

# Engineering Technology Plan and Digital Delivery



April 26<sup>th</sup>, 2022



# Agenda

- Engineering Technology Plan
- Digital Delivery Program
  - CAD / PIM Standards
- Pilot Projects
- Challenges
- Next Steps

# Engineering Technology Plan

## PTC GROUPS INVOLVED

### DESIGN ENGINEERING

- Survey/ROW
- Environmental and Planning
- Geotechnical
- Total Reconstruction
- Interchange/Special Projects
- Facilities (Engineering)
- Bridge
- Pavement/Highway

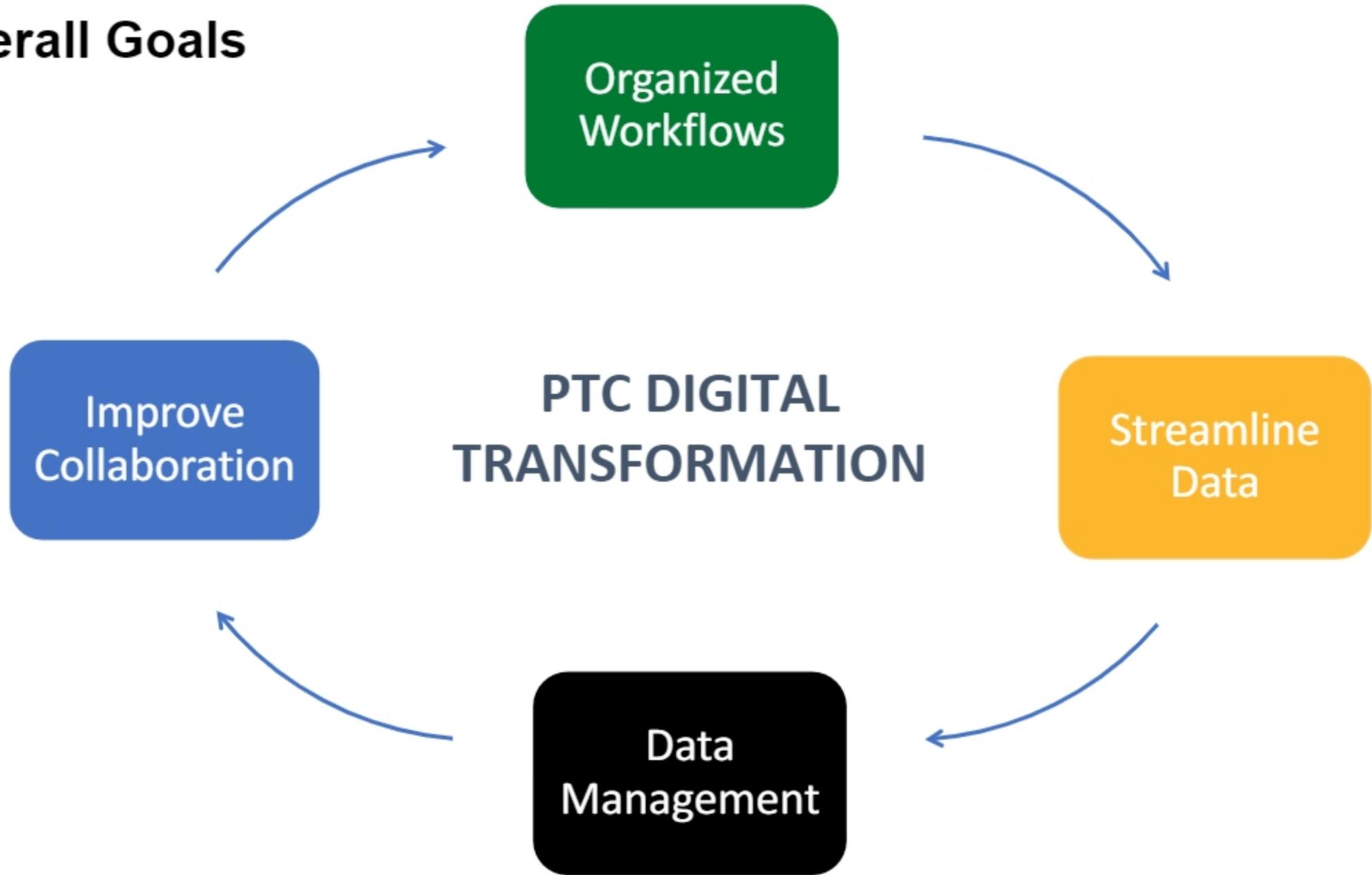
### CONSTRUCTION ENGINEERING

- Quality Assurance
- Quality Control  
(Materials)
- Contract Management
- Collaboration & Records
- Construction  
Management

### ADDITIONAL DEPARTMENTS

- Facilities (Operations)
- Information Technology
- Legal
- Maintenance
- Traffic
- Contracts Administration

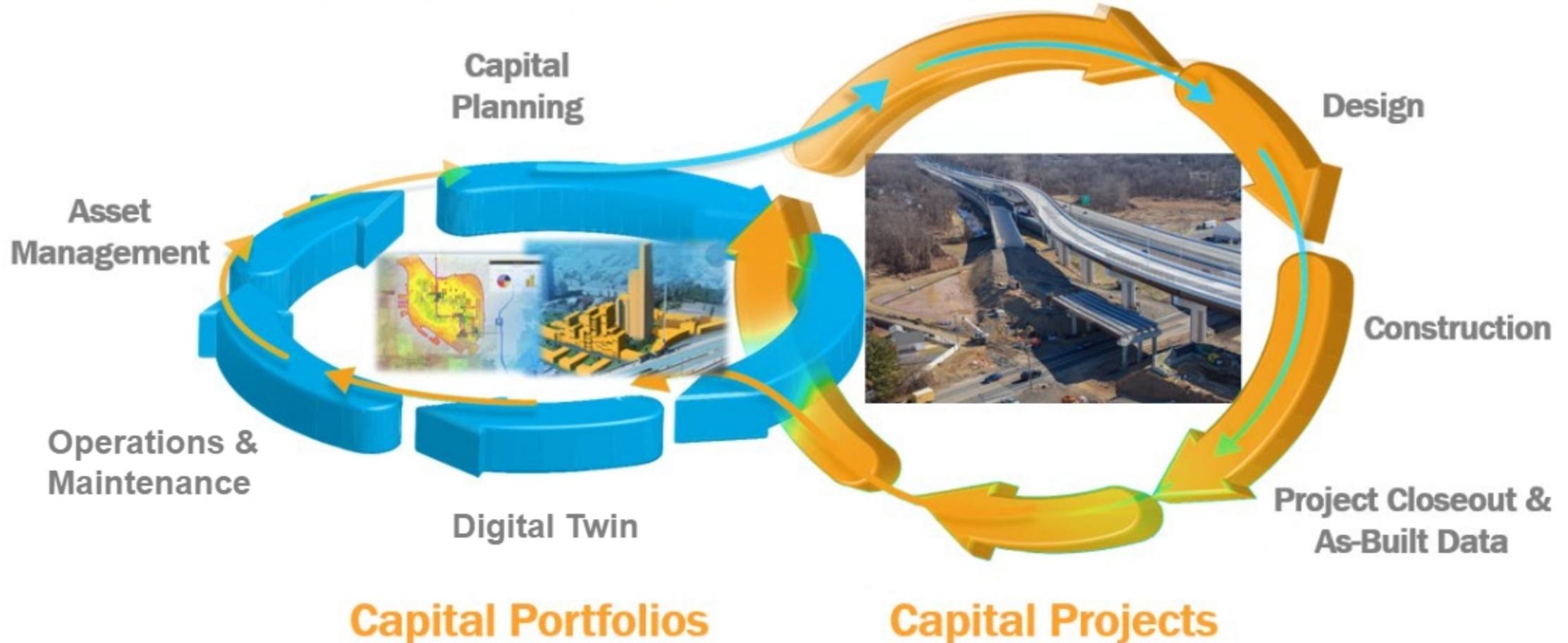
# Overall Goals



The **Engineering Technology Plan Vision** is to strategically transform the exchange of information, capture and streamline authoritative data, automate processes, and efficiently retrieve existing information with organized, secured workflows in support of the Digital Delivery Program.

# Project Life Cycle

*Advancing Technology impacting the Project Life Cycle with more efficient workflows*



# Engineering Technology Plan Status

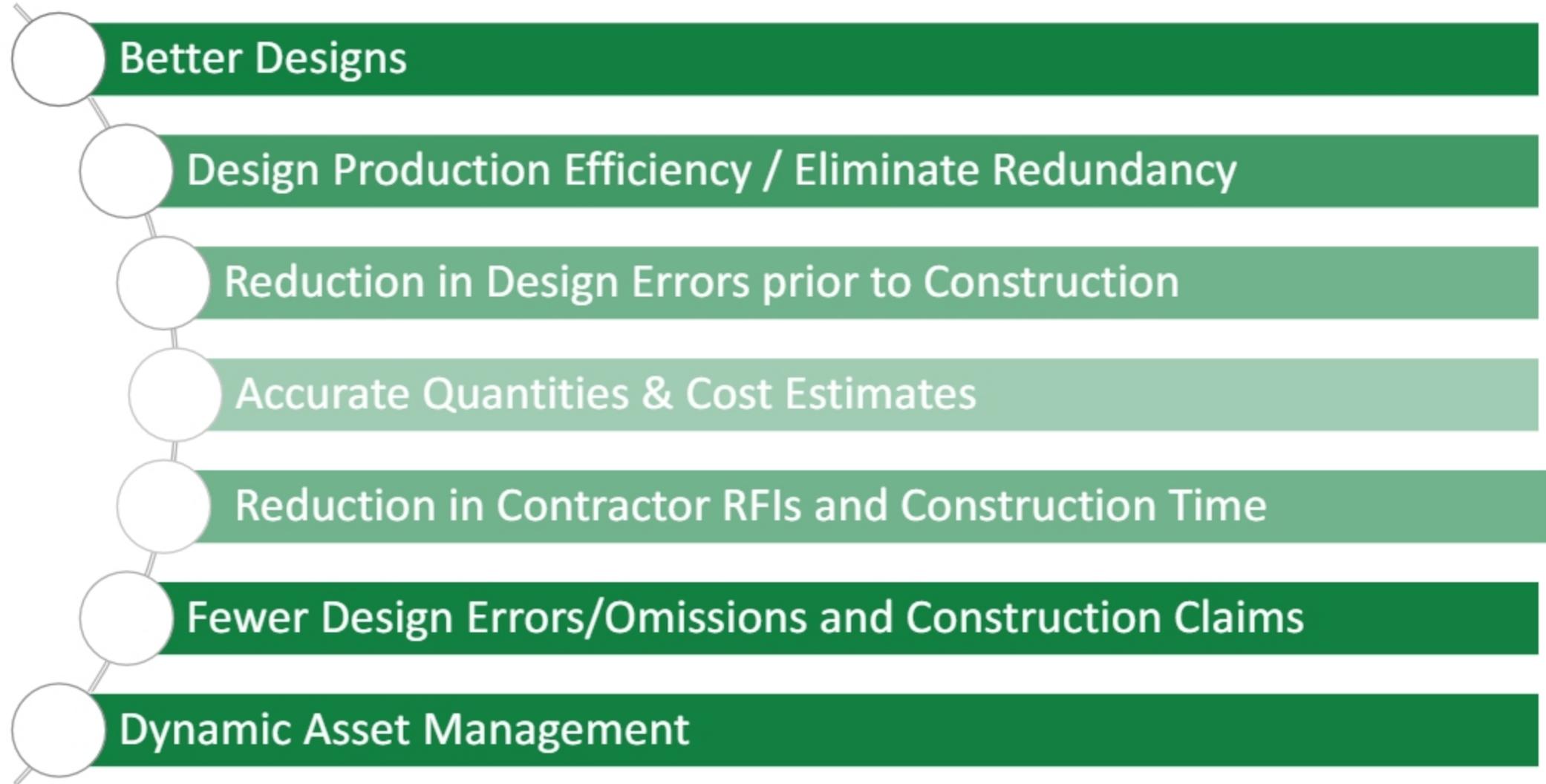


- Completed March 2021
- Identifies critical workflows necessary for project success
- Prioritized goals based on impact to Digital Delivery Program
- Developed Roadmap for future initiatives
  - Established immediate goals for 2022.
  - Specified Short-Term (1-2 years) and Long-Term (2-5 years) goals.



# Digital Delivery Program

# Digital Delivery Benefits



# Critical Immediate and Short-Term Goals

## CAD / PIM Standards

- Project Execution Plan (PxP)
- Level of Development (LOD)

## \*Digital Model / Hybrid Bid Documents

- Eliminate Redundancy
- Reduce Errors

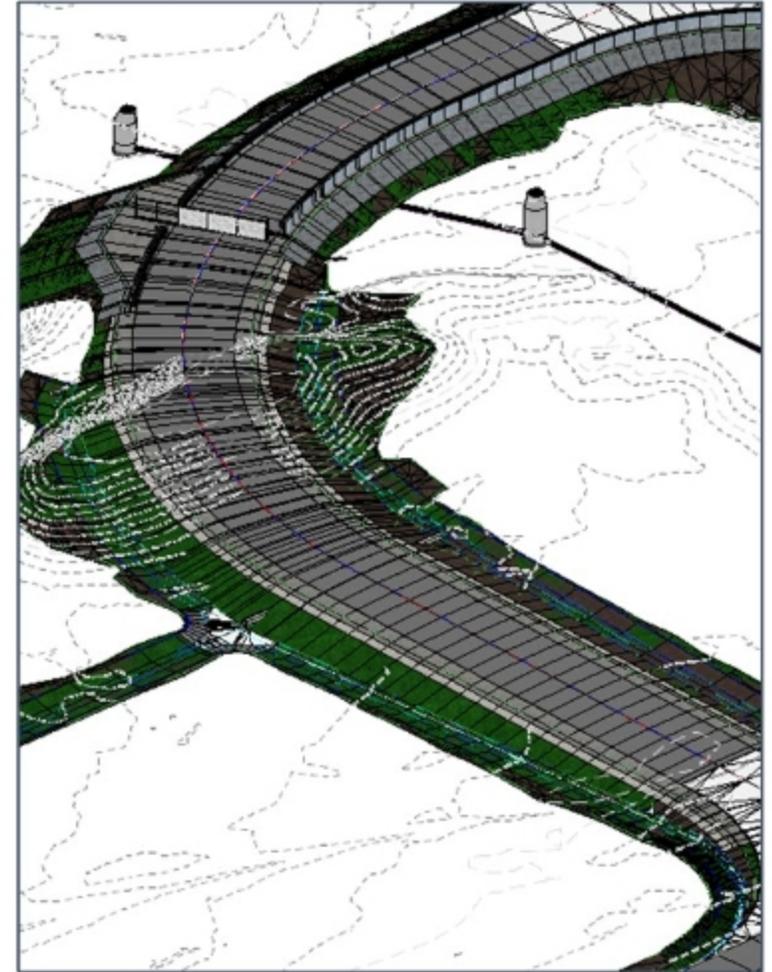
## \*As-Built Records

- Updated Design Models
- Digital Twin

## \*Project Collaboration Solution

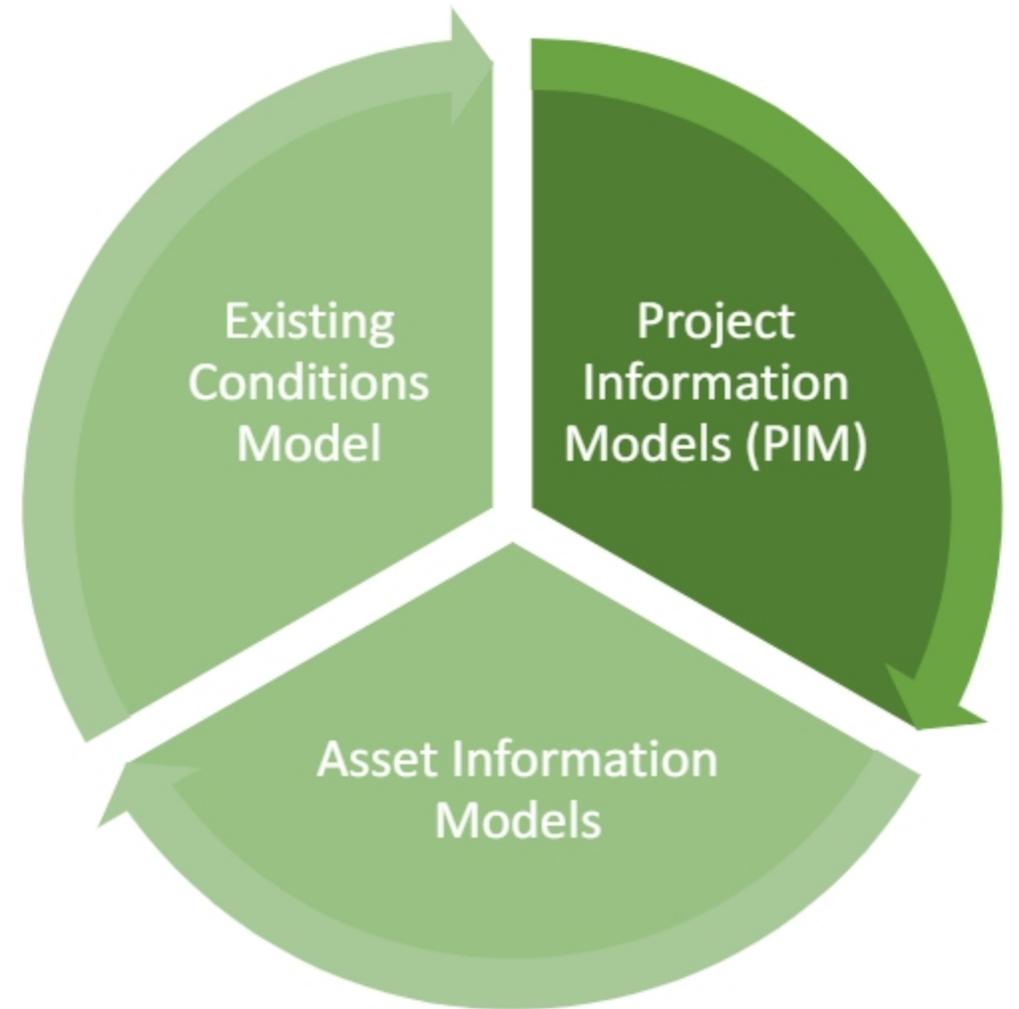
- Centralized Location for Project Data
- Design Reviews

## \*Pilot Project(s) Required



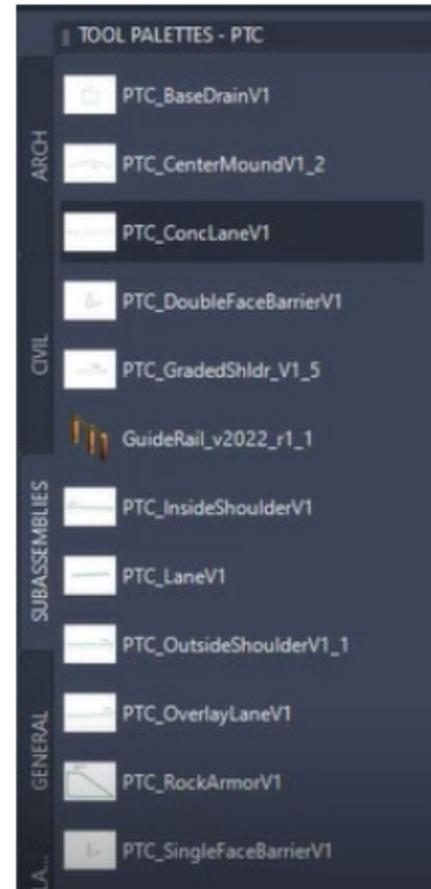
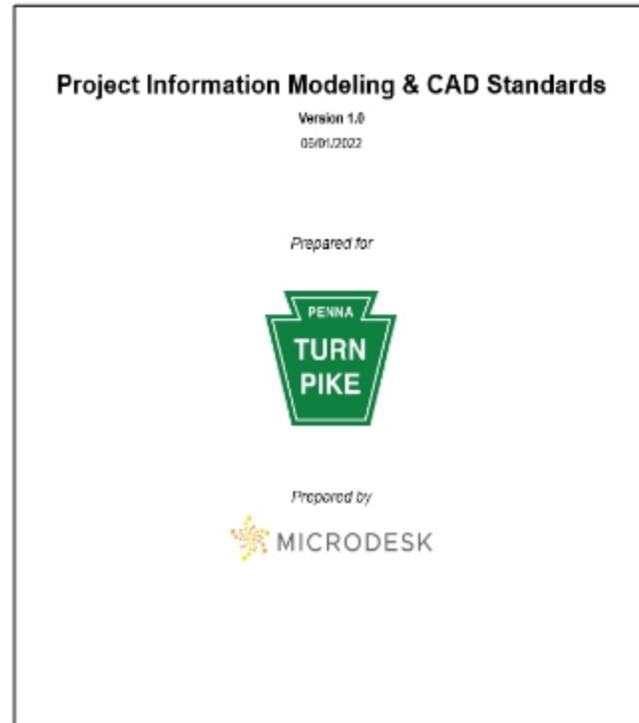
# CAD/PIM Standards

- Promote consistency across all PTC projects
- Enable project teams to work more efficiently



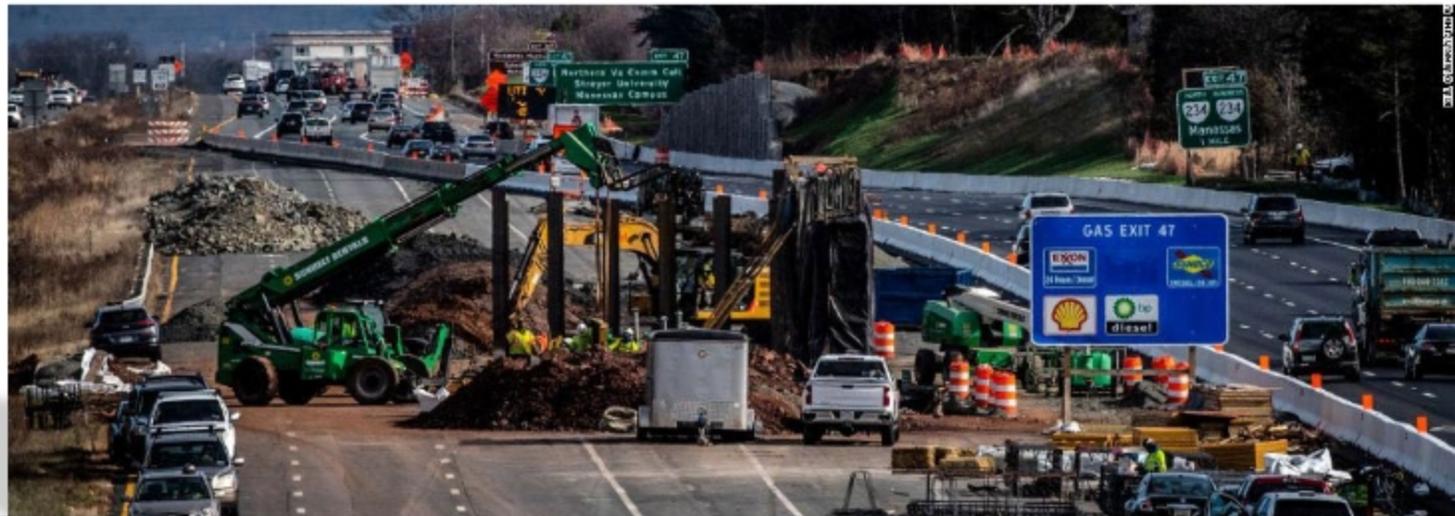
# CAD/PIM Standards

- Anticipated Release in Summer 2022
- New Content under development
  - Project Execution Plan (PxP)
  - Level of Development (LOD) Matrix
  - Workspace/Template files
    - Autodesk Civil 3D
    - Bentley OpenRoads Designer
    - Autodesk Revit
- Anticipating Quarterly Updates



# Keys to Digital Delivery Program

- Project Execution Plan
  - Outline the direction and organization of project teams
  - Describes project delivery
    - Milestones
    - Schedule
    - Project team roles
    - Specifications
    - Risks
    - Dependencies
- Level of Development Matrix
  - Specify the level of clarity and content that is to be developed for the Project Information Models at various points of the design phases of each project



# Project Execution Plan (PxP)

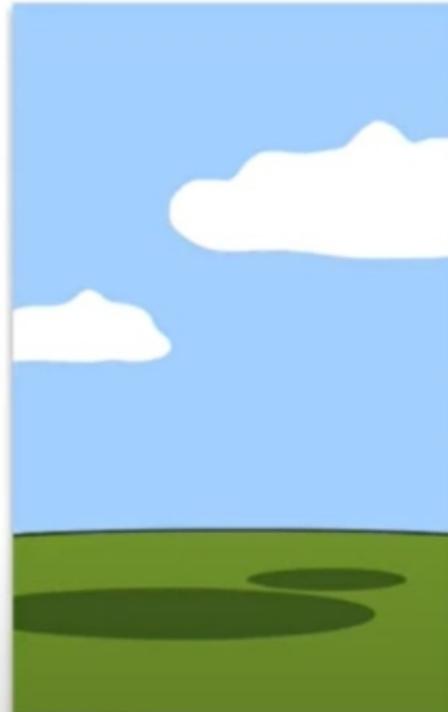
- Identifies a foundational framework to ensure successful deployment of advanced design technologies on PIM projects. The PxP will optimize workflows, create understanding of content, and identify responsibilities.



How the customer explained it



How the Consultant designed it



How the project was documented



What was installed



How the customer really needed

# Level of Development Matrix (LOD)

- Developed during Engineering Technology Kickoff meetings at the start of each PTC project
- Set the roadmap for Project Information Model development
- Prescribe the modelling effort for each stage of the design process



# Level of Development Matrix (LOD)

- **LOD 100** elements are not geometric representations. Examples are information attached to other model elements or symbols showing the existence of a component but not its shape, size, or precise location. Any information derived from LOD 100 elements will be considered approximate.
- **LOD 200** elements are generic placeholders. They may be recognized as the components they represent, or they may be volumes for space reservation. Any information derived from LOD 200 elements will be considered approximate.
- **LOD 300** elements contain the quantity, size, locations, and orientation of the element as designed and can be measured directly from the model without referring to non-modeled information such as notes or dimension callouts. The project origin is defined, and the element is located accurately with respect to the project origin.
- **LOD 350** elements contain parts necessary for coordination of elements with nearby or attached elements modeled. These parts will include such items as supports and connections. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension callouts.
- **LOD 400** elements are modeled at sufficient detail and accuracy for fabrication of the represented component. The quantity, size, shape, location, and orientation of the element as designed can be measured directly from the model without referring to non-modeled information such as notes or dimension callouts.
- **LOD 500** relates to field verification and is not an indication of progression to a higher level of model element geometry or non-graphic information, this specification does not define or illustrate it.

# Project Collaboration Solution

## Project Files

- Autodesk BIM360
- Bentley iTwin Design Review
- Trimble Quadri
- Esri/Autodesk ArcGIS GeoBIM



# Project Teams

## PTC Project Manager

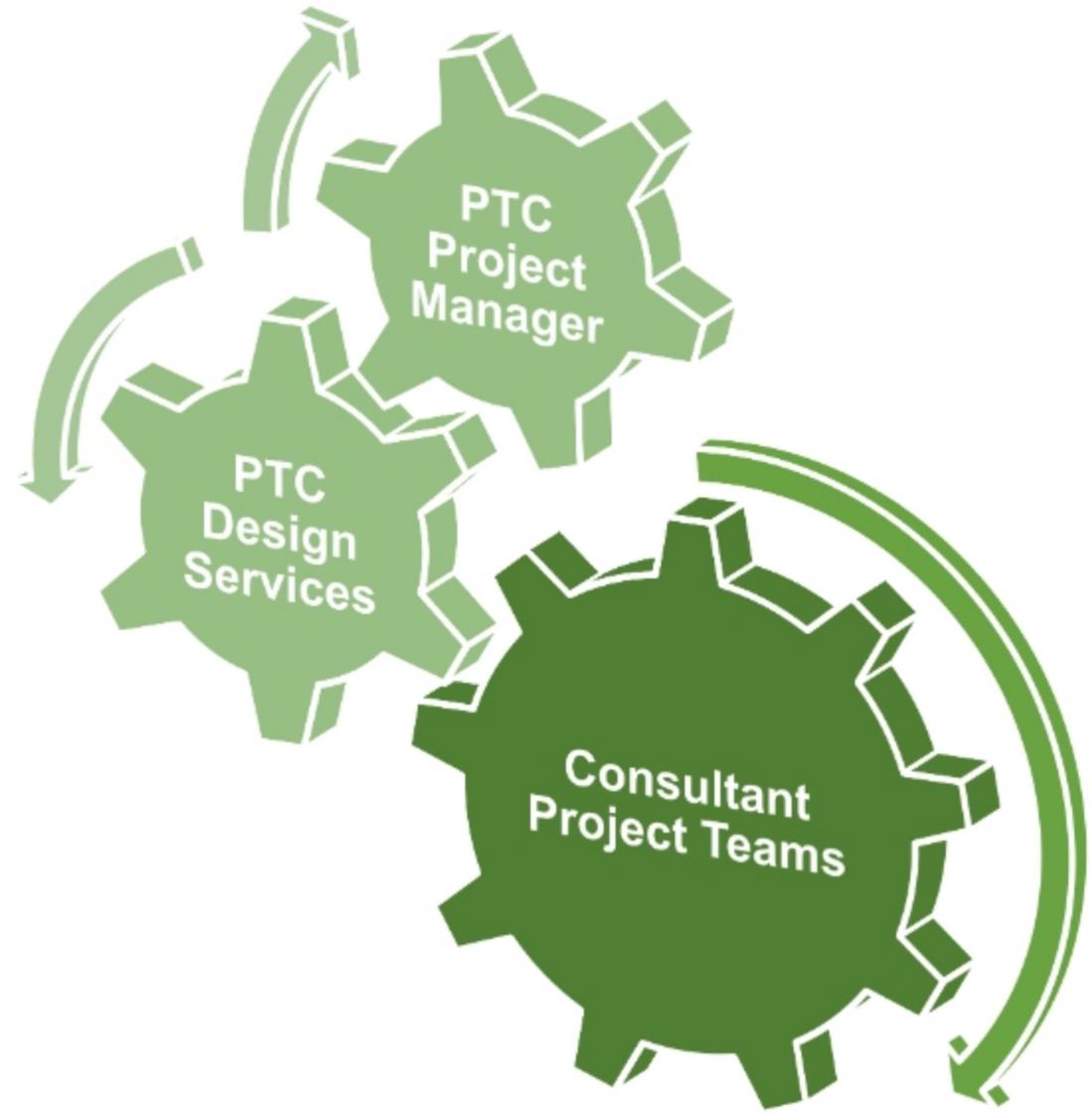
- Oversee all project **deliverables**
- Ensure **technology** specific needs are met
- Coordinate entire **project team** stack

## PTC Design Services Unit

- Oversee digital **deliverables**
- Review project **requirements**
- Ensure compliance with PTC CAD/PIM **Standards**

## Consultant Project Teams

- Responsible for adhering to **PTC standards**
- Complete engineering technologies **project activities**





# Pilot Projects

# Pilot Projects

## Objectives



- Implement Standards and pilot Digital Delivery Requirements
- Different project types/disciplines
- Start with smaller low-risk projects
- Identify Challenges
- Provide feedback to improve current workflows with revisions to the Standards
- Streamline data to PTC Systems
- Determine what is feasible
- What are realistic expectations for deliverables with current technology?
- Vet workflows and processes from standards
- Update LOD Matrix

## Pilot Projects

### A83.88 Bridge Replacement

- Bridge Replacement on Northeast Extension.
- Currently in design (DFV Review)

### T238 EB & WB Access Roads

- New access road on Pennsylvania Turnpike Mainline
- Anticipated Bid in Spring 2023

### New Cumberland Maintenance Facility

- New Facility project for New Cumberland Maintenance-(T244)
- Anticipated Bid in Summer 2023

### T180-184 Resurfacing

- Single Project PDF
- Anticipated Bid in Fall 2022



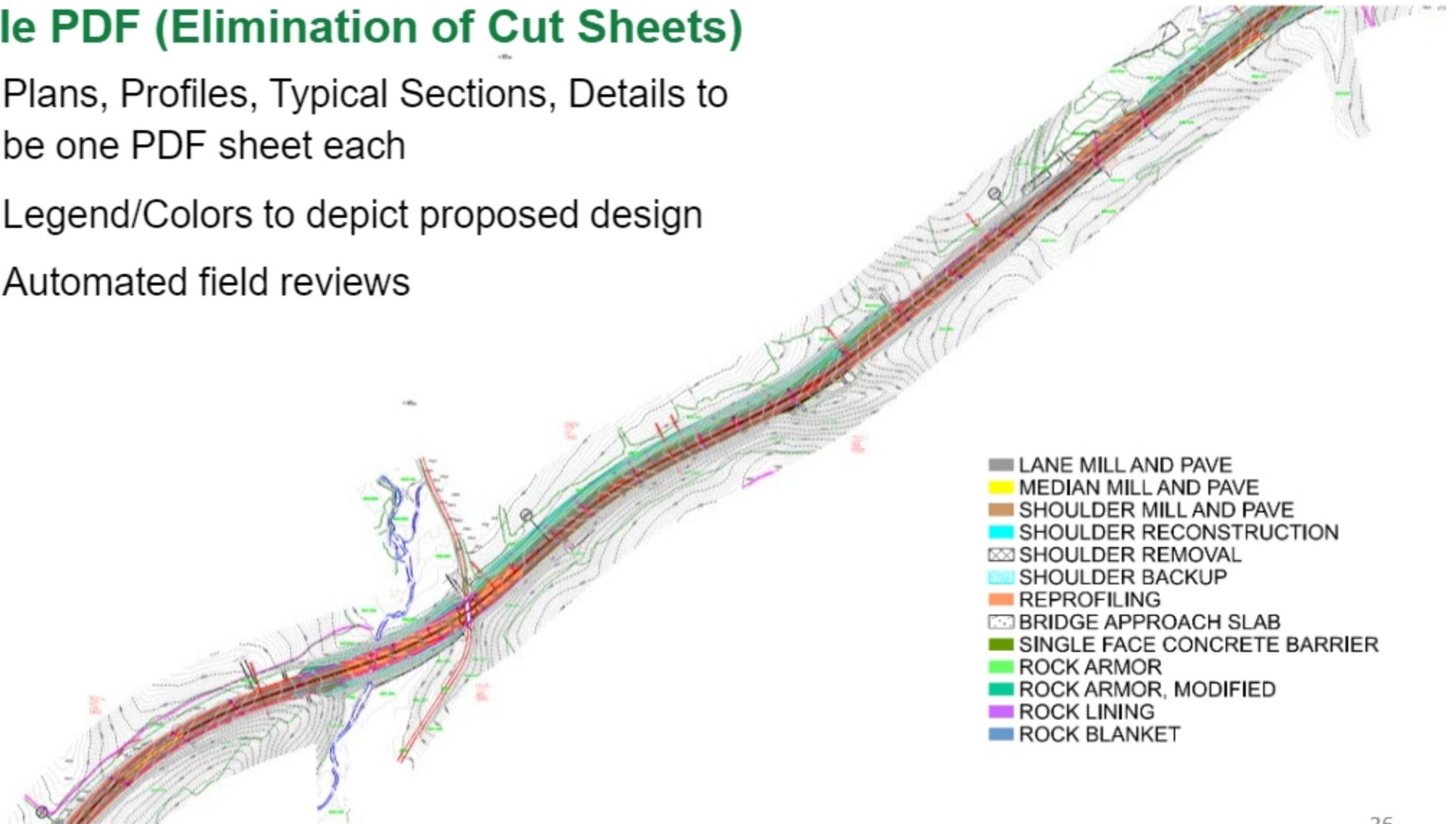




# T180-184 Resurfacing

## Single PDF (Elimination of Cut Sheets)

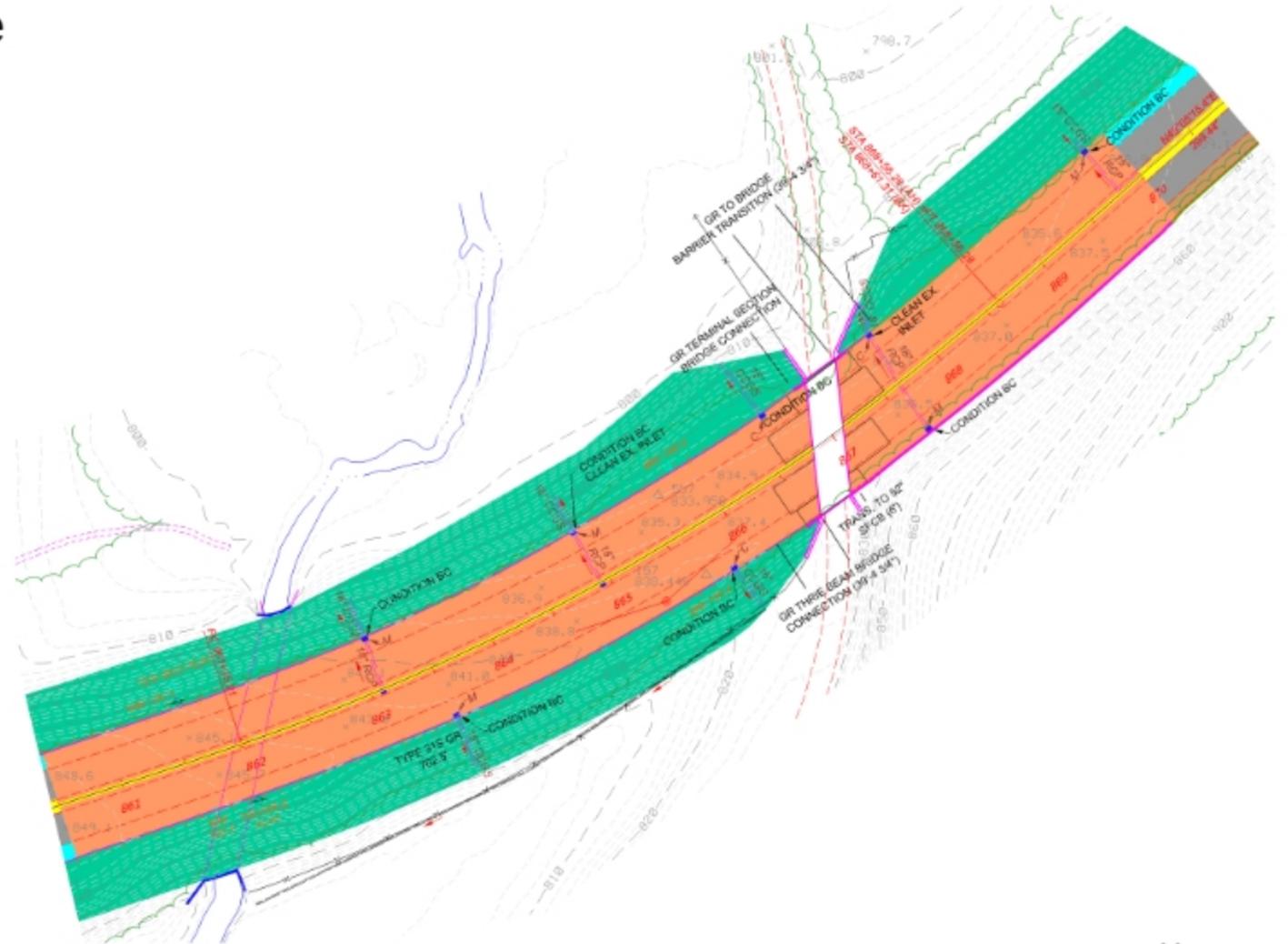
- Plans, Profiles, Typical Sections, Details to be one PDF sheet each
- Legend/Colors to depict proposed design
- Automated field reviews



# T180-184 Resurfacing

## Re-Profile T180.3-180.5

- Variable Depth Mill and Pave
  - Terrestrial Laser Scan
  - 3D Model



# Challenges

- Environmental Permitting – Cut Sheets Required for Reviews?
- Model as the Legal Bid Document – Signatures/Seals
- Industry Expertise
- Digital As-builts – Model revisions?
- Guidelines and Training for Model Reviews
- Construction Participation in Hybrid Phase

# Next Steps

- **Continue Development of Standards**
  - Apply lessons learned from current pilot projects to the standards documentation, implement on future projects.
  - Identify what custom content is a priority to include in the standards next.
- **Additional Pilot Projects**
- **PIM data export to Asset Management Systems**
  - Develop workflows to extract content from the model to be utilized part of other efforts within the project life cycle
- **Begin to Eliminate Information within PDF Documents**
  - Currently in a Hybrid phase which requires a model-based design and PDF plans.



Questions?

