

Network for Success
Local Programs Workshop



Designing Today with an Eye on Tomorrow

Breakout Session # 3

September 10, 2019

Moderator – Paul Trapp

Director of Infrastructure Services, Timmons Group

Network for Success

Local Programs Workshop



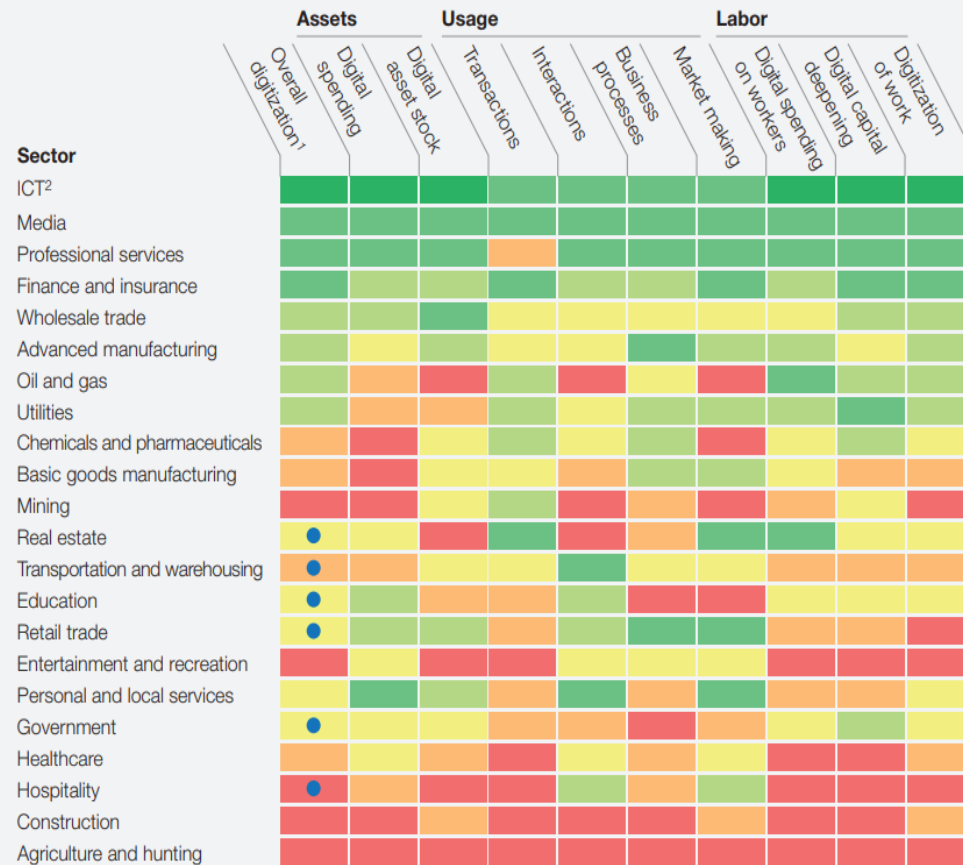
Tablet Based Inspection

Ian Millikan, P.E.
Assistant State Construction Engineer
Virginia Department of Transportation

Exhibit 3 **The construction industry is among the least digitized.**

McKinsey Global Institute industry digitization index;
2015 or latest available data

Relatively low digitization  Relatively high digitization
● Digital leaders within relatively undigitized sectors



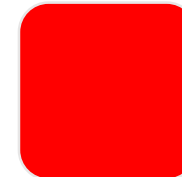
¹Based on a set of metrics to assess digitization of assets (8 metrics), usage (11 metrics), and labor (8 metrics).

²Information and communications technology.

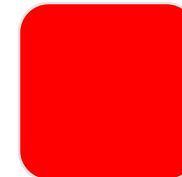
Source: AppBrain; Bluewolf; Computer Economics; eMarketer; Gartner; IDC Research; LiveChat; US Bureau of Economic Analysis; US Bureau of Labor Statistics; US Census Bureau; McKinsey Global Institute analysis

The Construction Industry in a Digital World

Construction Assets



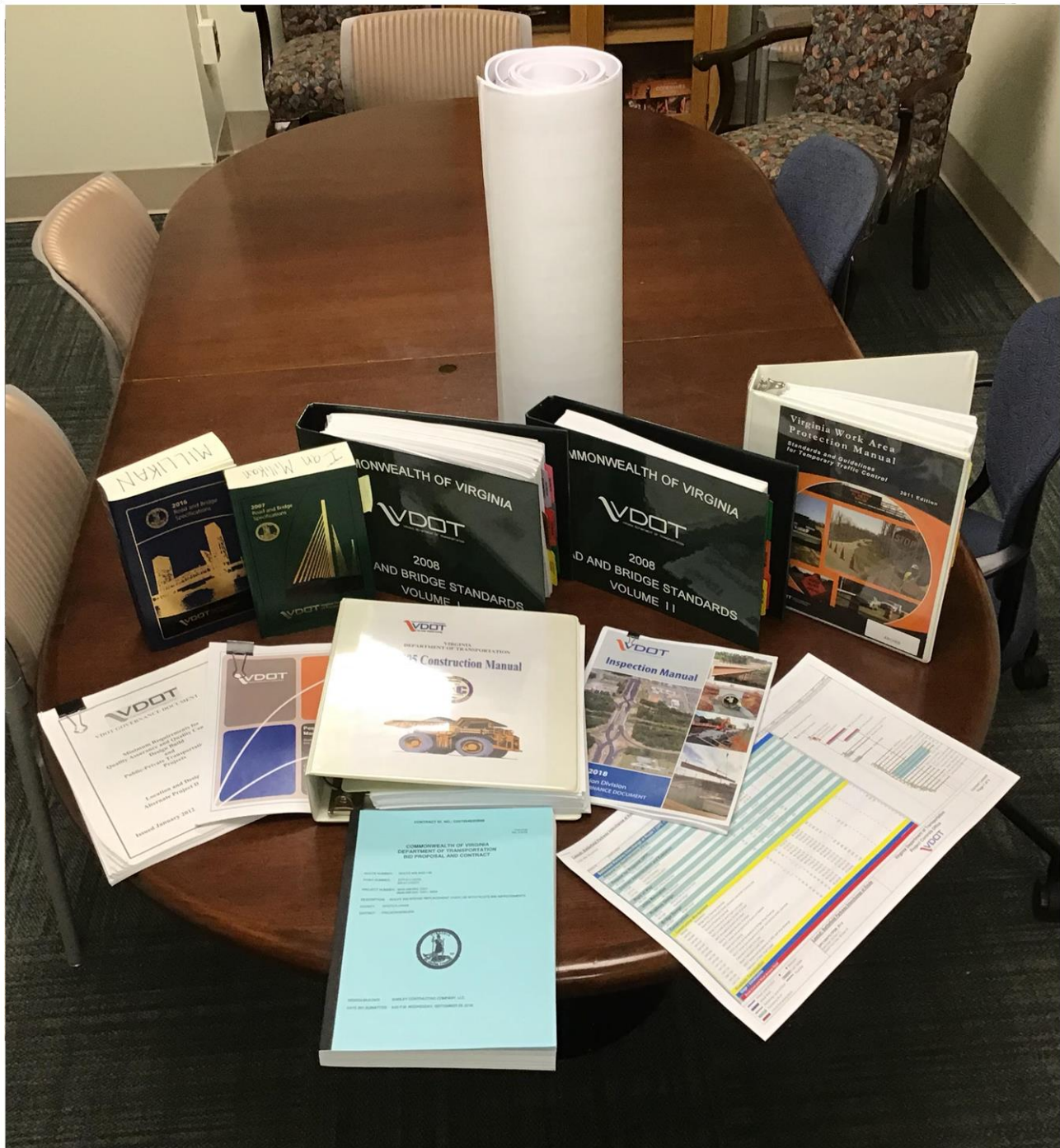
Overall digitization



Digital spending



Digital asset stock



Bringing iPads onto the construction site



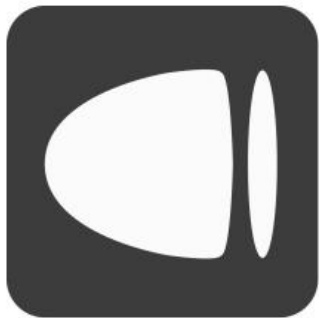
Reasons Tablet Based Inspection Makes Sense

- Reduced printing costs
- Immediate access to project documents in a searchable PDF format
 - Plans
 - Contract
 - Reference documents
- Improved collaboration, coordination, and communication
 - Owner to Contractor
 - Field to Office

Apps VDOT is testing for Construction Inspection



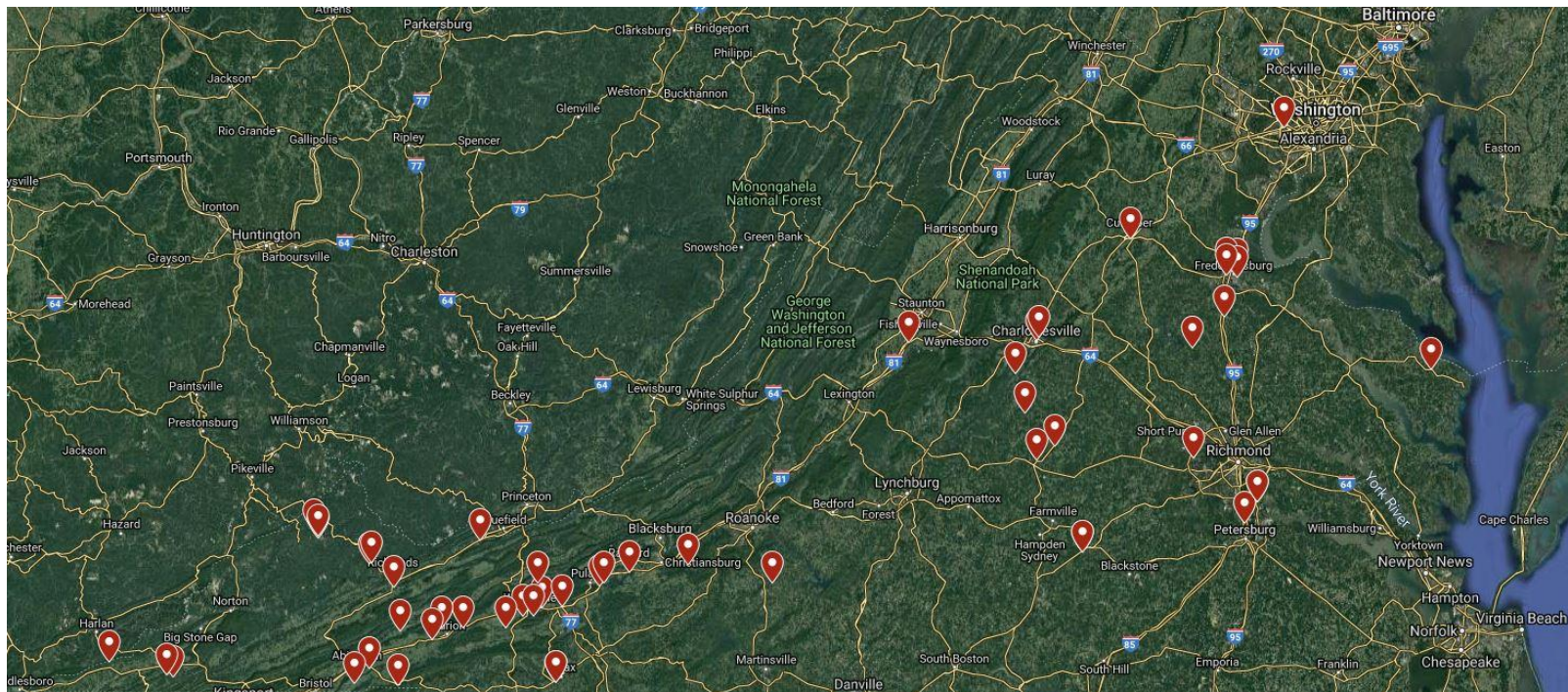
PlanGrid



HEADLIGHT®
paviasystems



PlanGrid



50

Projects

75

Participants

8

Districts



PlanGrid

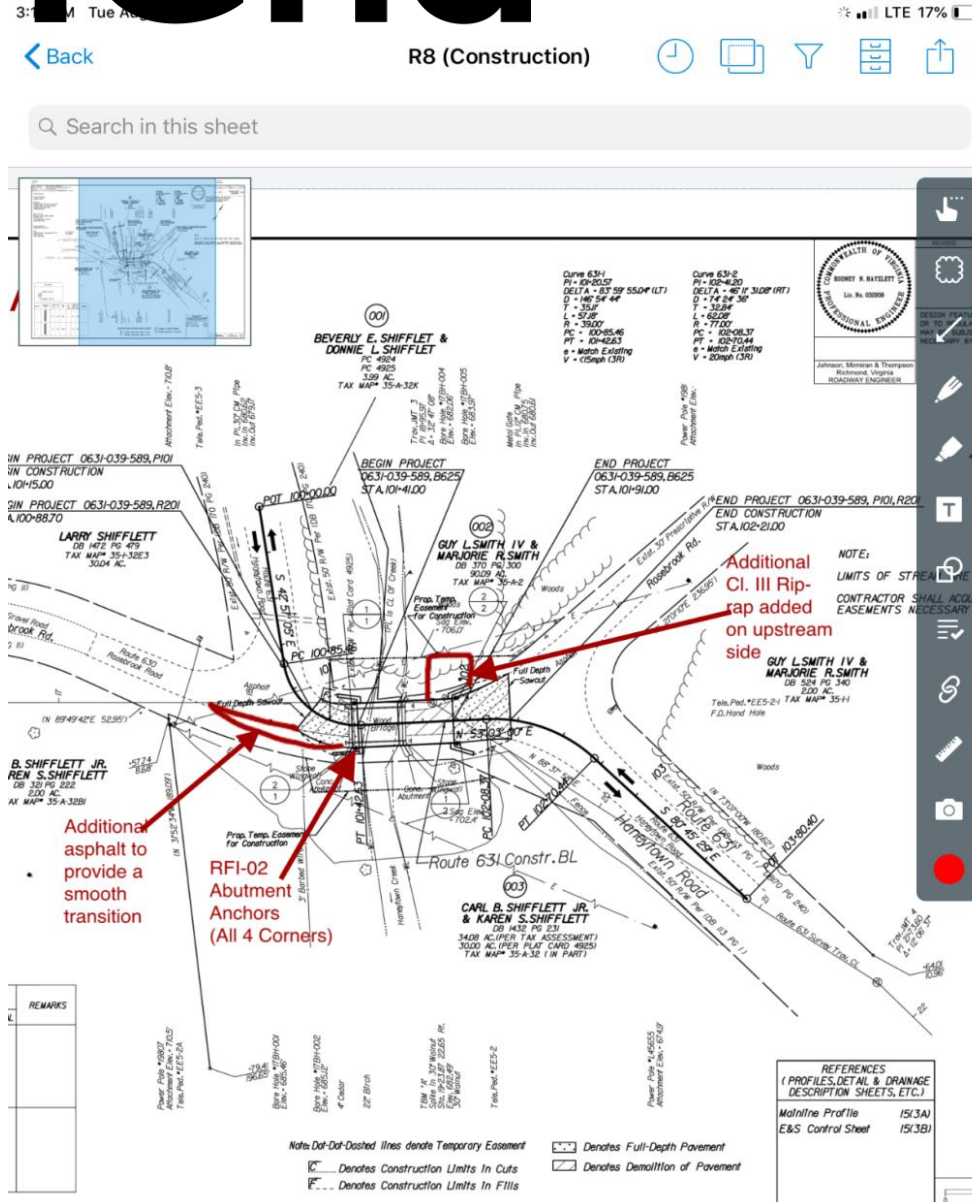
- Review and mark up plans
- Access project documents
- Search and filter plan sheets
- Take progress photos and tag them to the plans
- Identify issues, assign responsible parties, and track resolutions
- Collaborate with design team instantly
- ~~Complete daily diaries~~





PlanGrid

Review and mark up plans



— Arrow Tool

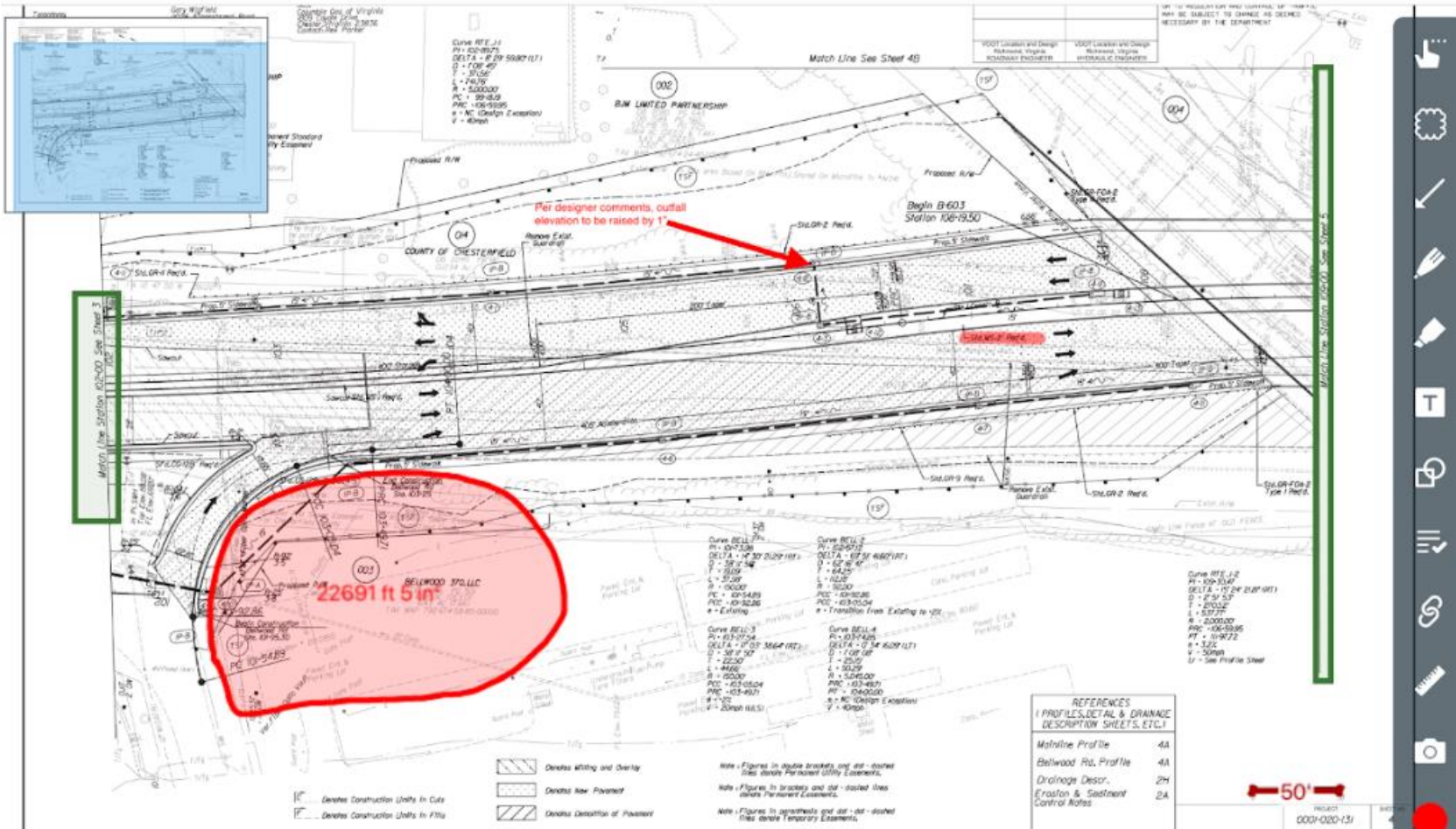
— Text Tool



PlanGrid

Review and mark up plans

Search in this sheet



— Highlight Tool

— Measurement Tool

Undo

Redo

3 Related



PlanGrid

Access project documents

11:21 AM Thu Aug 8

Projects

Documents

Folders

List all documents

All Documents

Reference Docs

- Inspection_Manual.pdf
- Post Construction Manual.pdf
- Virginia Test Manual.pdf
- WorkZoneSafetyChecklist_Instructions.pdf

Standard Manuals

- 2016_RB_Standards_Vol_1.pdf 49
- 2016_RB_Standards_Vol_2.pdf

Standard Specifications

- 2007 Road and Bridge Specs.pdf
- 2016 Road and Bridge Specs.pdf**
- 2018 Supplement to the 2016 Specifications.pdf

LTE 64%

2016 Road and Bridge Specs

608.01—Description

This work shall consist of mowing designated areas to a height of not less than 4 inches, and shall be directed by the Engineer until final acceptance.

608.02—Equipment

Equipment used for mowing operations shall be mechanical with a cutting width of not less than 42 inches, and shall be otherwise restricted by access limitations. Mowing equipment operators shall load, unload, temporarily store, and safely operate equipment according to Section 608.03—Measurement and Payment

608.03—Measurement and Payment

Mowing, when a pay item, will be measured in hours of operation and will be paid at the rate of \$ per hour. This price shall include furnishing equipment, operators, fuel, lubricants, and maintenance, and shall include traffic control including signs and warning devices.

Maintenance of traffic costs will be considered incidental to mowing operations.

Payment will be made under:

Pay Item	Pay Unit
Mowing	Hour

SECTION 609—TREE WELLS AND TREE WALLS

609.01—Description

This work shall consist of constructing wells and walls to protect the root system of trees and other woody plants at the locations shown on the Plans or as designated by the Engineer. Tree walls shall conform to the details shown in the Standard Drawings or as otherwise shown in the Plans.

609.02—Materials

(a) Aggregate shall conform to Section 203.

(b) Polyvinyl chloride (PVC) pipe shall conform to Section 232(g).

(c) Geotextile fabric shall conform to Section 204.

(d) Stone for rubble masonry shall conform to Section 204.

833 of 1,091

tree well

Page 23

789 SECTION 609—TREE WELLS AND TREE WALLS 789

609.01—Description 789

Page 833

SECTION 609—TREE WELLS AND TREE WALLS 609.01—Description

This work shall consist of constructing wells and walls to protect the root system of trees, shrubs,

Page 833

by the Engineer. Tree wells and Tree walls shall conform to the details shown in the Standard Drawings or as otherwise shown in the Plans. 609.02—Materials

Page 834

for constructing tree wells and tree walls in a manner that will not damage the root system of the

8 matches found

Sheets

Documents

Tasks

Field Reports

Team

More



PlanGrid

Search and Filter Plan Sheets

Try searching for 'door', 'floor', or 'wall'

Abutment

5:08 PM Thu Aug 8

Projects

Found in sheet 228 sheets

000000
Sheet Numbering/...

E-0

E-1

Rock 1

E-4

E-5

E-6

E-9

E-10

E-11

E-14

E-15

E-16

E-19

E-20

E-21

E-24

E-25

E-26

GreatBridge-0
8 matches

GreatBridge-1
12 matches

GreatB
10 matches

GreatBridge-5
8 matches

GreatBridge-6
5 matches

GreatBr
4 matches

GreatBridge-16
4 matches

GreatBridge-19
4 matches

GreatBr
1 match

GreatBridge-39
2 matches

GreatBridge-41
2 matches

GreatBr
1 match

HighRise-6
2 matches

HighRise-8
10 matches

Hig
9 matches

1 match

5 matches

2 matches

000000
Sheet Numbering/Tagging C...

E-3

E-4

E-0

E-4

E-3

E-4

E-0

E-4

E-3

E-4

E-0

E-4

Filters

Clear

bridge

581

cross-section

30

e&s

24

e&s phase 1

43

e&s phase 2

43

general

8

geotech

99

greatbridge

48

highrise

315

information

1

its

207

Sheets

Documents

Tasks

Field Reports

Sheets

Documents

Tasks

Sheets

Documents

Tasks

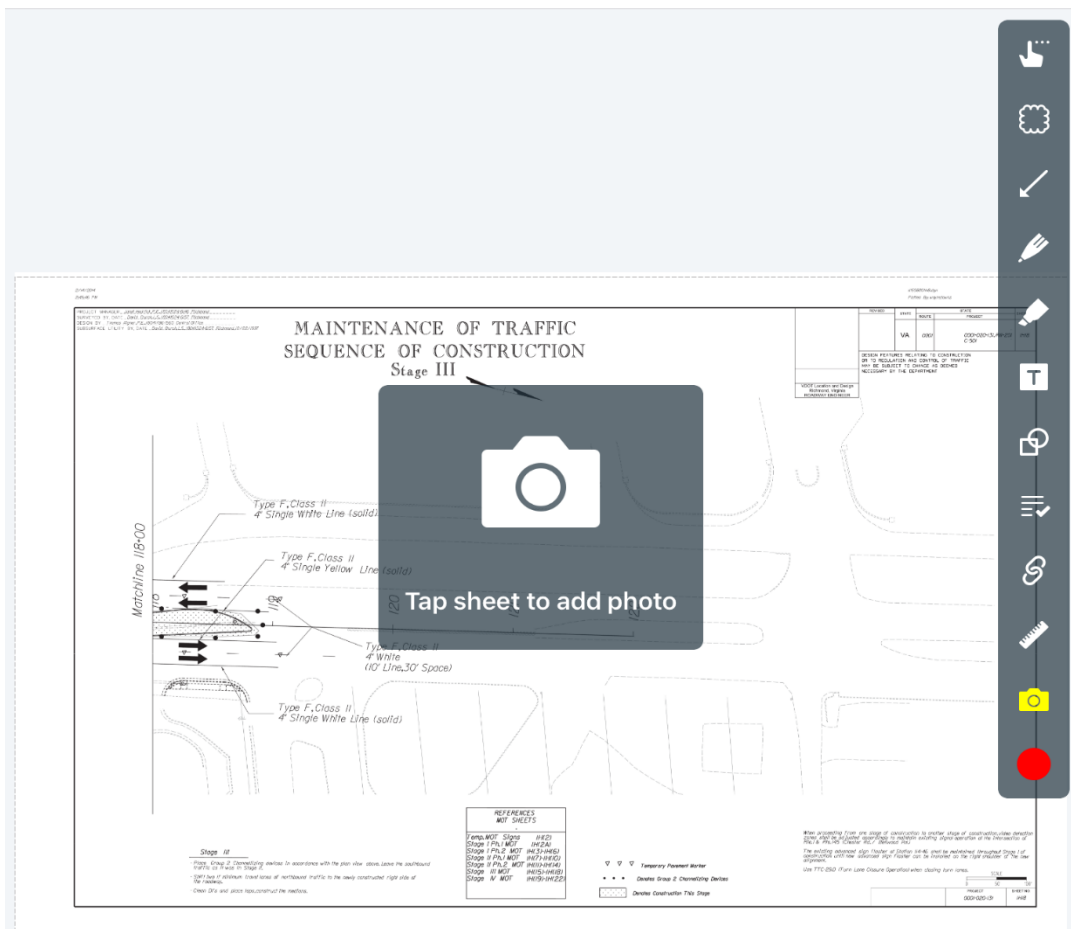
Field Reports



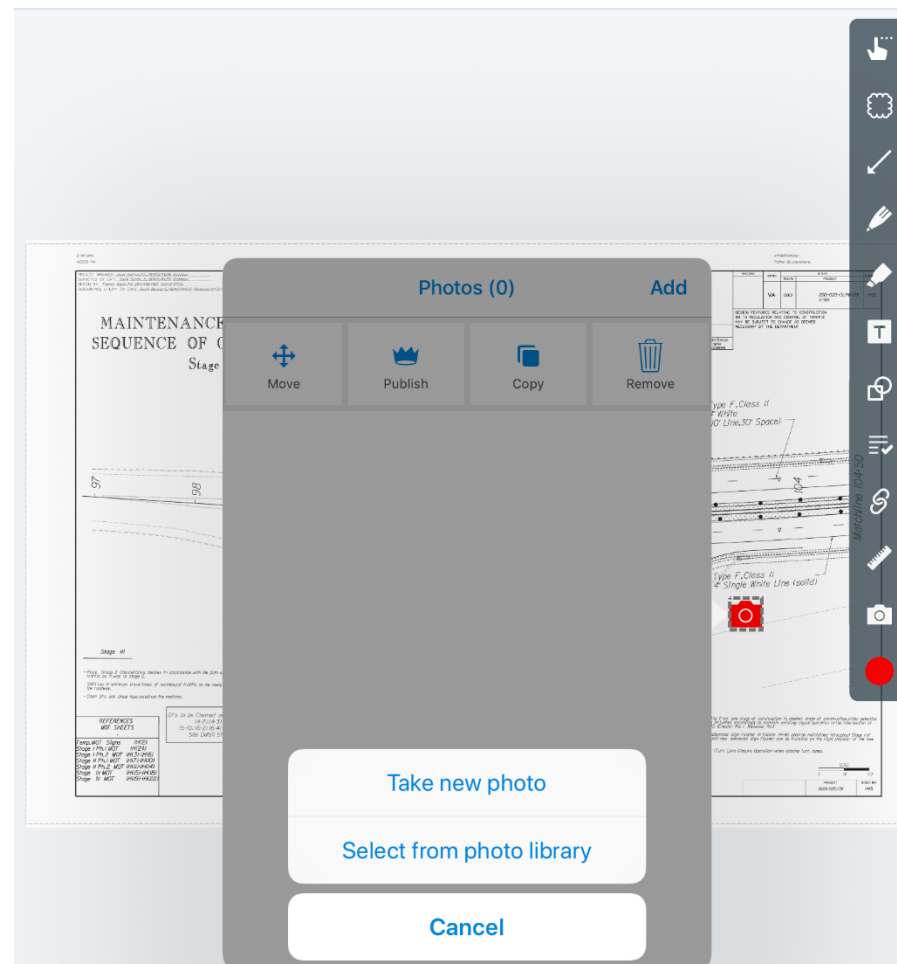
PlanGrid

Take progress photos and tag them to the plans

Search in this sheet



Search in this sheet

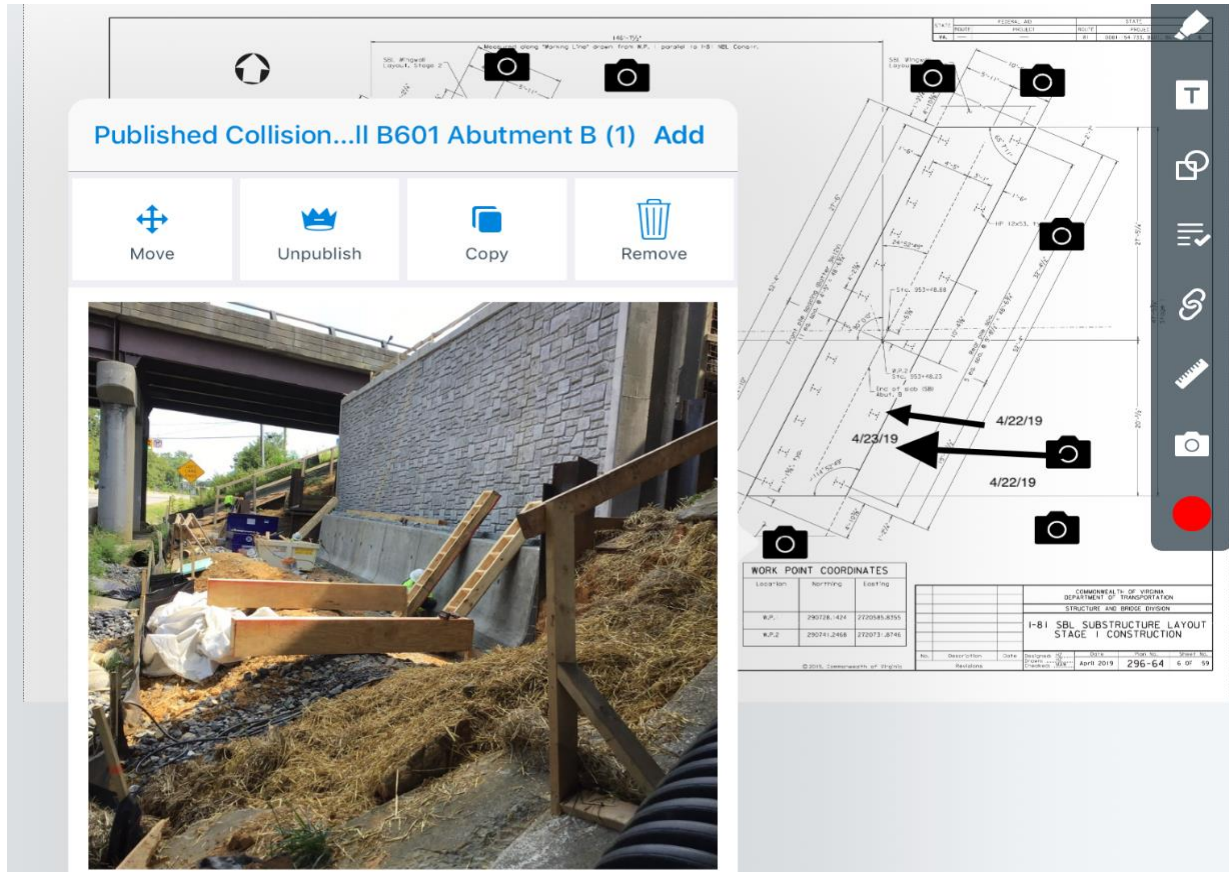
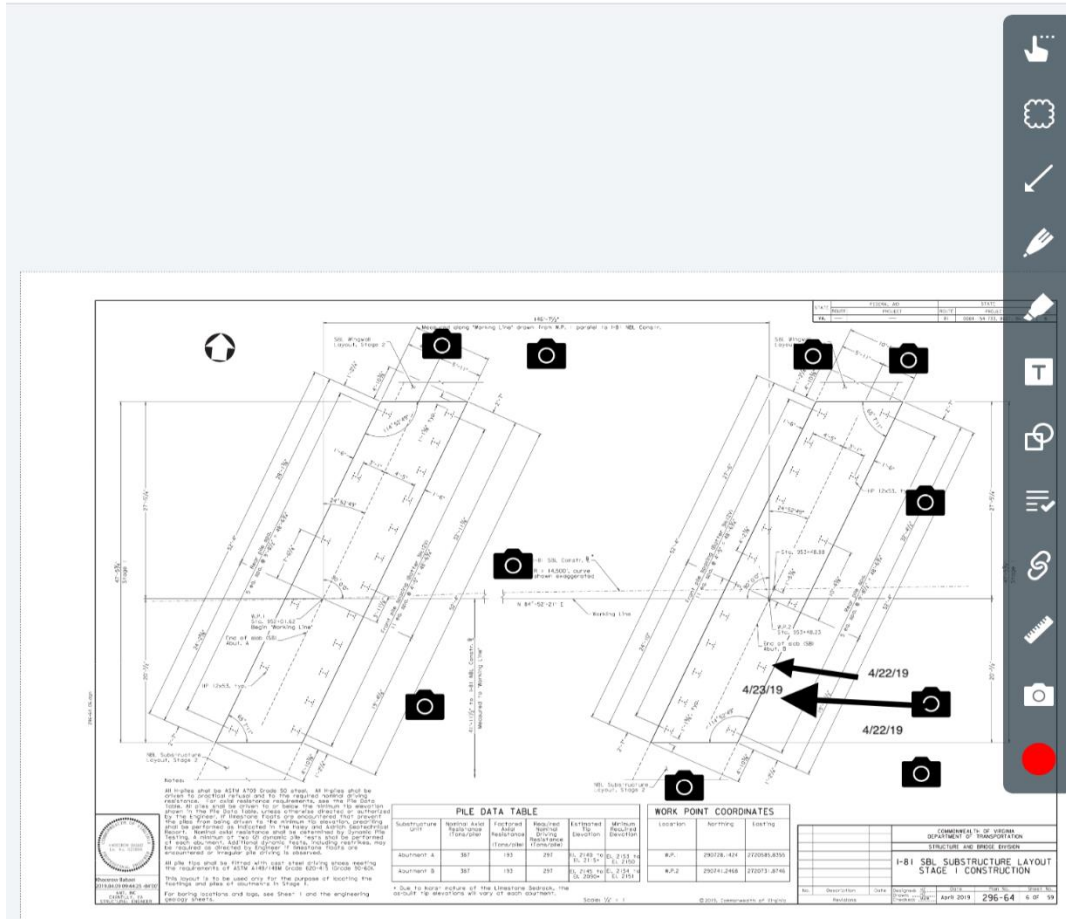




PlanGrid

Take progress photos and tag them to the plans

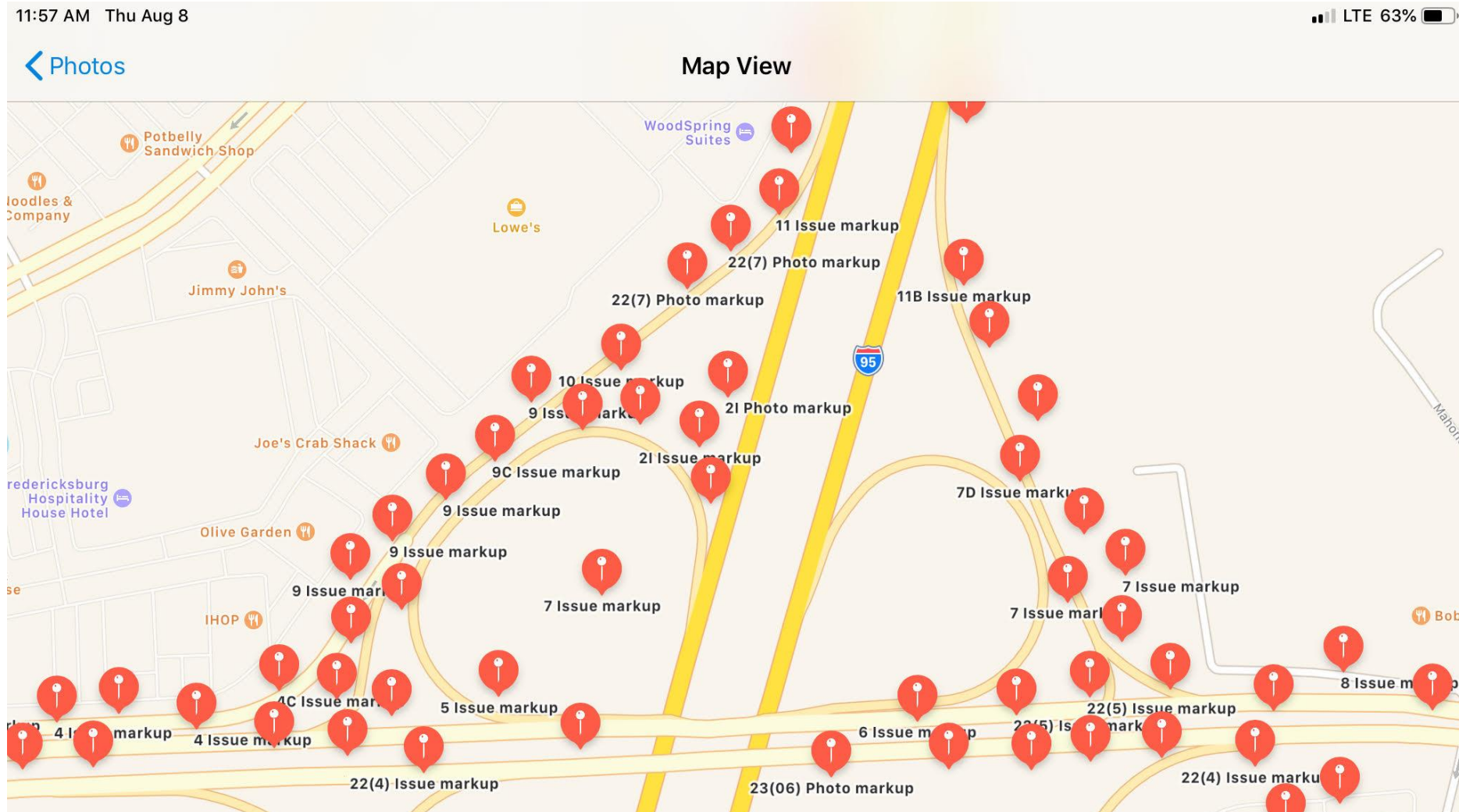
Search in this sheet





PlanGrid

Take progress photos and tag them to the plans





PlanGrid

Identify issues, assign responsible parties, and track resolutions

12:46 PM

LTE 61%

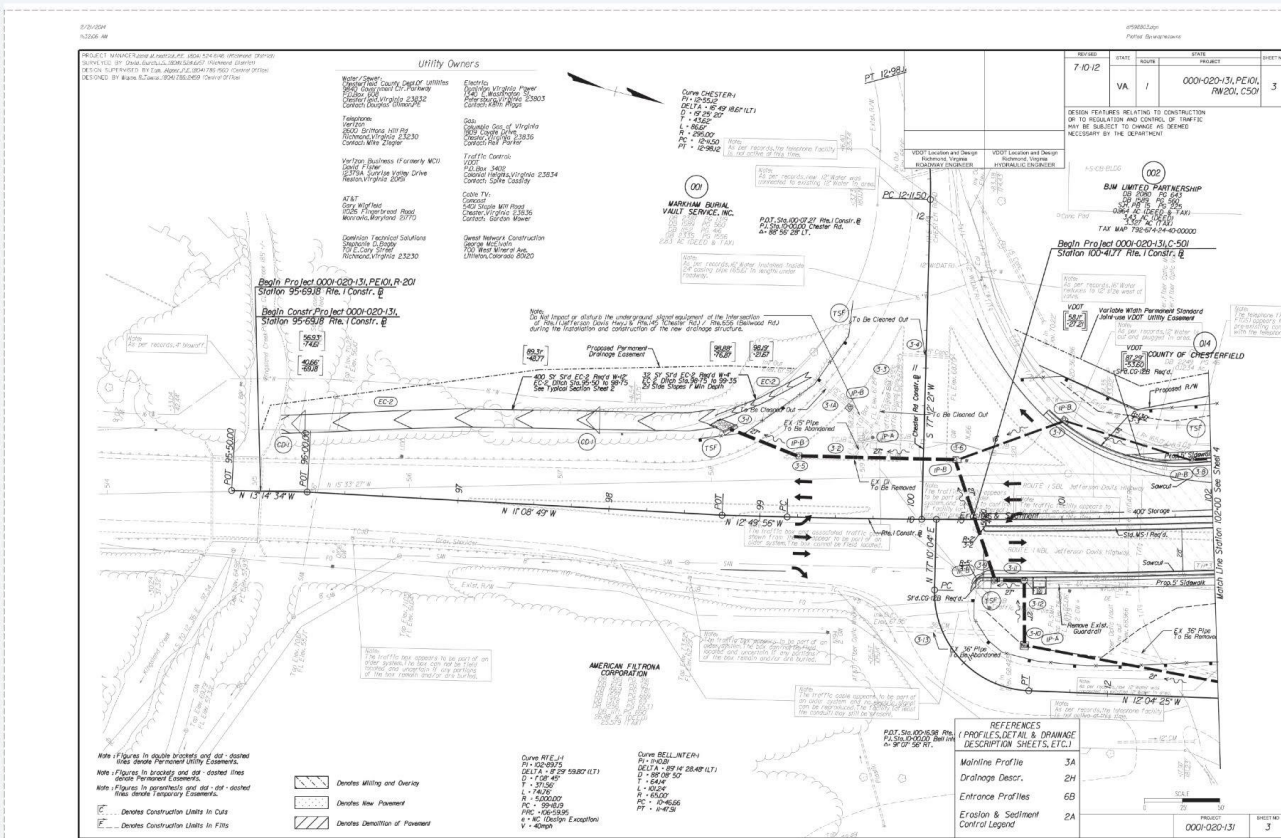
< 000000 - Ben's practice project

45 (V1)



Search in this sheet

Search in this sheet



Tasks

New

- ☒ General
- ☐ ALL TASKS
- ☐ Constructibility
- ☐ Bridge Concrete
- ☐ Bridge - Miscellaneous
- ☐ Bridge Steel
- ☐ General Comment

MAINTENANCE OF TRAFFIC
SEQUENCE OF CONSTRUCTION
Stage III

Matchline 118+00

Type F, Class II
4" Single White Line (solid)

Type F, Class II
4" Single Yellow Line (solid)

Type F, Class II
4" White (10' Line, 30' Space)

Type F, Class II
4" Single White Line (solid)

Stage III

Temporary Pavement Marker

Draw Construction Time Step



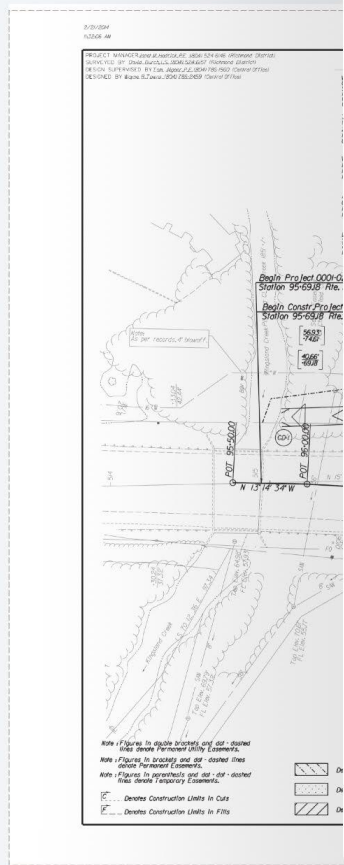
PlanGrid

Identify issues, assign responsible parties, and track resolutions

12:51 PM Thu Aug 8

< 000000 - Ben's practice project

Q Search in this sheet



45 (V1)

Task

Constructibility



Move



Publish



Copy

Status Open

Type Issue

Assigned to Abraham Lincoln

Watching Abraham Lincoln + 1

Location Select location

Start date Sep 1, 2019

Due date Sep 8, 2019

Stamp Constructibility

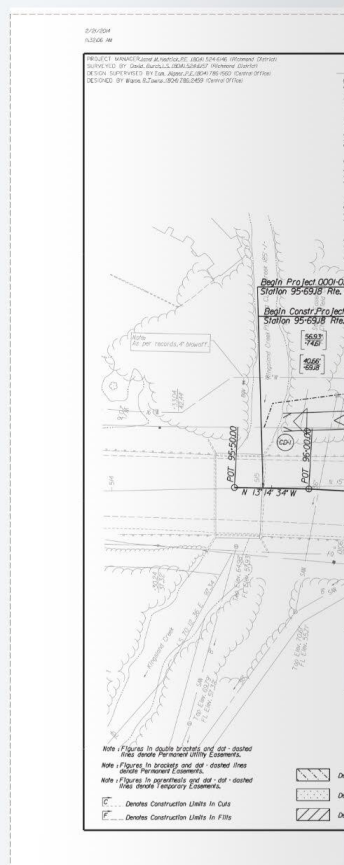
List Unlisted

Sheet 45

12:56 PM Thu Aug 8

< 000000 - Ben's practice project

Q Search in this sheet



45 (V1)

Task

List Unlisted

Sheet 45

Description

Curb and gutter at tie in is not constructable. Need plan revision.

Comments

No one's said anything yet...

Start a conversation.

REFERENCES



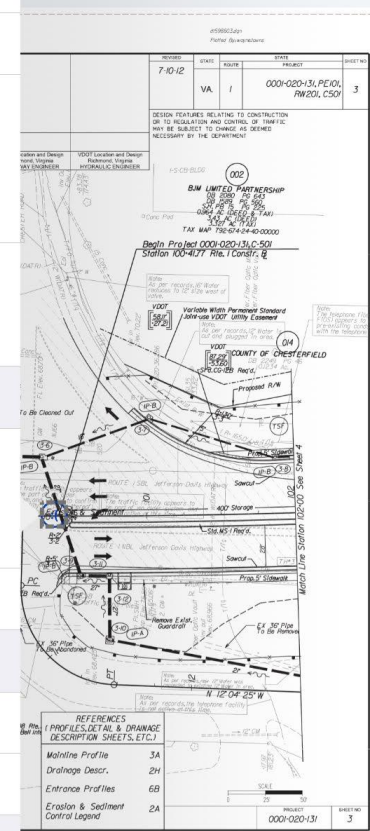
Add photo

IMPACT

Cost impact

Schedule impact

MORE





PlanGrid

Collaborate with design team instantly

9:53 AM Thu Aug 8

< Back

B-10 (UPC 86442 Bid Let)

Search in this sheet

Drilled Shaft Reinforcing (1)

Add



Move



Publish



Copy



Remove



#10 Hook Bar Left Out



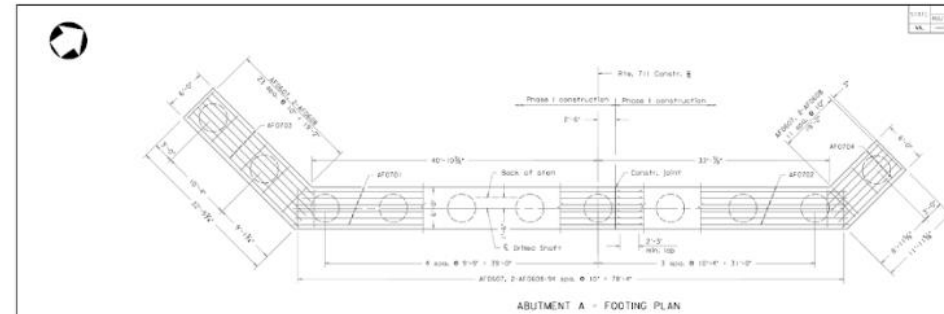
Undo Redo

9:52 AM Thu Aug 8

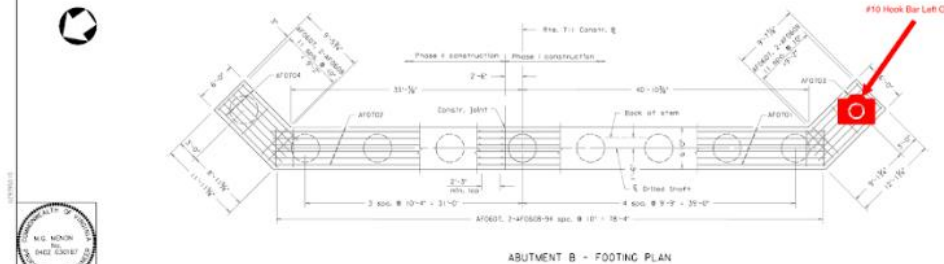
< Back

B-10 (UPC 86442 Bid Let)

Search in this sheet



ABUTMENT A - FOOTING PLAN



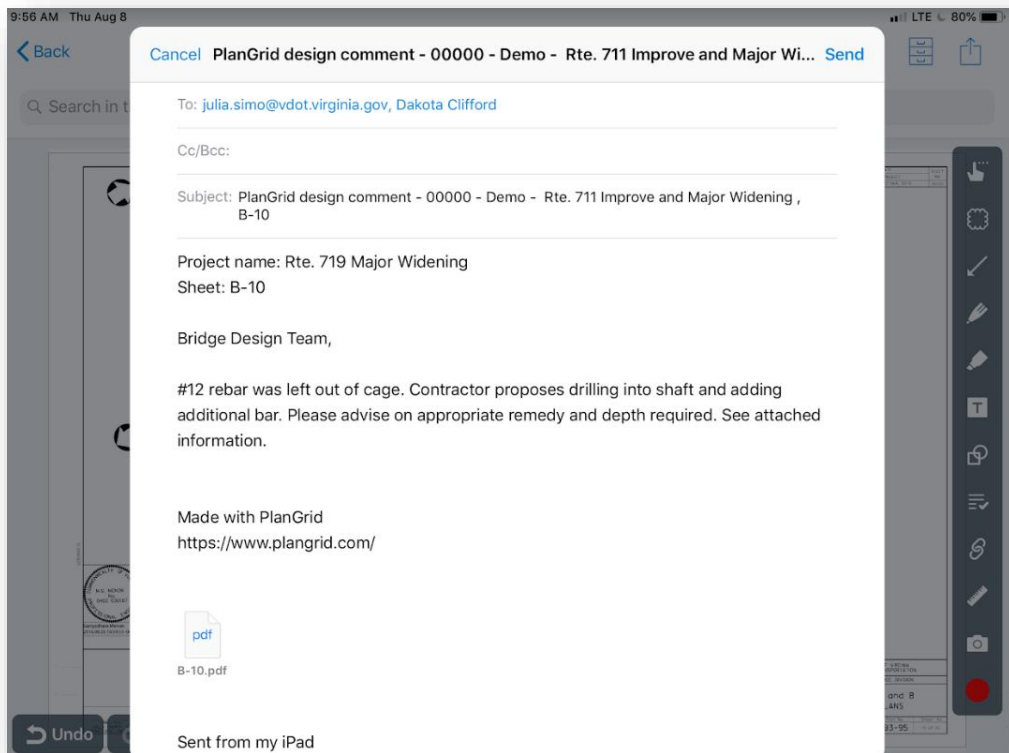
ABUTMENT B - FOOTING PLAN

COMMUNITY OF VICTORIA DEPARTMENT OF TRANSPORTATION STRUCTURE AND BRIDGE DIVISION			
ABUTMENT A and B FOOTING PLANS			
No.	Revision	Date	Drawn By
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57			
58			
59			
60			
61			
62			
63			
64			
65			
66			
67			
68			
69			
70			
71			
72			
73			
74			
75			
76			
77			
78			
79			
80			
81			
82			
83			
84			
85			
86			
87			
88			
89			
90			
91			
92			
93			
94			
95			
96			
97			
98			
99			
100			

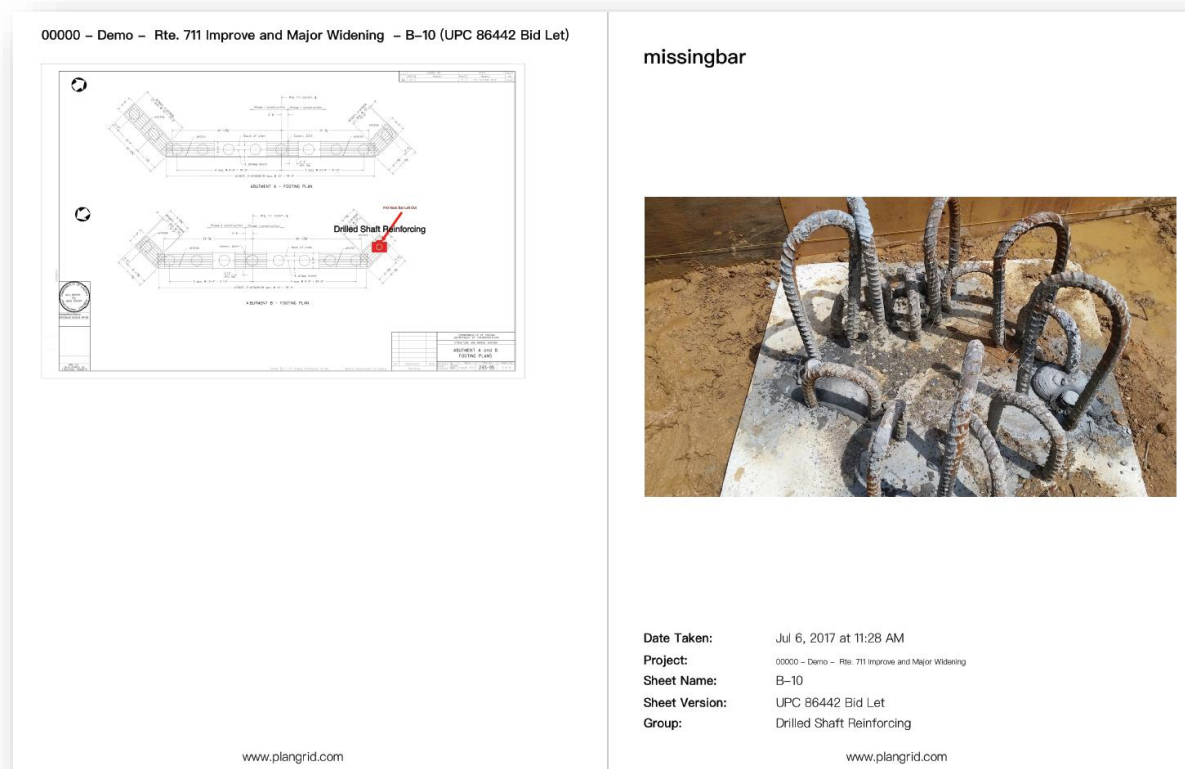


PlanGrid

Collaborate with design team
instantly



Email sent directly from PlanGrid



PDF Package generated by PlanGrid.



PlanGrid

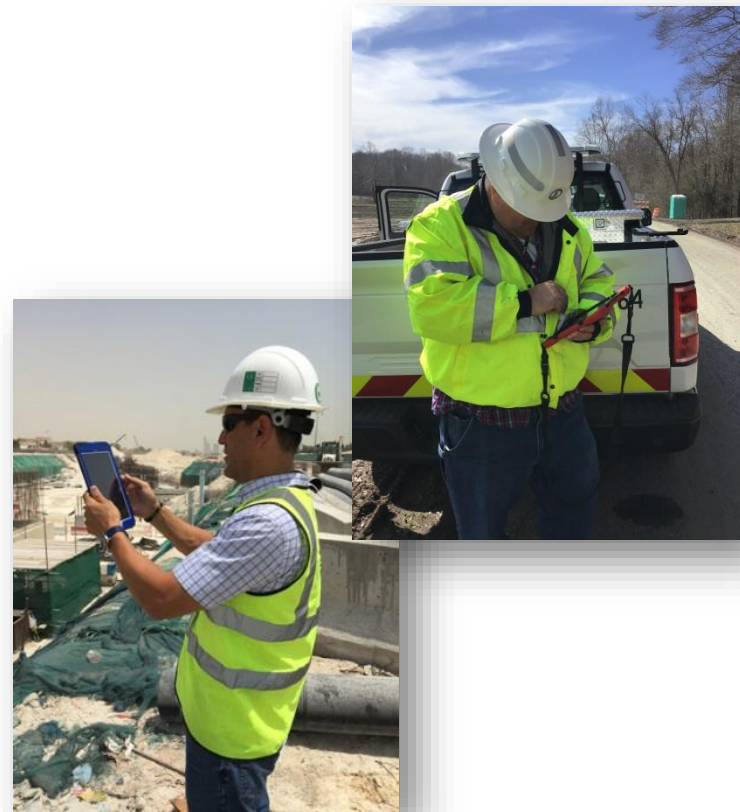
Pilot Study Results

94%

Users say PlanGrid makes them more efficient

87%

Users view plans more frequently because of PlanGrid





PlanGrid

Pilot Study Results

3.6

Average Total hours/week saved

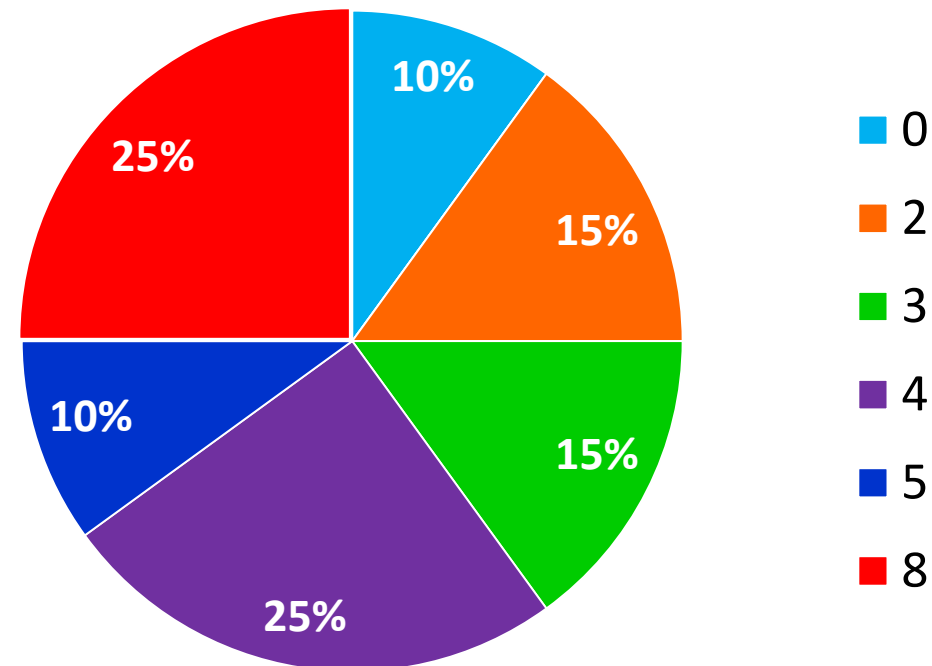
4.2

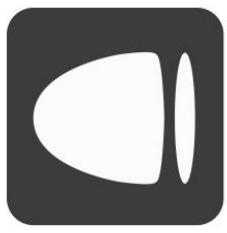
Additional hours/week spent on jobsite by inspectors

16

Additional photos taken per week per inspector

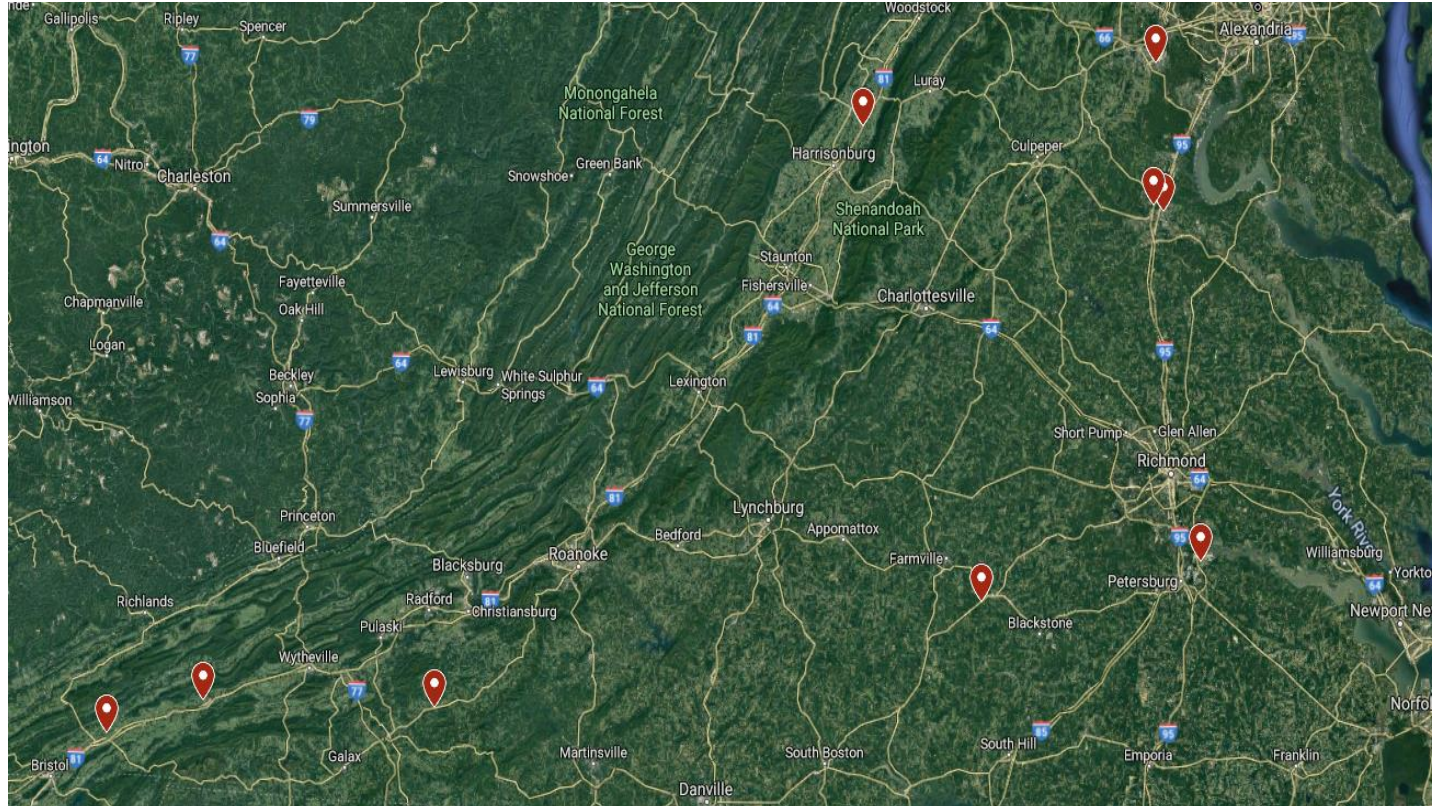
Additional Hours Spent on Jobsite





HEADLIGHT[®]

paviasystems



8

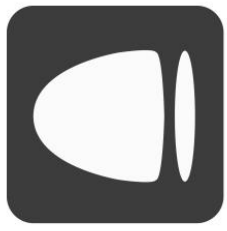
Districts

9

Projects

45

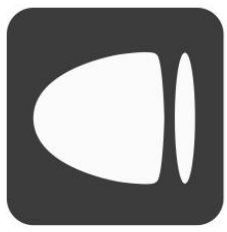
Users



HEADLIGHT[®]

paviasystems

- Input field observations (weather, work activities, etc.)
- Identify labor, equipment, and materials
- Complete materials testing reports
- Develop daily diaries
- Generate monthly list of completed work items
- Programmatic level reporting



HEADLIGHT[®]

paviasystems

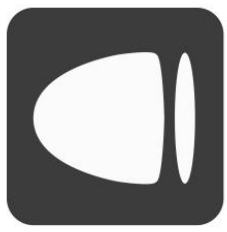
Input field observations

The image displays three overlapping screenshots of the HEADLIGHT Fieldbook mobile application interface, demonstrating how to input field observations.

Left Screenshot (Main Menu): The 'Journal' menu is open, showing options for adding data. The 'Image' and 'Weather' options are highlighted with red boxes. Other visible options include Journal, Spreadsheets, Reports, Forms, Academy, and New.

Middle Screenshot (Photo Entry): A photo of a 'DANGER HIGH VOLTAGE' sign is being captured. The interface shows the 'Journal' menu on the left and the 'VDOT Training Project' header at the top.

Right Screenshot (Weather Entry): A 'New Weather' entry is being created. The temperature is 84° F, and the condition is 'Cloudy Mostly'. The location is 'Benjamin Brown'. The interface shows the 'Journal' menu on the left and the 'VDOT Training Project' header at the top.



HEADLIGHT[®]

paviasystems

Identify labor, equipment, and materials

Fieldbook

Search: Date: 06/05/2019 08/05/2019 User: Any Labels: Any

Reset

Hide

Rte 11 over I-81

Equipment Contract Personnel Work Item

LineItem Tag Equipment Contractor BidItem

+ 05 August 2019

Equipment	Nbr Pecs.	Nbr U
BDTC Chevrolet 2500	1	
John Deere 35D #7027 Davis Elliot	1	
John Deere 35D #7027 Davis Elliot	1	
F550 Bucket Truck # 2123	1	
A&J Komatsu 51dpxi dozer	1	
A&J Komatsu 210 Excavator #HEX025	1	
Ford F-250 #148 "Jakes"	1	
Chevrolet 2500 #1374	1	

Fieldbook

Search: Date: 06/05/2019 08/05/2019

Observation Types: Contract Personnel

Hide

Rte 11 over I-81

Equipment Contract Personnel Work Item

LineItem Tag Equipment Contractor

+ 05 August 2019

Personnel Type	Number
Laborers	
Foreman/Male	
Superintendent	
Electricians	
Foreman/Male	

+ 02 August 2019

Personnel Type	Number

Fieldbook

2:59 PM Thu Aug 8

Search

VDOT Training Project

Equipment Contract Personnel Work Item

LineItem Tag Equipment Contractor BidItem

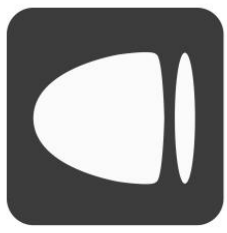
Select

+ 04 June 2019

BidItem	LineItem	Placed Qty	Units

+ 22 May 2019

BidItem	LineItem	Placed Qty	Units
50485:	50485: CONC. FOUNDATION STP-1, TYPE A		TON



HEADLIGHT[®]

paviasystems

Complete materials testing reports

HEADLIGHT Fieldbook

Journal Observation

Image Aa Narrative

Weather Audio

Video Density Measurement

Temperature Start/Stop Work

Materials Traffic Control

Spreadsheet Observation

Equipment Contract Personnel

Work Item

Report Types

Bid Item Summary VDOT Daily Report

MyDaily

Form Types

VDOT-TL59B VDOT-NED

VDOT-TL60 VDOT-WZSC

Virginia-TL59A

VDOT-TL59A 19 Jul 2019 7:56 AM Travis Lambert ✓ Approv... Final No

4:38 PM Mon Aug 5
Back to App Reload

VDOT Virginia Department of Transportation
Asphalt CorePlug Density Report - Method A (TL-59A)
VDOT-TL59A FORM #3

PROJECT

Project	Item Number	Date
Pavement Overlay Washington County	16350	07/08/2019

LOCATION

Route & Direction	Lane(s)	County
I81-N	Right	WASHINGTON

Lot Number	Application Rate (lbs/ty)	From (Station, MP, Int., etc)	To (Station, MP, Int., etc)
201901	220	9.7	11.00

PRODUCTION

Application Length (ft)	Application Width (ft)	Application Rate (lbs/ty)	Calculated Tonnage (tons)
1920	16.50	221.26	389.4

Asphalt Producer	Asphalt Plant	Asphalt Mix Type	Mix Job Number
W-L CONSTRUCTION	ABINGDON	0.925	Option 1

CONTROL STRIP

Control Strip Number	Control Strip Date	Target Nuclear Density (lbs/ft ³)
1	07/07/2019	146.0

Min Joint Density (lbs/ft ³) [-95% CS Density]	Min Density (lbs/ft ³) [-98% CS Density]	Max Density (lbs/ft ³) [-102% CS Density]
138.7	143.1	148.9

NUCLEAR GAUGE

Model Number	Serial Number	Calibration Date	Depth Setting
4604B	778	02/08/2019	0.25

ACCEPTANCE TESTING RESULTS BY PLUGS/CORES

Daily Average Gmm	Plant Lot & Sample Number(s) for Gmm Testing
2.481	

Offset Reference Line (C) = Confined Joint, (U) = Unconfined Joint

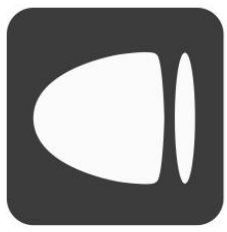
Left

SubLot	Distance + Offset (Left) (in)	Thickness (in)	Weight (g) Air [A]	Weight (g) Water [B]	Weight (g) SSD [C]	Volume [C-B]	Gmb [A/(C-B)]	% Gmm	Bonus	Joint Density Left (lbs/ft ³)	Joint Density Right (lbs/ft ³)
1	1453	2	1106	643	110	464	2.38	96.1	Yes		

VDOT-TL59A - Travis Lambert

Page 1 of 2

HEADLIGHT Form #3



HEADLIGHT[®]

paviasystems

Develop daily diaries

HEADLIGHT

Journal

Spreadsheets

Reports

Forms

Academy

New

Fieldbook

Edit Favorites

Journal Observation

Image

Weather

Video

Temperature

Materials

Aa Narrative

Audio

Density Measurement

Start/Stop Work

Traffic Control

Spreadsheet Observation

Equipment

Work Item

Contract Personnel

Report Types

Bid Item Summary

VDOT Daily Report

MyDaily

Form Types

VDOT-TL59B

VDOT-TL60

VDOT-TL59A

VDOT-NED

VDOT-WZSC

Spreadsheets

Reports

Forms

Academy

New

VDOT Training Project

Create Report

Report Name

Inspector's Daily Report

Report Type

Bid Item Summary

Report Date

05 August 2019 4:21:27 PM

Shift

Day

Cancel

Back to App

Reload

1 of 4

VDOT

Inspector's Daily Report

I-95 Rappahannock River Crossing

C00101595DB94

July 31, 2019

WEATHER

Date	Time	Conditions	Temperature	Wind	Humidity
07/31/2019	7:00 AM	Cloudy Partly	90°F	4 mph	54%

DIARY

07:30 AM	Wagman	Image	— End section placed on run 25-14.		
09:00 AM	Wagman	Image	— Sub-base placement from 3592 to 3587.		
10:00 AM	Wagman	Image	— Continued work on the coffer dam material for piers 2 & 3. Also placed crane pads on the sills for the second temporary bridge.		
12:30 PM	Image	— Fill placement stations 3619+50 to 3622			
01:00 PM	Wagman	Image	— Construction of ST6. Seed and straw being placed for stabilization.		
01:30 PM	Wagman	Image	— Fill placement at ST5e in the new ditch line.		
02:00 PM	Wagman	Image	— Prepping phase 2 of Column 1 of B604		
03:00 PM	Wagman	Image	— Preparing for the sleeper pad at abutment B of B651.		
04:00 PM	Wagman	Image	— Area of SB7 where the new storm sewer from 26-4 to 26-3 was installed.		
05:30 PM	Wagman	Harvest	The contractor performed work in multiple areas of the project on this day.		

The contractor had two crews working in area 3. The contractor continued the placement of sub-base stone in the area that was proofrolled Monday. They were able to place the stone from stations 3592 to 3587. The second crew began and completed filling in ST5e which falls in the new ditch line.

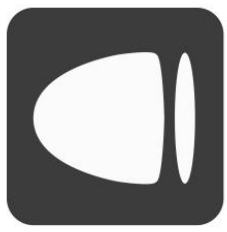
The contractor's crews in Area 4 continued working to place fill around 26-3 and placed two risers on the structure. The second crew in the area worked to continue filling in the area of CSB3e at approximately stations 3619+50 to 3622+00. The third crew completed the work on construct ST6 and stabilized the trap. The pipe crew in this area is being moved to area 2.

The contractor had a crew at the causeway for B604 to continue prepping for the coffer dams for piers 2 & 3. They also continued prepping for phase two of column 1.

The subcontractor Harvest was in Areas 2 and 4 to continue to the clearing/mulching work. Area 4 is for the FedEx project scope swap.

The contractor had a crew in area 1 cutting material to send to area 4 for fill placement.

The contractor had a crew at B651 which began preparations for the sleep pad on the Abutment B side of the bridge.



HEADLIGHT[®]

paviasystems

Generate List of completed work items

Journal

Spreadsheets

Reports

Forms

Academy

New

Journal Observation

Image

Weather

Video

Temperature

Materials

Spreadsheet Observation

Equipment

Work Item

Report Types

Bid Item Summary

MyDaily

Form Types

VDOT-TL59B

VDOT-TL60

Virginia-TL59A

Edit Favorites

Aa Narrative

Audio

Density Measurement

Start/Stop Work

Traffic Control

Contract Personnel

VDOT Daily Report

VDOT Training Project

Create Report

Report Name

Work Item Summary Report

Report Type

Bid Item Summary

Report Date

12 June 2019 4:31:26 PM

Shift

Day

Cancel

Inspector's Daily Report

18 Jun 2019 12:02 PM

Dakota

Work Item Summary Report

12 Jun 2019 4:31 PM

Benjam

Work Item Summary Report

12 Jun 2019 4:30 PM

Benjam

Work Item Summary Report

12 Jun 2019 10:34 AM

Admin VDOT

Waiting for Approval

No

CQUIP Summary

12 Jun 2019 9:49 AM

Admin VDOT

Draft

No

Back to App

Reload

VDOT

Virginia Department of Transportation

WORK ITEM SUMMARY REPORT 5/20 - 6/1

VDOT Training Project

June 12, 2019

#	Description	Units	Quantity
00098	NS MOBILIZATION	LS	54.07
24160	TEMPORARY (CONSTRUCTION) SIGN	Each	85.00
24242	TEMPORARY (CONSTRUCTION) SIGN	Each	4.00
24281	ELECTRONIC ARROW BOARD	Each	1.00
50108	SIGN PANEL	Each	11.00
50485	CONC. FOUNDATION STP-1, TYPE A	TON	100.00
50486	CONC. FOUNDATION STP-1, TYPE B	TON	34.00
51930	NS MAST ARM	Each	1.00
24160	TEMPORARY (CONSTRUCTION) SIGN	Each	0

Project Inspector Signature

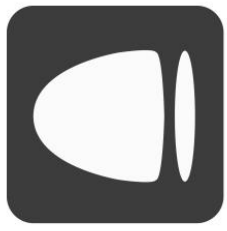
Admin VDOT

Date

06/12/2019

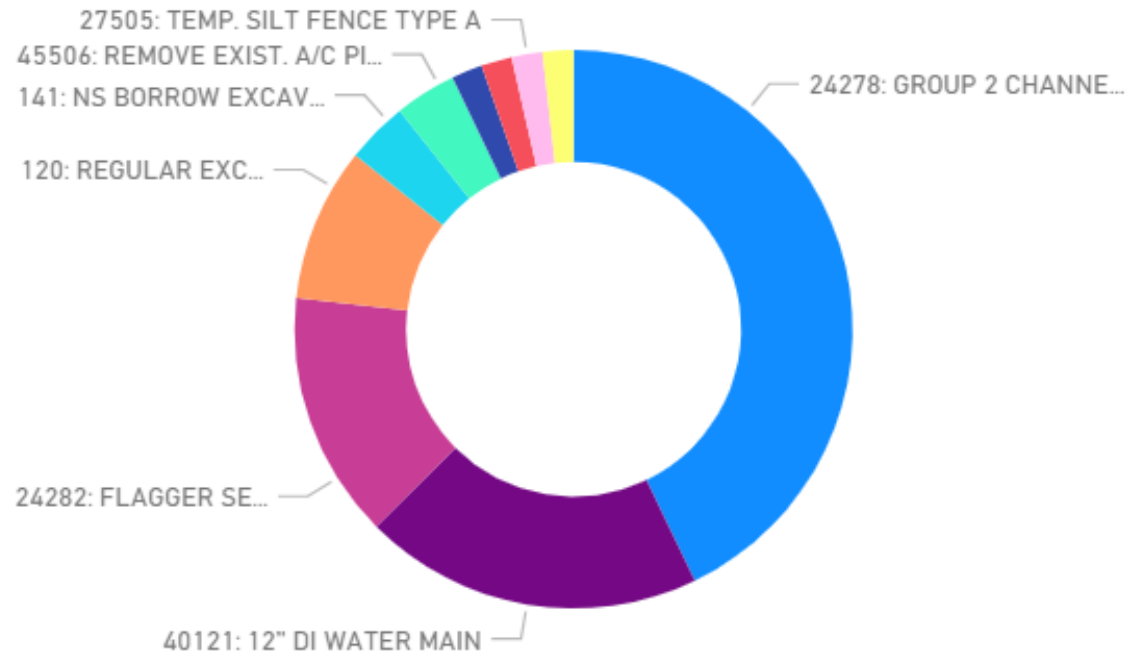
Reviewer Signature

Date

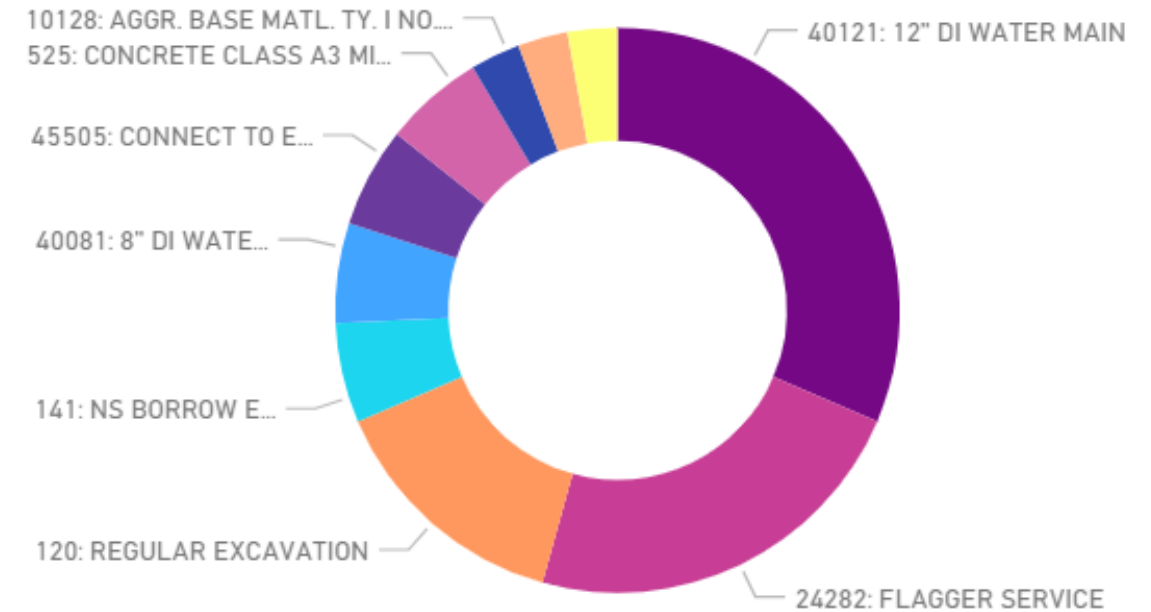


Programmatic Level Data and Reporting

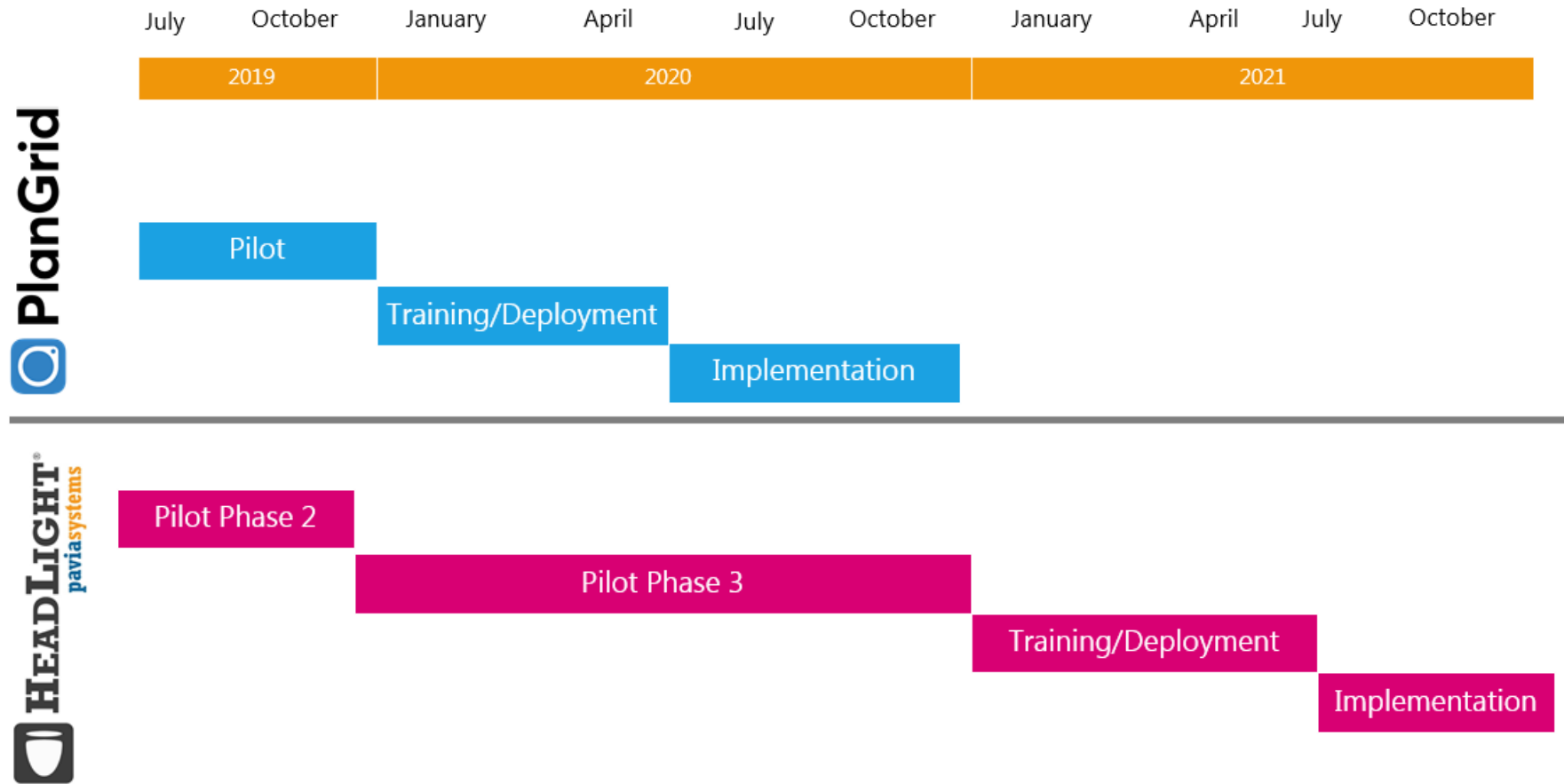
Top Ten Pay Items by Qty



Top 10 Pay Items By Cost



Implementation Timeline



Contact Information

Ian Millikan, P.E. , PMP, DBIA

Assistant State Construction Engineer

Virginia Department of Transportation

o: 804-786-2045 | c: 804-310-0216

ian.millikan@vdot.virginia.gov

Questions?

Network for Success
Local Programs Workshop



Unmanned Aerial Systems and their Applications for DOTs and Local Governments

Chris Dodson
Principle-Director of Field Services
Timmons Group

Acronyms and Terms:

- **UAS:** Unmanned Aerial System
- **UAV:** Unmanned Aerial Vehicle
- **AR:** Augmented Reality
- **VR:** Virtual Reality
- **COA:** Certificate of Authorization
- **FAA:** Federal Aviation Administration; U.S. Department of Transportation Agency with the power to regulate and oversee civil aviation
- **LiDAR:** Light Detection and Ranging; remote sensing technology for mapping
- **AWP:** Aerial work platforms; Common method of bridge inspection involving equipment like bucket-trucks, snoopers, lifts, etc.
- **HMD:** A head-mounted display or augmented reality display device
- **Collision/Obstacle Avoidance:** A vision system that allows UASs to detect obstacles and avoid collision.



Figure 1: DJI Matrice 600 field deployment by Timmons Group

Background

- An Unmanned Aerial System (UAS), commonly referred to as a drone, is an aircraft controlled by an operator on the ground.
- The term Unmanned Aerial Vehicle (UAV) has been used interchangeably with UAS.
- The UAS is controlled either autonomously or by a pilot on the ground with a remote control.
- Camera feed can be viewed live from a monitor or through goggles.
- Demand for UASs is growing in both the public and private sectors, with transportation and civil applications growing.

VDOT and LAP Applications

Bridge Inspection⁸:

- UAS technology is a cost-effective and safe approach to the logistical challenges of bridge inspections.
- As technology evolves inspection-specific features are coming into the marketplace that will increase overall effectiveness of bridge inspections.
- UASs with the ability to point the camera upwards and fly without a GPS are ideal for under-bridge inspections.
- Safety risks to both work crew and the traveling public are minimized. Traditional bridge inspection methods require temporary work zones, detouring traffic, and heavy equipment, unlike UAS technology.
- Drones have the capability to be used instead of aerial work platforms, providing significant savings. With drone use there is also reduced or eliminated traffic control and aerial lift costs.

VDOT and LAP Applications

Bridge Inspection:

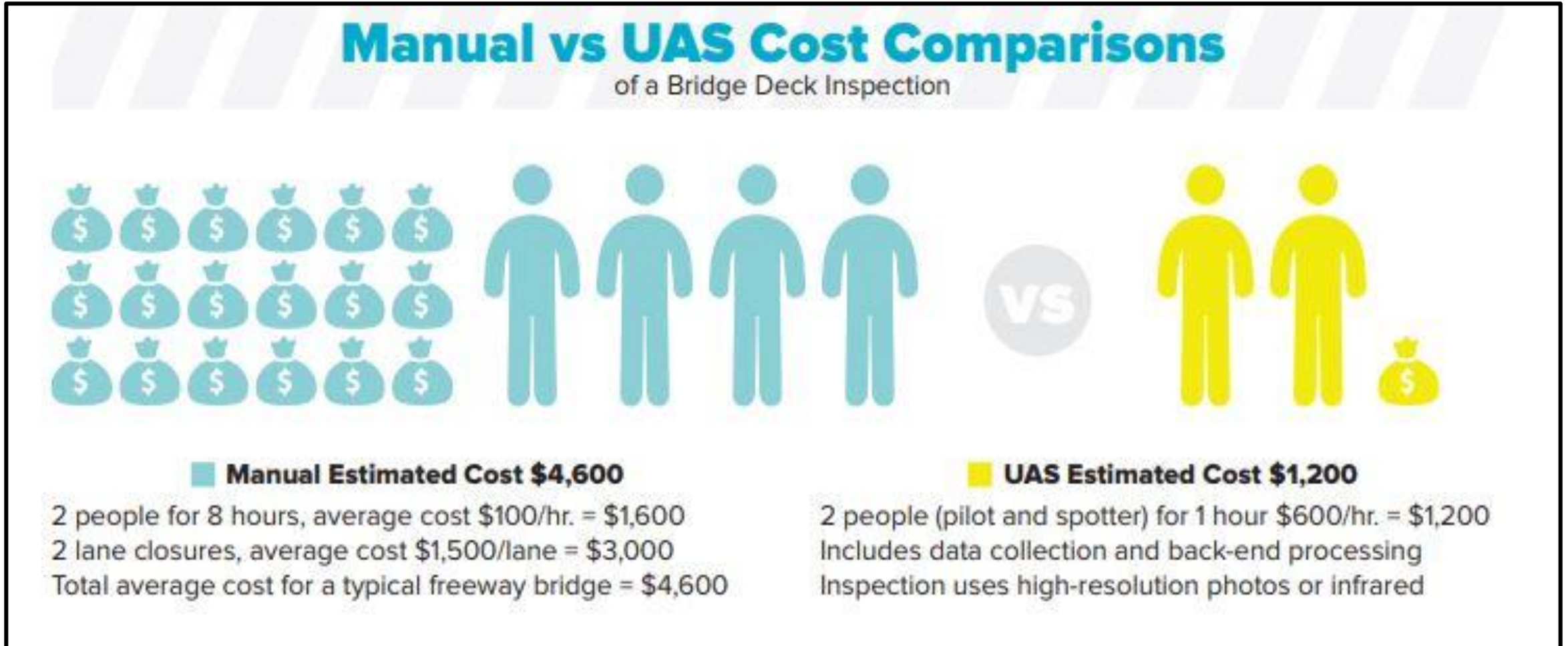


Figure 2: 2019 AASHTO UAS/Drone Survey findings⁸.

VDOT and LAP Applications

Bridge Inspection¹³:

- UAS use for routine inspections improves overall quality by obtaining information not readily gathered without costly access methods.
- UASs are commonly equipped with an infrared camera. Infrared images of bridge decks and elements are a common tool to obtain information on concrete delamination.
- Algorithms, once updated, can automatically identify and quantify defects, such as spalls, delamination, and cracks.
- UASs can capture nearby waterway conditions upstream or downstream of the bridge. They can also provide large aerial maps of bank erosion and lateral scour conditions.

VDOT and LAP Applications

Bridge Inspection²:

- Pre-inspection planning elements are easily obtained with UAS. Common information gathered includes clearances, rope access anchor points, and general conditions .
- “Digital imagery from flights can be mosaiced, geo-referenced, and converted into 3D point clouds for detailed spatial inventorying.”¹¹
- Currently Michigan DOT and the Michigan Technological Research Institute are improving upon drone bridge and roadway corridor inspection and capabilities. The new computer systems and algorithms will strengthen the flow of information and help state DOTs make faster decisions regarding transportation infrastructure.

VDOT and LAP Applications

Bat Inventory Inspection:

- U.S. Fish & Wildlife Service and Virginia Dept. of Transportation provide guidelines for visual bat inventory inspections.^{20 & 21}
- Visual and infrared inspections for evidence of bat presence are easily conducted with UASs. Bridges spanning wide floodplains provide excellent roosting and food sources. UASs allow for rapid, safe inspections without the need for snoopers trucks, lane closures, or inspection personnel contacting bat droppings.^{20 & 21}
- New drone designs, such as the DJI Matrice 200 and Parrot Anafi, provide top mounted gimbals and 180° vertical-swivel gimbals that allow for upward-looking inspections below structures.²²⁻²⁴

Bridge Inspection



Figure 3: Bridge details taken by Timmons Group with the DJI Phantom 4 Pro UAS.

Bridge Inspection

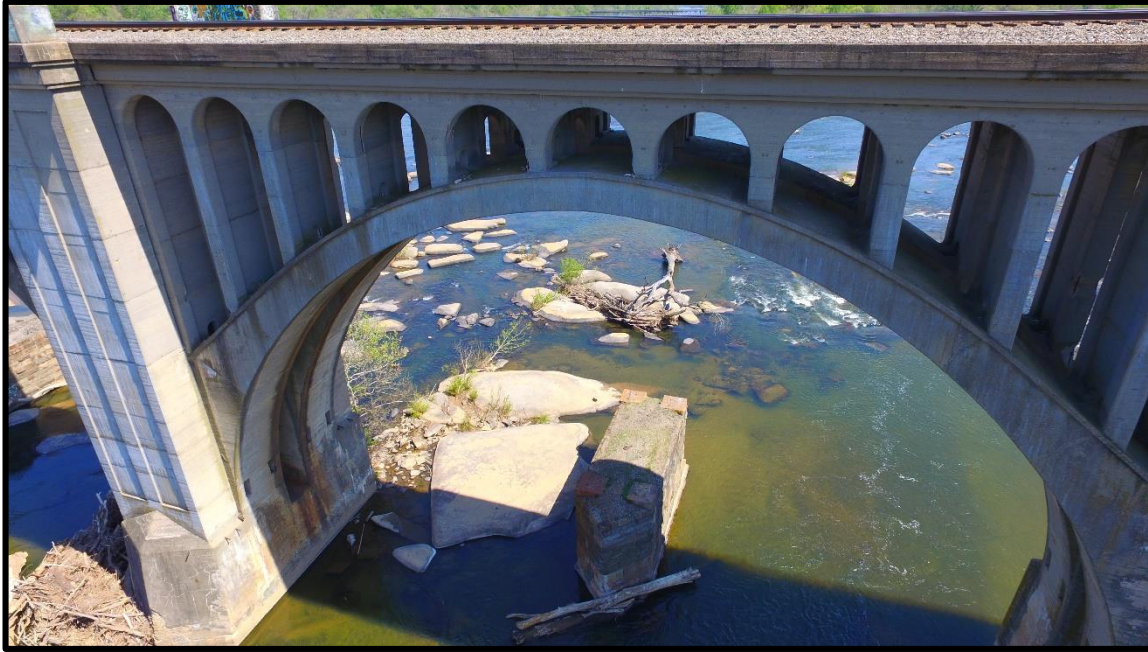


Figure 4 and 5: Bridge details taken by Timmons Group with the DJI Phantom 4 Pro UAS.

Bridge Inspection-Drone Platforms



Figure 6, 7 and 8: DJI Matrice 200 top mount; Parrot Anafi; Zenmeuse XT-2 IR sensor.²²⁻²⁴

VDOT and LAP Applications

Pavement Evaluation:

- UAS payload options allow for a variety of road and bridge surface analyses via remote sensing.
- UASs equipped with an infrared (IR) camera can be utilized to detect subsurface irregularities in asphalt roadways and delaminations in reinforced concrete bridge decking. ^{25 & 26}
- Heat island effect reduces applicability in urban settings for IR remote sensing accuracy. ²⁵
- UAS mounted LiDAR can be utilized to measure surface deficiencies, such as potholes, to quickly determine fill quantities needed. 3D surface models can be used to identify areas prone to flooding within a 2cm elevation accuracy. ²⁵
- Low altitude digital photos are used to rapidly identify surface distress such as potholes, ruts, and washouts, particularly after major storm events. ²⁵

VDOT and LAP Applications

- **Construction Site Inspection:**

- UASs can be used as aerial image and data capture devices to inspect and monitor construction and infrastructure projects.¹⁵
- UASs can be equipped with radar, infrared, and other technology to enhance surveillance.
- There is reduced risk to workers when drones can inspect difficult-to-reach locations or hazardous areas such as highway work zones.⁴
- Construction inspection with UAS allows for the development of terrain models that document the construction process and assist in earthwork quantity measurement.²
- Aerial images produced by UASs can be used to plan the placement of materials, the flow of workers, and to identify potential issues.
- The faster rate of data collection operations and exact quantity calculations make for accelerated construction.⁸

VDOT and LAP Applications

The following states are examples of DOT programs incorporating UASs.⁸

- **North Carolina:** using UAS to support construction inspections and perform accident scene reconstructions to open travel lanes more quickly.
- **Ohio:** using UAS for construction inspections, traffic monitoring, and emergency response.
- **New Jersey:** using UAS for construction project monitoring, traffic incident and congestions management, structural inspections, aerial 3-D corridor mapping, and emergency response.
- **Washington:** using UAS applications for aerial roadway surveillance and potentially for avalanche control situational awareness.

Construction Site Inspection



Figure 9: Woolridge Road Widening Project, Chesterfield, VA.
Construction monitoring imagery by Timmons Group.



Figure10: Magnolia Green Parkway Extension Project, Chesterfield, VA.
Construction monitoring imagery by Timmons Group.

VDOT and LAP Applications

Roadway Asset Management

- UASs are a low-cost collection method for monitoring roadway conditions and traffic control devices.
- Any images taken with a UAS can help update the DOT GIS database. Aerial images taken by the UAS are beneficial for wetland monitoring and plant classification.²
- UASs ability to routinely and consistently map terrain allows problem areas to be isolated before an emergency event occurs.
- In an emergency, UAS technology can quickly survey damage for a more informed recovery operation.
- A study by the Texas A&M Transportation Institute found UASs to be capable of real-time confirmation and monitoring of a traffic incident, real-time monitoring of alternate routes, and real-time monitoring of traffic incident queueing.¹⁴

VDOT and LAP Applications

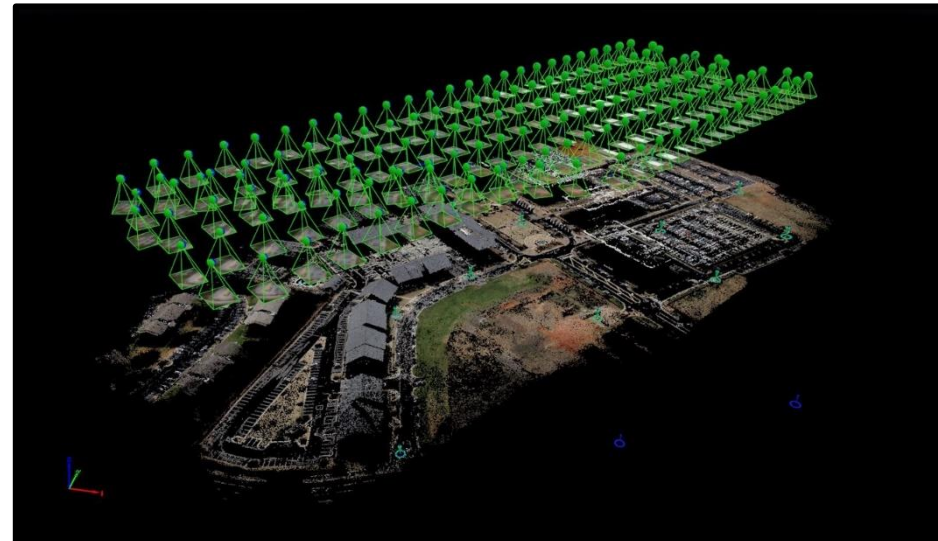
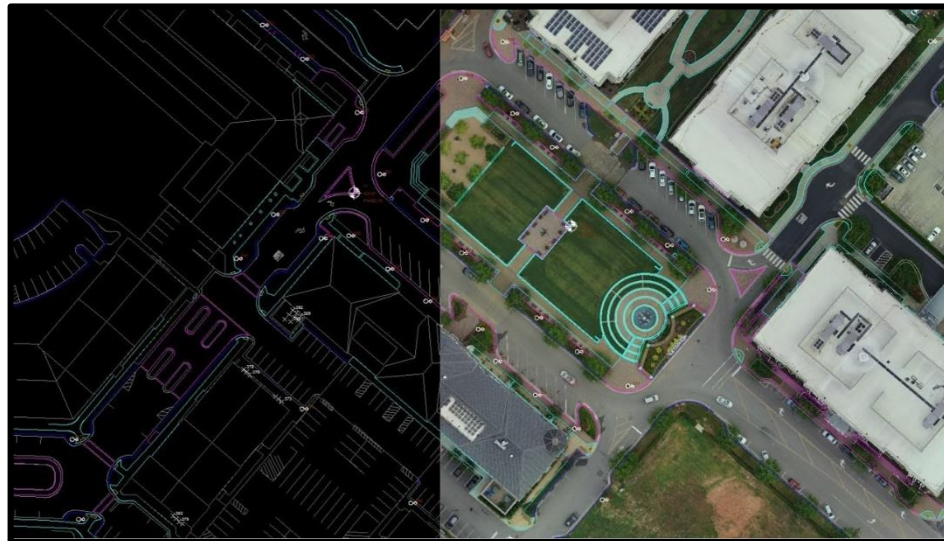
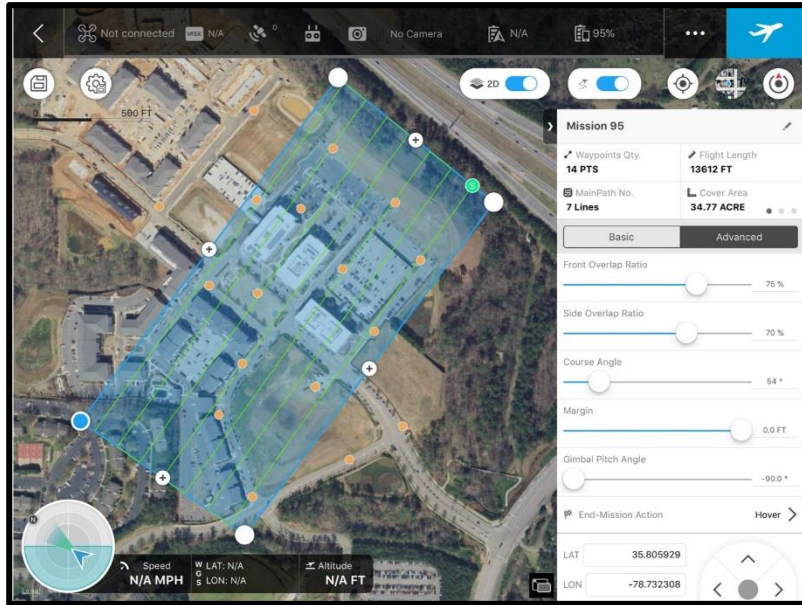
Roadway Asset Management¹³:

- Pilots can use UAS to assess damage to critical infrastructure and inform recovery plans.
- These operations are more cost-effective and safer than manned aircrafts after a natural disaster or major incident.
- Survey and imagery can be gathered where traditional surveying and mapping practices are unable to access.
- Recorded applications include determining flooding extent and transportation infrastructure impact, general damage assessment, and the monitoring of rising waters.
- There is inherent risk when UASs are flown near inhabited areas, however discussed risk mitigation strategies include parachutes and inflatable wings.

Photogrammetry

- Photogrammetry is a remote sensing technology that uses georeferenced images to map the earth's surface. Photogrammetry is used for terrain and elevation modeling.
- GPS device triggers the camera to take images every X meters based on flight altitude and desired coverage and creates a timestamped GPS file for camera trigger events.
- Ground base station continually logs information to submit to OPUS to gain corrected positioning.²⁹
- Images, GPS files, and OPUS correction are post-processed to yield CM level accuracy image geotags.
- PPK GPS can assign geotags of 2 cm accuracy or less to unprocessed images.³⁰
- End-result can yield survey grade 1ft contour intervals in open areas.

Photogrammetry Workflow



Light Detection and Ranging (LiDAR)

- LiDAR is remote sensing technology that uses light (laser pulses) to map the earth's surface. LiDAR is frequently used for terrain and elevation models.¹⁰
- LiDAR sensors are often mounted onto a UAS for an all-in-one 3-D mapping device.
- LiDAR sensors can penetrate vegetation and the topography underneath making it useful for generating Digital Terrain Models (DTM).
- Uses for LiDAR include drone collision avoidance, imagery, structural inspections, and night work.
- Aerial LiDAR scanning by UAS is experiencing ongoing growth as manufacturers develop lighter and more affordable versions.⁹

Light Detection and Ranging (LiDAR)



Figure 7: Several models of LiDAR Sensors for UASs.³

Augmented Reality (AR) and UAS

- Augmented Reality (AR) is a relatively new technology with diverse applications. AR produces computer generated images over the user's real-world perception. AR systems play a large role in the visualization of 3-D data.¹⁶
- UAS-AR technology aids in the visualization of both the field environment and virtual construction in site layouts.
- With head mounted displays (HMDs) becoming more light-weight AR applications are open to the outdoors.
- AR systems provide many benefits. Objects can be located with greater speed and accuracy, physical markers can show previously invisible features, and information can be overlaid for comparison.
- AR systems allow for multi-UAV missions where the virtual UAVs interact in real-time.
- Existing applications include heads-up displays in inspection, industrial design, maintenance work, and construction.¹⁹

Augmented Reality (AR) and UAS

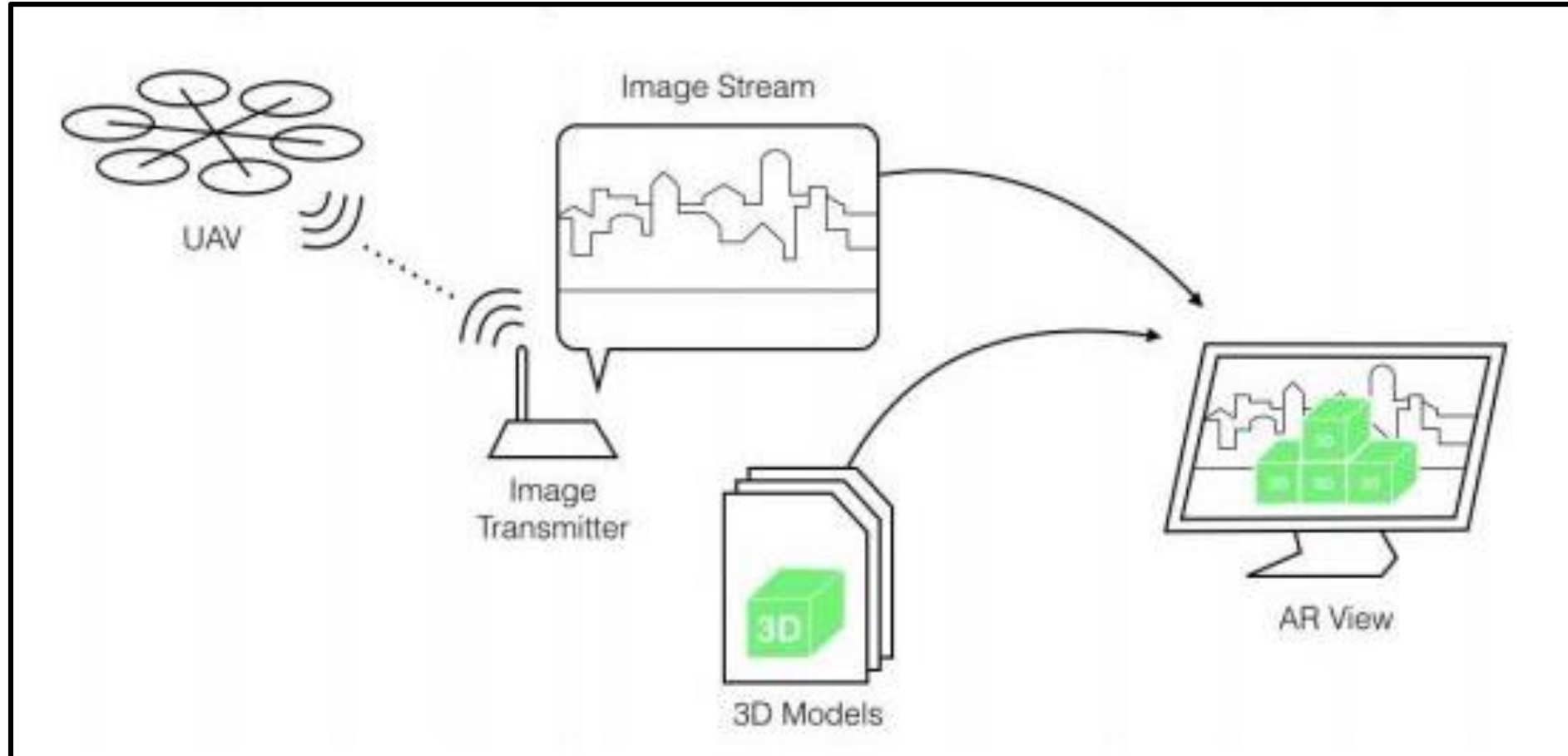


Figure 8: Concept of applying AR on the image stream from UAS.¹⁹

Differentiating between VR and AR²



Fig 8: Visual depiction contrasting VR and AR.¹

- The fields of AR and VR are collectively referred to as mixed reality.
- AR adds digital elements to a live view. VR is a fully digital experience, shutting out the physical world.
- AR uses clear glasses for immersion, whereas VR uses head-mounted goggles that occlude your vision.
- Using a VR headset linked to a UAS the operator can get a first-person perspective of the flight.
- In short, augmented reality enhances current perception, whereas virtual reality substitutes a simulated reality.
- There is current drive to optimize VR headsets with gesture recognition sensor during flight for more intuitive navigation and exploration.

FAA Commercial Use Guidelines

- Part 107 of FAA standards or the Small Unmanned Aircraft Regulations apply to a wide range of commercial uses with drones less than 55 lbs. in weight.¹⁸
- The operator must hold a remote pilot airman certificate with a small UAS rating or be under the direct supervision of a person with such certificate.
- sUAS operators must give way and not interfere with manned aircrafts.⁶
- An sUAS may not fly over anyone not directly participating in the operation.
- Minimum weather visibility is three miles from your control station.
- The sUAS must remain within visual line of sight (VLOS).
- Speed must be kept below 400ft AGL (above ground level). The maximum speed is 100 mph (87 knots).
- A waiver is required to operate a drone contrary to the rules in part 107.

FAA Commercial Use Guidelines

Insurance^{27 & 28}

- While not mandated by the Federal Aviation Administration, drone liability insurance is a must for risk mitigation.
- Drone insurance comes in two categories: Hull and Liability.
- Hull insurance covers damage to the drone and payloads (sometimes covered under separate Payload insurance).
- Liability insurance covers damages to third parties, both bodily injury and property damage.
- Insurance plans vary due to fleet size, types of sensors and cameras, training and experience of operators (FAA licensure), maintenance and records, safety programs, and operational parameters.
- Typical liability insurance coverage is \$1,000,000.

Federal Aviation Administration Integration Pilot Program⁷

- Three state DOTs (Kansas, North Dakota, and North Carolina) are in the UAS Integration Pilot Program, allowing them to fly missions beyond line of sight, at night, and above people.
- This program is helping the USDOT and FAA evaluate operational concepts, address security and privacy risks, and improve communications with local jurisdictions.
- Areas expected to benefit from this program include commerce, agricultural support, infrastructure support, emergency management, and photography.
- The actionable information provided will help in the formation of new rules regarding more complex low-altitude operations.
- Ultimately, a more efficient strategy for overall integration of UASs is being determined.

UAS Data Exchange (LAANC)¹⁷

- FAA is currently testing the Low Altitude Authorization and Notification Capability (LAANC) as a part of the UAS Data Exchange.
- The system will be deployed initially at nearly 300 air traffic facilities and help support the safe incorporation of drones into airspace.⁵
- LAANC facilitates the sharing of data between the FAA and companies providing LAANC. Companies providing LAANC are known as UAS Service Suppliers (USS).

UAS Data Exchange (LAANC)¹⁷

- This will ultimately allow for real-time processing of airspace authorization requests for UAS operators. The application and approval process is automated.
- Access to the capability through a USS offers two uses of LAANC:
 1. Receive near real-time authorization for operations under 400 ft. in controlled airspace around airports.
 2. Submit a “further coordination request” to fly above the designated altitude ceiling up to 400 ft. Approval is coordinated up to 90 days in advance and by the FAA.

LAANC Service Providers

Approved Service Supplier	Part 107 Near – Real Time Authorization	Part 107 Further Coordination	Exception for Recreational Flying/Section 44809
Aeronyde	✓	✓	
Airbus			
AirMap	✓	✓	✓
AiRXOS			
Altitude Angel			
Converge	✓	✓	
DJI			
Harris Corporation			
Kittyhawk	✓	✓	✓
Project Wing			
Skyward	✓	✓	
Thales Group			
UASidekick	✓	✓	✓
Unifly			

✓ = Publicly available service

Figure 9: Various companies in agreement with the FAA to provide LAANC Services.¹⁷

Concerns of UAS Usage¹²

- **Privacy:** Current regulatory mechanisms involving UAS do not address civil liberties and privacy concerns. Surveillance in the public's opinion has ethical and privacy concerns that must be addressed.
- **Data Protection:** UAS applications can involve highly controlled areas and situations. In addition, the privacy of civilian behavior is impacted.
- **Safety:** There are inherent public safety issues with new technology. In this case accidents and violent usage are of concern. Most UASs have safety features and a lighter weight to reduce damage. Negative effects can also be minimized with a regulatory regime to evaluate drone usage.

State of UAS Operations: AASHTO Survey

- The May 2019 AASHTO UAS/Drone Survey of All 50 State DOTs concluded the following to be the most frequent drone missions by state DOTs.⁸

Top 5 Drone Missions

1. Photo/Video
2. Surveying
3. Infrastructure Inspections
4. Emergency Response/Natural Disasters
5. Public Education and Outreach

State of UAS Operations: AASHTO Survey

- The May 2019 AASHTO UAS/Drone Survey of All 50 State DOTs concluded 36 out of 50 state DOTs (72%) funded centers or programs for drone operations. The previous year only 45% (20 of 44 states) had such operations.⁸
- The survey also found 24 state DOTs to be collaborating with universities on research.
- To keep up with demand 10 state DOTs are training new pilots with the help of academic organizations.

References

1. Barel, A. (2017, August 13). The differences between VR (Virtual reality), AR (Augmented reality) and MR (Mixed reality). Retrieved from <https://www.startux.net/the-differences-between-vr-ar-and-mr/>
2. Brooks, C., & Cook, S., P.E. (2019, January 16). Implementation of Unmanned Aerial Vehicles (UAVs) for Assessment of Transportation Infrastructure – Phase II. Retrieved July 31, 2019, from https://mtri.org/mdot_uav.html
3. Corrigan, F. (2019, July 01). 12 Top Lidar Sensors For UAVs, Lidar Drones And So Many Great Uses. Retrieved from <https://www.dronezon.com/learn-about-drones-quadcopters/best-lidar-sensors-for-drones-great-uses-for-lidar-sensors/>
4. Dorsey, A. (2018). Using Drones to Monitor Construction Safety. *Laborers' Health & Safety Fund of North America*, 15(3). Retrieved July 31, 2019, from <https://www.lhsfna.org/index.cfm/lifelines/august-2018/using-drones-to-monitor-construction-safety/>
5. FAA Begins Drone Airspace Authorization Expansion. (2018, April 30). Retrieved July 31, 2019, from <https://www.faa.gov/news/updates/?newsId=90245>
6. Fact Sheet – Small Unmanned Aircraft Regulations (Part 107). (2014, September 19). Retrieved July 31, 2019, from https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=20516
7. Fact Sheet – The UAS Integration Pilot Program and UAS Traffic Management Pilot Program. (2019, April 30). Retrieved July 31, 2019, from https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=23574
8. Gray, J., & Yew, C. (n.d.). Unmanned Aerial Systems (UAS). Retrieved from https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/docs/uas-factsheet.pdf
9. LiDAR Equipped UAVs. (n.d.). Retrieved August 1, 2019, from <https://enterprise.dji.com/news/detail/how-lidar-is-revolutionizing-mapping-and-geospatial-data>
10. LiDAR scanning - Aerial laser scanning by drone. (n.d.). Retrieved August 1, 2019, from <https://www.onyxstar.net/lidar-scanning-aerial-laser-scanning-by-drone/>
11. Lovelace, B., & Zink, J. (2015). Unmanned Aerial Vehicle Bridge Inspection Demonstration Project. *Minnesota Department of Transportation: Research Services and Library*. Retrieved July 31, 2019, from <http://www.dot.state.mn.us/research/TS/2015/201540.pdf>
12. McGuire, M., Rys, M., Ph.D., & Rys, A., Ph.D. (2016). A Study of How Unmanned Aircraft Systems Can Support the Kansas Department of Transportation's Efforts to Improve Efficiency, Safety, and Cost Reduction. *Kansas State University Transportation Center*. Retrieved July 31, 2019, from <https://trid.trb.org/view/1420349>.
13. Murphy, R. R. (2019). Use of Small Unmanned Aerial Systems For Emergency Management of Flooding. *Federal Highway Administration*. Retrieved from <https://www.fhwa.dot.gov/uas/resources/hif19019.pdf>.

References

14. Stevens, C. R., Jr., & Blackstock, T. (2017). Demonstration of Unmanned Aircraft Systems Use for Traffic Incident Management (UAS-TIM). *Transportation Policy Research Center*. Retrieved July 31, 2019, from <https://static.tti.tamu.edu/tti.tamu.edu/documents/PRC-17-69-F.pdf>.
15. Tatum, M. C., & Liu, J. (2017). Unmanned Aircraft System Applications in Construction. *Procedia Engineering*, 196, 167-175. Retrieved July 31, 2019, from <https://doi.org/10.1016/j.proeng.2017.07.187>.
16. Thomas, B., Piekarski, W., & Gunther, B. (1999). Using Augmented Reality to Visualise Architecture Designs in an Outdoor Environment. *Advanced Computing Research Center*. Retrieved July 31, 2019.
17. UAS Data Exchange (LAANC). (2019, July 22). Retrieved July 31, 2019, from https://www.faa.gov/uas/programs_partnerships/data_exchange/
18. Unmanned Aircraft Systems/Drones. (2019, June 17). Retrieved July 31, 2019, from <https://www.state.nj.us/transportation/airwater/aviation/drones.shtml>
19. Wen, M., & Kang, S. (2014). Augmented Reality and Unmanned Aerial Vehicle Assist in Construction Management. *ASCE: Computing in Civil and Building Engineering*, 1570-1577. Retrieved July 31, 2019, from <http://itc.scix.net/data/works/att/w78-2014-paper-195.pdf>
20. U.S. Fish & Wildlife Service Appendix D – Bridge Assessment Guide and Form. (2016, August). Retrieved August 2, 2019, from https://www.fws.gov/midwest/endangered/section7/fhwa/pdf/AppendixD_BridgeAssessmentAugust2016.pdf
21. VDOT Environmental Division – Preliminary Bat Inventory Guidelines for Bridges and Buildings, ver. 3.1.2. Retrieved August 2, 2019, from <http://www.virginiadot.org/business/resources/const/VDOTBatInventoryGuidelines.pdf>
22. DJI Matrice 200. Retrieved August 2, 2019, from <https://www.dji.com/matrice-200-series>
23. Parrot Anafi. Retrieved August 2, 2019, from <https://www.parrot.com/us/drones/anafi>
24. DJI Zenmuse XT-2. Retrieved August 2, 2019, from <https://www.dji.com/zenmuse-xt2>
25. Schnebele, E., Tanyu, B.F., Cervone, G., & Waters, N. (2015). Review of remote sensing methodologies for pavement management and assessment. Pennsylvania State University Center for Geoinformatics and Earth Observation Laboratory. Retrieved August 2, 2019, from http://geoinf.psu.edu/publications/2015_ETRR_RS-roads_Schnebele.pdf.
26. American Concrete Institute – Thermal detection of Subsurface Delaminations in Reinforced Concrete Decks Using Unmanned Aerial Vehicle. Retrieved August 2, 2019, from <https://www.concrete.org/Portals/0/Files/PDF/18-JI-Paper.pdf>

References

27. Drone Insurance: A Step-by-Step Guide to Liability & Drone Hull Insurance (2019). Retrieved August 2, 2019, from <https://uavcoach.com/drone-insurance-guide/>
28. Drone Insurance and Liability Coverage: Do You Need It? (2018, January 17). Retrieved July 31, 2019, from <https://blog.dronedeploy.com/drone-insurance-and-liability-coverage-do-you-need-it-b042485c46d5>
29. OPUS: Online Positioning User Service (National Geodetic Survey). Retrieved August 23, 2019, from <https://www.ngs.noaa.gov/OPUS/about.jsp#about>
30. Why use PPK with your Drone (Not RTK) (2018). Retrieved August 23, 2019, from <https://www.altavian.com/blog/use-ppk-not-rtk>

Prepared by C. Dewey and S. Vargo – Timmons Group (2019)

Contact Information

Chris Dodson

Principal - Director of Field Services

Timmons Group

804.200.6438

chris.dodson@timmons.com



Questions?

Network for Success
Local Programs Workshop



Pathways 4 Planning (P4P)

**A map-app for data driven decisions where
transportation professionals View, Edit, and Plan**

**Geraldine S. Jones
Transportation Planning Specialist
VDOT, Transportation Mobility Planning Division
VDOT Central Office**

Purpose

To provide an accessible, easy-to-use application for VDOT and VDOT's external business partners including localities, PDC's, MPO's, universities, and consultants to view, manage, edit, and query transportation data in order to plan and make informed funding decisions.

*Fund transportation projects that make sense by
improving conditions and increasing safety!*

P4P Features

- ☐ One stop shopping for transportation planning data
- ☐ Accessible to external VDOT partners
- ☐ Permissions based accounts
- ☐ Spatial viewing
- ☐ Identify
- ☐ Spatial queries
- ☐ LRS queries
- ☐ Ad hoc queries
- ☐ Data Export

Data Categories

Types of data

Static Data

- Maintained outside of the application
- Ideal for data-sets that are not constantly updated
- Ability to link to the LRS
- Examples:
 - National Highway System
 - LRS
 - Jurisdictions

Editable Data

- Maintained inside of the application
- Ideal for data-sets that are updated frequently
- Ability to link to the LRS
- Examples:
 - Access Point Inventory
 - Functional Class Change Status
 - Studies

Metadata

Layer Groups

How the data is organized

- Freight
- Improvements
- Linear Reference System
- Multimodal
- Political Boundaries
- Route Classification System
- Route Physical Characteristics
- Safety
- Studies and Recommendations
- Traffic Volume, Capacity, and Performance
- VTRANS Needs

Example Use Cases

Questions P4P can answer

- ☐ What are the existing road conditions in a corridor being considered for transportation funding applications?
- ☐ Where are the PSI intersections and segments in my jurisdiction?
- ☐ Number of crashes in an area of interest?
- ☐ Number of SMART SCALE applications and projects in each VDOT district?
- ☐ Have there been studies performed in a my area of interest?
- ☐ What are the preferred recommendations?

Demo

<https://vdotp4p.com>



About Pathways

VDOT Pathways for Planning is an easy-to-use, interactive mapping and data analysis tool. Users of all GIS skill levels can spatially view and query a variety of data including route classification systems, traffic characteristics, safety, improvements, and forecasts.

The application also enables data owners to create and edit data within the system, such as access points, and potential improvements for streamlined analysis and viewing. Pathways for Planning is accessible internally and externally to VDOT's local and regional planning partners.

Login

☐ Remember Me

Login

[Forgot Password?](#)

Requesting Access

How new users access P4P

Contact Us



First Name

Synthia

Middle Initial

Last Name

Waymack

Email

synthia.waymack@vdot.virginia.gov

Organization(s)

VDOT Central Office

Subject

Request Access

Message



Submit

About Pathways

VDOT Pathways for Planning is an easy-to-use, interactive mapping and data analysis tool that provides a variety of data including route classification systems, traffic characteristics, safety, and more.

The application also enables data owners to create and edit data within the application. Pathways for Planning is accessible internally and externally.

Login

Username

Password

☐ Remember Me




Login

[Forgot Password?](#)

Data Layers

Adding layers to the map view

VDOT | Pathways for Planning

[View](#) [Admin](#)    [Log Out](#)

[Layers](#) [Query Builder](#) [Saved Queries](#)

Locate:

No Added Layers

Add Layers

- Safety
- Studies and Recommendations
- Traffic Volume, Capacity, and Performance
 - AADT
 - Buffer Time Index
 - Level of Service
- Peak Hour Expansion Factor

[Cancel](#) [Add Layers](#)

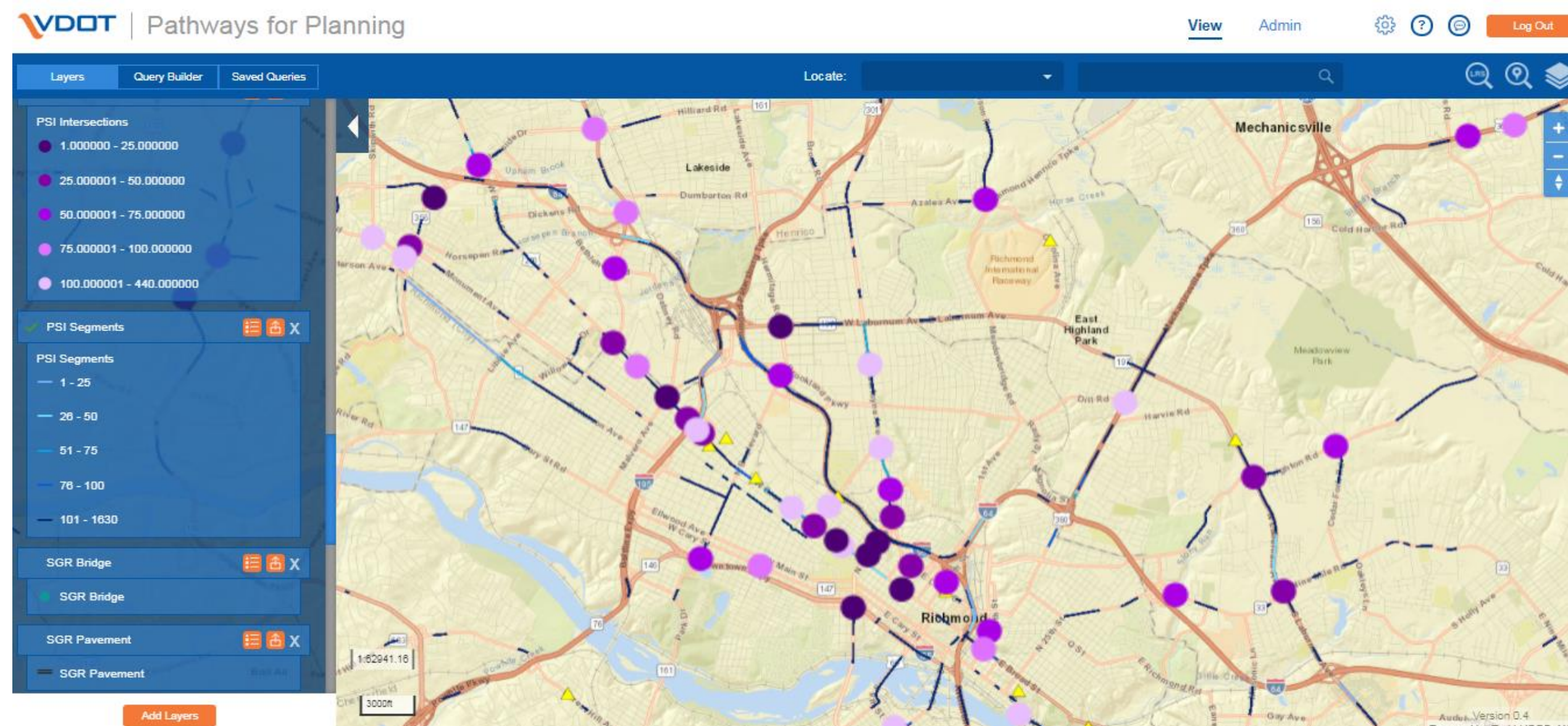
1:2021898.89

20mi

Version 0.4
Powered by FERI USGS, NOAA


Viewing Data on the Map

Understanding conditions in an area of interest



Identify Features

Quick tool to distinguish features and view attribute information



Pathways for Planning

View

Admin

?

⌂

Log Out

Layers

Query Builder


Saved Queries


Identify


Locate:

⌕

Pick a tool







Search Distance: 328.08 ft

☒ Bike & Pedestrian Safety (14 features)

☒ PSI Intersections (4 features)

☒ PSI Segments (7 features)

☒ SGR Bridge (0 features)

☒ SGR Pavement (0 features)

☒ AADT (16 features)


☒ Level of Service (16 features)


☒ VDOT LRS Intersections (139 features)


☒ VDOT LRS Route Edges (538 features)


☒ VDOT LRS Routes (190 features)


Results


☒  Bike & Pedestrian Safety (14 features)


☒  PSI Intersections (4 features)

☒  PSI Segments (7 features)

☐  SGR Bridge (0 features)

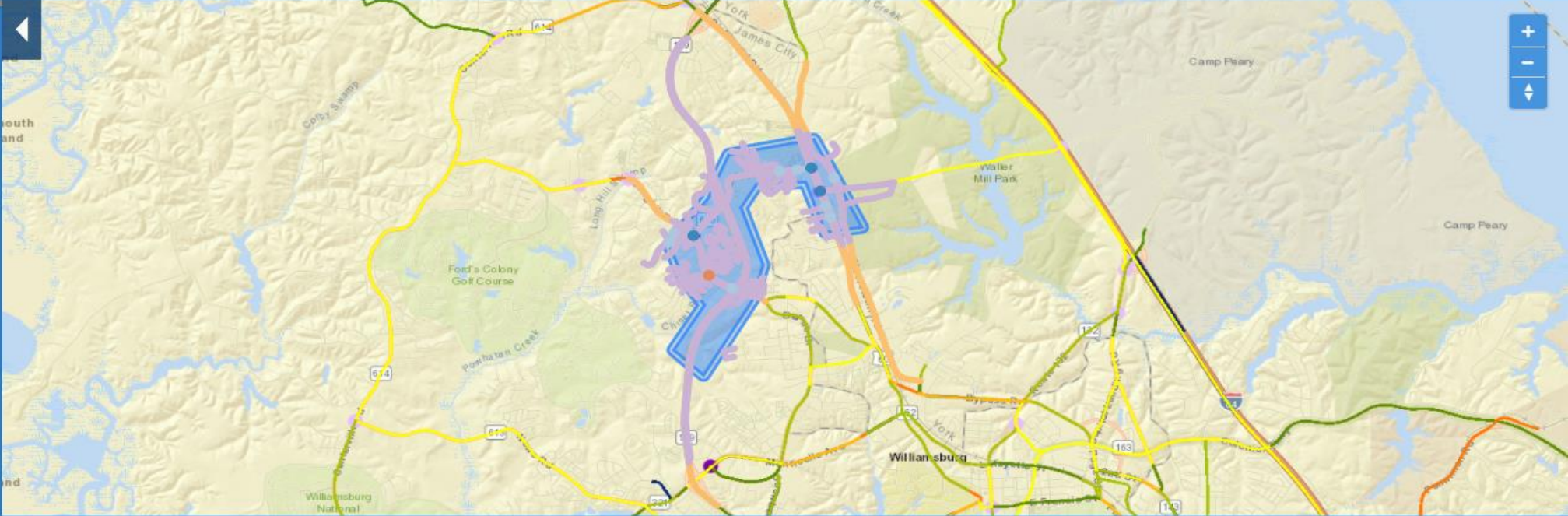
☐  SGR Pavement (0 features)

☒  AADT (16 features)

☒  Level of Service (16 features)

Apply

Clear



Bike &

PSI

PSI

AADT

Level

VDOT LRS

VDOT

VDOT

SLD

Statistics

Items per page: 5

1 - 4 of 4

<<

<

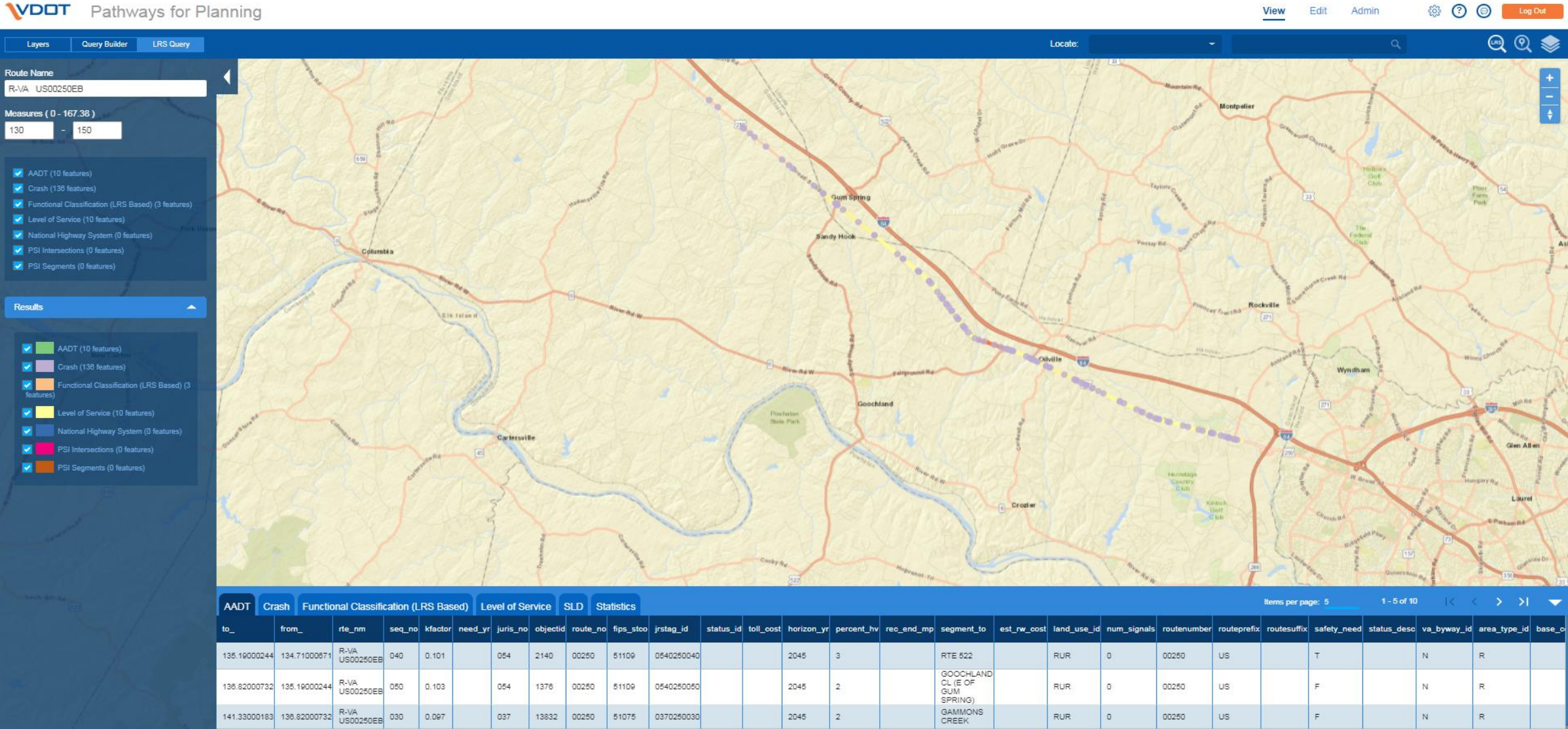
>

>>

tcd	tsn	url	app1	app2	app3	app4	from_	belong	config	rte_nm	intrnode	point_m	point_x	point_y	district	objec
Traffic Signal Control	NO	http://maps.google.com/maps?f=q&hl=en&geocode=&q=37.301281471,-76.7497496299	4701501	4700612	4700612		2.78922811	VDOT	3	R-VA047SC00612EB	398050	0	-76.74974963	37.30128147	Hampton Roads	775
Traffic Signal Control	YES	http://maps.google.com/maps?f=q&hl=en&geocode=&q=37.3127236999,-76.7324139595	4700645	US00060	US00060		236.52906548	VDOT	3	R-VA US00060EB	398129	0	-76.73241396	37.3127237	Hampton Roads	872
Traffic Signal Control	YES	http://maps.google.com/maps?f=q&hl=en&geocode=&q=37.3066611578,-76.7521452693	4701517	4700658	4700612	4700612	2.38903866	VDOT	4	R-VA047SC00612EB	398049	0	-76.75214527	37.30666116	Hampton Roads	948
Traffic Signal Control	YES	http://maps.google.com/maps?f=q&hl=en&geocode=&q=37.3158760295,-76.7338128686	4700658	US00060	US00060		236.28901662	VDOT	3	R-VA US00060EB	398156	0	-76.73381287	37.31587603	Hampton Roads	1091

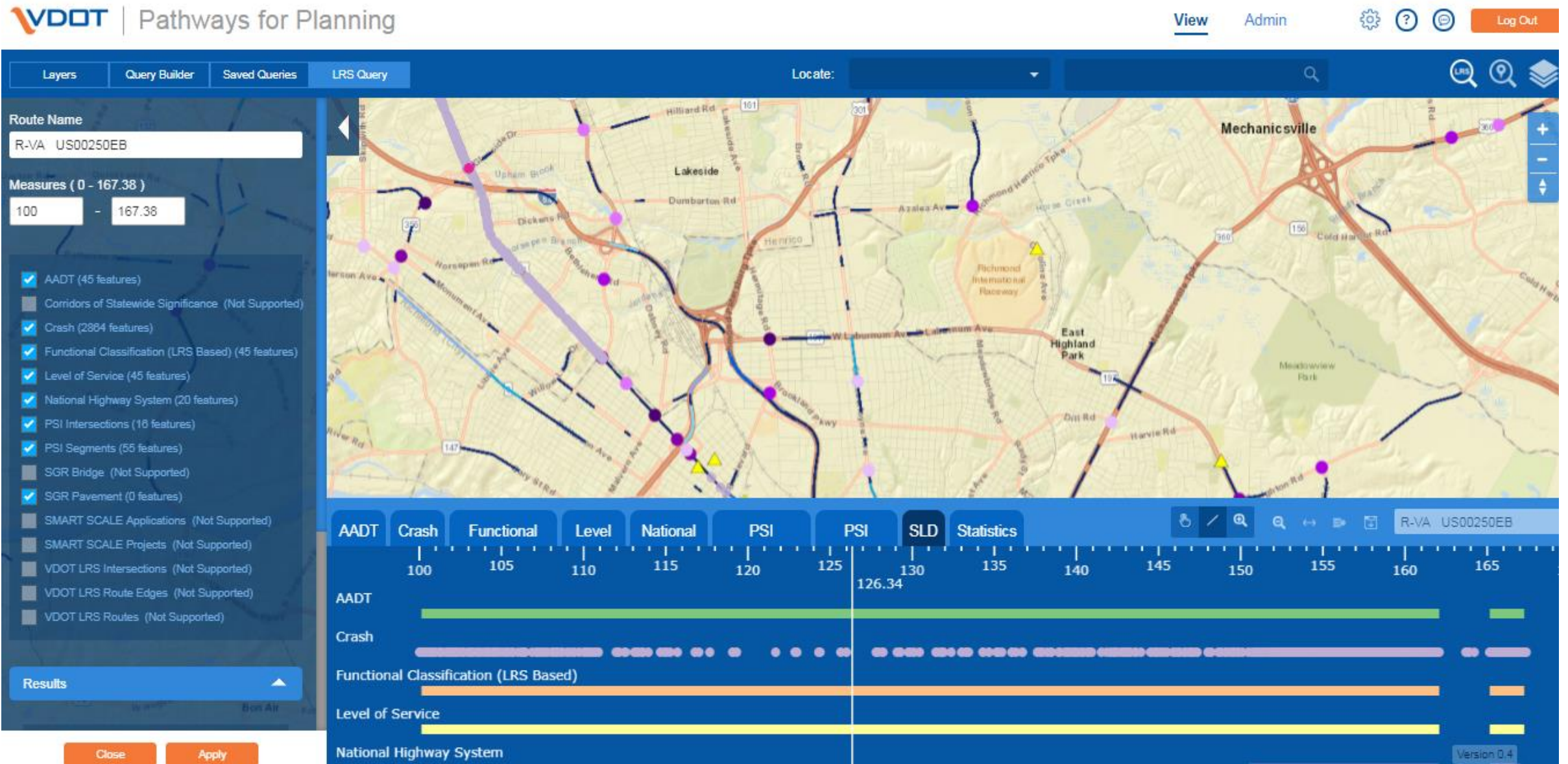
Linear Referencing System (LRS) Query

Existing conditions for 250 EB, measures 130 to 150



Slide Line Diagram

Concentration of crashes along LRS for 250 EB



Query Builder

Query non LRS data to view locations of SGR and SMART SCALE projects

Layers Query Builder Saved Queries

Area of Interest

Draw Shapes

Add Point filters...

Start tracing

Select Boundaries

Add boundaries filters...

Add

Layer

SGR Bridge X

SGR Pavement X

SMART SCALE Applications X

SMART SCALE Projects X

Add Layers

Apply Clear Save

VDOT Pathways for Planning View Admin Log Out

Layers Query Builder Saved Queries LRS Query Locate:

Area of Interest

Layer

SGR Bridge X

SGR Pavement X

SMART SCALE Applications X

SMART SCALE Projects X

Add Layers

Results

☒ SGR Bridge (64 features)

☒ SGR Pavement (100 features)

☒ SMART SCALE Applications (489 features)

☒ SMART SCALE Projects (489 features)

Export

SGR SGR SMART SCALE SMART SCALE SLD Statistics

Items per page: 5 1 - 5 of 489

funded	appid_1	org_name_1	district_r_1
	F15-00000005021-R01	Louisa County	9
	F15-0000004474-R01	Roanoke City	24
	F15-0000004879-R01	Westmoreland County	17
	F15-0000004573-R01	James City County	53
	F15-0000004549-R01	Lee County	43

Version 0.4

Apply Clear Save

Query Builder

SYIP projects with expenditures greater than \$1,000,000

VDOT Pathways for Planning

View Edit Admin

Layers Query Builder LRS Query

Locate:

Area of Interest

Draw Shapes

Polyline 1

Nearby: 2 miles

Start tracing

Select Boundaries

Layer

SYIP Project Clusterpoints

+ Add

Total Expenditures > 1000000

SYIP Project Lines

+ Add

Total Expenditures > 1000000

Add Layers

Results

SYIP Project Clusterpoints (2 features)

SYIP Project Lines (3 features)

Export

Apply Clear

Add Attribute Filter

Total Expenditures

is greater than

1000000

Done

Add

Map showing project locations in the Fredericksburg area, including labels for Elkton, Crozet, Ashland, Tuckahoe, Bon Air, Richmond, High and Springs, Mechanicsville, Lakewood, West Point, Warsaw, Tappahannock, Colonial Beach, and California. The map also shows major roads like I-95, I-86, and I-66.

SYIP Project Clusterpoints

SYIP Project Lines

Statistics

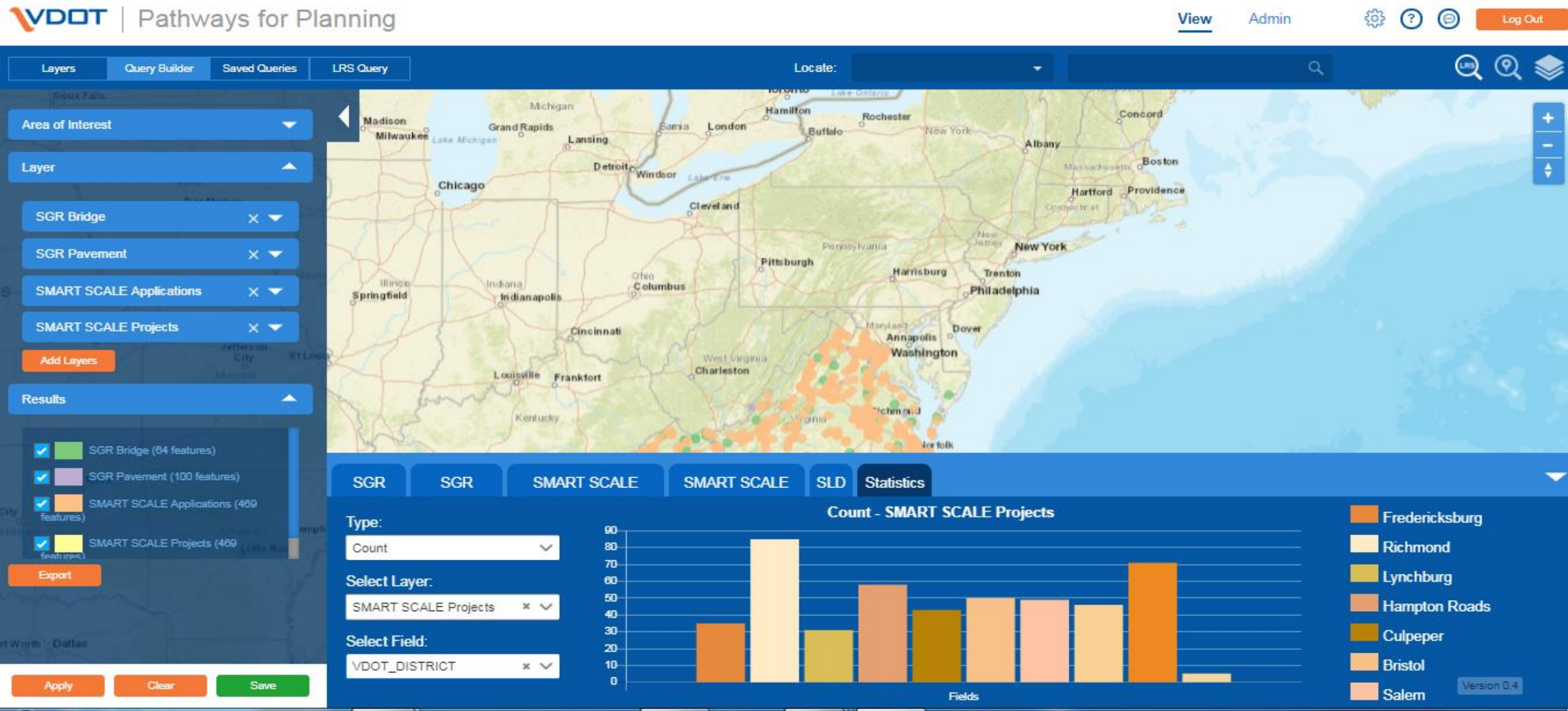
upc	route	objectid	zipcodes	limits_to	town_name	county_name	description	limits_from	street_name	project_phase	residency_desc	const_comp_date	project_manager	project_purpose	const_begin_date	sb_no_of_bridges	jurisdiction_desc	district_code_desc	state_highway_desc	total_est_approved
107140	17	353	22407,22408	0.399 miles East of Int with Germanna Point Dr / Hospital Bl		SPOTSYLVANIA	#HB2 FY17 ROUTE 17 I95 BRIDGE TO HOSPITAL BLVD	0.618 miles West of Int with Germanna Point Dr / Hospital Bl	Mills Drive	DESIGN UNDERWAY	FREDERICKSBURG		Catherine Coffey	Widen Route 17 from 2 lanes to 4 lanes to accommodate increased traffic volumes and replace the structurally deficient Bridge over Interstate 95 INTERSECTION IMPROVEMENTS		1	Spotsylvania County	Fredericksburg	Primary	20000000

Items per page: 5 1 - 2 of 2

Version 19.08

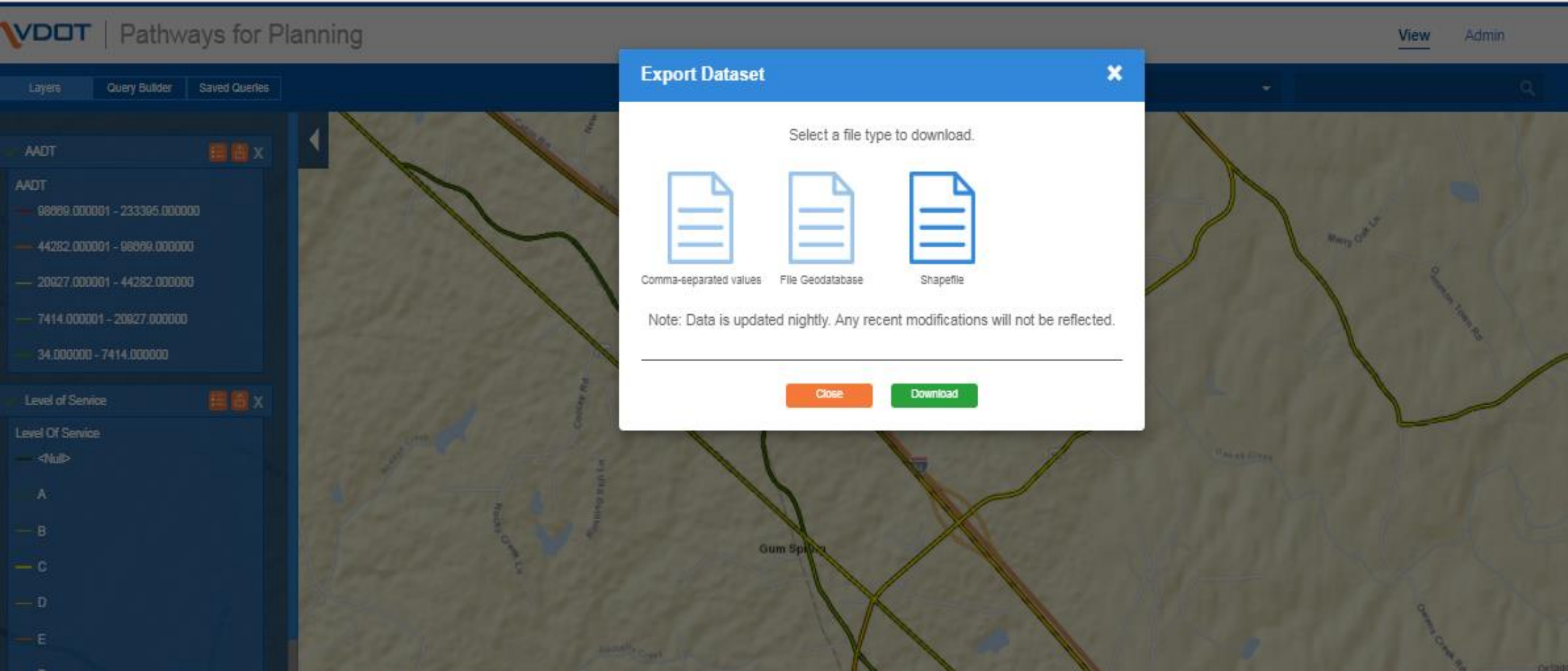
Statistics

Number of SMART SCALE projects by VDOT district



Exporting

Ability to export data as statewide datasets or query results as CSV, Geodatabase, or Shapefile



Moving forward

Monthly Releases

- ❑ Finalize requirements
 - Metadata
 - Edit – ability to create and maintain data
 - Plan – store data by relationships
 - Integration with other systems
- ❑ Enhancements
- ❑ Static data updates

Business Goals Advancing P4P

- ☐ Define future functional needs
- ☐ Formalize a Change Management Process
- ☐ Engage all business units and planning partners to identify system enhancements
- ☐ Form a User Advisory Committee
- ☐ Select a Steering Committee
- ☐ Governance
- ☐ Training

Contact Information

Geraldine S. Jones
Transportation Mobility Planning Division
Virginia Department of Transportation
geraldine.jones@vdot.virginia.gov

vdotP4P@vdot.virginia.gov

<https://vdotP4P.com>

Questions?

Thank You!