NWX-US DEPT OF COMMERCE
Moderator: GREGORY PEWETT
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Operator: Welcome and thank you for standing by.

At this time all participants are in a listen-only mode. During the question-and-answer session, please press *1.

Today's conference is being recorded. If you have any objections, you may disconnect at this time.

Now I'd like to turn the meeting over to Earlene Dowell. Thank you. You may begin.

Earlene Dowell: Thank you, (Diane). Good afternoon everyone and thank you to Greg Pewett from the US Census Bureau for hosting this webinar. On behalf of the US Census Bureau and the local employment dynamic partnership, in collaboration with the Council for Community and Economic Research and the Labor Market Information Office, welcome to the April LED webinar, combining Census data with open street map data in developed - to develop highway access measures with our presenter, Colby Brown.

In light of the recent transition to 100%, telework we are utilizing technology offsite to continue operations. We aim to minimize interruptions as much as possible so we appreciate your patience if we experience any technical delays. Please utilize the chat features to notify us of issues should any arise and we will be - we will do our best to address them.

All webinars and Q&A sessions are recorded and will be accessible from the Census Academy's webinar tab. Once the recording and transcript are available, please go to www.census.gov/academy. And thank you for your continued support of our outreach and education efforts.

While it is now straightforward to develop accessibility measures for pedestrians, bicycles and even public transit modes of travel using free data, highway modes remain expensive to analyze because of the need for high resolution congested link speed data.

This presentation outlines a workflow for developing accessibility measures for an auto mode such as journey to work time and highway travel time by combining Census data with OpenStreetMap, a free editable map.

Colby Brown is a transportation planner software executive and data scientist who is in the - who in the past decade has developed over a dozen socioeconomic land-use forecasting models for regional planning agencies across the country. After winning top honors at Wesleyan University for his sociology thesis on comparative urban freeway development, Colby earned a Master's degree in transportation technology and policy from the University of California at Davis in 2003.

He then returned to Connecticut to spend several years as a toll traffic and revenue consultant before moving to St. Paul's to work for the Twin Cities Metropolitan Council, leading air quality conformity analysis of the region's transportation improvement program.

There Mr. Brown was discovered by a local representative of the software from Citilabs, Incorporated, who shortly thereafter hired him in a customer support role which quickly grew to encompass other duties such as training, technical sales and product management.

Prior to leaving Citilabs to start his own company in 2014, Mr. Brown

developed and helped launch Sugar Access, a transportation accessibility mapping application for the Esri ArcGIS platform that has since been adopted statewide in Virginia as part of the Smart Scale program for local project prioritization.

With that, I welcome Mr. Colby Brown.

Colby Brown: Well thank you, Earlene, and thank you to Greg as well and to the Census Bureau for hosting this presentation today and making it available for everyone as a webinar.

This is similar and largely the same as a presentation I gave at the Census Bureau's LED workshop last fall and we received a lot of great questions at the presentation and I look forward to your questions at the end of my presentation. So without further ado, I'll get started.

Earlene, I guess next slide. Okay. So this presentation is going to be discussing accessibility measures and I'd like to define those very briefly. Accessibility is defined as the ease with which someone, anywhere, can reach destinations of interest. The classic formulation is a simple tabulation of how many jobs could I reach within a reasonable drive time or travel time by any mode such as 20 minutes from my house.

And you could do the same thing for other trip purposes, such as shopping. You could say how many grocery stores could I reach, you know, you could ask this question of different modes such as bicycling, walking or using transit or time of day.

And this is a kind of increasingly popular metric used as an alternative to the traffic engineering-oriented metrics such as level of service or capacity ratio as a way of understanding how well a transportation system is serving the public in terms of connecting different parts of the economy, consumers and producers, workers and jobs.

It has a long history and use as an equity measure and it's a part of many regions' equity analysis in justifying an expenditure of federal projects and showing whom it benefited by increased access to jobs, for example, via transit. And it's increasingly becoming a popular measure in its own right.

A lot of the land use forecasting models that I've built and that others have built include transportation accessibility measures as an indicator of potential positive growth because they correlate strongly with things like property value and propensity for development or redevelopment.

The graphic shown here is not my data. These are accessibility data gathered, compiled and published for use by the University of Minnesota Accessibility Observatory, and that included the link here, in case you're interested in browsing that resource.

Go to the next slide. So...

Earlene Dowell: Sorry, I'm having difficulty.

Colby Brown: Okay. Shall I just hold on? Okay. I'm going to wait for just a moment. Oh there we go. Okay.

So this slide is just talking about more detail about those things I was just referring to. This is a commonly reported measure for environmental justice and Title 6 equity analysis, which is required when federal funds are being spent on a transportation project. It's also associated with increased real estate values and development. There's whole literature on documenting that.

And, as I said earlier, it's an increasingly popular performance measure for sketch-level planning so Sugar Access, that was alluded to in my bio, is a sketch-level tool for quantifying and analyzing and digitalizing accessibility, and there are many others out there. There's a whole ecosystem of software tools which can be explored.

This is another graphic here which is a resource provided by EPA, Smart Location Mapping, which you can access at that link, provides free accessibility measures as part of a broader web database for the entire country. Now it's getting a little old now but it provides block-group level accessibility data for the entire country that may be useful for many circumstances and the idea is about how certain kinds of accessibility measures can be calculated.

Let's go to the next slide. So one of the challenges of accessibility modeling in the US is that a very large majority of Americans drive to work or carpool and you can't really talk about driving to work or commuting by car without understanding congestion.

Most of our major urban areas are congested and some understanding of the extent of the degree of that congestion is really required in order to estimate auto accessibility measures that use travel times to determine what opportunities can be reached within a set - a reasonable commute system.

However, congestion data is pretty expensive actually when you really look at it. Unless you're inside of the government or inside of one of the agencies that's actually collecting data themselves, there's proprietary data that is available from various companies. There are also models, forecasting models that attempt to predict congestion and either the so-called traffic forecasting and travel demand models.

But they're really designed, as I just said, travel demand models, not so much as congestion prediction models. That's changing a little bit. Increasingly micro-simulation, dynamic traffic assignments are trying to make these models a little bit more accurate in reflecting congestion but it's still a major challenge. The models are more designed to just generally forecast flows of travel demand originally.

And so trying to get one of these models to really provide accurate or useful congestion data is not an insignificant burden. So this is a major challenge in doing accessibility modeling in the US for auto loans, which is really

necessary in order to understand the bulk of commuting behavior.

And there are other simpler measures that can be tracked, other methods that can be applied using open data for other modes, such as pedestrian and transit. So really what this presentation is about is trying to see if there's a way that we can calculate auto accessibility measures, taking this view into account, using exclusively open data.

Let's go to the next slide. And the idea that came to me in approaching this topic was what if we used something like the travel time index that is commonly reported for metropolitan regions around the country in order to sort of rank and quantify which regions are more congested. And what this is it's a relationship between the travel times that are experienced in the peak hour and what would be experienced if all of the facilities in a region were moving at free-flow speed.

So it's a relationship between peak and off-peak travel time and vehicle hours of travel essentially. So this travel time, as I said, is normally tabulated at this sort of regional scale and used to rank regions but what we - what I found is that it's also possible to do this at a local scale using open data. So that's the idea that I support here in this work as a root to beginning to calculate accessibility using open data.

So let's take a look at that on the next slide. So which open data sources are we talking about or which ones can we use to compute local travel time indices? Well a very popular one is OpenStreetMap. This is a crowd-sourced, routable map of the whole world actually. Crowd-source means that people succeeded of course with very good initial data. I think in the US it was Tiger/Line files which were a starting point.

But then from that point forward, a huge collaborative effort by volunteers was taken to keep that updated and to keep adding facilities. In some ways, OpenStreetMap is even better than other sources for certain modes like bicycles because bicycle people go and update the bikeways within

OpenStreetMap whereas it's sometimes hard to get a proprietary source of bikeway data.

But for autos it just provides a really very complete and detailed and routable map of all of the roadways in a region. And there are three libraries that you can use to get drive times from origin to destination, and the one that I used here in this work is called DODGR, or DODGR. I sort of came across it in the process of researching a different study and realized this is a really flexible library for the R statistical programming language, also free and open-source, that can get us in a free-flow pattern from origin to destination at a really detailed level pretty quickly.

So we used this DODGR routing library and that gives us travel times at free-flow or excess speed limit from place to place, from Census block group to block group or block even to block across the network. Then of course this is a Census webinar, we used Census data extensively in this work and especially the LEHD and LODES resources, which I'm a huge fan of and have used for years and years.

What this provides is origin destination worker flows from block to block at the most detailed level. And you might not necessarily always want to use those at the block level, but you can aggregate to the block group level or track level and if you want something a little more details. The nice thing about it being block level is you can aggregate really to a variety of different geographies if you had some other geography such as transportation OSM times that you want to use.

So what I do here is combine those worker flows with the open street map travel time skims -- origin destination times -- to calculate what the average commute would be if taken at free-flow speeds for every origin. For every place of residence, essentially within a region. And then we use the workplace area characteristics table familiar sheet to figure out what the jobs at the various destinations available are to get counts of jobs, essentially. And so that allows us to begin to quantify the accessibility at free-flow.

But what we do to get congested accessibility is use the ACS summary file data -- the journey to work questions -- to adjust the average commute and to come up with a relationship between what the average commute would be if -- according to the LEHD data and OpenStreetMap data if it was free-flow and the commute as reported - experienced -- in congestion, let's say -- by respondents to the census ACS questions. So that gives us a ratio - a local travel time index that we can use to adjust the travel time to calculate accessibility measures.

And an example of that I believe is on the next slide. So here - this work actually got applied - this methodology was applied in the study I was doing – land-use forecasting study in support of the French Broad River MPO's long-range transportation plan. We were looking at land-use forecast for the greater Ashville region. And so here on the left, you see the estimated local travel time index. I think it's very interesting that this is not - these patterns are not necessarily something that we would get that - a priori. It doesn't follow the sort of concentric picture of increasing density at the core area of a region. It's - the darker blue areas are showing where the relationship between congested drive times and uncongested drive times is a higher ratio, meaning more congestion or more impacted by congestion. There's a very clear quadrant in the sort of northwest portion of the region that is more impacted by congestion than, say, the southern tier that's just outside of Ashville and extending south.

Now, when we apply this, though, to the free-flow travel times skins and then calculate accessibility, you do see this kind of concentric pattern of access to jobs increasing as you get closer to the urban core. But this is, you know, a little different than the map we would see if we were just looking at free-flow travel time at speed limit.

There's a few more technical notes on this on the next couple of slides, I think, if you want to take a look. So one thing about this that I had been convinced of by - through discussions with other experts in accessibility modeling is that it's a good idea to apply some sort of decay function, rather than doing the

simple kind of cumulative opportunities accessibility measures that I showed in my earlier slides as examples where you're just calculating - just counting the number of jobs.

So increasingly, what's being recognized as a better practice and accessibility modeling is to apply a decay function to the number of opportunities at a destination based upon the travel time and reflecting sort of a typical trip points distribution and the probability of making a trip that long based upon people's actual propensity of travel for certain amounts of time. What this does is it kind of smooths out some of the imperfections of using estimated data like we're using here with OpenStreetMap and, you know, reported ACS travel times.

So if we're using like a hard threshold of 20 minutes or something like that, little deviations or errors in the reporting of travel times or in the skims could create more of an impact than they do because we're using this weighted decay function to kind of smooth out the results. And then I think there's another note on the next slide about a related topic. No, it's just my contact information. So yes, with that - I also want to give an acknowledgment to the French Broad River MPO staff who were very, very closely involved in the work that implemented this methodology. (Tristen Winkler) and (Nick Kroncke). Excellent folks, great to work with. As well as (Daniel Sellars) from North Carolina DOT.

Part of the way this came up and part of the reason he did this approach here in Ashville - in the Ashville study was because of the need to look at how could we get observed accessibility in the - to use to estimate and calibrate our models in the interim while the travel model was being updated to reflect new base year socioeconomic data? So what happens, we collected new data for an updated base here to feed into the travel model and found that there were big differences. That Ashville had been growing substantially faster than expected. And probably may have been counted different ways.

So that triggered a need to really relook at the travel model and -- again – we

didn’t want to delay things successively for MPO while the DOT was looking at that. So that was what triggered this study and, you know, deciding to push forward with this methodology. But coming up with a way to really calculate and observe accessibility quickly and cheaply without increasing the study budget just simply by using open data. And with that, I'll be happy to answer any questions that the audience might have.

Operator: Thank you. We will now begin the question and answer session. If you would like to ask a question, please press star one. You'll be prompted to record your name. To withdraw your request, please press star two. Again, if you do have a question, please press star one and record your name.

(Earlene): While we're waiting for questions to come through, I would just like to remind everyone to keep the questions to pertaining to the presentation. And also, if you could keep your questions to one question with one follow up. Thank you.

Operator: We do have a question your line is now open.

(Caller 1): I just had a quick question. You know, I'm just out of my undergraduate in my bachelor's for economics and I have started a basic economics position with the State of New Mexico. And everything that I - I just feel like I'm a tadpole in water in this presentation. But, you know, everything that I have done so far is all Excel-based. And I keep watching these presentations on, you know, open source data and R program and I just feel like I'm not aware of, you know - I just feel like I'm the caveman, you know, using a stone and chisel compared to what you're using to display and analyze data.

And I just really want to know if there's any suggestions that you'd have for someone like me who's trying to further his education and also help an underfunded program in learning or advancing myself in that analytical, you know - like you said that there was open source availability for our program, where would I find that? And is there any courses that I can take or anything like that? Thank you.

Colby Brown: Yes, sure. I don't mind answering that, even though it's not directly related to the methodology. I mean, I'm a fan of R. I like R a lot. It's not necessarily always the most powerful tool in the data scientist's toolbag, but it's often the most versatile. And sometimes I find surprisingly user-friendly, surprisingly easy to get started with. Less intimidating than some of the more pure programming languages that are out there that get used for things like, you know, really higher order data scientist tasks like machine learning and stuff like that. Python and things.

That said, it's not the only language out there. Python is really commonly used for GIS manipulations for geographic data, for example. And maybe a little stronger and sometimes more popular with, say, planning departments and transportation planners and mileage planners for that reason. So I wouldn't just focus necessarily on R, I would just more think of it as integrating data science tools and methodologies into the scope of what, you know, an economics group at a public agency might do, and I think that will reap huge benefits because - primarily because there's such a huge community of contributors to the libraries and packages associated with these languages.

So really, R by itself would not be that an amazing - that much of an amazing tool, but because there are these fantastic contributors out there creating libraries like DODGR, dplyr, the whole Tidyverse, for example. It's really become a really robust system. I should mention also I - I'm a heavy user of the R studio interface - user interface for R, which makes things a lot easier and more user-friendly.

So R studio offers a bunch of resources themselves. They are a company based in Boston, Massachusetts and they have a bunch of training available. I do recommend if you're just dipping your toe in the water with R, getting a copy of R studio, which is pretty easy to download. Also open source, I believe. And then checking out some of their training courses. Then as you start to dip into the libraries, I would recommend looking -- for example -- at the dplyr - dplyr library. The source for all documentation and sort of how to things are - the definitive source is called CRAM -- C-R-A-M. That's a Web

site set up to sort of coordinate the whole community.

And there's also a conference useR that meets I think once a year, although who knows this year. For people to discuss what they're doing with R. And you can probably get a lot of examples and, you know, ideas there. The RCO conference has another event. But outside of that, just search the Web. You know, there's tons of resources out there, there's tons of free classes...

((Crosstalk))

(Caller 1): you've given me plenty to - just with that, you've given me plenty to Google and definitely, you know, research and start a planning path for my own. And I really appreciate that.

Colby Brown: Yes, feel free to contact me, too, offline if you want more links.

(Caller 1): Okay. Thank you so much.

Colby Brown: No problem.

Operator: Our next question, your line is now open.

(Caller 2): Yes, hi, I'm one of the local census office workers who's furloughed and I'm just fascinated by not only data science but I'm a toolization expert, VR, AR trying to look at Google Earth, multiple layers. Things like that. And I just wondered whether or not some of the work -- I missed the beginning where you introduced what you're doing -- could you apply kind of visualization techniques in more than two dimensions? Like could you apply to the different layers of Google Earth and get a wider scope than the narrow focus I saw at the end of the slideshow?

Colby Brown: Yes. There's a guy named (Michael Brown) whom I've worked with. In fact, he was a sub-consultant - his firm Metro X was a sub on this study. And he didn't do it on this study, but in other work for Salt Lake NPO in Utah, I

believe he's done some 3-D visualizations of - I forget if it was accessibility or land use density changes using Google Earth - exactly with probably non-estrusion and based on a very effective communication mechanism.

(Caller 2): And you should be aware -- if you're not aware -- that the Quest -- the latest Oculus Quest, which is relatively cheap -- has both augmented and virtual reality -- a mixture of the two -- and I just - a Google Earth that lives inside there, that lets you use your hands to reach out and zoom the globe, thin it out and touch things, very natural user interface. It might be interesting for visualization purposes, in case you guys care about that kind of thing in the future.

Colby Brown: Yes, my father gave me one of those Google cardboard things and I played with it for a while and then threw it away.

(Caller 2): Just Google Oculus Quest or just Quest VR. Q-U-E-S-T.

Colby Brown: Yes, I haven't played with it that much yet, but thanks for the suggestion.

(Caller 2): Yes. It maps your hand right into the virtual world and it's much more sophisticated than the other (unintelligible) out there.

Colby Brown: I suspect we'll be relying more and more on VR and AR as this pandemic proceeds.

(Caller 2): All right. Well, listen, thanks again for taking the time to give us this talk. If you need to find me in the future I'm at (rendezvous.com). I can give you some advice if you've guys need some visualization help in the future.

Colby Brown: Okay.

Operator: Your line is now open.

(Caller 3): Yes. Hello. I was wondering if you have any example code in (R) that

demonstrates the methodology discussed today?

Colby Brown: Yes, and I'd be happy to share it. I really would like to put it up on GitHub or something. I just haven't gotten around to it. But if anybody is interested, just contact me at this email address and I'll be happy to share the code with you.

(Caller 3): Okay. Thank you. I'll send an email.

Colby Brown: Great.

Operator: Your line is now open.

(Caller 4): Hi. I joined this group a few minutes late. I'm wondering how, if there's a way to go back and hear the beginning of this? I'm also a bit uncertain as to whether I should be in this group. I'm going to be just a regular census -- what are they called -- numerators or something like that.

I did do this ten years ago and this - (nothing) seems to sync together for me. So, perhaps I shouldn't have been here?

Earlene Dowell: Hi, this is Earlene Dowell. Yes, this is actually separate from the 2020 Census. So, just to let you know, this will be recorded, or it has been recorded, and will be on our Census Academy Web site. And you might want to go and look at the Census Academy Web site to look at other things for the Census 2020.

(Caller 4): Rather than this seminar, correct?

Earlene Dowell: Yes.

(Caller 4): Oh, then why did they invite me?

Earlene Dowell: I'm sorry. Thanks for your question.

Operator: Our next question, your line is now open.

(Caller 5): Hey, I really appreciate the conversation and presentation today. I'm just wondering if you were to look at, say, Richmond, Virginia, and try to do a similar study that was done on - in (ACCESS). How long would it take you because I must admit, I'm new to what you're talking about and I was able to follow it. But at the same time, I'm thinking that this might take a long time.

And I know you're an expert at it and (your job is to predict). I'm just trying to see if how long does it take to do a study like that? How long would it take you, Colby, to do a study like that in Richmond, Virginia? Thank you very much.

Colby Brown: Well, thank you for your question. And the short answer is maybe max a week, but the actual run time, you know, could be like a day, you know, and I'd spend most of the time probably gathering and checking inputs and then, you know, checking outputs, basically. It's more, sort of, the human time than the actual computation and number crunching.

The reason we specifically used this approach was because - so, we needed something quick and we needed something cheap, basically. We wanted to use open data because we didn't want to go out and buy data and we couldn't wait for the travel model to be updated.

And this is an approach that I've been, kind of, noodling on for a while and thought, oh well, if I ever need it, I can try this. And so, I tried it and went very quickly. So, I would say like a week.

(Caller 5): Oh, thank you very much.

Colby Brown: No problem -- would be happy to help. And you can get in contact with me if you want to actually try to do that.

(Caller 5): I'm going to shoot you an email requesting the code. If you...

Colby Brown: Okay.

(Caller 5): ...developed (for this).

Colby Brown: Sure.

(Caller 5): Thank you.

Operator: Our next question, your line is now open.

(Caller 6): Hello. I'm a regional transportation planner. So this is, kind of, right up my alley. But the only caveat is is that I only do it for the rural areas. So, I was wondering - this might be a silly question - but would this be applicable to rural areas or is primarily just for those high-clustered MPO kind of areas?

Colby Brown: Yes. It is applicable. The only caveat I would say is that - and maybe Earlene can comment more on this, or someone from the Census Bureau - but there is data suppression in some of the - like the journey to work responses, I believe. There's plenty of small sample sizes. So, you can come into some issues with that.

And what I've done in the past to get around that is use spatial interpolation to fill in values based upon adjacent geographies. So, what I would recommend doing is you have a situation like that where you have missing data because it's a low-density area or something like that is do the spatial interpolation. If you're going to do something, or another method, let's say, to fill in missing values, even on the TTI itself, on the local Travel Time Index, rather than on the output side of the process, I think you'll get better results because you can fill in the travel times, the free-flow travel times, for every area, right? The OpenStreetMap method is available everywhere. It's the sort of reported congestion or the reported travel times that you might have a harder time finding. And I haven't seen any (data suppression) issues with LEHD or LODES data either.

So, all of that should work fine. It's, sort of, free-flow average travel time should be fine to get, even in a rural area. It's more of the, sort of, congested - reported congested travel time that you might have some missing data for.

And you could always do a survey and come with it - up with it a different way, if you did a survey or if you have population, that would be another way too.

(Caller 6): All right. Thank you. Thank you, that helps a lot.

Colby Brown: No problem.

Operator: Your line is now open.

Caller 7: Yes. My question is about the DODGR library and that portion of the code particularly with active transportation. Routing decisions often vary from the shortest path to the most, you know, straight-line kind of path to account for other characteristics...

Colby Brown: Yes.

Caller 7: ...about level of traffic stress and things like that. I've seen other methods for calculating level of traffic stress using OpenStreetMap data. I'm wondering if the methodology you have here can grab those other tags across the processes of other tags whether you'd consider something like that?

Colby Brown: I did a lot of research into this when I was developing Sugar Access. I spent a long time looking into traffic, you know, bike stress measures and looking for the research on that and trying to figure out whether we could come up with a bike stress measure from available traffic and roadway data from a source like here, networks and traffic data.

We didn't ultimately build that into the offering. With OpenStreetMap, what it

does well at is - has a greater universe of the bikeways and the exclusive bike facilities and they, like here, and other proprietary network source

So - so from that standpoint, it's a better benefit because you can automatically assign an exclusive bikeway, a lower traffic stress, right? And one of the nice things about DODGR, it's like, it's not unique entirely but it's designed around being able to weight the links in the network in a flexible way.

And the automatic weighting is, sort of, this, speed limit based kind of weighting and they have a set of assumptions of speed limit based for assumption of facility class, but you can override that and you can assign custom weight.

So, that would be where I would start with this is for those, you know, seeing if there's attributes or features in the network. And it doesn't have to be an OpenStreetMap network, by the way, to use DODGR, it could be from another source. But I would look for attributes to features that are correlated with higher stress and then use those to calculate a new kind of weighting function that would better reflect what's, you know, bicyclists experience.

The other thing that's occurring to me just now listening to your question is a methodology like this could be used to dampen the distance that bicyclists are actually willing to travel compared to where they could travel, how far they could go based upon bike stress.

So, for example, if you do a similar thing here and you say, All right, well, we'll collect, you know, this - distances along a bike network using reasonable assumptions with DODGR using OpenStreetMap. But then we'll look at reported distances, right? So, you could average bike commutes according to reporting, you know, according to the standard reported sort of data and then look at actual reported bike commute distances.

There's probably some relationship there that is almost like the TTI that we're

talking about that's, sort of, like, a locally-specific, like, block group level bike stress that you could quantify. Like, how far do I go versus how far I could go to get to work? The problem is that the LODES - the origin destination point of data, it's not segmented by mode. And so, it's just giving us total employment. It's a reasonable approximation in this case because so many people drive. But given that biking is, sort of, a minority commute mode, I want to use an origin destination flow source that would targeted at that mode and do that kind of analysis.

Caller 7: And that last part makes a lot of sense. Thank you for going into some detail there. But just to make sure that I understand this, DODGR itself doesn't have, like the package doesn't itself have access to those other tags in the OSM network, right? You have to go and create that weighting function of whatever kind independently and load it in?

Colby Brown: To a certain extent, it is engineered around OpenStreetMap. Yes - no, it's very - it's easy as falling off a log to bring in an OpenStreetMap extract and do routing on it. It's sort of got default for all those things. I think it has a profile for bicycling as well as for driving needs. It's as simple as saying these all should be bicycle routes basically, you know?

All I'm saying is that to get a route that's more reflected of bike stress, I think you'd probably want to tweak that a little bit based upon the research.

Caller 7: Right. No, that makes sense. Thank you. Thank you very much.

Colby Brown: No problem.

Operator: And again, if you do have any further questions or comments, please press Star 1 and record your name. Again, please press Star 1. Our next question, your line is open.

(Caller 8): Hi there. Thank you for the presentation today. I work at a company called Mapbox which is a mapping and location data company and I work on this in

networks for social good projects. We work a lot with OpenStreetMap data and we also contribute to it as well as build-out various tools, many which are Open Source for use of spatial data visualization, traffic, routing, navigation, bike usage to work.

I am curious whether you see any gaps in the tools that are available that companies like Mapbox could help to address? Or, on the flipside, perhaps it's more of a barrier access of geo-spatial tools that especially our team could help assist with?

Colby Brown: Yes, well I mean, this is a gap for sure. You know, there have been a variety of companies like yours, some of them I know personally, doing accessibility tools, development at the - look for non-motorize modes, you know, for biking and transit and pedestrian mode.

But they haven't touched auto accessibility because they just generally felt they didn't have a way to go there because they didn't have congestion data. Congestion data was too expensive, exactly what I said at the beginning of the presentation.

So, and even the - like the Sugar Access, the tool that I developed, that was - that required a fairly, well, a partnership between the company I was working for and two other companies, here being one of them, to put that all together to allow people to do highway accessibility, highway mode accessibility using congestion data - proprietary congestion data.

And so there was, like, a multi or partnership that led to that. Whereas, you know, for folks like you who are working for social good who want to make tools available potentially, you know, in developing countries and things like that.

I think - I think it really - and also for community groups, I think this is, you know, this work speaks to job access. It speaks to access to employment opportunities for underserved groups.

So, I think this is an area that's been missing. And, you know, if you wanted to talk to me more about figuring out a way to build an offering around it or, you know, integrate into your suite of offerings, I'm happy to discuss how we can go about doing that.

So, you know, feel free to get in touch at the email address and we can discuss further.

(Caller 8): Great. Thank you.

Operator: And again, as a reminder, if you have any further questions or comments, please press Star 1. Our next question, your line is open.

(Caller 9): Hey, thank you. Can you talk more about the limitations of travel demand models for travel forecasting and what might be a better option for forecasting accessibility 20 years in the future the way MPOs need to do?

Colby Brown: Right. So I want to be very careful about approaching this, because I do a lot of work with agencies that do travel forecasting. I have myself a history of doing travel forecasting and have a lot of friends in that field, so I don't want to speak ill of anybody. But the limitations and the shortfalls are well documented. You know, it requires really a lot of data collection and in many cases the data simply are not available, so parameters are kind of asserted based on expert knowledge or transferred from another region or some sort of standard report that, you know, research was done a while ago.

And there's - what is good about it is that there's a fairly standardized set of like knowledge and methods and approaches that are accepted. And so there's certain kinds of models you can build and you just sort of pick from the menu of options and customize from there and consultants are available to help you with that and there are software platforms, too, that you can get to implement it. Sort of the Excel of that world, as it were.

What is a limitation is that it's relatively specialized knowledge how to run the model. And you have to go back to the origins of what all this activity was originally for and it's to plan new facilities, particularly highway facilities. That's how travel demand forecasting got started as a field. And so the emphasis there is on-demand. It's on trying to identify those interchanges, origins, destinations, pairs that have heavy flow that's being unmet by the current supply of transportation infrastructure.

So these models are not bad at forecasting demand, I would say. Where they are a little weaker is in understanding the supply side. And this is because traffic congestion in itself is a very complex and in fact chaotic phenomenon. I mean, that's also well-documented that, you know, traffic flow is turbulent when it becomes congested. And actually inherently unpredictable, which is why more and more folks who do this kind of work at a really detailed level for facility design and things like that do gravitate towards microstimulation approaches where every single car is simulated interacting with every other car on the roadway.

There are compromised approaches that fall short of that. They are a little simpler and easier to integrate into like a travel demand forecasting tool, but the challenge still remains, you know, pretty technical, pretty challenging. Computationally intensive to do that for planners. And so what I'm focusing on here is not - is a lower bar. I'm not trying to predict demand. I'm trying to quantify accessibility. And accessibility isn't about what people actually do, either. It's about what they could do. It's about what opportunities are available. What opportunities does the transportation network make available to residents of a region or to businesses, on the flip side? And this approach works especially well for the journey to work. For other trip purposes, it might be not as good of a fit, quite frankly.

So, you know, I think what we could do is work on forecasting the local travel time index forward. So if what you want to do is forecast accessibility 20 or 30 years in the future, I think there are non - there are other approaches in travel demand models for doing that. In this study, we did run the travel

demand model -- once it was brought up to speed and was updated -- I ran it for the base year and then for the third long-range plan horizon for greater Ashville. And then the congestion data from that travel model was used to update the accessibility measures that fed into the land use forecasting system.

So we did use the travel model here. But I have been doing some research and sort of exploratory work around machine learning approaches to forecasting these local travel time indices without using travel models. And I think that could potentially be a very powerful avenue, particularly for land use forecasting applications -- like the ones I do -- because when we do a use forecasting, we want to have some feedback with the transportation systems in order to understand whether facilities are being built that are going to basically sort of confound the intent to provide supply or a shift in demand or a shift in location of development that basically more demand volume as soon as you've built the supply.

So we need to have that feedback. And it's better forecasting practices to have some feedback, but we don't want to get bogged down in running a really complex travel demand model. So this is part of my interest in seeing if we can shortcut that and just forecast the accessibility using some sort of different approach. And I have done some work on that. It's not in scope of this presentation, but I have a paper accepted to the Innovation and Travel Modeling Conference in Seattle, which I haven't heard from the organizers whether it's going to go virtual. But if it does, then you may be able to see a webinar about that sometime in the future.

(Caller 9): Okay, thank you.

Operator: And again as a reminder, if you have any further questions or comments, please press star one and record your name. Again, please press star one. I show no further questions.

Earlene Dowell: Thank you, (Diane). And thank you everyone for such great questions. I want to thank you for joining us this afternoon and thank you to Mr. (Brown) for

his interesting presentation. Join us next month on May 20th at 1:30 pm Eastern Standard Time when (Erica McEntarfer) presents Veteran's Employment Outcomes. Until then, have a wonderful day and please be safe.

Operator: This can concludes today's conference call. Thank you for participating, you may disconnect at this time.

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