Model Based Design & Construction (MBDC):

Use of Digital Data in Construction

Presented by: Robert Stewart, UDOT's Director of Construction

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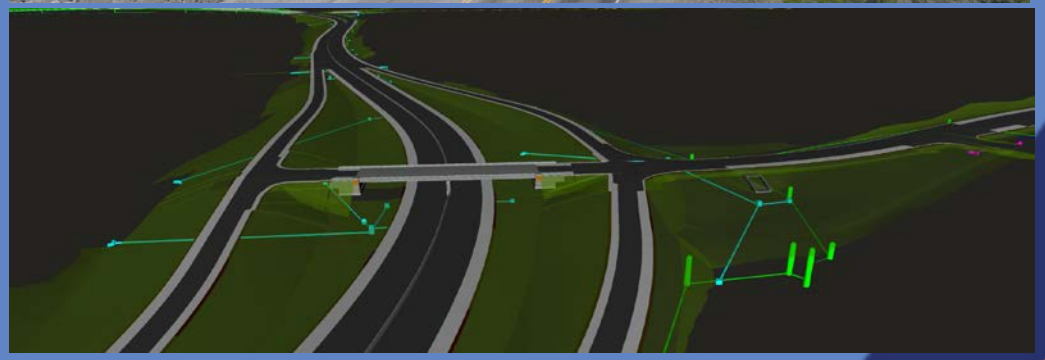
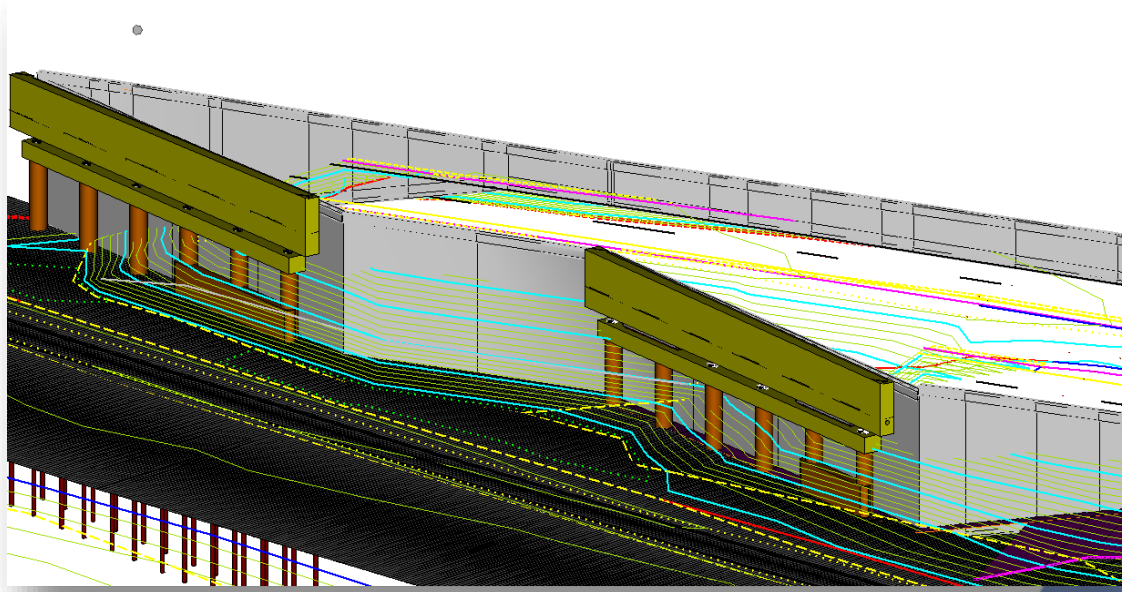
Presentation Overview

- Why – UDOT Goals
- Implementation Strategy
- Current Work
- Tools demonstration



GOALS:

- Produce a more optimal design
  - Provide clash detection, grading, details, etc.
  - Fully develop the model i.e. all design elements attributed/all meta-data
  - Balance the design intent to construction
- Improve information transfer
  - Quantities
  - Reduce Risk



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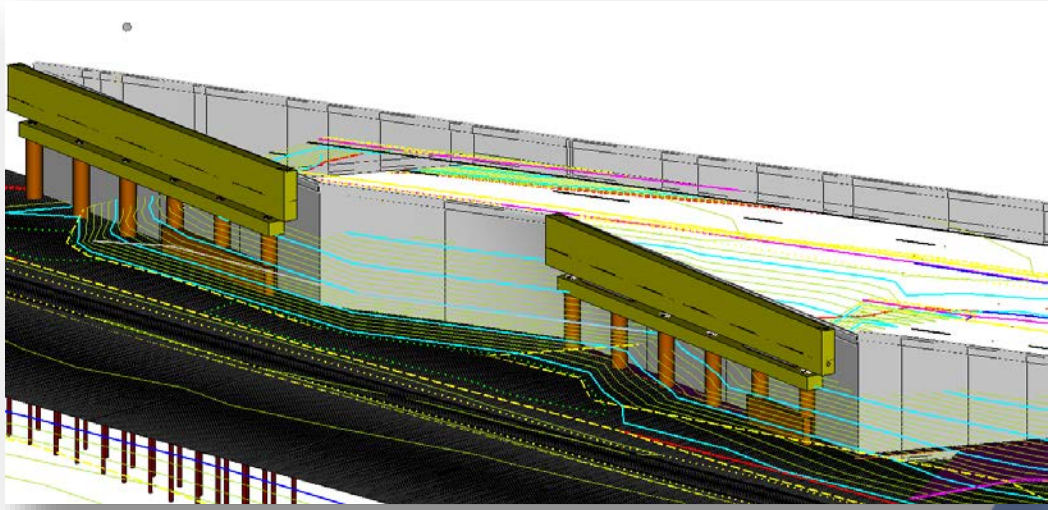
GOALS:

- Obtain and manage quality data to improve decision making
  - Prevent rework from project to project
  - Collect asset management information
- Improve efficiency
  - Minimize the recreation of data
  - Eliminate the practice of 3D design to 2D (paper) to 3D Construction
  - Improve procedures and processes
  - Improve workflows to reduce overlap and unnecessary work



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~~"Become the first DOT in the country to go completely paperless"~~ – Carlos' Top Ten

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E-Construction gets us out of paper

1. Paper is incredibly slow and inefficient
2. Handoffs are much faster
3. Updates are faster
4. Distribution more comprehensive
5. Gets technology in the hands of field people.

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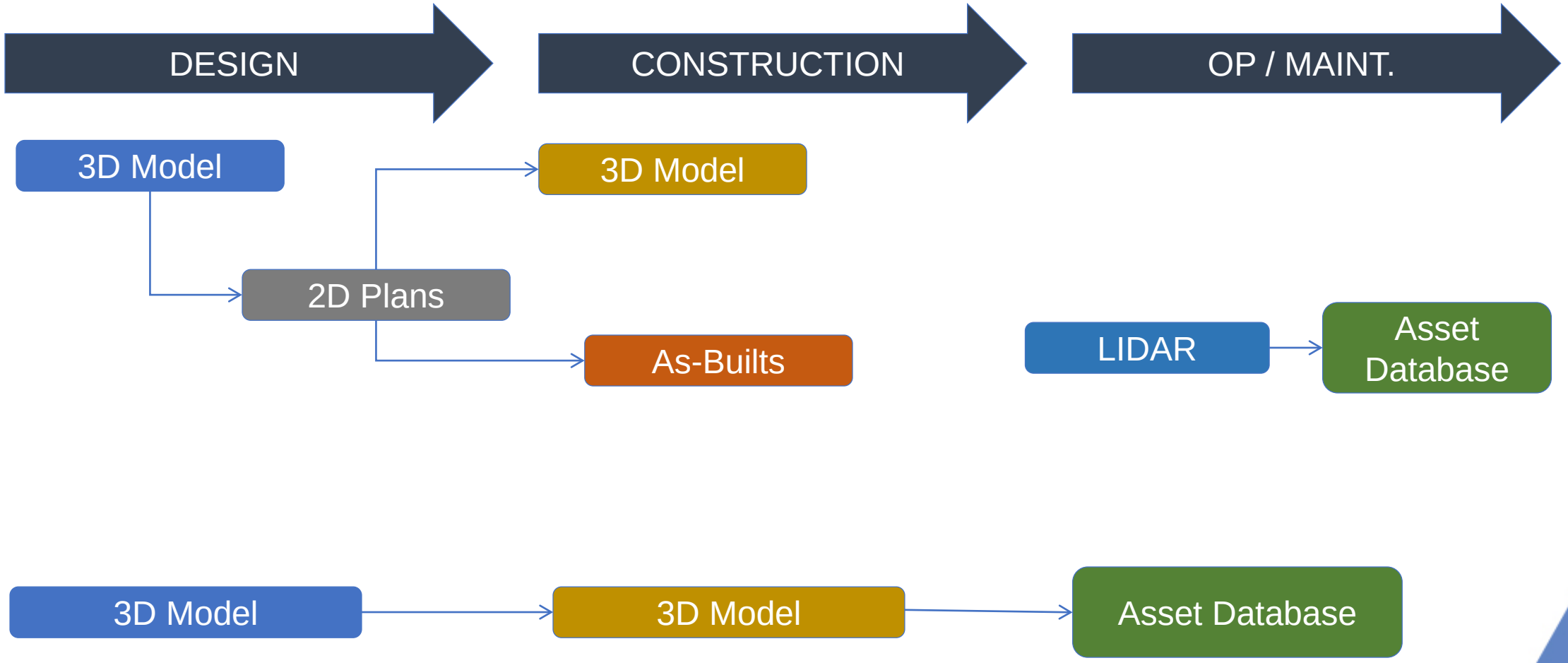

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IMPLEMENTATION STRATEGY – 2014/2015/2016

- Visit Iowa
- FHWA 3D Engineered Models for Construction Workshop
- Short-term Implementation Plan
- Make electronic plans available on all projects FIO
- Risk Workshop ➔ Brainstorm Workshop
- Mid-term Implementation Plan

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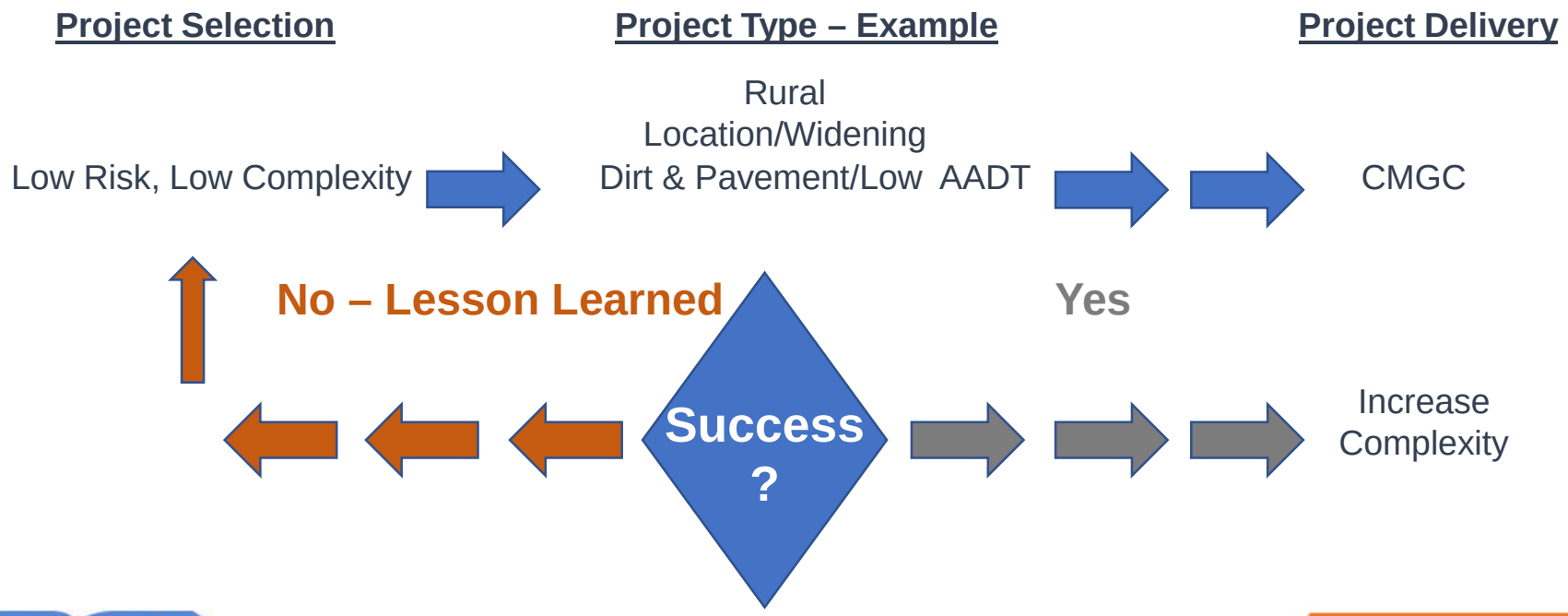
IMPLEMENTATION STRATEGY



IMPLEMENTATION STRATEGY

Project Selection	Project Type – Example	Project Delivery
Low Risk, Low Complexity	Rural Location/Widening Dirt & Pavement/Low AADT	Bid Build
Higher Risk, Medium Complexity	Urban Reconstruct	CMGC
Higher Risk, Higher Complexity	Urban Reconstruct	Bid Build
High Risk, High Complexity	Large Dollar Interstate Bridges & Structures	CMGC
Highest Risk, Highest Complexity	Large Dollar Interstate Bridges & Structures	Bid Build

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PILOT PROJECTS – CMGC

- SR-20, MALD, Rural/low ADT/low risk, Constructed 2016, Sheets FIO, in-house
- SR-10, MALD, low-medium risk/rural reconstruct, 2018-2019, Sheets FIO
- SR-68, MALD, medium risk/urban reconstruct, 2017-2018, Sheets FIO
- I-80, MALD, medium risk/passing lane, 2018, Sheets FIO
- I-80, MALD, medium-high risk/bridge project, 2018, Sheets FIO

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PILOT PROJECTS, BID BUILD:

- I-70, MALD, medium risk, constructed 2017, Sheets FIO, in-house
- SR-193, MALD, low-medium risk/Greenfield Connector, constructed 2017, sheets FIO, in-house
- I-15, MALD, medium risk/climbing lane, awarded 2018, Sheets FIO, in-house
- SR-209, MALD, medium-high risk/urban reconstruct, awarded 2018, NO SHEETS!

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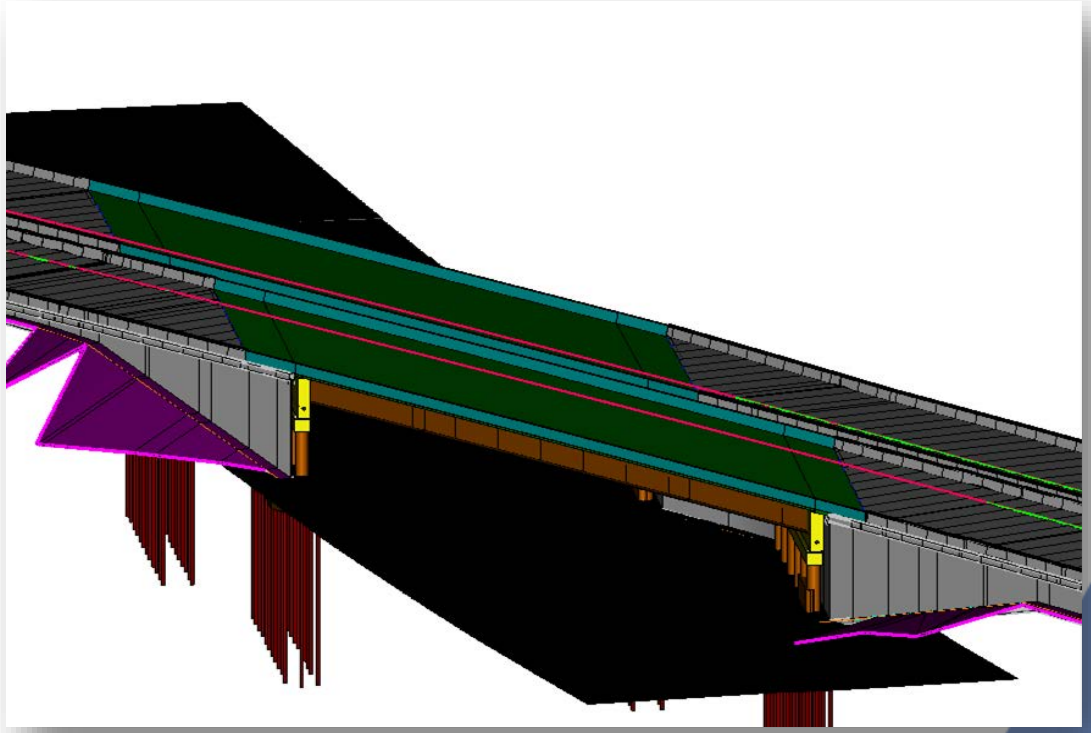
CHALLENGES

- Design/contractor 3D modeling software platforms
- Review/Construction/field tools
- Quantities – advertising for contractors and construction management
- Validating surfaces – which model?
- Validating surfaces – Owner procedure
- Design focus from plan development to model development
- Sub-contractors



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MILESTONES/SUCCESSES

- Confidence to award projects with MALD
- Collaboration with consultants/contractors/software industry
- Workshops to address issues
- In-house GIS Field Tool Solution using Collector for ArcGIS
- Award MALD without plan sheets on low-medium risk projects
- Some Sub-contractors are using mobile devices for bidding/contracting
- UDOT Digital Delivery of MBDC Committee
- Contractor estimator workshop Feb 2019 with designers (UDOT/consultants), contractors (modelers/estimators/subs), Industry (Trimble, Esri, Autodesk, Bentley, Topcon, Onstation, RDV Systems)
- Preparing deliverables guidance document to implement MALD and no plan sheets on these type projects. Expect distribution June 2019

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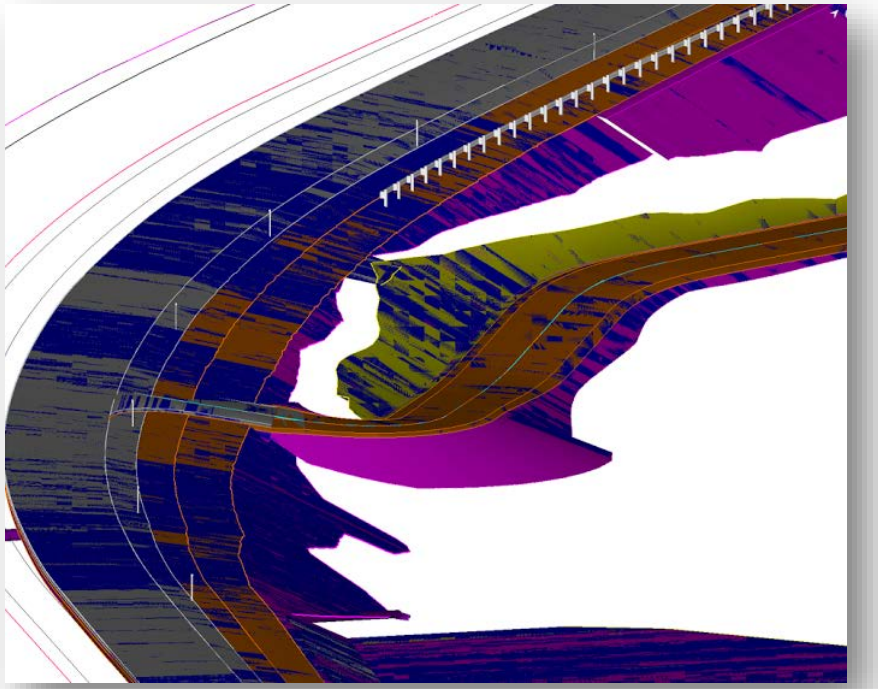
FINAL PROCESS – ALL PROJECTS DELIVERED DIGITALLY

- Design a 3D model
- Construct & Inspect using the 3D model
- Update the 3D model during construction
- Add feature information directly in asset management database during construction



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Digital Delivery AID Grant Project

BASELINE WORKSPACE FOR DESIGNERS

- PROJECT DATA
- CUSTOMIZED INTERFACE
- EXPANDED METADATA
- CONSISTENT DELIVERABLES
- UPDATED PROCESSES

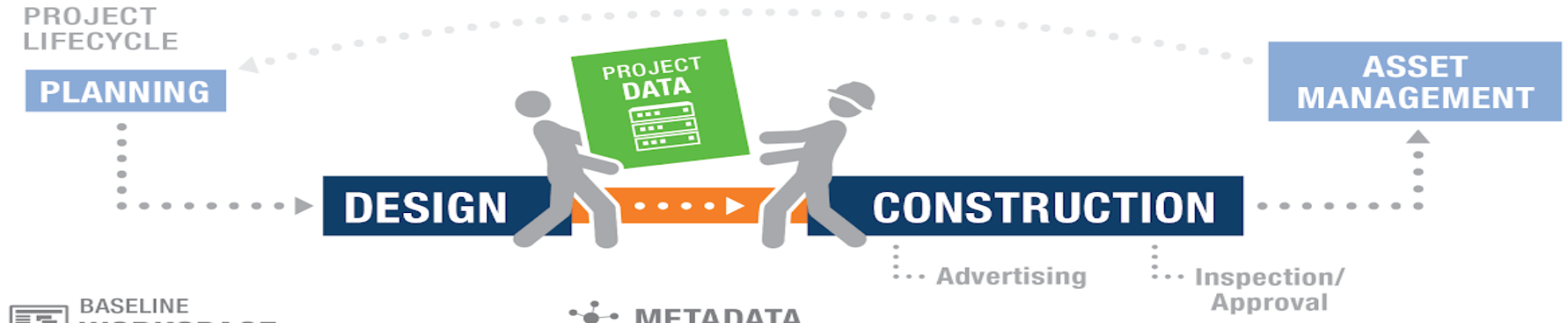
AVAILABLE JULY 31

4 PILOT PROJECTS

- I-15 Climbing lanes Baker Canyon
- I-80 SR 201 to SR 36 Aux lane
- SR 30 SR 23 to SR 252
- SR 209 Redwood Road to I-15

BUILDING A REPEATABLE PROCESS

- ☑ Baseline workspace
- ☑ Naming conventions
- ☑ Standard attributes
- ☑ Links
- ☑ Attachments



BASELINE WORKSPACE

Using a baseline Workspace promotes adoption of new technologies, increases accountability for CADD standards, and produces consistent data.

METADATA

Additional data for these pilot elements will be tracked from Design to Asset Management:

- ☑ Signs
- ☑ Barrier
- ☑ Striping
- ☑ Guardrail

DATA TRANSFER

Data transfer from **DESIGN** to **CONSTRUCTION** can be streamlined through the use of a consistent workspace & supporting processes.

Lessons learned on the pilot projects will be incorporated to enhance both the workspace and the process.

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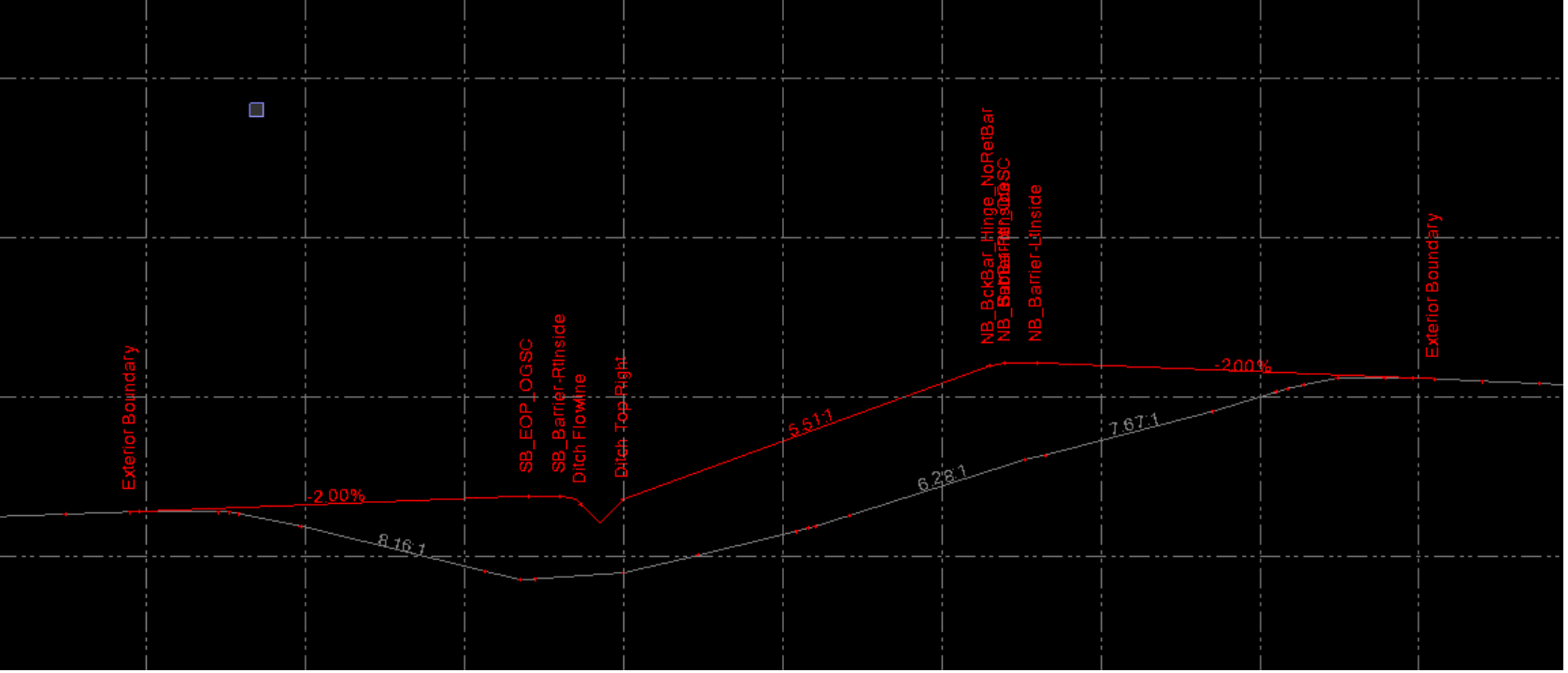
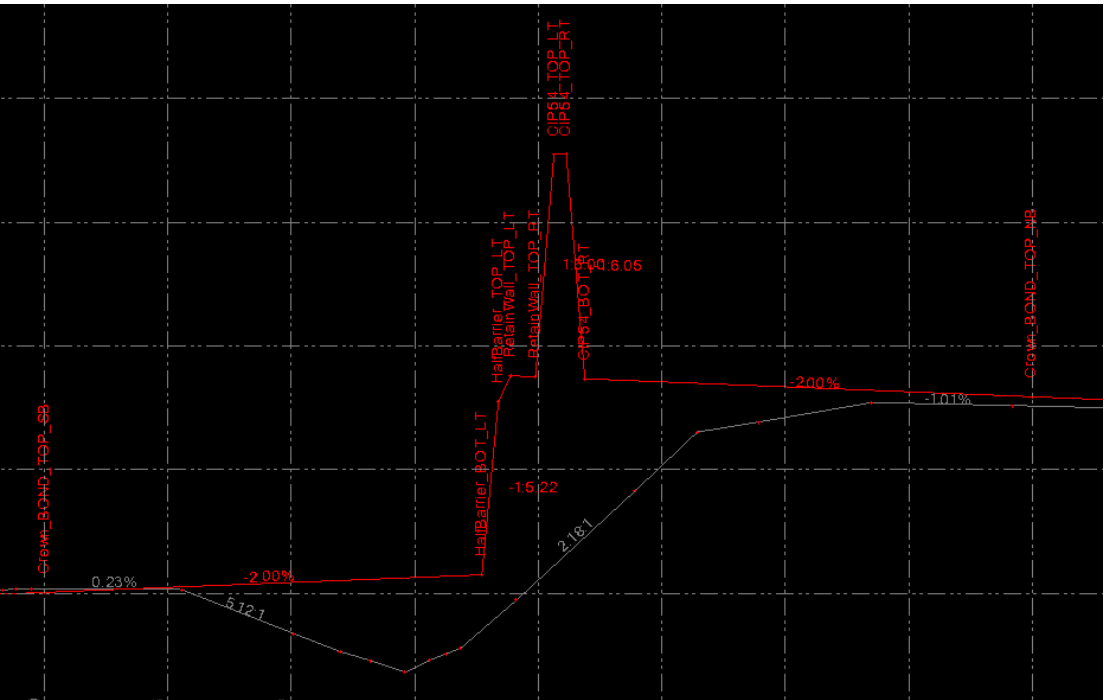
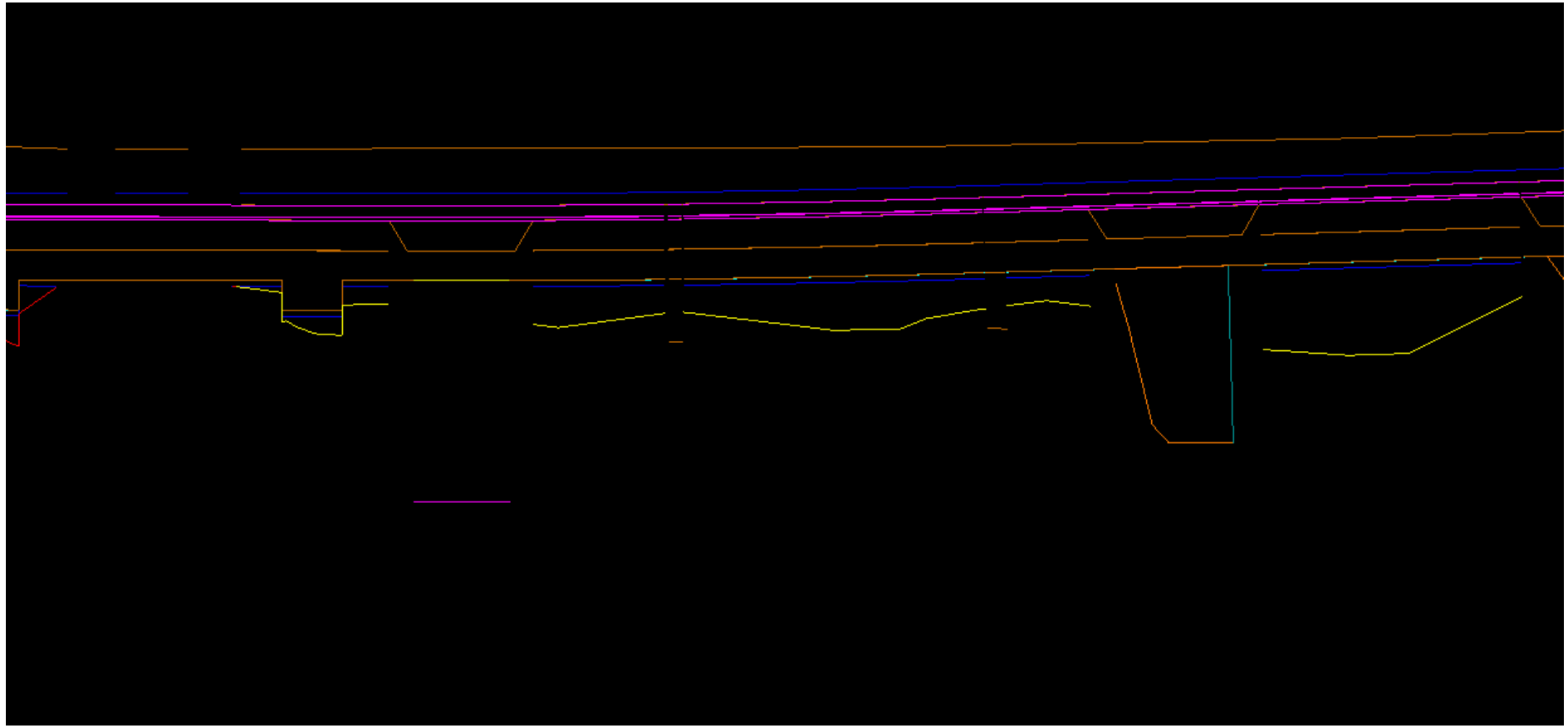




- These screen shots are from the *same project* along the *same corridor*
  - Note, barrier is not triangulated in the surface on top screen shot, but it is in the bottom screen shot.
    - Barrier should never be included in the surface for takeoff & estimating. We have to remove this by hand.
  - Note the inconsistencies in point *naming*. This is raw XML data brought in from the designer DTM's
    - It is often a guessing game to know what some of the names mean – it is often difficult to know if information is missing or correct.
- **The *inconsistencies* raise concerns over the accuracy of information we have received.** It also raises concerns that we may not have all the information we need to make adjustments for subgrade and intermediate surface work.



- Note the number of breaklines that are not connected. Look at the cut/fill lines – they do not all tie into the driveways. There are breaks in the breaklines where the designer templates/components turn on/off.
  - This can cause triangulation issues, **raises concern over *accuracy* and *completeness***

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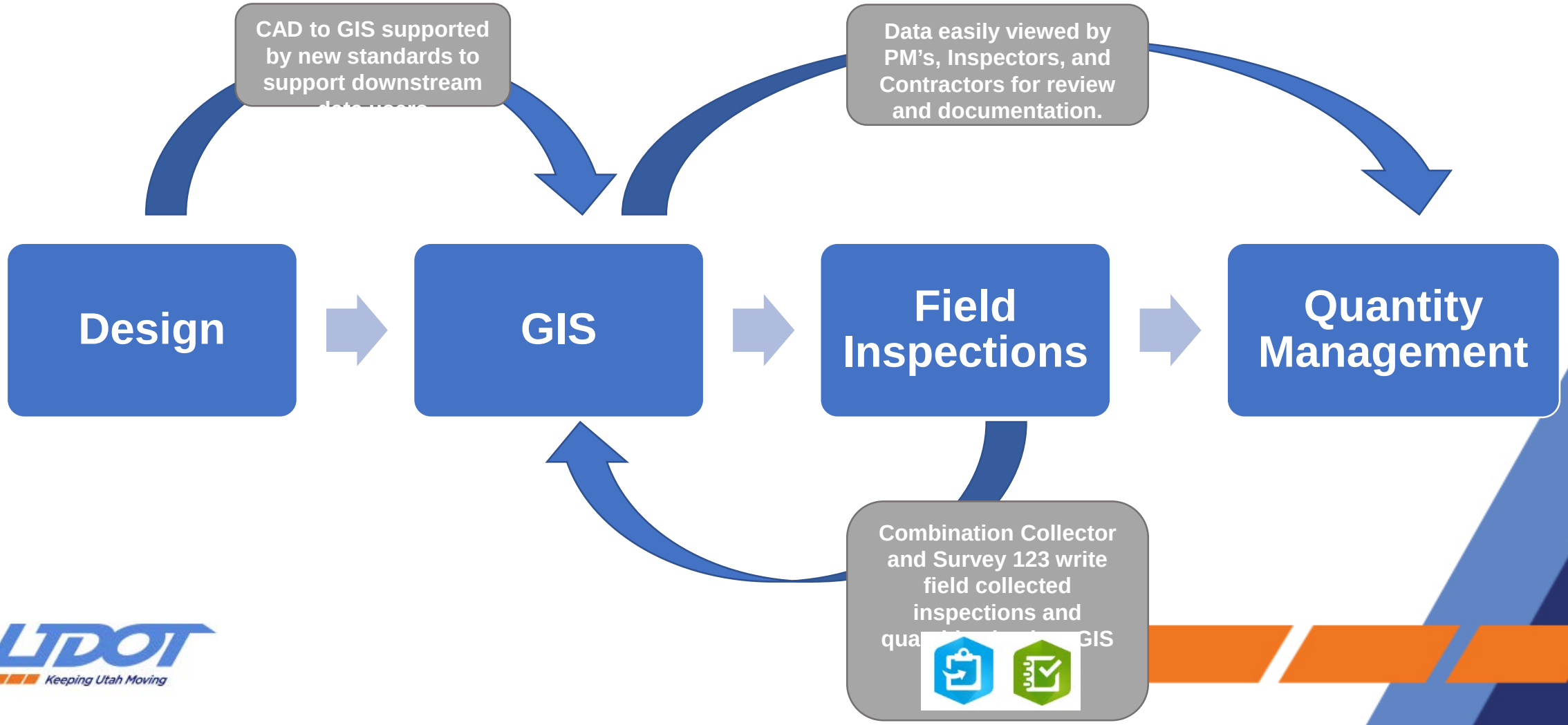
The Process



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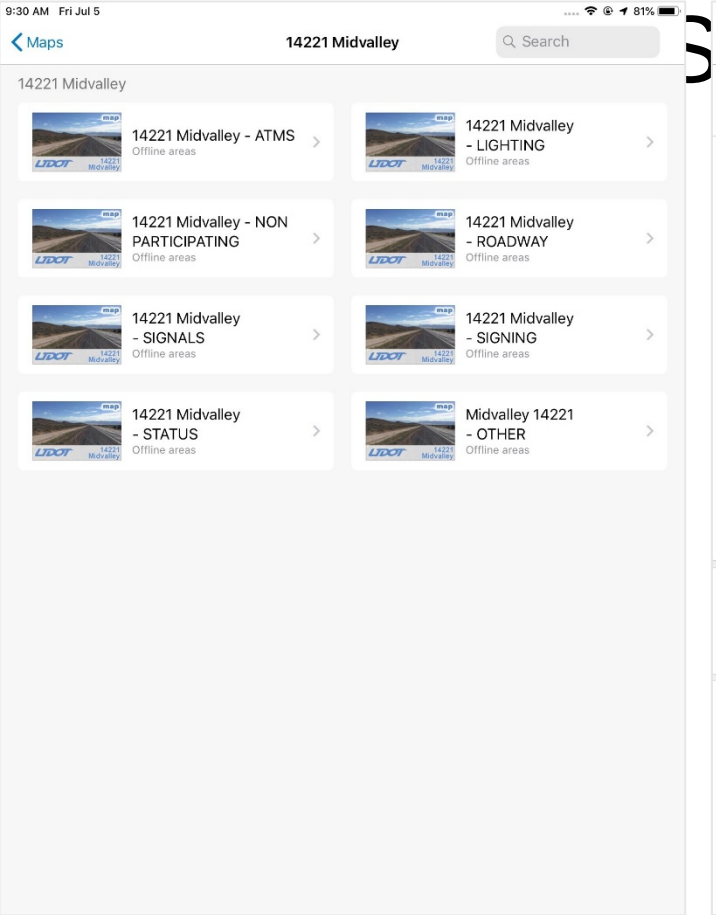
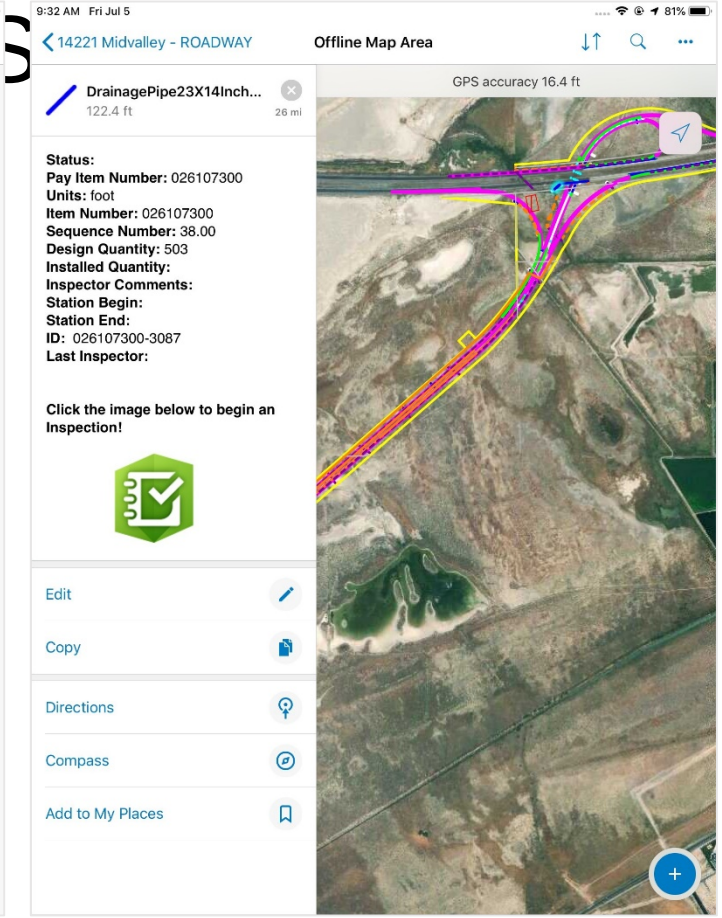
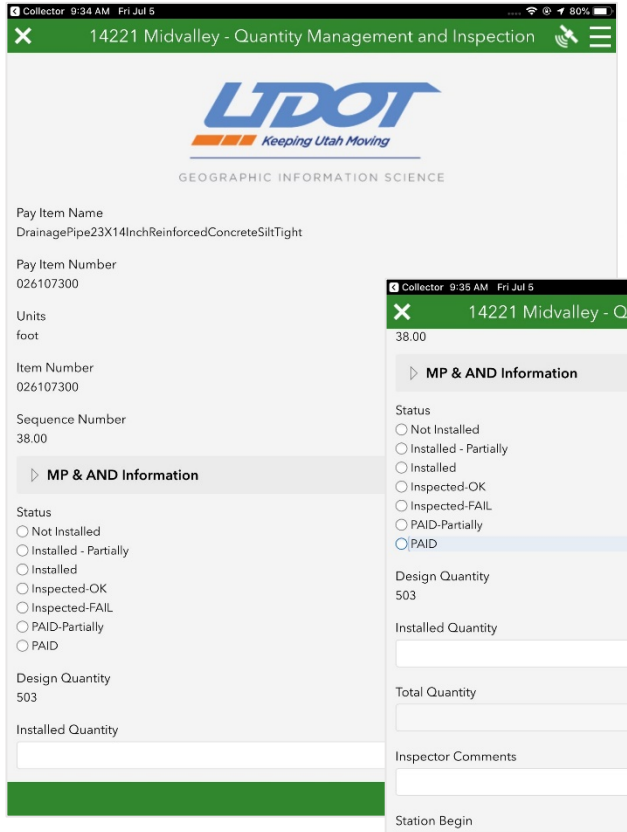
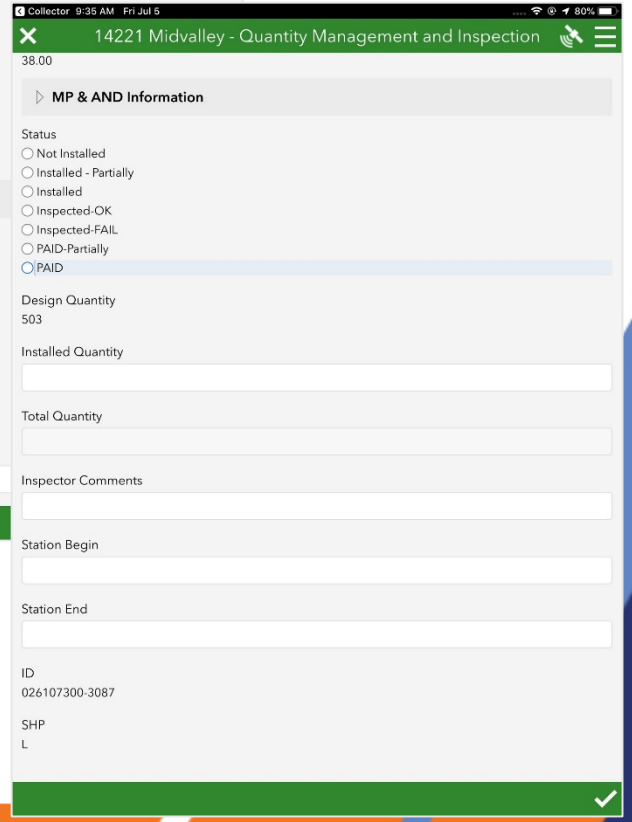






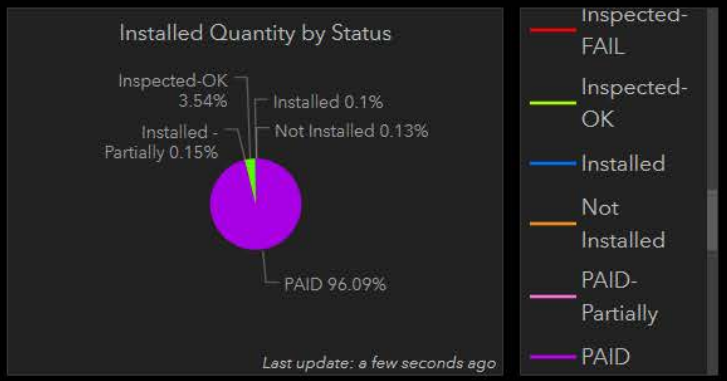


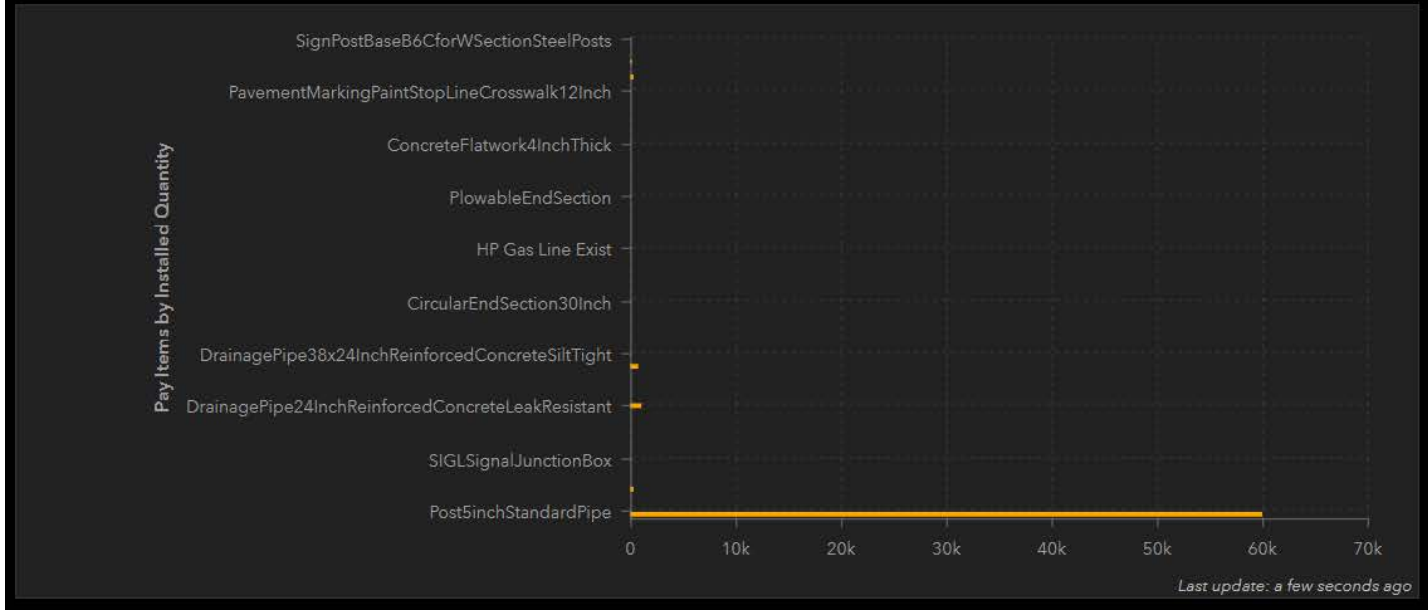
Step 1: Select Map

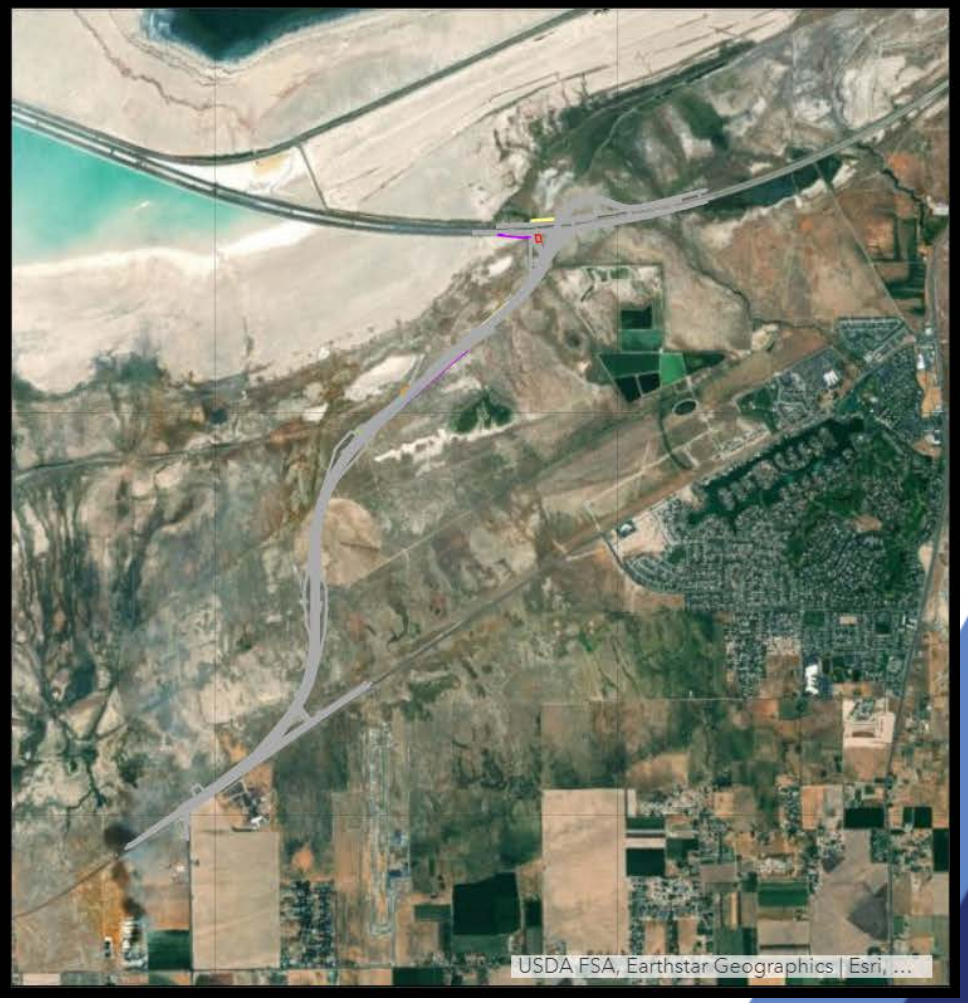
Step 2: Select feature for inspection

Step 3: Fill out inspection form

14221 Midvalley Operations Dashboard







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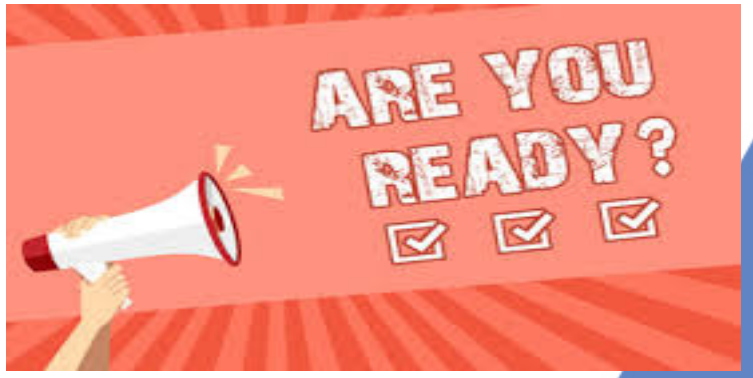
Present Approach

2D for civil elements

- Why? GIS field tools do not currently support 3D and 3D is not needed for inspection work
- Working around limits of current technology

3D for breaklines

- Why? Contractors have said breaklines are most useful
- ** Exploring parametric cells



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UDOT Goals for AID Grant

- A single site to support Digital Delivery
- Documented repeatable processes
- Bentley Workspace to support migration to ORD
- 3D Translation Tools:
  - Tool to enforce accountability on CAD Standards
  - Tool to extract and provide breaklines for construction
  - Tool to extract and provide data for GIS field apps
- Training strategy to support migration to Digital Delivery
- Business case for future investment

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Questions?

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