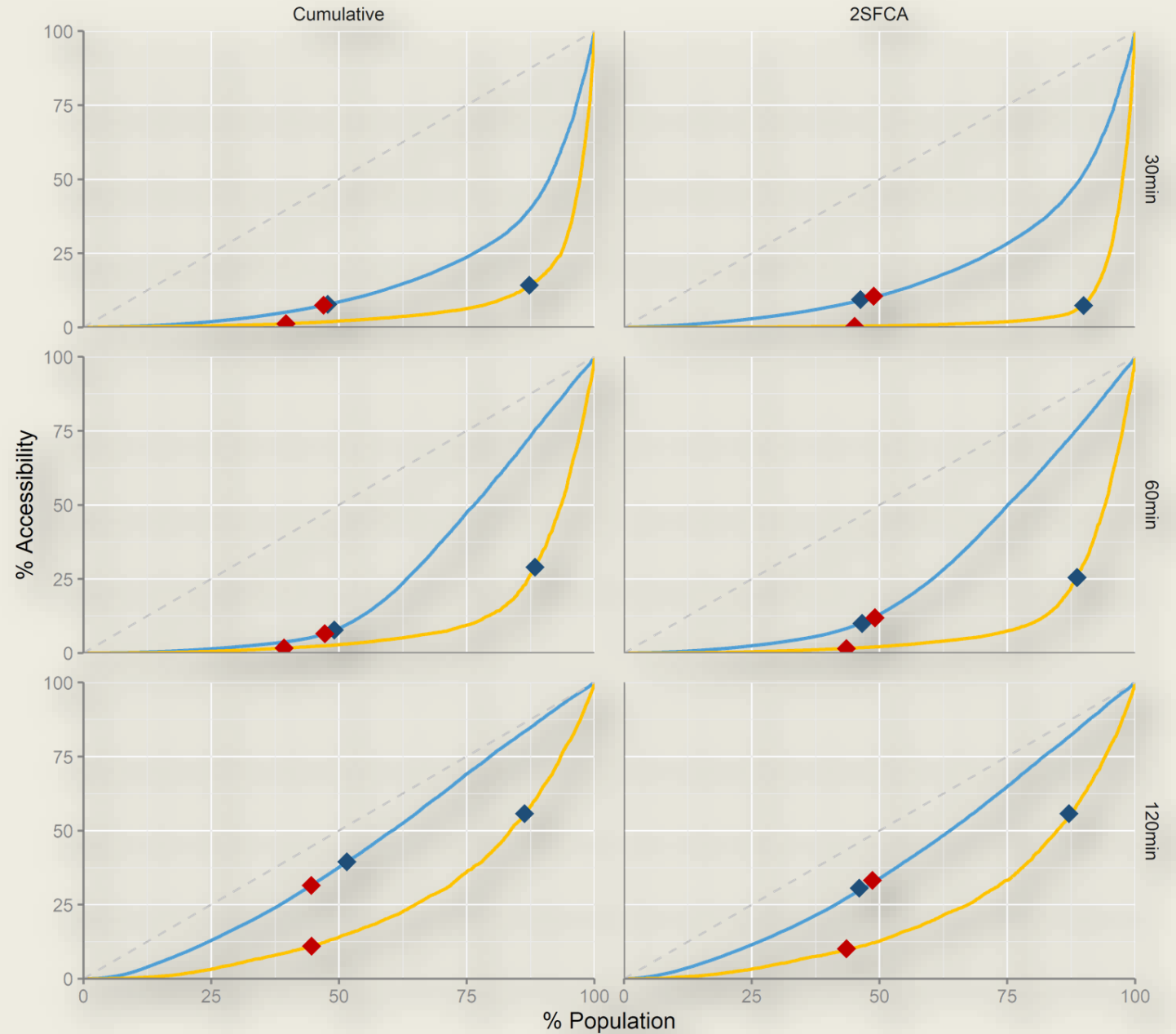
Cities

journal homepage: [www.elsevier.com/locate/cities](http://www.elsevier.com/locate/cities)



Inequalities in transit accessibility: Contributions from a comparative study between Global South and North metropolitan regions

Mariana Giannotti<sup>a,c,\*</sup>, Joana Barros<sup>b</sup>, Diego B. Tomasiello<sup>a</sup>, Duncan Smith<sup>c</sup>, Bruna Pizzol<sup>a</sup>, Beatriz M. Santos<sup>a</sup>, Chen Zhong<sup>d</sup>, Yao Shen<sup>e</sup>, Eduardo Marques<sup>e</sup>, Michael Batty<sup>c</sup>



City and Class  
— London  
— Sao Paulo

◆ Median Value G1  
◆ Median Value G7

# ACESSO EM MÚLTIPLAS CIDADES ASTRID PROJECT

Netherlands, UK, Brasil



Netherlands Organisation for Scientific Research



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TRANSPORT FINDINGS

## An International Comparison of Equity in Accessibility to Jobs: London, São Paulo and the Randstad

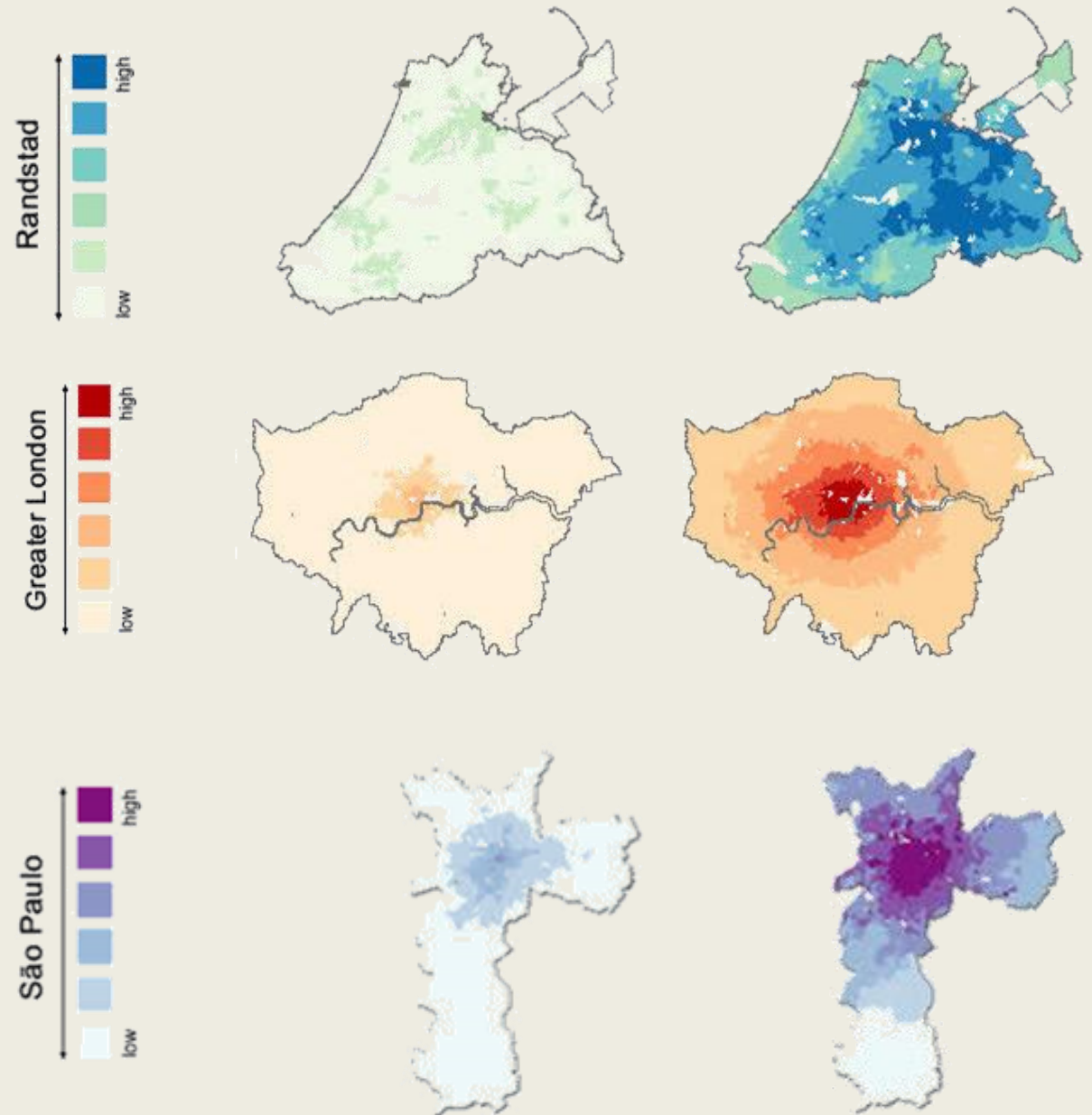
John P. Pritchard<sup>1</sup>, Diego Tomasiello<sup>2</sup>, Mariana Giannotti<sup>2</sup>, Karst Geurs<sup>1</sup>

<sup>1</sup> Centre for Transport Studies, University of Twente, <sup>2</sup> Polytechnic School, University of São Paulo

Keywords: london, randstad, são paulo, palma ratio, gini coefficient, equity, potential accessibility

<https://doi.org/10.32866/7412>

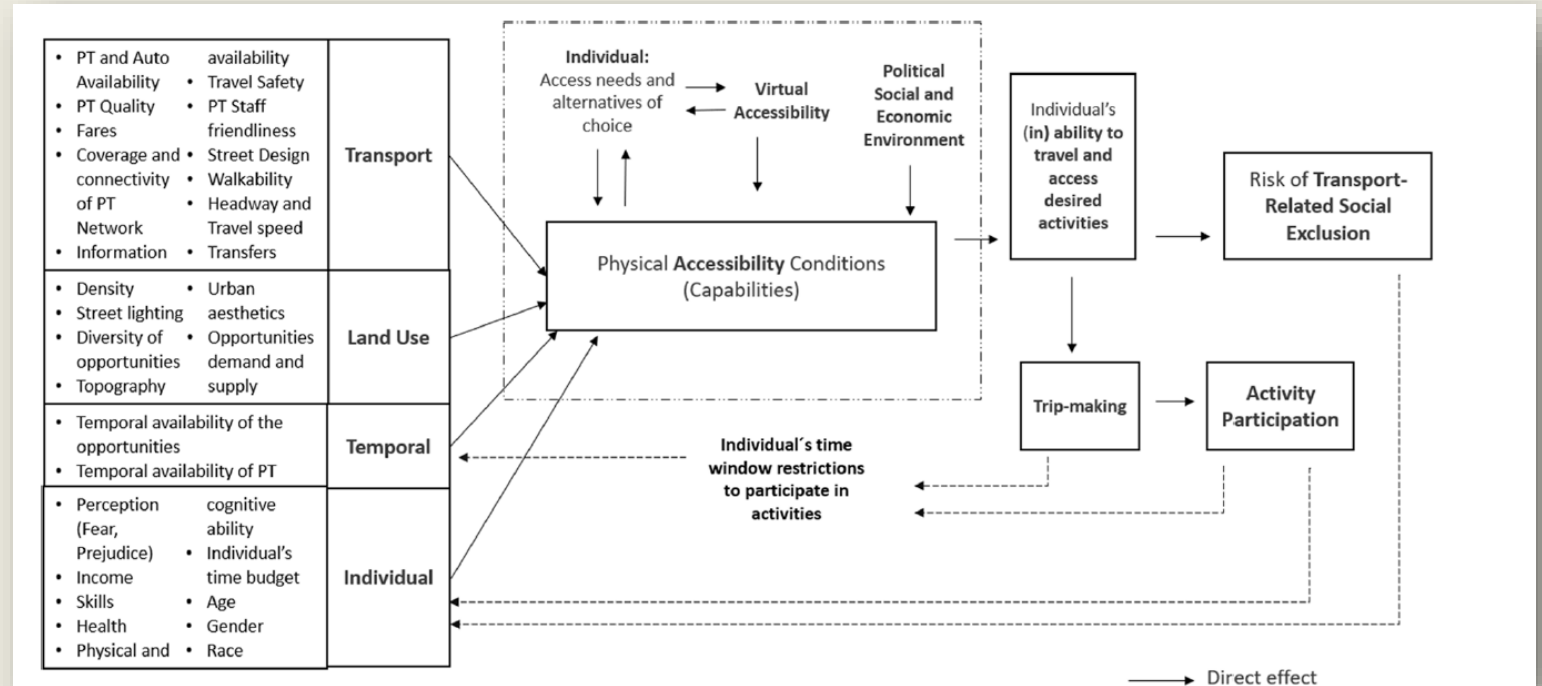
Transport Findings



PRITCHARD, J. P., TOMASIELLO, D., GIANNOTTI, M., & GEURS, K. (2019). An international comparison of equity in accessibility to jobs: London, São Paulo and the Randstad. Findings.

# ACESSO A CIDADE? RELAÇÃO CAUSAL COM ATIVIDADES

Método de inferência causal a partir de variável instrumental



$$\lambda_i = \exp(\beta_{0_i} + \beta_{1_i} X_1 + \beta_{2_i} X_2 + \beta_{3_i} X_3)$$

where,

$\lambda_i$ – Number of activities in which the individual participated..(i = Total, mandatory, discretionary)

$\beta_{0_i}$ – Intercept.

$X_1$ – Accessibility by public transport variable calculated from the CUM measure with a 90-minute threshold.

$X_2$ – Vector of variables with individual sociodemographic information.

$X_3$ – Vector of variables with information regarding the urban environment of the individual's residence.

$\beta_{1_i}, \beta_{2_i}, \beta_{3_i}$ – Coefficients or coefficient vectors of the respective independent variables.

Transportation Research Part A 166 (2022) 186–217



Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: [www.elsevier.com/locate/tra](http://www.elsevier.com/locate/tra)



Does better accessibility help to reduce social exclusion? Evidence from the city of São Paulo, Brazil

Gregório Luz<sup>a,b,\*</sup>, Matheus H.C. Barboza<sup>c,d</sup>, Licínio Portugal<sup>a</sup>, Mariana Giannotti<sup>e</sup>, Bert van Wee<sup>e</sup>

<sup>a</sup> Transport Engineering Program, Alvaro Luis Coimbra Institute for Graduate Studies and Research in Engineering (COPPE), Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro, Brazil

<sup>b</sup> Center for the Study of the Politics and Economics of the Public Sector, Getúlio Vargas Foundation (CEPES/PGV), São Paulo, Brazil

<sup>c</sup> Polyztechnic School, University of São Paulo (USP), São Paulo, Brazil

<sup>d</sup> Department of Civil Engineering, University of Twente, The Netherlands

<sup>e</sup> Transport and Logistics Group, Faculty Technology, Policy and Management, Delft University of Technology, Delft, The Netherlands

LUZ, G., BARBOZA, M. H., PORTUGAL, L., GIANNOTTI, M., & van WEE, B. (2022). Does better accessibility help to reduce social exclusion? Evidence from the city of São Paulo, Brazil. Transportation research part A: policy and practice, 166, 186-217.



## Mapear a cidade: dados para soluções em engenharia dos problemas urbanos

- ✓ Mobilidade
- ✓ Infraestrutura viária
- ✓ Acesso a cidade



## Subsidiar a inovação, o monitoramento e a avaliação de políticas e práticas urbanas

- ✓ Transporte público (redes metroferroviária e ônibus)

Transporte ativo (redes cicloviária e pedonal)

Habitação de interesse social

### Visão estratégica

Pesquisa

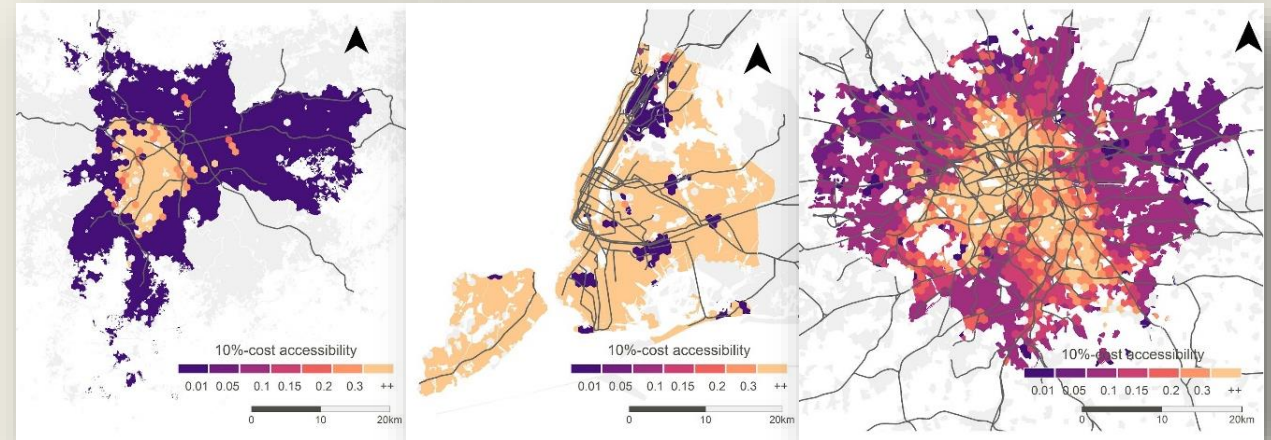
Extensão

# AVALIAÇÃO DE POLÍTICA TARIFÁRIA

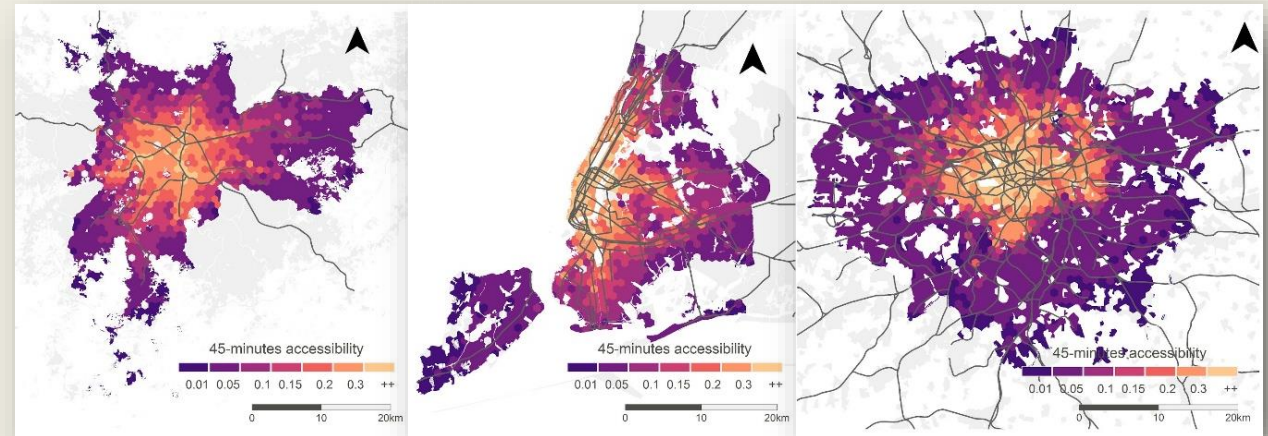
São Paulo, New York, London



Cost 30-40 % x 5-10%



Time



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

**Cities**

journal homepage: [www.elsevier.com/locate/cities](http://www.elsevier.com/locate/cities)



The unequal impacts of time, cost and transfer accessibility on cities, classes and races

Tainá A. Bittencourt<sup>\*</sup>, Mariana Giannotti

*Polytechnic School and Center for Metropolitan Studies, University of São Paulo, Brazil*

BITTENCOURT, T. A.; GIANNOTTI, M. The unequal impacts of time, cost and transfer accessibility on cities, classes and races. *Cities*. , v.116, p.103257, 2021.



# Subsidiar políticas públicas e práticas urbanas para o transporte público (ônibus)

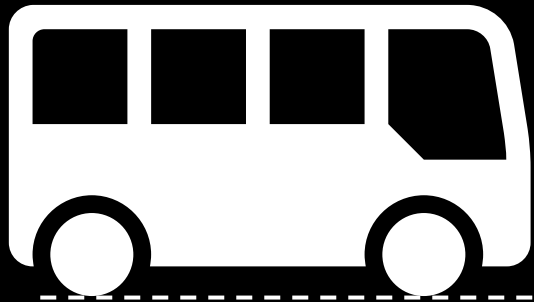
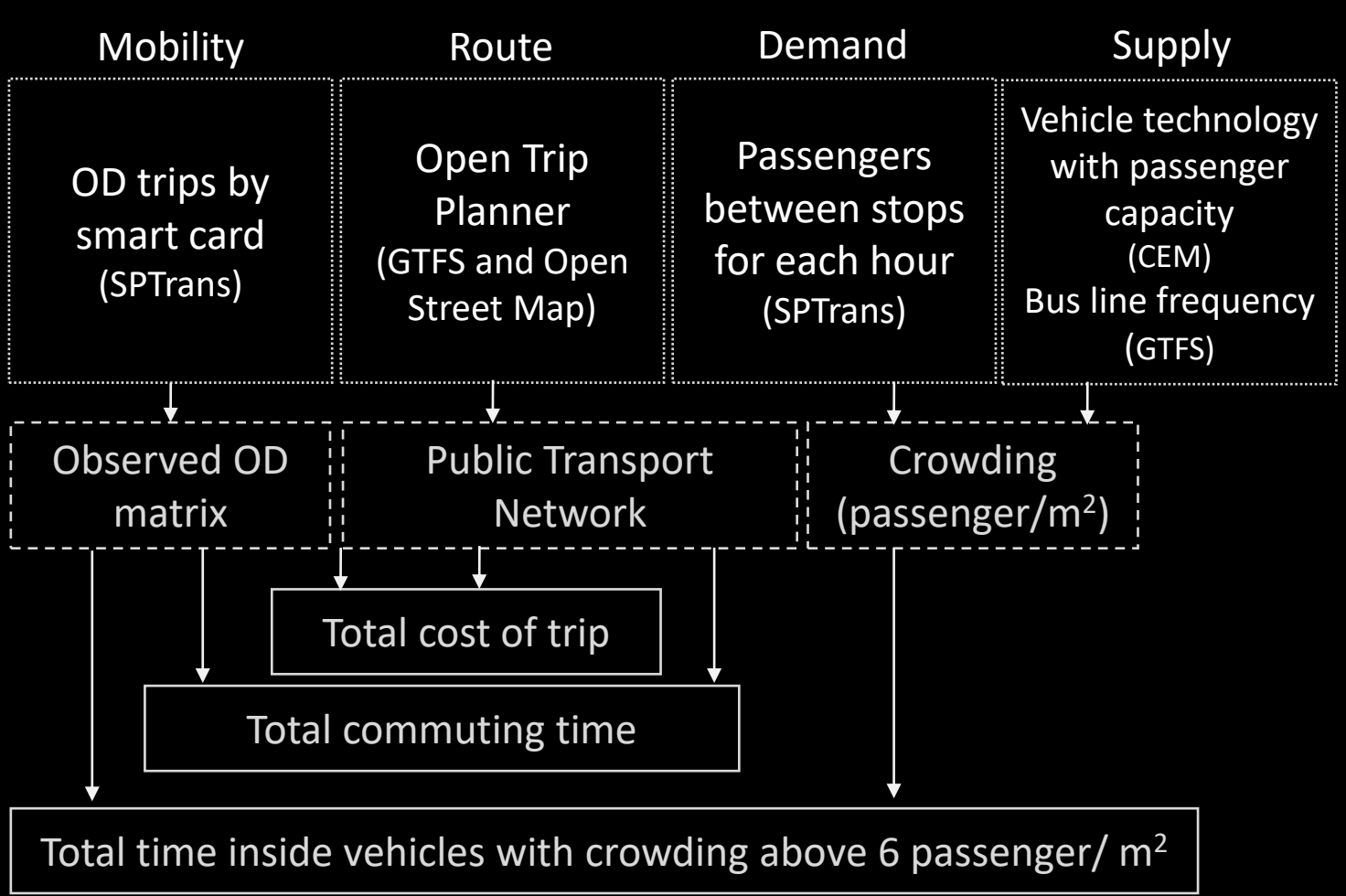


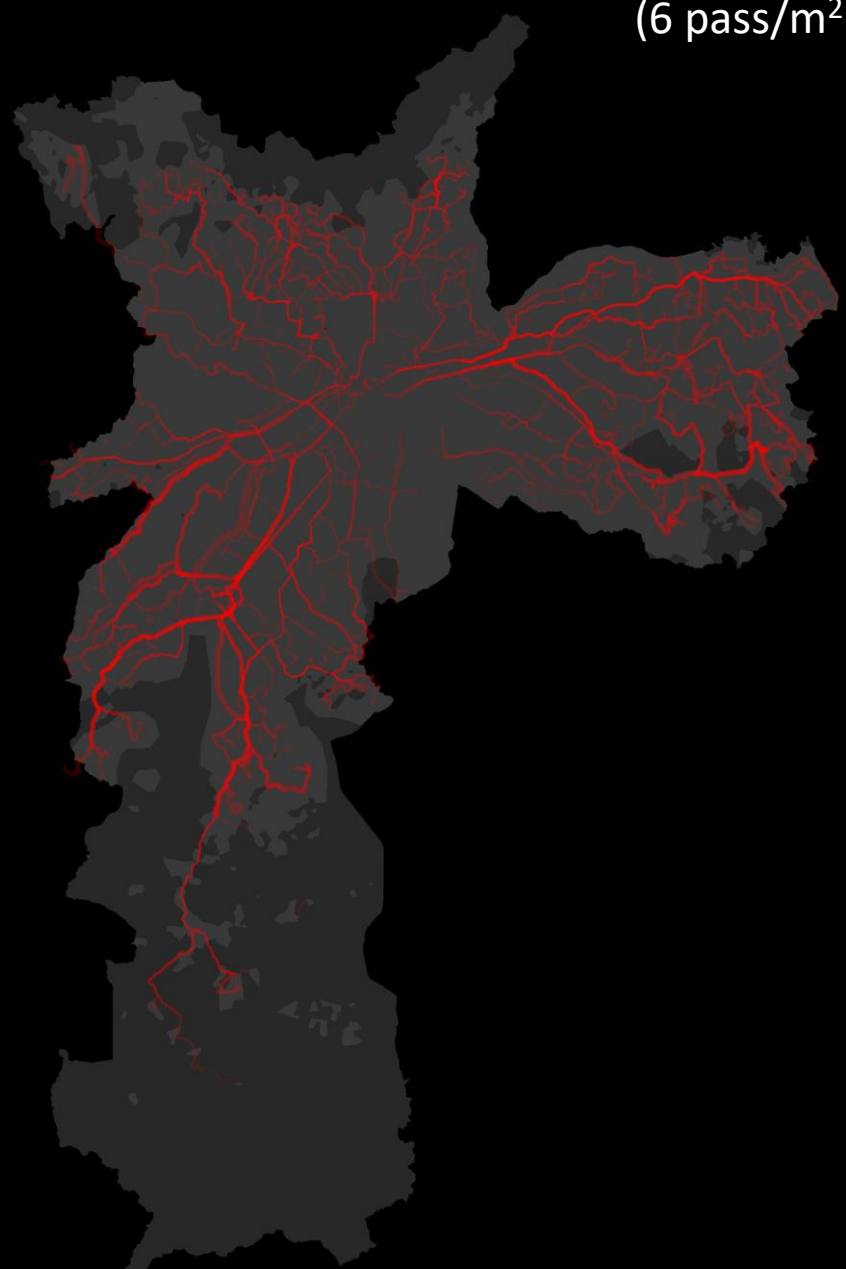


Foto: Yan Marcelo

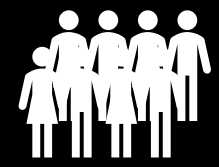


0 horas

Crowding  
(6 pass/m<sup>2</sup>)



**14,000** bus  
**1,300** bus lines  
**20,000** bus stops  
**10 mi** card holders



0 min white middle - upper class  
 > 30 min white / black - lower class



< 9 BRL white - upper class  
 > 18 BRL black - lower class

# TRANSPORTE PÚBLICO ÔNIBUS BEonTIME-SP

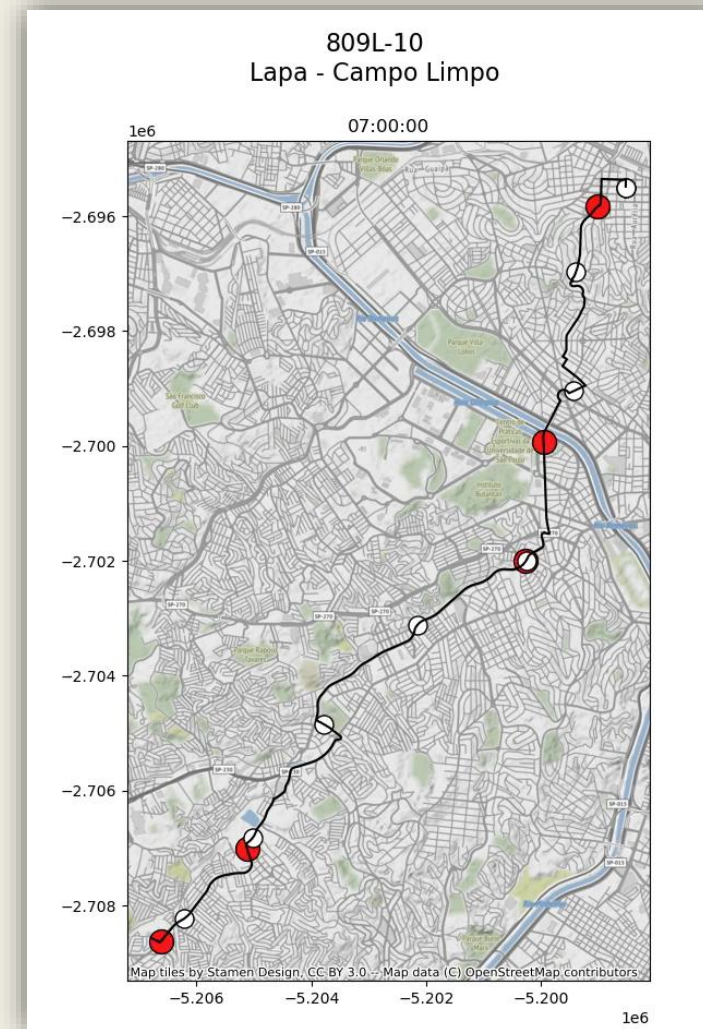


UNIVERSIDAD  
COMPLUTENSE  
MADRID

centro de estudios da metrópole



Proyecto CAS21/00281 (BEonTIME-SP),  
movilidad de jóvenes doctores "José  
Castillejo" 2021, Ministerio de Universidades  
(Spain)



white – theory  
red - reality

GÓMEZ, B., M.; GIANNOTTI, M. Open Data for Evaluating Transit Systems. Challenges in Converting Real-Time Data into GTFS?. CIT 2023 XV Congreso de Ingeniería del Transporte., La Laguna, Tenerife, 2023.

# TRANSPORTE PÚBLICO ÔNIBUS

## BEonTIME-SP



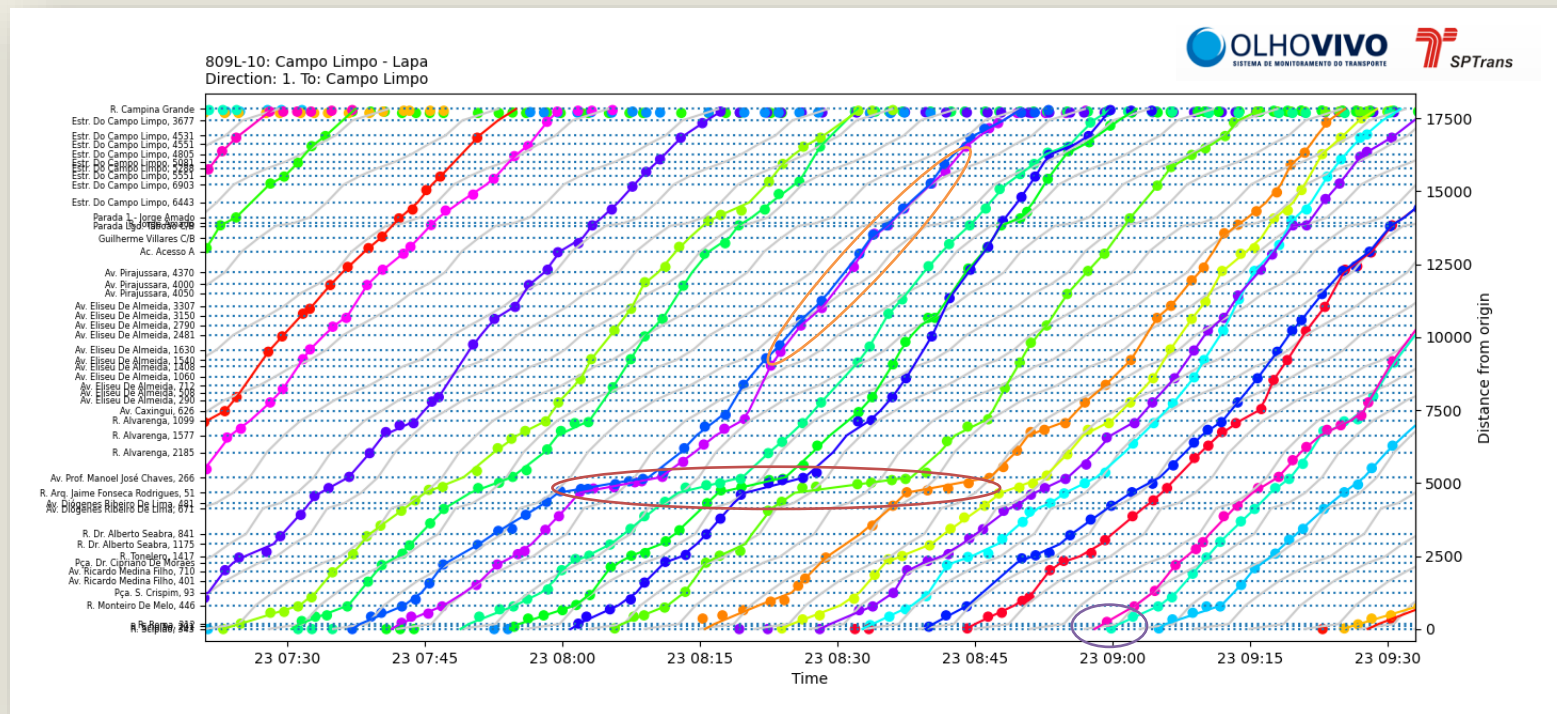
centro de estudos da metrópole



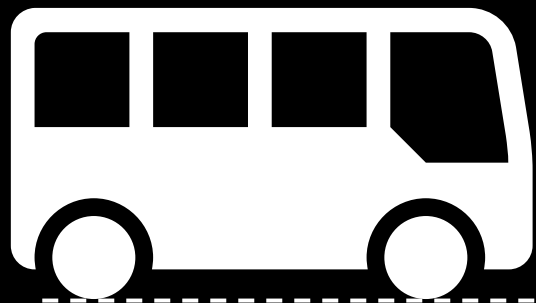
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COMPLUTENSE  
MADRID



Proyecto CAS21/00281 (BEonTIME-SP),  
movilidad de jóvenes doctores "José  
Castillejo" 2021, Ministerio de Universidades  
(Spain)

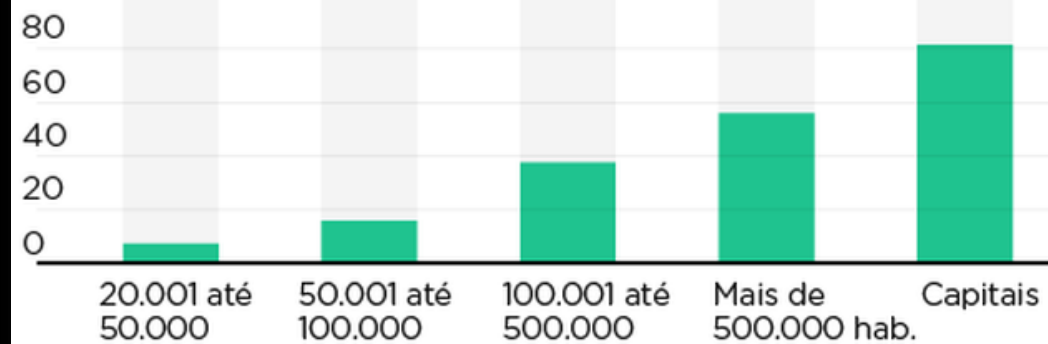


GÓMEZ, B., M.; GIANNOTTI, M. Open Data for Evaluating Transit Systems. Challenges in  
Converting Real-Time Data into GTFS?. CIT 2023 XV Congreso de Ingeniería del Transporte., La  
Laguna, Tenerife, 2023.



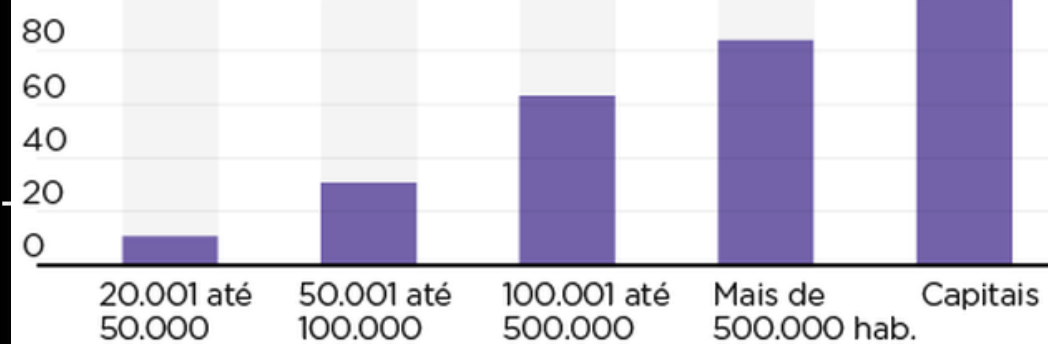
## GPS

100% de presença



## BILHETAGEM

100% de presença



# Subsidiar políticas públicas e práticas urbanas para o transporte público (rede metroferroviária)



# AVALIAÇÃO DE POLÍTICAS PÚBLICAS REDE METROFERROVIÁRIA

Avaliação *ex-post* de diferentes configurações da rede a partir de machine learning e geoprocessamento

Journal of Cleaner Production 237 (2019) 117732

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: [www.elsevier.com/locate/jclepro](http://www.elsevier.com/locate/jclepro)



Learning about spatial inequalities: Capturing the heterogeneity in the urban environment

Juliana Siqueira-Gay<sup>a,\*</sup>, Mariana Giannotti<sup>b</sup>, Monika Sester<sup>c</sup>

<sup>a</sup> Escola Publicidade, University of São Paulo (USP), Brazil  
<sup>b</sup> Laboratory for Geospatial Analysis at Escola Politécnica, University of São Paulo (USP), Brazil  
<sup>c</sup> Institut für Kartographie und Geoinformatik at Leibniz Universität Hannover (LH), Germany

## ARTICLE INFO

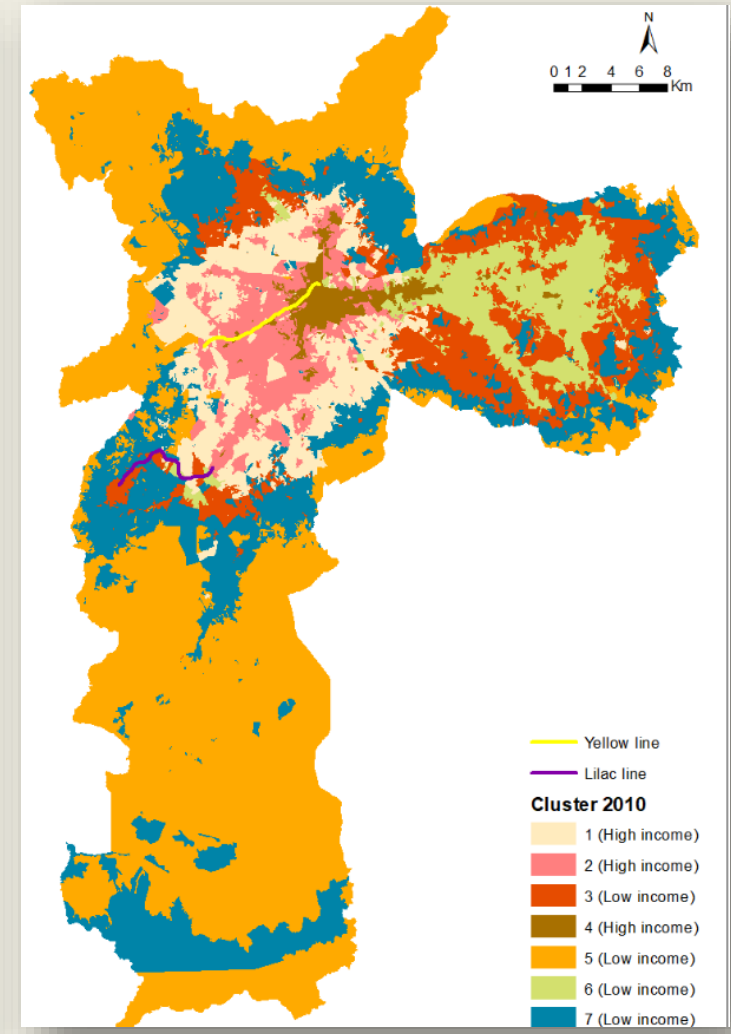
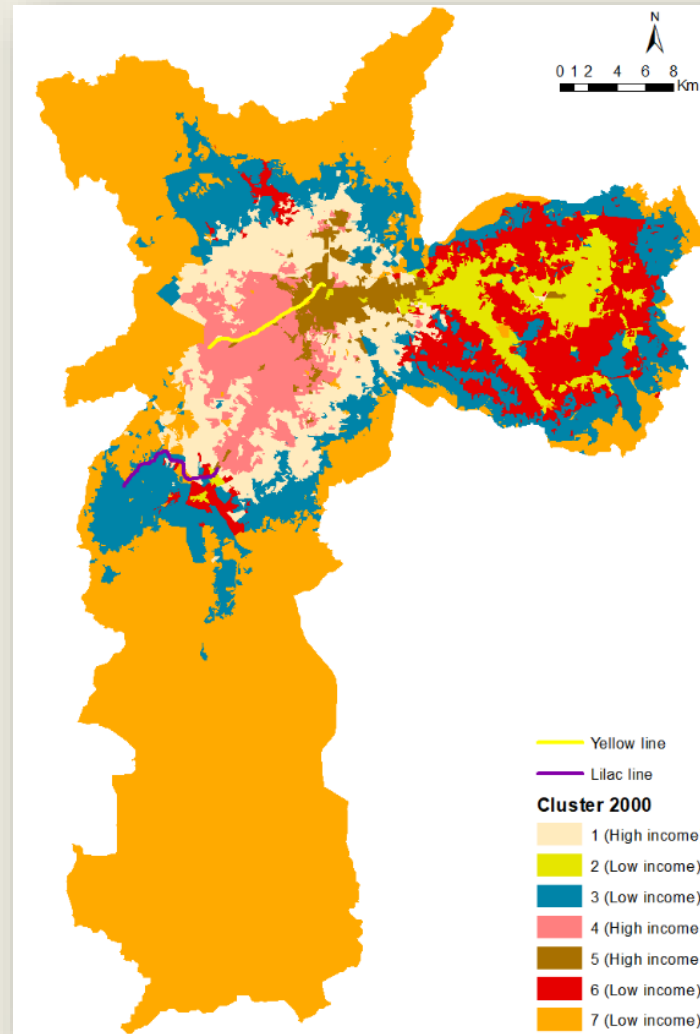
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Accessibility  
K-means  
Sustainable development  
São Paulo  
Urban planning

## ABSTRACT

Transportation systems can be conceptualized as an instrument of connecting people and their activities over the territory, playing an important role in developing sustainable cities. The current rationale of transport provision is based on population demand and rarely considers the potential of minimizing spatial disparities and uneven distribution of services. To meet the challenge of supporting a more equitable resources distribution, this work aims at identifying and describing patterns of urban services supply, their accessibility, and household income. By using a multidimensional approach, the spatial inequalities of a large city of the global south reveal that the low-income population has low access mainly to hospitals and cultural centers. A low-income group presents an intermediate level of accessibility to public schools and sports centers, evidencing the diverse condition of citizens in the peripheries. These complex outcomes generated by the interaction of land use and public transportation emphasize the importance of comprehensive methodological approaches to support decisions of urban projects, plans and programs. Reducing spatial inequalities, especially providing services for deprived groups, is fundamental to promote the sustainable use of resources and optimize the daily commuting. © 2019 Elsevier Ltd. All rights reserved.



SIQUEIRA-GAY, J., GIANNOTTI, M., & SESTER, M. (2019). Learning about spatial inequalities: Capturing the heterogeneity in the urban environment. Journal of Cleaner Production, 237, 117732.



# AVALIAÇÃO DE POLÍTICAS PÚBLICAS REDE METROFERROVIÁRIA

Avaliação *ex-ante* de diferentes  
configurações da rede



Journal of Transport Geography 116 (2024) 103825



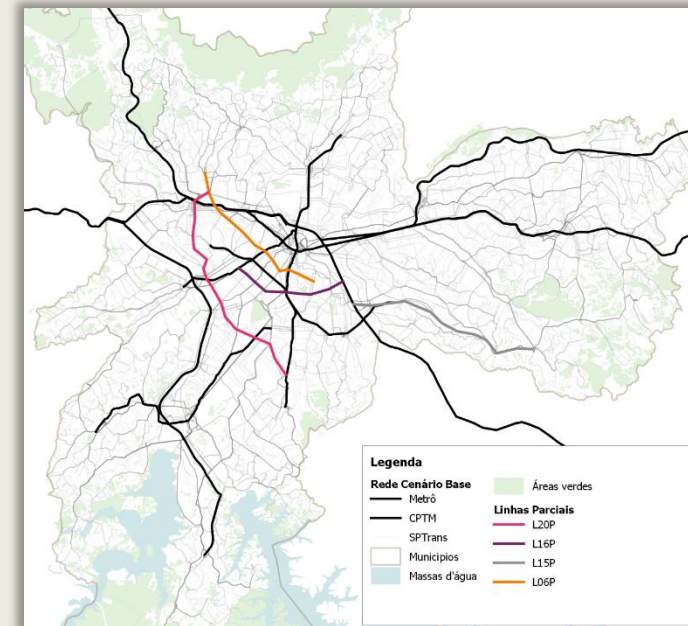
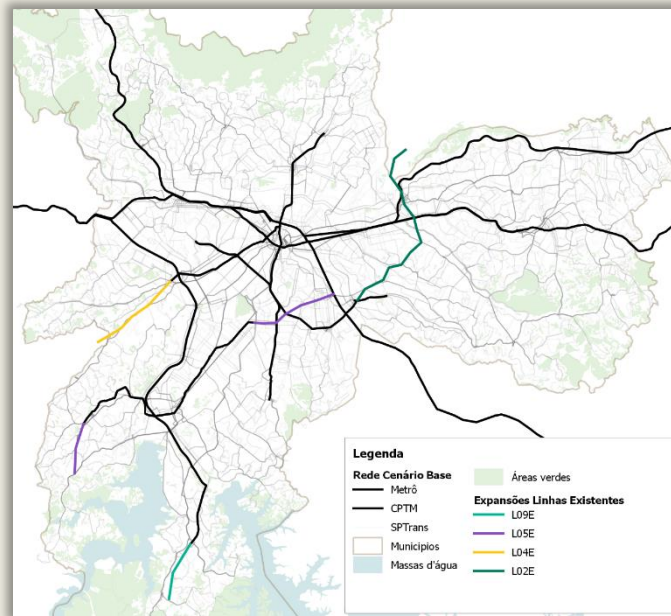
Contents lists available at ScienceDirect  
Journal of Transport Geography

journal homepage: [www.elsevier.com/locate/jtrangeo](http://www.elsevier.com/locate/jtrangeo)

Are mass transit projects and public transport planning overlooking uneven distributional effects? Empirical evidence from Sao Paulo, Brazil

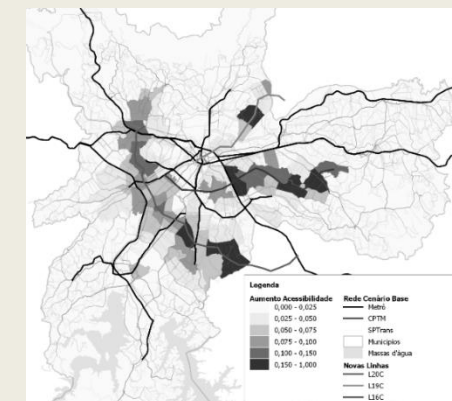
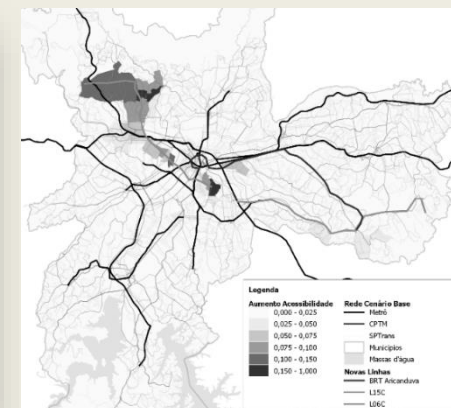
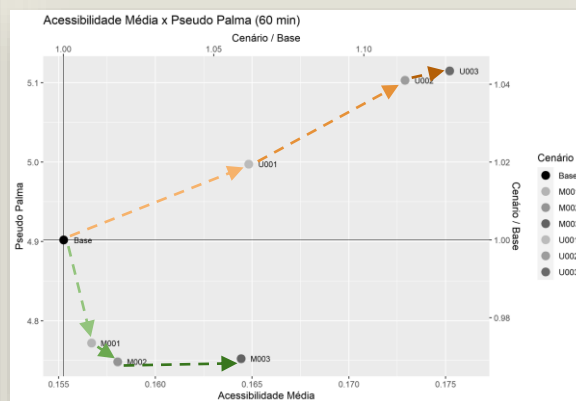
Germán Freiberg<sup>a</sup>, Mariana Giannotti<sup>a</sup>, Taina A. Bittencourt

<sup>a</sup>Center for Metropolitan Studies and Laboratory for Geospatial Analysis at Polytechnic School, University of São Paulo, São Paulo 05508-070, SP, Brazil

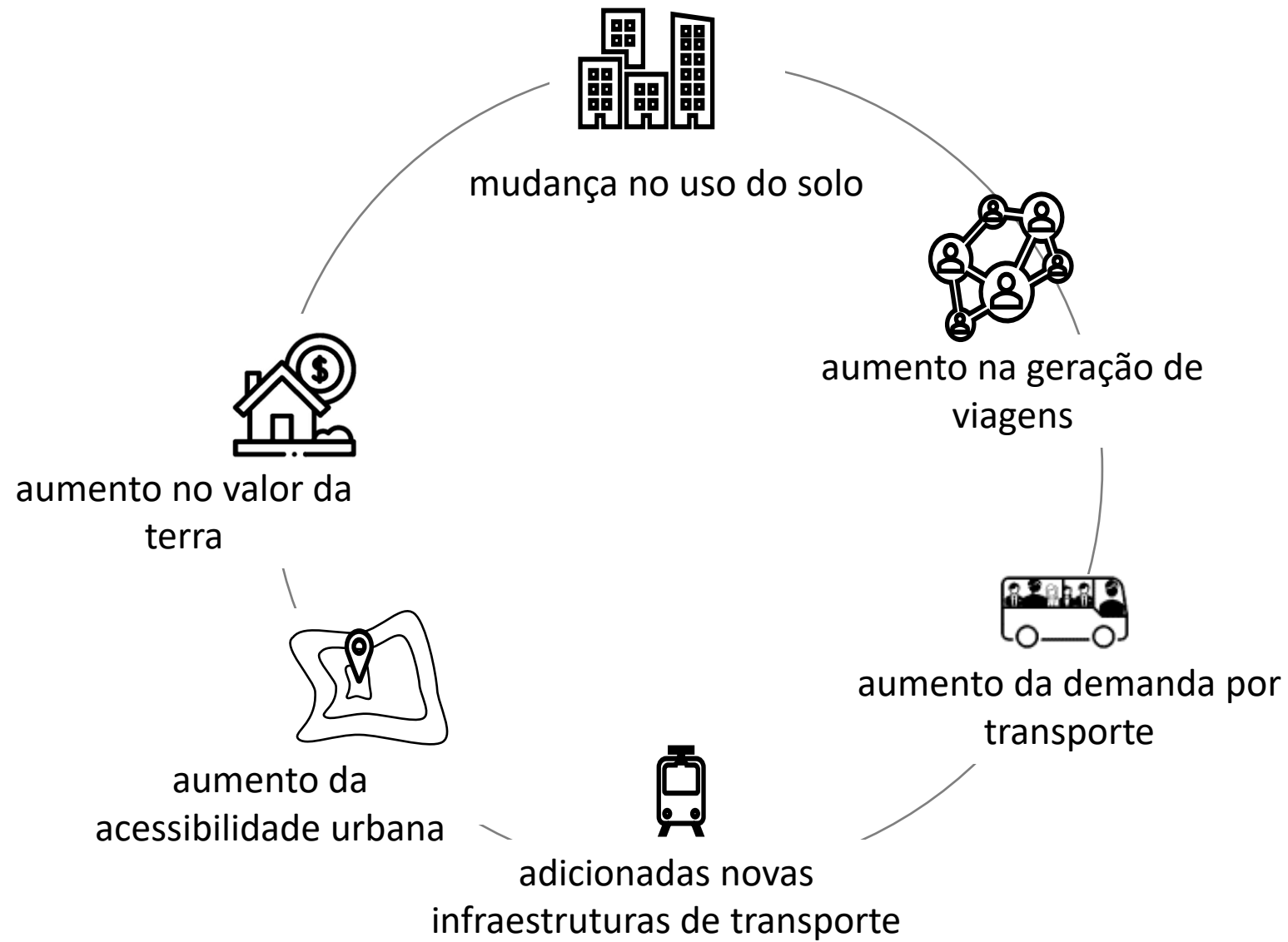


Cenários Maximax

Cenários Utilitaristas



FREIBERG, G., GIANNOTTI, M., & BITTENCOURT, T. (2024). Are mass transit projects and public transport planning overlooking distributional effects to tackle inequalities? *Journal of Transport Geography*, 116, 103825.



Ciclo do uso do solo e transportes (traduzido de Paquette et al., 1972)



# AVALIAÇÃO DE POLÍTICAS PÚBLICAS MODELAGEM DINÂMICA ESPACIAL

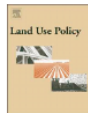
Gentrificação relacionada às  
infraestruturas de transporte,  
mudanças de uso do solo

Land Use Policy 99 (2020) 104992

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: [www.elsevier.com/locate/landusepol](http://www.elsevier.com/locate/landusepol)

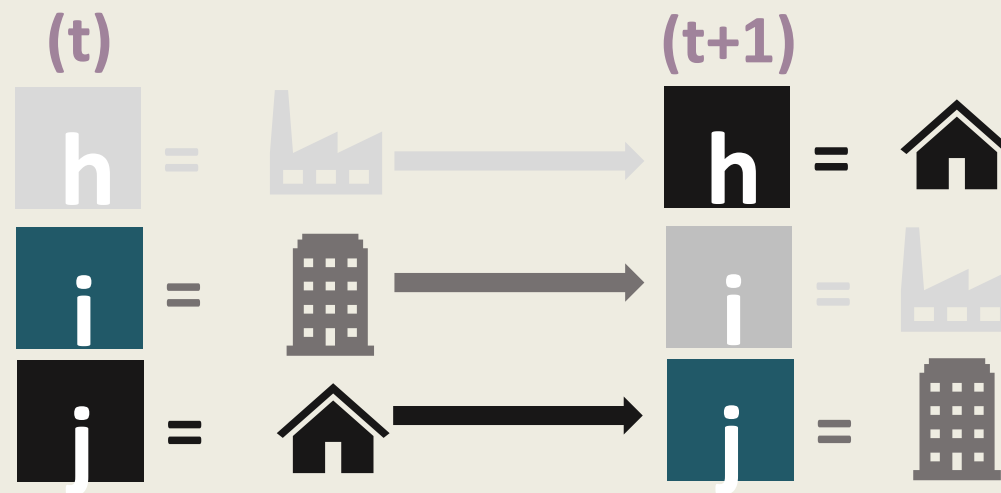
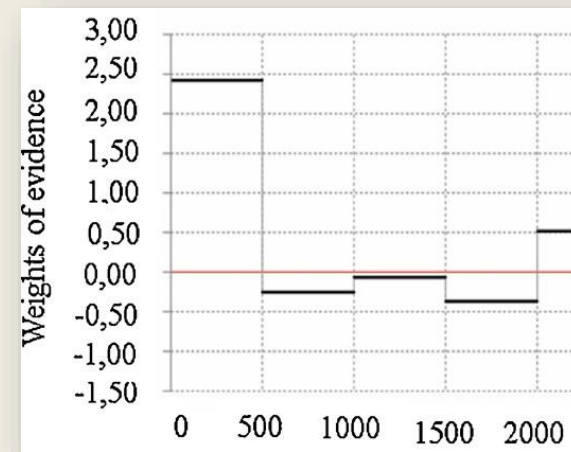
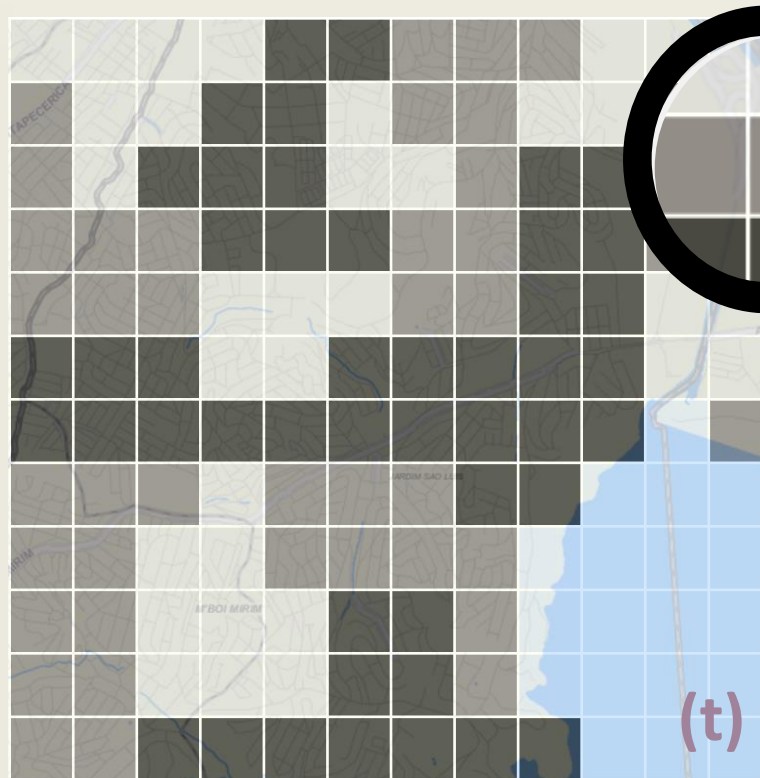


Dynamic modeling to support an integrated analysis among land use change, accessibility and gentrification



Camilla Almeida Silva<sup>a,\*,</sup> Mariana Giannotti<sup>a,b,</sup> Cláudia Maria de Almeida<sup>c</sup>

<sup>a</sup> Polytechnic School of the University of São Paulo (USP), Av. Prof. Almeida Prado, 83 - 05508-070, São Paulo, Brazil  
<sup>b</sup> Center for Metropolitan Studies (CEM), Av. Prof. Luciano Gualberto, 315 - Sala 116 B, 05508-010, São Paulo, Brazil  
<sup>c</sup> National Institute for Space Research (INPE), Av. dos Astronautas, 1758 - 12227-010, São José dos Campos, SP, Brazil



SILVA, C. A.; GIANNOTTI, M.; ALMEIDA, C. M. Dynamic modeling to support an integrated analysis among land use change, accessibility and gentrification. **Land Use Policy**, v.99, p.104992, 2020.

# AVALIAÇÃO DE POLÍTICAS PÚBLICAS MODELAGEM DINÂMICA ESPACIAL

Modelagem baseada em agentes  
(bottom-up)  
Simulação de cenários, diferentes  
configurações de rede e HIS

Computers, Environment and Urban Systems 81 (2020) 101462

Contents lists available at ScienceDirect



Computers, Environment and Urban Systems

journal homepage: [www.elsevier.com/locate/ceus](http://www.elsevier.com/locate/ceus)

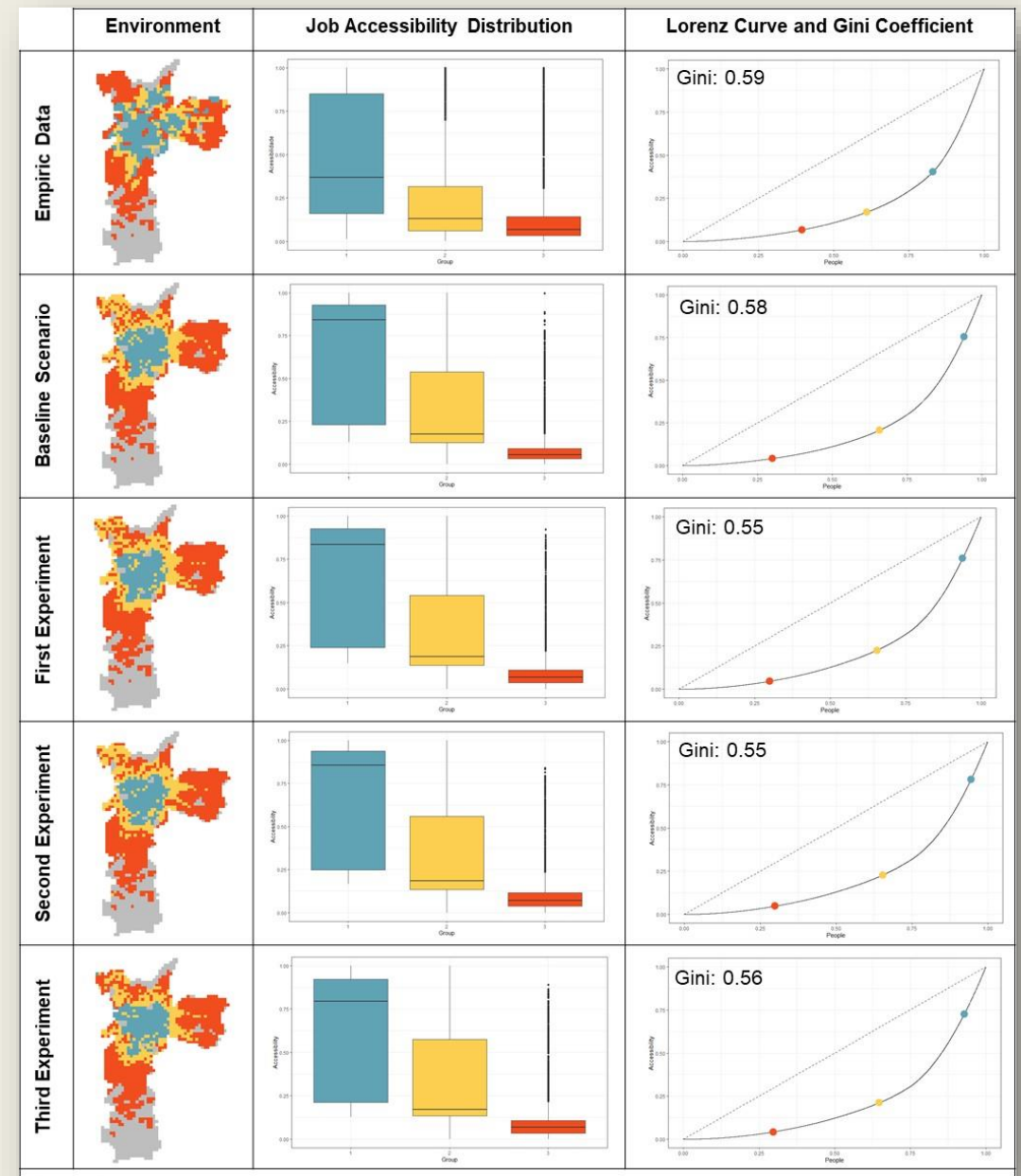
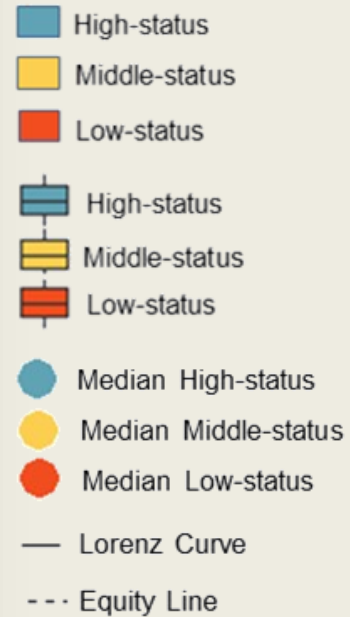


ACCESS: An agent-based model to explore job accessibility inequalities

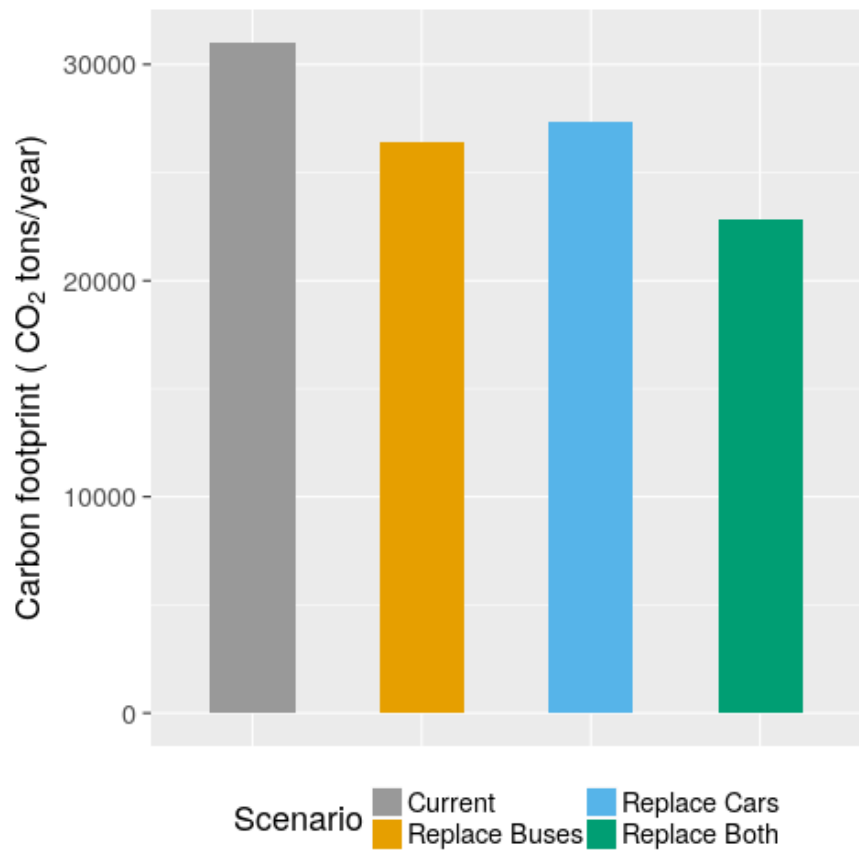
Diego Bogado Tomasiello<sup>a,\*</sup>, Mariana Giannotti<sup>b</sup>, Flávia F. Feitosa<sup>b</sup>

<sup>a</sup> LabGeo - Laboratory for Geospatial Analysis, Polytechnic School, University of São Paulo, Av. Prof. Almeida Prado, trav.2 n.º 83, Edifício Paula Souza (Prédio da Engenharia Civil), São Paulo, SP 05508-900, Brazil

<sup>b</sup> Federal University of ABC, Center for Engineering, Modeling and Applied Social Sciences, Alameda da Universidade, Anchieta, São Bernardo do Campo, SP 09066-045, Brazil

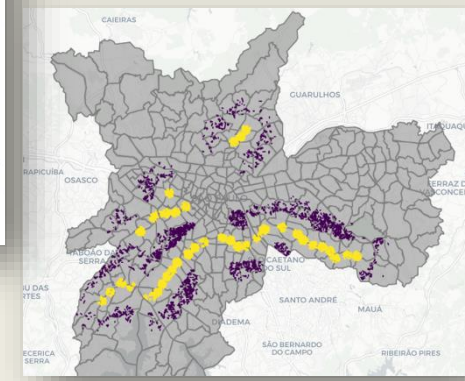
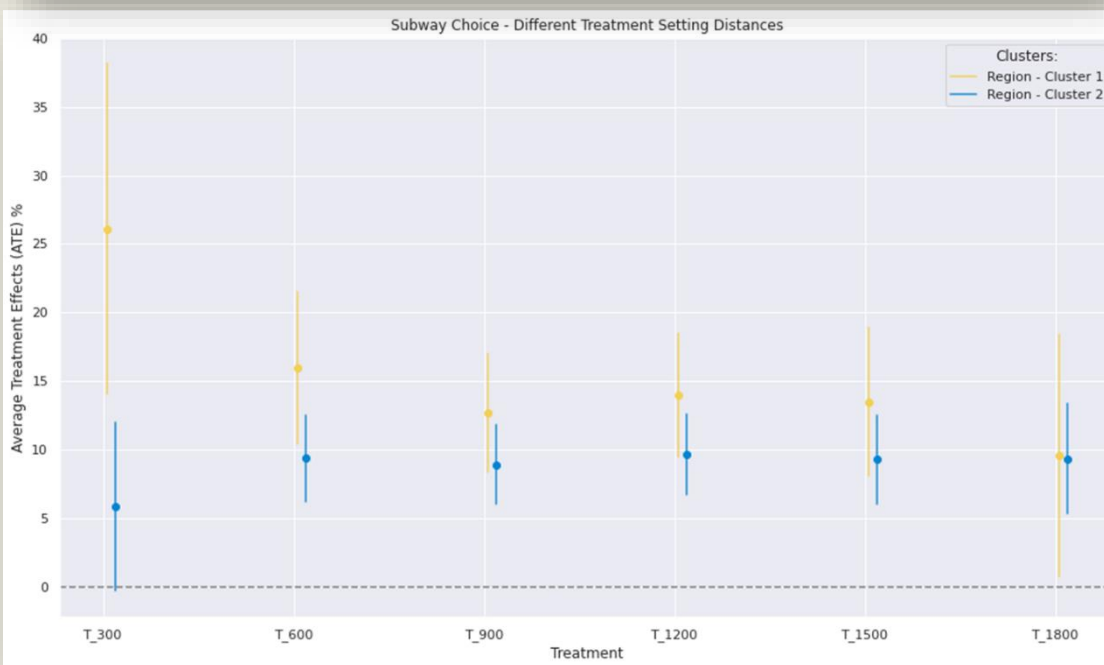
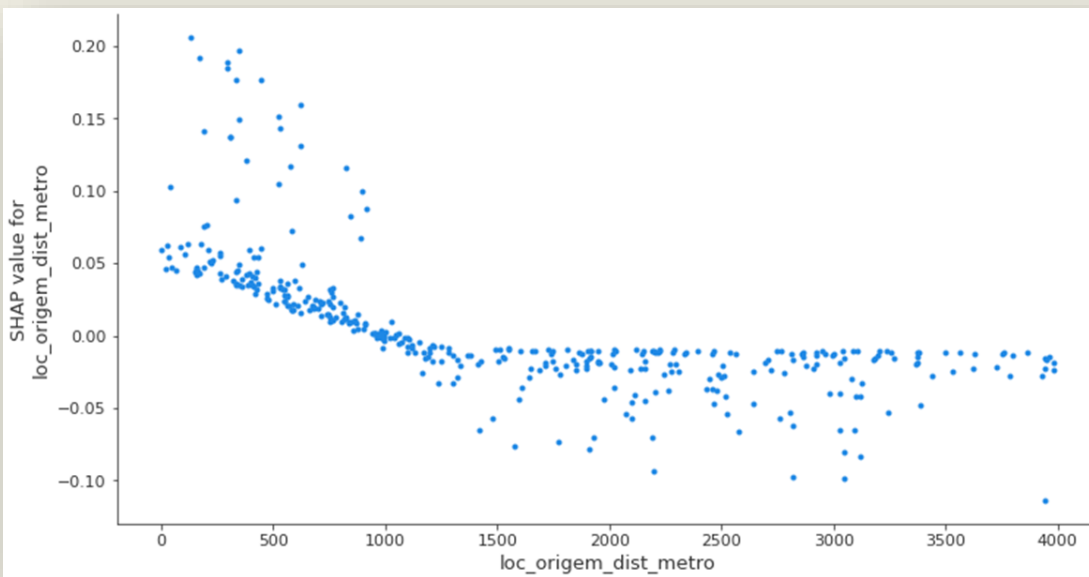


TOMASIELLO, D. B.; GIANNOTTI, M.; FEITOSA, F. F. ACCESS: An agent-based model to explore job accessibility inequalities. Computers Environment and Urban Systems. , v.81, p.101462 , 2020



# AVALIAÇÃO DE POLÍTICAS PÚBLICAS REDE METROFERROVIÁRIA

# INTELIGÊNCIA ARTIFICIAL E INFERÊNCIA CAUSAL





## Mapear a cidade: dados para soluções em engenharia dos problemas urbanos

- ✓ Mobilidade
- ✓ Infraestrutura viária
- ✓ Acesso a cidade



## Subsidiar a inovação, o monitoramento e a avaliação de políticas e práticas urbanas

- ✓ Transporte público (redes metroferroviária e ônibus)
- ✓ Transporte ativo (redes cicloviária e pedonal)

Habitação de interesse social

Visão estratégica

Pesquisa

Extensão



# Subsidiar políticas públicas e práticas urbanas para o transporte ativo



# POLÍTICAS PÚBLICAS E PRÁTICAS URBANAS TRANSPORTE ATIVO

Pesquisas qualitativas em cidades brasileiras: bicicleta e baixa renda



- (i) **questionários** estruturados (pesquisa) com usuários de transporte público
- (ii) **entrevistas espontâneas** em **espaços públicos** (ruas, praças, pontos e estações de ônibus)
- (iii) **entrevistas semiestruturadas** agendadas e
- (iv) **grupos focais**



# POLÍTICAS PÚBLICAS E PRÁTICAS URBANAS TRANSPORTE ATIVO

Diagnóstico do impacto potencial da integração modal entre bicicleta e transporte público no acesso ao trabalho



UNIVERSITY OF TWENTE.



ELSEVIER

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: [www.elsevier.com/locate/tra](http://www.elsevier.com/locate/tra)



Potential impacts of bike-and-ride on job accessibility and spatial equity in São Paulo, Brazil

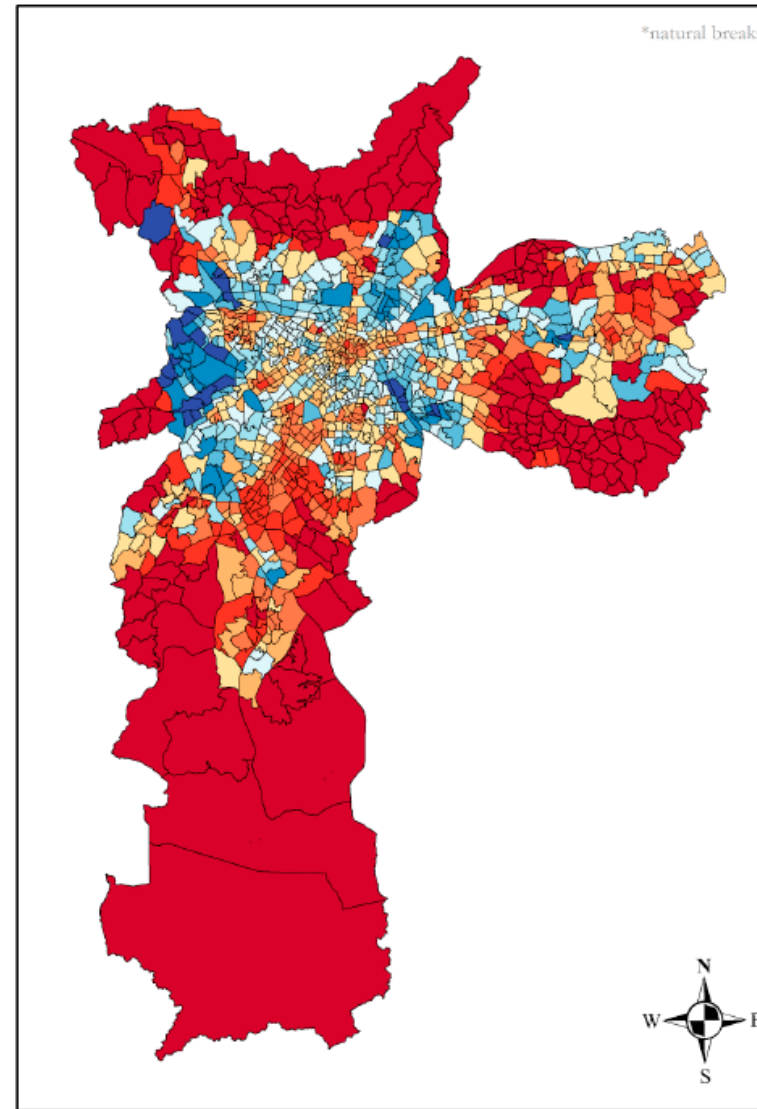
John P. Pritchard<sup>a,\*</sup>, Diego Bogado Tomasiello<sup>b</sup>, Mariana Giannotti<sup>b</sup>, Karst Geurs<sup>a</sup>

<sup>a</sup>Centre for Transport Studies, University of Twente, 7500 AE Enschede, the Netherlands

<sup>b</sup>Polytechnic School, University of São Paulo, São Paulo, Brazil



Percentage increase of accessibility due to bike-and-ride - 7:00 a.m.



## Increase

- 0.0% - 4.7%
- 4.8% - 10.9%
- 11.0% - 16.7%
- 16.8% - 22.7%
- 22.8% - 28.7%
- 28.8% - 34.7%
- 34.8% - 41.6%
- 41.7% - 51.5%
- 51.6% - 67.0%
- 67.1% - 92.3%

Paul, Jan, Ruetger e Koen

PRITCHARD, J. P.; TOMASIELLO, D. B.; GIANNOTTI, M.; GEURS, K. Potential impacts of bike-and-ride on job accessibility and spatial equity in São Paulo, Brazil. Transportation Research Part A- Policy and Practice. , v.121, p.386 - 400, 2019.

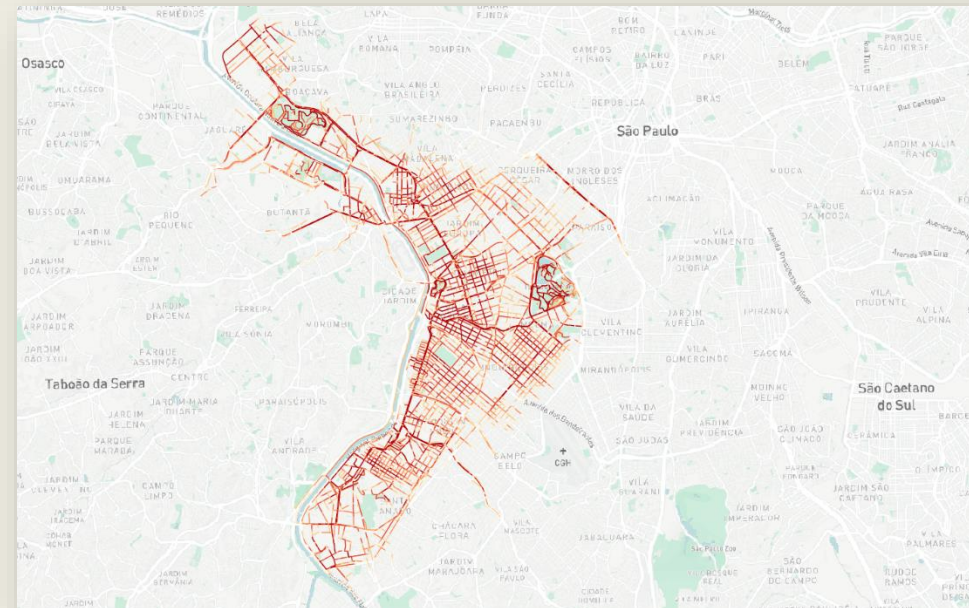
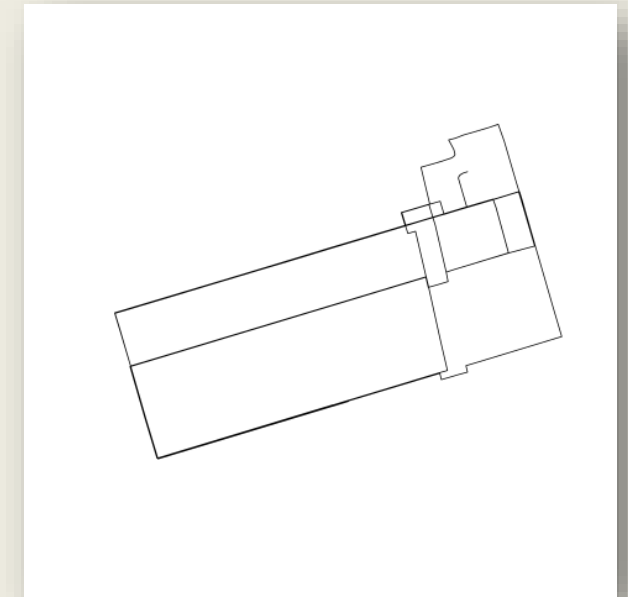
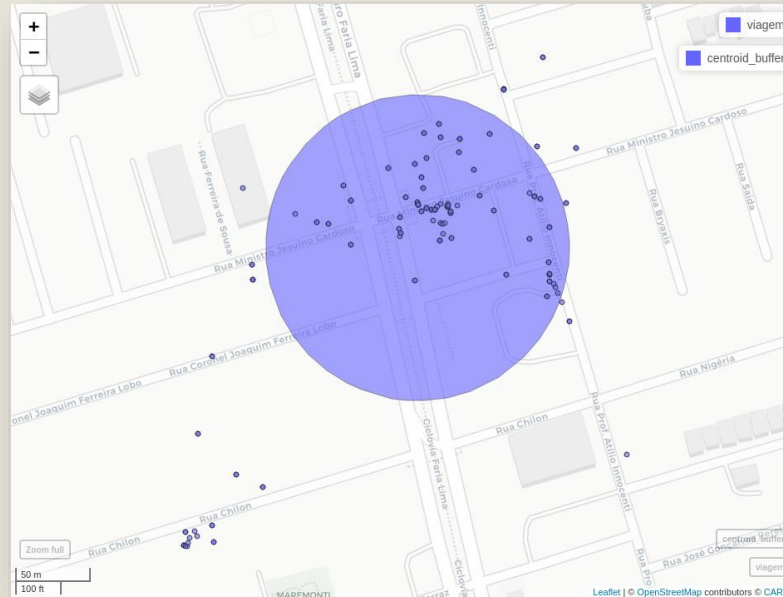
# POLÍTICAS PÚBLICAS E PRÁTICAS URBANAS TRANSPORTE ATIVO

Modelo de velocidades baseado em dados da Yellow

Nov/18 a Jan/19

301.696 viagens rastreadas

5 segundos de interval (médio)



Mestrado Flávio Soares (em andamento)

# POLÍTICAS PÚBLICAS E PRÁTICAS URBANAS TRANSPORTE ATIVO

Avaliação de desigualdades de gênero a partir de dados da Tembici



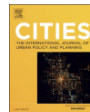
Cities 148 (2024) 104822



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Cities

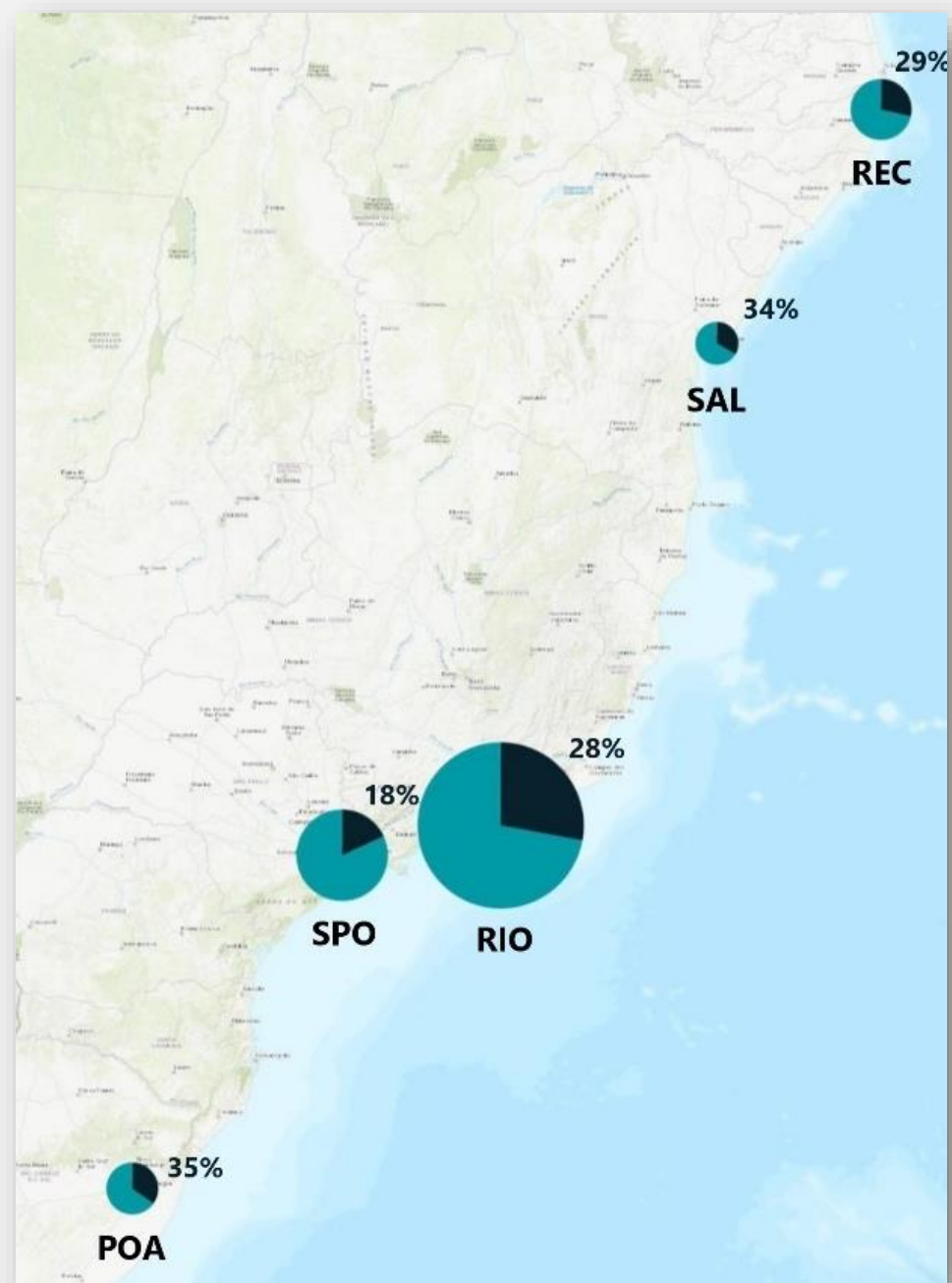
journal homepage: [www.elsevier.com/locate/cities](https://www.elsevier.com/locate/cities)



Gender, class and race uneven access to bike systems across five Brazilian cities

Laura M. Fortes<sup>\*</sup>, Mariana Giannotti, Flavio Soares de Freitas

Center for Metropolitan Studies and Laboratory for Geospatial Analysis at Polytechnic School, University of São Paulo, São Paulo 05508-070, SP, Brazil



FORTES, L.; GIANNOTTI, M, SOARES F. Gender, class and race uneven access to bike systems across five Brazilian Cities. *Cities*, 148, 104822.

# POLÍTIICAS PÚBLICAS E PRÁTICAS URBANAS

## TRANSPORTE ATIVO

Avaliação da infra ciclovitária em várias cidades



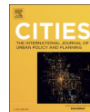
Cities 148 (2024) 104822



Contents lists available at ScienceDirect

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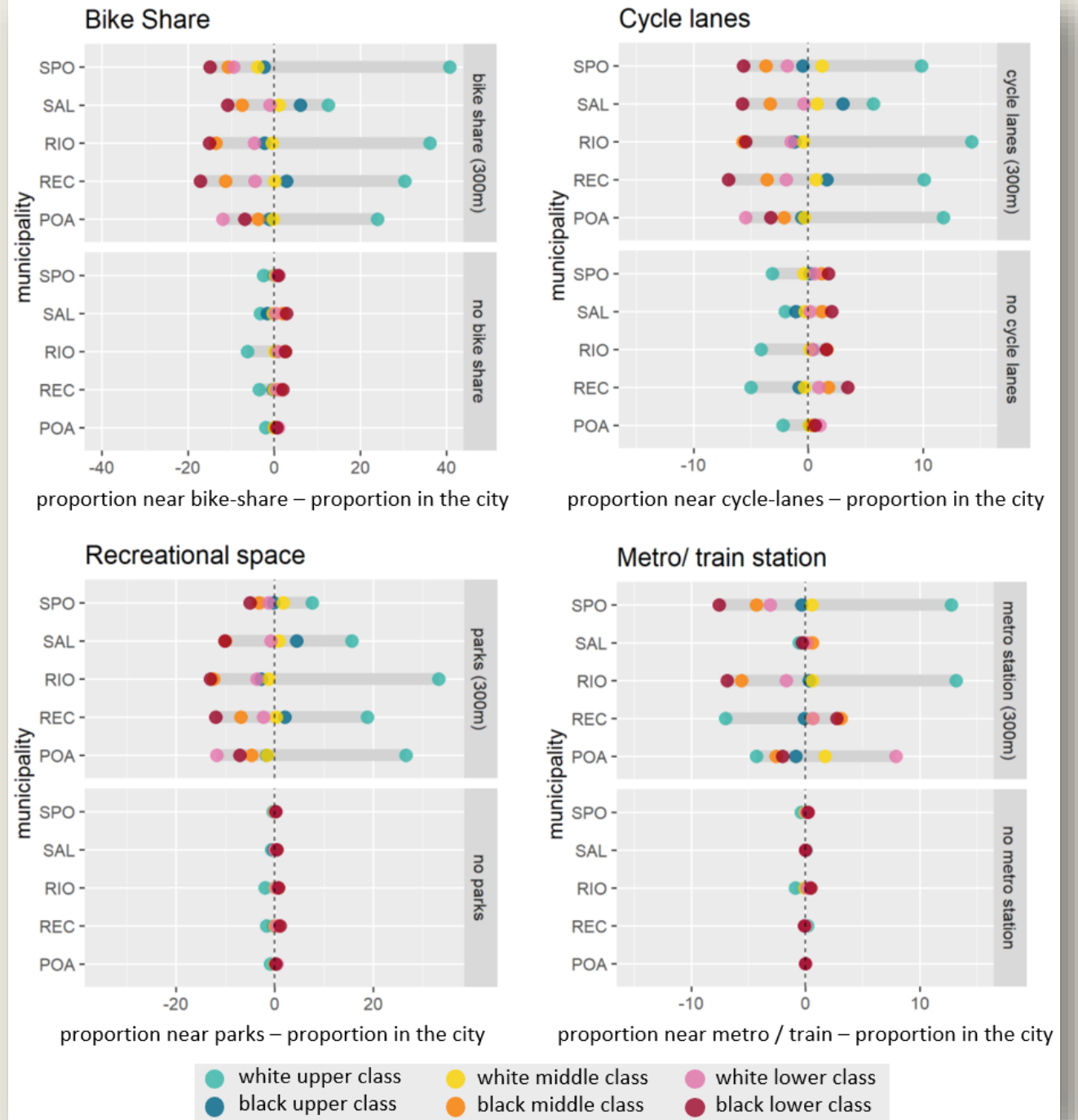
journal homepage: [www.elsevier.com/locate/cities](http://www.elsevier.com/locate/cities)



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# POLÍTICAS PÚBLICAS E PRÁTICAS URBANAS

## TRANSPORTE ATIVO

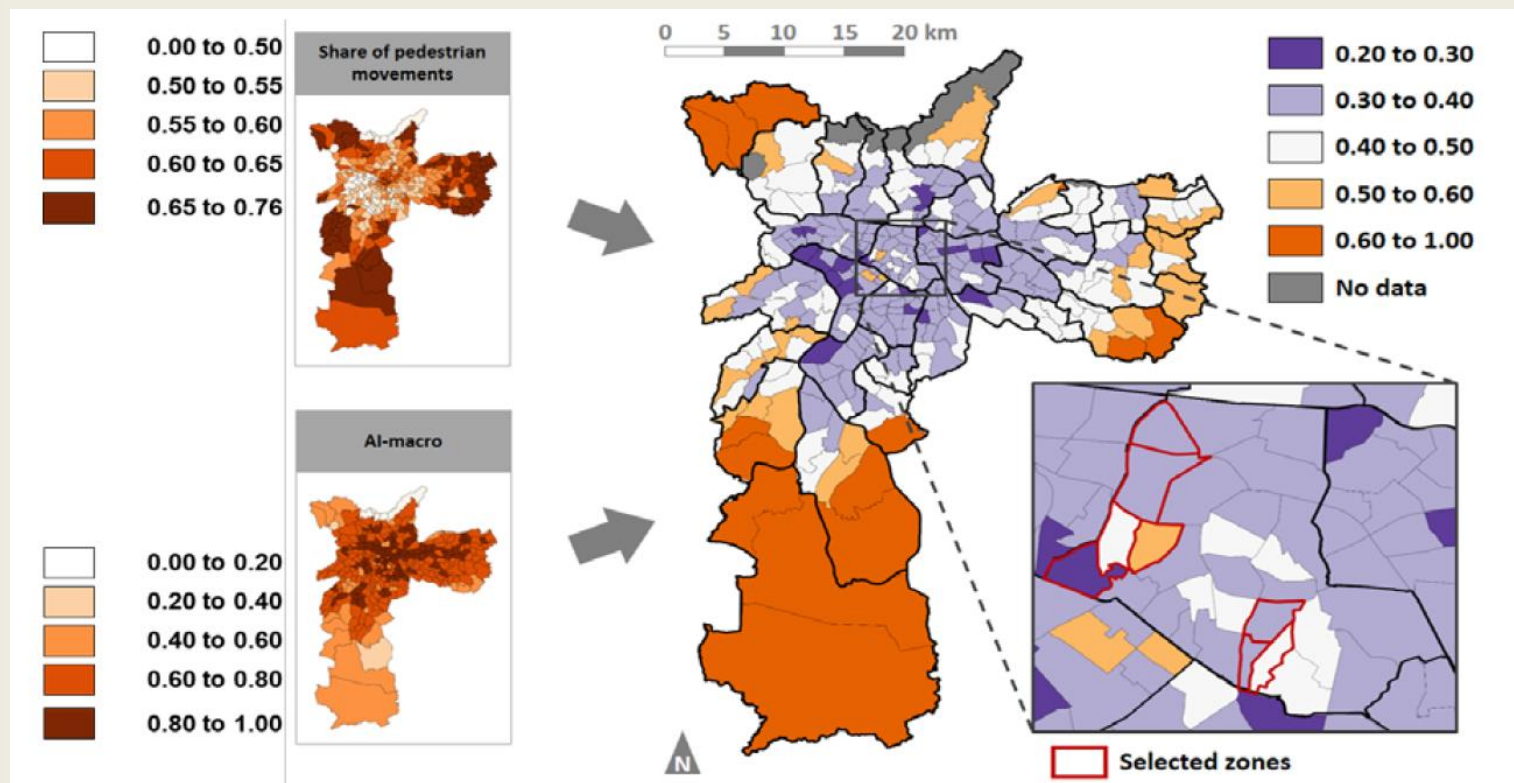
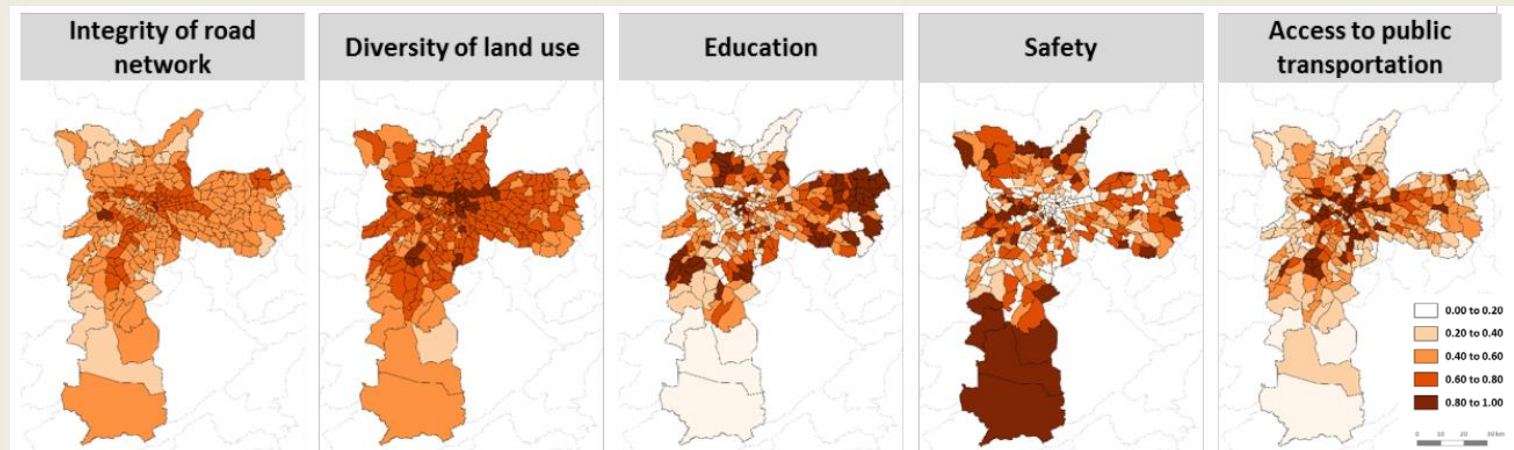
### PEDESTRES



**Walking and walkability: do built environment measures correspond with pedestrian activity?**

*Caminhadas e caminhabilidade: como métricas do ambiente construído e as atividades de pedestres estão relacionadas?*

Mateus Humberto  
Rodrigo Laboissière  
Mariana Giannotti  
Cláudio Luiz Marte  
Daniel Agostini Cruz  
Henrique Primon



HUMBERTO, M., LABOISSIÈRE, R., GIANNOTTI, M., MARTE, C. L., CRUZ, D. A., & PRIMON, H. (2019). Walking and walkability: do built environment measures correspond with pedestrian activity?. *Ambiente Construído*, 19, 23-36.

# POLÍTICAS PÚBLICAS E PRÁTICAS URBANAS

## TRANSPORTE ATIVO

### PEDESTRES

Indicadores para políticas públicas (Capabilities Approach)

*Journal of Human Development and Capabilities*, 2020  
Vol. 21, No. 2, 183–204, <https://doi.org/10.1080/19452829.2020.1745163>



Investigating the Mobility Capabilities and Functionings in Accessing Schools Through Walking: A Quantitative Assessment of Public and Private Schools in São Paulo (Brazil)

MATEUS HUMBERTO <sup>✉</sup>\*, BRUNA PIZZOL\*\*, FILIPE MOURA\*,  
MARIANA GIANNOTTI\*\* & MARCOS PAULO DE LUCCA-SILVEIRA†

\*CERIS, Instituto Superior Técnico, Universidade de Lisboa, Lisbon, Portugal

\*\*Escola Politécnica, Universidade de São Paulo, São Paulo, Brazil

†Center for Metropolitan Studies, Universidade de São Paulo, São Paulo, Brazil

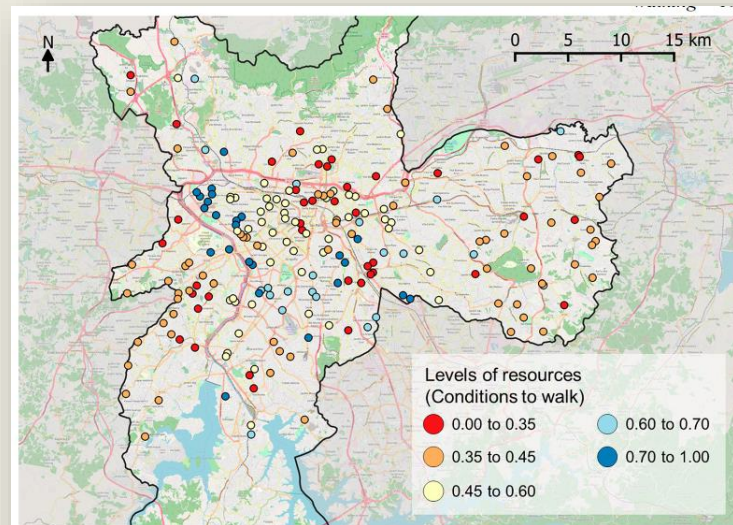
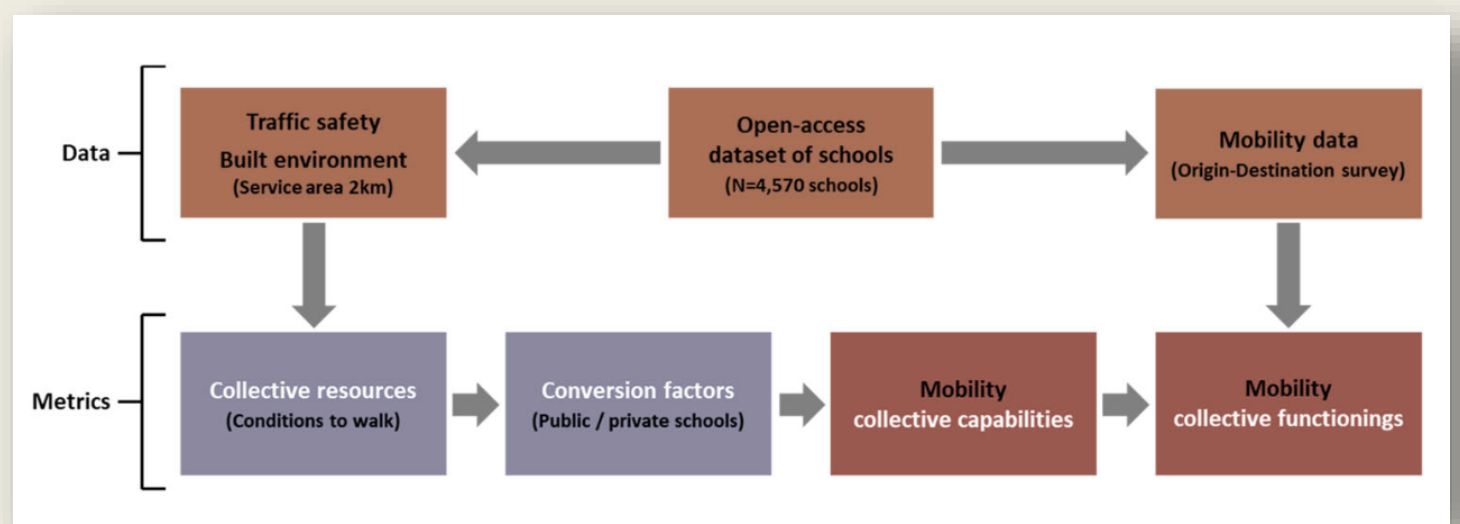


Figure 4. Levels of resources (conditions to walk) of schools.

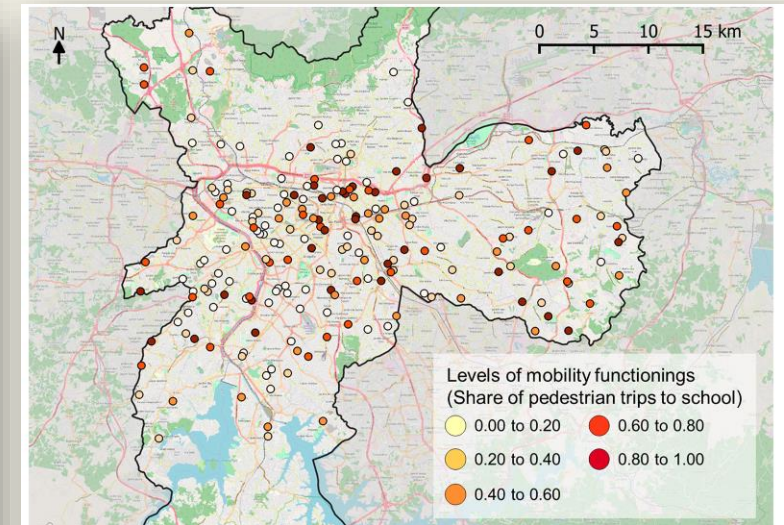


Figure 3. Levels of mobility functionings (share of pedestrian trips to school).

HUMBERTO, M., PIZZOL, B., MOURA, F., GIANNOTTI, M., & DE LUCCA-SILVEIRA, M. P. (2020). Investigating the mobility capabilities and functionings in accessing schools through walking: a quantitative assessment of public and private schools in São Paulo (Brazil). *Journal of Human Development and Capabilities*, 21(2), 183-204..





## Mapear a cidade: dados para soluções em engenharia dos problemas urbanos

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- ✓ Transporte público (redes metroferroviária e ônibus)
- ✓ Transporte ativo (redes cicloviária e pedonal)
- ✓ Habitação de interesse social

Visão estratégica

Pesquisa

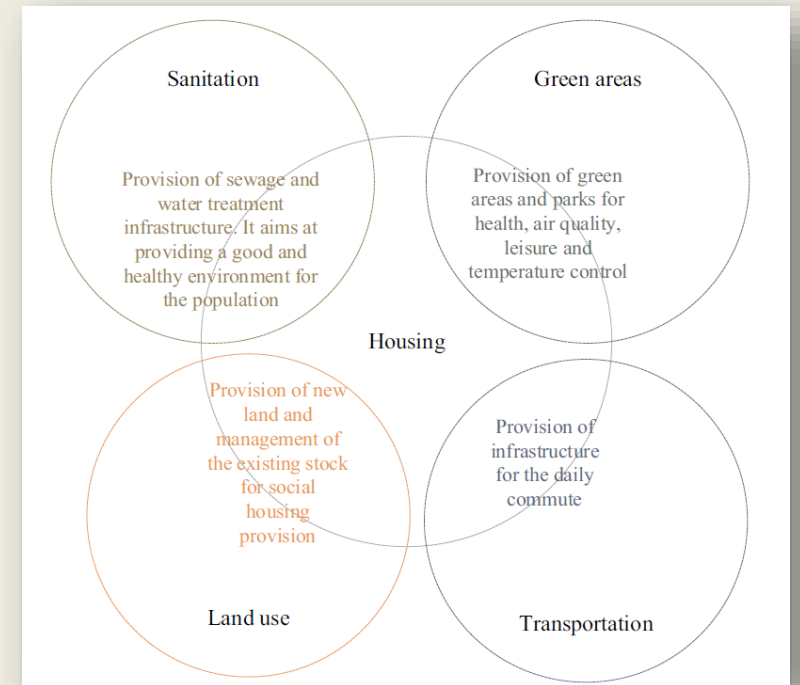
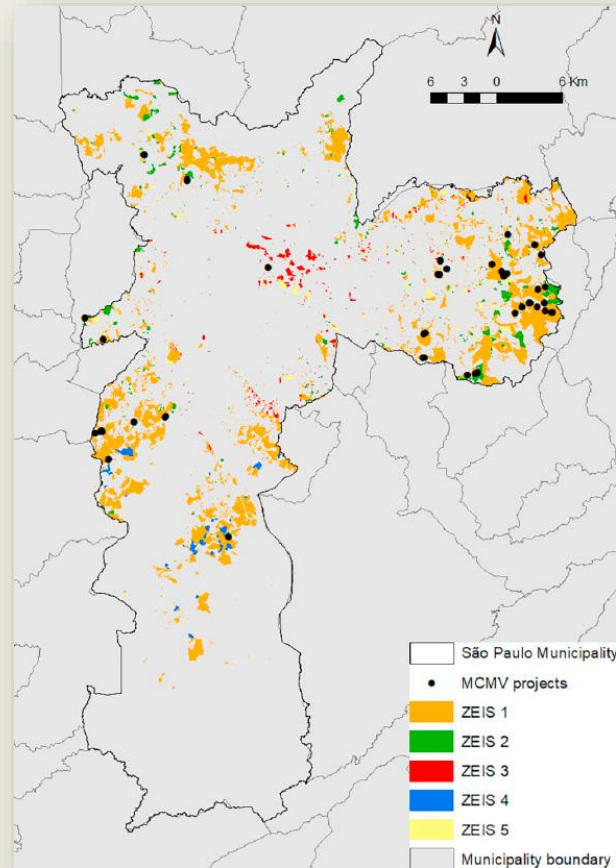
Extensão

# Subsidiar políticas públicas para a habitação de interesse social



# AVALIAÇÃO DE POLÍTICAS PÚBLICAS HABITAÇÃO DE INTERESSE SOCIAL

Avaliação ex-post do programa  
Minha Casa Minha Vida e das  
Zonas Especiais de Interesse Social  
em São Paulo



Cities 91 (2019) 106-115

Contents lists available at ScienceDirect



Cities

journal homepage: [www.elsevier.com/locate/cities](http://www.elsevier.com/locate/cities)



Integrating socio-environmental spatial information to support housing plans



Juliana Siqueira-Gay<sup>a,\*</sup>, Amarilis Lucia Casteli Figueiredo Gallardo<sup>a,b</sup>, Mariana Giannotti<sup>a</sup>

<sup>a</sup> Universidade de São Paulo, Av. Prof. Mello Moraes, 2373 Butantã, 05508-900, São Paulo, SP, Brazil

<sup>b</sup> Universidade Nove de Julho (Uninove), Rua Vergueiro, 235/249, Liberdade, 01504-000 São Paulo, SP, Brazil

SIQUEIRA-GAY, J., GALLARDO, A. L. C. F., & GIANNOTTI, M. (2019). Integrating socio-environmental spatial information to support housing plans. *Cities*, 91, 106-115.

# AVALIAÇÃO DE POLÍTICAS PÚBLICAS HABITAÇÃO DE INTERESSE SOCIAL

Avaliação ex-post do Programa  
Minha Casa Minha Vida



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Habitat International

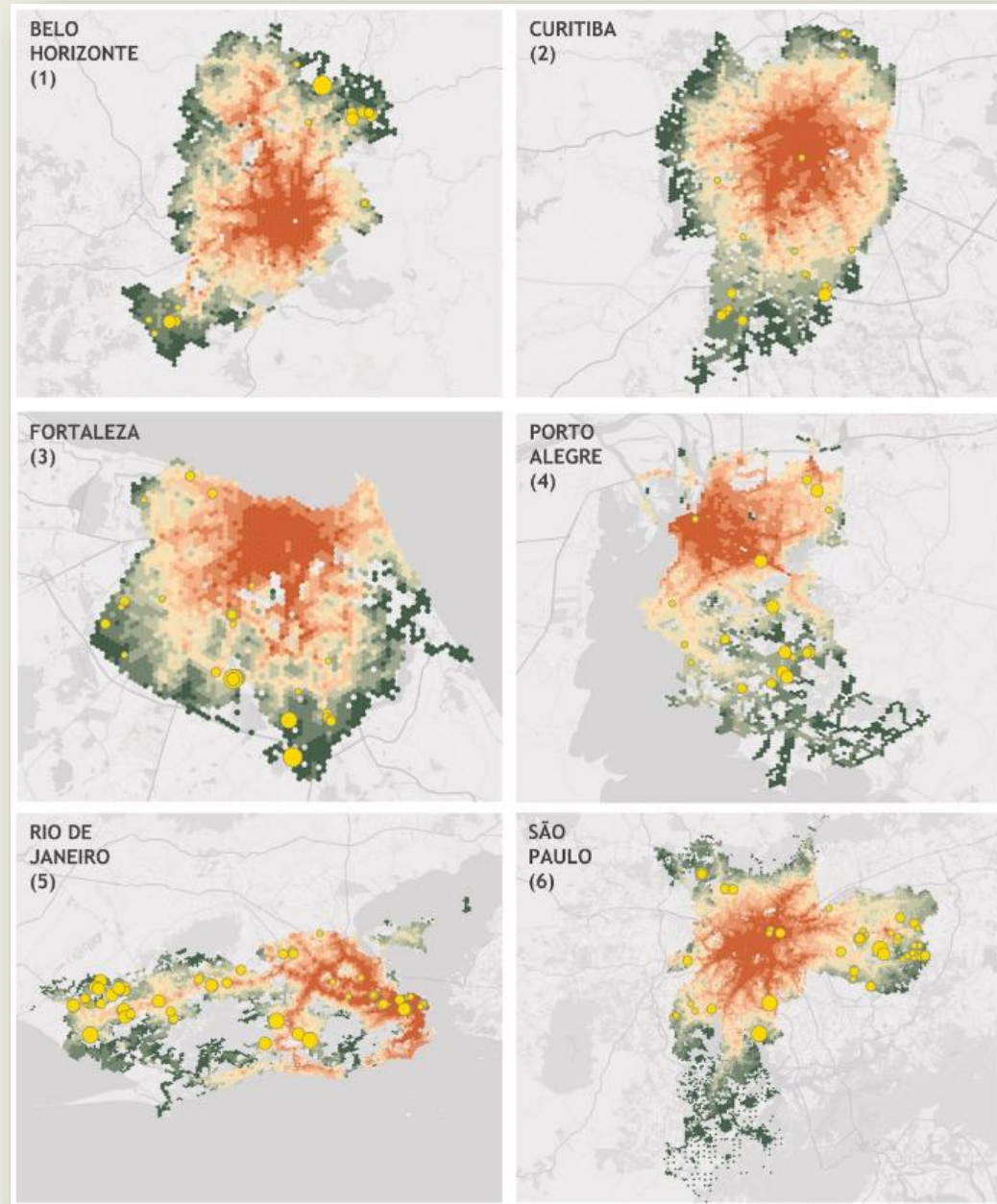
journal homepage: [www.elsevier.com/locate/habitatint](https://www.elsevier.com/locate/habitatint)



Social housing and accessibility in Brazil's unequal cities

Camila Cardoso Leite, Mariana Giannotti\*, Gilmara Gonçalves

Center for Metropolitan Studies and Laboratory for Geospatial Analysis at Polytechnic School, University of São Paulo, São Paulo, 05508-070, SP, Brazil



LEITE, C. C., GIANNOTTI, M., & GONÇALVES, G. (2022). Social housing and accessibility in Brazil's unequal cities. *Habitat International*, 127, 102628.

# AVALIAÇÃO DE POLÍTICAS PÚBLICAS HABITAÇÃO DE INTERESSE SOCIAL

Avaliação ex-post do Programa  
Minha Casa Minha Vida



Contents lists available at ScienceDirect

Habitat International

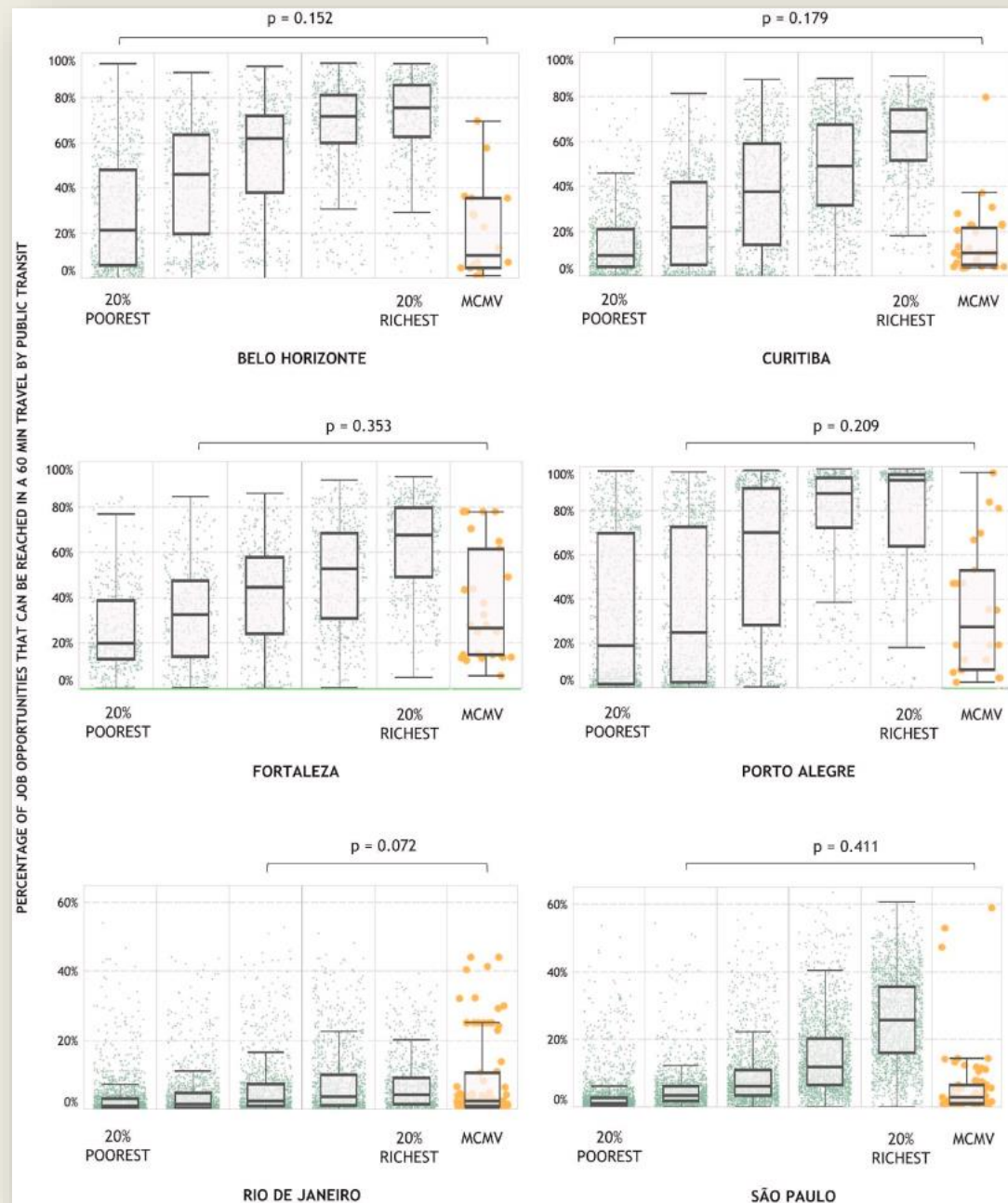
journal homepage: [www.elsevier.com/locate/habitatint](http://www.elsevier.com/locate/habitatint)



Social housing and accessibility in Brazil's unequal cities

Camila Cardoso Leite, Mariana Giannotti, Gilmar Gonçalves

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LEITE, C. C., GIANNOTTI, M., & GONÇALVES, G. (2022). Social housing and accessibility in Brazil's unequal cities. *Habitat International*, 127, 102628.



## Mapear a cidade: dados para soluções em engenharia dos problemas urbanos

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- ✓ Acesso a cidade



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- ✓ Transporte público (redes metroferroviária e ônibus)
- ✓ Transporte ativo (redes cicloviária e pedonal)
- ✓ Habitação de interesse social



## Visão estratégica

- ✓ Pesquisa
- ✓ Extensão

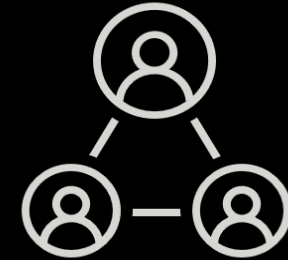
# PESQUISA



foco nas  
cidades



modelos e  
métodos  
complementares



perspectiva  
interdisciplinar

# EIXO SUSTENTABILIDADE PLANO HABITACIONAL 2040

Secretaria Nacional de Habitação  
Ministério das Cidades

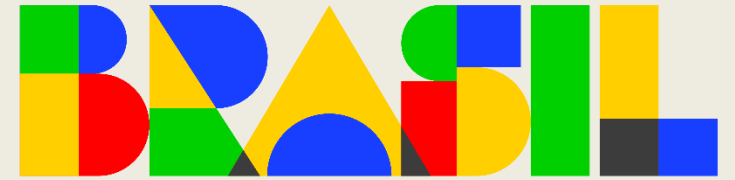
**giz**

Deutsche Gesellschaft  
für Internationale  
Zusammenarbeit (GIZ) GmbH

MINISTÉRIO DAS  
CIDADES



GOVERNO FEDERAL



UNIÃO E RECONSTRUÇÃO





Panorama do município

Gráficos do empreendimento

Selecione o município

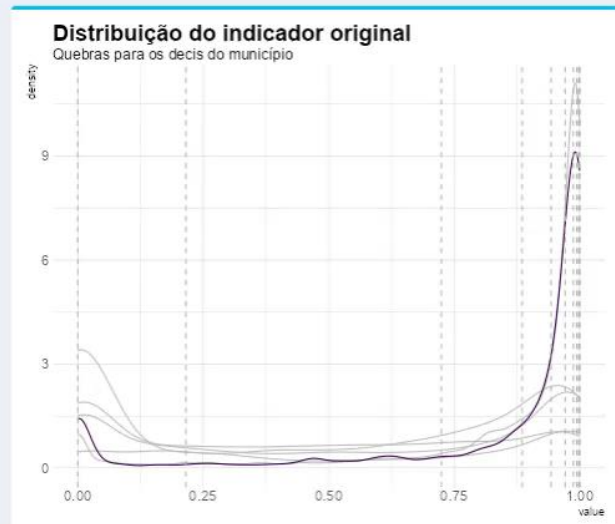
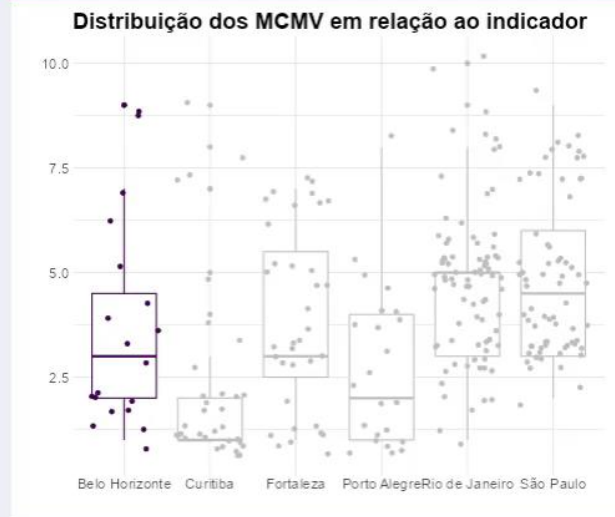
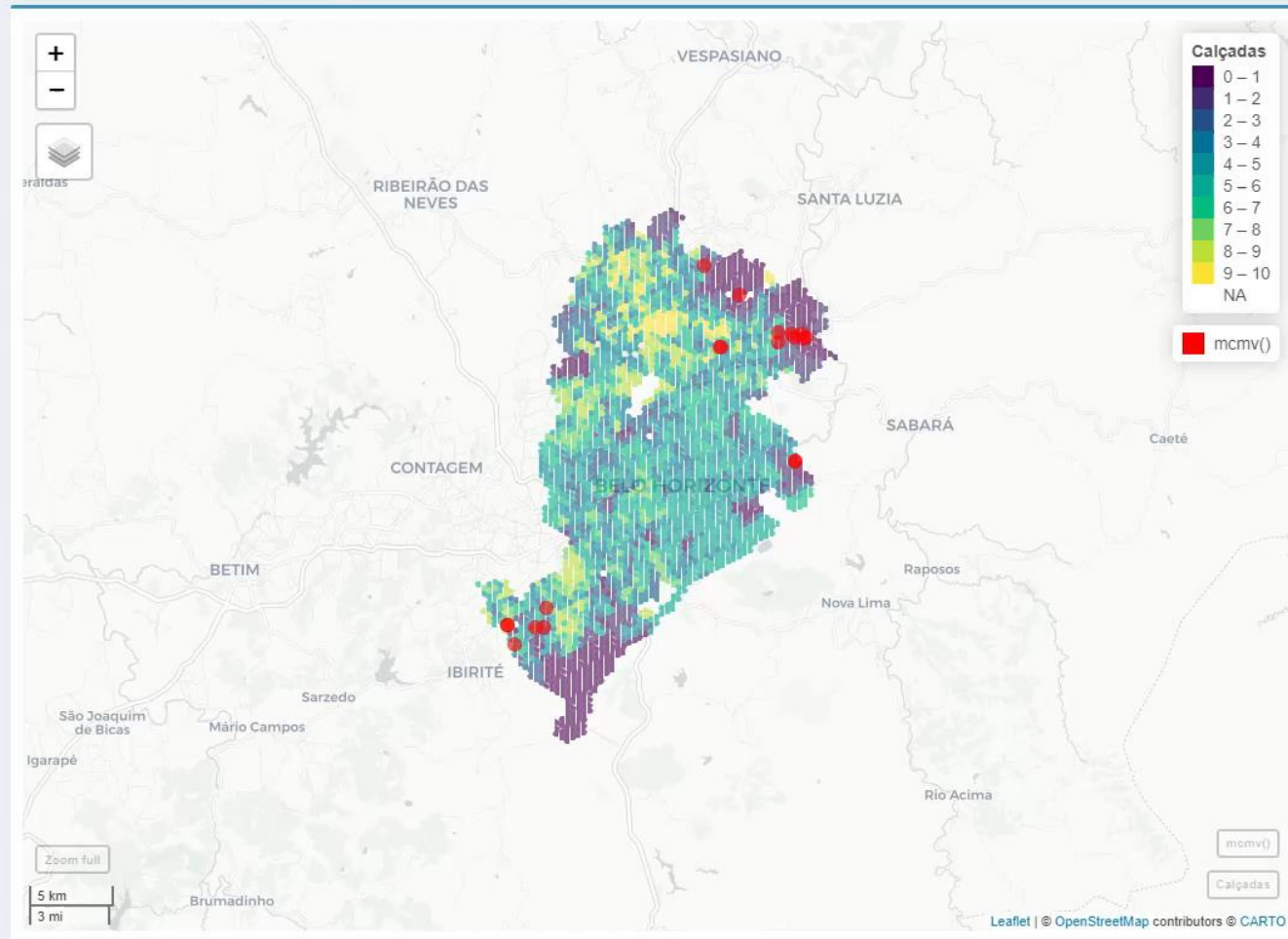
Belo Horizonte

Selecione o indicador

Calçadas

- Calçadas
- Iluminação
- Pavimento
- Guias
- Esgotamento
- Água
- Energia
- Calçada de livre

## Indicadores de inserção urbana de Belo Horizonte

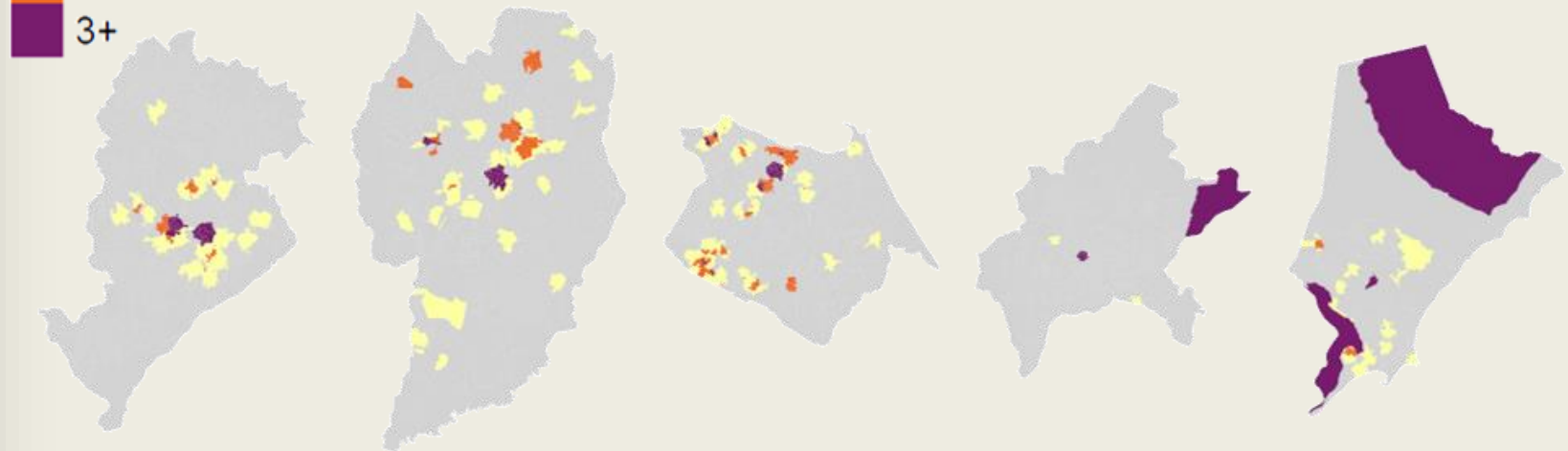
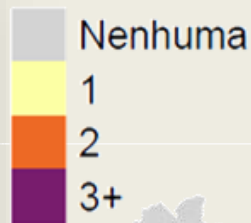


# POLÍTICAS PÚBLICAS DE SEGURANÇA ALIMENTAR E NUTRICIONAL NAS CIDADES

Equipamentos de segurança alimentar e nutricional



MINISTÉRIO DO DESENVOLVIMENTO E ASSISTÊNCIA SOCIAL, FAMÍLIA E COMBATE À FOME



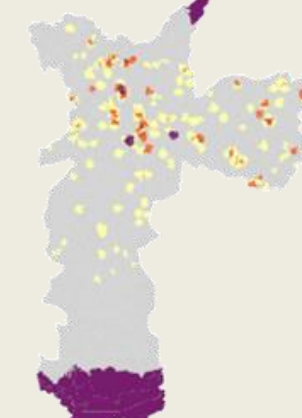
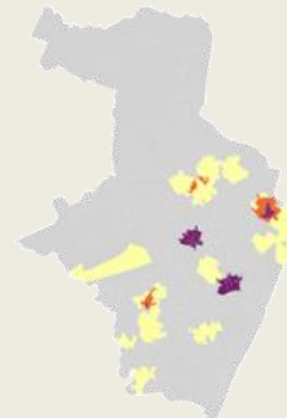
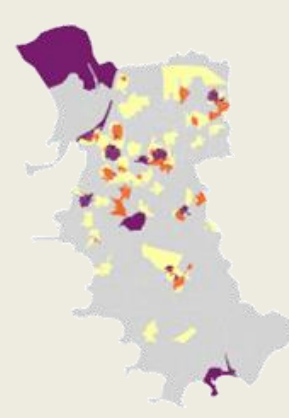
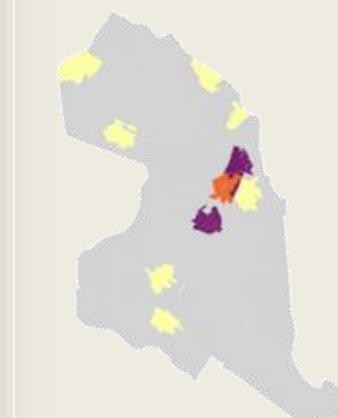
Belo Horizonte

Curitiba

Fortaleza

Goiânia

Maceió



Natal

Porto Alegre

Recife

Rio de Janeiro São Paulo

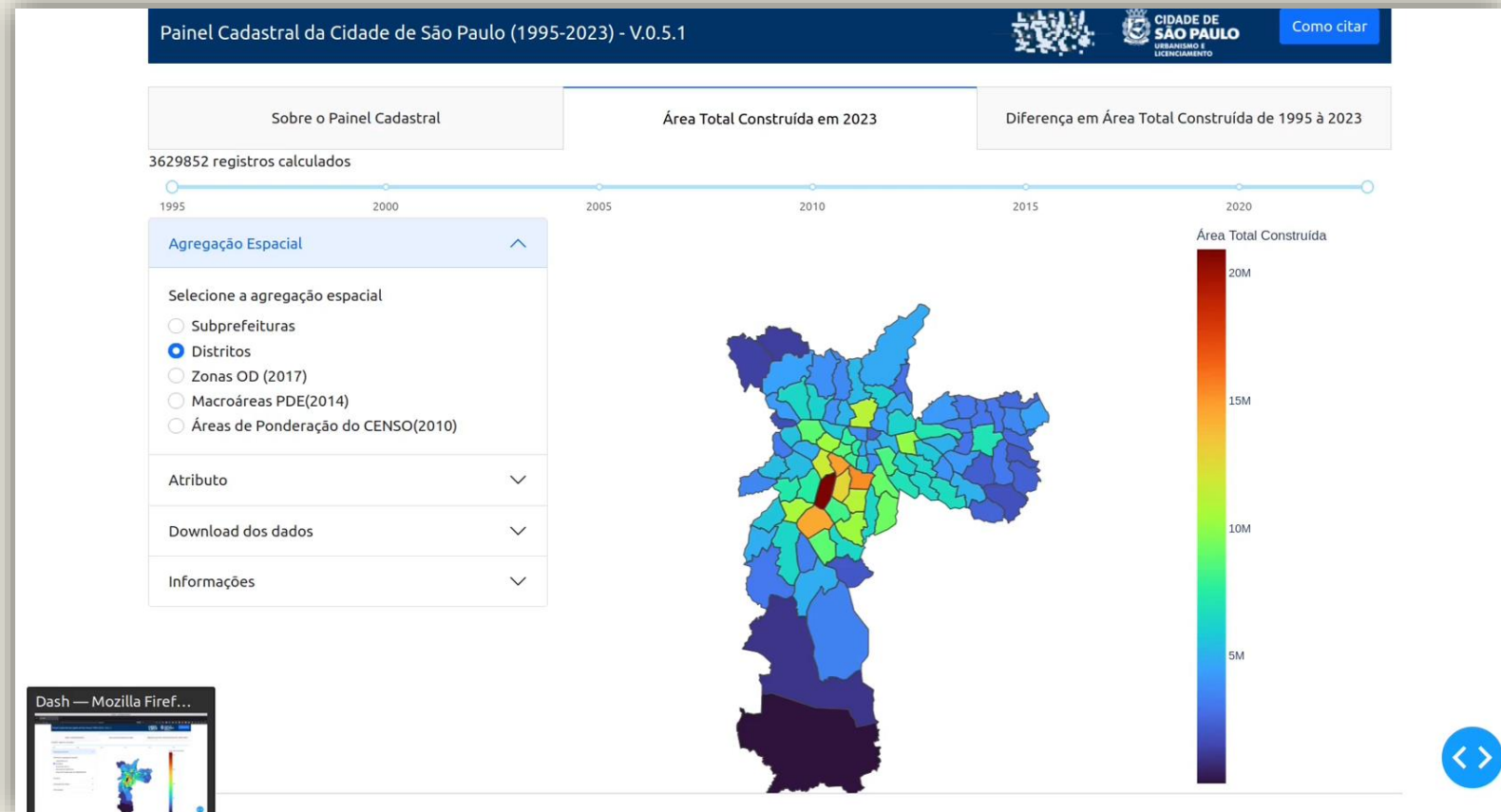
PROJETO DE COOPERAÇÃO TÉCNICA PARA A SEGURANÇA ALIMENTAR E NUTRICIONAL: A DISPONIBILIDADE E O ACESSO À ALIMENTOS SAUDÁVEIS E O COMBATE À POBREZA RURAL IICA/BRA/17/001

# PREFEITURA DE SÃO PAULO TERMO DE COOPERAÇÃO

Secretaria Municipal de  
Licenciamento e Urbanismo  
Prefeitura de São Paulo



centro de estudos da metrópole



> 86 milhões de registros, 28 anos de dados cadastrais, 46 atributos, diferentes agregações espaciais, dados abertos!!!

Realização:



centro de estudos da metrópole



Parceria firmada pelo acordo de cooperação técnica entre o Centro de Estudo da Metrópole (CEM) e a Secretaria Municipal de Urbanismo e Licenciamento (SMUL nº001/2022/SMUL)

Apoio:



CEBRAP



CEPID





... e mais...

OBRIGADA!

[mariana.giannotti@usp.br](mailto:mariana.giannotti@usp.br)



Centro de Estudos da Metrópole

