

Agenda

▪ Purpose of this Webinar

- To share insights about mapping indoor transit environments for accessible navigation, resulting from UW work on the Transportation Data Equity project.

▪ Webinar Content

- ITS4US Deployment Program Overview (*Kate Hartman*)
- UW team; Anat Caspi, DL Transportation Data Equity Initiative
- Stakeholder Q&A
- How to Stay Connected (*Kate Hartman*)

▪ 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

Brief Program Overview

Kate Hartman, ITS JPO/FHWA

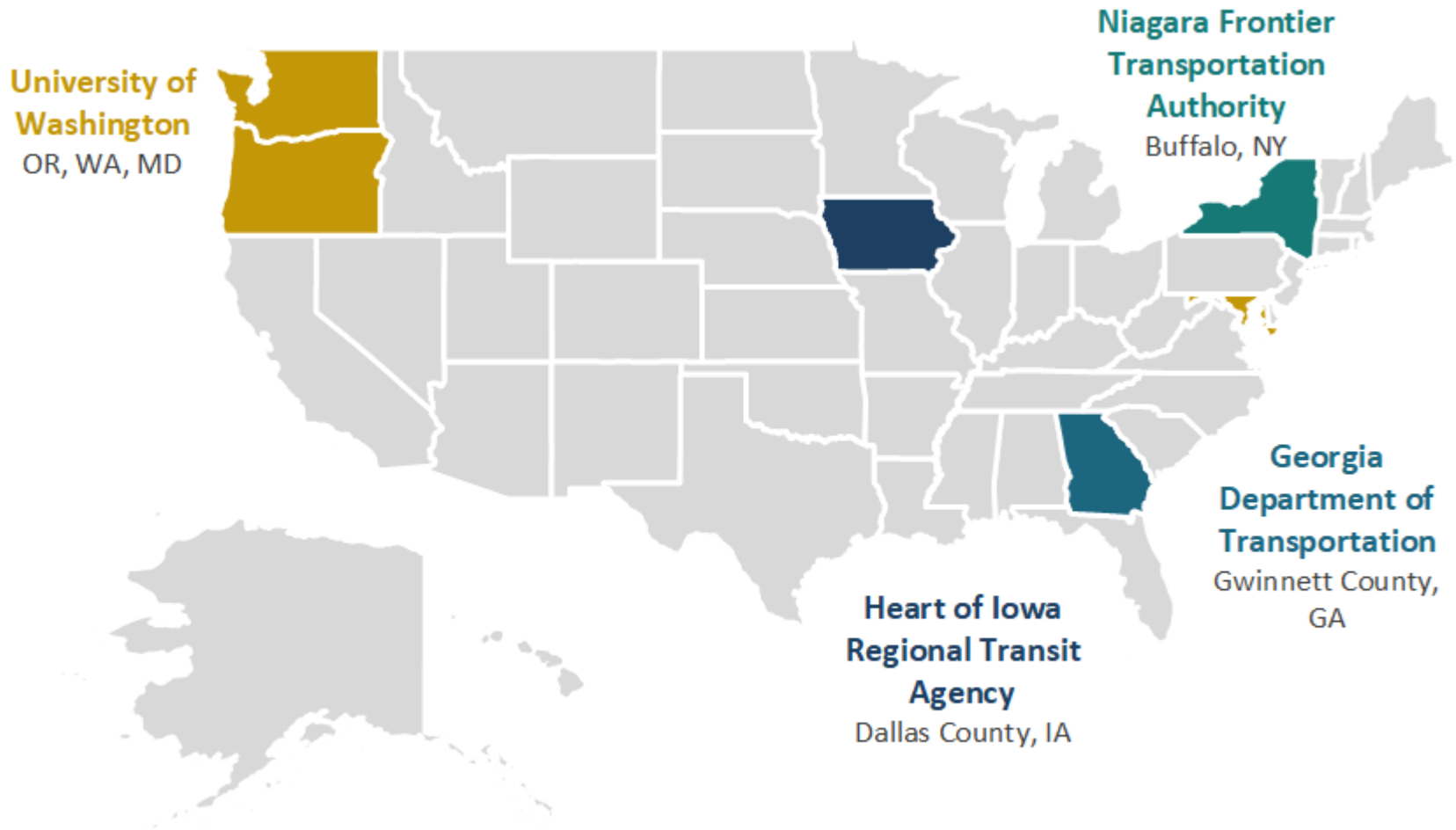
ITS4US Program Overview

- 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



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

ITS4US Deployment Sites



Deployment Phases

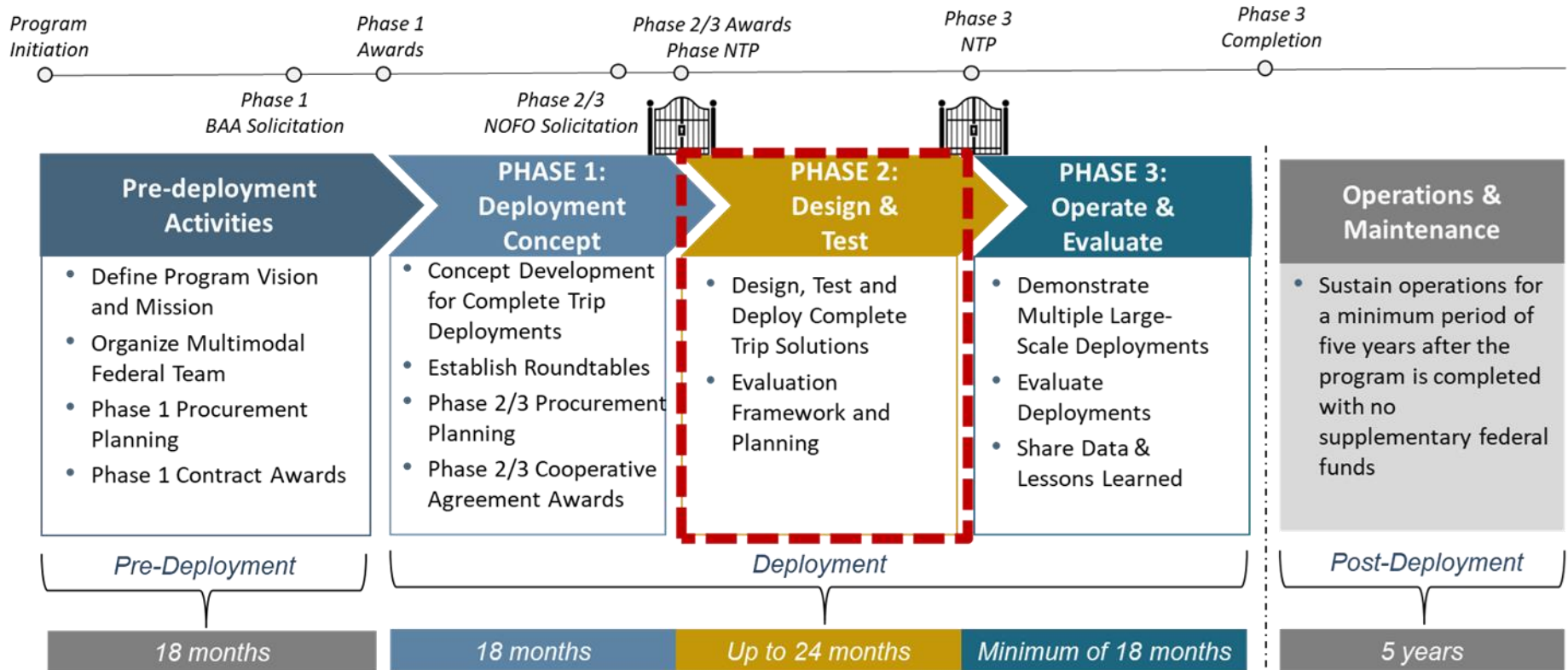




image source: TCAT,
Jess Hamilton

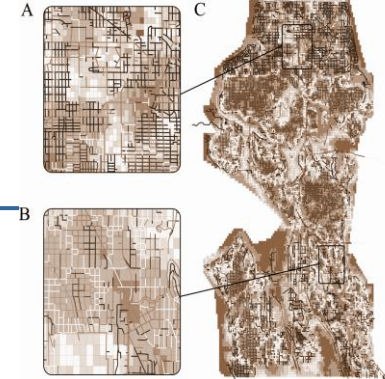


image source: TCAT,
<https://tinyurl.com/SidewalkScore21>

Mapping Indoor Transit Environments for Accessible Navigation

Anat Caspi, PhD
Wisam Yasen, Rati Rastogi, Cy Rosignol
University of Washington



TCAT The Taskar Center for
Accessible Technology

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Who are we?



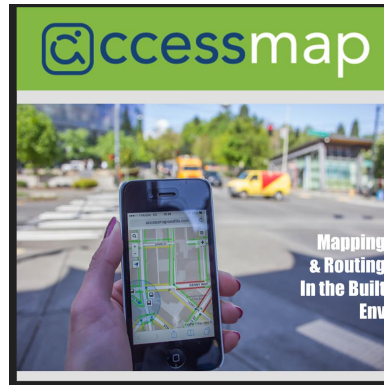
Director, Taskar Center for Accessible Technology
Dev Lead, Transportation Data Equity Initiative



OpenSidewalks

Opensidewalks.com

Pedestrian-centered approach, data specification and tools to share accessibility information about urban street environments



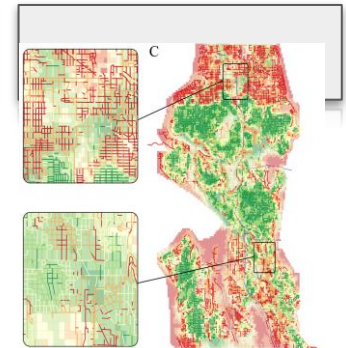
Accessmap.app- automated custom routing for personal mobility profiles

image source: Taskar Center for Accessible Technology, AccessMap.app



TactileMaptile- 3D printed pedestrian-centered cartograph

image source: Taskar Center for Accessible Technology, Jessica Hamilton



EquicityLab- Urban analytic dashboards for equitable urban planning

image source: Taskar Center for Accessible Technology, publication: <https://tinyurl.com/SidewalkScore21>

Goal of this presentation is Threefold

1

Surface and highlight stakeholder needs for mapping indoor transit environments in a consistent way, for accessible navigation

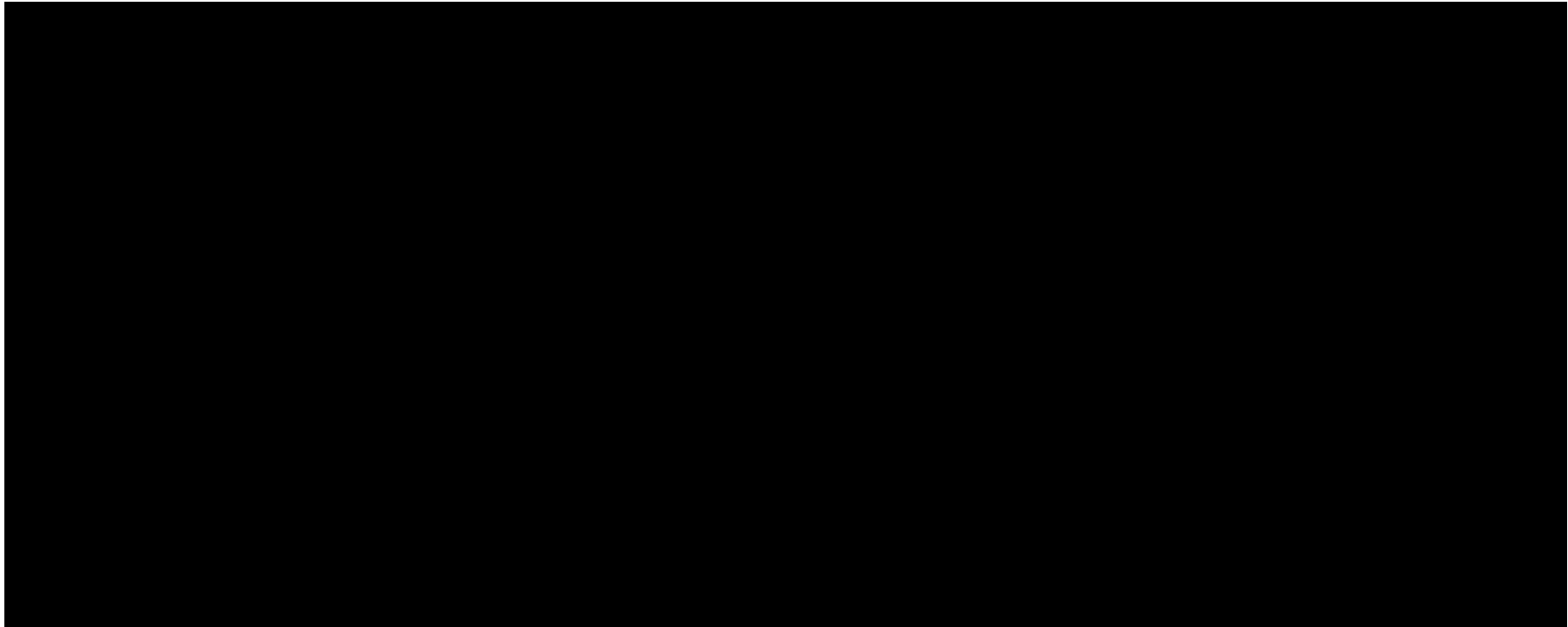
2

Identify the challenges and open problems in mapping indoor spaces

3

Identify several internal mechanisms and collection processes for building routable indoor data

Transit spaces are difficult to navigate



The challenge we are trying to address in our project is enhancing existing data standards and providing tooling to capture multi-floor indoor environments with the specific focus on use of that data for navigation.

video: Anat Caspi, Taskar Center for Accessible Technology

Overview

- **What information is needed for routing in indoor spaces?**
- **What information do PWD want for routing in indoor spaces?**
- **What data formats are available?**
- **What are some data specification enhancements we can make?**
- **What are some tooling contributions we can make to improve indoor mapping capabilities?**

What information do people need to know?

Exploring heterogeneity in population

Methodology:

We did an extensive literature search, interviewed people, followed Orientation & Mobility specialists, had 2 data spec co-design sessions, & followed ADA compliance architects.

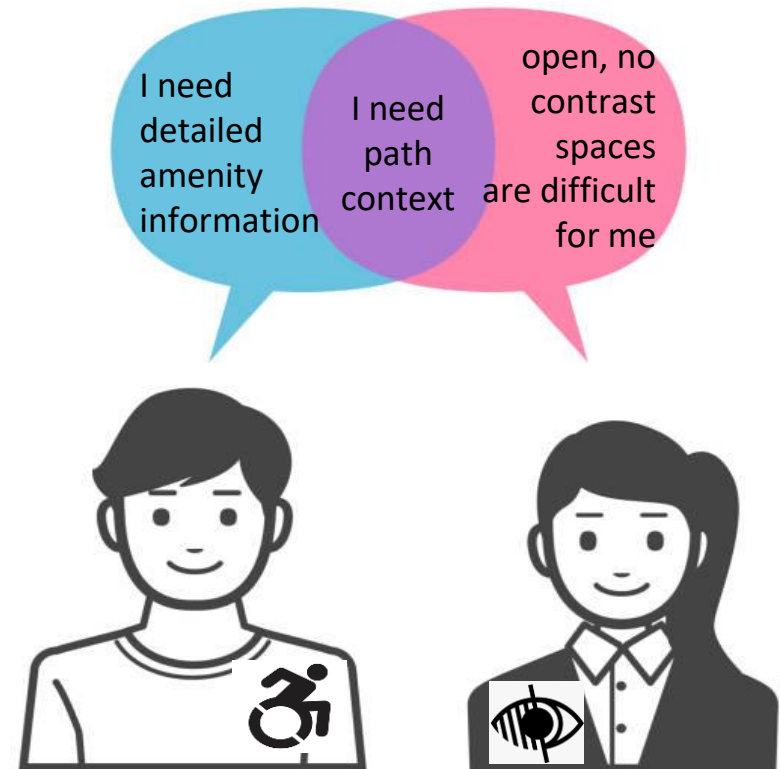
The Taskar Center for Accessible Technology follows a **participatory design** approach.



What information do people need to know? (continued)

Exploring heterogeneity in population

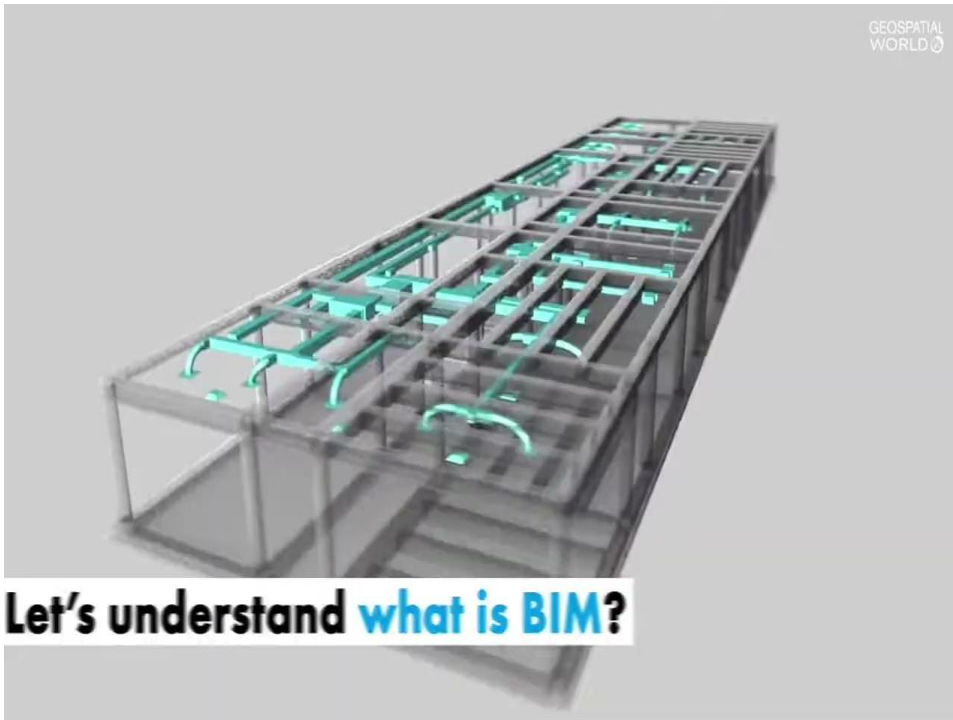
- General Outcomes:
- GPS localization presents hurdle in indoor navigation. Waypoints must be within 0.5m accuracy.
- Amenity information serves both for orientation and utility.
- Paths need contextual information
- Generic nodes are limited value, more confusing, in the context of navigation
- Amenity life-cycle should be captured in the schema



What information do routers need to know?

- **Nodes:** These represent the connection points in the graph, such as decision points & stops.
- **Edges:** These represent the path connections between nodes, such as hallways or walkways.
- **Weights:** These represent the cost of traversing an edge, such as the distance or travel time.
- **Directions:** These indicate the direction of travel on an edge.
- **Routable Graph:** to calculate the shortest path between any two nodes, graphs must be connected, directed, and have weights on the edges.

Indoor Format 1: BIM



video: GeoSpatial World
<https://youtu.be/3pAbmaEjgAs>

Open and Closed Standard(s)!
Different open BIM flavors: Industry Foundation Classes (IFC), building information Modeling for Data Exchange (bsDD), Construction Operations Building information Exchange (COBie)

Original purpose: construction industry

Pros:

- Improves stakeholder collaboration in construction
- comprehensive view of a construction project (decision making, simulated scenarios, Virtual tour)
- holistic analyses of energy use, air quality, other environmental factors for entire bldg

Cons:

- Complex: hard to learn or use
- Large files: hard to handle, process, exchange
- Software support: Few software applications support BIM, and there is no interoperability even within BIM software! limited usability.
- No Validation- WYSIWYG
- Not hierarchical or semantically separable
- High cost
- Skills and tool gap– difficult to collect, work with, and maintain

Indoor Format 2: cityGML with indoorGML



video: mago3D supporting CityGML and IndoorGML
<https://youtu.be/e5NOSyn5o4U>

Open Standard(s)!
Incorporate semantic hierarchical descriptions

Original purpose: disaster management, environmental monitoring, virtual globes, urban planning

Pros:

- Common data format for 3D city models.
- Open standards (OGC 2003, 2011)
- Wider software application support.
- Well documented
- Hierarchical, semantically separable, XML format

Cons:

- Complex: hard to learn or use
- Large files: hard to handle, process, exchange
- Software support: Not all software applications support CityGML, limited usability.
- Validation: CityGML files are difficult to validate, which can lead to errors.
- High cost
- Skills and tool gap– difficult to collect, work with, and maintain: in 2022 only 8 open shared CityGML datasets

Indoor Format 3: IMDF

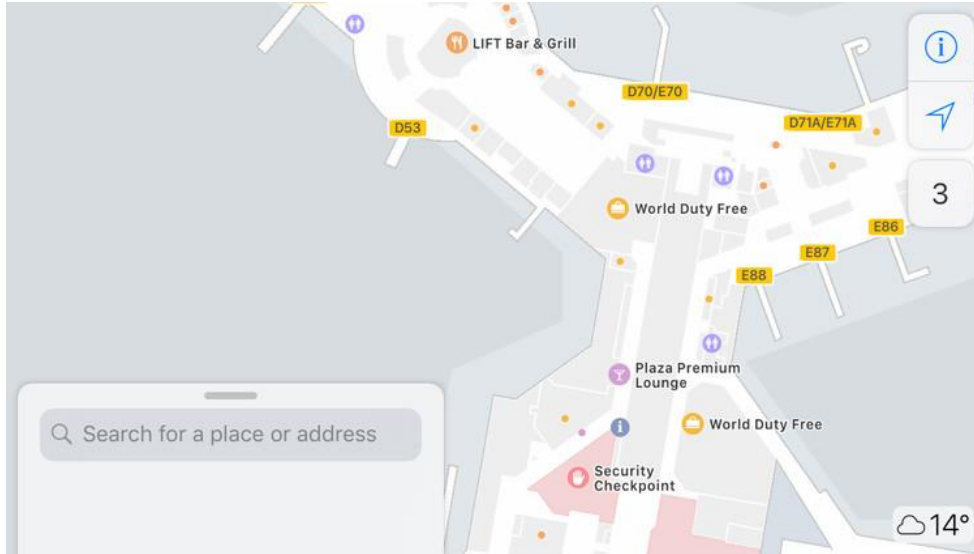


image source: [Tiana Warner](#)

Open Standard(s) originally by apple

Original purpose: lightweight, mobile-friendly format that can be rendered on any device, OS, or browser. Support for organizations that want to create IMDF maps for their own building

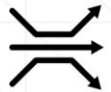
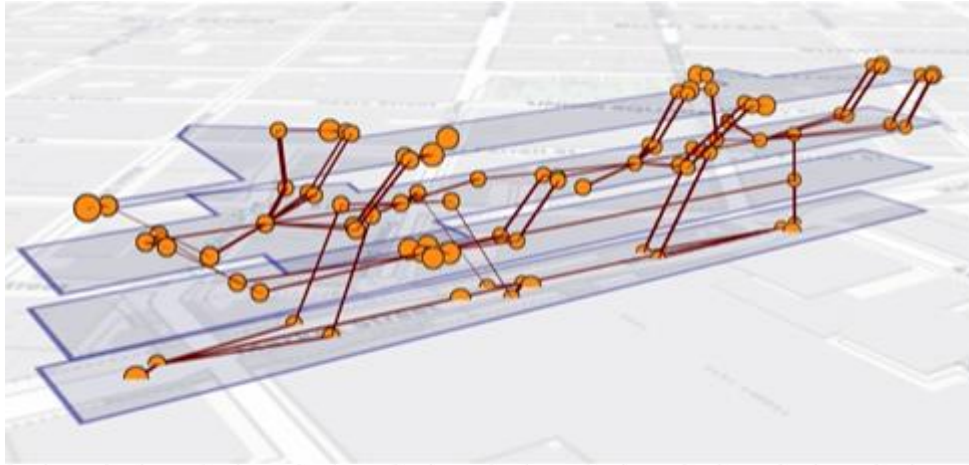
Pros:

- Open standard (OGC 2021)
- Wide software application support- shareable, exchangeable, interoperable
- Well documented
- Lightweight, mobile-friendly
- Supports indoor positioning
- Flexible, extensible
- Validation is possible

Cons:

- Complex: hard to learn or use
- High cost
- Lack of detail- not as accurate or precise
- No support for some indoor features- no underground tunnels, escalators and stairs! (think routing)
- Some skills and tool gap- difficult to create and maintain (though better than previous)
- A lot of data needed to create a map

Indoor Format 4: GTFS-Pathways (GTFS Extension)



Interline

Transitland Station Editor

image source: Interline, the one commercial editor

Open Standard, and part of GTFS already familiar to transit agencies!

Original purpose: lightweight, mobile-friendly format for transit indoor spaces explicitly

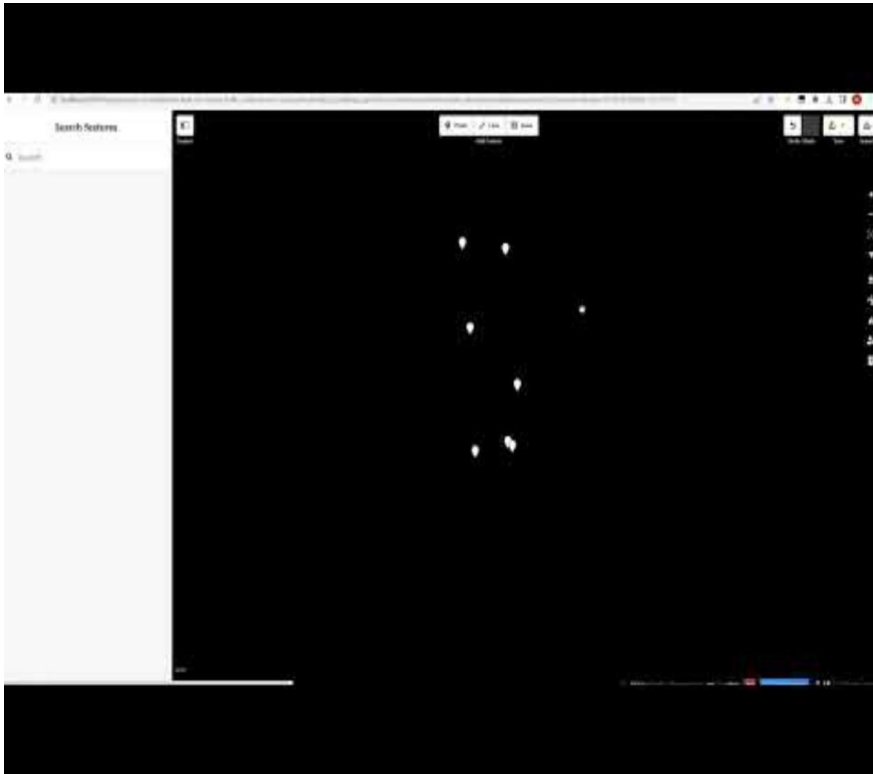
Pros:

- Open standard (Mobility data)
- Well documented
- Lightweight, mobile-friendly
- Flexible, extensible
- Not Complex: excel can be used
- Low cost

Cons:

- Does not support indoor positioning out of the box
- Variable detail- as much or as little as agency would provide- Could be accurate & precise with best practices in mind.
- No support for some indoor features (paid fare zone)
- Some skills and tool gap- difficult to create and maintain
- no current validators!
- Minimal data needed to create a map

Early prototype of a GTFS-pathways editor



Video: Wisam Yasen, Taskar Center for Accessible Technology

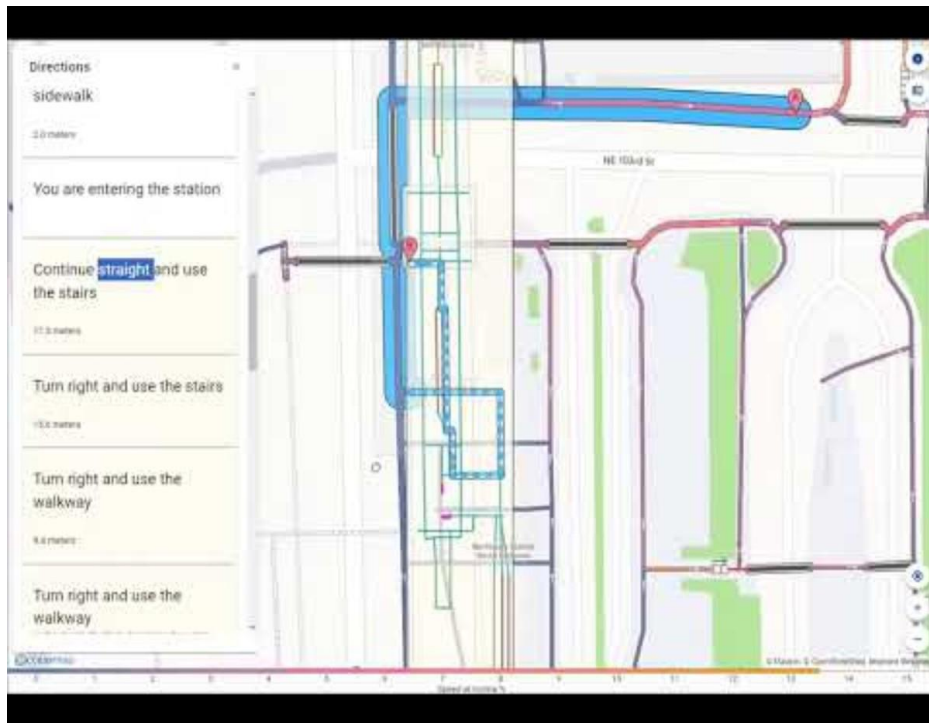
GTFS-pathways editor features:

- open source
- input multiple geojson & pathways files
- familiar to people using iD editor
- save GTFS-pathways and change record (audit traceability)
- easily extensible with new node and pathway attributes
- easily maintainable/updatable

future work:

- UX/UI
- tool tips
- Pathways validation on save
- guidance on connecting indoor/outdoor environment towards multimodal nav

Early prototype of multimodal routing indoor/outdoor pedestrian pathways



Video: Wisam Yasen, Taskar Center for Accessible Technology

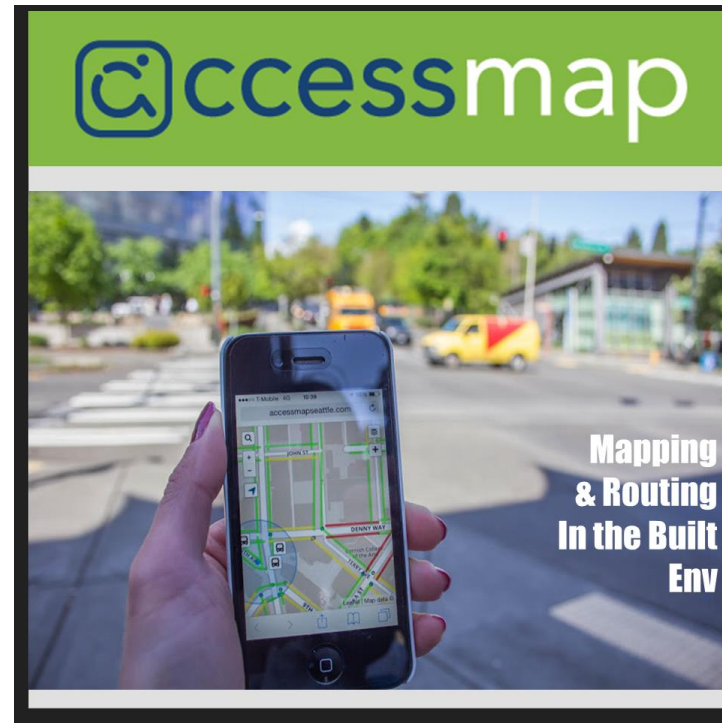


Image source: TCAT, AccessMap.app

TDEI GTFS-Pathways Summary

The first community goal was to route a **wheelchair user through a station**. The secondary goal is to route anybody through a station, with a focus on step-free accessibility.

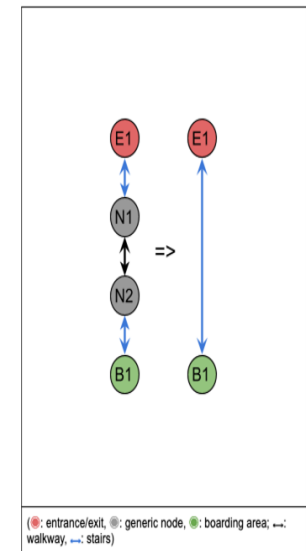
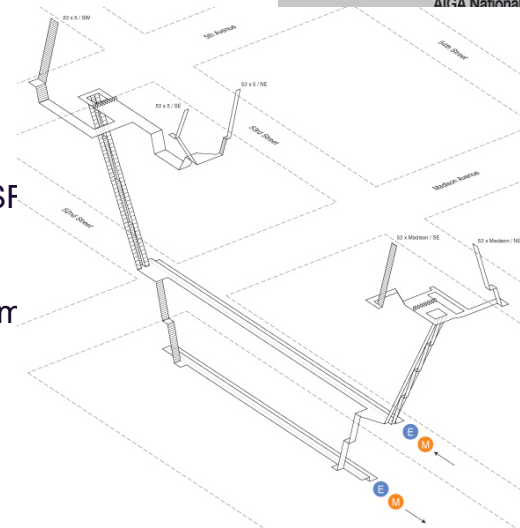
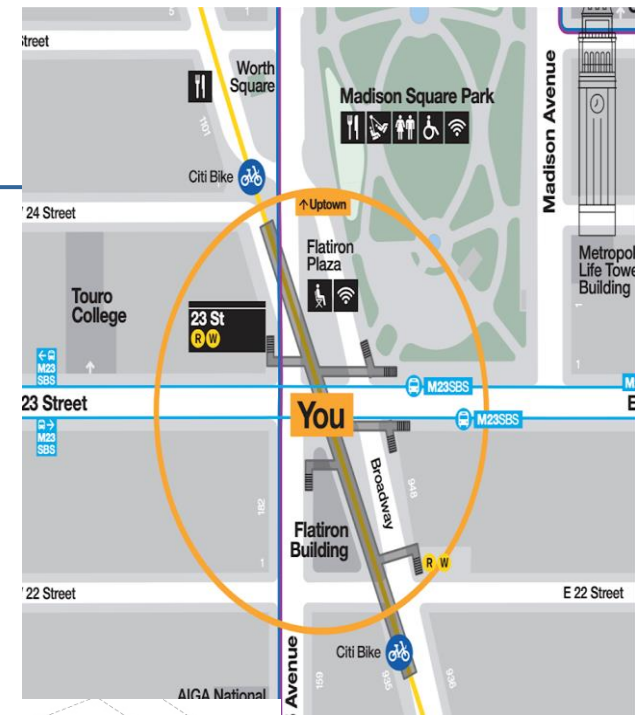
Concluded GTFS-Pathways satisfies current format needs

Could extend and scale to other formats

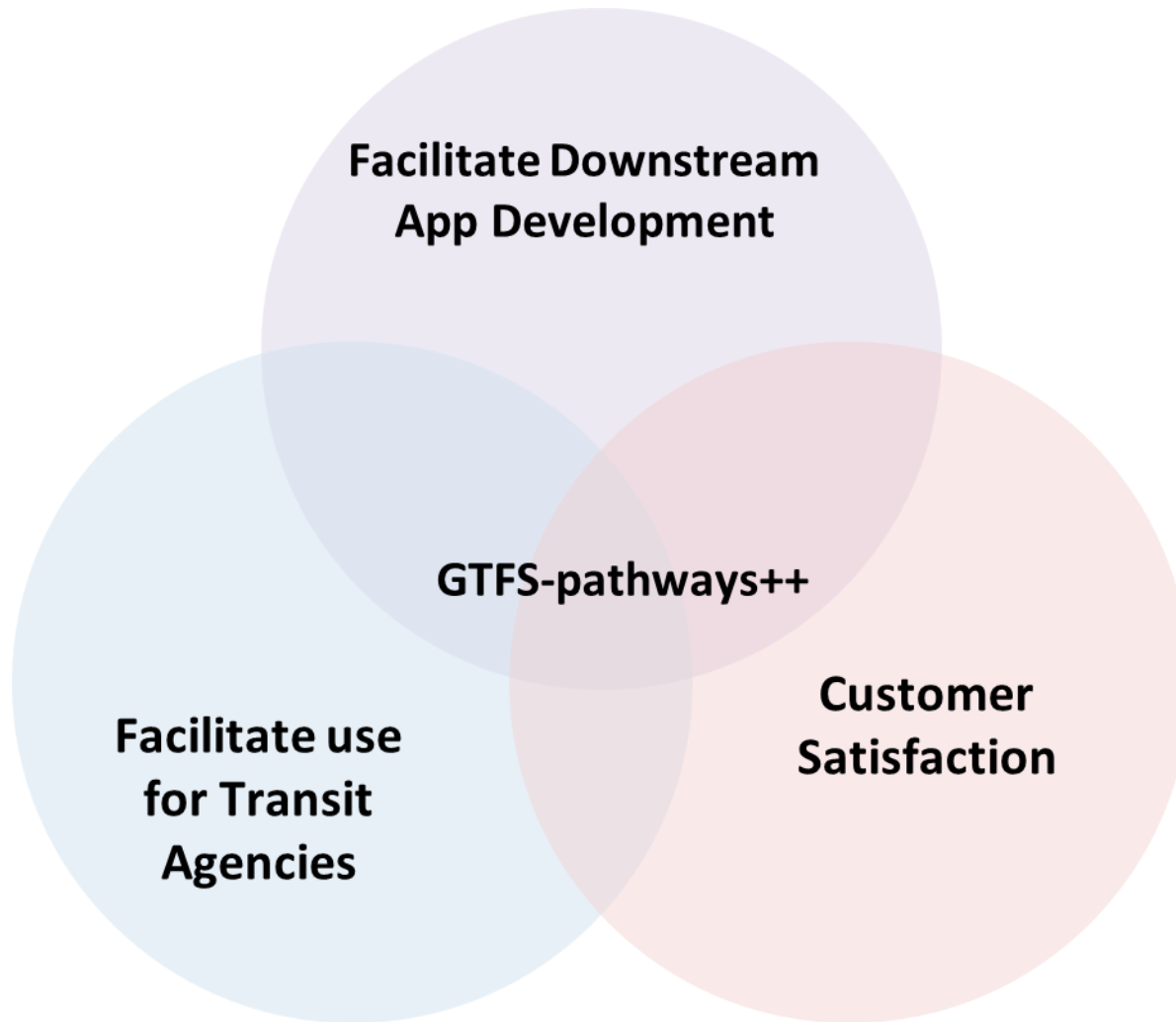
- Creation of **replicable processes for collection, vetting editing and disseminating**

TDEI work

- **Extended** an existing seldom-used data format
- **Working groups** included:
 - ◆ Transit agencies (incl. Sound Transit, NY MTA, SF)
 - ◆ Software vendors (incl. CS, Kisio Digital)
 - ◆ Consuming apps (incl. Google, AccessMap Multir)
 - ◆ Third parties (incl. Sozialhelden)
- **Editing tool will be in production** before Q4, 2024
- Calling for alpha and beta testers beginning Jan, 2024



Questions? Want more information?



Stay Connected

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Visit the Complete Trip - ITS4US Deployment Program Website and FAQs:

<https://its.dot.gov/its4us/>

https://www.its.dot.gov/its4us/its4us_faq.htm

