



VDOT eConstruction

How did we get here and
where are we going next?

Ian Millikan

Assistant State Construction Engineer

VDOT

Virginia Department of Transportation

- 9 Districts + Central Office
- 7,500 Employees
- Maintain 128,500 lane miles of pavement:
 - Interstate: 5,500 lane miles
 - Primary: 22,000 lane miles
 - Secondary: 100,300 lane miles
 - Frontage: 650 lane miles



VDOT

Virginia Department of Transportation

- \$5.4 Billion annual operating budget
 - \$1.7 Billion Construction
 - \$2.2 Billion Maintenance
 - \$471 Million – Regional Projects
 - \$960 Million – Admin/Other
- MegaProjects
 - HRBT - \$3.8 Billion
 - I-66 OTB - \$1.89 Billion
- 300 +/- Construction projects per season



VDOT

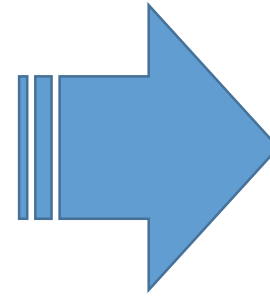
Main eConstruction Stakeholders

401

In-House Construction
Personnel

+/- 600

Avg. Consultants



40%

Avg. In-House



60%

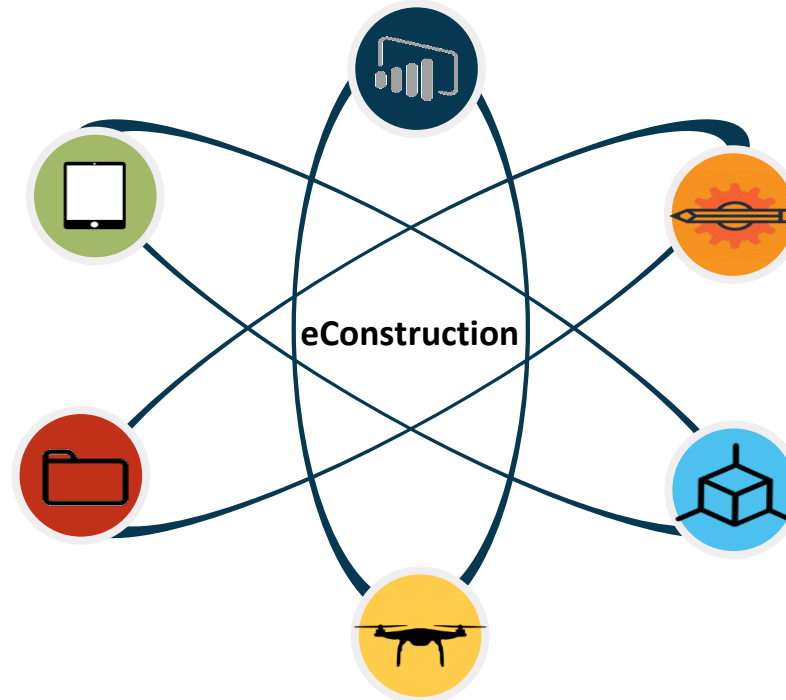
Avg. Consultants

+/-1,000*

Owner Representatives
*Not Including Contractors

DIGITAL STRATEGY

- Project Analytics and Dashboarding
 - Evaluation of Current Systems
- Business Process Re-development
 - Seamless Integration



UNMANNED AERIAL SYSTEMS

- Progress Photos
- Plan Verification
 - As-Builts

TABLET BASED INSPECTION

- PlanGrid for advanced PDF tools
- Headlight Pilot for Field Data Capture

DOCUMENT MANAGEMENT SYSTEMS

- Submittal processes
- Workflow mapping
- Project Document Management

JOBSITE TECH & FURTHER RESEARCH

- Headlight Data Usage
- RFID
- Team Member
- eTicketing
- Augmented Reality
- 3D Printing
- Further Research & Development

3D/4D MODELING

- 3D engineered model linked to project schedule (4D)
- Automated Machine Guidance (AMG)

Key Priorities

On Time & On Budget

Business Process
Reengineering

Digital Transformation

Complexity
Reduction

Change
Management

Strengthen Core
Competencies

User Focus

Reduce
Fragmentation

Data Driven
Decision Making

Eliminate Paper
Processes

Business Process Reengineering

Identifying and Prioritizing Business Needs



Priority Business Needs

Digital Plans &
Documents

Punchlist Tools

Progress Photos

Field Collaboration

Field Data Capture

'Single Source of
Truth'

Data Integration

Field Reporting

Uniform Document
Management
System

Submittal
Workflow Process

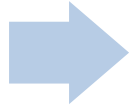
Cradle to Grave
Solution

Process
Integrations

VDOT eConstruction's Tiered Approach

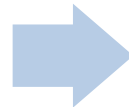
Provide the right tools for the right ROLE

ProjectWise



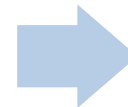
Centralized data and document management system

PlanGrid



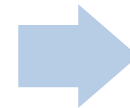
PDF and collaboration tool for inspectors

Headlight



Field data collection tool

AWP*



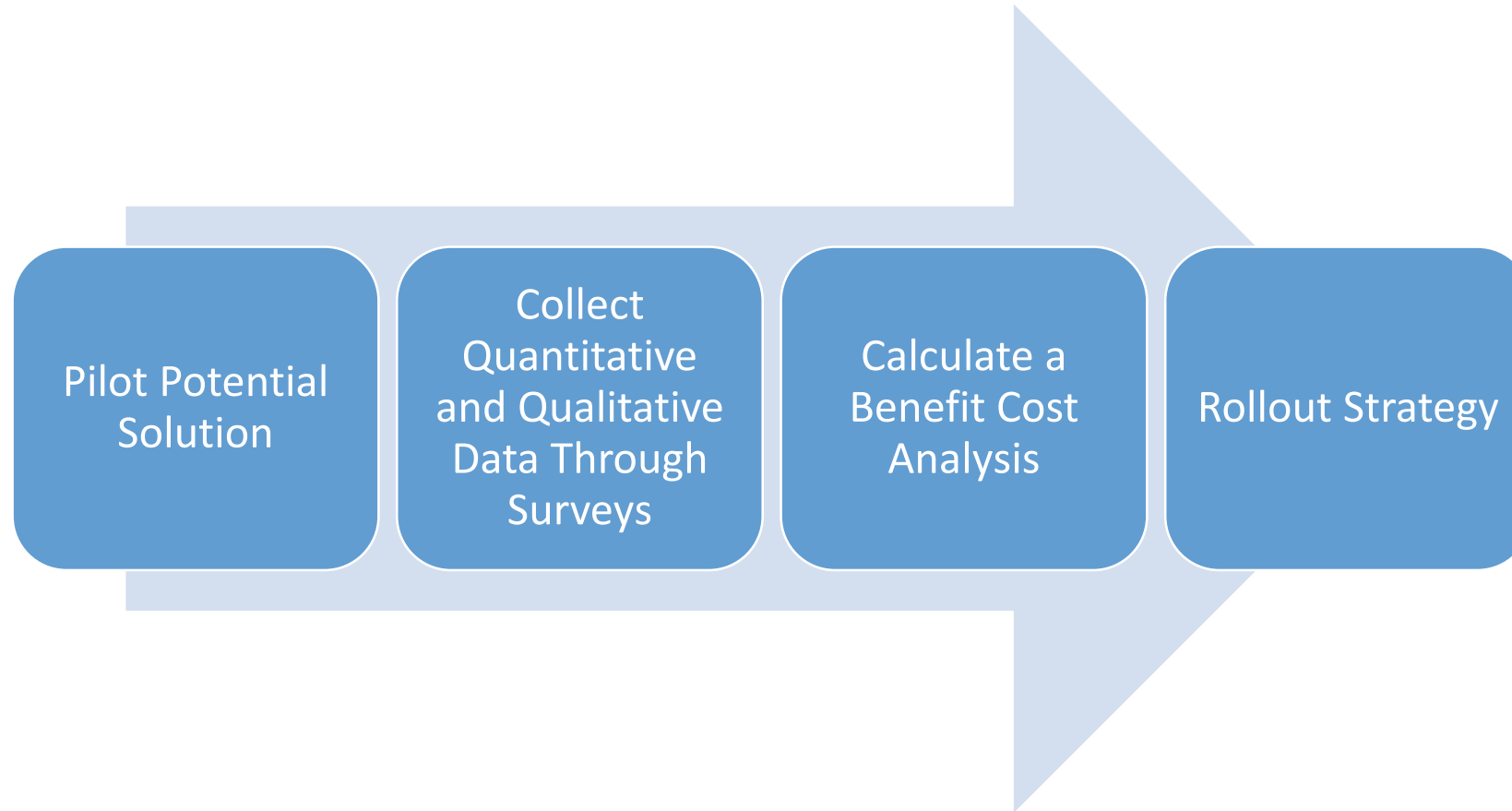
Contract Management

Digital Transformation

A Guide to Piloting Solutions



Digital Implementation Strategy



Pilot Program Strategy



Field Test User Applications

- Assess program strengths and limitations
- Collect User Feedback
- Identify additional areas for use



Develop Best Practices

- Help set standards for larger scale use
- Establish internal experts/power users



Assess Value

- Formal return-on-investment analysis
- Usability Assessment

Digital Transformation Timeline

iPads in Field



PlanGrid



Headlight



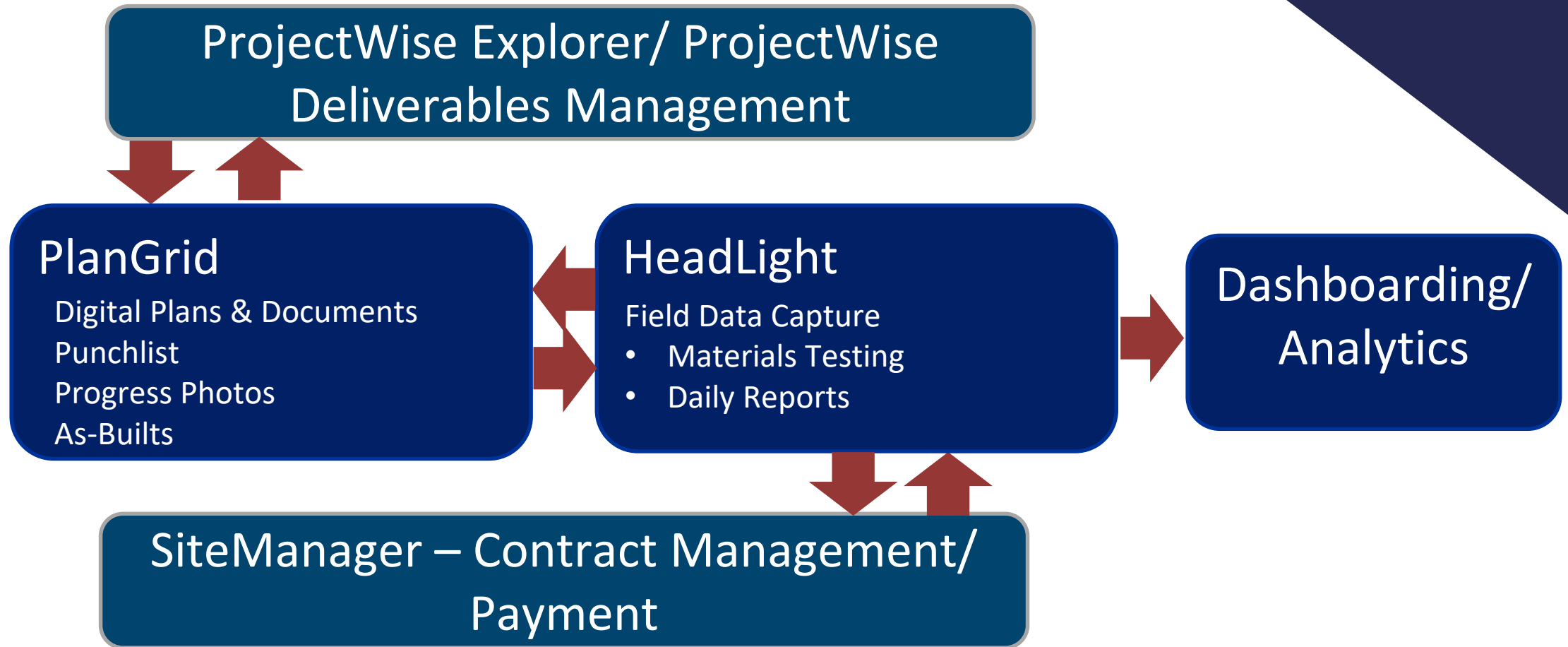
DMS/Submittal Workflow



Seamless Integrations



Seamless Integrations



PlanGrid Pilot Program



Background

- Grassroots effort started in field
 - Fredericksburg District
 - Consultant community
- Formalized Pilot in 2018
 - Start September 2018
- Research Funding, VTRC
- Moving toward Statewide Implementation in 2020



Snapshot of the Pilot Program

70

Projects

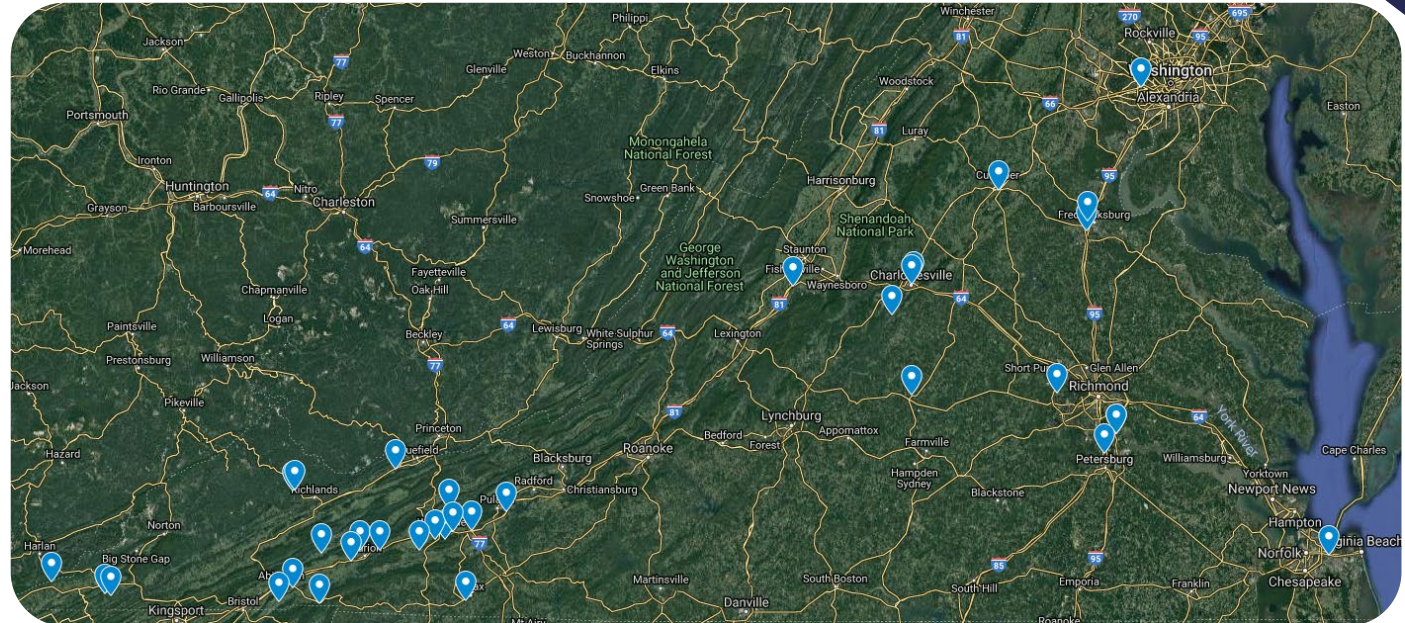
- Design Build
- I-66 OTB Mega-Project
- Emergency, on-call, schedule

75

Pilot Program Participants

8

Districts Participating



Business Needs - Tested

Digital Plans & Documents

Mark Ups

Progress Photos Tied to Plans

Real-Time Field Collaboration

PunchList

Field Reporting

Digital 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

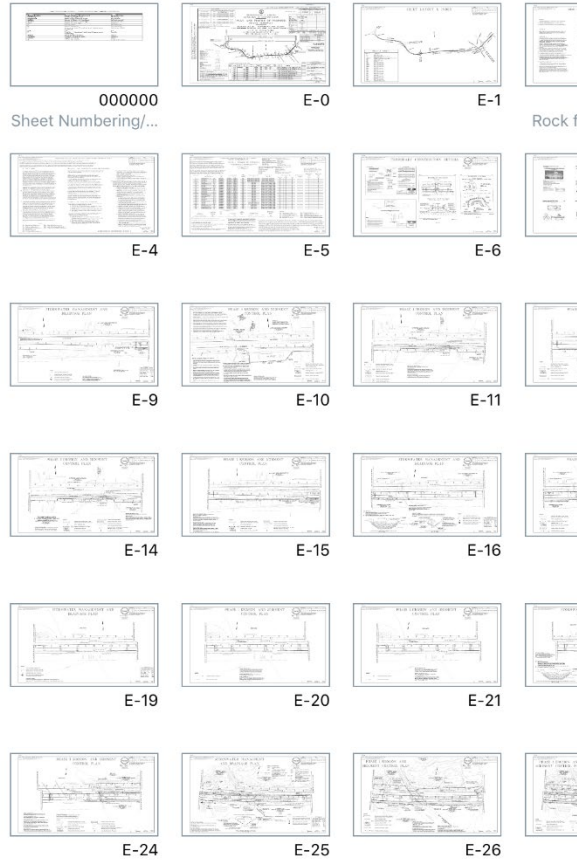
LTE 64%

The screenshot shows a mobile application interface. The top bar displays "2016 Road and Bridge Specs" and a search icon (magnifying glass) circled in red. Below the top bar, the document content is visible, including sections like "608.01—Description", "608.02—Equipment", and "608.03—Measurement and Payment". A search overlay is active, showing the search term "tree well" and several search results. The results include "789 SECTION 609—TREE WELLS AND TREE WALLS" (Page 23), "SECTION 609—TREE WELLS AND TREE WALLS 609.01—Description" (Page 833), and "SECTION 609—TREE WELLS AND TREE WALLS" (Page 833). The search results are highlighted in yellow. At the bottom of the search overlay, it says "8 matches found".

Sheets Documents Tasks Field Reports Team More

Digital Plans

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



Abutment

Found in sheet 228 sheets

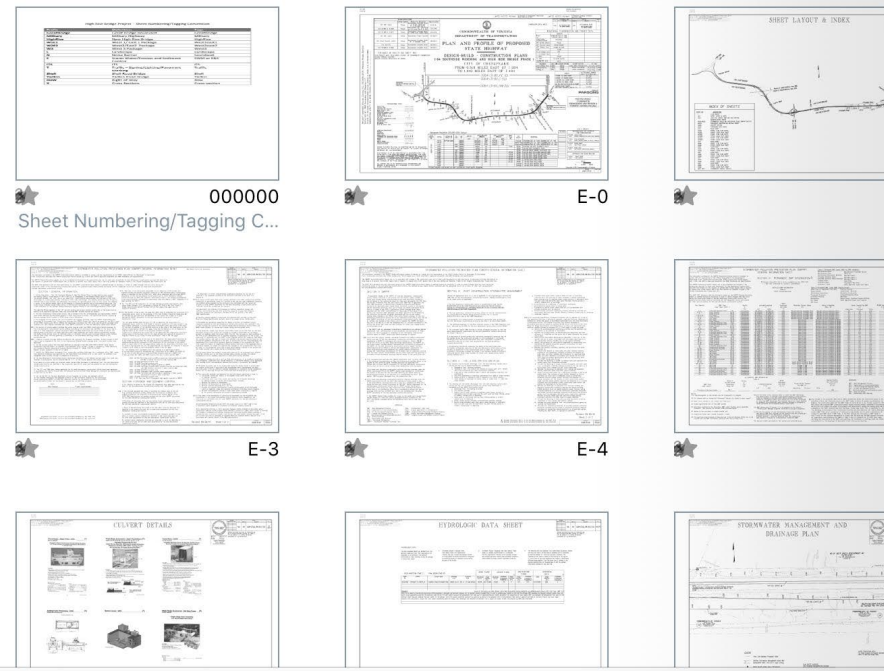


5:08 PM Thu Aug 8

Projects

000000 - Highrise Bridge

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



LTE 54%



Filters Clear

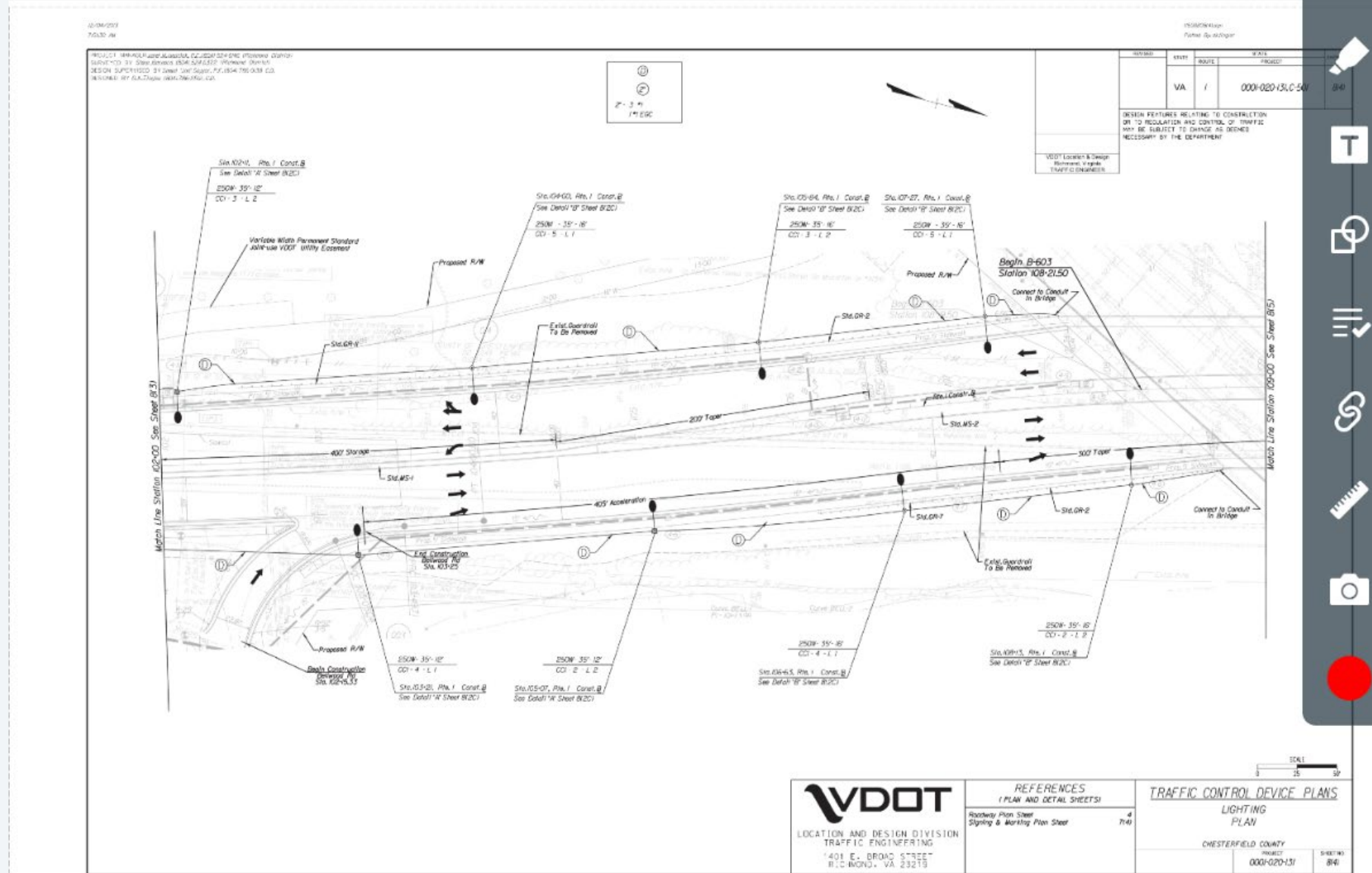
Filter	Count	Toggle
bridge	581	<input type="checkbox"/>
cross-section	30	<input type="checkbox"/>
e&s	24	<input type="checkbox"/>
e&s phase 1	43	<input type="checkbox"/>
e&s phase 2	43	<input type="checkbox"/>
general	8	<input type="checkbox"/>
geotech	99	<input type="checkbox"/>
greatbridge	48	<input type="checkbox"/>
highrise	315	<input type="checkbox"/>
information	1	<input type="checkbox"/>
its	207	<input type="checkbox"/>

Sheets Documents Tasks Field Reports

Sheets Documents Tasks

Sheets Documents Tasks Field Reports

Mark Ups



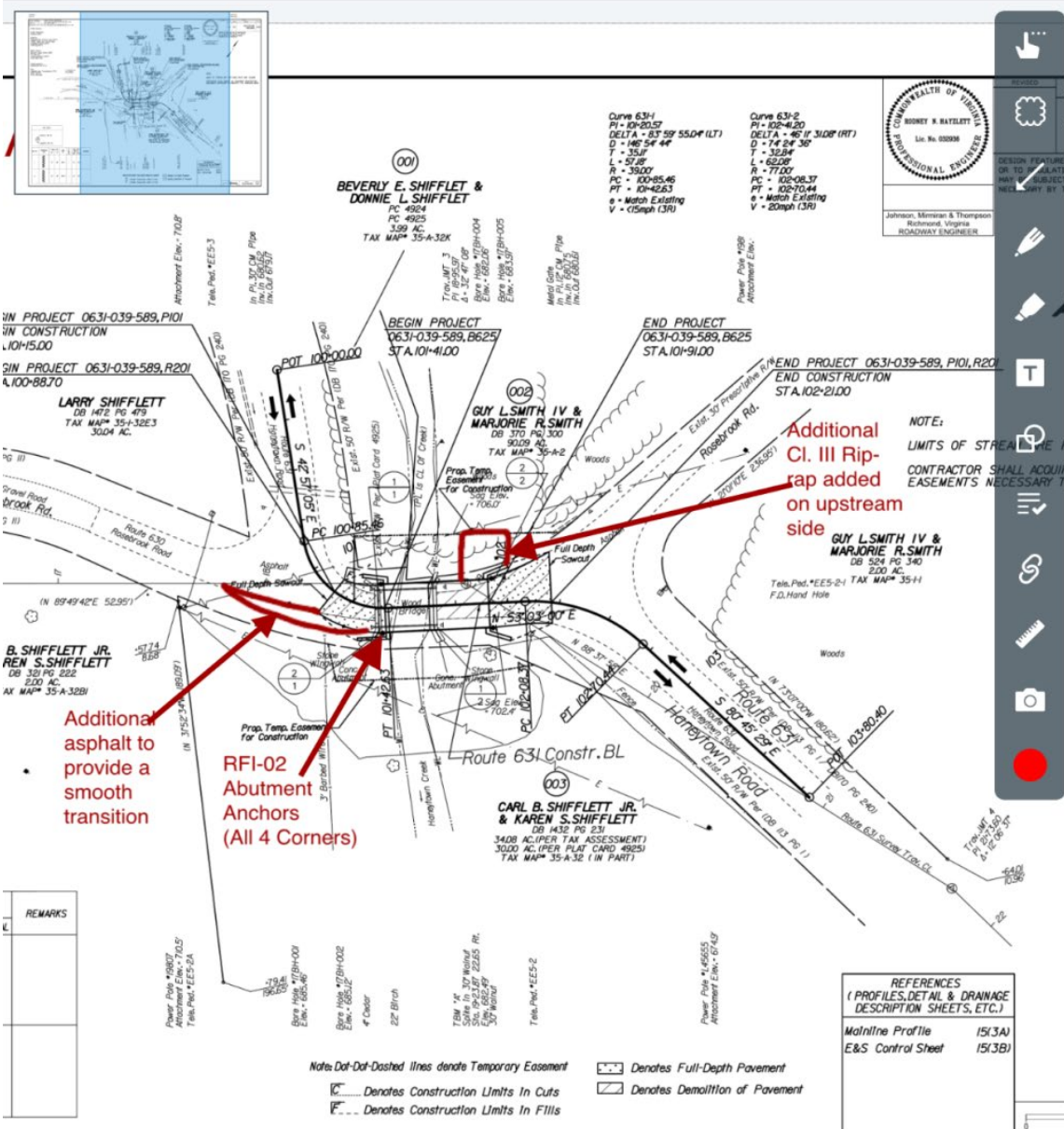
Back

R8 (Construction)



Search in this sheet

Mark Ups



Arrow Tool

Text Tool

Mark Ups

10:05 AM Thu Aug 8

LTE 77%

< 000000 - eConstruction Demo Project

47 (Plans_1)



Search in this sheet

Per designer comments, outfall elevation to be raised by 1'

22691 ft 5 in

50'

3 Related

Undo Redo

REFERENCES
PROFILES, DETAIL & DRAINAGE
DESCRIPTION SHEETS, ETC. 1

Melrose Profile	4A
Belwood Rd. Profile	4A
Drainage Descr.	2H
Erosion & Sediment Control Notes	2A

Notes:
Note: Figures in square brackets and dot-dashed lines denote Proposed Utility Connections.
Note: Figures in brackets and dot-dashed lines denote Temporary Connections.
Note: Figures in parentheses and dot-dashed lines denote Temporary Connections.

Legend:
[Symbol] Denotes Construction Limits In Cuts
[Symbol] Denotes Construction Limits In Fills
[Symbol] Denotes Existing and Overlay
[Symbol] Denotes New Pavement
[Symbol] Denotes Detention of Pavement

Highlight Tool

Measurement Tool

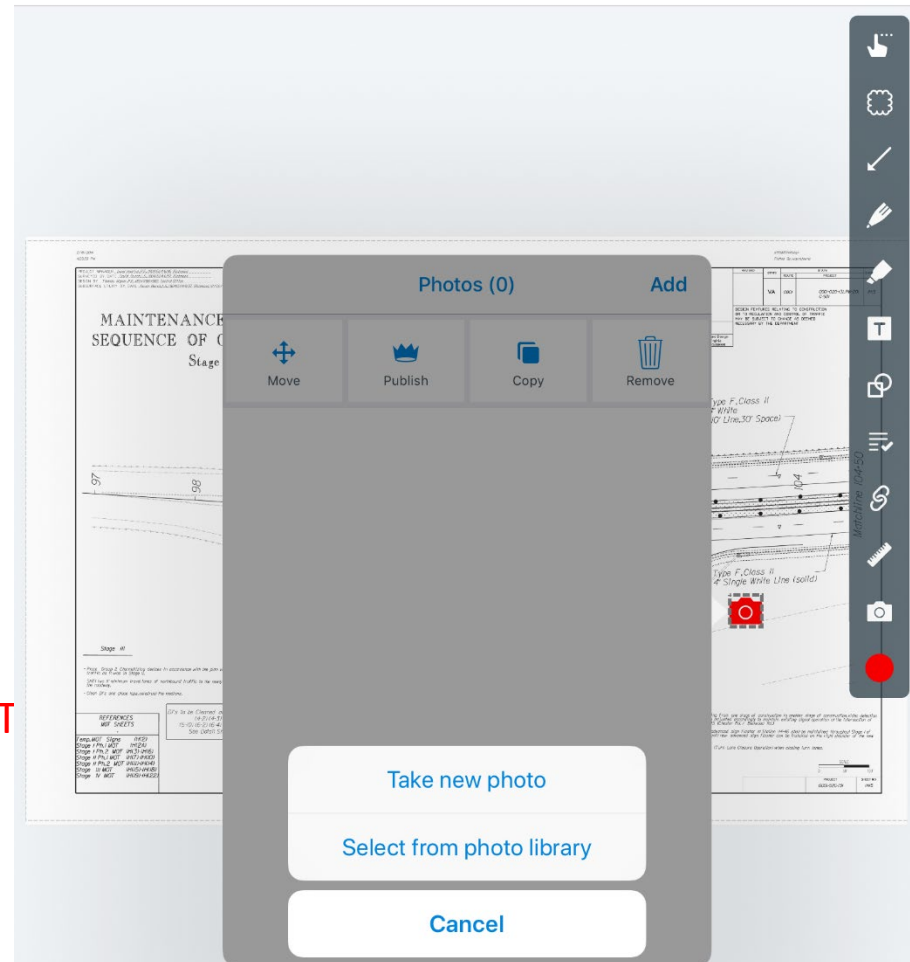
Photos tied to plans

Search in this sheet



Photo T

Search in this sheet



Photos tied to plans

Search in this sheet

Published Collision...II B601 Abutment B (1) Add

Move Unpublish Copy Remove

4/23/19 4/22/19 4/22/19

Substructure Unit	Spanning Area (Square Feet)	Estimated Total Deck Area (Square Feet)	Estimated Total Deck Volume (Cubic Feet)	Minimum Deck Depth (Feet)	Work Point Coordinates
Abutment A	367	193	291	2.03	K.P. 290728.424 220545.8355
Abutment B	367	193	291	2.03	K.P. 290741.2468 220731.8746

WORK POINT COORDINATES

Location	Northing	Easting
K.P.	290728.424	220545.8355
K.P.2	290741.2468	220731.8746

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION
STRUCTURE AND BRIDGE DIVISION
I-B1 SBL SUBSTRUCTURE LAYOUT
STAGE I CONSTRUCTION

NO. Description Date Designed By Scale Project No. Issue No. Issue Date
Revisions
1 APR 2019 296-64 6 OF 19

Published Collision...II B601 Abutment B (1) Add

Move Unpublish Copy Remove

4/23/19 4/22/19 4/22/19

Substructure Unit	Spanning Area (Square Feet)	Estimated Total Deck Area (Square Feet)	Estimated Total Deck Volume (Cubic Feet)	Minimum Deck Depth (Feet)	Work Point Coordinates
Abutment A	367	193	291	2.03	K.P. 290728.424 220545.8355
Abutment B	367	193	291	2.03	K.P. 290741.2468 220731.8746

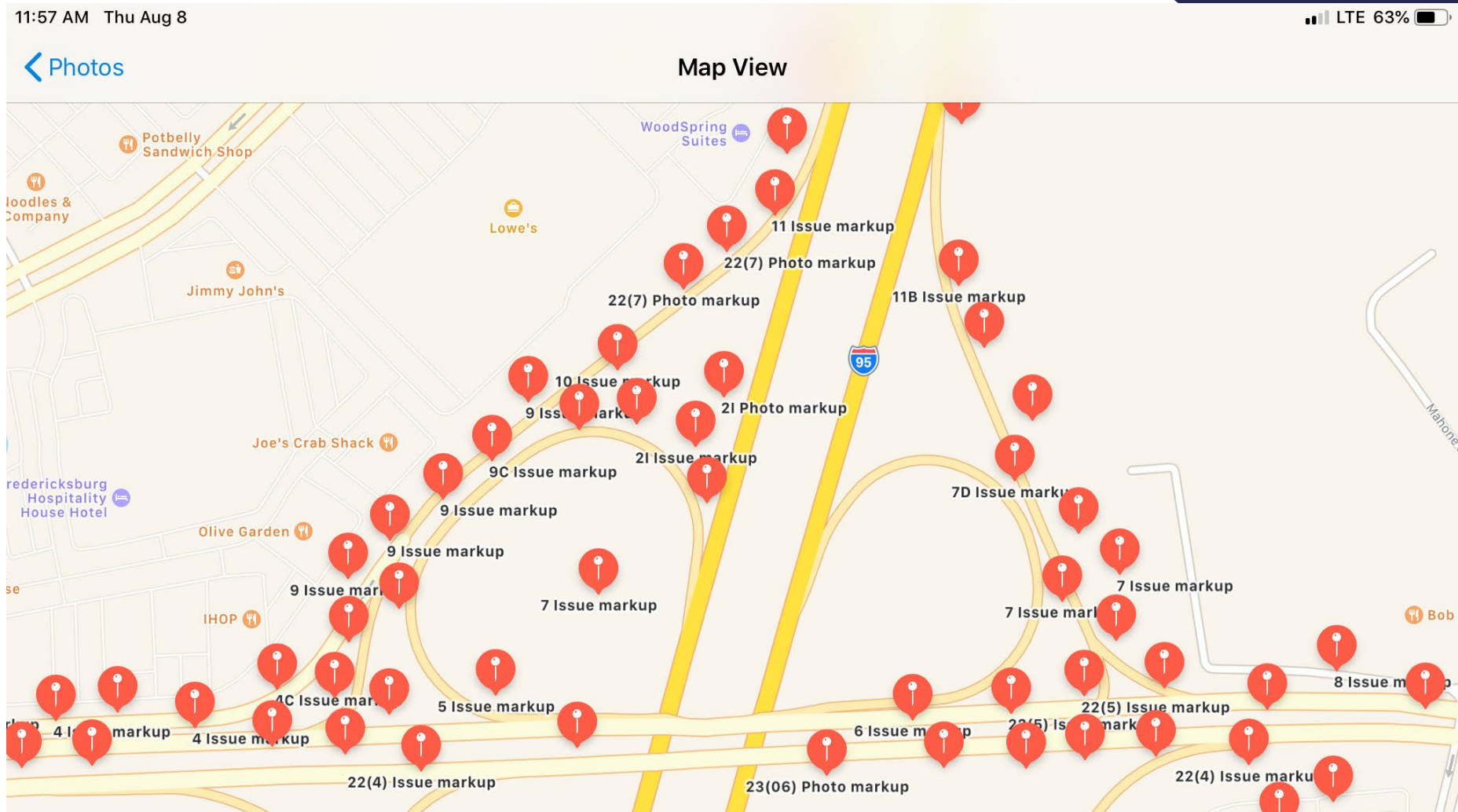
WORK POINT COORDINATES

Location	Northing	Easting
K.P.	290728.424	220545.8355
K.P.2	290741.2468	220731.8746

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION
STRUCTURE AND BRIDGE DIVISION
I-B1 SBL SUBSTRUCTURE LAYOUT
STAGE I CONSTRUCTION

NO. Description Date Designed By Scale Project No. Issue No. Issue Date
Revisions
1 APR 2019 296-64 6 OF 19

Photos tied to plans



Punchlist

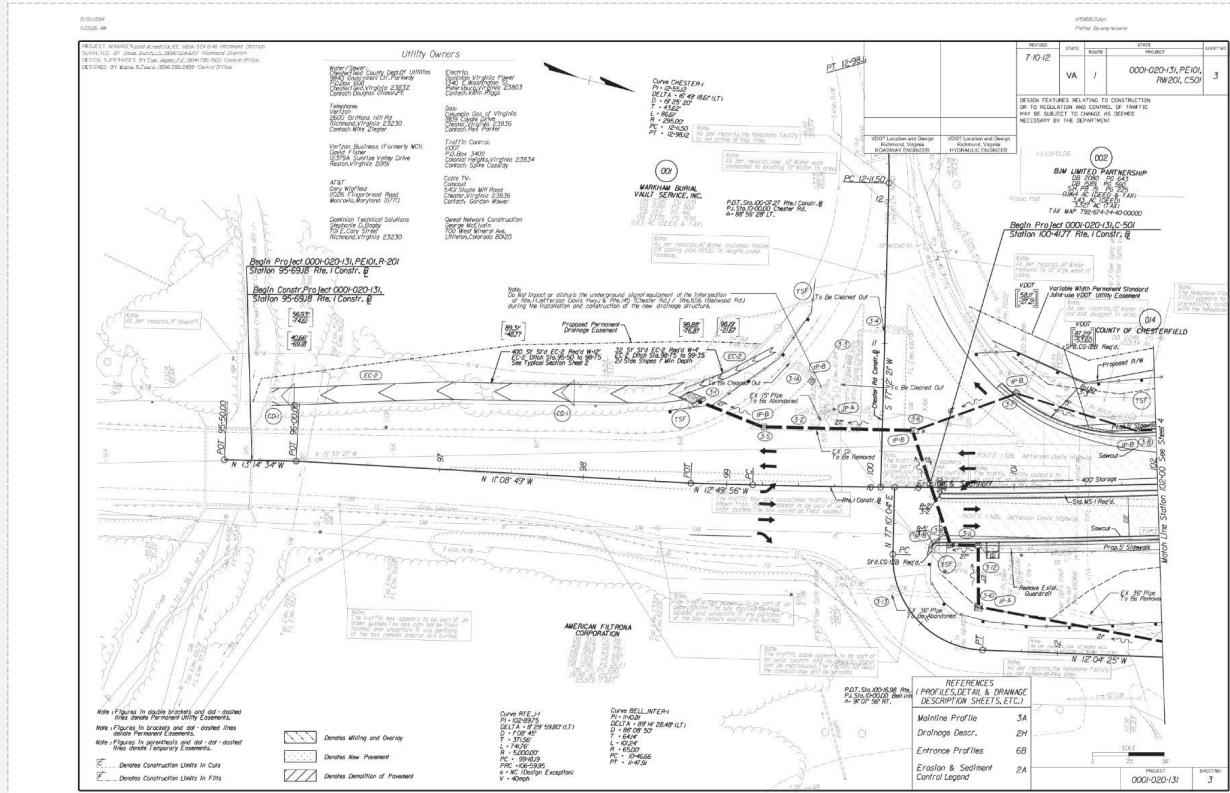
12:46 PM Thu Aug 8

< 000000 - Ben's practice project

45 (V1)



Q Search in this sheet



Tasl

Q Search in this sheet

Tasks New

General

ALL TASKS

- Constructibility
- Bridge Concrete
- Bridge - Miscellaneous
- Bridge Steel
- General Comment

Punchlist

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


















Real Time Field Collaboration

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

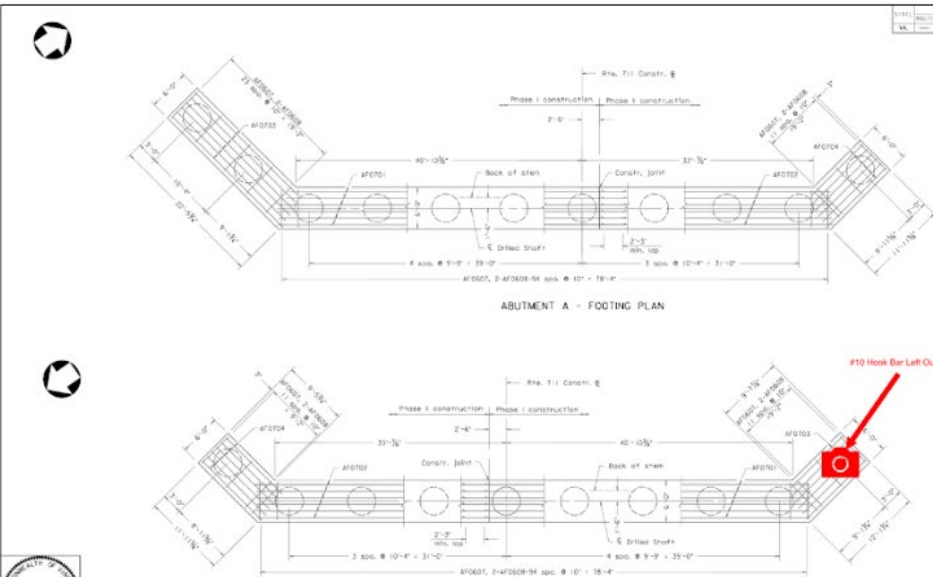
Undo Redo

9:52 AM Thu Aug 8

[Back](#)

B-10 (UPC 86442 Bid Let)

Search in this sheet



ABUTMENT A - FOOTING PLAN

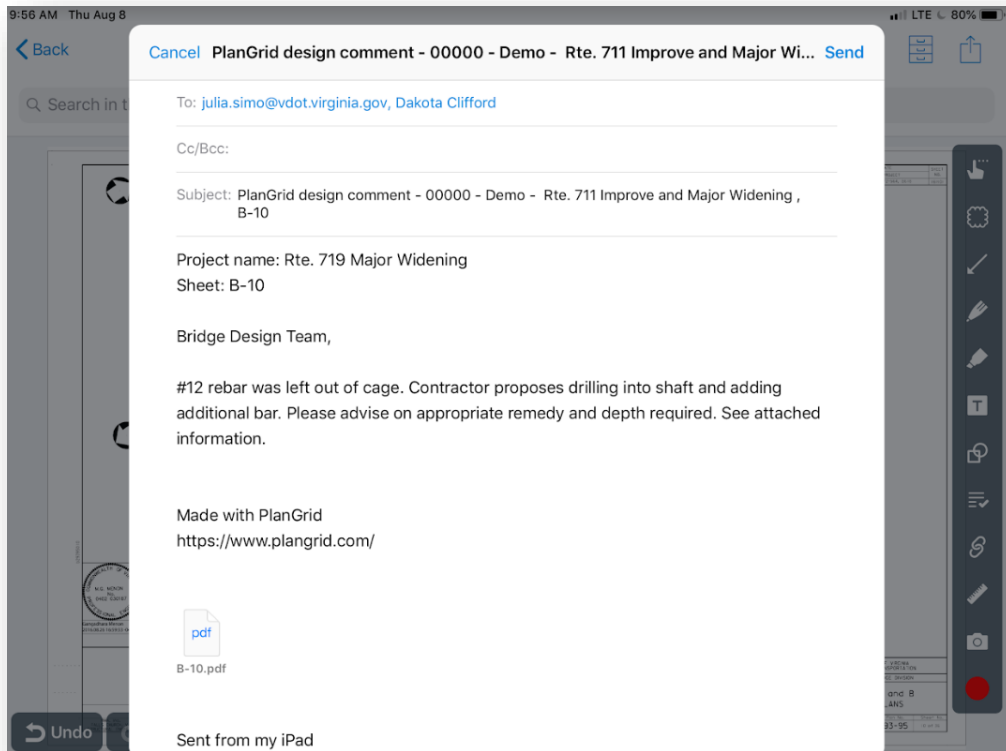
ABUTMENT B - FOOTING PLAN

#10 Hook Bar Left Out

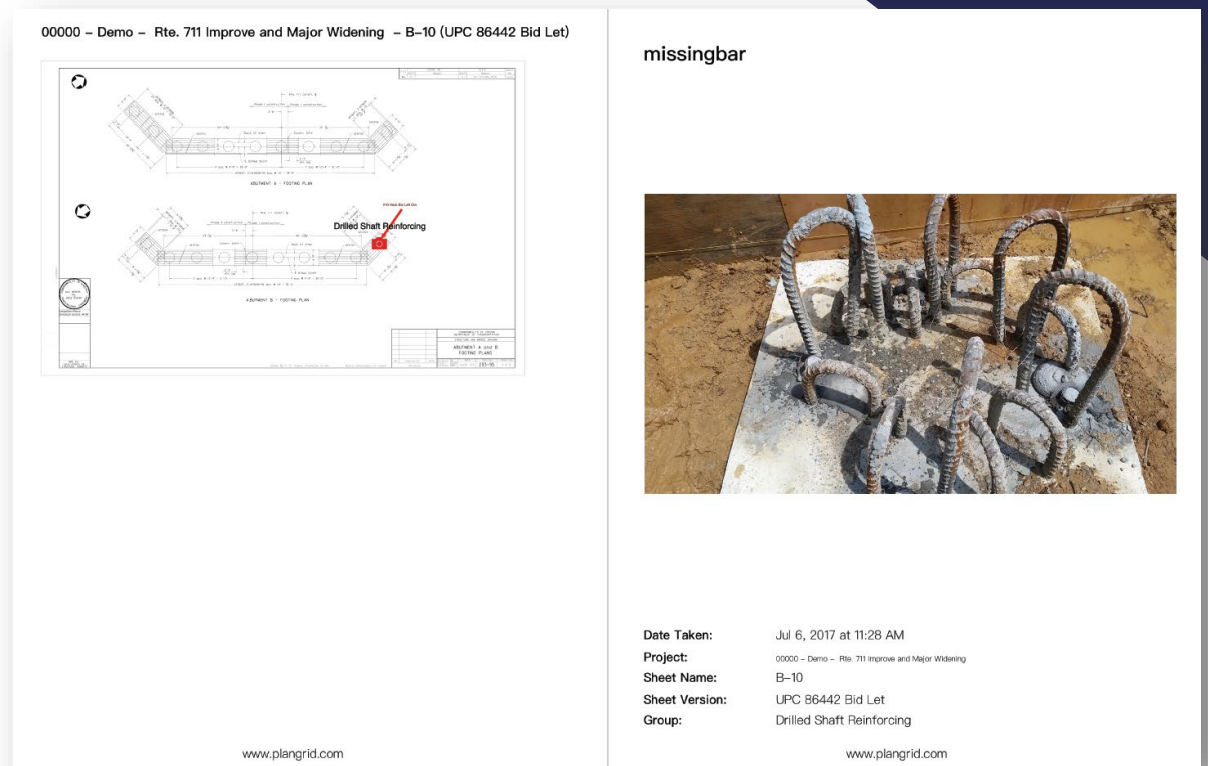
NO.	REVISION	DATE	BY	CHKD.	APP'D.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF TRANSPORTATION
STRUCTURE AND BRIDGE DIVISION
ABUTMENT A and B
FOOTING PLANS
293-95

Real Time Field Collaboration



Email sent directly from PlanGrid



PDF Package generated by PlanGrid.

Pilot Program Results

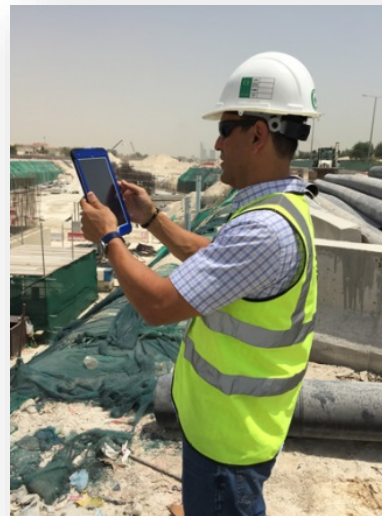
94%

Users say PlanGrid makes them more efficient



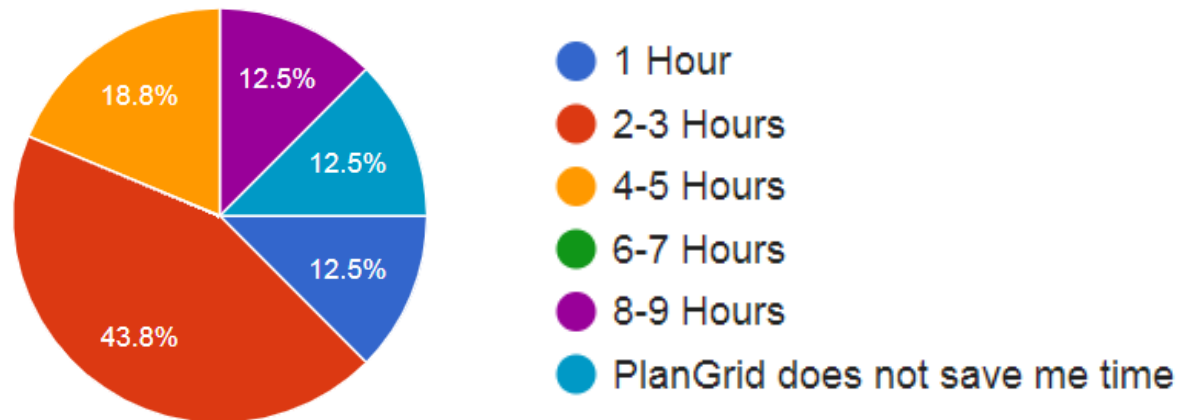
87%

Users view plans more frequently because of PlanGrid



Pilot Program Results

User survey – Estimated time per week saved by PlanGrid



2.6

Additional hours/week spent on jobsite

3.5

Total hours/week saved

16

Additional photos per week

Business Needs - Satisfied

Digital Plans & Documents

Mark Ups

Progress Photos Tied to Plans

Real-Time Field Collaboration

PunchList

Field Reporting

HeadLight

Real-Time Field Data Capture Tool



Snapshot of the Pilot Program

9

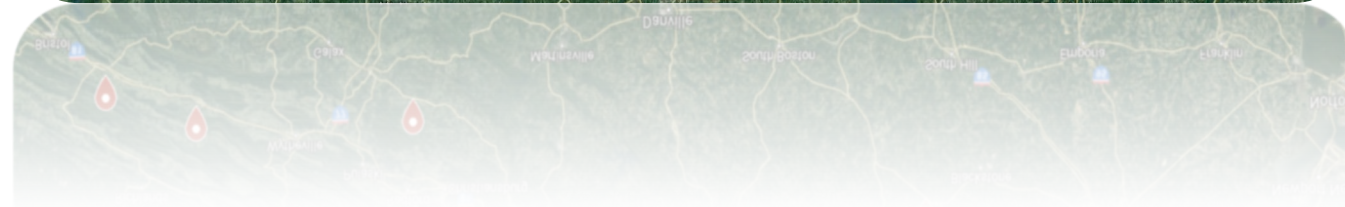
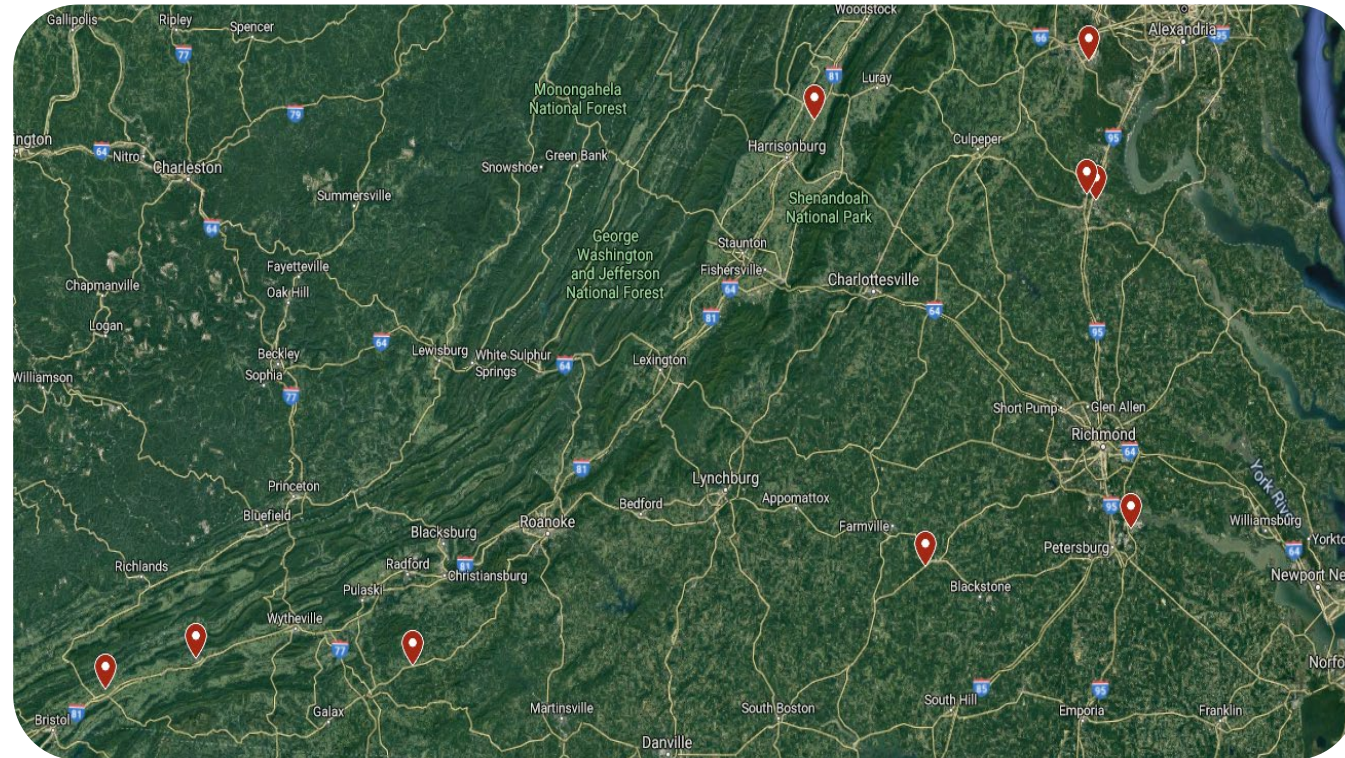
Projects

45

Users

8

Districts



Business Needs

Input field observations (weather, work activities, etc.)

Identify labor, equipment, and materials

Complete materials test reports

Develop daily diaries

Generate list of pay items completed

Programmatic level reporting

Input Field Observations

The image displays three overlapping screenshots of the HEADLIGHT Fieldbook mobile application interface. The top-left screenshot shows the main menu with a sidebar containing options: Journal, Spreadsheets, Reports, Forms, Academy, and New. A 'Journal Observations' dropdown menu is open, with 'Image' and 'Weather' options highlighted in red. The middle screenshot shows a 'VDOT Training Project' entry titled 'Haul road embankment' with a photo of a 'DANGER HIGH VOLTAGE' sign. Below the photo is a camera icon and the name 'Ian Millikan'. The rightmost screenshot shows a 'New Weather' widget for the 'VDOT Training Project' location. The weather data includes a temperature of 84°F, 'Cloudy Mostly' conditions, and a timestamp of 05 Aug 2019 4:12 PM. Below the weather data are fields for 'add description', 'LineItem', 'Tag', 'Equipment', 'Contractor', and 'BidItem'. The location is identified as Benjamin Brown with coordinates 37.5380, -77.4299.

Identify Labor and Equipment

HEADLIGHT Fieldbook

Search: 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	

HEADLIGHT Fieldbook

Search: 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

HEADLIGHT Fieldbook

2:59 PM Thu Aug 8

Search

VDOT Training Project

Equipment Contract Personnel Work Item

LineItem Tag Equipment Contractor BidItem

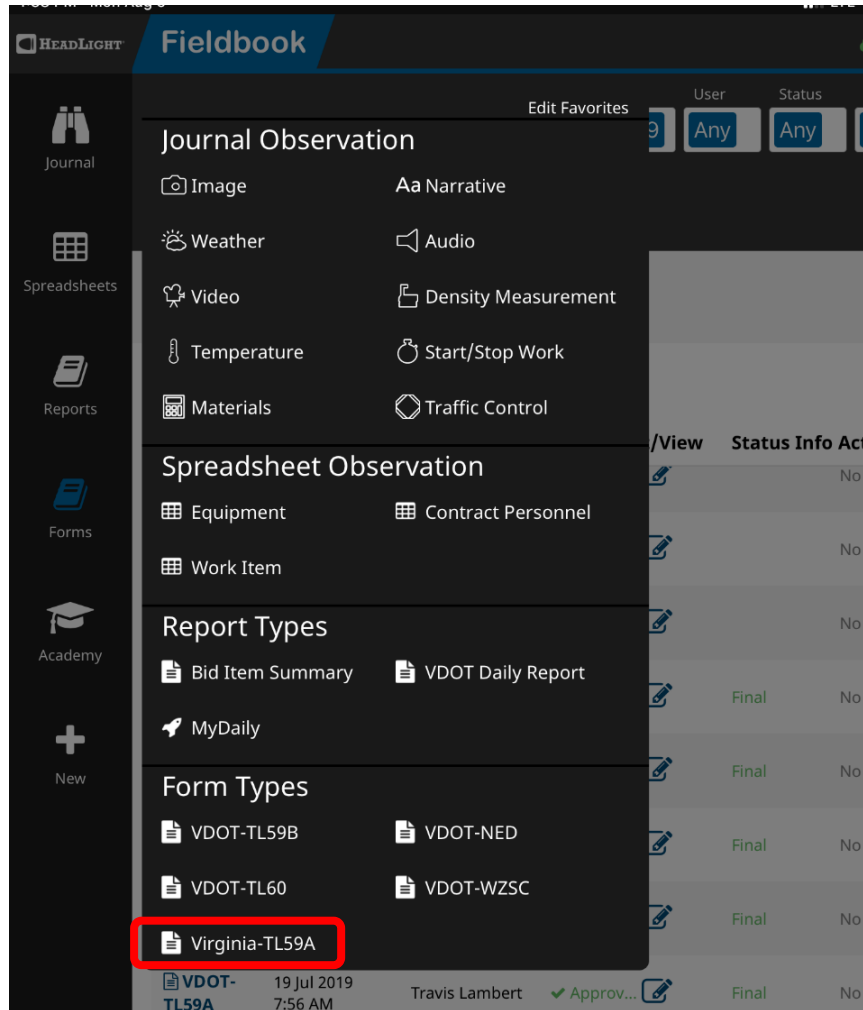
04 June 2019

BidItem	LineItem	Placed Qty	Units

22 May 2019


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

Complete Materials Test Re



4:38 PM Mon Aug 5 LTE 32%

Back to App Reload



Asphalt Core/Plug 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/sy)	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/sy)	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	110	643.	110.	464.	2.38	96.1	Yes		

VDOT-TL59A - Travis Lambert

Page 1 of 2
HEADLIGHT Form #3

Develop Daily Dairies

Fieldbook

Journal Observation

- Image
- Weather
- Video
- Temperature
- Materials

Journal Observation

- 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-NED
- VDOT-WZSC
- Virginia-TL59A

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

1 of 4

VDOT
Virginia Department of Transportation

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 proflorled 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.

Completed Pay Items List

The screenshot displays the 'Fieldbook' mobile application interface. On the left is a navigation sidebar with icons for Journal, Spreadsheets, Reports, Forms, and Academy. The main screen shows a 'Create Report' form for a 'VDOT Training Project'. The form fields are: Report Name (Work Item Summary Report), Report Type (Bid Item Summary), Report Date (12 June 2019 4:31:26 PM), and Shift (Day). Below the form is a list of recent reports, with 'Work Item Summary Report 5/20 - 6/1' highlighted. To the right, a 'Work Item Summary Report 5/20 - 6/1' is displayed, featuring the VDOT logo and a table of work items.

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

WORK ITEMS

#	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

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 5/20 - 6/1 12 Jun 2019 10:34 AM Admin VDOT **Submit...** Waiting for Approval No

CQUIP Summary 12 Jun 2019 9:49 AM Admin VDOT **Draft** No

Survey Highlights

Field Users

4.4 hours

Average time saves per week on data entry

5.4 hours

Average added time per week in field

21.4

Average # of additional pictures

Office Users

13

Average # additional observations

All Users

81%

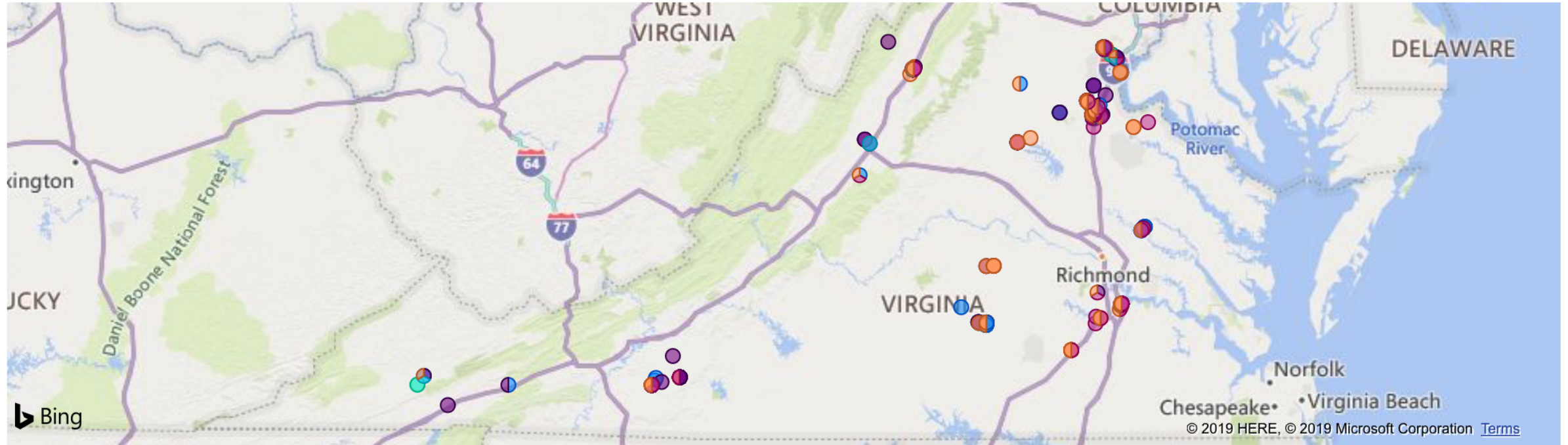
HeadLight Reports submitted within
24 hours

Virginia Department of Transportation - Construction Programs Dashboard (R&D Only)

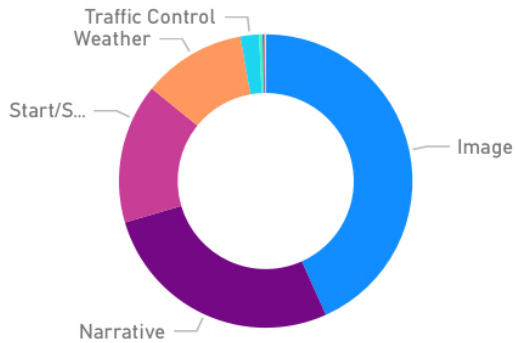


Observations Statewide

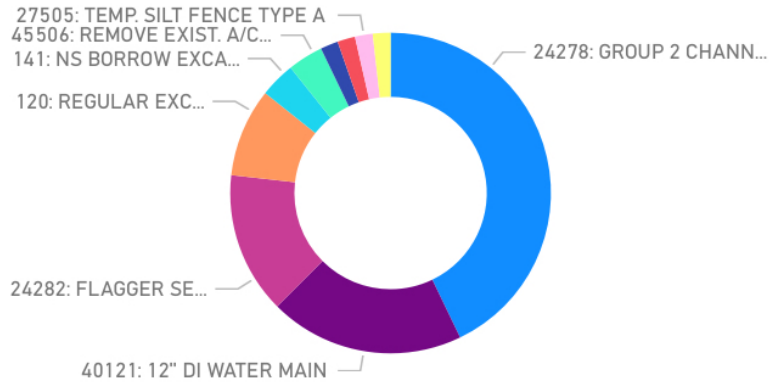
Type ● Density Measurement ● File ● Image ● Materials ● Narrative ● Start/Stop Work ● Temperature ● Traffic Control ● Video ● Weather



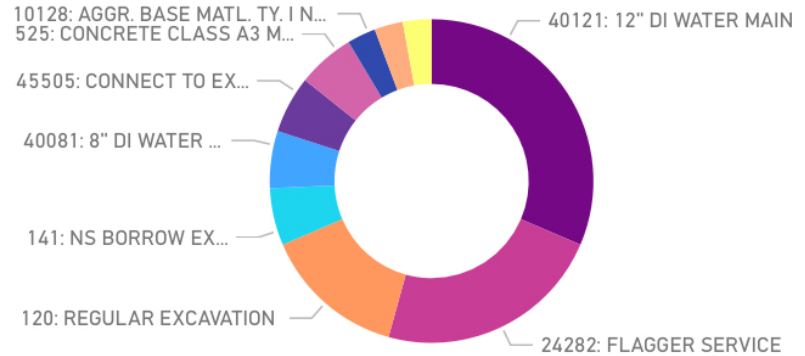
Count of Type by Type



Top Ten Pay Items by Qty



Top 10 Pay Items By Cost



ProjectWise

Document Management System (DMS) /
Submittal Workflow



Main Goals

Replace file cabinet

One stop shop for project documents

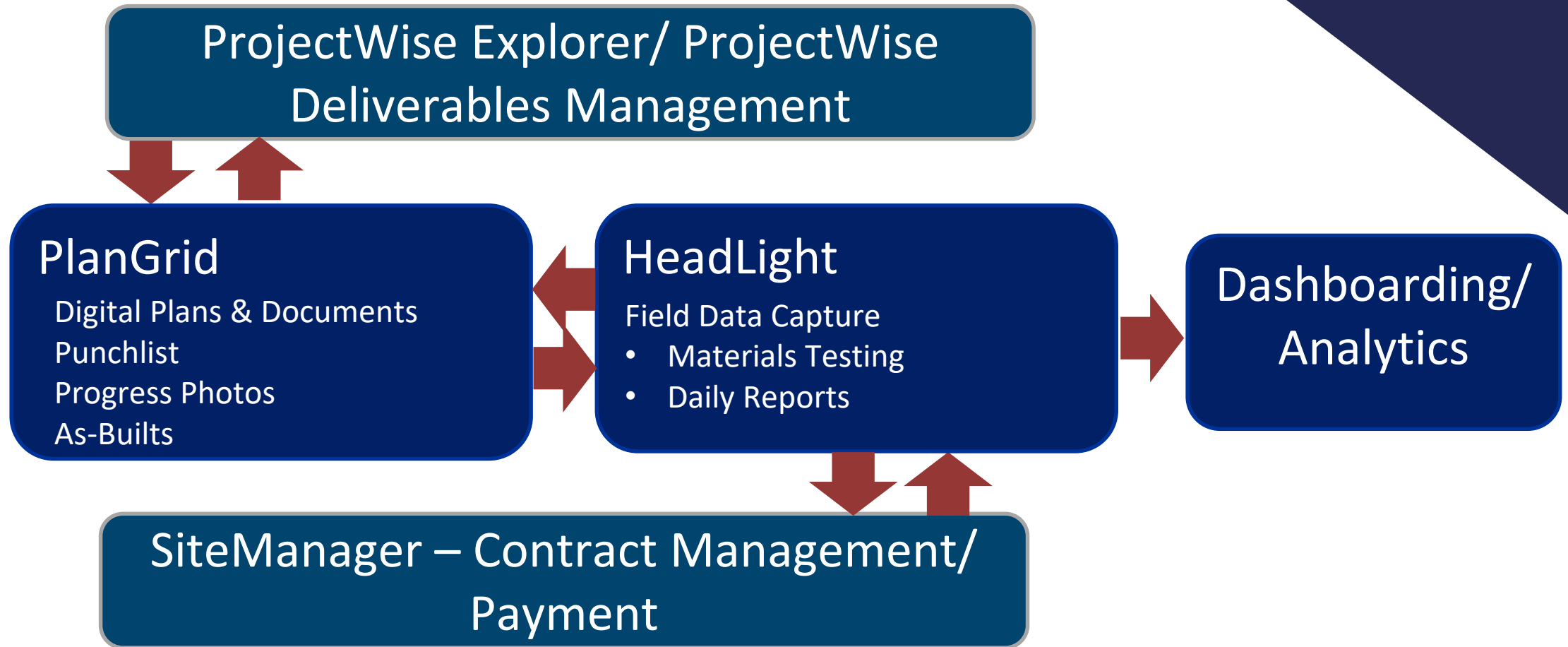
Improve collaboration across Divisions

Improve review quality

Improve review time

Asset management

Seamless Integrations



3D & 4D Engineered Models



Main Goals

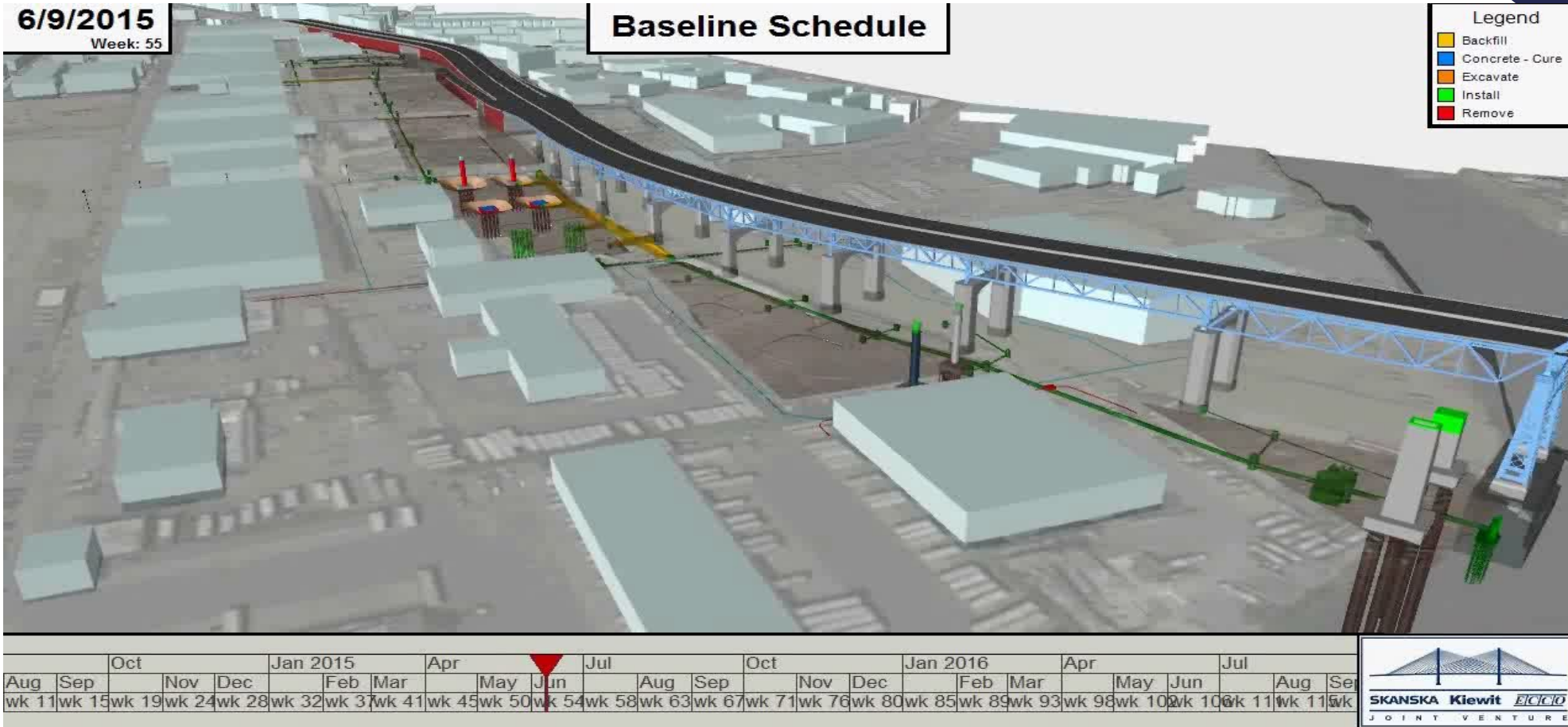
Baseline Schedule
Accuracy

Constructability
Reviews

Reduce Change
Orders

Claims Defense

4D



Unmanned Aerial Systems in Construction



Main Goals

Monitoring
Construction Progress

Estimating Sediment
Runoff

As-Built
Documentation



Questions



Ian Millikan



804-786-2045



Ian.Millikan@vdot.virginia.gov



eConstruction@vdot.virginia.gov