November Meeting

11/10/2021

AGENDA

1. Announcements
2. Esri Update
3. Event Data Quality Checks
4. Open Discussion

**** Please mute phones!! ****

ANNOUNCEMENTS

- GeoNet Updates
- Community Polling

Esri Updates

Nathan Easley

Event Data Quality Checks

Shaun Perfect and John Ehlen

Open Discussion

RHUG Community

Upcoming Meetings / Contacts

Wednesday December 8th, 1:30-3pm

Contact Info:

Erin Lesh ealesh@ncdot.gov
Patrick Whiteford pwhiteford@azdot.gov

Product Team Update
RHUG meeting 11/10/21

Nathan Easley

Capabilities currently under development

- Stationing event type support
- Two scripts to assist with migration to Pro
  - Add Calibration Points to loop portions of routes
  - Update Intersection Referents on Events

Support Incidents/Defects

- **BUG-000143396** – Deleting a version in Roads & Highways 10.8.1 does not release route locks (developer fixing)
- **BUG-000143813** – Selecting events by route in Event Editor doesn't return point events at the start and end of the route (fixed for next release)
- **BUG-000144357** – Running Append Events for non-alpha routes fails with Error 999999 (developer investigating)

Other Announcements

- ArcGIS Pro 2.9 and Enterprise 10.9.1 publicly available later this month
- Interest in a Hands-On Learning Lab for Roads and Highways in Pro at GIS-T?

esri
THE
SCIENCE
OF
WHERE

Visualizing Roads & Highway's Errors

Creation of an Executive Dashboard

Shaun Perfect - ADOT
John Ehlen - Gistic Research, Inc.

Shaun Perfect

Senior GIS Analyst

ADOT

John Ehlen

GIS Project Manager

Gistic Research, Inc

Agenda

- ❑ Introductions
- ❑ Background & Need
- ❑ Dimensions and Metrics
- ❑ Architecture
- ❑ Challenges

Challenges with large-scale data maintenance

Many of us can relate to data bugs and errors getting introduced in day-to-day editing activities especially using large datasets that consist of many different data layers.

Why So Many Errors?

- 105 editable registered features
- Many Editors
- Multiple projects that all involve manual editing
- Automated processes
- ADOT's 2014 Roads & Highways migration
- New errors can be introduced in fixing existing errors

Not Quite Yet To Pro

- ADOT MPD upgraded to 10.7 not too long ago
- Have yet to implement Data Reviewer
- Have yet to implement Insights
- Still need to upgrade Workflow Manager and initiate better, more concise workflows to assist in our daily processes
- Waiting for full confidence in how Roads & Highways works with Pro

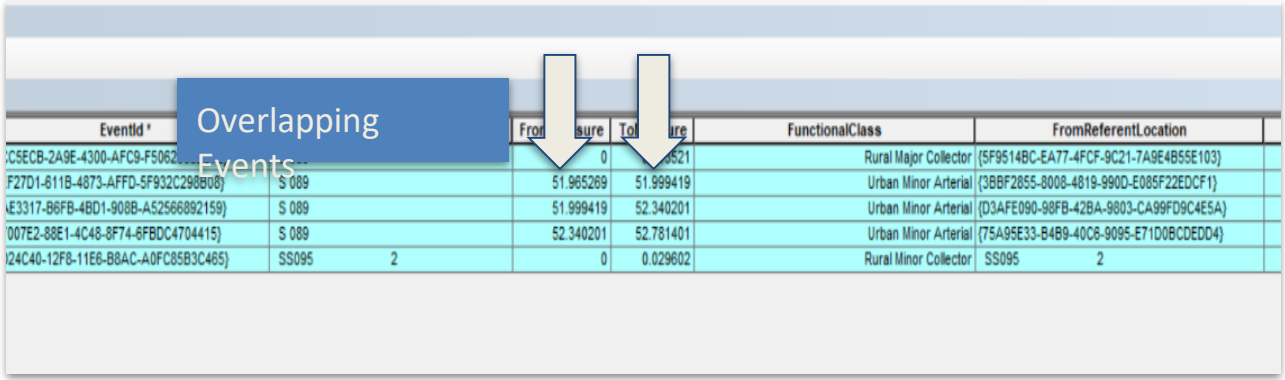
The Need For More

- GIS and Project managers want to have quick feedback to see who and what type of errors are being made.
- Esri currently does not have dashboards that provide managerial tools to view errors

ADOT Data Quality Control Process in RnH

Before Dashboard Development

- Manual data quality control process only done when needed or when specific errors found
- Data bugs proceed in data easily
- No automated processes
- No standard QC rules in place



EventId					FunctionalClass	FromReferentLocation
{C5ECB-2A9E-4300-AFC9-F5062			0	8521	Rural Major Collector	{5F9514BC-EA77-4FCF-9C21-7A9E4B55E103}
{F27D1-611B-4873-AFFD-5F932C298B08}	S 089		51.965269	51.999419	Urban Minor Arterial	{3BBF2855-8008-4819-990D-E085F22EDCF1}
{E3317-B6FB-4BD1-908B-A52566892159}	S 089		51.999419	52.340201	Urban Minor Arterial	{D3AFE090-98FB-42BA-9803-CA99FD9C4E5A}
{007E2-88E1-4C48-8F74-6FBDC4704415}	S 089		52.340201	52.781401	Urban Minor Arterial	{75A95E33-B4B9-40C6-9095-E71D0BCDEDD4}
{24C40-12F8-11E6-B8AC-A0FC85B3C465}	SS095	2	0	0.029602	Rural Minor Collector	SS095 2

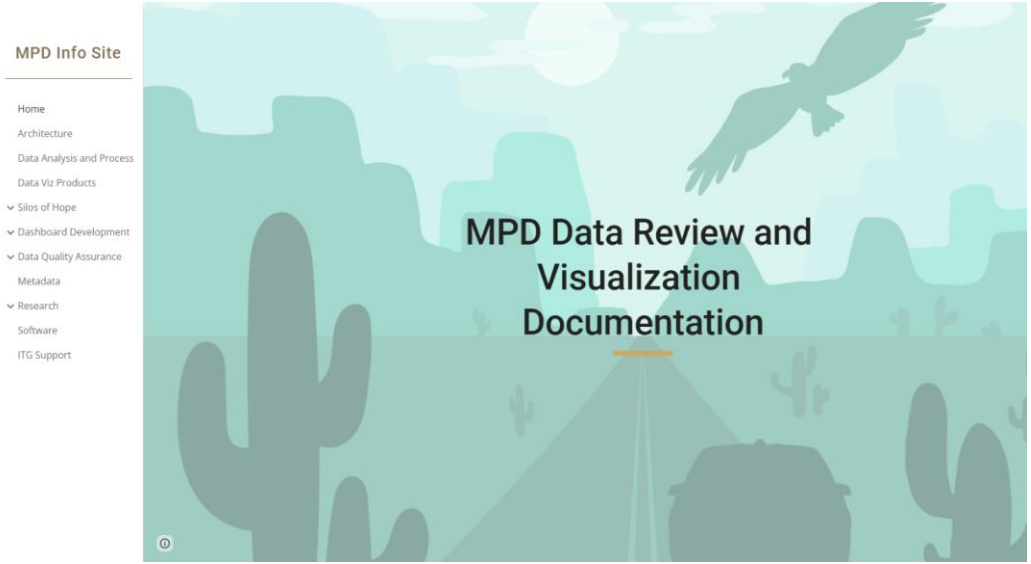
ADOT Data Quality Control Process in RnH

After Dashboard Development (Tableau)

- Managers can review data bugs real time
- Automated processes to find and catch data bugs
- Prioritize data issues to tackle high order items
- Transitioned from Tableau to Google Data Studio

ADOT QC Rules Defined & Documented

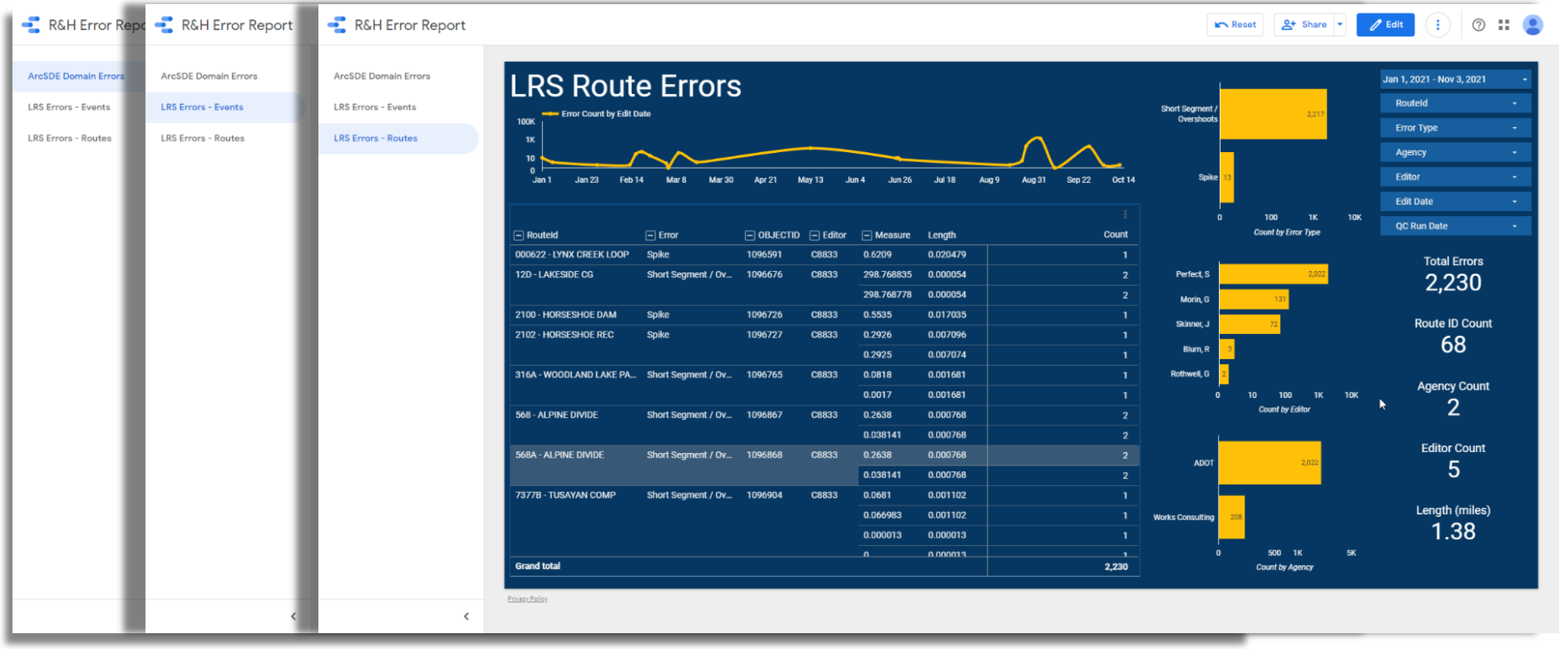
As MPD GIS made its transition from using the Tableau dashboard to the Google Data Studio, we documented all QC rules and implementations as they were put together using Google Sites.



Dashboard Dimensions

- Who
  - Editors / Editing Agency
- When
  - Rolling 60 days
- Layers
  - All relevant features in SDE
- Error Type (Displayed on separate tabs)
  - Domain Violations, LRS Event Errors, LRS Route Errors
- Error Description
  - General description of the error to assist in resolution
- Error Location
  - Along which route, and at what measure, and for which event is the issue located?
- Error Specification
  - Object ID(s) of specific record showing error is given

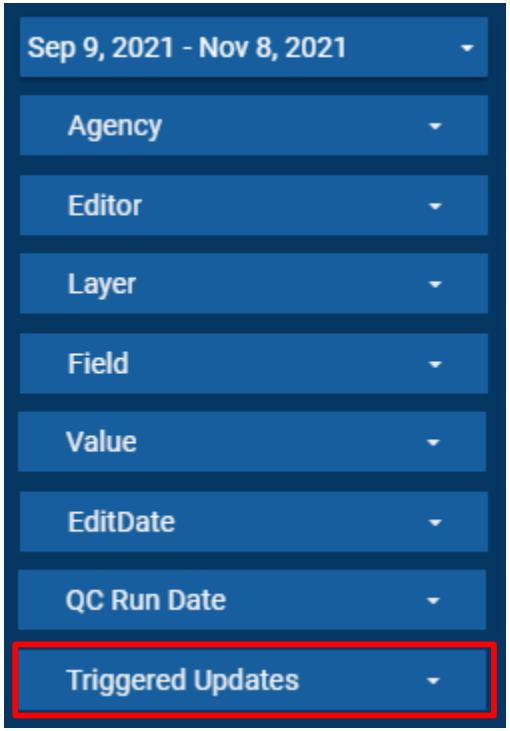
R&H LRS Quality Control Dashboard

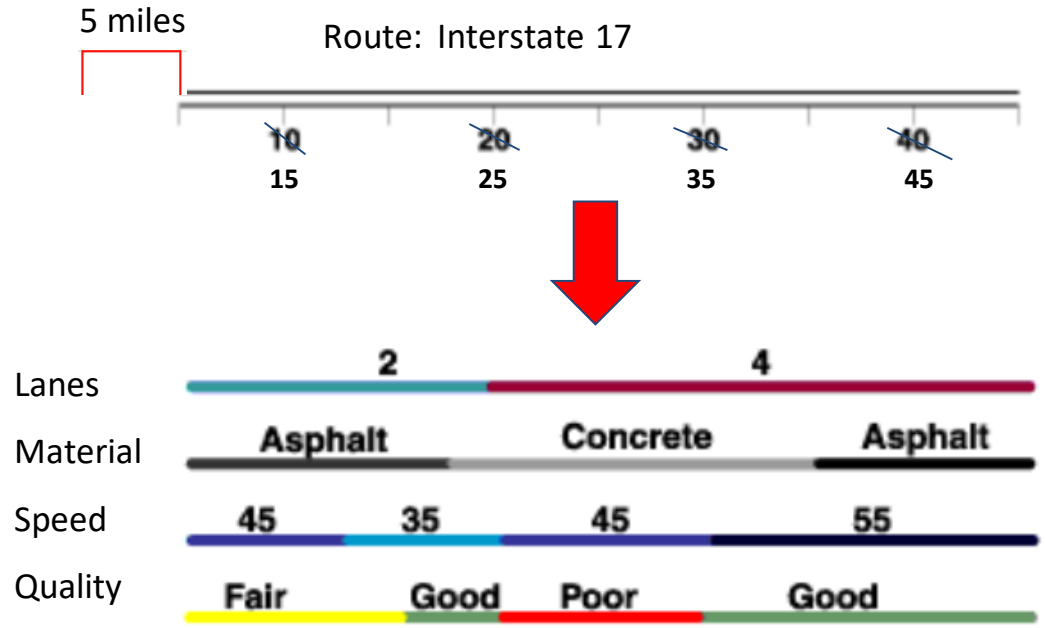


QC Categories

- ArcSDE Domain Violations
  - All domain controlled layers/fields minus pre-determined exclusion list
- LRS Event Errors
  - Gaps, Overlaps, Out-Of-Bound events
- LRS Route Network Errors
  - Undershoots, Overshoots, Spikes, Overlaps, etc
- ★ *Triggered Updates*
  - Error resulting from route edit propagating to event

Triggered Updates





```
WITH ffd AS (
    SELECT
        substring(i.Name, charindex('.', i.Name) + 1, 50) AS FeatureClass
```

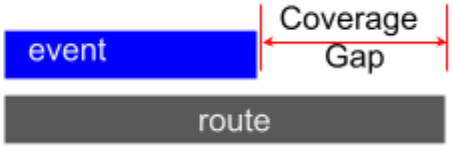
	FeatureClass	field	DomainValueType	domain	Code	Value	ValueRange
1	DBO.LRSE_ACCESSCONTROL	AccessControl	Coded Value Domain	AccessControl	1	Full Control	<null>
2	DBO.LRSE_ACCESSCONTROL	AccessControl	Coded Value Domain	AccessControl	2	Partial Control	<null>
3	DBO.LRSE_ACCESSCONTROL	AccessControl	Coded Value Domain	AccessControl	3	No Control	<null>
4	DBO.LRSE_ACCESSCONTROL	AccessControl	Coded Value Domain	AccessControl	0	Unknown	<null>
5	DBO.LRSE_ADMINISTRATIVE	Administrative	Coded Value Domain	Administrative	0	Non-administrative	<null>
6	DBO.LRSE_ADMINISTRATIVE	Administrative	Coded Value Domain	Administrative	1	Administrative	<null>

```
        ('/GPCodedValueDomain2/CodedValues/CodedValue') AS CodedValues(codedValue)
      WHERE itemtypes.Name = 'Coded Value Domain'
    ),
```

	FeatureClass	field	DomainValueType	domain	Code	Value	ValueRange
5597	DBO.LRSE_THICKNESSRIGID	SourceYear	Range Domain	Years	<null>	<null>	1900, 2050
5598	DBO.LRSE_TRUCK	SubmittalYear	Range Domain	Years	<null>	<null>	1900, 2050
5599	DBO.LRSE_WIDENING	SourceYear	Range Domain	Years	<null>	<null>	1900, 2050
5600	DBO.LRSE_YEARLASTCONSTRUCTION	SourceYear	Range Domain	Years	<null>	<null>	1900, 2050
5601	DBO.LRSE_YEARLASTIMPROVEMENT	SourceYear	Range Domain	Years	<null>	<null>	1900, 2050
5602	DBO.RIGHTOFWAY	SourceYear	Range Domain	Years	<null>	<null>	1900, 2050
5603	DBO.LRSE_RCI_TRACKER	ProjectInServic...	Range Domain	Years	<null>	<null>	1900, 2050
5604	DBO.LRSE_JUNCTION	SourceYear	Range Domain	Years	<null>	<null>	1900, 2050

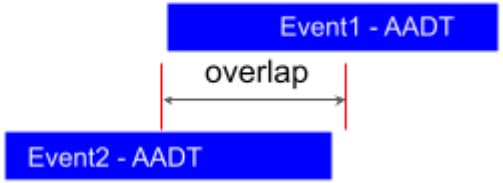
QC Category - Events

Coverage Rule	An event feature class should cover entire network



Extent Rule	No event should exists beyond the route extent

Overlap Rule	Within an event feature class, there should not be overlap



QC Category - Routes

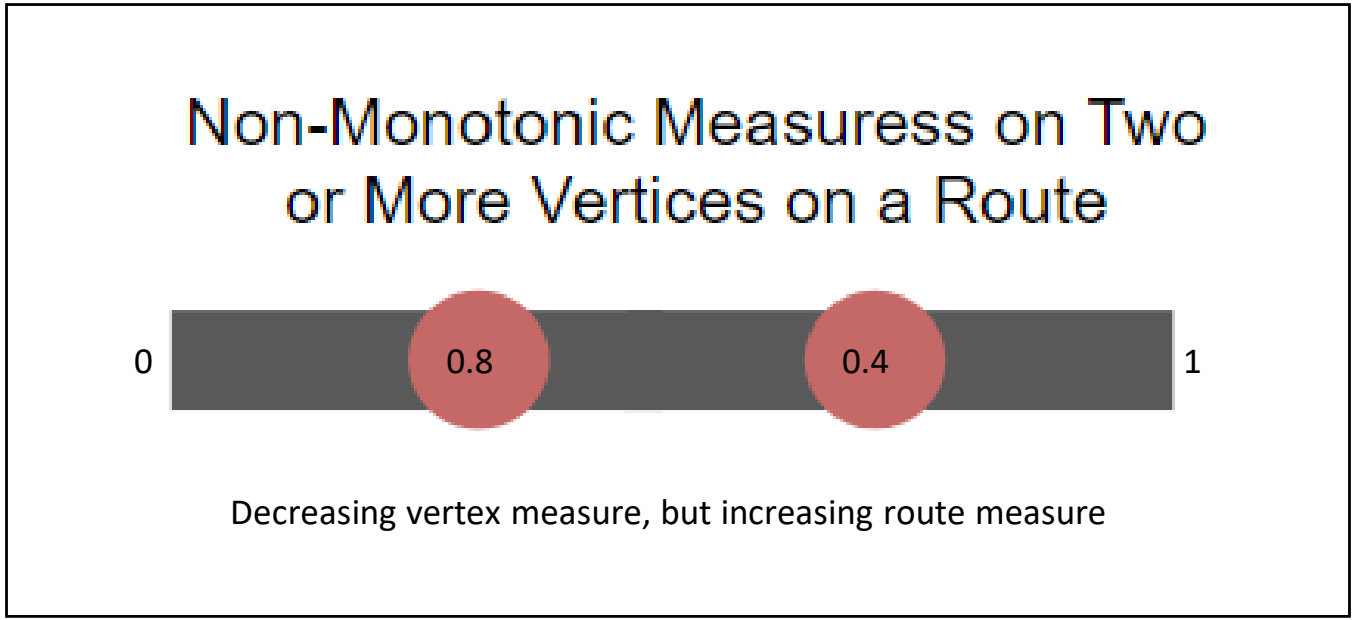
- Geometry Errors
  - Invalid, empty, degenerate, etc.
- Route Measure Inconsistencies
  - Monotonicity - one spatial location corresponds to one unique measure, and each unique measure corresponds to one spatial location.
- Route Vertex Inconsistencies
  - Geometry contains short segments, points, minor gaps, undershoots, overshoots, or a switchbacks.

QC Category - Route Geometry

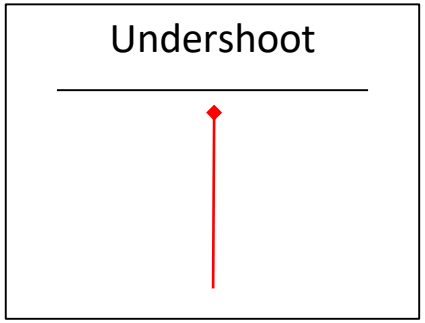
SHAPE	ROUTE_ID	F_MEAS	T_MEAS
Polyline	I 010 1	99.2998	99.3998
<Null>	I 010 1	99.3999	109.3741

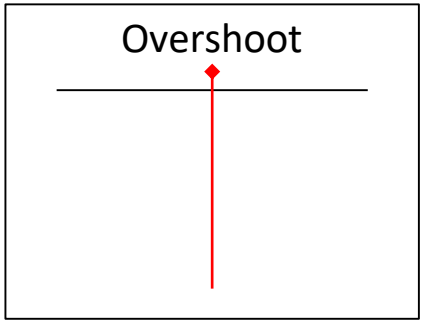
Null Geometry

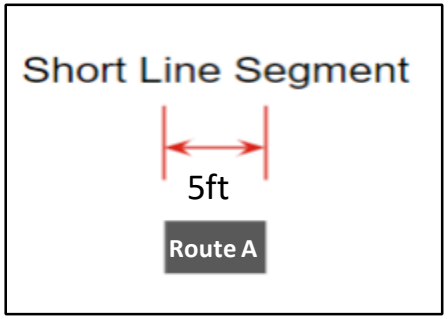
QC Category - Route Measure

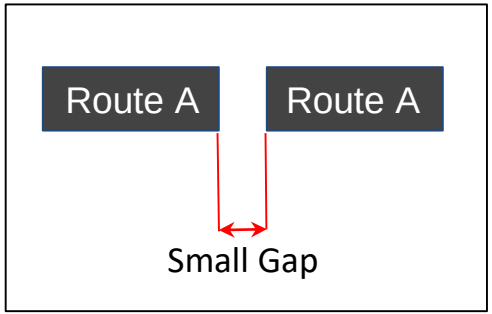


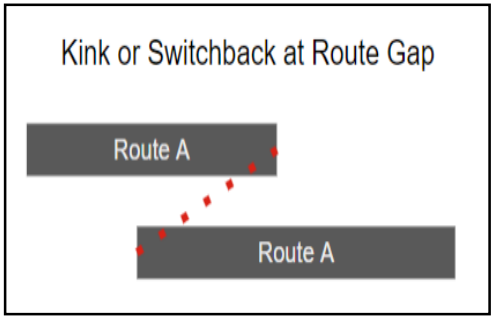
QC Category - Route Vertex











Dashboards Options:

Tableau vs AGOL VS Google Data Studio

Tableau:

Pros:
- Can do OTF calculations
- Can create calculated fields
- Much easier to work with tabular data
- Easier to accommodate landing page, disclaimer

Cons:
- Can be cumbersome to develop and maintain
- **ADOT Internal network required for viewing**

AGOL:

Pros:
- Great w/ spatial data viewing and analysis
- Can be viewed outside ADOT network

Cons:
- **Poor Tabular Visualization**
- No OTF calculations
- No calculated fields
- Hard to fully replicate tableau

Google Data Studio:

Pros:
- Can replicate most Tableau functions
- Can be viewed outside ADOT Network

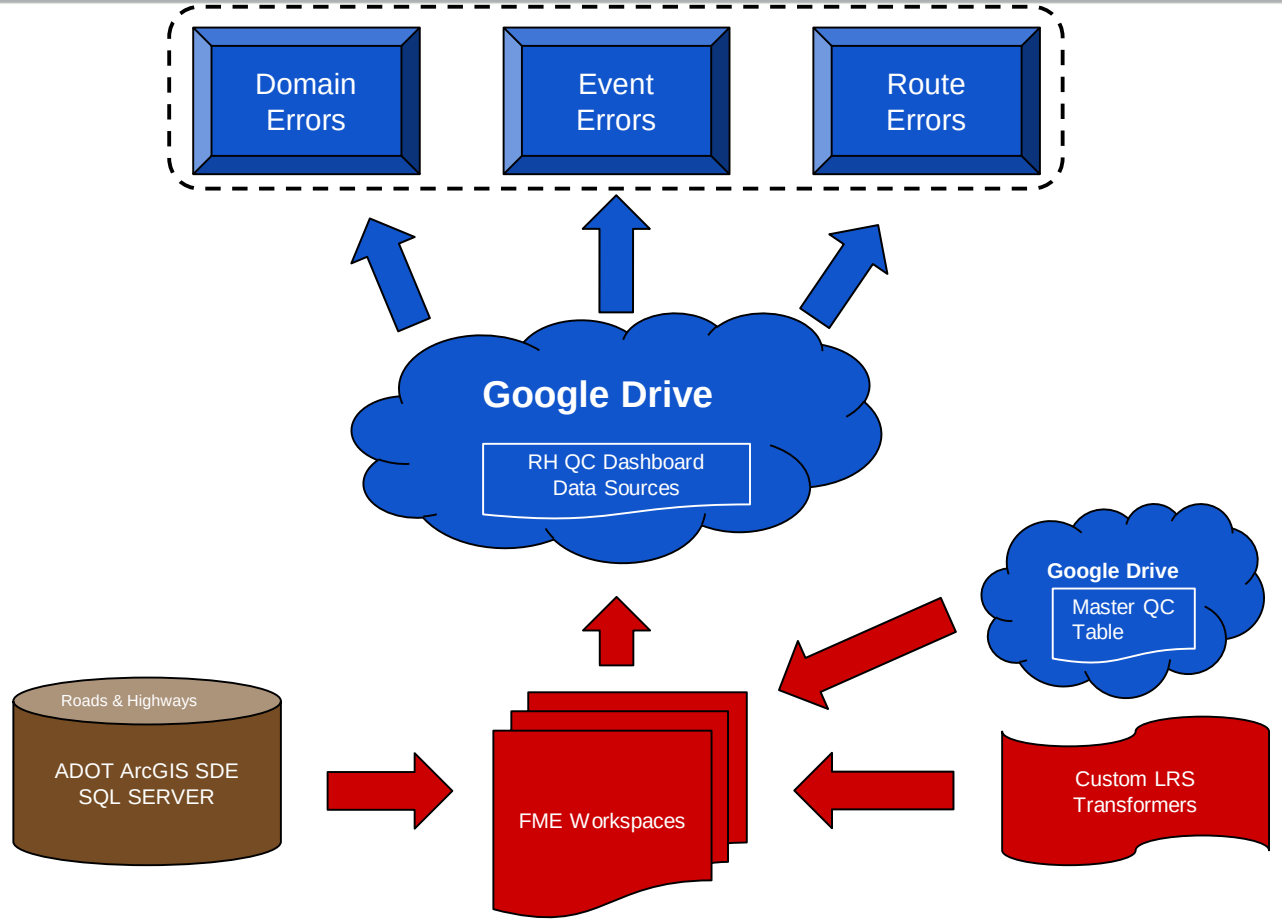
Cons:
- Manual workflow to update data
- Can't publicly be viewed without ADOT log in
- **Cell count limitations for google sheets**

AGOL VS Google Data Studio

Can it pivot? Can it Group?

Layer	Error Type	RouteID	ObjectID	ObjectID_2	Editor	FromMeasure	ToMeasure	Count
AADT	Gap	U 191	633422	null	C864	366.418	366.486	1
			633427	null		178.696	211.648	1
			633425	null		372.606	373.079	1
		I 010273A	632214	null		0.183	0.2	1
AADT_DIRECTIONAL	Overlap	UX191 0	29180	2918		14.195	14.344	1
		U 191	29182	29		372.606	372.629	1
		U 191 0	29198		642	372.688	372.764	1
ACCESSCONTROL	Overlap	12 ARIVACA RD	275797		E5802	0	2.646	1
ADMINISTRATIVE	Overlap	SA089	520418		C8642	79.472	79.488	1
		12	22440		E0837	0.773	1.01	1
		SA089 0	33	438	C8642	79.496	79.497	1
		05S LA MESA DR		23939	E0837	0	0.004	1
		05S CONQUISTADO...		523884	E0837	0	0.003	1
AUXILIARYLANE	Overlap	02E 3RD ST	87	875294	E5800	122.287	122.292	1
				875295	E5800	122.3	122.372	1
				875296	E5800	122.372	122.472	1
Grand total								2,694

Data Flow



FME
Google
Esri

Automation…w/o FME Server?

- Challenges
  - No FME Server
  - No local admin access to PCs
- Process
  - Batch Scripts
  - Working with IT
  - MS Task Scheduler

Automation Continued

Translation Log

0 Errors | 0 Warnings | Information

```
1     Command line to run this workspace:
2         "C:\FME 2021.1.1\fme.exe" "I:\Data\TableauVisualization\FMEConversion\PRODUCTION\QC Dashboard\GenerateQCDashboardSheets.fmw"
3           --p_gmailEmailConnection "John"
4           --p_emailAddress "john.ehlen@gisticinc.com"
5           --pSQLEnv "RNHSQLP98001"
6           --p_ignoreFields "DataSource, Source, SourceDataset, TempReviewStatus, AssignedTo"
7           --p_dateDimension "dd"
8           --p_dateValue "90"
9           --p_timeOffset "2"
10          --p_sdeConn "I:\Data\TableauVisualization\DataSources\ATIS_Prod\SDE Connections\Connection to RNHSQLP98001.sde"
11          --p_routeFilter "%"
12          --p_precision "5"
13          --p_DomainWorkspace "$(FME_MF_DIR_USERTYPED)IdentifyRecentEdits_DOMAIN.fmw"
14          --p_EventWorkspace "$(FME_MF_DIR_USERTYPED)IdentifyRecentEdits_EventQCER.fmw"
15          --p_EventWorkspace_2 "$(FME_MF_DIR_USERTYPED)IdentifyRecentEdits_ROUTES.fmw"
16          --FME_LAUNCH_VIEWER_APP "YES"
17
```

Automation Continued

```
@set log="I:/Data/TableauVisualization/FMEConversion/PRODUCTION/QC Dashboard/RecentRun.log"
@rem assign start time to t0, calculation won't work right if the program run spans local
midnight.
@set t0=%time: =0%

@echo STARTING QC DASHBOARD UPDATE %TIME% - %DATE% >%log%
@echo LOCATED AT %~f0>>%log%
@echo **************************************************>>%log%
@echo **************************************************>>%log%

call "C:\FME 2021.1.1\fme.exe" "I:\Data\TableauVisualization\FMEConversion\PRODUCTION\QC
Dashboard\GenerateQCDashboardSheets.fmw" --p_gmailEmailConnection "John" --p_emailAddress
"john.ehlen@gisticinc.com" --pSQLEnv "RNHSQLP98001" --p_ignoreFields "DataSource, Source,
SourceDataset, TempReviewStatus, AssignedTo" --p_dateDimension "dd" --p_dateValue "90"
--p_timeOffset "2" --p_sdeConn "I:\Data\TableauVisualization\DataSources\ATIS_Prod\SDE
Connections\Connection to RNHSQLP98001.sde" --p_routeFilter "%" --p_precision "5"
--p_DomainWorkspace "$(FME_MF_DIR_USERTYPED)IdentifyRecentEdits_DOMAIN.fmw" --p_EventWorkspace
"$(FME_MF_DIR_USERTYPED)IdentifyRecentEdits_EventQCER.fmw" --p_EventWorkspace_2
"$(FME_MF_DIR_USERTYPED)IdentifyRecentEdits_ROUTES.fmw" --FME_LAUNCH_VIEWER_APP "YES"


@rem assign end time to t
@set t=%time: =0%
@rem make t0 into a scaler in 100ths of a second, being careful not
@rem to let SET/A misinterpret 08 and 09 as octal
@set /a h=1%t0:~0,2%-100
```

Dynamic Parameters

Table - QC Rules for Google Dashboard

File Edit View Insert Format Data Tools Add-ons Help Accessibility Last edit was yesterday at 9:20 PM

Parameter	Value	Description	Domain	Event	Route
DateDimension	dd	dimension to retreive edits (hour=hh, day=dd, week = wk, month = mm, year= yy)	x	x	x
DateValue	60	numeric dimensions value to look back. 2 weeks, 3 months, 90 days, etc.	x	x	x
TriggeredUpdateOffset(hours)	2	time in hours to associate an LRS Route Edits to a triggered event edit	x		
RouteFilter	%	Sql query to filter routes. You can populate dashboard with data for a single route by specifying with something like %I 008%	x	x	x
DecimalPlaces(eventPrecision)	5	decimal precision for event geometry (in miles)		x	
DomainFieldsToIgnore	DataSource, Source, SourceDataset, TempReviewStatus, AssignedTo	fields to ignore domain violations in	x		
MissingTableEmails	John.ehlen@gisticinc.com, jehlen@azdot.gov, rblum@azdot.gov, sperfect@azdot.gov	Users to email of missing tables		x	
MissingUsersEmails	John.ehlen@gisticinc.com, jehlen@azdot.gov, rblum@azdot.gov	Users to email of missing racf users	x	x	x
DomainLayersToIgnore	None	Feature classes to ignore domain violations in	x		

Master Rules | Event QC | RACF Lookup | Runtimes

Google Drive

Event QC Rules

Dynamic Parameters

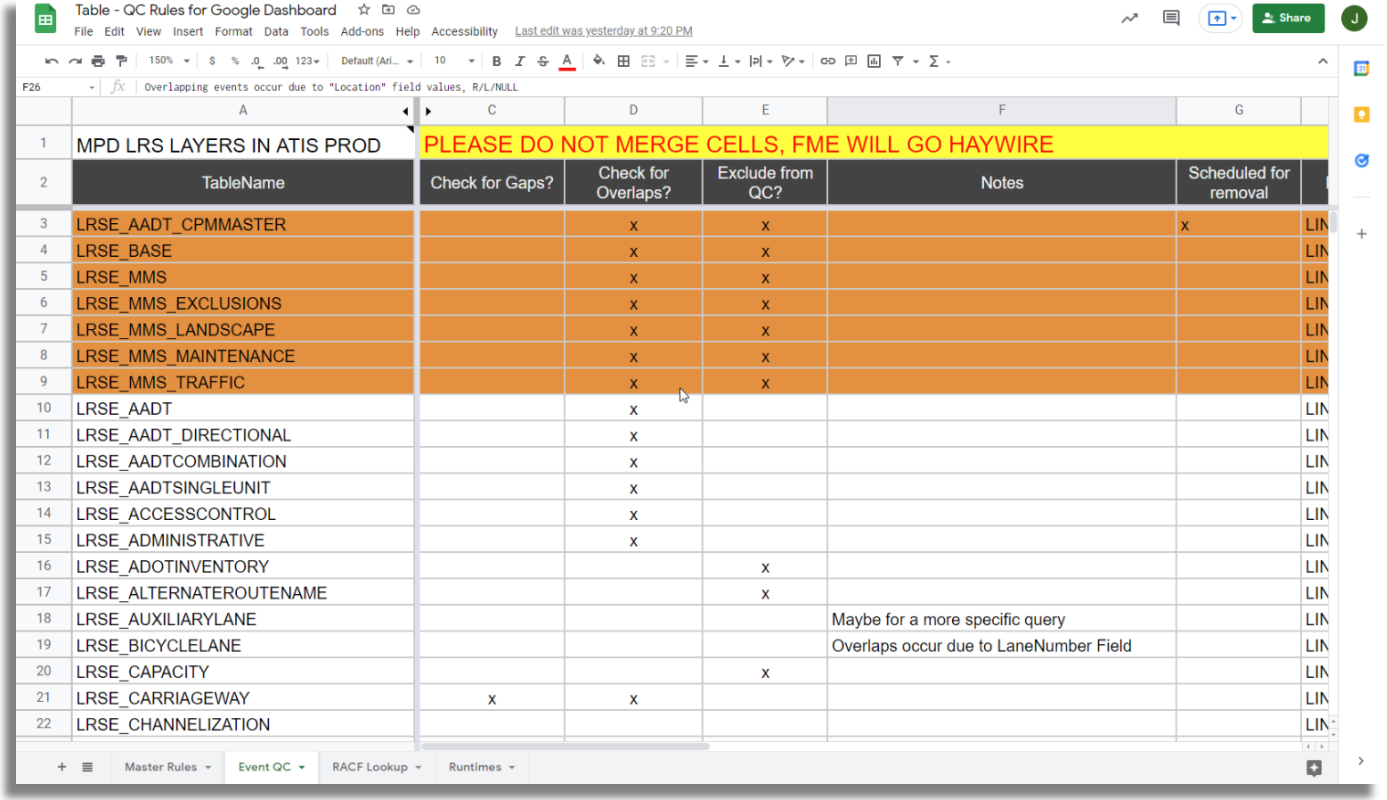


Table - QC Rules for Google Dashboard

File Edit View Insert Format Data Tools Add-ons Help Accessibility Last edit was yesterday at 9:20 PM

Share

F26: Overlapping events occur due to "Location" field values, R/L/NULL

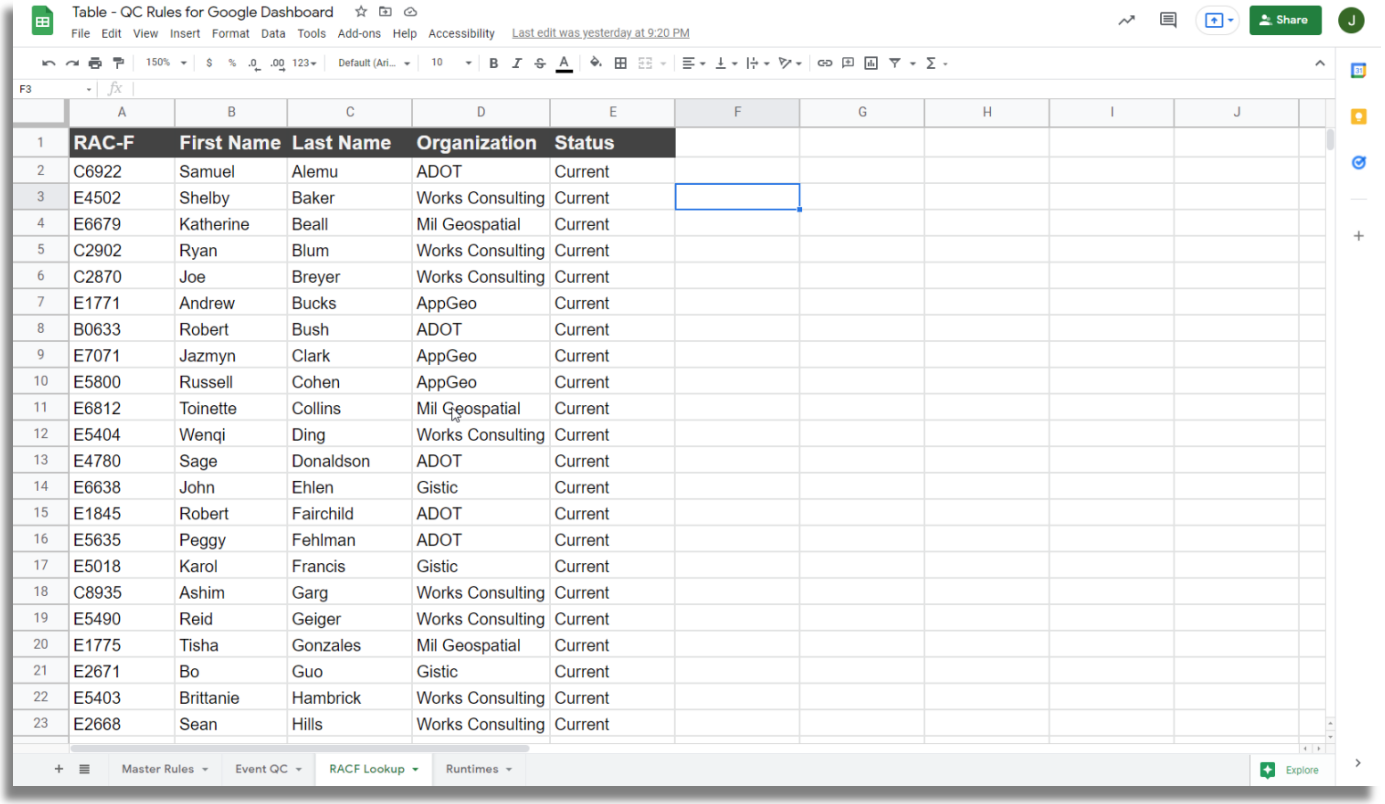
	A	C	D	E	F	G
1	MPD LRS LAYERS IN ATIS PROD	PLEASE DO NOT MERGE CELLS, FME WILL GO HAYWIRE				
2	TableName	Check for Gaps?	Check for Overlaps?	Exclude from QC?	Notes	Scheduled for removal
3	LRSE_AADT_CPMMASTER		x	x		x
4	LRSE_BASE		x	x		
5	LRSE_MMS		x	x		
6	LRSE_MMS_EXCLUSIONS		x	x		
7	LRSE_MMS_LANDSCAPE		x	x		
8	LRSE_MMS_MAINTENANCE		x	x		
9	LRSE_MMS_TRAFFIC		x	x		
10	LRSE_AADT		x			
11	LRSE_AADT_DIRECTIONAL		x			
12	LRSE_AADTCOMBINATION		x			
13	LRSE_AADTSINGLEUNIT		x			
14	LRSE_ACCESSCONTROL		x			
15	LRSE_ADMINISTRATIVE		x			
16	LRSE_ADOTINVENTORY			x		
17	LRSE_ALTERNATEROUTENAME			x		
18	LRSE_AUXILIARYLANE				Maybe for a more specific query	
19	LRSE_BICYCLELANE				Overlaps occur due to LaneNumber Field	
20	LRSE_CAPACITY			x		
21	LRSE_CARRIAGEWAY	x	x			
22	LRSE_CHANNELIZATION					

Master Rules | Event QC | RACF Lookup | Runtimes

Google Drive

Event QC Rules

Dynamic Parameters

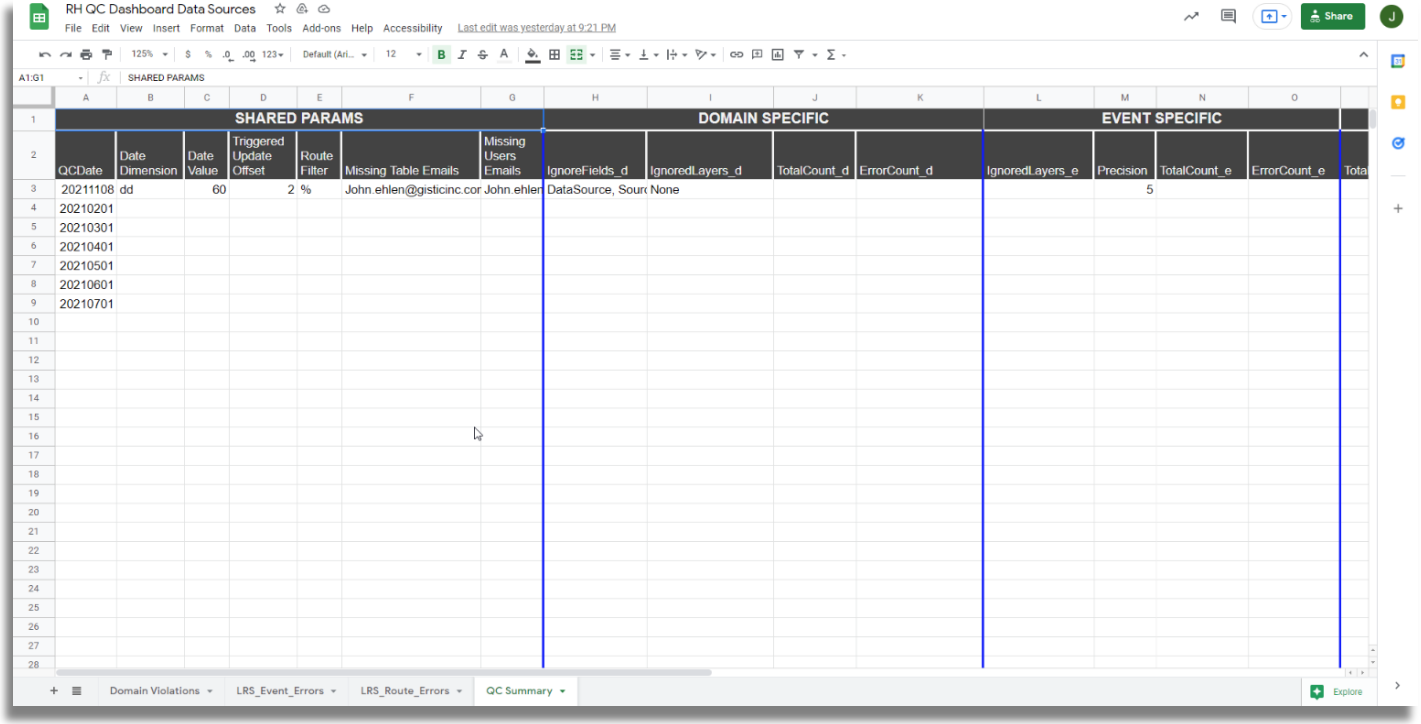


	A	B	C	D	E	F	G	H	I	J
1	RAC-F	First Name	Last Name	Organization	Status					
2	C6922	Samuel	Alemu	ADOT	Current					
3	E4502	Shelby	Baker	Works Consulting	Current					
4	E6679	Katherine	Beall	Mil Geospatial	Current					
5	C2902	Ryan	Blum	Works Consulting	Current					
6	C2870	Joe	Breyer	Works Consulting	Current					
7	E1771	Andrew	Bucks	AppGeo	Current					
8	B0633	Robert	Bush	ADOT	Current					
9	E7071	Jazmyn	Clark	AppGeo	Current					
10	E5800	Russell	Cohen	AppGeo	Current					
11	E6812	Toinette	Collins	Mil Geospatial	Current					
12	E5404	Wenqi	Ding	Works Consulting	Current					
13	E4780	Sage	Donaldson	ADOT	Current					
14	E6638	John	Ehlen	Gistic	Current					
15	E1845	Robert	Fairchild	ADOT	Current					
16	E5635	Peggy	Fehlman	ADOT	Current					
17	E5018	Karol	Francis	Gistic	Current					
18	C8935	Ashim	Garg	Works Consulting	Current					
19	E5490	Reid	Geiger	Works Consulting	Current					
20	E1775	Tisha	Gonzales	Mil Geospatial	Current					
21	E2671	Bo	Guo	Gistic	Current					
22	E5403	Brittanie	Hambrick	Works Consulting	Current					
23	E2668	Sean	Hills	Works Consulting	Current					

Google Drive

Event QC Rules

Data Store



Google Drive

RH QC Dashboard Data Sources

Dashboard Live Demo

Future Evolution…?

Questions For Esri/Community

1. Enhancements to tabular visualizations in AGOL dashboard?
    a. LRS-Centric AGOL reporting?

2. Additional Functionality in ArcGIS Insights?
    a. on-the-fly DynSeg
    b. Linear Mileage summarization by district/boundary

3. What are other agencies doing to visualize data for non-spatial customers?

4. What types of route edits trigger cascading event edits?
    a. Geometry and/or attributes?
    b. Time delay for route edits to propagate to events?

Contact Info

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from Ryan Koschatzky to everyone: 12:33 PM
https://community.esri.com/groups/roads-and-highways-user-group-rhug
from Shaun Perfect to everyone: 12:47 PM
Quick question about the intersection referents - will the intersection tool still find and give the measurements for all intersecting routes or will it only give one intersecting route measure per intersection after this change is implemented?
from Ryan Koschatzky to everyone: 12:48 PM
What database are you using?
Oracle 8
SQL Server 26
PostGres 1
from Ryan Koschatzky to everyone: 12:48 PM
Has anyone prepopulated existing events with referent offset information?
Yes 9
No 14
from Ryan Koschatzky to everyone: 12:49 PM
Future Pro presentation?
Yes 1
No 10
Maybe 6
from Amit Hazra to everyone: 12:49 PM
The endpoint for server changes from LRSServer to LRServer. (Find and Replace)
from Elsit Mandal to everyone: 12:49 PM
Is the RouteConcurrency Tool be in ArcPro in the next release or later?
from Nicole Hanson to everyone: 12:50 PM
YES PLEASE - Hands on learning!
from Ryan Koschatzky to everyone: 12:50 PM
Yes, to Pro lab at GIS-T
from Lesh, Erin A to everyone: 12:50 PM
yes!
from Sam Coldiron to everyone: 12:50 PM
Yes for lab!
from Ryan Blum to everyone: 12:50 PM
Yes for Lab
from Shaun Perfect to everyone: 12:51 PM
Yes, to Pro lab at GIS-T
from Amit Hazra to everyone: 12:53 PM
@Yelena - noted. We will consider different learning tracks for the HOLL.
from Shaun Perfect to everyone: 12:55 PM
For our business needs (i.e. saftey) it is very important that we have all measures for intersections for all routes so I'm glad to hear that you are working on that. Thanks Nathan!
from Tom Brenneman to everyone: 12:56 PM
Does the geometry to measure web service call allow you to just return the closest route vs. all routes within the tolerance?
from Kevin Hunt to all panelists: 12:56 PM
Erin, Ryan, Patrick, I would like to begin sharing our experiences with the AgileAssets integration via GeoNet. Let me know if you have thoughts on where and how I could do that most effectively.
from brian bieber to everyone: 12:57 PM

yeah!!
from Tom Brenneman to everyone: 12:57 PM
Woohoo!
from Yueming Wu to everyone: 12:57 PM
nice!
from Amit Hazra to everyone: 12:58 PM
@TB great question. Good to hear from you.
from Ryan Koschatzky to everyone: 1:01 PM
I will look Kevin. I am not sure we can have different areas like before. Maybe we can add a label (aka tag) for searching later.
from Amit Hazra to everyone: 1:07 PM
ArcGIS provides a user interface for Data Reviewer. You can also configure attribute rules and validations and use the ArcGIS Error Inspector to visualize errors.
from Amit Hazra to everyone: 1:18 PM
Re: ArcGIS doesn't constrain users. Please review Geodatabase Attribute Rules - Constraints: https://pro.arcgis.com/en/pro-app/latest/help/data/geodatabases/overview/constraint-attribute-rules.htm
from Michael Clement to everyone: 1:23 PM
@Amit/Nathan. This presentation looks like another process that benifits from the editable version views. At Iowa we are hesitant at going to Pro and Branch Versioning since the EVW are going away. Is there any chance these can be added to the Branch Versioning mode?
from brian bieber to everyone: 1:24 PM
agree with Michael Clement
from Amit Hazra to everyone: 1:26 PM
I can't speak to the underlying VMS architecture. I can say that migrating to Pro will likely depracate many of these creative validation methods since you'll be able to leverage underlying attribute rule logic to constrain, calculate, and validate.
from Ryan Koschatzky to everyone: 1:27 PM
I think ROW might be the only event that might have valid short segements depending on the event is captured.
from Nathan Easley to everyone: 1:29 PM
@ John, Did you investigate Insights at all or did you only look at ArcGIS Online?
from Kevin Munro to everyone: 1:33 PM
INDOT is also batching FME with task scheduler but we were able to get an IT security exception to allow 2 GIS staffers to get these rights.
from Nicole Hanson to everyone: 1:41 PM
Do you send the event errors to those event owners to fix? Do they have access to this dashboard to see what errors they need to fix? Can they run data reviewer themselves?
from Nicole Hanson to everyone: 1:49 PM
ITD uses Roadway Reporter and Data Reviewer to help with looking at data.
from Nicole Hanson to everyone: 1:51 PM
Yelena - I'm sending you a message :)
from Amit Hazra to everyone: 1:53 PM
@Yelena - good question. At 2.9/10.91 all the capabilities of the classic version of R&H has been built out. The future for our product enhancements is Pro-based LRS services. Since you are beginning your implementation and do not need to worry about any legacy R&H process, we would recommend you go directly to ArcGIS Pro/Enterprise.
from John Ehlen to everyone: 1:58 PM

@Amit Hazra: You are correct about Pro doing most of these checks. We hope to utilize the features in Pro once ADOT migrates to Pro.
from Sam Coldiron to everyone: 1:58 PM
Thank you!
from Jean Hannon to everyone: 1:58 PM
thank you