Understanding Pedestrian Accessibility

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Louis A. Merlin, Florida Atlantic University; Ulrike Jehle, Technical University of Munich

COMPARISON OF FRAMEWORKS FOR PEDESTRIANS

Conceptual Comparison of Measurable Walkability Concepts

Quality of Service

- Overall perception of pedestrian of their experience while on a particular facility (link or crossing)
- All aspects of subjective experience is included

Level of Traffic Stress

- Focus on the effect of traffic in making the travel experience more psychically difficult
- Excludes physical effort involved in travel
- Issue is Comfort + Safety

Accessibility/ Impedance

Overall measure of the difficulty of overcoming a given distance for a particular person

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 Depends upon the experience of safety, comfort, and pleasure, as well as distance

4 Hierarchy of Walking Needs (Alfonzo 2005) N.B.: The entire framework Pleasure comes from a perceptual or subjective point of view. It is how people perceive feasibility, Comfort accessibility, safety, comfort, and pleasure that drives their decision to walk or not. Safety Accessibility Feasibility

Hierarchy of walking needs: Questions for Pedestrians

At any given moment in time and space:

- Feasibility Are you able to walk? Are you able to walk right now?
- Accessibility Do you have destinations of interest to walk to from where you are now?
- Safety Do you feel safe? Concerning both traffic and crime.
- Comfort Are you comfortable walking here? Is there any environmental feature making you uncomfortable?
- Pleasure Is this walking experience enjoyable?

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⁶ Walking Needs: Realm of Influence



7 Walking Needs: Quality of Service View



8 Walking Needs: Level of Traffic Stress



9 Walking Needs: Accessibility View



Accessibility/ Impedance

Scoping Literature Review on Pedestrian Accessibility

Explore the boundaries of a field (Xiao and Watson, 2019)

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Inclusive – only filtering based on relevance, not quality Explore the range of concepts and methods employed

What methods are most commonly applied What methods "stand out" as unusually promising or interesting



Search Strategy

Databases

Title search terms

- Web of Science (112)
- Google Scholar (56)
- TRID database from the Transportation Research Board (62)
- Total = 181

 Pedestrian, walk, nonmotorized, nonmotorized

AND

- Accessibility
 - N.B. Also tested "Access"

Paper Screening Criteria Available in English

The primary mode of travel analyzed must be walking

Must discuss walking to destinations

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Must include some measure of distance, time, cost or impedance



85 papers met these criteria

Analysis Framework

Following Geurs and van Wee (2004), we analyzed the papers along the following dimensions of accessibility:

- Transportation
- Land Use
- Individual
- Temporal
- We also added the following dimension:
 - Impedance Calculation

Global Interest in Walk Accessibility



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Growing Interest in Walk Accessibility

Data Extraction

- Authors
- Title
- Journal
- Year
- Study Area
- Study Continent
- Measure of Impedance or Distance
- Origins

- Destinations
- How the pedestrian network is created
- Individual-level variations
- Analysis method
- Main findings
- Innovative features
- Limitations
- Later: Temporal features

Generalized Accessibility Formula (Wu and Levinson, 2020)

$$A_i \propto \sum_{j=1}^J g(O_j^t) f(C_{ij})$$

Accessibility = sum(Attractiveness * Impedance)

Dimensions of Accessibility



Summary of Findings

Findings: Transportation Dimension

- Lack of adequately detailed data on the pedestrian network
- Generally, the roadway network is used with minor modifications
- In a few cases, researchers go to substantial trouble to construct detailed pedestrian networks
- Pedestrian networks can be dependent upon the user type, i.e., wheelchair-using persons
- Walk accessibility can vary depending upon the pedestrian network constructed (Tal & Handy, 2012, Erath and Eggermond, 2016)

Pedestrian Link Information

Types of Pedestrian Links

Pathways through Plazas or Parks

Sidewalks

Shared Use Paths

Off-Road Paths

Marked and Unmarked Street Crossings

Underpasses

Overpasses

Stairways and Escalators

Interior Building Corridors

Measurable Characteristics of Pedestrian Links

Pathway Features

Surrounding Environment Features

Obstacles

Operational Characteristics

Crossing Features

Findings: Land-Use Dimension

- Land use features both as origins and destinations and as a context for a given route
- Origins: Zones, neighborhoods, residences, buildings, or any street address
- Destinations: Include jobs, parks, health service facilities, schools, childcare facilities, shopping centers, and transit stops
- Surrounding land use can influence route impedance
 - Evidence of preference for walking on commercial streets (Broach and Dill, 2015)
 - Evidence of preference for walking along streets with greenery (Blecic et al., 2015)

Individual Dimension

Individual factors are more important for differentiating walking accessibility than for motorized modes

Demographic variables considered include: age, gender, income, health, mobility constraints, vision constraints, and more

Older adults most commonly analyzed group; wheelchair users also common. Surprisingly, children rarely analyzed

Two approaches: Population segment approach and fully individualized approach (i.e. Cheng, 2019)

Socioeconomic variables, such as **income**, **vehicle ownership**, **and housing type**, are also sometimes used

Temporal Dimension

- Temporal dimension relatively unstudied
- Time can enter through variations in weather and lighting conditions needed for nighttime travel
- Erath et al. (2015) note that shaded and covered routes are preferred in hot, sunny Singapore and that the value of covered routes increases during rainfall events.
- Jehle (2020) examined how accessibility to points of interest varies based on the opening hours

Impedance: Dependent upon all four dimensions and their interactions



Current vs. Recommended Practice

Dimension	Current Practice	Recommended Practice
Transportation	Roadway Network	Pedestrian Network, including Street Crossings
Land Use	Administrative Zones as Origins Specific Destination Types	Building as Origins Specific Destination Types
Individual	All Persons the Same	Distinct Population Segments
Temporal	Not Considered	Consider the Effect of Weather and Nighttime
Impedance	Distance	Time

Discussion and Recommendations

- Considering all of the measurable variables relevant to walk accessibility, a complete measure of pedestrian accessibility is likely impossible
- Important to focus on variables that have the largest effect and are the most policy-relevant
- Shift from roadway networks to pedestrian networks should be feasible
- More focus on the quality of street crossings and the impedance these impose
- Recommend a population segment rather than fully individualized approach

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Contact

Louis A. Merlin, AICP, Ph.D. Department of Urban and Regional Planning Boca Raton, Florida Email: Imerlin@fau.edu



Bonus Slides

Walk Accessibility vs. Walkability

- Walkability is a broad and inclusive topic
- Differing definitions of Walkability
- Walk accessibility is more narrowly conceptualized based upon accessibility – ease of access to destinations

- Two key exclusion criteria:
- The paper must consider walking to destinations of some type
- The paper must include some concept of impedance, distance, or cost