ITS4US GDOT & UW Webinar 10-24-24

0:03
Hey, hello again everyone.

0:05
We are going to go ahead and get started.

0:07
My name is Carlos Albin with ITS America and I wanted to welcome you all to today's ITS for US deployment program webinar, which is being sponsored by the USDO TS Intelligent Transportation Systems Joint Program Office.

0:26
Today's webinar will focus on paving the way innovative data collection methods for sidewalk or pedestrian infrastructure.

0:35
Today's webinar is presented by the University of Washington and Georgia DOTITS for US deployment sites.

0:45
So if we go to the next slide, we can cover today's agenda.

0:51
So the purpose of today's agenda is to explore innovative methods for collecting and digitizing sidewalk data aimed at enhancing pedestrian safety, mobility and access.

1:05
First, we will hear from Alina Slotchenko, who will provide an overview of the ITS for Us deployment program.

1:13
We will then hear from Doctor Randy Gensler, We will talk about the safe trips in a connected transportation network project from the Georgia dot deployment site and we will also hear from Doctor Anat Cosby who will discuss the transportation data equity initiative that is being led by the University of Washington deployment site.

1:35
We will also have some time set aside for moderated question and answer.

1:40
With the speakers so quickly wanted to cover today's webinar protocol.

1:46

We are asking everyone to please provide any questions or comments you may have in the Q&A chat box.

1:54
You will find the Q&A chat box in the lower cursor of the Zoom webinar.

2:01
Application questions will be added to the queue by our moderators, so there's no need to resubmit even if you haven't seen your specific question in in the queue.

2:16
I would also add that we do have ASL interpreters providing service in support of this webinar and if you would like, you are able to pin the ASL interpreter's screen as needed.

2:32
You also have the ability to change the way the Zoom platform windows look on your screen to best fit your needs, so you do have that flexibility.

2:46
This webinar is also being captioned, so live captions are provided and you can enable those at the bottom of your Zoom webinar screen as well.

2:58
And finally, did want to mention that today's webinar is being recorded and a copy of the recording along with the presentation material will be posted on the ITS For U.S.

3:08
website within the next two weeks.

3:11
So with that, I will now turn things over to Elena Slotchenko, who is the ITS For Us Deployment Program Program Manager with the USDO TS ITS Joint Program Office.

3:26
Alina.

3:27
Thank you, Carlos, and welcome to our webinar on ITS for us program for two great sites, University of Washington and Georgia dot.

3:38
My name is Alina Zolchenko is Carl said.

3:40
I'm program manager for the ITS for us program with U.S.

3:45
Department of Transportation, ITS joint program office within Federal Highway Administration.

3:51
I wanted to be brief with the ITS for Us program overview materials because I know you're all here to hear about the great work our speakers have been doing to improve site work data collection.

4:04
We will have links to and other materials at the end of the presentation for you to go to our website and find out more about our overall program and all four individual sites.

4:17
Next one please.

4:19
So the USDOTCITS for Deployment program is a department wide 40 million multi model effort that is led by the ITS joint program Office aimed at enabling communities to demonstrate innovative and integrated technology deployments supporting independent and similar travel for all users across all modes, regardless of location, income or disability.

4:44
The overall goal of the program is to solve mobility challenges for all travellers, with a specific focus on travellers that often face greater challenges in accessing essential services, including people with disabilities, older adults, low individuals, rural residents, veterans and people who have limited English proficiency.

5:05
An important consideration when we selected the projects was the ability to be replicable across the US, which is why today's webinar on sidewalk data collection methods is so exciting and so important.

5:19
We know that the quality and quantity of pedestrian infrastructure data pales in comparison to highways and streets, so these projects have developed methods that may help close that informational gap.

5:34
Next one please.

5:36
So the program is divided into multiple phases to ensure that deployments are successful and sustainable.

5:44
The deployment teams completed first phase concept development in June 2021 and in phase two the sites are finalizing design, integrating systems and conducting testing of their projects.

6:00
Each project will conduct an operational readiness demonstration to show that their systems are prepared to go into operation and move to phase three, which is public operation.

6:10
Three of the four sites are currently in the second-half of the phase two and the four side Herta successfully demonstrated their system over the summer and is now in the operation space.

6:23
So the four deployment sites are heart of five regional transit agency HERTA, Georgia Department of Transportation, G dot, University of Washington and Niagara Frontier Transportation Authority NFT Buffalo.

6:37
So with that, without further ado, I would like to give Mike to Doctor Randall Gensler, our ITS for us STCTN pedestrian impedance Lead Associate Director with our G dot Project.

6:54
Randall.

6:55
Thanks, Alina.

6:56
The picture here is about 15 years old, so you see the real knee here on the screen.

7:01
Let's talk a little bit about the safe trips in the connected transportation network or STCTN.

7:06
It's in Gwinnett County, which is one of our largest counties in in Georgia.

7:10
It involves a number of key technologies, some of which were in existence that have been modified and, and linked to this project and others that that have really kind of evolved into this project.

7:21
It includes connected vehicle messaging, transit signal priority for the for the users of the system, machine learning, both in terms of, of machine vision processing to identify features and also machine learning in terms of some congestion projection that comes late in the project.

7:39
Predictive analytics.

7:40

And the the main glue that holds everything together and provides that interface for the user is what's known as GMAP, the Georgia Mobility and Accessibility Planner.

7:51
This is an app that runs on on iPhones as well as Android that provides the route suggestions for the users of the system.

7:59
Next slide, please.

8:01
As Elena already said, we have the same general goals that everybody does in the in the ITS 4S projects.

8:06
And that's really to enhance the complete experience that users have in getting from their origin to their destination, underserved communities, as well as providing specific navigation for different mobility modes.

8:21
So for example, users of electric wheelchairs, users of manual wheelchairs, users of mobility aids, providing different navigation that meets the needs of those users.

8:35
The idea also is to provide reliability improvements in the system so that folks know that that they're going to be able to get to the transit on time, that the transit is going to be there for them.

8:46
And then also that they're going to get some, some extended walk times on the on the the walk signals as well as some transit priority in this project as well.

8:56
Go on to the next slide please.

8:58
The study area, if you know Atlanta, you know that Atlanta is down to the the bottom left, that's the edge of the 285 ring freeway that goes around Atlanta.

9:09
And as you head up the freeway and into Gwinnett County, we're covering about 40% of the Gwinnett County population, as I recall, and a significant portion of ADA users.

9:21
For example, it includes the major transit routes.

9:24
There's about 220 miles of sidewalks that connect to those transit routes.

9:29
You've got Marta down in the lower left.

9:30
You've got Gwinnett County transit stop or transit operations hub as well.

9:36
And over on the far right in the, in the end there you'll see the city of Lawrenceville.

9:41
Lawrenceville served as the demonstration zone for a lot of the work that we were doing early on.

9:46
They have relatively complete sidewalks and a lot of their features like ramps and curb cuts and the like are in very good shape.

9:52
So, you know, the things we learned in Lawrenceville were translated and adapted as we moved through the rest of the study area.

10:01
It does have a lot of wide and high speed roadways and I'll show you an example of where you can get into trouble with some of those.

10:08
And then throughout the study area, the pedestrian infrastructure is really inconsistent just in terms of the availability and connectivity of those sidewalks.

10:17
Again, really good in Lawrenceville in the demonstration zone.

10:20
But as you move into other areas the the coverage tends to decline a bit and the quality of some of those features also declines.

10:28
Next slide, this is our Wendy diagram for the project.

10:32
And essentially Wendy is here at at spot one in the wheelchair pre planning a trip and the origin of destination.

10:42
Wendy knows what those are and goes to the G map application and and plugs those in along with the departure times.

10:48
And what G map does is it essentially uses the open trip planner.

10:54
So open St.

10:55
maps to open trip planner, but then within open trip planner, there's going to be a different values of of impedance, which I'll talk about in a second.

11:04
They're applied to each link that are they're really designed to provide the best route.

11:09
We call it shortest path, but it's really not.

11:11
It's kind of the least resistance, least impedance route for Wendy in her wheelchair to get from origin to destination.

11:19
As she begins that trip, she receives turn by turn directions that can take her to transit transit.

11:25
If she gets on transit, transit will receive priority that the vehicle receives a notification that she's on her way.

11:31
Intersection crossings.

11:32
If she's rolling across an intersection, the times are extended broadcast messages are sent out through the standard RSU systems for notification that that she's in the area.

11:43
And then this even provides indoor navigation in a couple of the demonstration areas.

11:48
Let's go to the next slide.

11:52
When I talk about the, the mobility modes that we're providing for, there's 8 primary categories for which we, we want to be able to provide different routes.

12:03
Wendy in the wheelchair really wants to avoid any, any intersections where there's not a pedestrian

ramp, a curb cut for, for her to use to get into the intersection, get across the intersection and get out the other side.

12:16
And so when we talk about impedance, normally when you're using a route planner, it's just a travel time impedance.

12:21
It says, well, what's the shortest route to get there?

12:24
Most of these navigation aids are based on the current travel times on roadways.

12:28
You can do something similar in the routes where pedestrian infrastructure is present.

12:32
You can say, well, walking speed is 2 1/2 miles an hour, so what's the shortest available path connecting from sidewalk to sidewalk, from origin to destination.

12:42
And that's great.

12:42
We use travel time impedance all the time, but we also want to introduce what we call event impedance into the system where we can look at the other factors that may make that trip either unsafe or uncomfortable or or it's very difficult.

12:58
If Wendy doesn't have that wheelchair ramp, the pedestrian ramp, curb cut, taking you down into the crosswalk, it may mean that she's going to be forced to go down somebody'd driveway into the street, cross the street, and then come up somebody'd driveway on the other side, which is a significant safety and burden issue.

13:16
So the the categories that we have for which we're applying impedance include people who are walking with no mobility limitations, minor mobility limitations, and they self define that in the in the app, if they're using a mobility device, a standard or an electric wheelchair mobility scooter.

13:31
And then also there's interaction categories, low vision and blind interact with all of those above.

13:37
So I think we have 17 or 18 total categories so that we're using to provide a route.

13:42

So if you're in a wheelchair and you have low vision, you may get a different route from someone who who's using a mobility device like a cane.

13:50
Next slide please.

13:53
So when I talk about advanced impedance, this is the kind of thing that can happen here.

13:57
We have a link that's missing for a significant section.

14:00
You also have no ramp to take you into the crosswalk there.

14:04
And so there's there's a link defect impedance, there's a crosswalk impedance, there is a a ramp impedance.

14:12
And this impedance really is so large that a wheelchair user does need to divert to another route out.

14:16
And so something we're not talking about today is how all of those are calculated.

14:20
But there is a standardized methodology that comes along with all of this that we're using to calculate impedance.

14:26
Next slide.

14:32
So in order for GMAP to run, you have to have a navigable pedestrian network.

14:36
Only about 30% of the sidewalks were available in our study area in OSM, and all of those sidewalks that were present in there were what we call very long ways.

14:47
These are stretches of pedestrian infrastructure that cross streets and go along multiple block paths.

14:52
And all of that works great in terms of navigation because you're navigating from node to node, but it doesn't work so great for assigning impedance to each of those links.

15:01
If I have significant pothole defects on, on one stretch of sidewalk, it may be that crossing the street and going around that is something that that a wheelchair user would want to use.

15:11
But I it's hard to pull all of that out.

15:13
There are some methods that can do it.

15:15
We're doing it with some bikeway activity.

15:18
But with respect to sidewalks, what we really wanted to do here was to break the sidewalks up into what we call logical link levels, where it's really along the block face.

15:28
You get to the corner, you turn any place the pedestrian could turn for a mid block crossing at the block end where they're turning and crossing intersections, The logical links are the links to which we can assign impedance.

15:40
And if there's a broken curb ramp, if there's a broken curb cut that takes you into the crosswalk, we can assign that impedance to the road crossing, the pedestrian crossing that goes across the road.

15:50
All right.

15:51
We used to do all of our network development just off of the parcel level, land use data, roadway center lines, roadway widths.

15:59
And we essentially put a map of where all sidewalks ought to be.

16:03
And then we'd go out and inspect those and, and see which ones were there and fill them in and, and move them around as necessary.

16:09
OSM was selected for this project because we, we wanted to be able to use OTP, We wanted to be able to transfer all that information over.

16:18
And so we kind of used OSM as the base map for GMAP development.

16:24
And then we take that Lincoln node structure and we put it into the Neptune system in AWS so that it, it's open source through AWS for all impedance calculations.

16:35
And then we transmit the impedance for each of those OSM links to the GMAP folks so that they can apply the impedance on each of the links.

16:43
Next slide.

16:44
So in doing that, we developed a whole bunch of open St.

16:47
network coding protocols.

16:49
We got a wiki that's coming out, did a couple of conference presentations at the OSM user group meetings with respect to path assessment.

16:57
We also had to identify private links that are in in private gated communities and remove those from public access.

17:05
So keep everything that's open and available in the navigation network, but also at the same time remove unsafe paths.

17:12
And and then everything like I said has to reconcile between the network that is in OSM that we do our initial development and and over in Amazon Web Services Neptune where we calculate the impedance.

17:23
If you go back a couple slides, one more.

17:27
Yeah, this is just what I wanted to show you in terms of safe crossings.

17:31
After we had done our network development, a public user in OSM actually dropped in a new roadway crossing for pedestrians here.

17:39
And you can see it's on a very wide sweeping turn.

17:42
And the basic problem here in the map on the left, you can see how it crosses the over to the to the the traffic island to the median that's there.

17:50
The problem is there's no curb ramps.

17:52
There's there's no curb cuts to get you out of the street and onto those facilities and then across the other side.

17:57
So this is one that we would not want to put in the navigation for wheelchairs, but it's been added by the public.

18:05
So there's a a little oversight that has to be done.

18:07
Next slide.

18:09
So in terms of vehicle, pedestrian infrastructure data collection, we have two platforms.

18:14
1 is a vehicle based platform, the second is a wheelchair based platform.

18:18
We have 52 undergrads out there collecting data, about 13 grad students involved in the project.

18:23
Next slide, please.

18:25
The video data collection is easy and it's cheap.

18:29
Essentially a roof mounted rack at a specific height that that rack is a standard off the shelf rack at REI 3 GoPro cameras, one facing forward, one to the passenger side, one to the driver side.

18:41
We use a stereo optical camera to get a distance cloud.

18:44
We're not using that for very much right now, but these GoPro cameras are ideal.

18:48
They've got image stabilization, very high resolution, high frame rates, and they're really reliable.

18:54
And the data last for the whole data collection.

18:56
Next slide, we take the data back into the lab and I'm sorry, I forgot to put the slide in here about the presence and absence, but there's two steps in presence and absence.

19:05
We play back those videos and undergrads are, are looking through the the the video and, and identifying where sidewalks are and are not.

19:14
And then we use that information to develop a machine learning model so that we can identify the presence and absence of sidewalks using we don't basically don't have to have the undergrads do it anymore.

19:24
They just have to spot check.

19:26
And it's working quite well for identifying presence and absence of sidewalks.

19:30
It's doing pretty well for really well for identifying crossings and pretty well for identifying curb cuts and ramps, Although the positioning isn't as good as we would like.

19:40
Fortunately we are going back through and collecting everything with wheelchair video, which is on the next slide and the wheelchair set up involves 2 cameras, one that's pointing straight forward and one at a down angle of 45°.

19:53
It's got the GPS is already built into the cameras and the GPS on this is for each frame.

19:59
So once you have that video it's a great archive.

20:02
You can look at anything in space and time for when you collected it.

20:06
We roll these cameras around or the wheelchair platform around at about two to three miles an hour.

20:11
That's a a standard cutting board for a restaurant that that we've milled and and cut to the right dimensions to hold everything.

20:20
And so this this applies to field team.

20:22
They're doing the rolling video and at the same time, some folks are taking nominal width measurements of various sidewalks.

20:28
Next slide, the study area, like I said, it's pretty big, 446 miles of sidewalks which got broken down to about 11,000 links, 3000 Rd.

20:39
crossings, 4000 pedestrian ramps, 17,000 vehicle curb cuts, so driveway curb cuts coming through.

20:46
So this is a lot of a lot of stuff to inspect.

20:49
Next slide.

20:50
But fortunately the, the video archives that we're collecting make that inspection fairly easy.

20:56
The nice thing about the video archives, not just for inspection that you'll see on the next slide, but this video archive is available to engineers and planners in the in the zone and they can play back those videos even before they go out in the field.

21:08
If, you know, we see something that's a problem, they can actually bring up that video or they, they will, they, we, we can do it.

21:14
They'll bring up that video and they'll be able to roll through it to see what the problem is before they go out there.

21:19
Next slide.

21:20
So the inspection routines with the machine vision video.

21:24
So it's it's by manual semi automated process here where individuals watch the video and report problems.

21:33
Then the next step is the machine vision process to identify specific kinds of problems.

21:37
And then we go out and collect some some actual physical inspection data in the demonstration zone to to show how all these things work.

21:46
On the left you have the map panel.

21:48
You got rolling video images.

21:50
Those are time aligned.

21:51
You have to roll them forward and backwards to get them to match up.

21:54
And then as you're rolling through the video, you can click on the screen and see the red box that's in there.

22:00
You click on the screen to identify the problem.

22:02
You get the pop up on the right and then you identify what problems exist in at that location.

22:08
And we really can get like 90% of the design and condition issues in this, this deal, even down to the quarter inch height displacements when you have that downward looking view.

22:17
So it works quite well.

22:19
We know when something's off.

22:21
We don't know if it's, you know, 1/2 an inch or 3/4 of an inch or 7/8 of an inch, but we know that it's, it's a problem.

22:28
It's it's over the quarter inch threshold and it's not not beveled.

22:32
Next slide.

22:34
So here's an example.

22:35
Just so you got the downward view onto this, this texture pad.

22:39
And you can see as you're rolling to the intersection, this is on a one of those little islands, a little bit of damage and wear and tear here next slide.

22:48
And so for the demonstrations on this is Lawrenceville.

22:51
When we're done rolling through this video process, we've I said we are inspecting each one identifying problems, but at the same time they're identifying every single curb cut and every single ramp in the demo zone in the whole zone.

23:03
Every, every video for the entire study area has been processed through the the semi automated video process where people are reviewing the video.

23:13
So every single mile of sidewalk, all the ramps and curb cuts have been identified and then the defects are inspected in this process and we can use an interactive map to zoom in on each one next slide.

23:26
So in terms of the pedestrian aspects that we inspected, we did every sidewalk stretch and every pedestrian crossing.

23:32
All of the pedestrian curb cuts are what we call the ramps.

23:35
Every vehicle curb cut or the driveway crossings and cross slope tends to be the biggest issue.

23:41
Sidewalks rolling along nice.

23:42

But when they installed the driveway curb cut back in the 1930s and 40s, they're at an angle and, and they're pretty rough for folks in wheelchairs.

23:50
We inspect every intersection, every intersection we hit, we go around clockwise.

23:54
And this allows us to do a separate intersection inspection where we can record the the individual features like the signs and the lights and the signal heads and whether everything is aligned and things like that.

24:05
And then finally in the manual field data collection, we go out and we collect on an inspection form tablet based vehicle entry for each individual asset that's inspected.

24:16
So rolling video inspections for everything.

24:19
And then in the demonstration zone, manual field inspections of every sidewalk crossing, pedestrian curb cut, vehicle curb cut, every intersection component and then every every other element.

24:31
OK, next slide.

24:33
OK, I just just a an image of the of the Microsoft Excel forms that are used on the ramps, curb cuts and crossings.

24:42
This works quite well in an app.

24:44
We didn't have the funding for updating that app.

24:47
The app is a little bit old, doesn't need any of the current security features, but an app can be developed to transmit all of these things as well as as I said, everything's kind of standardized in terms of, of the features that are inspected in the link data structure, there's over 100 features that are being tracked For every ramp, curb cut and crossing.

25:06
There's typically 60 to 80 features that are being tracked and then a subset of those are used to calculate impedance.

25:13
Next slide.

25:15
So in terms of the outputs, you, you get a full asset inventory.

25:19
We didn't really talk about the development of, you know, the additional 70% of those sidewalks that had to be manually entered, all of the the medians and the locations every every turn point location has to be brought in there.

25:33
That asset inventory development took quite a while.

25:35
It took a long time in terms of making everything structured for OTP.

25:41
Anything that was in OSM, we disaggregated that to the logical links so that impedance could be assigned, added those 70% and that gives us our initial, our initial navigable network.

25:52
From that, again, we had to screen out all of those private paths and then we also had to screen out inaccessible paths, dead end paths that weren't serving needs and also some unsafe pads that needed to be removed.

26:05
We then assigned, I'm sorry, inspected all those assets both for design conformance with, with federal highways and ADA design criteria.

26:14
So slope, cross slope, ramp approaches, surface condition.

26:20
All of those parameters that are on a standard inspection form for an ADA transition plan inspection are are gathered and put into the data structure and some of those are used for impedance calculation.

26:32
Then the inspections were were through the three mechanisms.

26:35
You have the initial fly through to identify the assets and identify where everything's positioned.

26:40
You have the wheelchair data collection and wheelchair inspections to identify all of the problems.

26:45

You can't identify what that cross slope is off the video and the GPS and gyros are not quite good enough to do that, but you can tell if they're off.

26:54
You definitely can tell if they're in violation of the of the design specifications and then the manual inspections to gather those things where we know it's off.

27:03
But now we can get the actual percent measurement of the the slope or the cross slope.

27:08
We then calculate and provide the lowest impedance path before each mobility mode given all of the travel time impedance and the event impedances which are discussed in in other papers.

27:18
And I guess the kind of the final concluding point is that everything that we're doing is open source, open data structure.

27:25
So at the end of phase two here, we have tech transfer documents that we're in the process of finalizing that tell you exactly what pieces of equipment, how to mount them to the vehicle, how to process the video, our recommended file name structure, the video review programs are all open source.

27:43
So how to run then operate those training materials that go with those.

27:46
And then we also have some techno economic analysis that are coming, which essentially say, here's how much it costs when you're doing all that stuff manually and and drawing all these things and inspecting all these things manually.

27:58
And here are the benefits you get when you bring in some of the some of the machine vision and semi automated, you know, sit in the laboratory and watch the video processes.

28:07
So with that, I'll turn it back over.

28:16
All right, I'm not take the stage.

28:19
Hey, good morning, everyone.

28:22
This was a delightful presentation.

28:24
We'll have a chance to answer questions afterwards.

28:27
I'll go ahead and begin.

28:29
My name is Anat Kaspi.

28:30
I'm the director of the Tasker Center for Accessible Technology at the University of Washington, and today we'll talk about methodologies and the different criteria that we use to evaluate what we call accessibility first, pedestrian data.

28:47
So to begin, our accessibility first focus is really on ensuring that the data that we collect is accurate, comprehensive, and reflective of the real world experience of pedestrians.

29:00
We can roll to the next line.

29:04
Cool, thank you.

29:09
And so in our practice, we explore different AI based collection methods like the video that is shown here.

29:17
And we also look at crucial changes to the evaluation techniques that people use out there to evaluate pedestrian maps and that include different user feedbacks as well as assessments of connectivity.

29:31
Because we want to maintain really high standards in our data evaluation and aim to provide reliable information that can be used by real pedestrians on the ground.

29:41
And the app that was featured in the beginning of this video is an accessible customized pedestrian routing application called Access Map dot app.

29:50
You can go there right now.

29:52
It's been active and provides customized routing options and has been doing so since 2017.

29:59
And so the question is asked is how can we scale up such applications as well as downstream applications for planners to improve both assessments of pedestrian infrastructure as well as overall be able to measure how well we've been impacting pedestrian infrastructure for equity and accessibility?

30:21
So what the video is showing is one of the three methods that I'll discuss today.

30:26
In this case, much like the system that Randy showed, it is collecting video data on the ground on the public right of way and producing segmentation results for these pathways as well as identifying any obstacles that might be there.

30:46
And so our objective with that specific system is to collect these data without passing the video information to the cloud or any other location.

30:57
We're doing everything just in time as we move through the environment to identify the past information.

31:04
Let's go to the next slide.

31:07
So that was just a preview, but what is it that we are doing as a as an organization?

31:12
The Tasker Center for Accessible Technology is actually located at the Paul G Allen School for Computer Science and Engineering, and our mission is to develop, translate and deploy technologies that increase independence and improve quality of life for people with disabilities.

31:27
Our work with the ITS FROST program, it involves the build up of an open data infrastructure to support different producers and consumers of accessibility First data like I, I discussed earlier.

31:42
And today we'll be describing the part of the larger transportation data equity initiative, which is the work supported by the ITS FROST grant that where the core philosophy is to leverage applied AI to solve real world problems.

31:59
So today we'll be discussing how our approach focuses on practical applications of AI, not necessarily theoretical AI advancements.

32:08
And we integrate these with deep domain knowledge in order to create impactful solutions to address the specific challenges that have to do with accessibility and transportation.

32:21
We can move on to the next slide.

32:23
So if we are to look at the overall system that we're building with the ITS, for us the idea is to allow for scaling and extending the collection and management of overall transportation data that addresses accessibility and equity concerns.

32:42
So the full on system, which is a very dense image that we're showing, it illustrates the four components of that proposed system.

32:52
I'm going to move from left to right.

32:53
So on the left are the different data collection subsystems where some the three AI based methods I'll discuss fall in there.

33:03
But we're also open to plugging in other collection subsystems, for example, the one that was just presented earlier.

33:12
And the idea is as long as we all share a common data schema, we can push that information forward, openly sharing and collaborating on the collection of accessibility first transportation data.

33:27
And so the subsystems on the left include side sidewalk data production.

33:33
The idea is that either through crowd sourcing, sourcing or other technology companies, other infrastructure owner, operators of the sidewalk infrastructure, all of those would be stakeholders that are participating in the sidewalk data production.

33:49
And so then gathering that data from multiple data sources has specific requirements.

33:54
And this system is being built in order to allow for that kind of aggregation at scale.

34:01

And furthermore, the downstream application of this shared system has to do with vetting with different ways to do quality controls, which one of which I'll talk about today, as well as the ability to validate that the schemas are shared so that people, different stakeholders can continue and contribute to these data.

34:26
The idea being that usage keeps data stewarded and maintained.

34:32
So if we have downstream applications that are actively promoting the use of these data, that means that those users will continuously put be pushing to update and maintain this information.

34:44
One of the things that we identified pretty early on in the building of access map was that the data for sidewalks is scant.

34:53
It's not uniformly produced and various stakeholders contribute as they can, but they're it's pretty low resource as far as how much funding is often available.

35:05
And so maintenance of these data is really difficult to approach.

35:10
And so having a common tool set and a tooling ecosystem to allow for this producer consumer exchange is really the core of what the TDEI is doing.

35:21
We can move on to the next slide.

35:25
So this image shows a detailed map representation over an image of an urban area.

35:31
And what we're trying to show is what is accessibility First data schema for sidewalks.

35:37
The map is color-coded to differentiate between different types of pedestrian paths.

35:42
So we have sidewalks marked in pink and then those would be indicated as a safe accessible walking area.

35:50
Crossings are highlighting in Cayenne links between the sidewalks and the crossings are shown as a different color in green to represent pathways that connect the different segments of the pedestrian network.

36:02
And overlaid on these paths are additional attributes that provide more information, more deeper information about the accessibility.

36:11
And So what we're trying to demonstrate here is that as we developed a data schema to represent, you know, the scaled AI based methods we use to to represent these data, we think through the labeling and the data types to help users understand the different paths types as well as the attributes.

36:31
So the information ought to be clear, not only in machine readable form, but also clear and easily interpretable to app developers who might produce an app like access map, as well as those who are interested in providing the visual representation of what is here as far as accessibility is concerned.

36:51
So open sidewalks is what we call the overall project of creating a data, the schema for sidewalks, but also the tooling set and providing a lens onto pedestrian accessibility that can help both users and planners to interpret the data for navigation, for safety assessments or urban planning improvements.

37:13
So basically our objective today is really to discuss the challenges of how do we accurately extract this routable pass network at scale from either remote or on location sensing.

37:28
And the inputs particularly for pedestrian paths can be variable, right.

37:33
We can have satellite and aerial imagery.

37:35
We can have inputs like on the ground St.

37:38
level imagery or street level video.

37:40
We can also imagine a time where we will have additional sensors on the public right of way that can produce even more variable and and detailed the data.

37:52
And given, you know, everything that I and Randall have discussed, which is that these connected, these network paths are often disconnected.

38:03
They are variable on a regional scale.

38:06
And we have to be flexible enough in our approach to these schema to address the regional, the, the regional challenges and the regional diversity, but also be able to allow all these stakeholders to contribute to a single data schema that's cohesive and comprehensive throughout so that the downstream analytic analytic tools are also active there.

38:31
So let's let's go ahead and start looking at some of these scalable methods.

38:37
So the first that we've we've created is an end to end system to infer a connected pedestrian path network.

38:47
So it really, when we often look at the pedestrian path data that's out there, it is rarely disconnected, it is rarely connected and it is rarely in a format that allows for implicit routing like it is not represented as a graph.

39:04
And So what we really set out to do here is to take satellite or aerial imagery, the street map images, which exists fairly consistently throughout.

39:16
So this is Rd.

39:17
network data like an OSM as opposed to the sidewalk network data in OSM which might be more sporadic and use the existing St.

39:28
information to inform our segmentation and therefore build up of a base layer graph, a pedestrian network graph for the network.

39:40
And so what's being used here is that the two image types are provided to a segment segmentation network, which is implemented using a convolutional neural net.

39:51
We use a seeding domain informed heuristic method to provide an initial hypothesis as to where that graph is.

39:59
So there is an initial step which uses domain specific information that we provide as a seed for that segmentation process.

40:11

And so the past processing step is really to combine these hypothetical graph inputs with a segmentation outcomes in order to join together to a connected pedestrian pass map in that form format of open sidewalks.

40:27
And so in our big system approach, the idea is that this type of output could be provided as input to the transportation data equity system.

40:39
Next, next slide.

40:43
So what are some outcomes of doing this work?

40:49
So you can always look at our paper for the traditional methods of evaluating the quality of the output graph.

40:58
But what we wanted to really identify here is how for pedestrian networks, how you get around, especially how you get around the intersection is actually a microcosm of how you get around the city.

41:11
So we want to really question how different people evaluate the route ability of these pedestrian graph because that should be key to these methods.

41:22
And we way too often see piecewise kind of approaches to the evaluation of these outcome network.

41:31
The the one that we're showing here tile to net is the only one that's open and shared.

41:37
And so we were able to actually do the comparison.

41:39
But indeed, there are other methods out there that use satellite or aerial imagery to infer the pedestrian, pedestrian paths.

41:49
Often they're not actually inferring a network.

41:52
Title 2 Net does infer a network, but we wanted to be able to evaluate our method against anything that we have had access to, to open and share that.

42:03
And so the evaluation procedure here that I'm showing is really to emphasize graph connectivity.

42:10
And we ended up introducing a new metric of local traversibility, which is essentially an efficient proxy for identifying routability that focuses on the traveler's experience on the ground.

42:23
So the three graphs on the bottom are actually showing a sort of a Polygon wise comparison of traversability between what was in the ground truth versus the two methods that are being compared.

42:39
And so the next couple of slides I'm going to actually talk about what is this metric because it is not necessarily familiar to everybody here.

42:46
So we can move on to thank you for advancing the slide.

42:50
So on the left we see a representation of intersection with pedestrian paths that are all shown in yellow.

42:56
And that would be the ground truth.

42:58
So that would be sidewalks in a particular intersection.

43:03
And the reason we focus on intersections with the pedestrian paths is because we're going to say traversibility, which assesses the ability to travel through small intersections, is sort of the microcosm of large scale regional traversibility.

43:19
So we define a pedestrian graph inside this intersection scale Polygon, and we emphasize the importance of these end nodes at the end of those Polygon edges and the intersections inside.

43:33
And the concept of this Polygon traversability is really to focus on the ability to navigate from 1 boundary of the Polygon to another.

43:41
And we propose that comparing these sets of traversable boundary pairs for a Polygon from each graph is how we should account for data quality in these areas.

43:54
Next slide.

43:57
So this is that graph.

43:58
And so we have these the edges in that Polygon defined as ABC and D.

44:03
And you can see that the perfect traversible intersection is one in which all those paths are available.

44:09
Next slide.

44:11
But sometimes they're not available because there's this connectivity and we want to be able to account for that.

44:16
And in this image, we see three out of those 6 routes are not traversible.

44:21
And so we want to be able to account for that when the data is demonstrating that those are not connected.

44:29
Next slide and finally, you know with real inference data, the ones that are coming out of these AI based methods, we will have some some edges that are in the pedestrian graph that are totally missing as well as others that are disconnected and we want to be able to account for that.

44:49
So I won't go into more of the detail because of time considerations.

44:53
But if we advance back to that original to the next slide, we can now see that in the three grass shown at the bottom, the left most is actually showing the ground truth.

45:06
See these are the manually collected pedestrian pathways in this area of Seattle.

45:13
In the middle one we see the differential.

45:16
So how well matched was the traversability in tile 2 nuts inference here versus the ground truth.

45:24
And lastly is profit showing the one on the right most where we are not perfect, but we keep to the same basic traversability that the ground truth data is showing.

45:39
And so I encourage those of you are actually interested in deploying these methods to look into ways of accounting for traversability in the graph as opposed to essentially counting methods that are either pixel based methods to identify where segmentation results are exactly the same or edgewise counting methods.

46:01
Moving on to the next graph to the next slide, sorry.

46:05
So where have we used this?

46:07
We've been doing this work in four US counties as well as by the end of this year we will publish data for 39 counties in Washington state.

46:18
Sorry, the end of June next year is when we'll have that data published.

46:24
So the idea is to provide good quality everywhere as opposed to excellent quality in one place.

46:32
We really want scaling.

46:35
It is what matters in terms of providing data consumers with the scale and extensibility that they can then add in the additional attributes in different places.

46:49
And so one, as we move jurisdiction by jurisdiction, we open up that data for others to engage in with editing and commenting so that they're able to add in additional attributes and features to that graph.

47:05
And what's important to us of course, because of that is the additional interoperability with this massively collected data graph.

47:15
And we try to, well, we aim for the transportation data equity system to allow for seamless integration with whatever other repositories people would like to join and merge that data in next slide.

47:35
So what happens downstream?

47:38
Now let's say you have that graph.

47:40
Can you still scale the methods by which you add and enhance different types of attributes to the graph?

47:48
This this slide shows a schematic diagram of Oasis, which is an on device automated sidewalk mapping system.

47:56
The videos from which you saw at the beginning of this presentation, the image shows that on the left we developed system hardware.

48:05
It is including one NVIDIA motherboard with two GP us on board.

48:14
We have imagery for street level inputs and so you see AZ camera at the top of this, this mobility stroller.

48:24
And on board we have the segmentation module and the mapping module, both of which are operated just in time in the right of way so that no video data needs to be shared.

48:35
This was important for our stakeholders on the ground in King County, King County Metro access.

48:45
They did not want to have this data saved on their systems for privacy reasons.

48:50
And State of Washington is pretty specific about how data from public ways is collected and maintained.

48:58
And so they did not want to have that data.

49:00
They just wanted the mapped data in the open sidewalks format.

49:04
And so that's what's the outcome from this this method.

49:07
Next slide.

49:11
So the particular place where it has been used, it's been used to map areas in North Seattle as well as in Bellevue, WA.

49:24
It reduced operator time by over 80% where the comparable operator time was the pathway review team on the ground with tablets collecting data as they move around Oasis generated mapping data with comparable accuracy to the manual on the ground vetters.

49:44
And so this was a set of attributes that King County Metro was interested in collecting specifically width of the data and weather sidewalks were there.

49:57
And then finally Oasis generated mapping data per that open sidewalks data schema.

50:01
So it's all interoperable with the large scale collection from aerial imagery.

50:07
And that's really our aim to be able to integrate, integrate these different systems together so that when funding is available to do really detailed collection that happens, but you still have the baseline graph there for use.

50:23
Next slide.

50:28
So the last method is the least mature one.

50:32
But basically we've been thinking deep about how can we leverage a lot of this data that we're collecting, the imagery data and other data and how are we going to be able to potentially leverage that data, use that input, but look at other attributes that people on the ground care about.

50:51
We have a whole other arm of our organization that does participation and engagement with communities and different community members tell us about various attributes on the ground that they really care about locally.

51:06
And in order to address those local and regional concerns, we need to be able to have these zero shot types of, you know, not a full set of supervised learning data sets from which we can train because often times these will not be available.

51:26
If you have a specific type of parking meter structure that is regionally specific, you might not have the data set to train a full-fledged AI system on well, statistical AI system that's supervised to to train it in order to get the kind of large scale detection on the ground.

51:52
But rather, as the idea is that using VLM's, we're now able to use many fewer annotations in order to be able to leverage that image data set that we had from before, but extract the new features that people might have elevated on the ground in in those communities.

52:11
Next slide.

52:16
And so here we're just going to show some of the initial pilot results.

52:22
What we see is that quantitatively the baseline using direct prompting was VLM had failed.

52:30
But we can achieve essentially decent results with a method of zero shot annotation.

52:40
And then qualitatively the procedure is guaranteed to identify some of the features partially or at least fully for some, sorry, all of the features partially, but fully for some of them.

52:52
Next slide.

52:56
OK.

52:56
So we've gone through three different methods to potentially scale the acquisition of pedestrian pathway data in the open sidewalks format through both aerial imagery and remote sensing as well as on the ground imagery and and of video sensing on location.

53:18
What we want to show is that there's a wide range of network analysis that then become available once you have this open sidewalks or a single data schema approach.

53:29
And what we show is that essentially we were able to describe not just a user based custom routing application and access map dot app on the left, but also be able to provide it to an open data sharing ecosystem where other people are able to consume that data at scale and innovate on our approaches for sure.

53:52
And then finally a new tool that I haven't discussed here, but the whole point is to enable the network analysis and specific essentially simulation of different types of pedestrians on the ground and how they might traverse those environment.

54:10
And this is crucial in order to be able to assess access and reach in different locations as well as to be able to assess, you know, different safe systems approaches.

54:23
How well is level of traffic threats available here?

54:26
So all of that becomes available when you have a specific traversal model where we can evaluate the accessibility of entire cities at a time and derive insights about the access in those different areas.

54:42
And so the three applications that we're discussing here is like downstream recipients of the open sidewalks network is just the beginning.

54:53
And so the summary of what we've done is that pedestrian network data is essential to transportation networks.

55:00
The data is hard to collect and maintain manually.

55:04
We've presented several AI based methods to automate sidewalk data collection and mapping at various scales and with heterogeneous inputs.

55:13
The system provides sidewalk data in standardized format and that could benefit various downstream state stakeholders.

55:21
We use off the shelf components and everything is open and shared as far as the code and it's easy to replicate and deploy for larger scale use.

55:30

Finally, the systems can also be incorporated into smart city technology and other sensor network plans to automate regular city audits and data collections.

55:40
And pretty soon we will take some questions.

55:43
Thank you so much.

55:53
All right.

55:54
Thank you, guys.

55:56
I will be our moderator for the Q&A portion.

56:01
Several of you have been putting questions in the Q&A pod while we've been talking.

56:07
So please go ahead, add some more.

56:10
We're going to get started.

56:13
So as you all know, well, hopefully you all know now October is pedestrian safety month.

56:19
So thinking about several years down the road, what are you we'll go over Andy first, then not second, kind of seeing as some medium and long term impacts on pedestrian safety because of kind of the work that you're doing here under ITS for us and and applying the technologies you talked about.

56:43
So I think one of the most important things is to understand what you have was in a meeting and I walked in, I said, imagine if you were, you know, the CEO of a corporation, you walked into a meeting and said, I've got a billion dollars of assets, but I don't know where they are and I don't know what condition they're in.

56:58
You know, that's, that's kind of what we're dealing with in a lot of areas with respect to the system.

57:03
And if you don't know what the conditions of the assets are and their connectivity and how exposed the pedestrians are that the vulnerable road users are to vehicle traffic, it's really hard to mitigate.

57:14
It's, it's hard enough to mitigate and decide where we should put our money anyway, because the, the number of pedestrian deaths is, is, you know, relatively small compared to the overall population.

57:27
Studying and figuring out which intervention, intervention mechanisms work the best for specific events that have happened is really the key.

57:35
And so you got to have the data, you have to have both the infrastructure data, so you know what the design and condition is.

57:41
You also have to have the activity data.

57:42
So as we move into the future, we'll have a lot more activity data becoming available with, you know, the proliferation of cell phone use and tracking and you know, health apps and the like that can provide good information on people moving around the system.

57:57
We need to pair that with good solid infrastructure data so that we can develop these these mitigation intervention tools and, and invest in our assets in in the wisest way we can.

58:10
Not anything else to add.

58:13
Well, just a little bit in terms of the downstream analysis, I think we really want to agree on ways of assessing safety, accessibility, equity.

58:27
Like all of these things are guiding terms that a lot of planners use, but we don't necessarily agree on their functionality and operation ability on the ground.

58:41
And that makes things really hard.

58:42
It also makes it hard to compare across different regions.

58:46
Like we did a study with that that data from Oasis you saw for Bellevue schools and we were able to identify how reachability is different for different types of students in five different school environments and therefore be able to then identify potential projects to improve those safety conditions.

59:08
If there was no agreement that there was comparable assessments across these five different schools, you're not really able to to make these comparative assessments.

59:18
It's also cheaper to do it this way because when Bellevue was attempting to do the same thing with on the ground walk audits, they had to corral a lot of community members in order to do these walk audits, which are expensive.

59:31
They're not standardized, they don't allow for regional specificity because different people have different ways of, of or rather they're really focused on regional specificity, but don't allow for sort of a, a comprehensive planning for urban planners to be able to assess and prioritize how to address these projects.

59:55
So our hope is that data at scale with excellence on, you know at at very localized areas.

1:00:06
Can really allow for the scaling of safety accessibility and equity on the public right of way yeah if I could add to what and not just said it's it's the it's the data and the data quality that's all important but the I think the more important thing that you just said is that really the standardizing of the measures of effectiveness.

1:00:25
How do we compare and and what what are we going to use for accessibility and mobility and are we going to have these standards set across different mobility modes and and I think that's a big area where we need to we need to at least be investigating and doing the research on and getting consensus.

1:00:43
Maybe we're talking about having some meetings with the planning community, with the transportation community across the country to try to figure out what we'll use for those.

1:00:54
Excellent.

1:00:56
All right, next question.

1:00:58
There are commercial technologies available to collect data on side box that have some similarities to what both of your teams developed.

1:01:07
So what was the reasoning behind developing your own solutions instead of using existing commercial products?

1:01:13
So I'll let Anat answer this one first.

1:01:18
Yeah, so I I think I can talk about this in two ways.

1:01:22
One, none of them were open and sharing the data or open and shared themselves.

1:01:30
When I came in with my first PhD student to create Access map, no one was willing to share data with us.

1:01:39
And this this data is crucial to be open and shared because of that low resource environment that I described.

1:01:47
Different stakeholders are going to exchange information at different time points with different types of resources.

1:01:53
And for the disability community to get any benefit from this, the data has to be open and shared.

1:02:00
So if you know, without naming any names, when a jurisdiction buys up, buys up this data and in their licensing terms, they're not allowed to even share it within their same organization, the data is dead on arrival.

1:02:15
There's just no way that that data will be maintained and updated and used.

1:02:21
And so that's one factor.

1:02:23
The second factor is really about evaluation criteria because I've been talking to some of these, you know, commercial industry entities and cherry picking the data on which they evaluated without consistent evaluation methods is part and parcel of what's offered here.

1:02:47
And unfortunately, you know, the transportation area is not been used to active transportation data that's produced at scale with these methods.

1:02:56
So, you know, they look at something that says, Oh yeah, we detect 90% of the edges, right.

1:03:02
It's like bean counting, not really offering any real traversibility metrics like what I talked about or even graph metrics connectivity, you know, just basic between a centrality on these on on these graphs are is not produced by a lot of these commercial entities.

1:03:20
And so that's really what we're trying to inject as a practical guidance in the field of, you know, you don't have to buy it for me, but at least ensures that you're using evaluation methods that allow you to use this data in real ways as urban planners downstream.

1:03:37
And we find that it's, it's not really currently existing out there.

1:03:43
Sorry.

1:03:43
I have very strong feelings about this.

1:03:45
Yeah.

1:03:45
And I, I was laughing in agreement in background because those are the same exact experiences that we had all of our machine vision processing.

1:03:53
So the identification of assets, say the, the sidewalks and ramps and all that.

1:03:58
We developed it both with, with Google Street View as well as Bing's equivalent Street View.

1:04:05
And the systems worked great and we did it in house and we went and talked to them for over 8 months to get an agreement, a license agreement for us to be able to create new data from the video that had been collected, all to no avail by the time the the lawyers were done talking.

1:04:22
So those of you out there who may be using those private video sources and developing data and sharing that data from those private video sources, please talk to your folks about whether you are in potential violation of your user agreements.

1:04:39
I was told in no uncertain terms at Georgia Tech that we would not use those data because it would be a problem.

1:04:45
So fortunately, you know, collecting the equivalent video data was not really a problem.

1:04:50
We just went with the GoPro cameras.

1:04:52
They're awesome.

1:04:53
They had the GPS frame by frame.

1:04:56
In addition, we get a standardized view from everything from every platform that we have, which is a big advantage over some of the open source video sharing sites that are out there where you can get dash Cam videos and side shot videos from maintenance vehicles and the like.

1:05:11
We have a very standardized setup which helps in the machine vision process for identifying assets.

1:05:17
And, and another thing that not said earlier that is really important is that, you know, with the AI and machine vision stuff that we're doing, we can get all features partially, but it works really well for some stuff and not so well for other things.

1:05:28
You know, I need to identify a painted crosswalk.

1:05:31
I can do that.

1:05:31
And you got those yellow warning pads.

1:05:34
I can do that really well too.

1:05:36
When it comes to cross slope or the slope of the, of the, the ramp heading down into an intersection, those are, are not as easy to get with the machine vision process, even when you have the gyro and accelerometer reading.

1:05:50
So getting those consistent data from third parties is they're generally not available at that granularity.

1:05:57

And what is available, you run into issues with consistency and the best stuff you run into issues of license agreements.

1:06:04
Excuse me.

1:06:07
Excellent.

1:06:08
I just accidentally covered up the question box.

1:06:11
Give me one second.

1:06:13
Actually, Randy, you managed to answer a bonus question of somebody asking why didn't we use Street View?

1:06:19
So yeah, that's why we did.

1:06:22
It works good.

1:06:24
You wanted to we're gonna kind of jump around a little bit.

1:06:31
So one of the audience members asked what is the approach for managing asset changes both short term like work zones, for example, and more permanently?

1:06:47
Yes, Randy.

1:06:49
So I, I go first.

1:06:50
OK, so the, the way we've kind of structured everything you, you heard me mention that that we use OSM as the base, right.

1:06:57
We're starting with all the links and node structures in there, but the assets are managed in and and those links and nodes are managed in the AWS Neptune system.

1:07:06
So it's a, a graph structure, but but a difference between the system that a knots team is implementing and what we're implementing is, is we don't put ramps into the map because then you have to connect the, the, you know, each link to the maps.

1:07:21
And if you've got a, an island, now I've got 3 ramps and they've got connection activities on each side.

1:07:26
So it, it ends up complicating the network and, and besides, we're assigning impedance to each link.

1:07:32
So by having the a difference is then just associating, we associate the ramp asset as an asset that with the crossing and the curb cut asset the the driveway curb cut with the link and we have the location.

1:07:45
So it's just connected as a node and a join.

1:07:48
And then when we're doing impedance, we can say, well, I'm on this link and there's these five curb cuts that I'm crossing and these four are defective.

1:07:55
And so here's the impedance or I'm at the intersection, I'm going to cross the crossing.

1:07:59
It looks up and says, OK, well the ramp over there is defective, this one's fine.

1:08:03
So here's the impedance.

1:08:04
So by handling the assets as separate entities in essentially an asset management system, it's still in the same data structure, the same open source data structure, but that gives you the ability to then do updates on a real time basis.

1:08:18
We're not doing updates on a real time basis for ramps and curb cuts because they don't happen really in real time.

1:08:24
They're playing, but you can bring that construction manifest in and and do those changes as they happen.

1:08:29
Ours does have a live element in that through the Waze data structures.

1:08:34
If there's a closure, let's say there's an ambulance and a fire truck are dispatched to a crash on a roadway and it's adjacent to one of our sidewalk links or our crosswalks.

1:08:44
That actually can be done in real time, and it's inducing an impedance to essentially route folks around that disturbance.

1:08:50
So everything can be done in real time.

1:08:52
You just have to have the hooks set up so that, you know, when you're making the changes in the field and doing the construction, they've been inspected and finalized.

1:08:58
Those data on the changes to the assets flow into the Neptune system, and then the impedance is automatically updated every 5 minutes or 15 minutes with those changes.

1:09:08
Yeah, not any anything else to offer from your end about.

1:09:12
Yeah, I think for us it, it is about two things and and really kudos to the USCOTFHWAITS for U.S.

1:09:21
team for recognizing the value and interoperable data schemas so that the schemas are can work with each other and integrate well and these downstream tools and and upstream tools that we produce.

1:09:36
So as an example, like that data for six counties that USDOT effort has advanced was then used by our King King County partners from their health through housing units asking us, oh, can we add on specific features on the ground, you know, things we've changed, things we want to change.

1:10:01
So now there's an app for that.

1:10:03
And essentially it's about integrating a simple mobile based app that allows somebody on the public right of way to say, oh, hey, you know, I'm, I'm an authorized user of the system and I can just add this tweak to the data on the ground because either I witnessed that the data is incorrect or because I just changed it myself, right?

1:10:25
And so to us, again, it's really about driving use is about maintaining the data.

1:10:32
Data stewardship doesn't happen by itself.

1:10:34
It requires the people on the ground to to allow for that.

1:10:39
And the same app, you know, can variably be used to also allow crowds and communities to comment on the data and not change it necessarily because they may not have the permissions to do so, but they can let the authorities know.

1:10:53
And there's this full transparency and accountability in exchange about what data we have about the infrastructure that we do have.

1:11:02
And how, how do you allow sort of the democratic process to take place in order to allow for maximal equity and, and accessibility in in those environments?

1:11:14
Yeah, and, and authorized users is very important.

1:11:16
We, we see so many changes that get introduced by the public, for example, into OSM.

1:11:22
So like Anat was talking about having those standards set for how we're going to manage those assets and, and, you know, including the roadways, ramps, etcetera.

1:11:31
But then also the the fact that, that we don't just accept any changes into the network because, you know, we have vulnerable road users who are relying on that network.

1:11:40
So there is a a need to have those those changes reviewed before they're posted.

1:11:46
Is there anything either of you would like to add about Randy?

1:11:50
You mentioned the ways data of other real time information you all are pulling in from, from third party sources.

1:12:01
Well, there is that, you know, the real time spat messaging that's coming off of the signals and the connected vehicle data.

1:12:06
I'm not the best person to talk about that.

1:12:08
That's Doctor Gwen, Anshuman Gwen, who handles most of that on our end.

1:12:12
But I think the Waze data is kind of innovative because, you know, here you are using something that is that is broadcast in real time.

1:12:20
A set of rules are set down to say, you know, when an incident is important enough that we ought to consider rerouting pedestrians.

1:12:27
It's got the, the position information, it's linked to the, the crossings and to the, the roadway links so that if they have a severe event, you can go ahead and, and change those impedances and, and route people around.

1:12:39
But that's not the only source that would be potentially useful.

1:12:42
I mean, there's all kinds of different sources that are coming online that can be very valuable and crowd sourcing of data collection through both of these methods.

1:12:51
You know, getting volunteers out there to collect video.

1:12:54
We've had great experiences with that.

1:12:56
Hand measurements not as not as much.

1:12:58
I'd rather have the undergraduates out there at $20.00 an now we're collecting the inspection data, the actual physical inspection data for verification.

1:13:06
But in terms of collecting rolling video and driving video with the sets of standards, there's a lot of crowdsourcing that can be done and those data can be brought into systems and not.

1:13:17
What about the TDI team?

1:13:20
Anything from your end?

1:13:22
Yeah.

1:13:22
So we enable joining of any streams that you might want to join in.

1:13:28
It could be, you know, population and use data or it could be weather data.

1:13:36
So for us it was about forward-looking to understand what real time systems people might want to hook in, but not necessarily enabling like a specific stream right away.

1:13:50
All right, well, another one for I think I'll let a not start with this one.

1:13:54
So what demand do you see from cities or counties for a unified schema on sidewalk data and or the ability to assess the traverse ability of the network?

1:14:04
My company does a lot of manual data collections for the ADA that aren't leveraged for network analysis but could be adapted for this.

1:14:13
I think the demand is huge.

1:14:15
There are three national and international efforts that I'm aware of that are currently talking about these things.

1:14:23
So one is initiated by Openstream Map and Meta together, which will potentially feed the overture graphs that are produced.

1:14:35
Another is by the Bureau of Transportation Statistics through USDOT and that's I happen to Co chair that effort.

1:14:43
And then there's another ISO effort, the international standards organization that that the G dot team partners have been involved in, if that's a fairway to describe that.

1:14:58
So there are definitely and in each one of these, there are non overlapping entities and institutions that are super interested in.

1:15:09
Now the question also asked a very specific question, which is like if I'm collecting for a specific use case, how much how can it benefit others?

1:15:19
And I think a lot of that goes back to like the open data sharing and having baseline schema that's standardized throughout so that, you know, today for Bellevue with that safety, like the safe systems approach that we did the collection for schools, what they were interested in was level of traffic stress and traffic speeds and the buffer between the pedestrian and the car.

1:15:45
But in another ADA collection, obviously some of the attributes will be very different.

1:15:51
They'll look at compliance and the new Pro AG 2022 rules.

1:15:54
And so that would be collected.

1:15:56
But if they have the underlying shared graph, that's really where the benefit is in, in being able to to provide for different use cases at an ongoing rate and scale.

1:16:10
Randy, anything else, Dad?

1:16:11
Yeah.

1:16:11
Well, I think in addition to the efforts that are not mentioned, there's other efforts on the use of robotics on sidewalks, using robots for deliveries and that so you're getting, you know, potential I triple E standards coming forward that so it's it's all these different user communities that that use the sidewalks.

1:16:27
And then there's all these different interests.

1:16:29
We care about safety and mobility and walkability and accessibility.

1:16:32

So there's there's all these different elements that different sets of data that that individual users for applications would like to have.

1:16:42
So it's great that we have all these different groups exploring, you know, what kinds of data we want to associate with a sidewalk link with a, a ramp or a curb cut associated with the neighborhood.

1:16:54
With respect to safety.

1:16:55
My personal conviction here is that we need a lot of video data archived so that we can go back and look at these things.

1:17:01
So having that, that inventory where you can go back in where it's calibrated field of view so you can look at, well, what is the distance separation?

1:17:09
You know, do we have areas where there might be near misses between pedestrians and vehicles because there's not enough bug or there's no trees or there's no separations, there's no planting strip.

1:17:19
So looking at at having all of those data that then can be available for say case control studies for pedestrian safety, I think is very valuable.

1:17:28
So those video archives there, there's video out there, but we can't use it, right, because of the licensing agreements.

1:17:34
So we can standardize that and get those video archives available for others to be able to create new data.

1:17:40
I think that's going to turn everything because the the AI and machine vision and machine learning processes are so powerful that once you have that and you know what's in the field of view, you can do a lot with it.

1:17:52
Awesome.

1:17:53
I'm going to kind of rewind back a little bit Randy to to your presentation and I'll see if I can pull it up while you're talking.

1:18:02

But one of the audience members asked whether local roads were included in your Cybok inventory because the graph you showed, there were many minor roads in Gray that looked like they were not included.

1:18:17
No, every Rd.

1:18:18
What you saw was the map of the sidewalks.

1:18:20
So, so a lot of those minor roads out there just don't have sidewalks.

1:18:23
In Lawrenceville, you've got sidewalks everywhere.

1:18:25
The city has made a conscious effort to do that.

1:18:28
Some subdivisions, depending on when they were constructed, have sidewalks and some don't.

1:18:33
Some are gated access communities out there.

1:18:35
So they're not included in the in the sidewalks.

1:18:37
Even though some of them have sidewalks inside the gated communities, they're not showing on our map because it's not part of our public navigable network.

1:18:44
But yes, every local Rd.

1:18:46
Every.

1:18:47
We drove every Rd.

1:18:48
both directions and and gathered all that video.

1:18:51

The video platform works well for for small residential streets you can drive it just once because you have both sides and the field of view is good.

1:18:58
For wider roads you have to drive in both directions to get to get both data sets.

1:19:02
But every Rd.

1:19:03
was covered.

1:19:03
Yeah, awesome question for I think it applies to both of you, but what GIS software was used?

1:19:14
Was there any usage of Q field?

1:19:18
And we'll start with a not I'm not familiar with Q field.

1:19:24
I might call in Yujinjing if we used Q field.

1:19:30
We use Q GIS often because it's an open source system.

1:19:39
Yeah, for various things, but mostly QGIS.

1:19:44
Go ahead.

1:19:45
I think like we mainly use QGIS for some processing virtualization and then our like pipeline was developed in Python which is on open source and then the GIS to just use mainly for visualization stuff for us.

1:20:02
Yeah, same here.

1:20:03
We do the vast majority of all of our work in Python And and you can do most of the stuff that you're doing in GIS if you if you have the coordinates, you can do it in Python with without the GIS layer in it.

1:20:14
But the QGIS is good for, for visualization.

1:20:17
We do mapping now of all the assets so that we can see them.

1:20:21
And rather than having to try to find them, you know, bring up shape files and display them, we just put them on a map is what we're doing starting this last week.

1:20:31
I believe that once I did a quick Google on Q field once, it looks like that's a data entry kind of platform.

1:20:40
So Randy, we, we did our own data entry forms for, for use with tablets.

1:20:49
So which was a much faster way to go than trying to integrate some some out-of-the-box software into our processes?

1:21:00
Yeah, but that's possible.

1:21:03
They share all the same variable names, and so when you transfer, it's pretty seamless.

1:21:12
All right, so who, who do you both see as the main users of your data?

1:21:18
Have you discovered any unexpected uses or users of your data as a part of your stakeholder engagement?

1:21:26
We'll start with a not so our initial users were people with disabilities and mobility disabilities initially.

1:21:39
And then we expanded our access map app to also have a non visual experience.

1:21:45
So it seamlessly works with voice over.

1:21:47
And so now it offers step by So that was our community based users.

1:22:00
But then as this data became more and more variable in different areas, we now have 13 cities covered and soon to be many more in Washington state, but the 13 cities are international.

1:22:16
More and more institutions were asking us for that data and different use cases came up.

1:22:21
So I mentioned the safety approach.

1:22:24
There's a whole equity consideration.

1:22:27
So what is the reach for different types of pedestrians in this environment?

1:22:33
That's really what the Walk Shed tool addresses.

1:22:36
So you're able to enter the specification of a particular mobility profile.

1:22:41
You know, what is the ability to go up and down, etcetera.

1:22:46
And so urban planners are now using this to both do project plans to assess need for specific projects, but also to assess the impact of projects.

1:22:58
So if I tweak this curb ramp and if I make this path accessible, how does that impact the downstream Walkjet for different users?

1:23:10
Some of the surprising communities that have addressed us are people teaching their kids how to ride bikes and want to know where are things flat and connected and where am I going to find?

1:23:26
But also policy makers and also, you know, as mentioned, some of the robotics companies that are operating robots on sidewalks, we've done some joint projects with them as well in order to provide, you know, the best maps that they can access in order to plan, pass plan for their robots.

1:23:45
So awesome, Randy, I'll give you no more than two minutes to give your answers so we can wrap up on time.

1:23:51
3030 seconds because Annat said almost everything that that I would say.

1:23:55
So I would say a couple of things that came up were St.

1:23:58
lighting.

1:23:58
We have a master's thesis that came out on the street lighting and, and how that's going to potentially impact routing and safety.

1:24:05
There's a lot of interest in the bus stop data that's coming going to be coming out of this.

1:24:09
But I would say probably one of the prime things is 17 terabytes of video data that will be publicly available that can be used for all kinds of machine vision processes.

1:24:17
And because we have the forward-looking, you know, view on the vehicle, forward-looking view on the wheelchair as well as the down view, I think there's a ton of applications that people will dream up overtime based on the access and and processing using using machine vision with those, those videos.

1:24:36
Awesome.

1:24:37
All right, well, there are a few questions we didn't get to today.

1:24:41
So if you haven't already scanned the QR code, that was on my background, it's here on the screen.

1:24:48
And we just wanted to let you know that we have a lot of knowledge transfer materials on the program website.

1:24:55
That is where the slides and recording will be posted.

1:24:59
And I'm not fully sharing there We go and and you can learn way more about all these different projects there on the website.

1:25:10
We're so excited that so many of you hung in here all the way to the end.

1:25:15
And last but not least, here's the contact information.

1:25:19
I know it's an eye chart.

1:25:20
Again, these slides will be posted online within the next two weeks, but it has the contact information for the primary leads for each of the sites.

1:25:30
So if there's something interesting you heard today, you can get in touch with the projects directly to ask additional questions.

1:25:38
And they'll make sure that Doctor Cassidy and Doctor Gensler and Dr.

1:25:41
Ginn and Dr.

1:25:42
Zhang, I'll get the all the great questions that everybody's come up with today on all their technical information.

1:25:50
So with that, we're so excited to have you all with us today.

1:25:55
We hope you'll come back and join us in the future on another special topic for ITS for underserved communities.

1:26:03
Have a great day everyone.