Transportation Asset Management Webinar Series

Webinar 45

TAM Communications and Visualization

Sponsored by FHWA and AASHTO

U.S. Department of Transportation
Federal Highway Administration

AASHTO
THE VOICE OF TRANSPORTATION

Webinar 45 – August 19, 2020

0

FHWA-AASHTO Asset Management Webinar Series

- This is the 45th in a webinar series that has been running since 2012
- Webinars are held every two months, on topics such as off-system assets, asset management plans, asset management and risk management, and more
  - Now 3rd Wednesdays
- We welcome ideas for future webinar topics and presentations
- Submit your questions using the webinar's Q&A feature
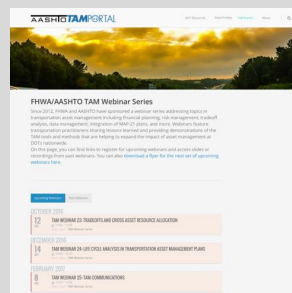
1

1

Welcome

FHWA and the AASHTO Sub-Committee on Asset Management are pleased to sponsor this webinar series
  - Sharing knowledge is a critical component of advancing asset management practice

2

2

Learning Objectives

- Building working knowledge of key concepts and definitions relevant to TAM Communications and Visualization
- Beginning to apply this knowledge in the context of new TAM programs and applications in order to answer the following questions:
  - What approaches are agencies taking to communicate and visualize TAM data and information?
  - What benefits can my agency expect by improving its communication and visualization abilities?
  - What are key lessons-learned for agencies as they move forward with building communication and visualization capabilities?
- **SHARE LESSONS LEARNED, IDEAS, KNOWLEDGE!!!**

3

3

Webinar Agenda

2:00	**Welcome and Introduction**
	Matt Hardy, AASHTO and Hyun-A Park, Spy Pond Partners
2:10	**Oklahoma DOT Presentation**
	Jeremy Planteen, Oklahoma DOT
2:15	**Seattle DOT Presentation**
	Steve Barham, Seattle DOT
2:40	**MBTA Skate Mobile Dispatching Application**
	Logan Nash, MBTA
2:55	**Augmented and Virtual Reality and Infrastructure Management**
	Felipe Jung, Atkins Global
3:10	**Q&A**
	Matt Hardy
3:30	**Wrap-Up**
	Matt Hardy and Hyun-A Park

4

4
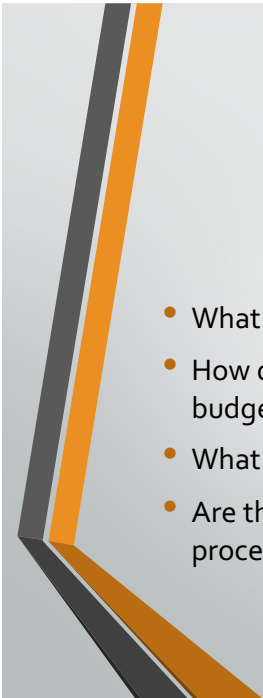
Visualizing TAM Data

Jeremy Planteen

Oklahoma Department of Transportation

jplanteen@odot.org

OKLAHOMA Transportation

Background

- ODOT heavily focused on data-driven decision making
- How do we make the data available?
- Map & Data portal
- Department's asset data at your fingertips
- Previously condensed into 'District Notebooks' once per year
- Now ad-hoc
- Static performance progress sheets

What Questions to Answer

- What data makes sense?
- How do we communicate if projects meet our stated performance and budgetary goals?
- What tools are at our disposal to provide this information?
- Are the tools accessible to and usable by people in every step of the process?

The Project Selection Process at ODOT

- 'Division Notebooks' provided to District Engineers
- GIS Map & Data Portal for wider information access
- District Engineers review, collaborate with central office Project Managers
- Executive staff & Commission approval
- Data driven
- Heavy, long-term use of TAMP principles but we may not always say the work 'TAMP'

Map & Data Portal

- First launched in late 2015
- Replaced aging, limited functionality custom GIS mapping product
- ArcGIS Online based
- Quickly expanded as various business units realized power of the tools
- Now over 300 unique datasets and over 200 unique web map applications
- Non-disruptive integration with downstream systems
- Transformed static, once-per-year, often PDF or KMZ project and asset data into accessible, dynamic, digital, and up to date information that allows for better, more responsive decision making
- https://spotlight-okdot.hub.arcgis.com/

District Notebooks
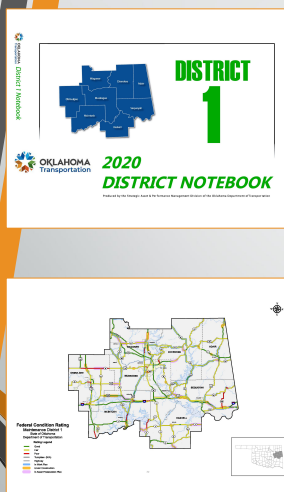
- The 'Bible' for project selection
- Provides network-level data and metrics for a variety of selected performance measures
- Helps direct project selection to adhere to FHWA TAM principles
- Work Plan & Asset Preservation Project Data
- Pavement, Bridge, Functional Class, and Deficient Shoulder granular roadway data
- AADT & collision data
- Condenses relevant data into a single, concise document
- Moving now into web-based, interactive maps
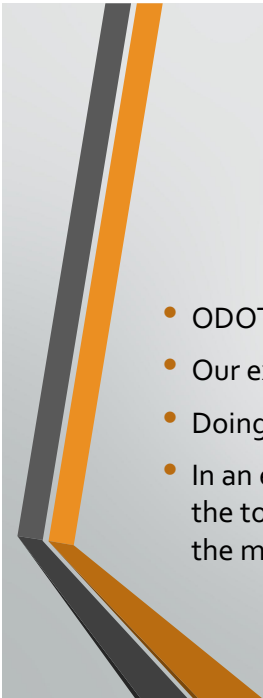
Performance Tracking Update Sheets
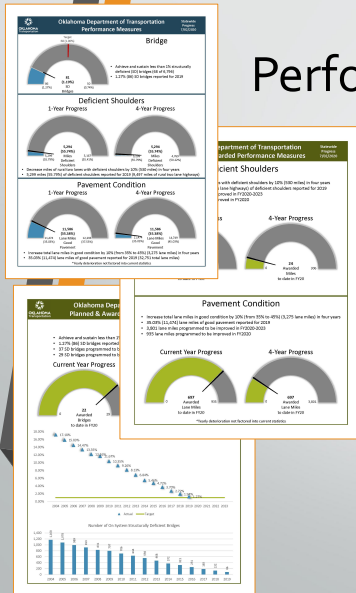
- Separate sheets for upcoming projects and completed projects

- Designed around Governor Stitt's agency performance measures

- Updated quarterly

- Progress tracking allows better communication throughout the year with executive staff and other stakeholders

Bringing it All Together

- Objective project selection processes

- Better tools to program projects as budgetary realities and department focus changes

- Decision Lens

- Incorporates GIS, Project Planning, and Financial data

- Allows criteria-based rankings and hypothetical funding situations

ODOT's TAMP

- ODOT prides itself on data-driven decision making
- Our existing processes lend themselves well to TAMP strategies
- Doing TAMP without even knowing it
- In an era of increasing demands on infrastructure and decreasing budgets the tools we have put in place help ensure that the Department is getting the most out of taxpayer dollars

Questions?

Equity Data Tool and Approach
Steve Barham
Seattle Department of Transportation

stephen.barham@seattle.gov

City of Seattle
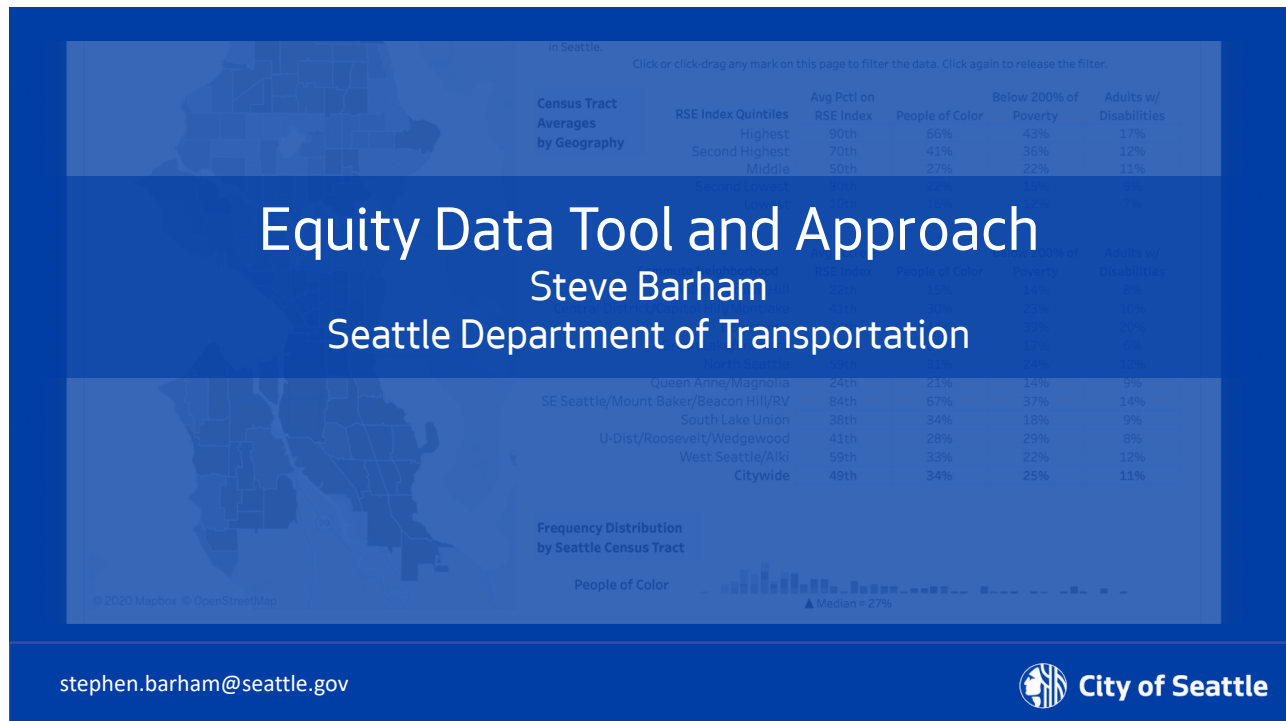
Equity evaluation requires rich contextual information about the people and places that are impacted historically, at the time of analysis, and in the future. It is a collaboration between disciplines.

We need common intersections:

TIME   LOCATION   MEASURES

Department of Transportation

City of Seattle

Descriptive Statistics

50	22	15	46	78
Average	Standard Deviation	25th Percentile	50th Percentile	75th Percentile

Collaborative Geography

Distribution
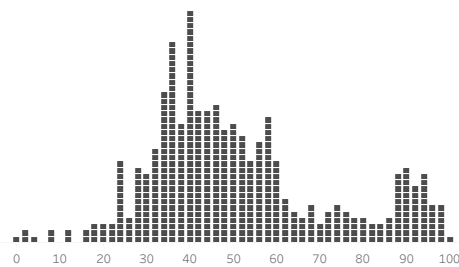
Comparative Analysis
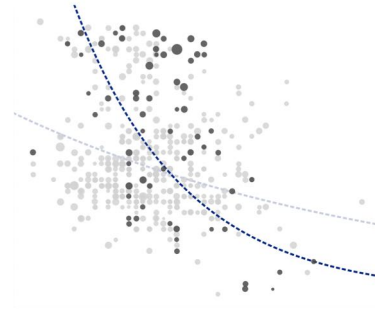
Collaborative Geography

Block Group	Neighborhood	Urban Village	Zip Code	Council District
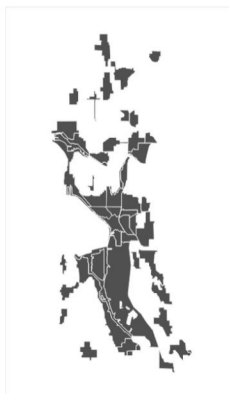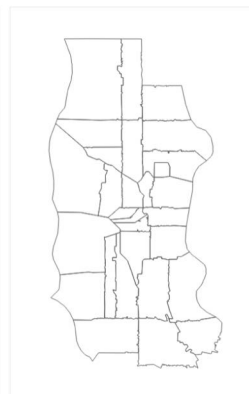
How can I label my data for collaboration and analysis?

- GIS Spatial Join
- Python, R
- Tableau, Power BI
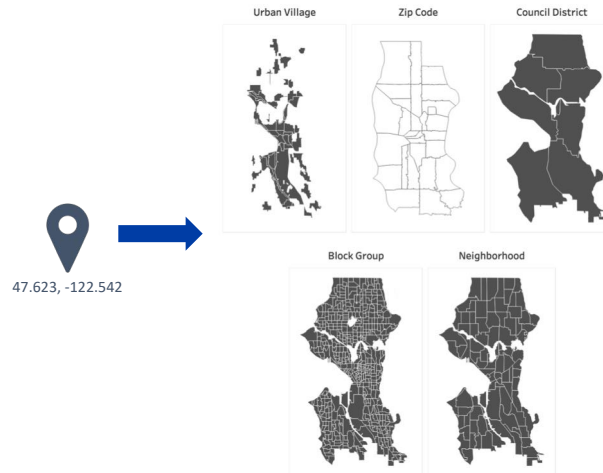
City of Seattle

Collaborative Data Structure Example — Long Format

Similar to Organization for Economic Co-operation and Development (OECD) datasets

TRACT10	year	subject	measure	value
53033005900	2018	Demographics	PCT_PEOPLE_OF_COLOR	.34
53033004700	2018	Demographics	PCT_PEOPLE_OF_COLOR	.36
53033001900	2018	Demographics	PCT_PEOPLE_OF_COLOR	.32
53033001300	2018	Demographics	PCT_PEOPLE_OF_COLOR	.64
53033005900	2019	Transportation	SIDEWALK_COVERAGE	nan
53033004700	2019	Transportation	SIDEWALK_COVERAGE	.88
53033001900	2019	Transportation	SIDEWALK_COVERAGE	.43
53033001300	2019	Transportation	SIDEWALK_COVERAGE	.24

City of Seattle
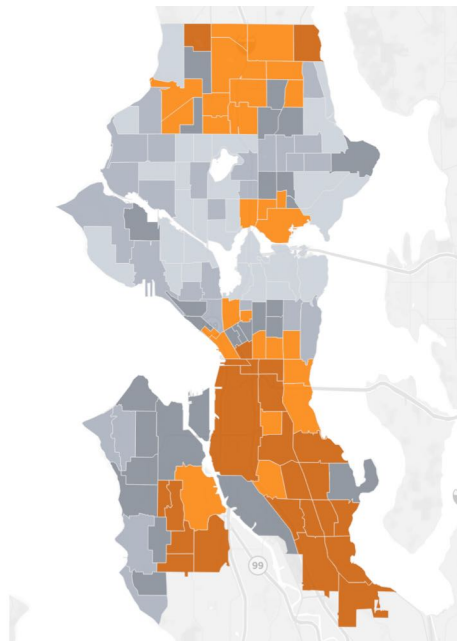
Seattle Race and Social Equity Index

The RSE Composite Index combines information on race, ethnicity, and related demographics with data on socioeconomic and health disadvantages. The color key is by composite index quintiles, each of which represent 20% of the Census Tracts in Seattle.

RSE Index Quintile	Arterial Miles	Housing Units	Population
Highest	● 145 (25%)	59K (16%)	128K (18%)
Second Highest	● 122 (21%)	81K (22%)	148K (21%)
Middle	● 104 (18%)	80K (21%)	135K (19%)
Second Lowest	● 101 (17%)	86K (23%)	153K (22%)
Lowest	● 109 (19%)	67K (18%)	142K (20%)
Total	581 (100%)	373K (100%)	705K (100%)

Department of Transportation

City of Seattle

Seattle Race and Social Equity Index

People of Color ▲ Median = 27%

Below 200% of Poverty ▲ Median = 20%

Adult with Disabilities ▲ Median = 10%

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%

Priority Areas
Highest ●
Second Highest ●

Department of Transportation

City of Seattle

88/17/20
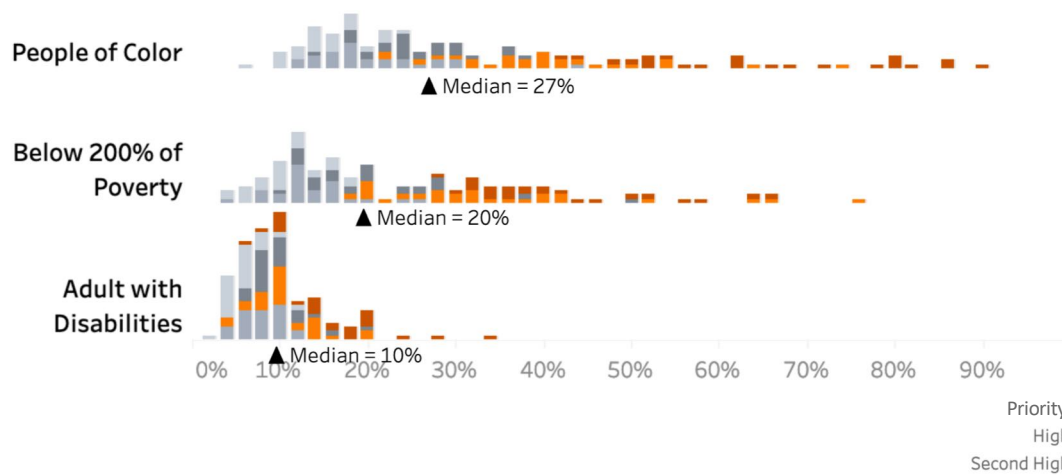
RSE Overlay Examples
Compare priority areas to the rest of the city

measure	Citywide	Priority Areas	Potential Priority Area Disparity?
Average Pavement Condition	53	53	In range of average/median
Pothole Repairs / Arterial Mile	30	28	6% below average ⬇
Sidewalk Coverage	71%	76%	7% below average ⬇
Sidewalk condition - % Poor or worse	5%	6%	7% better than average ⬆
Existing Bike Facilities	25 miles	26 miles	4% better than average ⬆
Planned Bike Facilities	110 miles	108 miles	In range of average/median

Department of Transportation City of Seattle

LIVE DEMO

https://public.tableau.com/views/Equity-Toolkit-2020/RSESUMMARY?

5
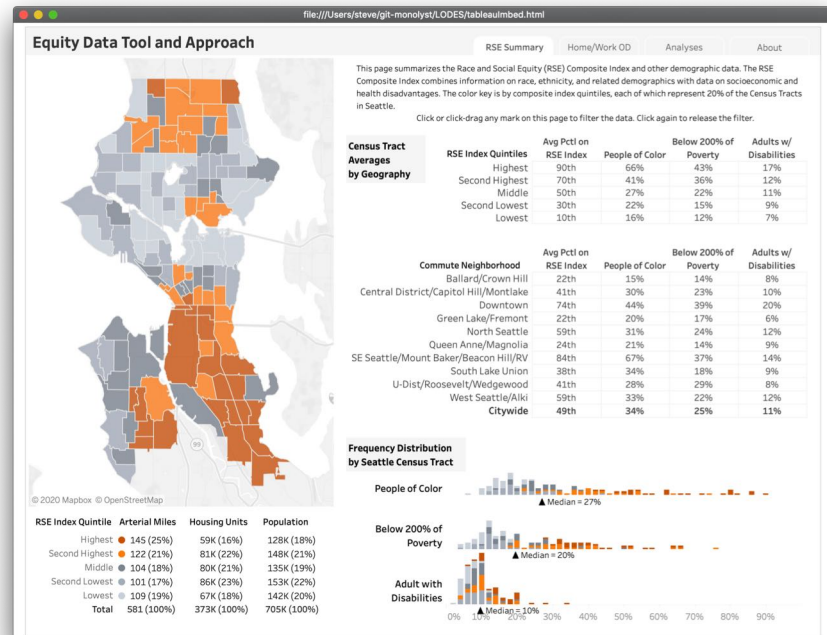
Skate:
Building a Better Bus
Dispatch App

**Massachusetts Bay
Transportation Authority**

Logan Nash, lnash@mbta.com
August 2020

Meet Skate

Relationship to TAM

FOR YOUR CONSIDERATION

"Good" visualizations, data, and even applications all happen because they are **useful to users.**

The only way to know what your users want, even for internal applications, is talking to them: **user research.**

MBTA Customer Technology

WHO WE ARE

A team of software engineers, designers, product managers, and others using technology to make the MBTA better for our riders.

WHAT WE DO
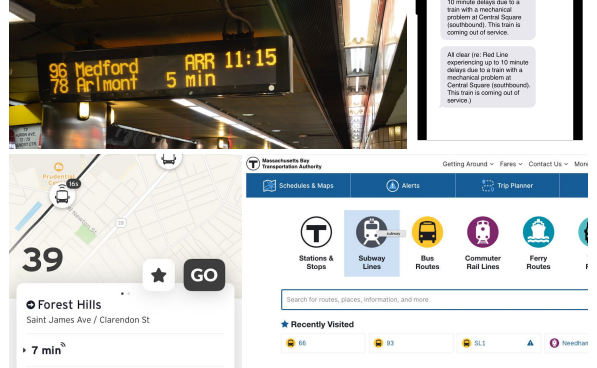
We have been investing in our bus tracking.

REALTIME BUS IMPROVEMENTS

- Procured an industry-leading **bus predictions** algorithm (Swiftly).

- Bus **vehicle locations** every 3 seconds instead of every 60 seconds (Samsara)

- About a 10% increase in bus prediction accuracy.
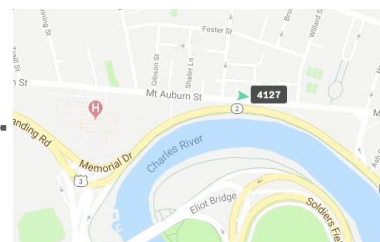
Here's a theory.

We can't just "math" our way to better real-time data for riders.

But, if we give our **operations** staff powerful, modern tools, we can:
1. Actually make service better.
2. Capture the "human" element of bus service that makes predictions hard...

   dropped trips...
   held buses...

The Bus Operations "Trinity"

Field Inspectors

Dispatchers

Operators
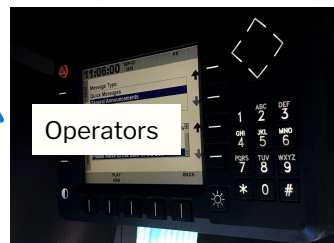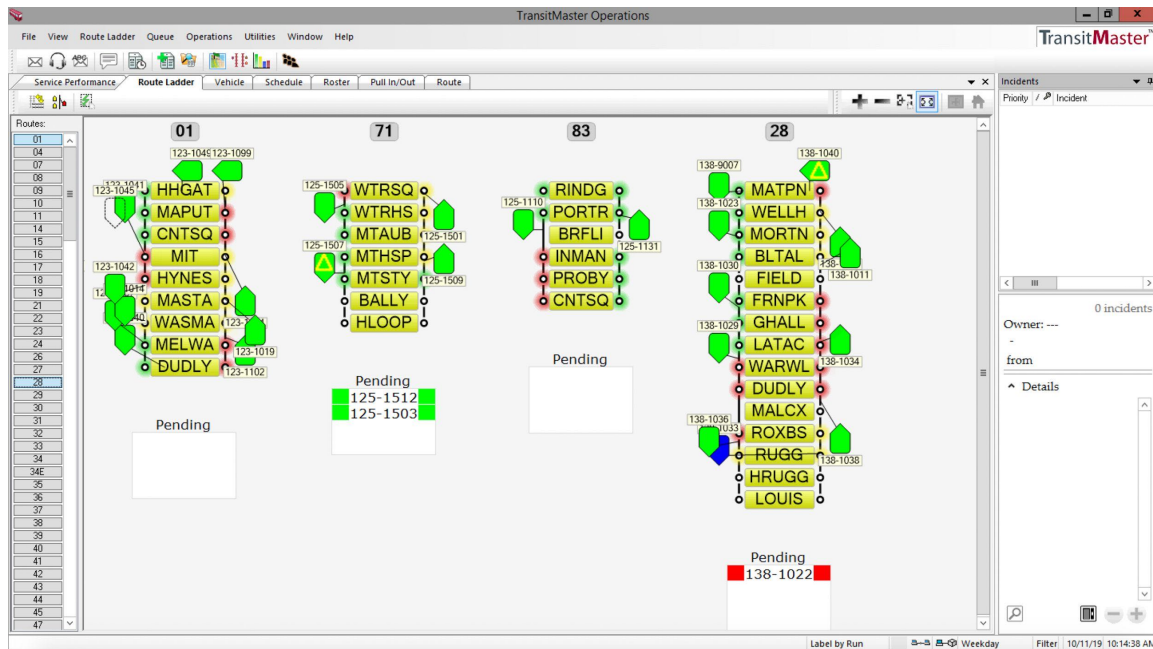
Meet Skate

What have bus inspectors had to manage service?

Q: Could we buy an off-the-shelf **modern, mobile** dispatch app for our bus inspectors?

A: No.

WHY?

- **Vendor-lock-in**
- Solutions don't scale to manage **many routes at once**.
- Not the **quality** our operations staff need/deserve.

We decided to build Skate.

HOW?

- Cheap, off-the-shelf hardware (Android tablets).

- Modern, mobile-first **engineering**

- Strategic use of **existing APIs** in-house (e.g., GTFS-RT) and from vendors (Swiftly)

- **User research** and constant conversation with our users and Bus Operations leads.

Meet Skate

It's a thing now.

WHERE ARE WE?

- Development started in **April 2019**. First version to inspectors in **July 2019**.

- Trainings at every MBTA bus garage.

- **Every week, around 125 officials** use it to do their jobs.

- We're continuously iterating to meet emerging challenges like **crowding and shuttles.**

Meet Skate

"Mini-Schedules"

A user research story

Going beyond this "ladder" -->
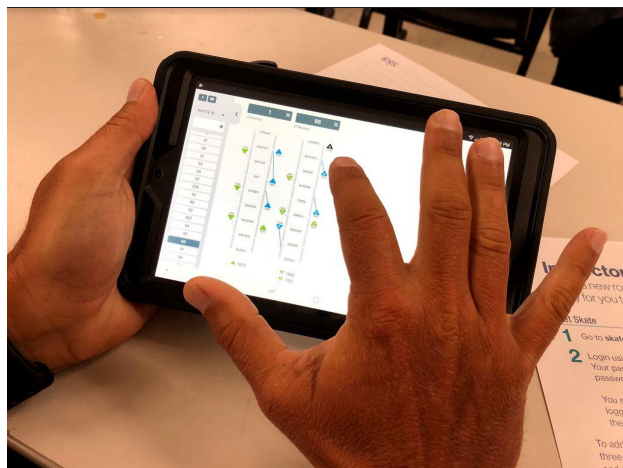
Run: One bus operator's work for the day

Block: One bus vehicle's work for the day.
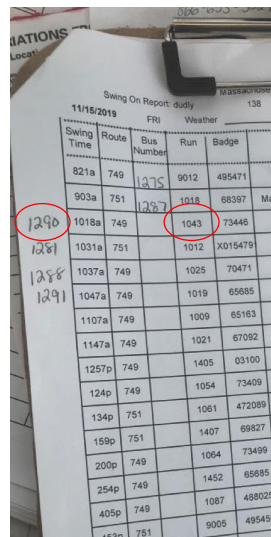
Swing-on: When the operator changes mid-block.

Meet Skate

Inspectors told us **swing-ons are very hard to manage.**

And it affects service to riders.

Strategy 1:
Notes in the margins

Strategy 2:
Cheat sheet

Strategy 3:
Wall calendar
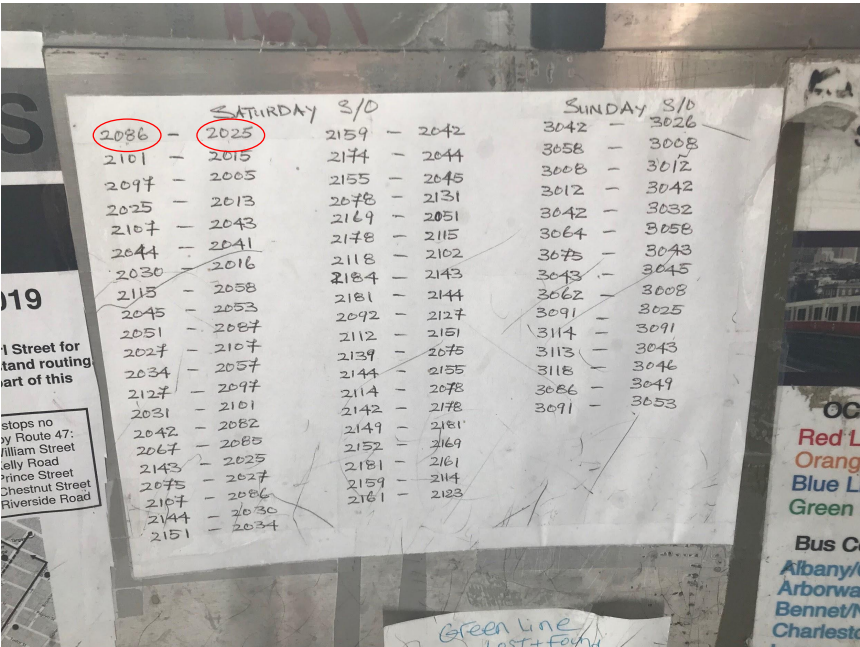
Mini-Schedules

"Could this operator do overtime after they swing-off?"

Mini-Schedules

LISTENING AND ITERATING

- We had **flexibility in our roadmap** to build a solution when we heard about the pain point.

- We **put draft designs in front of users**. Small tweaks can make a big difference. E.g., adding total working hours to run view.

- User research might actually be **easier for internal staff**.

People like being heard

"I'm loving this. I ain't got to be carrying all this stuff under my arm, I'm not trying to carry all this stuff!"

Then she tossed the headway sheets and books out of her hand.

"Everything's right here! I ain't gotta flip these pages. I can sit in the doorway and hold this one tablet.*"*

— Station inspector after a mini-schedule demo

Where do we go from here?

IMPROVEMENTS FOR RIDERS/OPS

- **Notifications** to let bus officials know what needs attention.

- Capturing dispatch actions and using them to **give riders better predictions,** info about dropped trips, "ghost buses," held buses, etc.

BUSINESS STUFF

- **"Feet to the fire"** with current and potential dispatch vendors.

- **Collaboration and code sharing** with other transit agencies.

Thank you

mbta.com/skate

lnash@mbta.com

Felipe Jung.

Felipe Jung is a business development manager for Atkins North America. With a focus on emerging visualization technologies for ATKINS' Digital Group, his expertise lies in project simulations and augmented and virtual realities with an emphasis on GIS (geographical information systems). He has been instrumental in the delivery of several successful projects in these visualization technologies realm.

Felipe Jung has been recognized as an experienced and knowledgeable advocate in AR visualization technologies by several institutions including the United State National Science Foundation and Augmented Reality Enterprise Association.

1

Augmented and Virtual Reality and Infrastructure Management

Presented by: Felipe Jung – ATKINS DIGITAL

2

ATKINS AR Partners and our own Guide for Best Practices.
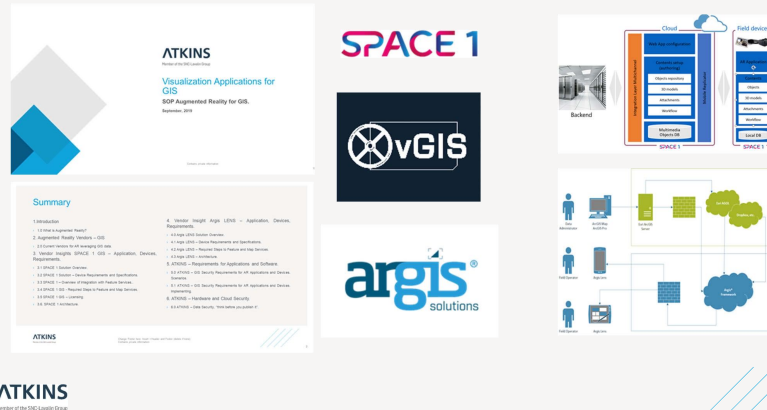
3

What is Augmented and Virtual Reality?

It's easy to confuse augmented reality (AR) and virtual reality (VR).

Augmented Reality (AR) is the technology that allows to enhance human visual perception by combining real vision with virtual information generated from sensory inputs such as video, graphics and georeferenced data.

Virtual Reality (VR) implies a complete immersion experience that shuts out the physical world, thus a re-creation of the "real-world" in a simulated environment and activities.

Change Footer here: Insert > Header and Footer (delete if none)
Contains *private* information

4

Impact of Mixed Realities on the Disruption Scale

Immersive Technology on the Digital Disruption Scale

Peak

DD5:
Revolutionize

DD4:
Reinvent

2023

DD3:
Transform

DD2:
Extend

2018   Growth

DD1:
Enhance   Emergence

Elements Affected	Technology	Industry
	Business	Society

ID: 349453   © 2018 Gartner, Inc.
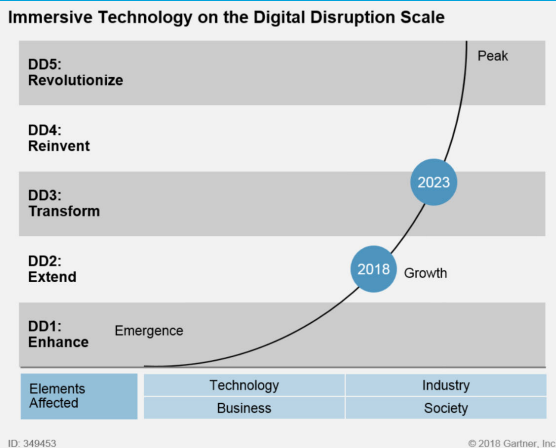
Strategic Planning Assumption

By 2020, augmented reality (AR) applications on mobile devices will be adopted in 30% of large enterprises as part of their digital transformation strategy.

5

Mixed Realities in 2020 - Scoped in Projects and Proposals

- **Drainage/Utilities Relocations** - The street environment is often far more co
  surface would indicate. The street network is the principal conduit of most o
  including water supply, drainage facilities, sewer lines, gas lines, and electrici
  team will communicate with utility authorities early in the project developm
  potential relocations. The Atkins team will gather available infrastructure m
  etc. to assist in an assessment of the extent a new BRT/LRT system may affect
  allows utility relocation prior to design in order to minimize delays to the mas
  maps, files and drawings will be transferred to GIS (Geographical Inform
  visualized in Augmented Reality (AR) via
  mobile applications (APPs) through
  commercial off-the-shelf (COTS) smart
  devices like smartphones and tablets. This
  ATKINS's own powerful mobile tool enables
  field workers to gain powerful insights by
  visualizing (pre-existing and proposed)
  underground utilities and above ground
  transportation assets (TAM), from field and
  on-location aiding the entire team and
  stakeholders to determine existing field conditions for design consideration s
  replacement of the existing utilities or above ground assets (as showed in the

  -
  -

KINS' Virtual User-Immersive Event Space is an online platform that can be accessed by anyone wi
sktop, laptop or mobile devices like smartphones and tablets. Meant to enhance the user experier
d interaction with stakeholders during virtual public hearings and town hall meetings thus obliging
blic restrictions due to pandemic or other disasters.

e user experience is immersive, think of virtually walking through a conference hall or ballroom an
iting stands or booth, collecting leaflets, deploying a video, or submitting a question or inquiry to
tual person also immersed in avatar-form but connected, engaged and on standby to help. In one
e rooms there a virtual public hearing, the main event, will soon take place and users can virtually
gin and remotely participate in the hearing and presentation. Officials and stakeholders would be
ning IN via
leoconference and
e users would see all
keholders in-video-
es within an
mersive
vironment-
perience that best
plicates actually
ng there in person
location.

e immersive environment can be modeled to the actual Town Hall or Conference Center or
stomized to the proposed structure(s) or building(s). All tailored to deliver deep and meaningful
gagement for any client, partner or project, without the need for virtual reality headsets or gadget

lly online platform – accessed in browser – nothing to download.

Change Footer here: Insert > Header and Footer (delete if none)
Contains sensitive information

6

6

FDOT – AR integrated with GIS and CAD - New drainage system design at Dale Mabry Street, Tampa, FL.

Augmented Reality for asset visualization and content management.

ATKINS' Transportation Group identified a suitable project for a PoC on Augmented Reality visualization and management of assets represented in GIS to support field crew's surveying activities on pre-existing assets on site of a new drainage system design at Dale Mabry Street, a busy street corridor in Tampa, FL. Prior to initiate the design stage it is important to account for all above and underground assets thus avoiding potential spatial conflicts with the new drainage system. **The only information our team had on pre-existing assets were in a public GIS database, presumably out of date and potentially inaccurate.** Augmented Reality was then integrated to the Municipalities' GIS to render these assets in augmented reality to be viewed on-site through the surveyor's field of vision, via his or her handheld device. **The surveyor while using augmented reality was able to immediately identify inconsistencies with the GIS data, ranging from missed assets to assets being improperly geo-located in GIS, results were then shared LIVE with our GIS center in the back-office via the device's camera and screen. Assets GIS information were then corrected, updated, and forwarded to our design team.**

GIS is a commonly used asset depository platform for DOTs, Municipalities and Government and by leveraging Augmented Reality as a mobile field visualization tool enables users to see assets through a more user-friendly and powerful prospective. Some of the benefits of augmented reality as an asset mobile visualization tool are improving communications and visibility, enabling on-the-go problem solving and decision-making, user-friendly and fast adoption that requires minimum training, ultimately providing powerful insights. Simply put a more powerful and efficient way to view and manage data from the field.

To watch a video on a similar instance-use-case of AR please scan this QR code or access this link.
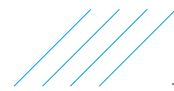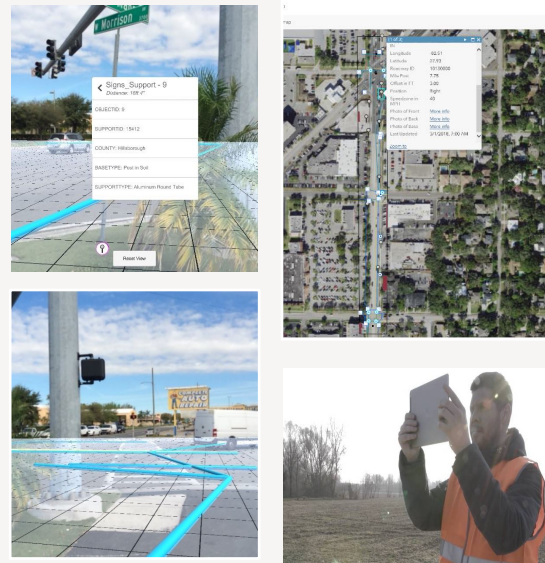
7

VR from Public Engagement to Project Management.

Gaile Avenue to Paul Russell Road, Leon County

Gaile Avenue to Ridge Road
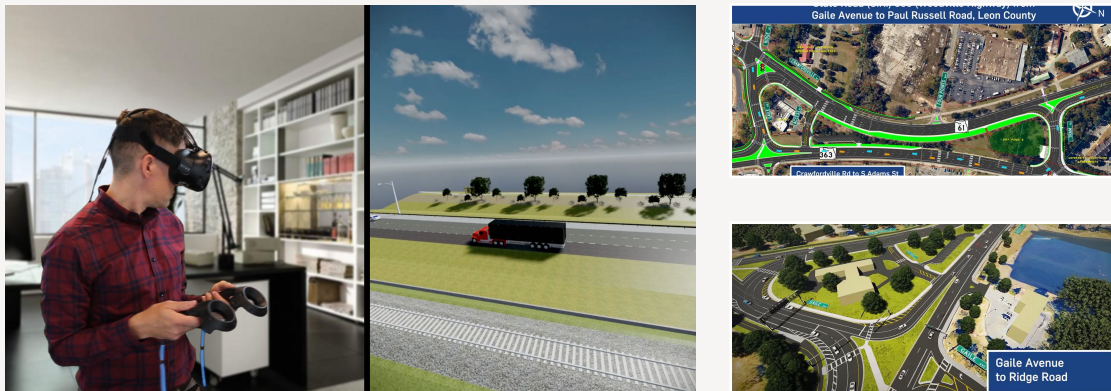
8

Mixed Reality – AR and VR

Immersive Collaboration with a Digital Twin

Public Engagement and Involvement

AR to support Field Operations

Change Footer here: insert > Header and Footer (delete if none)
Contains sensitive information

9

9

Information viewed in Mixed Reality – Only as good as the DATA

INVENTORY
› Assets Registry
› GIS Assets
› Facility Assets

INSPECT
› Condition
› Risk
› Valuation
› AR to support field activities.

PRIORITIZE
› Budget
› Projects

TRACK & MANAGE
› Service Calls
› Public engagement
› Work Orders
› CIP Projects

Asset ID
(Data Link)

Any business management software package

Mobility Tools
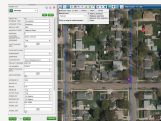
10

DATA for Performance Management

DATA to transition to a performance and outcome-based program and **achieve individual targets** that collectively will make progress toward **national goals**.

Safety

Infrastructure condition

Congestion reduction

System reliability

Freight movement and economic vitality

Environmental sustainability

Reduced project delivery delays

19 August 2020

11

11

Augmented Reality supporting Field Operations

12

12

Augmented Reality for Asset Visualization and Content Management
"X-RAY Vision" into underground networks utilities, above ground assets, and layers of information
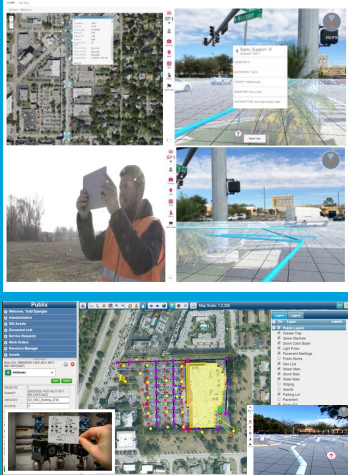
Mobile Application supporting field activities for:
- **Maintenance**
- **Inspection**
- **Survey**
- **Emergency Recovery/Preparedness**

Agnostic, ready for off-the-shelve mobile devices on both iOS and Android platforms.
- **In-house Resources**
- **Contractors**
- **On-loan Resources**
- **Civilians/Public Engagement**

User-friendly, interactive, leveraging data information from third party systems.

- **Technical Specifications**
- **Work activities, WOs, Condition Indexes**
- **Resources & Workforce Management**
- **Remote Support & Content Sharing between field user and back office collaborator(s).**
.

Miami Dade Water and Sewer PoC.

AR integrated with GIS(raster) for flooding layers
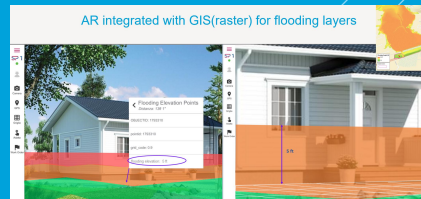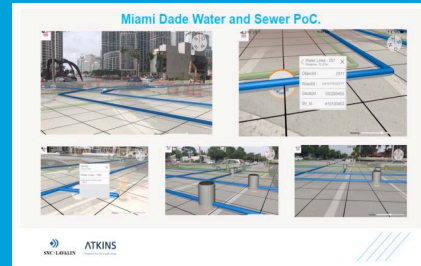
13

AR– Efficiencies, Resiliency and Accountability

From Planning through Management and beyond Turnkey.

Uses and Applications

Utilities Relocation.

Site Assessment.

Vault for Technical Information and Documentation.

QA/QC.

Field Management.

Asset Management.

Change Footer here: Insert > Header and Footer (delete if none)

14

14

Bring Data to the Field, Bring DATA to LIFE!
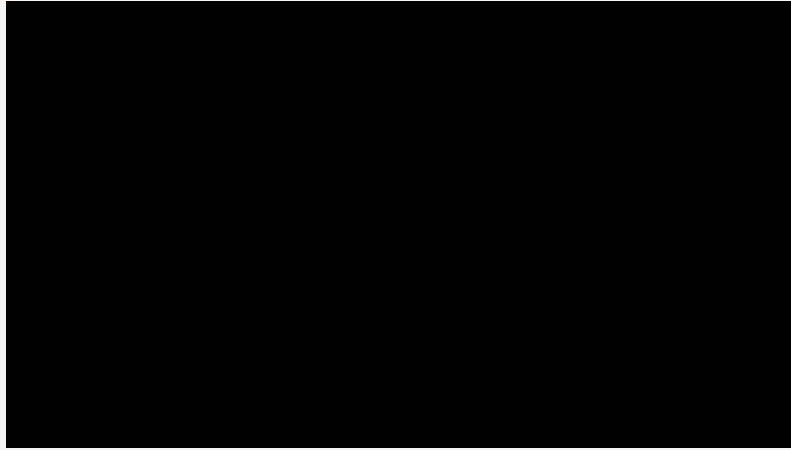
SPACE 1

15

15

Miami-Dade ATMS – SMART Intersections.
AR integrated with Constructions Management Systems for advanced visualization in mobility.
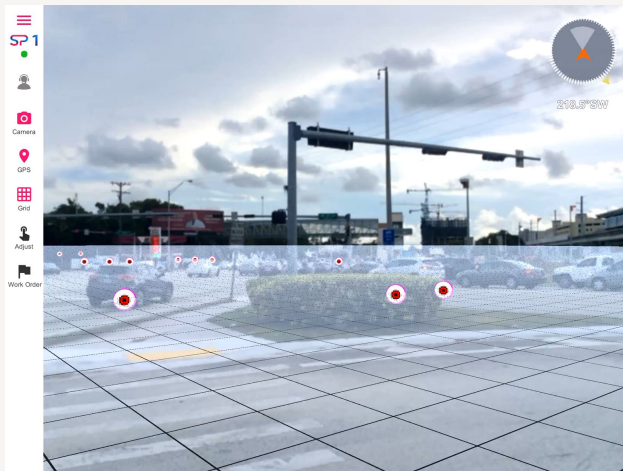
- **SAFETY**
- Inspection activities, "punch list".
- Field data collection via GIS.
- Information and documents for task at hand.
- Remote assist, collaboration, sharing with back-officers and stakeholders.
- Knowledge retention and accountability.
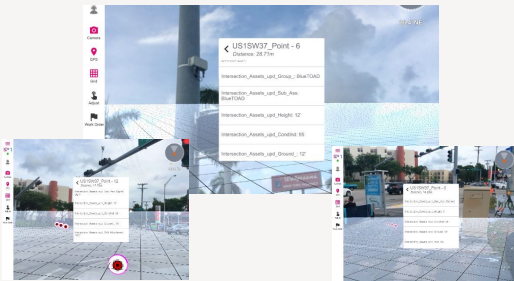
16

Utilities Assets in AR view.

Augmented Reality to support the operational processes, on the field, by the maintenance teams.

Bring your DATA to the field.

- AR view of networks and assets. "Utility Locater"
- Technical information on assets, log of Work
- Tracking and positioning.
- DATA Collection and Validation via GIS editing.
- Field surveying integrated with GIS.
- Remote assist, field view and content sharing between field user and other collaborators.
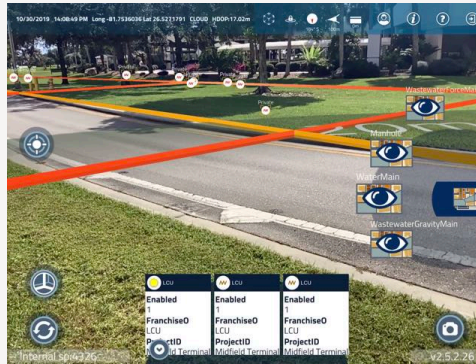
17

17

Augmented Reality Leveraging BIM and GIS.
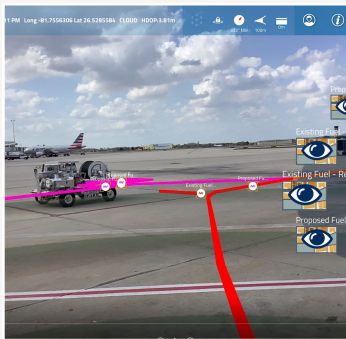
AR of Jet Fuel Utilities Lines: pre-existing, to be demolished, and new proposed lines
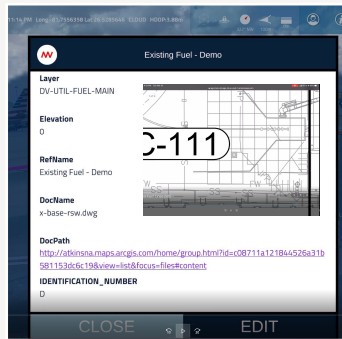
Interface to ArcGIS Online to gain access to Civil Demo Plans to support field activities. Decision on the go.
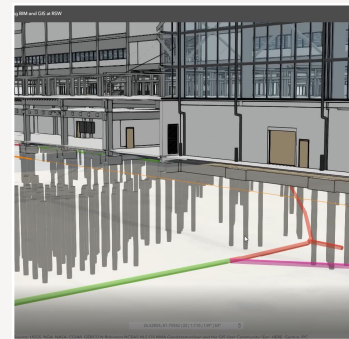
Remote assist and content sharing from back office to field user through AR mobile APP. BIM insights to underground utilities shown.

18

18

9

AR for Field Support – Site Assessment
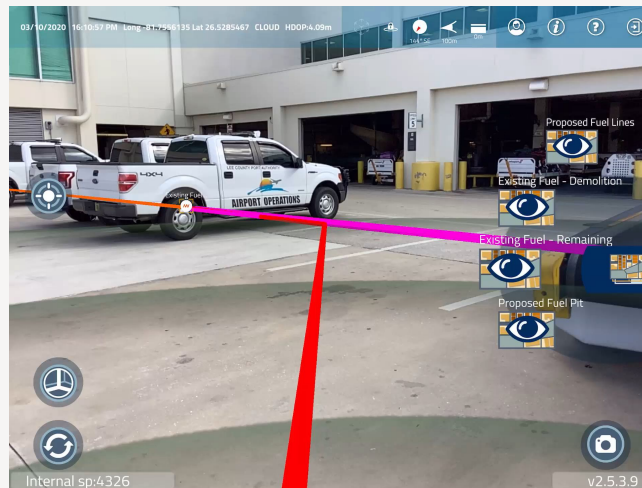
19

BIM in AR – Reduce Site Visits for Inspections
Studies on QA validation indicates time was **reduced by 66–85%.**
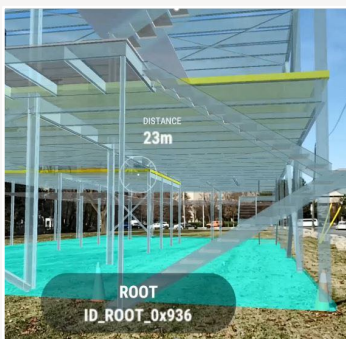
Platform Agnostic - Available through Bentley and Autodesk.

Devices and OS Agnostics – iOS or Android, smartphones, tablets, and Head-mounted Displays
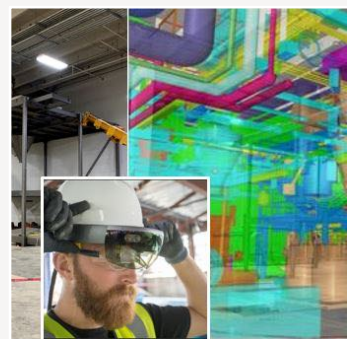
Reduce site visits by doing it remote. All call events are saved for later viewing. Revise and reload models with ease.

20

AR – Mea$urable Impact$

"If I had this tool it would reduce field trips to site by at least 50%" - Atkins RSW Engineer

Impact of Mixed Realiti

40%   **+30%**

g time   Resources productivity

50%   **+30%**

a half. In a third of the jobs locators realized even larger time savings of 66% or more.

Time savings from using AR as a percentage of the total job duration

The study did not identify statistically significant differences based on the infrastructure type (gas, water and sewer). Informal feedback suggested that the more accurate and complete the location information about underground utilities was, the greater the time savings. In other words accurate utility records amplified the benefits of the AR visualization system.

The study evaluated differences in savings based on different types of jobs, such as industrial, residential, and other types of locates. The comparison revealed that the time savings for validation jobs were significantly higher than for other types of jobs, ranging from 66% to 90%, suggesting that AR is exceptionally effective for quality assurance jobs.

On average, utility locators using AR reduced the time required to complete jobs by 50%. At the same time, QA validation time was reduced by 66–85%. This translates to cumulative savings of 12–20 hours per locator per month.

The impact on the ease of doing a job was assessed by asking participants to evaluate each job using a three-level scale whether AR made the job easier, made the job harder or had no impact. In 94% of
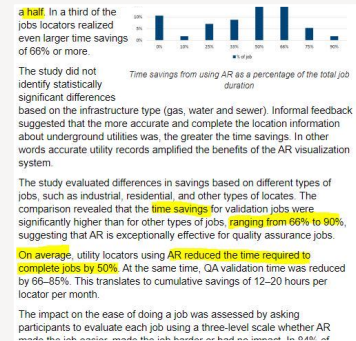
Early preliminary studies indicated potential for 30% increase on productivity.

Own feedback suggesting savings at around 50% on efficiencies.

Independent studies using the same technology corroborates with our own findings.

21

AR Integration to Third Parties Systems

Mixed Realities without integration(s) to systems governing assets and workforce are essentially **"useless"**. Geo localization is also very relevant in order to identify resources, assets and cross-referencing with BI and AI.

GIS – geolocation and identification of assets.
Field Service Management – for advance scheduling capabilities matching resources skills and availability with assets needs and requirements and WO.
Asset Management – to retrieve previous WO, assets information..
CRMs, ERPs for more insight.
IOT – measure flow, status, temperature, pressure.
Analytics – output data used to generate predictive, corrective, pro-active maintenance and activities.

22

AR and GIS Architecture.

ArcMap /ArcPro

Esri ArcGIS Server or Esri
ArcGIS Online (AGOL)

    Esri ArcGIS Portal

    Esri Identity

AR Framework

AR Application

23

Augmented Reality, BIM & GIS centric Enterprise Asset Management

Powerful integrations with third parties' systems: GIS, ERPs, EAMs.

Powerful Visualizations and Mobility capabilities: BIMs, IoT, AR and VR
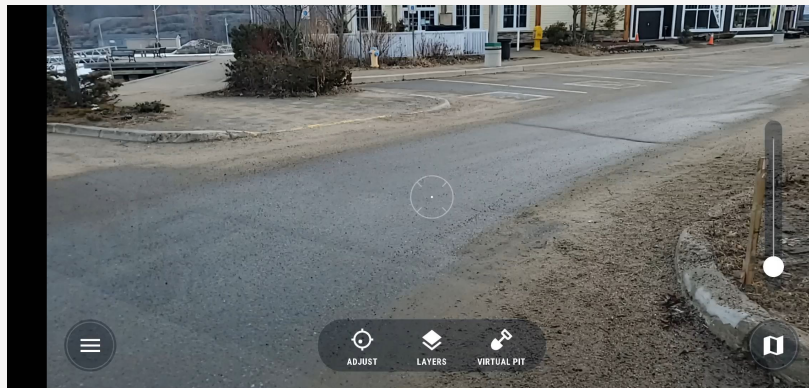
24

Advancements in MR

25

25

New Opportunities - Consumer-grade LiDAR

26

AR New Capabilities – Reality Mesh

27

27

AR for Flooding – Natural Disaster Risk Management

28

Thank you!
Felipe Jung – Business Development Manager ATKINS Digital

ΛTKINS
Member of the SNC-Lavalin Group

29

Questions?

Submit your questions using the Webinar's Q&A feature

5

5

All webinars available online:
http://www.tam-portal.com/event/

Save the Dates!

A bimonthly webinar series, Wednesdays at 2:00 PM EST

Next Webinar
Wednesday, October 21, 2020– 2:00 PM EST
Re-Evaluating TAM Targets

Wednesday, December 16, 2020 – 2:00PM EST
TAM and System Resilience

Wednesday, February 17, 2021 – 2:00PM EST
Adding New Assets to the TAM Program

More to follow!

Federal Highway Administration   AASHTO THE VOICE OF TRANSPORTATION

For more information or to register:
http://www.tam-portal.com/event/

6