U.S. Department of Transportation

ITS4US

IT'S TRANSPORTATION FOR ALL OF US

AccessMap MultiModal

University of Washington - Transportation Data Equity Project

April 3, 2024

Agenda

Purpose of this Webinar

- Share insights about accessible mapping
- Share insights about accessible wayfinding
  - Address scalability and regional extensibility of pedestrian access data
  - Address routing algorithms that optimize for more than time and distance
- Share results from UW work on the Transportation Data Equity project.

Webinar Content

- ITS4US Deployment Program Overview (Kate Hartman)
- UW team; Anat Caspi, AccessMap Multimodal
- How to Stay Connected
- Stakeholder Q&A

Webinar Protocol

- Please mute your phone during the entire webinar
- You are welcome to ask questions via chatbox at the Q&A Section
- The webinar recording and the presentation material will be posted on the ITS4US website

Kate Hartman

Chief – Research, Deployment & Evaluation

ITS Joint Program Office (JPO)

ITS4US UW Project AOR

ITS4US Program Overview

- A USDOT Multimodal Deployment effort, led by ITS JPO and supported by OST, FHWA and FTA
- Supports multiple large-scale replicable deployments to address the challenges of planning and executing all segments of a complete trip

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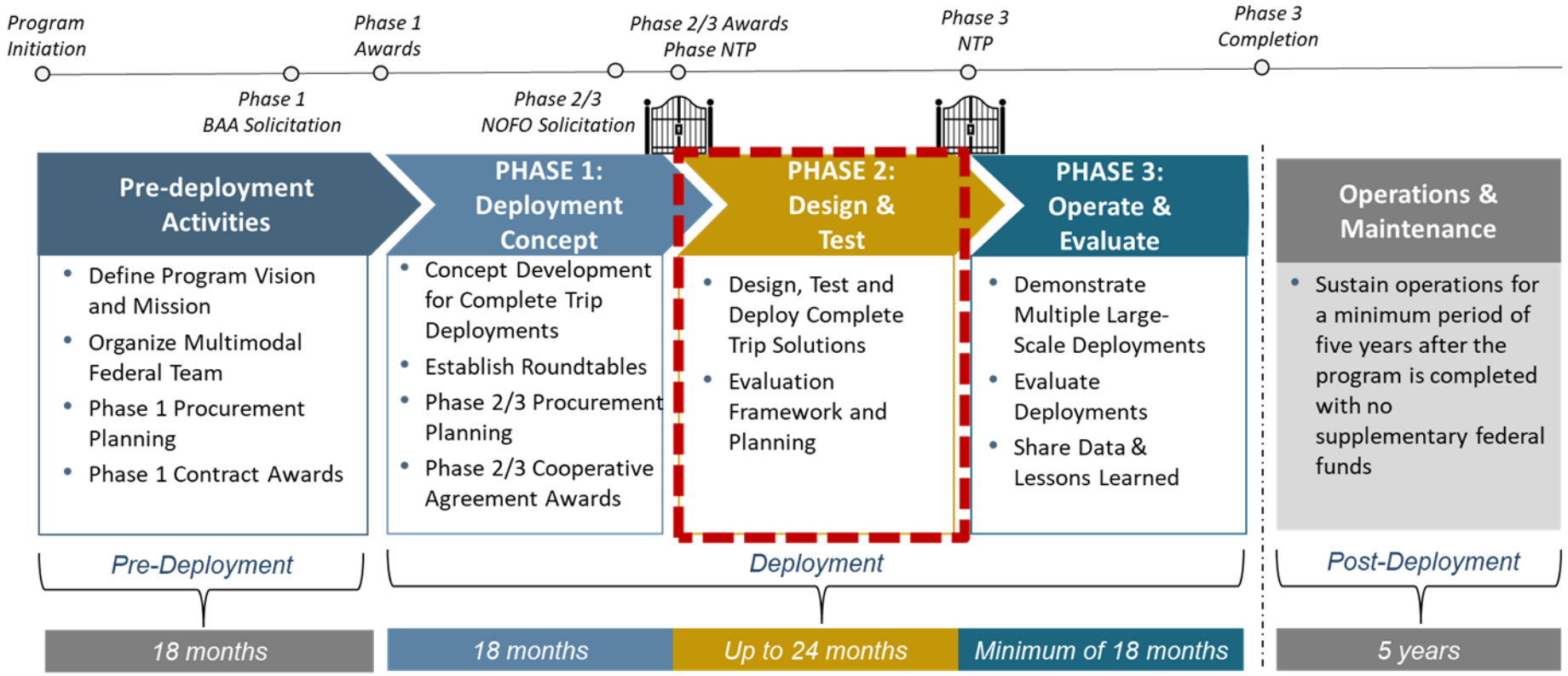
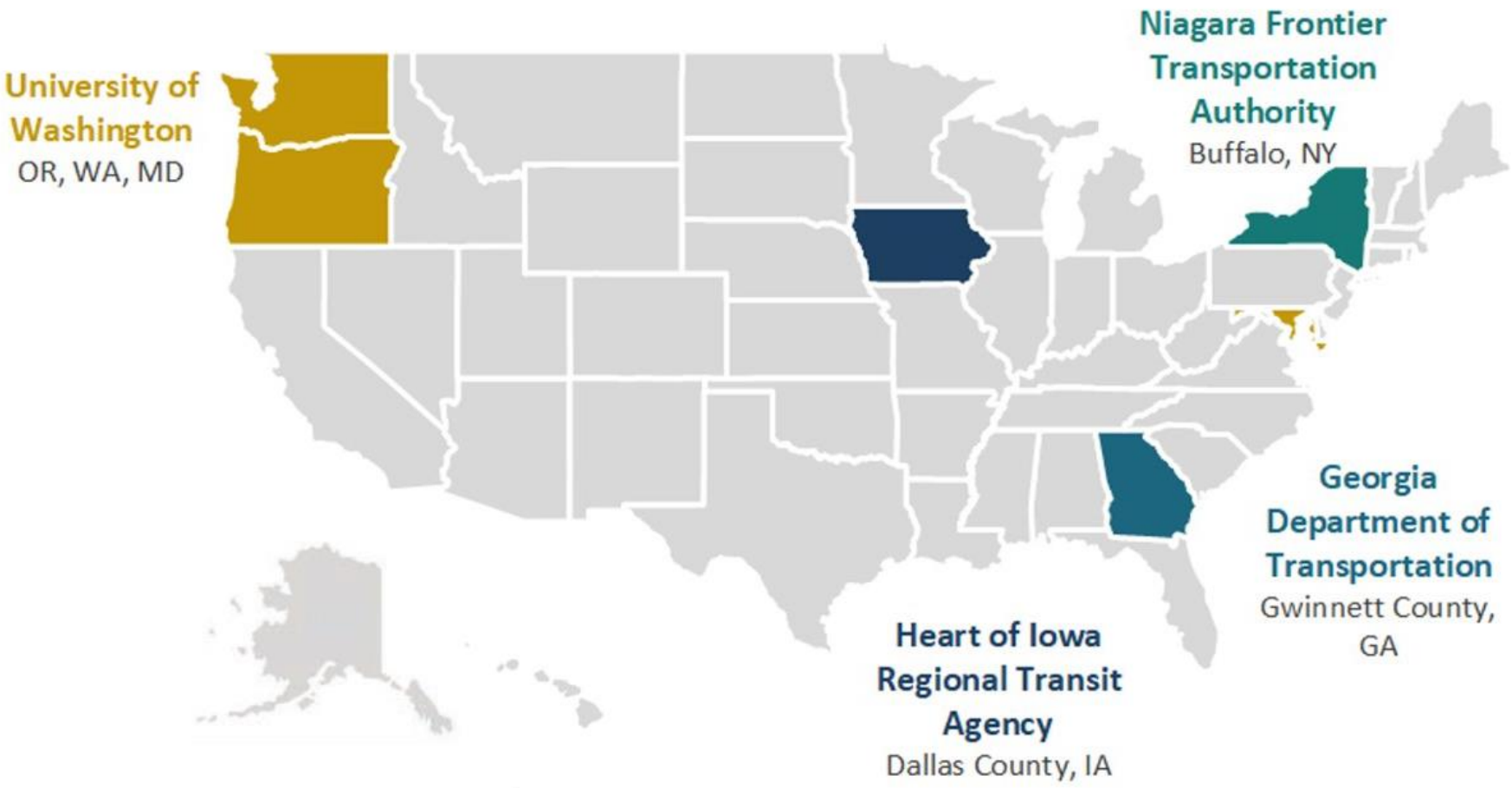
Vision: Innovative and integrated complete trip deployments to support seamless travel for all users across all modes, regardless of location, income, or disability

Deployment Phases



Source: USDOT

ITS4US Deployment Sites



Source: USDOT

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AccessMap Multimodal:

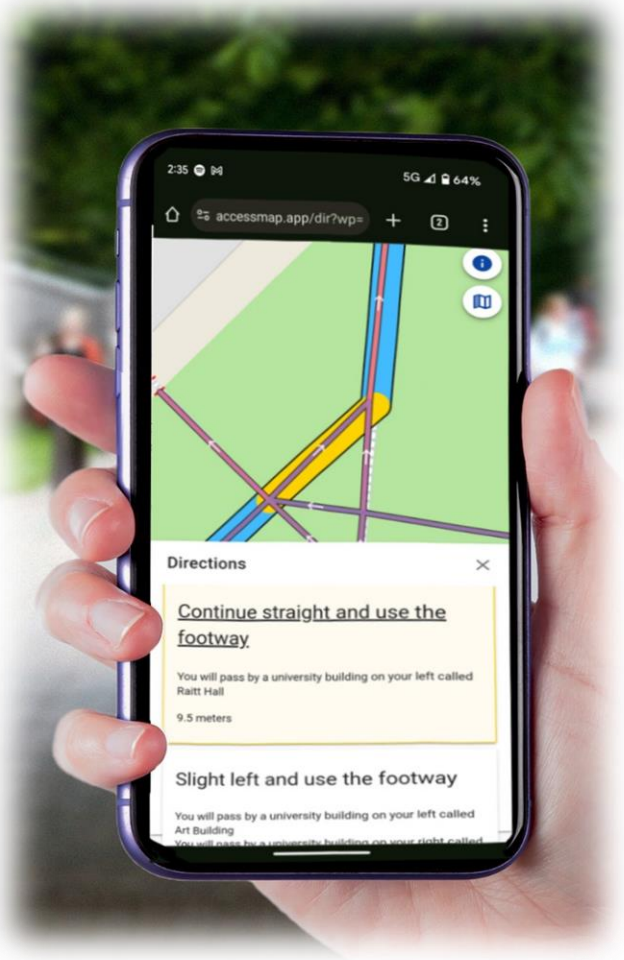
Advancing Pedestrian Wayfinding and Accessible Mapping

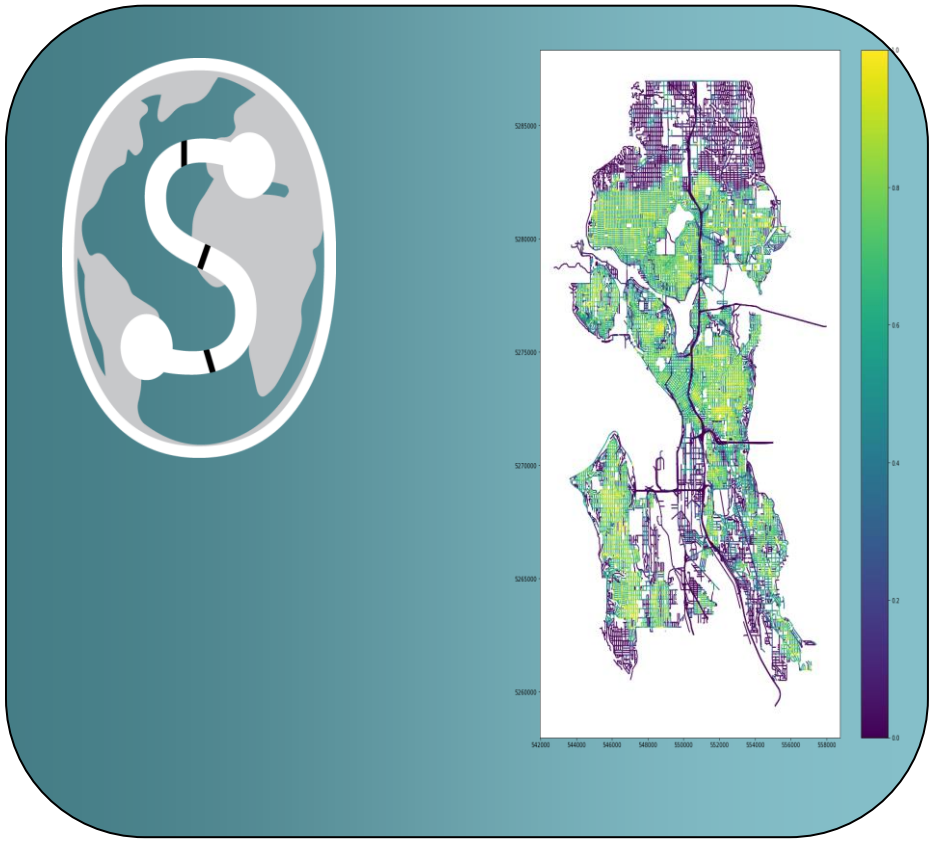
Anat Caspi, PhD
Director, Taskar Center for Accessible Technology

PAUL G. ALLEN SCHOOL OF COMPUTER SCIENCE & ENGINEERING

TCAT The Taskar Center for Accessible Technology

Accessmap is a customizable Pedestrian Routing Tool





Partner with us. Join our study to trial these tools.

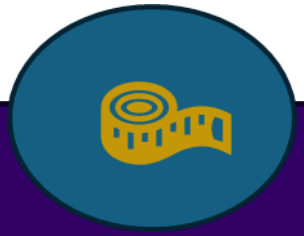
tinyurl.com/GoAccessMap

Guiding Principles

Access is Personal

Traveler categories like “wheelchair user” ignore variation.

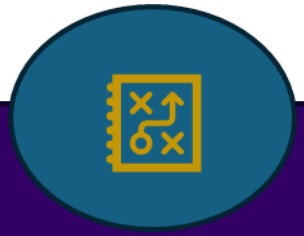
Personal Mobility profiles



Access is not a binary category

“accessible/inaccessible” is subjective & uninterpretable

Accessibility data must be value-neutral, non-subjective, describe environment



Actual infrastructure and its connectivity determines access

Access evaluation requires a pedestrian network, not separate assets

Accessibility data must detail ped transportation graph

Accessibility of streets and sidewalks

OpenSidewalks

To realize resilient, sustainable, accessible cities, we must standardize and metricize the full **Pedestrian & bike transportation network**.

Stakeholder information gaps: Pedestrians

Pedestrians, bikers, non-motorized travelers:

- "How do I find safe, accessible routes tailored to my abilities, needs and wants?"
- "What is my reach in a particular environment?"
- "What neighborhood is best fit for me, my family, my particular non-motorized transportation goals?"

Stakeholder information gaps: Planners

Planners:

"Can we improve how we…

- …prioritize infrastructure modifications?
- …address equity considerations?
- …metricize mobility and access to transportation for our diverse population?"

Stakeholder information gaps: Businesses

Businesses, private transportation providers (TNC, Transportation Network Companies), paratransit operators:

“Can we describe safe, accessible routes for diverse customers to our address/campus/fixed transit route station?”

Human-centric personal mobility models

ccessmap

Human-centric personal mobility models

- simulate different people's actual traversal through the environment
- explore how people navigate and make choices aboutthe built environment around them
- can assess true reach or access

Serving pedestrians must address human-centric factors:

- What is an individual's goal?
- What infrastructure exists to support their trip?
- What infrastructure cannot support their trip?
- How do multiple factors in the environment impact this experience?

What maps are people currently using?

We've been surveying people since 2018 on informational tools they use to support their pedestrian trips

People who indicated they have mobility limitations

- 90% used Mass Produced Maps (MPM) (Google, Apple, Bing)
- 10% indicated they don't seek information, they've given up trips
- Of the 90% using MPMs, 25% used only MPMs, remainder additionally used combination of:
  - StreetLevel Imagery
  - Crowd-contributed apps (Waze, Tiramisu)
  - Help and Suggestions from Friends/Family
  - used specialized accessibility maps (PDFs)

People who indicated they have no mobility limitations

- 100% used Mass Produced Maps (MPM) (Google, Apple, Bing)
- 8% indicated they additionally seek suggestions from friends and family

What resources are people currently using?

We've been surveying people since 2018 on informational tools they use to support their pedestrian trips

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Of the surveyed cohort, those who interviewed with us reported

from 30 minutes to 4 hours

seeking information about pedestrian travel before a trip

What do specialized maps show?

- Sidewalk assets, but…
- …disconnected in space
- … existence, density, unclear abstractions
- …not scalable:
  - No consistency
  - Siloed by organization or purpose
  - Difficult to maintain as the built environment changes
  - Limited information

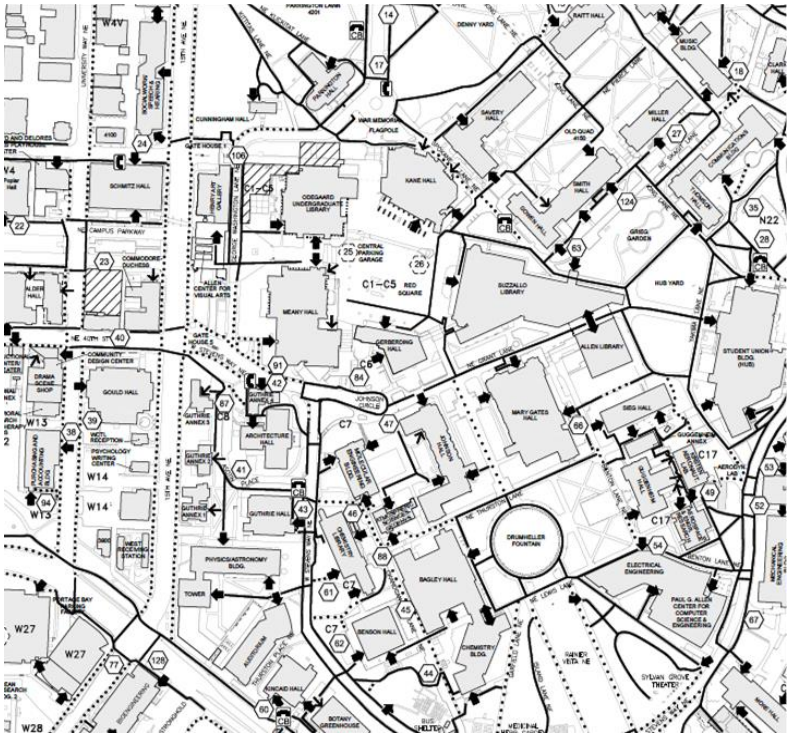


Image: University of Washington Accessibility Map

We start by talking to people (participatory codesign): What features impact travel?

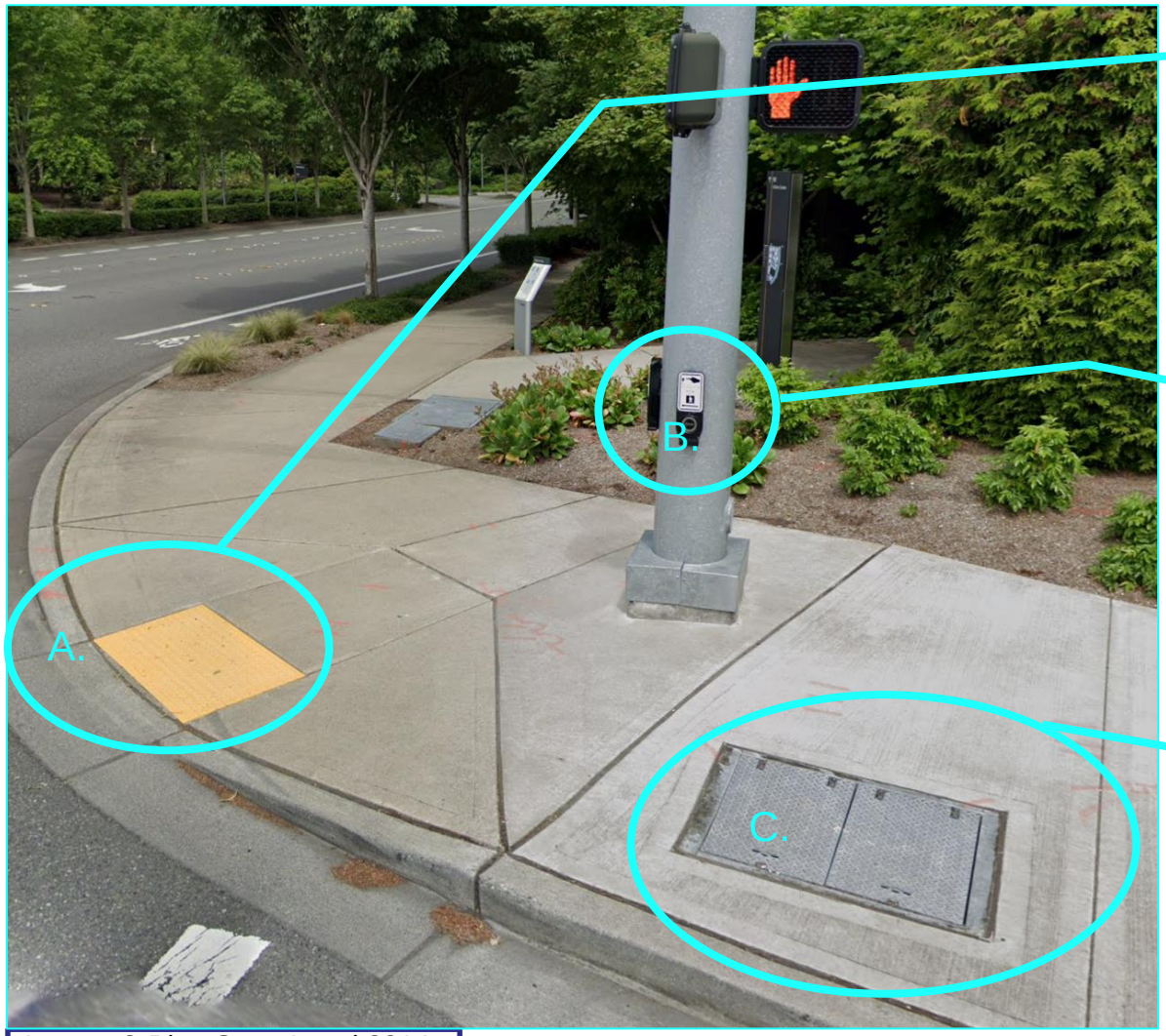


Image: © Bing StreetLevel 2014

A. Tactile curb ramp

```
barrier=kerb;
kerb=lowered;
tactile_paving=yes
```

B. Pedestrian signal button

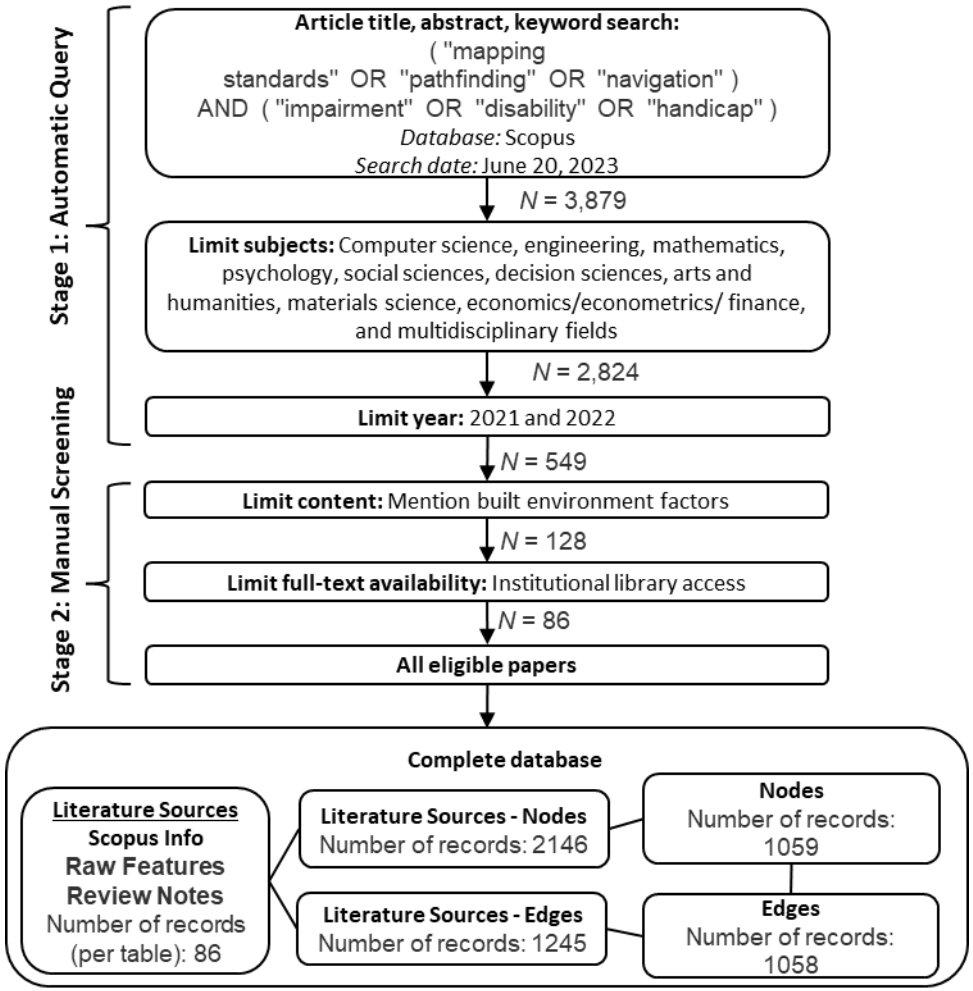
```
button_operated=yes
traffic_signals:sound
traffic_signals:vibration
```

C. Utility hole cover

```
man_made=manhole
manhole:shape=rectangl
   e
manhole:lid=metal
```

N. Bolten, S. Mukherjee, V. Sipeeva, A. Tanweer and A. Caspi, (2017) IBM JRD,
"A pedestrian-centered data approach for equitable access to urban infrastructure environments."

Incorporate prior work into data schema development



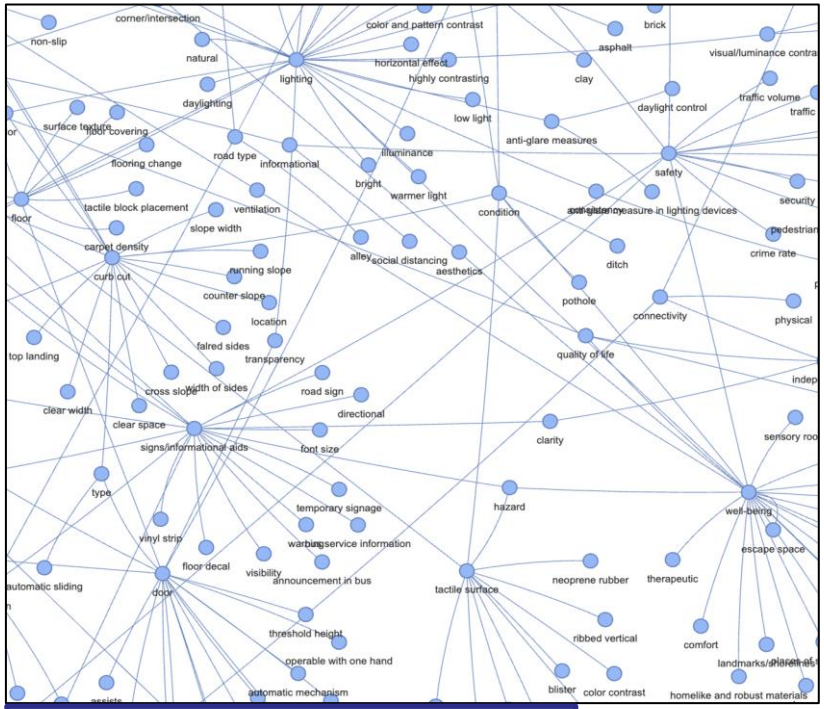


Image: Christine Mendoza, TCAT 2024

Term *(aggregated)*	Article Count
width	58
stairs	36
height	26
lighting	26
crossing	24

ramp	24
material	23
slope	23
handrails	22
regularity	22

OpenSidewalks: Data Standardization is Key

- Consistent data schema
- Integrates diverse data sources
- Enhances data reliability
- Ensure data compatibility and interoperability

OpenSidewalks translates pedestrian concerns into data elements and consistent feature tags

➢ See OpenSidewalks schema on github

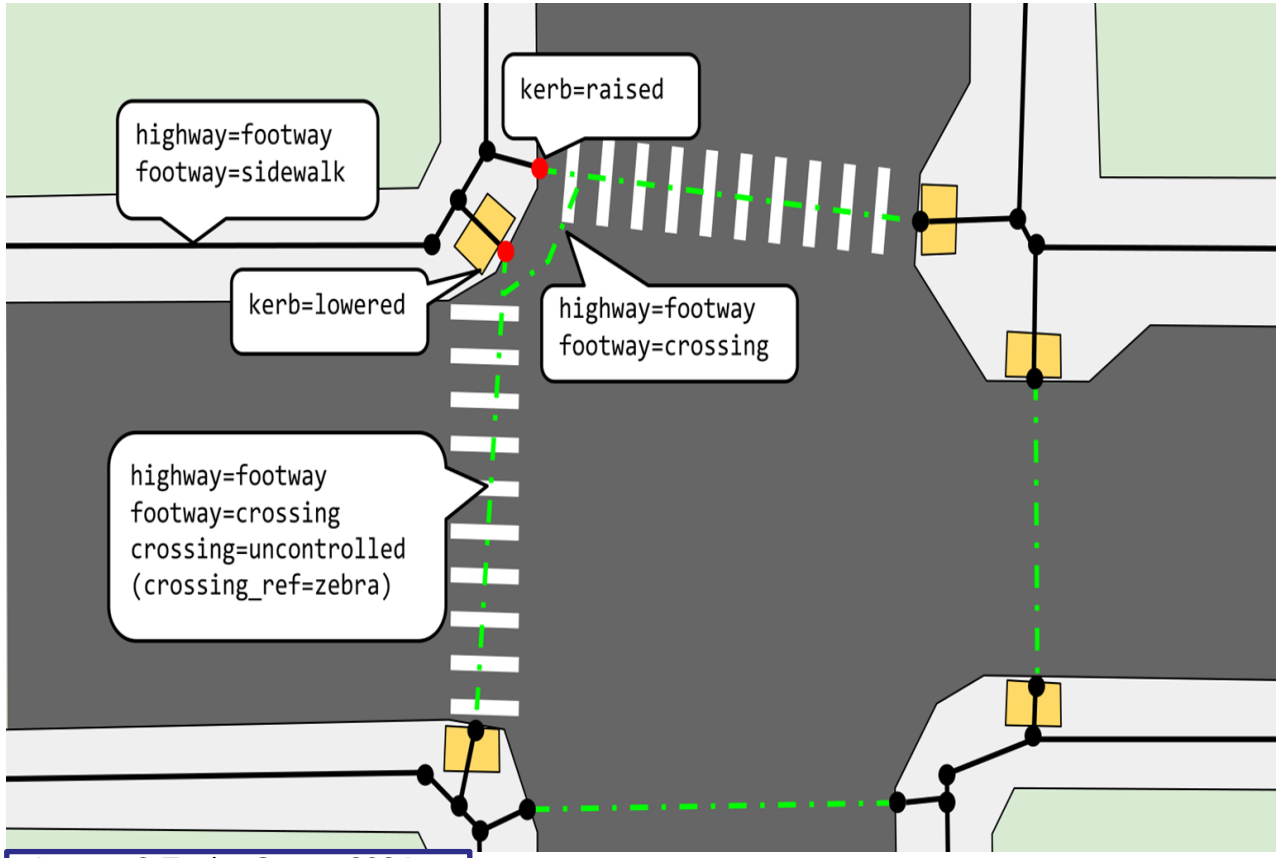


Image: © TaskarCenter 2024

AccessMap Multimodal: Visual Paradigms

The map provides visual primacy to pedestrian ways and crossings

Realtime custom views based on personal limits

Every element can be inspected

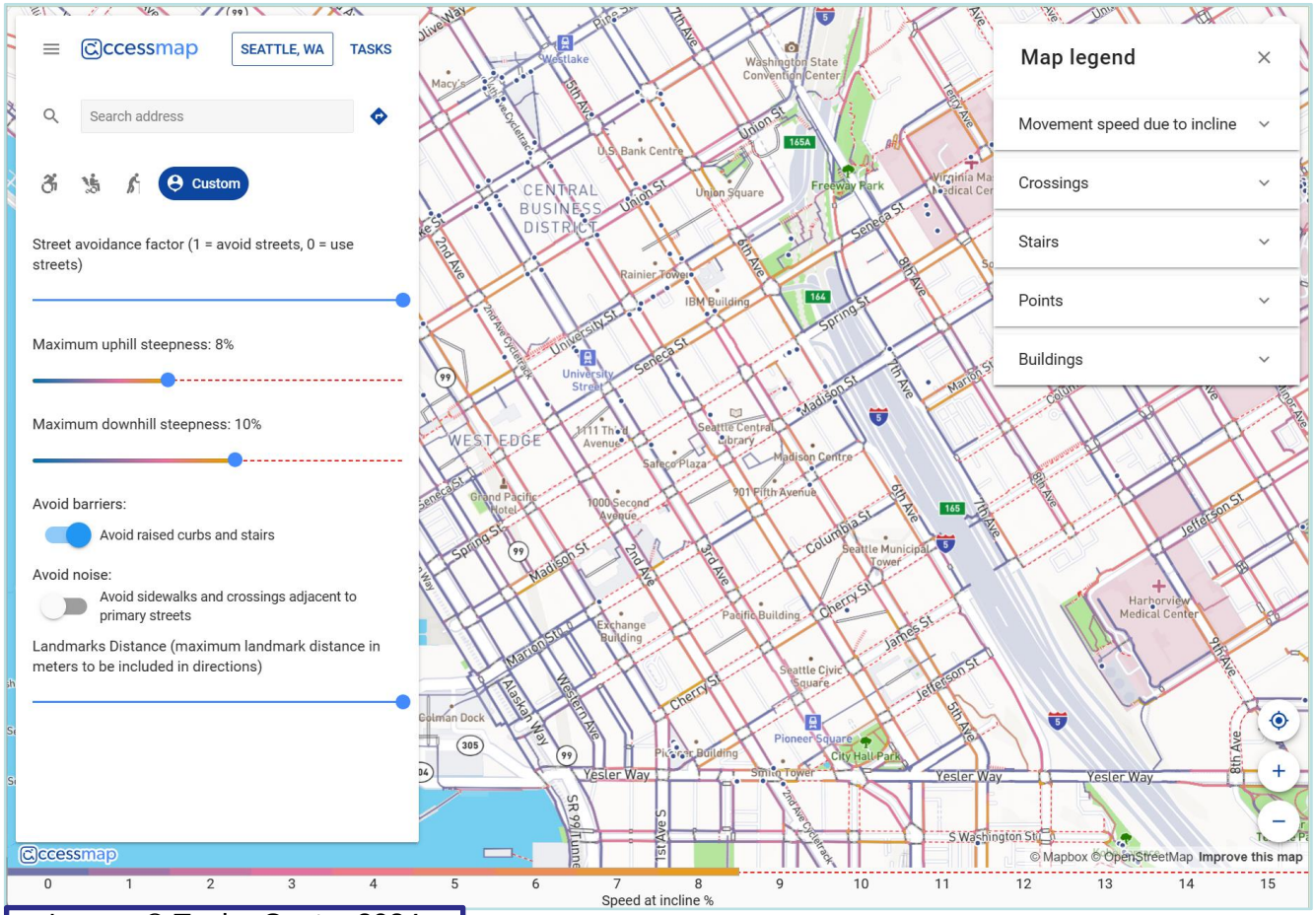


Image: © TaskarCenter 2024

AccessMap Multimodal: Routing Capability

A network allows us to use routing algorithms

Customized paths within users' limits.

No arbitrary interpretation of what's "passable" or "accessible."

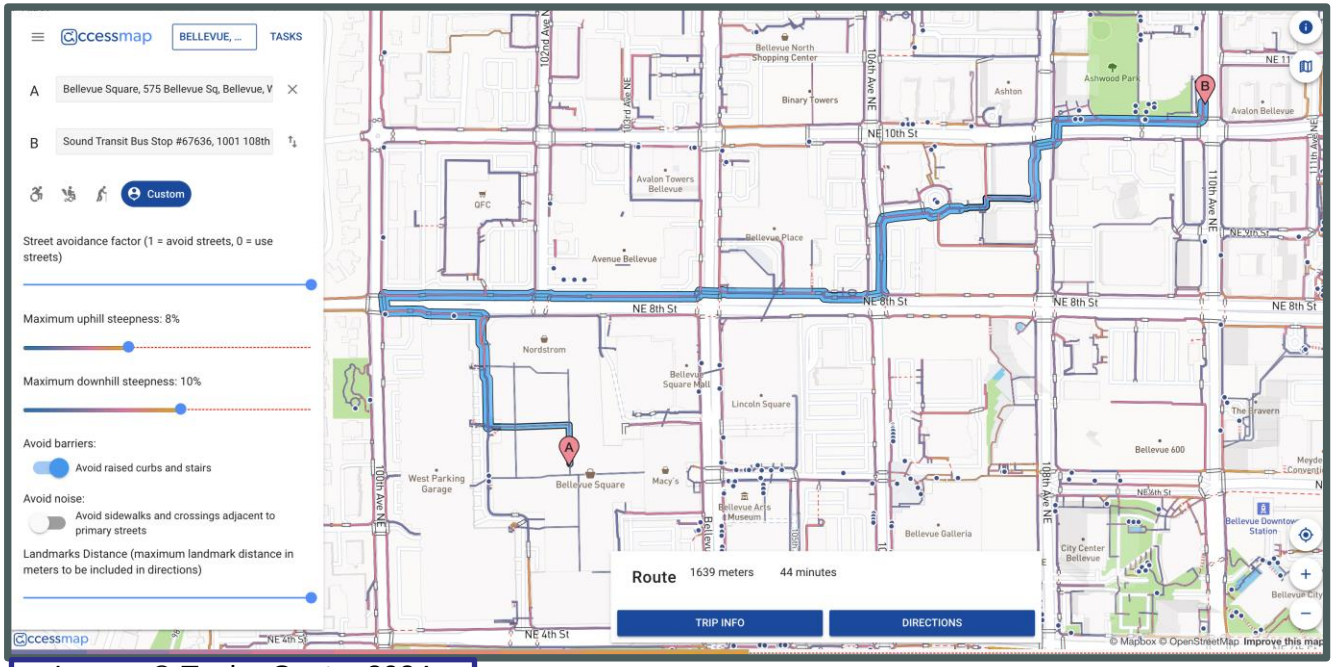


Image: © TaskarCenter 2024

AccessMap Multimodal: Non-visual interface

Informational Hierarchy

Directional cues

Tactile Context and Landmarks
- Presence
- Direction
- Distance from path

Spatial comprehension & timed alerts

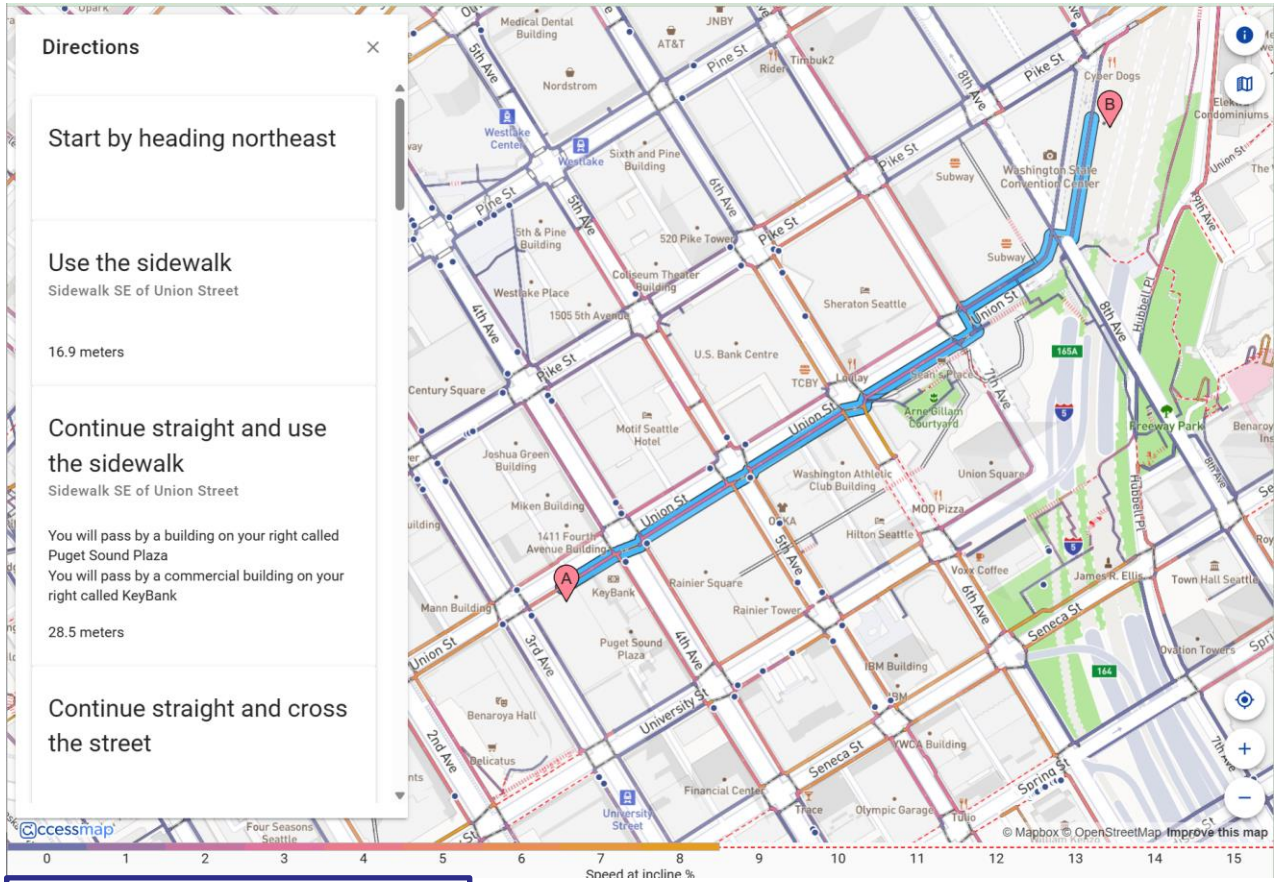
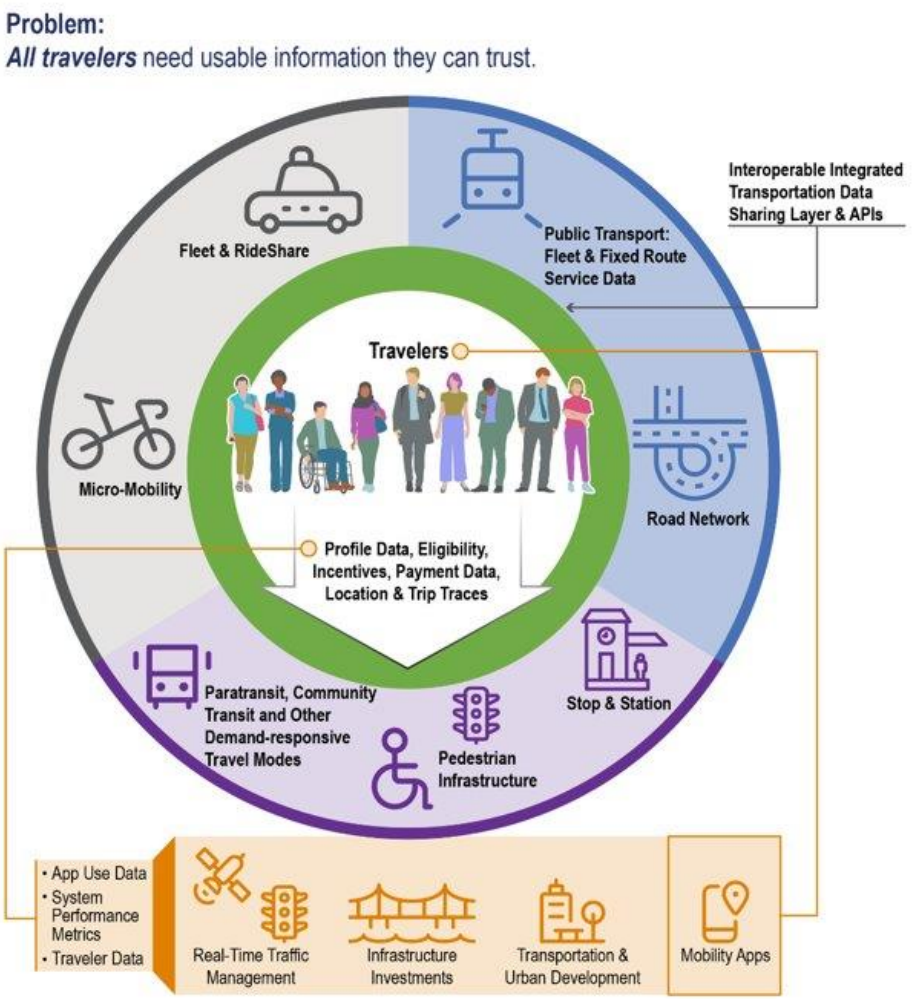


Image: © TaskarCenter 2024

AccessMap API Integration:

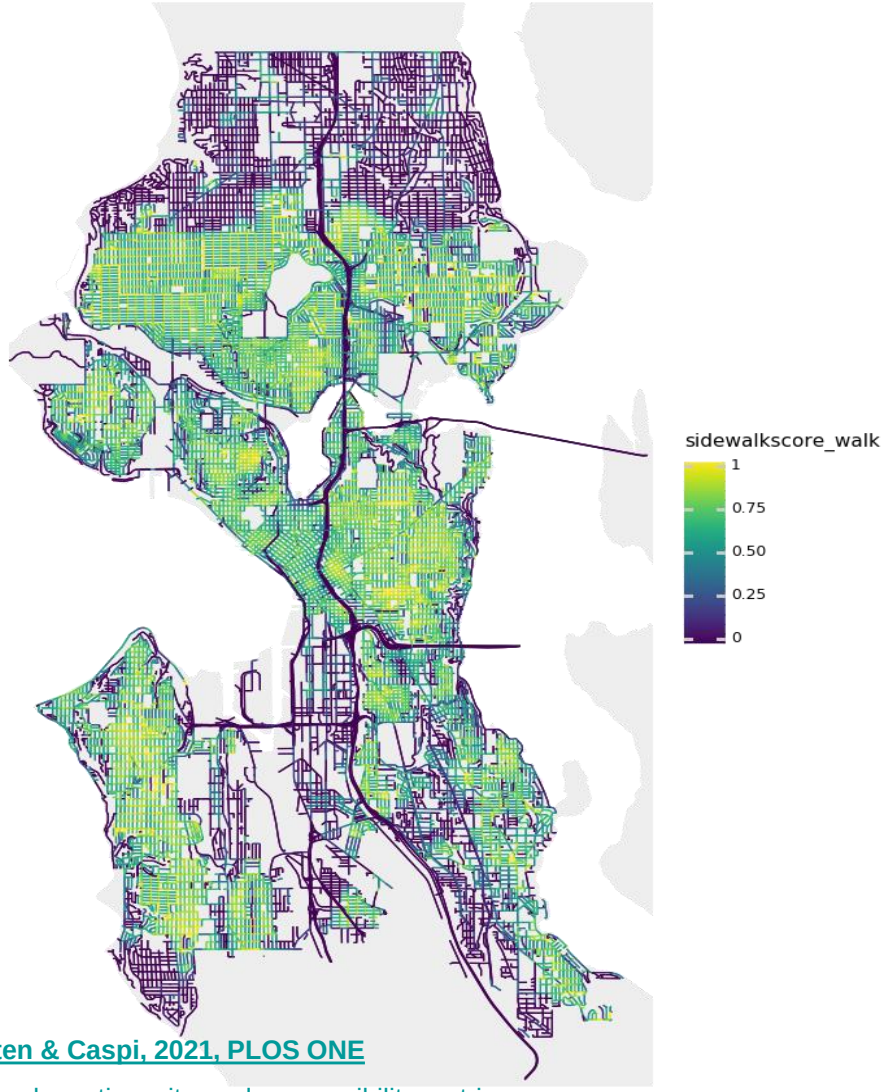
Utilize TDEI and OSM API's to get sidewalks data

- API integration for seamless data access
- Realtime retrieval and updates
- Facilitate cross-platform compatibility
- Flexibility for future extensions and new features
- Enhances accessibility and user experience



AccessMap scalable data pipeline: from data to pedestrian graph

- Utilize consistent data schema: OpenSidewalks
- Regionally scalable architecture
- Leverages ITS4US Transportation Data Equity's shared, open infrastructure
- Seamless integration of new data
- Immediate availability to the application

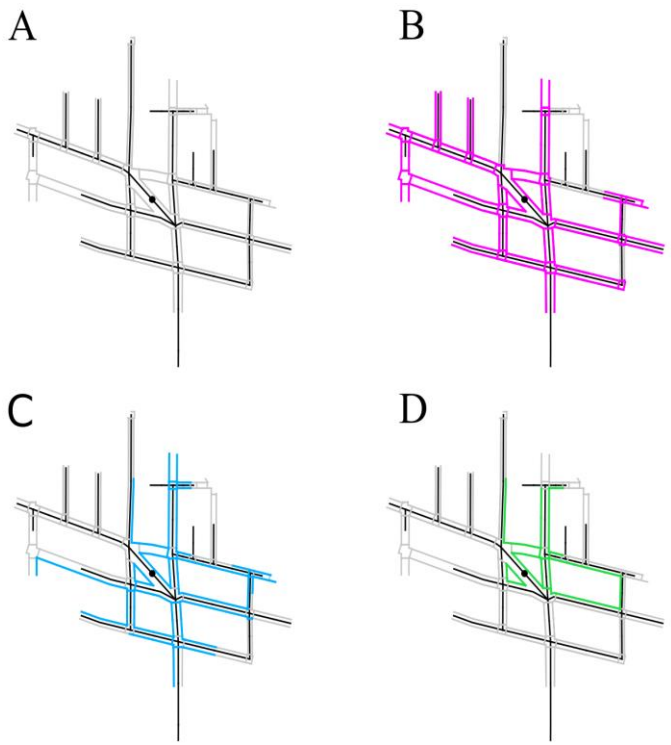


Bolten & Caspi, 2021, PLOS ONE

Towards routine, city-scale accessibility metrics:

AccessMap network routing:
interpretable pedestrian accessibility

400 meter "walksheds"



Street network

Pedestrian network

Ped network excluding paths >8% grade

Ped network excluding unlowered curbs

Ped network excluding unmarked crossings

Bolten & Caspi, 2021, PLOS ONE

Towards routine, city-scale accessibility metrics:

AccessMap routing:
multivariable cost function

Customized realtime routing capabilities

***not* shortest path distance or time**

Integration of user preferences and constraints

On-edge-device adjustment of routing priorities

•Real-world walking behavior depends on multiple factors, and accurate cost functions enhance accessibility modeling.

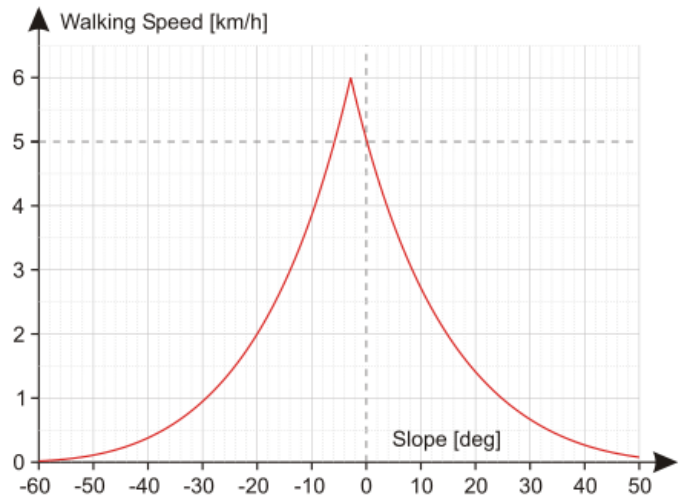
Tobler's Hiking Function (THF):

•**Purpose**: The THF was originally formulated by W. Tobler to describe the relationship between walking speed and slope angle during hiking or walking.

•**Formulation**: The THF is an exponential function:

$$v(s)=k\cdot e^{-3.5|s|}$$

- •Here, (v(s)) represents the walking speed (in meters per second) at slope (s).
- •(k) is a scaling factor (we determine regionally)
- •exponent (3.5) is empirically derived.



AccessMap.app by the numbers

- 500-800 monthly individual users
- 12 regions
- 415 square miles of total area
- 60K+ routing requests (since 2018)
- 250K+ sidewalks and footpaths
- 100K+ crossings
- 216K+ pedestrian zones
- 935K+ total paths described for detailed pedestrian access!

OpenSidewalks:

Advancing Pedestrian Data Collection and Interoperability, through an Open Data Collaborative and Accessibility-first principles

Want to contribute data?

App based – join Earth-a-thon with DemocracyLab on April 20th

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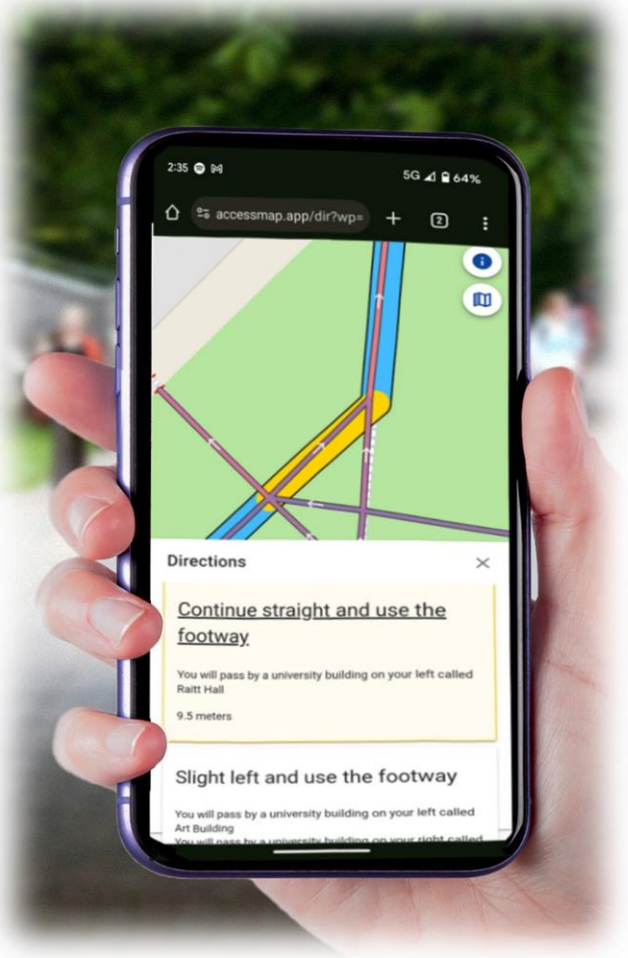
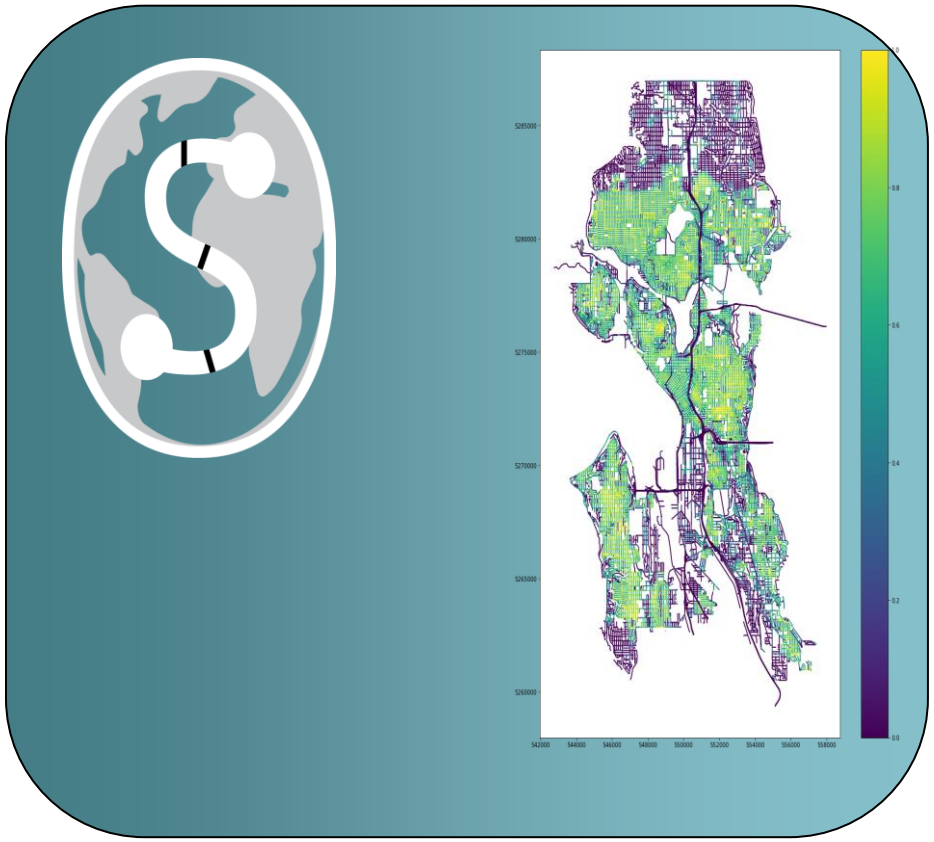
Accessmap and OpenSidewalks





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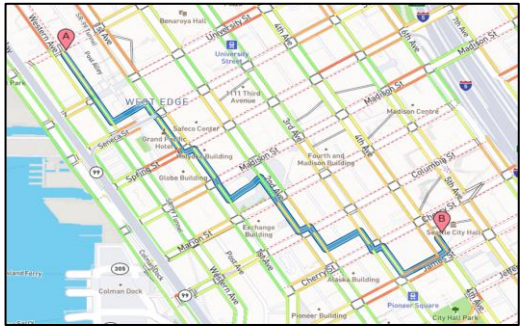
THANKS!



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Transportation Data Equity
an initiative by TCAT & UW TRAC

Visit ITS4US Deployment Program Website and Video:
https://its.dot.gov/its4us/
https://youtu.be/pztl1lRyXAc

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