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Transit Asset Management
Putting TAM Data to Use Webinar Transcript

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Introduction

Mshadoni Smith: All right, everybody. Thank you again for joining us this afternoon for *Putting TAM Data to Use* -- another offering in our TAM webinar series.

My name is Mshadoni Smith, I am the Program Manager and again, I welcome you. And I want to briefly introduce our speakers for today.

I'm sorry, I can hear whoever that is on the phone line. If you don't mind muting your phone. Thank you.

Our speakers for today, we have two good ones for you. First is going to be Daniel Hofer, he's the manager of SGR for Utah Transit Authority, and then we'll have ALEXI Miller, Director of repair for Houston metro.

I just want to mention a couple of things that are happening over here with FTA. I want to remind you that the roundtable registration is now open. You can get to those registration links from the URL that's highlighted there. Just a reminder that we're doing it a little bit differently this year, we're going to have two roundtables, one for multimodal, one for bus only, and you can find out the particulars of those roundtables at that link.

Also we have a couple of projects I wanted to update you guys on. We are updating the TAM guide supplemental, and it's going to be updated not only in terms of relevance to the rule but expansion to beyond the rule TAM. We're also investigating or doing research into a systems asset category to find out what the best practices are in the field, and we're updating the TAM template for small operators and state DOTs to have an automatic link to your NTD asset inventory. So those will be coming your way in the next year or so.

I also want to remind everyone we are still accepting documents to the peer library on our TAM webpage. We are not posting TAM plans, per se, but we are posting supporting materials such as public communications brochures, internal monitoring reports, policies, definitions, dashboards, et cetera, so you can learn from your peers and vice versa.

And without further ado, we're going to do a quick poll and go into our presentation. All right, folks. I know the easiest questions but it will be very helpful for us moving forward so please go ahead and take a last minute or so to fill out these poll questions and we will move on to our featured presentation.

All right, folks. It looks like we're kind of slowing down in our answers and I thank you all for participating and feel free to continue to share your answers in the chat pod if you didn't get a chance to answer the questions directly.

Just briefly from looking it at the questions, it looks like there are many of you who have not yet started using your TAM data and your dashboards. Though there are some of you who are using simple dashboards for performance measures, condition assessments, static dashboards, et cetera. So that is kind of what we expected that there is, you know, we're still at the beginning of this, and the measures and indicators that you use to plan replacing your assets,

age and mileage and then condition ratings seem to be kind of at least the standard, age and mileage are standard for everybody, some of you guys using conditions, useful life benchmarks and some of you guys have, like, a condition index, so forth. So it looks like you're all kind of around the same area, and it took most of you guys between six months and a year to get your data into the same system.

Oh, no, wait. Still waiting! I should have known that was going to be the highest rated.

Well, without further ado, I'm going to re-introduce your first speaker for today, Dan Hofer. He's with UTA, the manager of their state of good repair, and I'm going to turn it over to Dan.

Daniel Hofer

Daniel Hofer: Thank you.

So I was asked to give a little bit of a presentation talking about how we use condition data to support our capital replacement efforts. So starting to go through it, I want to give you a little background about UTA. We operate over six counties, serve approximately 2.2 million people. We have approximately 2,000 employees and we operate a multimodal fleet of approximately 700 buses, 400 vans, 117 LRVs and 60 commuter rail vehicles.

As asset managers, we definitely worry about failures. We also worry about replacing things too soon. The reality is we have to try to ideally plan for this replacement or these replacements just prior to the failure point, can be an extremely difficult thing to do. That's ultimately the goal. In order to do that, we have to have four basic elements to execute the effort. We have to have data, budget, coordination with the relevant groups, and an execution plan.

So here's an example of a time-based condition assessment. This is probably the easiest example to identify when the early budgeting or planning effort should begin. So depending on the asset, some planning efforts may take much longer than others. Sometimes additional funding strategies need to be considered in order to execute your plan. It's important for an asset manager to understand what the likely funding strategy is and adapt your process to that model, just to kind of complete the loop. It's probably a good thing as well to outline the strategy in your TAM plan or your supporting policies and procedures.

So starting to kind of focus in on the remainder of the presentation, for those who have ever been involved in a new build situation, you're faced with a pretty legitimate question, with the new build, replacement cycles for similar assets all hit at once. So the question is, how do I flatten the peaks and justify the need? So the tan bars that I have on this chart show what the model is projecting based on age. It doesn't take into account available resources or the internal capacity to complete the replacements, just what the model is saying.

You'll notice there are some gaps in some years. The red bars represent a flattened cycle. Flattened cycle implies some items were replaced maybe sooner than was ideal, others were delayed to flatten these peaks with good condition data in a well-managed backlog plan, flattening your peaks is probably more attainable than one may think. This initial flattening effort is key because if you can flatten your peaks and get to a point where you can get fairly

consistent funding requests year over year, in my opinion, I think your chances of receiving more adequate year-over-year budget allocations are greater and you'll be able to stretch those dollars further. In addition, if you do this properly, you can establish more accurate useful life values for these assets and setting up will replacement cycles based on actual experience and data. This lends itself well to the idea of doing the appropriate mitigation at the appropriate time that we're all big fans of.

So it's going to take a little bit of a detour for the remainder of the presentation, instead of focusing globally on how we might incorporate condition data, I was going to focus one real life example and kind of take you through the process, get down into the weeds a little bit about how we address this particular example.

So this example is an infrastructure scenario, it's a curved rail example. This approach is slightly different than the infrastructure performance measure prescribed by the TAM rule. Notice the disclaimer, we don't substitute this for the required performance measure, we just do this in addition to the required performance measure.

So in this scenario, I'm going to show you how we address a similar problem that we noticed showing up 60 miles apart on our frontrunner line, our commuter rail line that runs along these white dots indicate where the issues arose. So just to paint the picture, we have some fairly young rail that was exhibiting some really weird wear patterns. We found a couple locations during some inspections during the fourth quarter of 2017. We went back to the locations and did some speed analysis on them. One analysis suggested trains were going too fast through the location and the other ones suggested they were going too slow through the other location. But just wanted to point out the issue of what -- sorry, I'm having a hard time moving the pointer -- but kind of in this area, you can see the circle part where if you look closely, you can see about a quarter-inch of the railhead, the lower part of it breaking off.

This particular rail is on the upper rail going through a curve. So it was unusual to say the least. At the same time, we were bringing on a new rail condition assessment software package. Timing, being lucky or unlucky maybe depending on how you look at it, if we had had it sooner, we probably could have done a little bit better job in catching this earlier on in the life of this asset. But considering where we were, we were curious if we could establish a timeline for the decay.

So as mentioned earlier, this rail was fairly new, and we really had a question about what was going on here. So here's a screen shot of one of the locations from the software. So we call these different bands, these horizontal lanes, we call them swim lanes or channels. Going top to bottom, we have a schematic of the track with key elements like bridges, overpasses, stations or switches.

This particular example was on a bridge, there's a track representation next followed by a curve radius diagram, next is a loaded gauge lane, rail profile gauge is next. Following that is a look at the left railhead with a heat map depicting wear over time of that rail. Each rectangle on the heat map represents about 500 feet. Below that is a right railhead wear lane and finally below that is a heat map for that rail. As you can see, the lines and colors represent a measurement or calculation at a certain point basically aggregated over time. The thing that

really shocked us was on the lower lane, it's hard to see about the earliest date is a 2014 date. When this data was taken.

So by aggregating and establishing this timeline, we could get a sense that things were deteriorating because we had had very quickly because this rail was only about 18 months at the time of this, you know, this earliest measurement being indicated, so it was definitely deteriorating more quickly than we would have expected. So we knew there was a big problem there.

So how did we turn this into a capital project? So most railroads have to collect geometry data every year. The basic exercises -- sorry, it's jumping.

Most railroads have to collect this geometry data every year. The basic exercises, you have to have a third party come in and do a run and provide a report indicating any exceptions or defects your railroad may have on the alignment related to the track. The easy trap to fall into if you're not careful is, are we managing this rail or to a level just above an exception or a defect. Or maybe in the state of good repair world, a 2.5.

Is there something more you could do with this data? So the answer is yes, analysis of this data year over year could help you identify wear rates, establish more accurate representation or more accurate representation of the situation and better define replacement dates. So all in all, it just really bolsters your suggestions and recommendations.

So the basic idea I'm going to walk you through, it gets into the weeds a little bit is, how do we do this? First you have to assign wear rates to the track elements and establish the likely replacement year for those elements. It's always a good idea to ask what else can this data tell me, so in this case, the software led us to an additional four locations needing to be scheduled for replacement. The need wasn't as severe as those two that were highlighted, but they still needed to be addressed. So we also identified locations where we are going to install rail lubers to kind of help grease the rails going through those curves, help us get some extra life out of that.

So it's also important to remember that everything is still field verified. While we were using the software, we were using it as a decision support tool and not a decision making tool. So these are kind of the basic approach that can be used. It's like I said very, very basic but is still pretty effective. It should get you close, so I'm sure there are a lot more sophisticated methods out there but in the absence of a software program, this is pretty good. I've used it on some overhead wire analysis in the past. Depending on the data quality of the sample set, you know, it can be pretty effective.

So you'll be able to tell pretty quickly if your dataset is reliable or not using this basic approach, so basically what I'm going to do here is explain to you a process that we've used in the past that helped us better gauge when things needed to be replaced. The trick is you have to line up the data points linearly so you're collecting the same data at the same point year over year.

The model above outlines the critical data points needed to make this calculation, just kind of a big disclaimer there. Everything should always be field verified. Some values are either selected or provided by the agency. Those are on the left. And the ones on the right are the ones that we're trying to calculate. So here's some basic formulas that can be followed. I'm not going to

go through them in detail, but basically the process is first establish the age of the asset from it when the last measurement date was, then you can determine the wear rate.

So following that, determining the remaining life value from the date of the last measurement is key. And then you can calculate the likely replacement year for the different locations being evaluated.

Just a couple things to be aware of, if you ever get a negative wear calculation, highly suggest reach checking your signs, if the negative value wasn't what you anticipated. So everybody knows that infrastructure doesn't get bigger on its own. So I won't go through the formulas like I said but I will show you some of the calculations in the coming slides.

So just to emphasize, this approach is best if you can as I mentioned earlier line up the make sure you're collecting the same data at the same point year over year. And curious to see what the data is telling you in addition to just what you're looking for specifically.

So here's a data table that kind of walks through the formulas. So the items that were selected prior to analysis are on top. Calculated items are on the bottom. So the formulas are here, so you can see where they or how they play out.

So as outlined previously, by calculating the age of the asset at the time of the last measurement, you can establish the wear value for this asset as well as the remaining useful life value. When that is determined, establishing the year of replacement is a pretty straightforward calculation. So just a reminder that the year of replacement, you know, should be calculated from the day of the last measurement, not necessarily today's date.

This slide is just kind of an attempt to close the loop on this example. In projecting, I would say the level of accuracy is depending on the risk tolerance of the agency. If I were doing these, I'd probably stay in the hundredth to thousandth decimal point range, probably always round down on the year of replacement just to provide that little bit of extra time to stay ahead of the matter. And following the risk analysis exercise, that may push replacement back a little bit if you feel pretty comfortable with the situation or it may accelerate it depending on again your comfort level of the situation.

So now grouping the projects. This slide is pretty high level. But after you've done the analysis, now you can start building the projects. So start by grouping items with similar replacement dates. Depending on the size of your list, you may want to add in a step where you group the measurements into sections with average wear rate, over that section and assign a new replacement date to the consolidated group. Then you can go through the process shown above, what does the replacement schedule look like based on the year of replacement. Start to weigh the risks of the early replacement. Can you reasonably flatten some peaks to set the replacement cycles for future iterations? We're likely maintaining this type of asset in perpetuity.

After that, the projects can be submitted for consideration by the agency, including explanation and justification for accelerating or deferring the replacement activities. It's also very important to keep re-evaluating these numbers to ensure accuracy and consistency year over year.

Finally I just wanted to share some lessons learned with everyone. These have been pretty helpful for us. So starting off, some measures are definitely better than others. So the trick is to find the measure that best fits the action you're trying to justify.

For linear assets, wear seems to be a pretty good one to evaluate. "Feeding the beast" is a phrase we use to emphasize that projections get better as more data is fed into them. Fully as it sounds, early failures can be a blessing in disguise if you respond well and incorporate the lesson.

Early failures are also something that can be used to help justify accelerating the replacement cycle for some of the first replacements. It's not intended to be done dishonestly by any means, but chances are if one location has failed prematurely, there are some more that may be out there, might be due to a small radius on a curve or maybe an elevation is off, but there's things you can look at to see if some areas need to be accelerated for replacement. Hopefully the projections will highlight those high risk areas which will bolster your projection schedule.

Another item we're trying do is save and distribute justifications in a consumable format. Meaning they can be easily read and understood to someone who is seeing it for the first time.

Finally, see if there's other situations where this approach can be employed where we'll try to conduct an OCS wire survey this year, see if we can't get similar results out of that. Basically we're going to advertise for a vendor to come in, conduct a contact list wire survey over our entire rail alignment to see how the contact wire is wearing. Based on the wear. Part of the deliverable is to supply that rate of wear and the anticipated replacement dates based on the data.

So hopefully this has been of some benefit, hopefully it wasn't too high level on the global approach to translating condition data to projects, but I wanted to focus on a specific situation that we encountered. Obviously there's many ways to do this, so we just found this method to be pretty effective.

With that, I'll turn it back over to Mshadoni.

Mshadoni Smith: Wow, thanks, Dan.

That was a really great presentation, and I'm glad you walked you through a realistic example. One thing you mentioned about decision support tool but not a decision-making tool, I really like the way that you said that.

I do want to remind all of the participants that the chat pod is there for up to submit questions that we'll take at the end of both presentations. So feel free to write your questions in there for either presenter during the presentations.

With that, I'm going to turn it over to Alexi Miller, who is the Director of State of Good Repair at Houston Metro.

Alexi Miller

Alexi Miller: Thank you, Mshadoni. Nice job, Dan.

So this afternoon, our topic is managing and integrating data in support of TAM. I will as well start with an overview of some of Houston metro by the numbers.

Our service area is about 1300 square miles serving a population of 2.3 million. About 116 million rides annually. We do that on 76 light rail vehicles across almost 23 miles of track serving 44 stations. We've got about 95 miles of high-occupancy vehicle or high-occupancy toll lanes, close to 9,000 bus stops, about 2200 of them with shelters. 952 vanpool and paratransit vehicles. We've got about 1250 buses on 114 routes going through 61 transit centers, park & rides, and that 61 also includes our operating facilities.

Our presentation is really kind of about visualizing data. So I wanted to start by talking about what we think about when managing and integrating data. We think of continually improving the quality of our data over time because I'm sure we've all experienced the data isn't as good as we thought it might be initially or as good as was promised either by vendors or whatever.

So there's a few key points we focused on as part of this continuous improvement of our data. One is consolidation. Here at metro, we took a pretty major step over the past several years and we've consolidated our maintenance operation into a single ERP system, which is we used SAP for that. And there's some pretty big benefits on that.

We have it helps to have one source of truth over a system of record. As far as integration, we're all speaking the same language. As far as reporting, we're using one standardized reporting system, and there's a transparency across what I like to call silos of excellence. So even though we may operate some times in silos, they all do a very good job of doing what they do, and having one system really helps the transparency on that.

So another key point when we look at continuous improvement is clean data. We work closely with maintenance and operations. They help us to find required data that's niece kneaded be to be captured to provide elements downstream. As much as possible us a might expect, we try to use codes, lookups, drop downs and any other predefined collectible field. We're looking to keep our data with the business for timeliness, completeness, for accuracy. Of course this is a journey we know will never end or we hope each cycle raises the bar a little bit.

Now that hopefully we've got some clean data, we've scrubbed it, we've made sure it's as usable as possible, we of course have to make it available to decision makers so that they can act on it. Doing this supports some of the major elements of the TAM plan specifically for analytical processes, for decision making and for capital investment planning.

One of the ways we do that is through dashboards and that's really the focus of this presentation. Here what we're looking at is a look at one of our dashboards with an overview of our fleet portfolio, which includes maintenance sites, our SAP system calls them plants, that's

why it says plants, in certain area. Number of assets the in this case by bus or buses by site, the classification of our buses.

We categorize them basically as transit buses or suburban buses. Which also drives our useful life benchmark, they're different for each class. The average age by site and a location heat map, which shows number of buses by each of the facilities.

This data isn't just a static presentation. If end users select certain areas, whether it's a site or a bus class and all the charts on that dashboard will update dynamically. So what I wanted to do was drill in and we have a condition rating that we assign to our buses and we use an algorithm for that that's comprised of the age, the mileage, something that we call cost per mile, something we call reliability and something that we call availability. And it takes the FTA standard as well as some international asset management best practices.

Currently we equally weight them on a scale of 1 to 5. To get that overall score. We find how the fleet performs compared to all the others, so versus park & ride. We could adjust the weighting in the future if we need to, but currently they're equally weighted.

So the next few slides, we'll just look at columns 3, 4 and 5 in just a little bit more detail. This is an example of the average cost by mile for each of our bus fleets. Their maintenance costs, their labor and materials. They don't include overhead costs, just fuel, just materials and labor on the maintenance side.

And you can see here that the cost per mile is across all of our fleets. And there's an average age or I'm sorry an average cost per mile for the average fleets. The second graph displays our total maintenance costs by age and the bars show the accumulated maintenance costs for buses at that age and it's broken out by suburban in red and transit in blue. And the secondary access on the right again is the age, and us a look on this going from left to right, this would be the cost of the year zero, year one, year two, three, four, five and six, and you can see that for us, our buses peak in terms of costs per mile at about age 6.

Another chart here on costs. This one is broken down by maintenance activity. Or the different groups of work both for preventive and corrective maintenance. And you can see that it's also broken out by how those costs are distributed across our sites and we could drill down into that on the dashboards, the end users have that ability. These costs are aggregated annually.

So this chart is reliability, which is a measure of our mean distance between failures. Specifically what we're looking at on this chart is MDBF historically year over year by fleet for the last six years. We use six years because the average age of our fleet is six years so it's an easy enough number to go back to. So for instance, the green blocks shown on the bottom are year one. This is two years ago. Three years ago is the red. And so on. Going back to six years.

So you can see a difference where the MDBF is either getting better perhaps as in the case here, where three years ago it was pretty high and then starts to improve over time, or whether it might be a good mean distance between failure that starts to degrade slightly. And I

will make a caveat here for all these slides that this data is really for exhibition purposes, it's not for release or use. Lawyers made me say that.

This slide for availability, which is that final component of our overall state of good repair score is measure of days in service versus days out of service. Days operational versus days total days in the fleet. Operations takes a bus out of service in the system for significant maintenance events. So this is really a good measure of up time that we take into consideration when determining that overall condition rating.

So I've just put this slide back up just as a refresher, because this is one way obviously to look at data. We can look at it on a graph, like Excel, it's got columns and rows. But really what we wanted to do was transfer that to a heat map. I think some systems may call it a tree map. But in this case, the condition of our fleet, buses only on this slide, the next slide is a little bit different. The higher conditions which are the better operating buses are in the top left and the lower conditions are on the lower right. And on this particular graph, the color scale enforces that, so green being good, transitioning to yellow and then down to red, and sort of reads from top down, left to right. So as you get further down, you can just see the boxes get smaller or the condition ratings get smaller. That's one way to look at the data.

And looking at it just for fleet, just for buses, we wanted to do something a little more comparative with our other assets. So on this chart, we've made a couple changes. This is not just for bus fleets but now includes our facilities, some paratransit vehicles and rail assets. Another big change on this is really that the scale has been inverted. So we're not really looking at condition here as an example, but really either a priority or maybe a cost. The things of greatest concern are up here in the upper left hand corner. So as things become better, less important be or a lower priority, they would fall again, top down, left to right, down to here.

So now we get a comparison of our bus fleets, which is the green and also the coral colors, compared to our operating facilities, and our public facilities like park and rides and transit centers, we can look at our different fleets of rail vehicles incorporated in this. The paratransit is incorporated in this, so we could roll this up or drill down on this, depending what the users wanted to see, but this gives us a very good high level comparative view of all of our assets.

And really get the message here that we have the ability to respond to the end user's needs or management's needs and tailor the view the way they need to see it.

I'm going to switch gears a little bit here and touch on another tool that we use that we started exploring about nine months ago, and it's a tool called R. This topic of R really can be a presentation in and of itself. R is a statistical tool, it's a programming language really for data mining and modeling, and as I mentioned, we just started to explore its use here at Houston metro, but I'll quickly touch on just a couple highlights of the tool.

The first of the tools ability to analyze very large datasets, and look at all the distinct data elements and predict relations between the different variables. It can then assign a probability

factor describing how much one variable cost for example affects another, so maintenance costs, how that affects total life miles.

It's also great for identifying outliers. An outlier would be something completely out of the norm and what data elements to look at. One of the cases that we ran across as an example is there were work orders when employees were inadvertently entering their numerical employee number as the number of labor hours worked. So you can imagine if your employee number is 15,000, that's a lot of hours and obviously inflates erroneously the cost order on that work order. The R tool is very good at highlighting that and bringing those out. And I'm only using one chart here, there's a lot of behind the scenes analysis that goes on with this and goes on for this.

Another great ability of this tool is to help us make projections, and on this graph, if you look at this line here which I'll call the pink fleet compared to this green fleet, it may not be as obvious on this particular chart but I just picked one chart. You can see this is going to start overtaking the cost will per life mile at about 650,000 miles. So the pink fleet may look like it's operating better now but in the future, you can see that it's going to degrade. That's just one example.

We could go all day and talk about some of the examples that ours brought to bear on this. I will switch gear again just a little bit, just to a high level view of another tool that we are rolling out here at Houston Metro, and that's a map. Really we talk about using the map as the U.I., as the user interface because as users, we all tend to be more visual, so accessing and managing asset and work data, work order data from a map, it's pretty intuitive, we're all used to it.

And as an example on this screen, you can see icons of different shapes, different colors, they can depict different data, whether a lot fast or whether it's open work orders, overdue work orders, maybe work that's not been defined. Whatever's in the system. And also for the map to be useful, there needs to be a launching point to create work orders. So you can see that from a right click on a particular point asset, you have the ability to create a work order.

You can also look at historical work. The way this particular tool works, you also have the ability to look at the data in the system. And really, having this map to make it the most efficient, it really needs to be accessible by a technician or a mechanic in the field, so on a tablet, on some sort of mobile device.

The last point we have on there on the slide, you also need the ability to see what work is around you. So while you're out in the field, is there anything you can address while you're out there, and that's what we're hoping this tool helps us do. So I'm going to start to close here on this slide and talk very briefly about some of the infrastructure and some of the future items that we have that we're looking at.

So what you saw in terms of the visualizations today were done in Microsoft power BI. There's been a decision at the IT level to standardize visualization tool and use Tableau. There's reasons for that so we're going to be transitioning to that. We also use SQL Server for integration point, which is the dynamic drink between our ERP, which again is SAP, and the different

visualization tools. It's also useful to create measures that don't natively exist in the system, so that can help provide those measures going forward. Of course we have to work closely with IT. They maintain our systems, our infrastructure. They own our data so we work with them closely.

We're also working towards continually incorporating the data, the different data that exists across our silos of excellence, and looking to share that data also with our GIS system, with ESRI, and also exploring how to capture data from our connected systems. Whether we're using sensors or alerts from our vehicles or communication boxes, various assets that exist throughout our system. Hopefully the goal of that to make us more predictive.

So in conclusion, we're going to turn it over here in a second for all of you to ask questions but I thought I would go through some of the questions we ask as we continued through this process. Through this journey. Where do we go from here?

We're collecting this data, what else can we do with that? The story we're telling, is it a complete story, is it answering the questions people are asking? Are we sharing those across the silos of excellence or are we keeping to ourselves? We really believe that sharing the data obviously is key.

Are we even asking the right questions? We have to continually ask that to make sure we're meeting the need of the visit, getting the right answers to make the right decisions, and what are our next steps.

I put our contact information down there. Erikah is our senior asset management analyst and is also responsible for doing the visualization you saw. We also have another senior analyst, Adrian Hopkins, who works here at metro as well, and he's our -- hard to say -- he is our R data scientist. So if you have questions, we may bring them in to help answer those.

But thank you all very much and that's all I have.

Questions & Answers

Mshadoni Smith: Wow, another great presentation. You guys are really spoiling us with these details. I love how you showcased the different ways that you packaged your analysis to do the cross asset analysis.

So we have about 11 minutes left in the webinar. If we do not get to your question, I will share your question with the presenters and try and get an answer to you. So please be sure to add your question. If we don't get to it during the time, I will respond to you with a response from the presenter.

So the first question I believe was from -- can we go to Gregory's question?

Gregory asked -- Gregory Collins – were the prioritization of projects from asset condition taken into account for service availability? I'm assuming that was for Dan.

Daniel Hofer: Okay. I'm sorry, I'm trying to find the question again. To take into account service availability? Yes. So to be the quick answer is yes.

Condition data is always taken into account when we are dealing with assets that are directly related to our ability to provide our service. So that takes a pretty high precedence, and the balancing act is testimony the project or effort can be handled within one of our maintenance shutdowns, you know, the last X amount of hours overnight or weekend or if we need to possibly impose a greater service interruption to complete the project, so yes.

Mshadoni Smith: All right. And our question was already answered but I'm going to read it regardless. So the question for Martin to Dan was, Daniel, what is the staffing level in your SGR department? How many people do you have to look at this kind of data?

The answer was, Martin, our group has five people in it, we will review this data with our MOW group as well.

Anything else to add to that or was that sufficient, Dan?

Daniel Hofer: Maybe just a little bit of a breakdown. So our five people includes myself, three asset administrators and an office specialist.

Mshadoni Smith: Perfect. Thank you.

So the next question comes from David. What was the software UTA was using for showing the track swim changes swim lane and heat maps?

Daniel Hofer: So that's gone through a rebranding, I believe it's operational analytics, I believe is what it's called.

Mshadoni Smith: Great.

So the next question come from Rob. Dan, what kind of TAM database do you use?

Daniel Hofer: We with use another Bentley product for that. I believe it's called asset reliability, I believe is what it's called.

Mshadoni Smith: Great. Thank you. So we have a question from Tatiana. What is the asset software that you use and why did you decide to use this particular software?

Daniel Hofer: In regards to what I showed today, we've been trying to get a software package that did analytics on the linear assets. That was something we struggled with for a few years, and just because of the amount of data that has to be processed, I guess is the correct word, and this software, we went through an RFP process and we selected this because it could do all that, the visualizations why very helpful and it gave us everything we were looking for in regards to the linear asset management part.

Mshadoni Smith: Apologies in advance but we have a question that was answered but I'm going to answer it regardless so the question was, are there any considerations about whether

implications when projecting the useful life and replacement year, where Dan answered, environmental considerations are there but we find there are typical typically covered by condition analysis.

Dan, did you want to add anything else to that?

Daniel Hofer: Yeah, he had a follow up question to that, if we get anything about future weather impacts or forecast. You know, in Utah, the weather is unpredictable, but in regards to four seasons, it's pretty predictable. We just found that the past behaviors are pretty indicative of future events, so we take the condition and just translate it forward based on what's been observed.

Mshadoni Smith: Thanks, Dan.

The next question came from Uda. I'm not sure if you're saying we have a type error or you typed an error but it says please share with us about, quote, how average mileage by class and cost per mile I guess that's an end quote, is used in TAM reporting.

I believe this is for you, Alexi. And how do you keep a check on quality on this type of reporting?

Alexi Miller: So how we use that in TAM reporting, if it's internal reporting, we just report that actual average cost per mile, break it out by the different class, whether it's suburban or transit, and we actually have it by bus. So we share that with our business, that's one of the ways that we keep a check on that quality. If there's anything that doesn't look right, we'll ask for more detail in terms of work order costs or labor costs. So it's really just a matter of involving our business, vetting it with our operations group, and really trying to drill down to make sure that everything is consistent, the data is right. You want to add anything that to that, Erikah?

Erikah Abdu: Well, in terms of the classifications, that's all in our ERP system, which is SAP which Alexi mentioned. So the business units typically will update that whenever a bus comes into service. However, that may change throughout the life of that bus, but that information is maintained by them and the data visualization that you guys saw is just pulled straight out of SAP, and so it's just like Alexi said, an integrated approach to looking at all of this.

Alexi Miller: Hopefully that answers the question. If not, let us know.

Mshadoni Smith: So we have a question from Kathleen. She said I love the heat map idea. Are you averaging those different condition measurements to determine overall rating?

For Alexi.

Alexi Miller: If we're talking about the last couple of heat maps that had the color scales on there, those are averaged. The average for that particular level. So the first slide that we showed that had the green to red was similar fleets will of buses by age. So those blocks were

averaged by that. The next slide might take that same fleet but it would incorporate all the different ages and on that slide, those were also averaged.

Mshadoni Smith: All right, thanks, Alexi. This is probably going to be our last question. But I did want to point out that tree is a told us about the potential to find recourses with a quick search so that's another tool you might be able to use. So the last question is from Rob, Alexi, and again, to all of those that I haven't had a chance to respond to today, I will make sure the presenters get your questions and I will respond to you. But Alexi, what linear asset management system are you using on slide 14?

Alexi Miller: The actual system itself with the lamb, the linear asset management data is our SAP system. The map that you're seeing is using a connector between that SAP system and our GIS system which is ESRI. The base that data is actually pulling straight from SAP.

Mshadoni Smith: Okay, thank you for that.

And with that, I'm going to go ahead and close the webinar. Again, the remaining questions, I will make sure that you get answers to them.

Everyone, thank you so much and a special thank you to Dan and Alexi for extremely useful presentations today.

Keep in mind this webinar will be posted on our FTA YouTube page, and available on our outreach page on the TAM webpage.

So thank you so much, everyone. Have a great afternoon. See you at the next TAM webinar.

Alexi Miller: Thank you. Goodbye.

Daniel Hofer: Thank you.