Accessibility planning

Enrica Papa
School of Architecture and Cities
University of Westminster
E: e.papa@westminster.ac.uk

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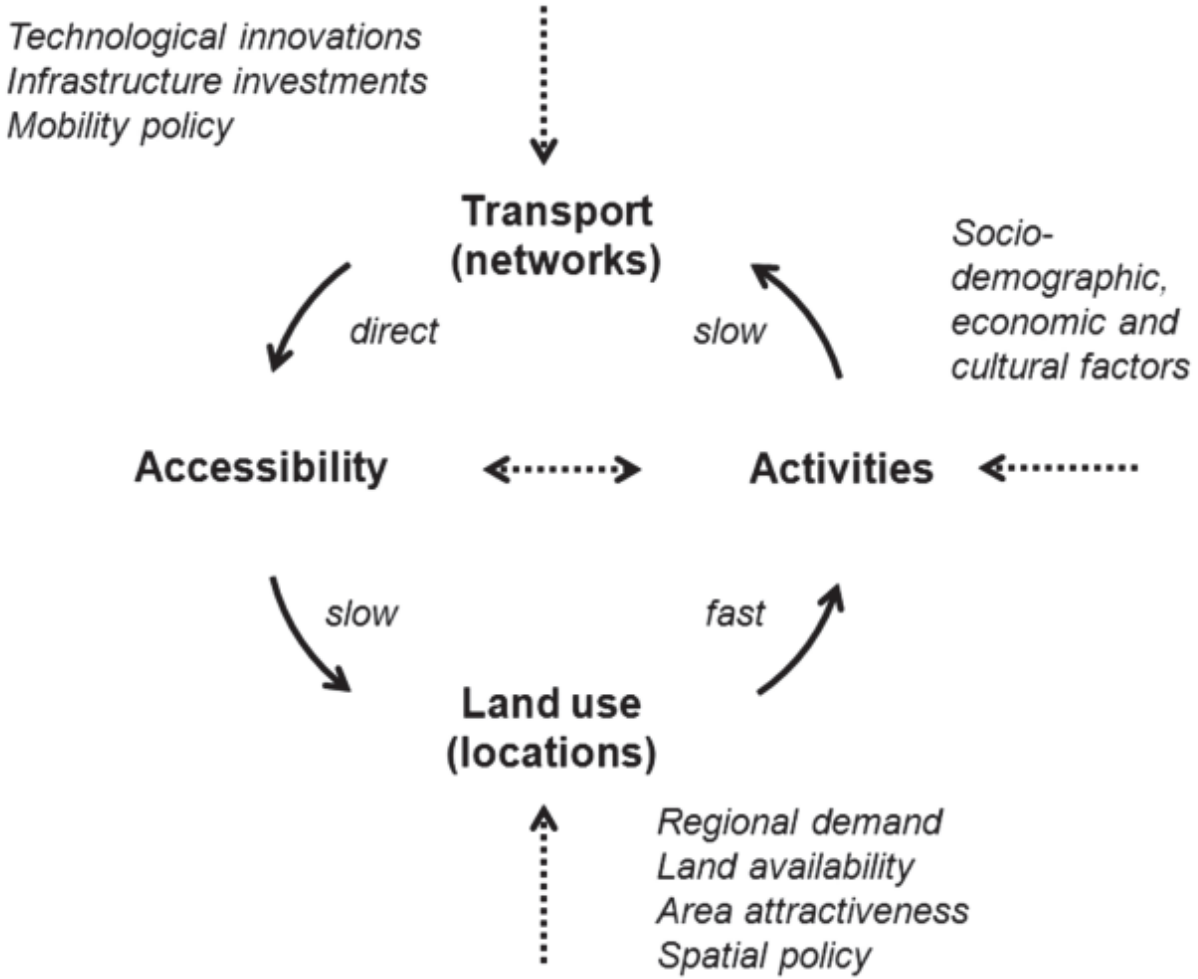
LUT feedback cycle



Accessibility

Concepts and origins

- The concept of accessibility provides a basis for making **trade-offs between land-use and transportation policies**.

- As a measure of the **potential for interaction** of one place and persons to all other places or persons, conceptually linked to Newton's law of gravity, accessibility's origins can be traced back to the 1920s when it was used in location theory and regional economic planning (Batty, 2009).

- In his classic paper '**How Accessibility Shapes Land Use**', Hansen (1959) was the first to define accessibility as a potential of opportunities for interaction and applied the concept to forecast employment development in Washington D.C..

- A plethora of accessibility definitions and operationalisations of accessibility measures has been developed in the past decades and applied in several academic fields such as urban geography, rural geography, health geography, time geography, spatial economics and transport engineering.

Planning for mobility vs planning for accessibility

Mobility	Accessibility
Potential for **movement**, to get from one place to another	The quality of being **accessible**, or of admitting approach. The potential for **interaction** (Hansen, 1959) Is a concept expressing the relationship between the activity system located in a region and the transportation system serving it (Cascetta, 2009) Is the extent to which individuals and households can access day to day services, such as employment, education, healthcare, food stores and town centres (Dft, 2014)

The 4 components of accessibility

1. The land use component

The land-use component **reflects the land-use system**, consisting of

a) the amount, quality and spatial distribution of opportunities supplied at each destination (jobs, shops, health, social and recreational facilities, etc.), and
b) the demand for these opportunities at origin locations (e.g. where inhabitants live),
c) the confrontation of supply of and demand for opportunities, which may result in competition for activities with restricted capacity such as job and school vacancies and hospital beds.

The 4 components of accessibility

2. The transport component

The transport component **describes the transport system**, expressed as the disutility for an individual to cover the distance between an origin and a destination using a specific transport mode; included are

- the amount of time (travel, waiting and parking),
- costs (fixed and variable) and
- effort (including reliability, level of comfort, accident risk, etc.).

This disutility results from the confrontation between supply and demand. The supply of infrastructure includes its location and characteristics (e.g. maximum travel speed, number of lanes, public transport timetables, travel costs).

The 4 components of accessibility

2. The temporal component

The temporal component reflects **the temporal dynamics** in transport impedances and temporal constraints **of individuals** such as the availability of opportunities at different times of the day, and the time available for individuals to participate in certain activities (e.g. work, recreation).

In the recent past, mainstream accessibility models were static measures of access.

However, nowadays, time-of-day variations in road network accessibility can be examined using realtime driving speeds on road networks based on GPS measurements from mobile phones and navigation systems such as TomTom or NavTeq (e.g., Moya-Gómez and Garcia-Palomares, 2015).

Recent advances in geospatial technology, open source web-based mapping (e.g., OpenStreetMap) and public availability of Transit Feed Specification (GTFS) data from transit authorities gives room for a growing field of research on time-of-day variations in public transit accessibility (e.g., Owen and Levinson, 2015).

The 4 components of accessibility

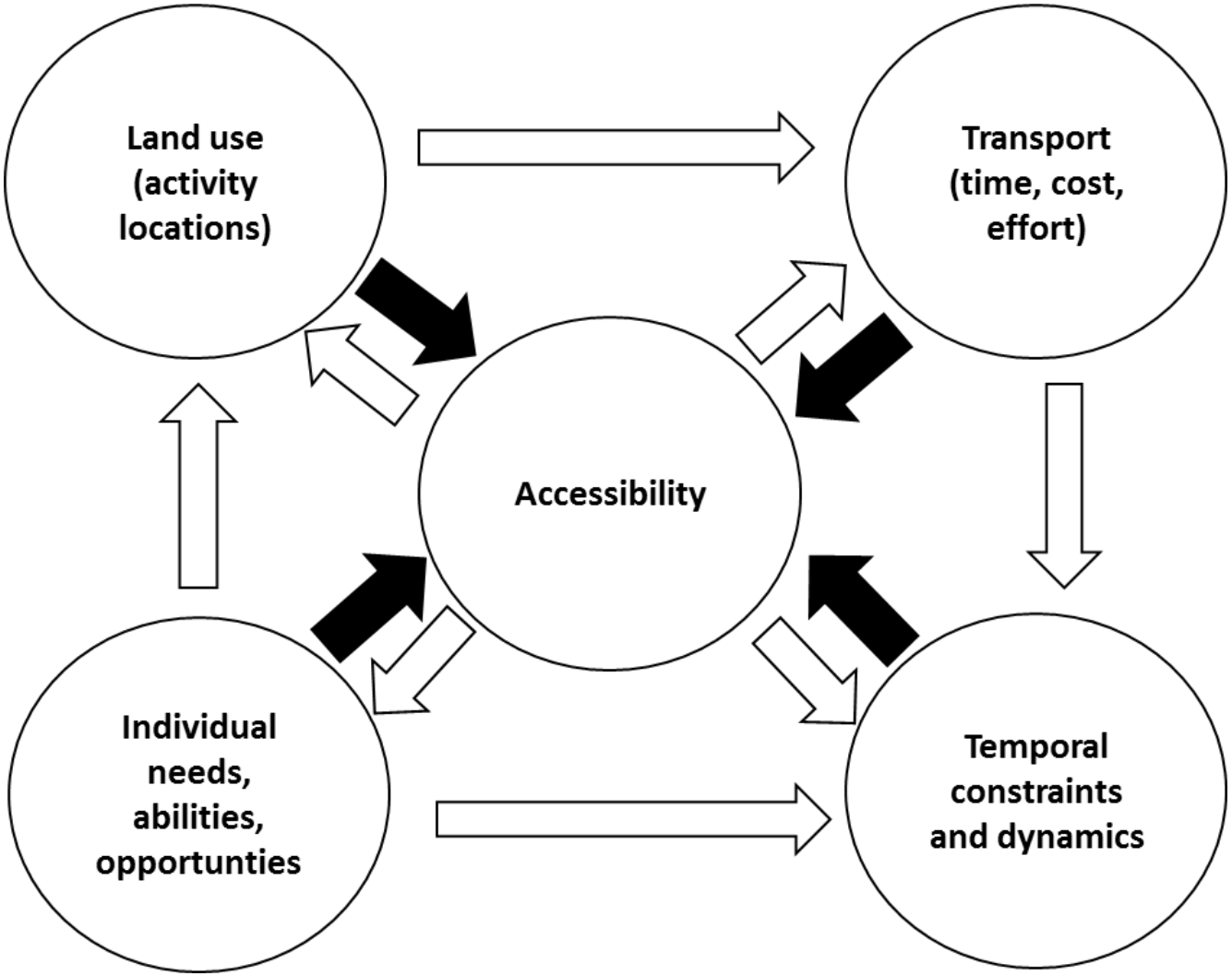
4. The individual component

The individual component reflects:

- the needs (depending on age, income, educational level, household situation, etc.),
- abilities (depending on people's physical condition, availability of travel modes, etc.) and
- opportunities (depending on people's income, travel budget, educational level, etc.) of individuals.

The 4 components of accessibility and their interactions

based on Geurs and Van Wee, 2004



Accessibility measures

Infrastructure-based measures

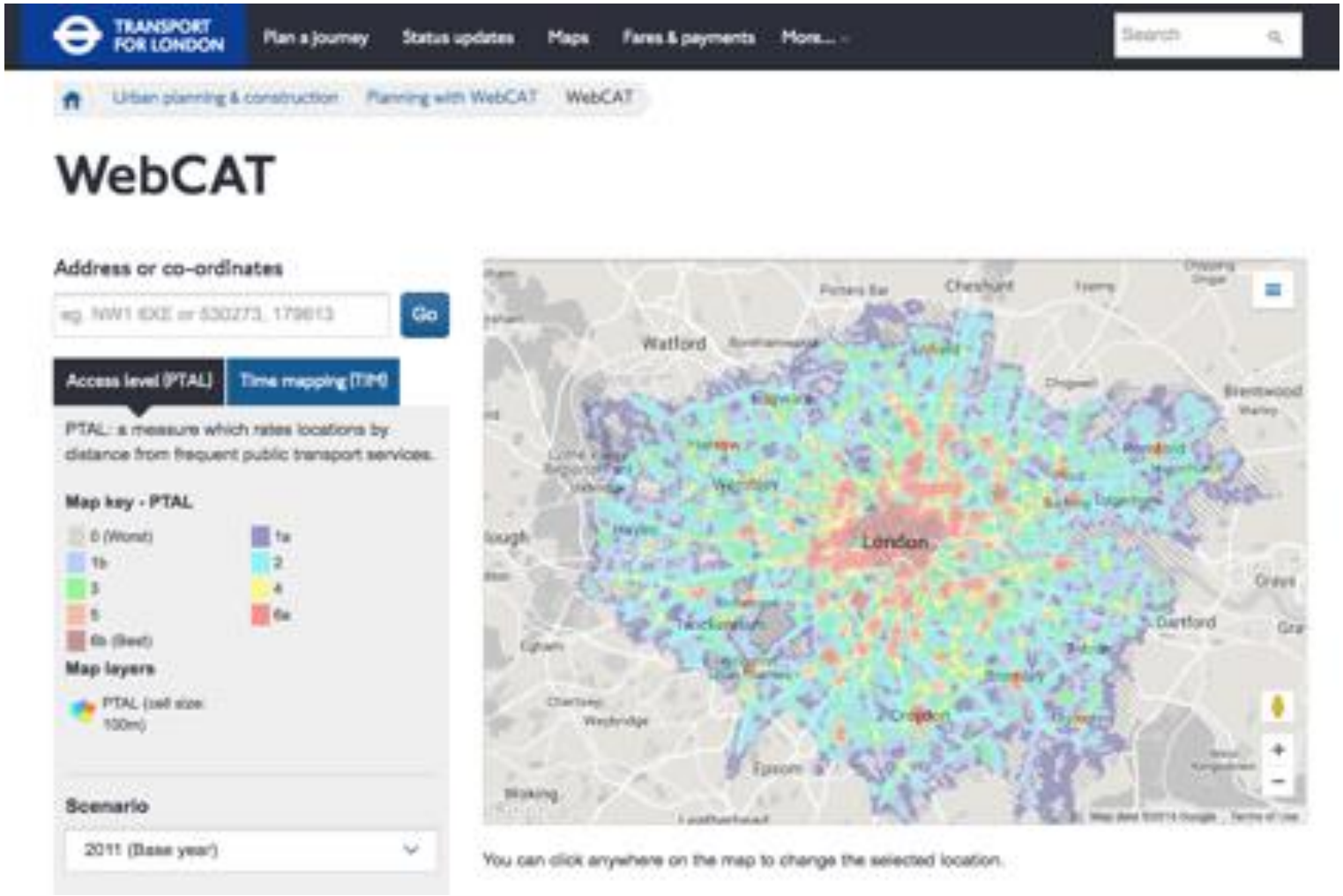
These range from simple to link-based travel speed and congestion indexes to more complex network-based measures analyzing the relative **performance of a node or an area in the transport network, based on graph theory**.

1. A first example of this type is the **access cost indicator**. This index is the summation of all travel impedances (time and/or costs) of area i to all areas j , divided by the number of locations. The lower its value, the better accessible a location is.
2. An relatively well known example is the **Public Transport Accessibility Level (PTAL)** used by Transport for London in the United Kingdom to assess the access level of geographical areas to public transport. PTALS measure of the accessibility of a point to the public transport network, taking into account walk access time and service availability.

Accessibility measures

Infrastructure-based measures

https://tfl.gov.uk/info-for/urban-planning-and-construction/planning-with-webcat/webcat



WebCAT platform London - Assessing transport connectivity in London

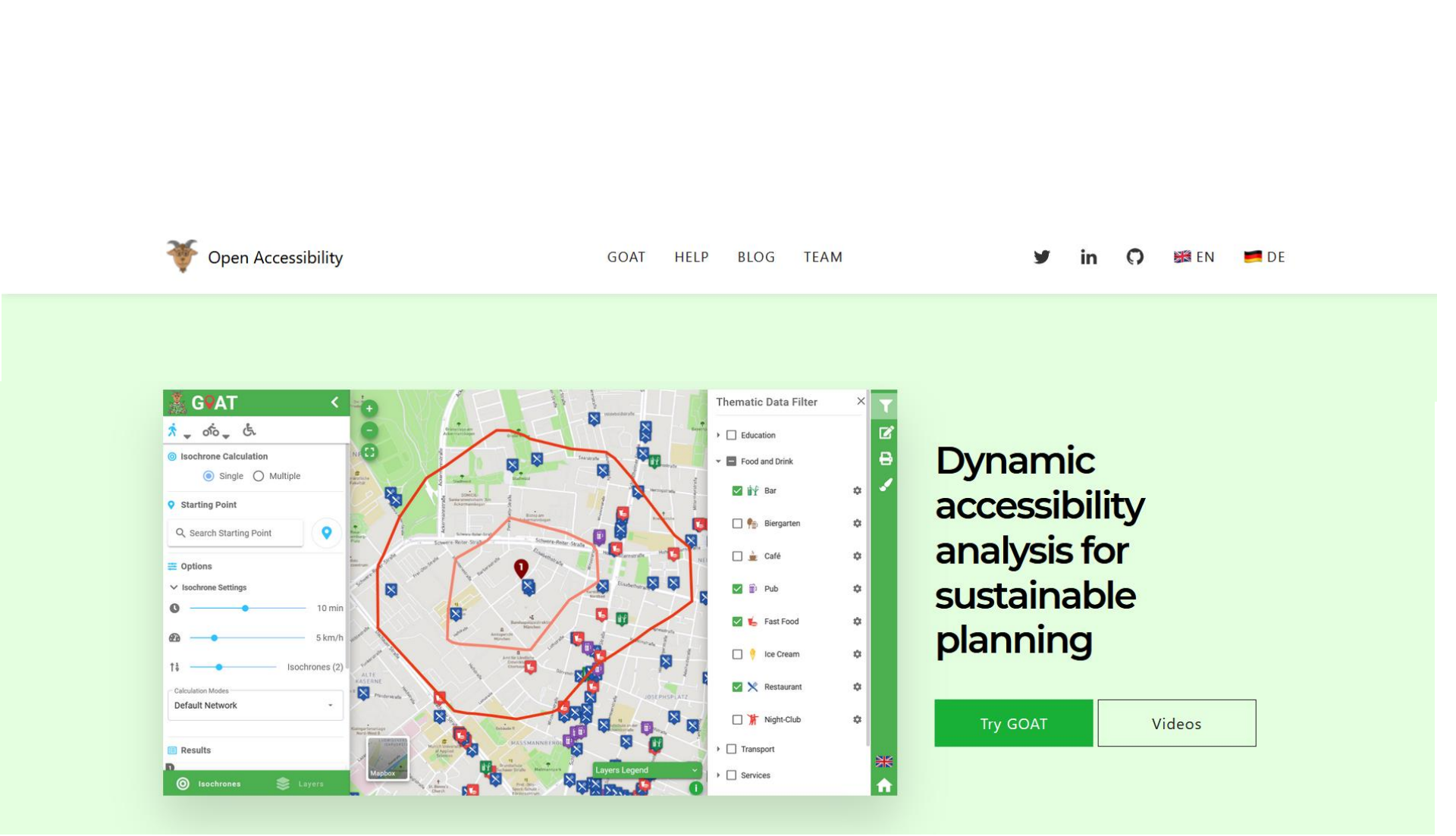
http://content.tfl.gov.uk/connectivity-assessment-guide.pdf

Accessibility measures

Location-based accessibility measures

- Location based measures can be used from the perspective of the origin, e.g. the location of the dwelling of a person, or from the perspective of the destination, e.g. a location of a shop, expressing, for example, the potential number of clients.

- The two most popular location-based measures are cumulative opportunity (threshold) measures and potential accessibility
  - The **cumulative accessibility** measure (CUM) is a simple indicator expressing the absolute number of opportunities within a specified cutoff travel impedance (e.g., 30 minutes)
  - The **potential accessibility measure**, or **gravity-based measure**, estimates the accessibility of opportunities in zone i to all other zones (n) in which smaller and/or more distant opportunities provide diminishing influences, and is based on the notion of potential which dates back to the social physics school in the 19th century.



https://www.open-accessibility.org/

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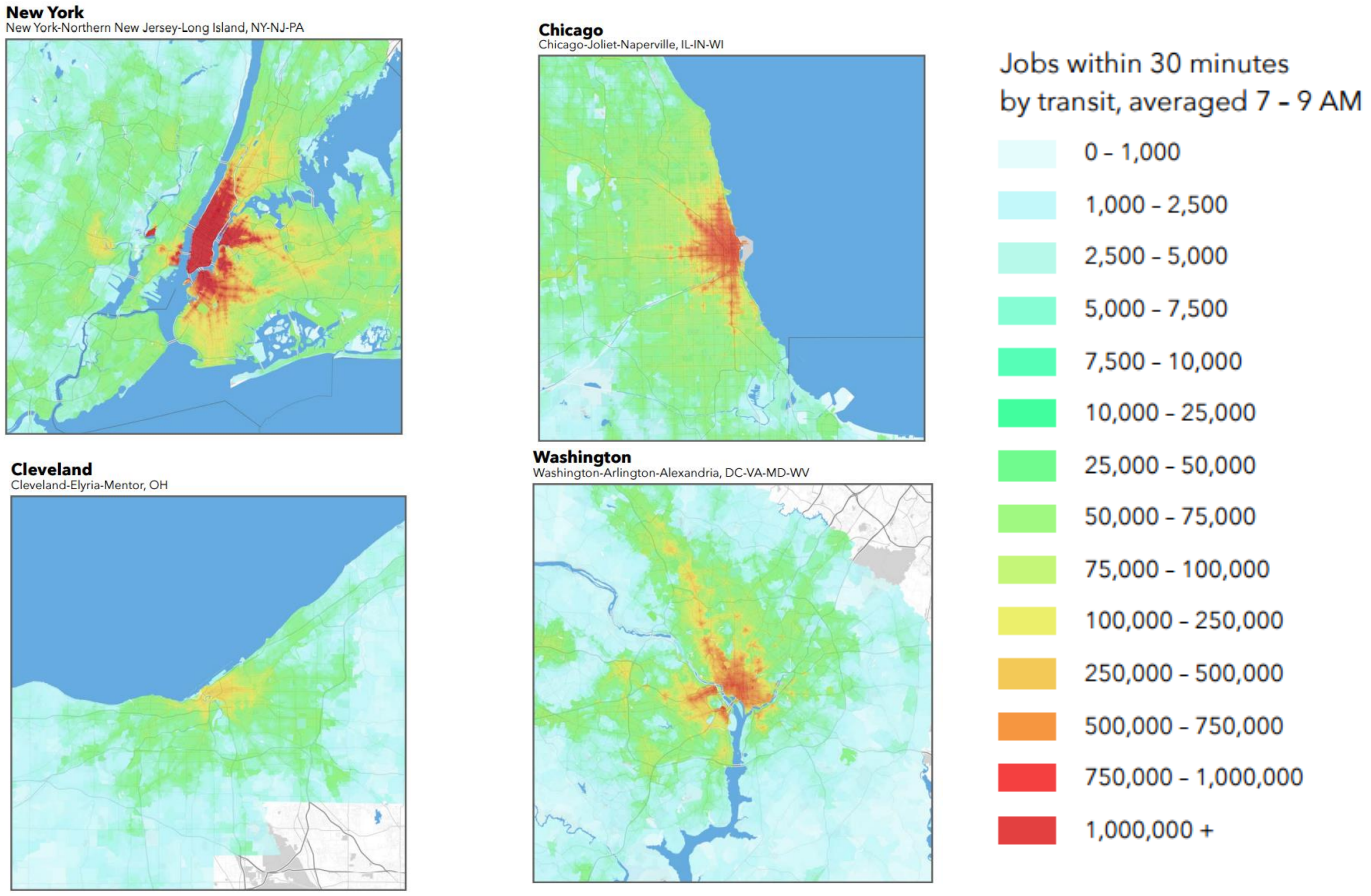
Accessibility measures

Location-based accessibility measures



Accessibility Observatory at University of Minnesota
Owen, A., & Levinson, D. (2014). Access Across America: Transit 2014

Accessibility measures

Utility-based accessibility measures

- This economic perspective on accessibility is founded in the economic utility theory of choice behavior (e.g. see Burns and Golob, 1976; de Jong et al., 2007; Geurs et al., 2010b). The focus is on analyzing the welfare benefits that people derive from levels of access to the spatially distributed activities.

- Several utility-based measures of accessibility have been developed, depending on the modelling framework used. Probably the most well-known measure is the **logsum measure** derived from the multinomial logit model

Accessibility measures

Person-based accessibility measures

- Analyzing accessibility at the level of the individual level, e.g. ‘the activities in which an individual can participate at a given time’
- This type of measure is founded in the space-time geography (Hägerstrand, 1970).
- Person-based measures recognize that activity participation has both spatial and temporal dimensions, that is, activities occur at specific locations for finite temporal durations (Miller, 1999)

Advantages and disadvantages of the measures

- Applications
- Theoretical basis
- Ease of operationalization
- Interpretation/ communication
- Usability in economic appraisal
- Usability in social evaluations

Why and how can we use these measures for LUT planning?

- Moving to Access: Is the current transport model broken?

MOVING TO ACCESS

BROOKINGS

Accessibility planning

Spatial planning, transport planning and accessibility planning

Accessibility planning

vs planning for mobility

Mobility based planning

Evaluation: Transport model

Re-active to urban development

Calculate effects of land-use plans

Accessibility based planning

Strategy: Accessibility mapping

Pro-active to urban development

Discuss locations for new development

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The ‘accessibility planning’ implementation gap

- “A distinct gap currently exists between the academic literature and the practical application of accessibility measures” (Handy and Niemeier, 1997)

- Mobility-oriented transport planning continues to dominate in local authorities, government agencies, and consultancy firms (Levine et al. 2017)

Workshop

1-2-4-ALL

- What are the advantages and limitation of accessibility planning?
- Why accessibility metrics and accessibility-based tools are not used in practice?

References

TRANSPORT ACCESS MANUAL: A GUIDE FOR MEASURING CONNECTION BETWEEN PEOPLE AND PLACES

https://transportist.org/2020/12/01/transport-access-manual-a-guide-for-measuring-connection-between-people-and-places/

ACCESSIBILITY INSTRUMENTS FOR PLANNING PRACTICE

https://www.accessibilityplanning.eu/

MOVING TO ACCESS INITIATIVE

https://www.brookings.edu/project/moving-to-access/

References - paper

Ferreira, A. and Papa, E. 2020. Re-enacting the mobility versus accessibility debate: Moving towards collaborative synergies among experts. Case Studies on Transport Policy. 8 (3), pp. 1002-1009. https://doi.org/10.1016/j.cstp.2020.04.006

Papa, E., Coppola, P., Angiello, G., & Carpentieri, G. (2017). The learning process of accessibility instrument developers: Testing the tools in planning practice. Transportation Research Part A: Policy and Practice, 104, 108-120.

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